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SUBJECT: THE LEAD ZINC POTENTIAL OF THE  
YOUNGER ROCKS (PRECAMBRIAN)  
OF NORTH WEST TASMANIA

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1 RECOMMENDATIONS

It is recommended that:

- 1.1 The uppermost Proterozoic - Eocambrian Corinna sequence be regarded as a regionally extensive mineralized stratigraphic horizon with potential for silver-lead-zinc and tin deposits.
- 1.2 Correlates of the Corinna sequence be determined on a structural model of broad domes separated by intervening synclines containing the favourable Corinna sequence.
- 1.3 The Smithton Dolomite and associated sediments be regarded as a potential western facies of the Corinna sequence which are not intensely downfolded in contrast to the Keith Metamorphics which are a metamorphosed and sheared downfolded equivalent of the Corinna sequence.
- 1.4 Plan compilations of previously obtained lead-zinc-copper values be prepared for the whole of north-west Tasmania and an attempt be made to determine regional trends of metal values after screening for spurious values.
- 1.5 Compilation and re-interpretation of the INPUT electromagnetic survey data be undertaken, together with selected ground surveys of conductor areas in an attempt to isolate base metal sulphide concentrations within the regionally persistent conductive zones.
- 1.6 Data of the Corinna sequence and correlates, together with the geology of relevant mines in western Tasmania be model fitted to the Sullivan lead-zinc-tin deposit in British Columbia in an attempt to establish vectors of potential lead-zinc occurrence for the "younger" Precambrian of north west Tasmania.

1.7 The following target areas with coupled anomalous base metal values and aeromagnetic trends and other indications of mineralization be field investigated an opportunity and ground tenure permits:

Lead Associated

- A. Donaldson River - Pieman River: stream sediment sample 300 ppm Pb associated with EM conductor on edge of Donaldson Quartzite (see Figure 7 for index).
- B. Delville Creek: stream sediment sample 550 ppm Pb coincident with magnetic anomaly over the Bernafai Volcanics.
- C. Headwaters of Pedder River: stream sediment sample 520 ppm Pb at north end of the Norfolk Range magnetic anomaly.
- D. Temma East: banded galena dump sample close to magnetic anomaly in lower upper Proterozoic.
- E. Nelson Bay: panned concentrate sample 3170 ppm Pb associated with aeromagnetic anomaly.
- F. Trowutta: panned concentrate with 300 ppm Pb - 150 ppm Zn and 400 ppm Pb - 670 ppm Zn associated with magnetic bearing Eocambrian volcanics.
- G. Atlas EL: gossans carrying up to 1.6% Pb, 0.5% Zn associated with dolomitic siltstone in the lower upper Proterozoic.

Zinc Associated

- H. Salmon River: panned concentrate sample with 1200 ppm Zn associated with magnetic anomaly in Eocambrian volcanics mudstone and dolomite.
- I. Smithton Volcanics: panned concentrate sample with 1500 ppm Zn associated with magnetically anomalous Eocambrian volcanics.

J. Balfour: sulphide (pyrrhotite) with anomalous lead-zinc-copper-tin in association with carbonate and magnetite.

## 2 CONCLUSIONS

- 2.1 The "younger" Precambrian (Proterozoic-Adelaidean) rocks of north west Tasmania are not generally regarded as being prospective for lead-zinc. Production of silver-lead-zinc has been restricted to the Zeehan area (837,000 kg Ag 0.2 Mt Pb, 0.003 Mt Zn), the Waratah area (248,000 kg Ag 0.004 Mt Pb, 0.004 Mt Zn) and the Interview River area (a few tonnes of lead-zinc). Copper occurrences are equally sparse with minor production from the Balfour area and the Keith River area. Two areas have been diamond drilled for copper - Murray's Reward and the Keith River Prospect.
- 2.2 The region is regarded as a top rank tin producer with major past and future resources occurring at Mt. Bischoff Renison Bell and Cleveland, and minor at Balfour and west of Zeehan. Tungsten is mined at King Island and magnetite is mined at Savage River. All these occurrences are in late Proterozoic or Eocambrian age rocks.
- 2.3 Exploration for tin has been intensive. Three major regional drainage surveys by Pickands Mather, the Consolidated Syndicate and CRAE resulted in detailed follow-up, particularly in the Balfour area and along the west coast. At least four targets have been diamond drilled for tin - at Balfour-Specimen Hill, St. Dizier, Granville, Temma East. Three airborne magnetic surveys and one airborne electromagnetic survey have covered the area of "younger" Precambrian rocks. Follow-up work has emphasized tin related magnetite-pyrrhotite anomalies and iron related magnetite-pyrite anomalies. It appears that the numerous electromagnetic

conductors detected by the Esso INPUT survey have been only superficially surveyed on the ground; many of these are regionally removed from magnetic anomalies and are "formational" responses.

- 2.4 There is some correlation between the location of anomalous lead and zinc drainage sample values and magnetic anomalies but little correlation between lead and zinc and electromagnetic conductors. Devonian granite bodies have generally low magnetic intensity except where magnetic stratigraphic formations have become incorporated in margin zones (e.g. Heemskirk Granite). This is taken to indicate that base metal sulphide and tin and iron sulphide pre-date granite emplacement and that the zoned mineral relationship seen at Zeehan could perhaps reflect original basin conditions. The data compiled contains some evidence that lead tends to occur regionally within the lower upper Proterozoic (e.g. Temma East and Atlas) and that zinc tends to occur in association with the upper upper Proterozoic (Salmon River, south of Smithton). Combinations of silver-lead-zinc-copper flanking tin occurrences laterally and up-stratigraphic column are indicated for the Magnet Mine, Cleveland and Balfour but the reverse may apply at Zeehan.
- 2.5 Structural and stratigraphic interpretation based on geological and geophysical data (but not on aerial photo interpretation) indicates that while several fold phases are present the principal regional structure is of broad domes about 20 km across separated by tight synforms about 10 km across (Figure 1). The older part of the Proterozoic, mainly laminated siltstone, mudstone and quartzite is exposed in the domes and the younger part of Proterozoic, mainly mudstones, quartzite, dolomite, lavas, ironstone and sulphide is preserved in the synclines, several of which are metamorphosed along the Arthur lineament. The younger part of the Proterozoic and Eocambrian rocks formed largely at a time of interrupted basin sedimentation with volcanics, dolomite and iron, tin

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and lead-zinc-copper sulphide accumulating in areas where the basement was disrupted by faults - particularly along the Arthur Lineament and related offset features such as the Savage River-Cleveland-Mt. Bischoff trend and the Renison Bell-Zeehan areas. An association in time and space between major tin deposition and lesser silver-lead-zinc-copper deposition, together with carbonate and volcanic tuff and lava is indicated and this suggests possible comparison with the Sullivan Deposit, British Columbia.

- 2.6 The evidence of the Tasmanian Geological Survey indicates an unconformity between the Oonah Formation and the Success Creek Formation. Similarly an unconformity is proposed below the Smithton Dolomite marking the Penguin Movement. However, it is proposed that, on the scale of the sedimentary basin in north west Tasmania, now exposed in an area of only about 10,000 km<sup>2</sup>, the Smithton Dolomite may be a transgressional facies equivalent in time to the complex upper Proterozoic volcanic, ophiolite, dolomite, mudstone sequence seen further to the east in the Savage River-Mt. Bischoff region. If this is the case then the sedimentation of the Smithton Dolomite may be distal to the activity along the Arthur Lineament and associated incipient synclinal areas. The potential for stratabound lead-zinc in the Smithton Dolomite could be further assessed in view of this conclusion.

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3 INTRODUCTION

The objective of this study is to outline the general potential for lead-zinc in the "younger" Precambrian of NW Tasmania as instructed by Peter Paizes and Rowley Brunker. CRAE in-house, Department of Mines open file data and published information (which mostly documents regional geology) was reviewed and supplemented by discussion with staff of the Geological Survey of Tasmania. The three days spent in Hobart and devoted to open file evaluation of NW Tasmania were sufficient to only scan the available data and determine which information most obviously relates to lead-zinc exploration. Plans produced by Esso for the Pieman Project have been copied and are held in Preston Office. A list of plans produced as the result of the extensive Pickands Mather surveys is enclosed as Appendix I. The most anomalous stream sediment lead-zinc-(copper) values obtained by Pickands Mather are reported but insufficient time was available to relocate the anomalous sample points. Some of the anomalous values were followed up by ACI and Esso and these are documented. CRAE repeat sampled many of the Pickands Mather sample sites and the results of this work for lead and zinc are presented.

Stratigraphic correlations in NW Tasmania and the environment of sedimentary accumulation are discussed, followed by a summary of the known distribution of lead-zinc-silver and the mode of occurrence. Exploration in NW Tasmania for lead-zinc is then reviewed. Potential target areas of both conceptual and specific interest are discussed in the section on conclusions and recommendations.

Much of the subject of this report is relevant to the area covered by EL 1/77. This area is currently being explored under joint venture between CRAE and Geopeko. This joint venture has commissioned Professor S.W. Carey to conduct an aerial photo interpretation of EL 1/77; the results of this work are not currently available and are not included in the enclosed interpretation.

4 REGIONAL GEOLOGY4.1 The Precambrian of Tasmania

Precambrian rocks occur in the western half of Tasmania as five main crustal blocks separated by troughs containing Lower Palaeozoic rocks. The geographic distribution of the five blocks, shown on Figure 2, is as follows:

- (i) Tyennan Geanticline of central west Tasmania
- (ii) Forth Geanticline of northern Tasmania
- (iii) The Rocky Cape Block of north west and west Tasmania
- (iv) The Badger Head Geanticline of northern Tasmania
- (v) The Jubilee Block of central south Tasmania

The Precambrian rocks are unfossiliferous. The youngest age is set by overlying fossiliferous Middle Cambrian Dundas Group rocks which accumulated after the close of the Precambrian and Eocambrian. The Precambrian closed with the manifestation of folding in the Penguin Orogeny; dolerite sills folded in this orogeny are dated at 720 My.

Two principal divisions of Precambrian rocks have been made based on differing tectonic deformation, lithology and metamorphism:

- (i) Older Precambrian - probably Lower Adelaidean sedimentary rocks with low to moderate regional metamorphism
- (ii) Younger Precambrian - probably Upper Adelaidean sedimentary rocks with slight metamorphism

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The event separating the two divisions is known as the Frenchman Orogeny. The older Precambrian rocks have a fabric not possessed by the younger rocks. The division is not a proven age relationship but there is evidence for unconformity at Artist's Hill where unmetamorphosed "younger" Precambrian (Rocky Cape Group dolomite) rests unconformably on strongly deformed "older" Precambrian quartzite and schist.

The contact between the "older" and "younger" Precambrian divisions is largely obscured by the Lower Palaeozoic cover rocks except for narrow outcrops of "younger" Precambrian overlying the western margins of the Tyennan and Forth Geanticlines (Figure 3). The "older" Precambrian in the Forth Geanticline is overthrust on the west by comparatively unmetamorphosed quartz-wacke turbidite which is correlated with identical sequences of the Burnie Formation and at the Badger Head Geanticline. Elsewhere only thin slivers of the younger Precambrian are in contact with the older Precambrian along the west margin of the Tyennan Block.

The Tyennan Geanticline consists mainly of metamorphosed interbedded siltstone and quartzite with some very minor dolomite. These now occur as quartz mica schist, quartz garnet mica schist, phyllite, albite schist and quartzite.

The Forth Geanticline contains rocks similar to the Tyennan Geanticline with quartzite, schist and interlayered amphibolite and conglomerate; layers range in width from 1 km to microscopic scale. Conglomerates show strong alignment of stretched pebbles.

On King Island strongly deformed sequences of interbedded quartzite and mudstone in the west have been intruded by deformed adamellite and granodiorite dated at 715-750 My BP; possibly the western part of King Island is of "older" Precambrian basement. No Precambrian granite is

recognized on the Tasmanian mainland.

The Tyennan and Forth Geanticlines probably provided the provenance for the "younger" Precambrian sediments but evidence is incomplete and a provenance to the west with an eroding Antarctic craton is also possible.

4.3 "Younger" Precambrian - Rocky Cape Group and Correlates

The "younger" Precambrian rocks are generally defined as those rocks younger than the Frenchman Orogeny and older than the Penguin Movement. Correlation of stratigraphy in the "younger" Precambrian succession remains imprecise but rocks lacking the multiple deformation and the regional metamorphism of the "older" Precambrian rocks and yet containing a more complex structural fabric than the Eocambrian and Cambrian rocks are placed into the category of being "younger" Precambrian.

The distribution of the "younger" Precambrian is shown on Figure 2. The geology of the Jubilee Block in southern Tasmania is unknown and is not discussed in the report. It lies in an extremely inaccessible area of Tasmania and has not been mapped. The geology of other "younger" Precambrian areas is variably documented.

4.3.1 Arthur River area: In the north west of Tasmania the area of "younger" Precambrian has been mapped in detail in the Rocky Cape region and also inland along the Arthur River in the Trowutta region. Along the NW coast of Tasmania the Rocky Cape Group comprises 5800 m of thinly bedded to laminated, cross bedded and ripple marked mudstone and orthoquartzite typical of accumulation in a basin undergoing gentle subsidence. In the upper part of the sequence are two orthoquartzite units, of super-mature quartz sand, each thicker than 1200 m;

a palaeostrand line is indicated to the south east and derivation of sediments from the "older" Precambrian Tyennan Geanticline is inferred. The area of the Arthur River - Rapid River has been mapped and subdivided (McNeil (1960), Matthews (1960) and Longman and Matthews (1961). This subdivision is given in Table 1 and shown in plan on Figure 4.

The sequence is the most continuous mapped to date and is correlated with the Rocky Cape Group. It also indicates that thick accumulations of laminated argillite and siltstone with abundant sedimentary structures, graded beds and impure quartzite accumulated in a gently subsiding basin without significant interruption. This sequence carries apparently authigenic tourmaline and several styles of tin mineralization at Mt. Bischoff and Balfour. Slump breccias of this sequence are found at Mt. Bischoff. Towards the end of accumulation the sedimentation pattern slightly changed and minor dolomite and black sulphidic and carbonaceous muds built up with the siltstone (Table 1). Dolomite occurs at several other localities south of the Arthur River including a zone at Rupert Point north of Pieman Heads, at Balfour with copper sulphide along the Murray's Reward line, in the Corinna Formation and Oonah Formation at Zeehan (see below) and near Granville Harbour where dolomite adjacent to intense magnetic anomaly peaks, is overlain by black shale and underlain by phyllite and quartz sandstone with thin magnetite bands; calc silicate also occurs near Granville Harbour.

The black siltstone contains schists that may be of volcanic origin or of an appearance caused by alteration along the margin of a basic dyke (Matthews, 1961). The black siltstone is highly

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conductive and causes strong "formational" INPUT anomalies but is rarely coincident with aeromagnetic anomalies.

- 4.3.2 Keith Metamorphics: the Arthur Lineament extends from the Pieman River along a NW belt 8-15 km wide to Wynyard and contains a suite of metamorphic rocks of an unassigned age. On the Arthur River at the Keith River confluence the Keith Metamorphics are principally of mica schist and quartz mica schist with chlorite and biotite schist, phyllitic quartzite and quartzite. Schistosity largely obliterates bedding and strike varies from  $0^{\circ}$  to  $70^{\circ}$  with dips both east and west at  $50^{\circ}$  -  $90^{\circ}$ . Quartz veins are common. The Keith Metamorphics according to McNeil (1960) are possibly conformably overlain to the west by the Neasy Formation which dips west at  $30^{\circ}$  to  $50^{\circ}$  and correlates with the Rocky Cape Group.

The metamorphics are termed Whyte Schist near Zeehan. At Savage River, within the Keith Metamorphics a belt of amphibolite contains magnetite-pyrite lenses (see section 5.5). In the Keith River area the Keith Metamorphics contain dolomitic siltstone probably of a sedimentary origin; these were unmapped by McNeil (1960) but are known from exploration on the Keith River prospect (see section 8.2) and at the Victory Mine. At the Victory Mine the dolomite is 15 m wide at the Arthur River and widens north to several scores of metres (Waller 1901 in McNeil 1960).

The Keith Metamorphics show gradational boundaries at some locations and they are generally accepted to be of modified Rocky Cape Group sedimentary rock. Gee (1968) indicated that the Keith Metamorphics overlie the Rocky Cape Group rocks which face south east. A similar east facing was obtained by Coleman (1975) for the rocks just west of the Keith Metamorphics at Savage River and therefore there is a conflict with McNeil's (op cit) interpretation.

4.3.3 Burnie Formation: At the north coast in the Burnie area the unmetamorphosed Burnie Formation consists of 5000 m of a monotonous alternation of flysch type well bedded slaty mudstone with quartz-wacke turbidite layers, minor spilite and a thin conglomerate at the base (Figure 5). Accumulation was generally in deep water. Large areas of the Burnie Formation are overturned and there is a general younging to the east (Gee, 1968). This suggests that the Burnie Formation is younger than the Rocky Cape Group but a facies variant of the Rocky Cape Group also seems likely. Slate from the Burnie Formation gives K-Ar dates of 670-690 Ma (Black and Adams, 1980). Correlation problems result because the Keith Metamorphics of the Wynyard area lie between the Rocky Cape Group and the Burnie Formation. Rocks identical with the Burnie Formation overlie the "older" Precambrian Forth Geanticline near Ulverstone.

4.3.4 Badger Head Geanticline: To the east of the Burnie Formation, the Badger Head Geanticline is flanked by Cambrian and Eocambrian rocks that dip away from the fault bounded Geanticline. The rocks are of some 900 m of comparatively unmetamorphosed interbedded turbidite quartz-wacke, siltstone and phyllite; correlation with the Burnie Formation is indicated but there is a lack of spilite. The potential for mineralization in this area has not been reviewed.

4.3.5 Waratah: To the south of the Burnie Formation a small dome (?) of Precambrian rocks is exposed within the Cambrian volcanics at Mt. Bischoff. Thin bedded turbidite and laminated siltstone contain quartzite and minor dolomite with massive stanniferous sulphide; quartz porphyry dykes cut the sequence and carry low grade tin. The sedimentary rocks are correlated with the upper part of the Rocky Cape Group and possibly the Burnie Formation.

4.3.6 The Oonah Formation: At Zeehan, located west of the Keith Metamorphics is a sequence of more than 2000 m of alternating pale grey quartzite, siltstone and slate with locally developed dark grey limestone, dolomitic limestone spilitic lava and pyroclastic bands (Figure 8). Magnetite quartzite bands are evident particularly around the north and west margins of the Heemskirk granite. It is overlain unconformably by the Success Creek Formation of probable lower Cambrian age which at the base consists of shallow water sandstone which filled a basin in the Oonah Formation (Brown 1980).

The unconformity represents a structural hiatus. Slate from the Oonah Formation gives K-Ar dates of 670-690 Ma (Black and Adams, 1980). A transitional boundary is present between the Oonah Formation and the Keith Metamorphics.

4.3.7 The Corinna Sequence: is located along the Pieman River west of the Keith Metamorphics. Five formations are recognised (Spry, 1962) -

Youngest:	Savage Dolomite	122m
	Delville Chert	61m
	Bernafai Volcanics	396m

	Corinna Slate	305m
	Donaldson Group (quartzite, slate conglomerate dolomite)	579m
Oldest:	Interview Slate and Quartzite	1524m

The Bernafai volcanics are of altered amygdaloidal basic volcanics and fragmental tuff and may be coeval with the late Precambrian dolerites which intrude the Rocky Cape siltstone and quartzite as Pieman Heads and elsewhere.

The younger Precambrian is also found in two slivers on the margins of the Tyennan Block. The Sticht Range quartzite and silicious conglomerate and lesser slates overlie the Tyennan Metamorphics in a belt extending from Lake Beatrice to the Murchison River. A similar sliver is found on part of the northern margin of the Tyennan Block north of Cradle Mountain.

#### 4.4 Smithton Trough

At Smithton Middle Cambrian rocks overlie the Eocambrian Smithton Dolomite conformably. The Middle Cambrian rocks are of fossiliferous siltstone overlain by conglomerate with quartzite and chert pebbles in a tuffaceous matrix then tuff, siltstone greywacke and basic lavas totalling 1500 m (Guilline, 1959).

The Smithton Dolomite was considered to be the youngest succession of the Rocky Cape Group but is now considered to post date the Penguin Movement. It is 610 m thick and extends inland from Smithton to 17 km south of the Arthur River where it transgresses the underlying formation and has a basal conglomerate/breccia (Lennox, 1980). In places, on the Tyennan Geanticline, it appears that the Smithton Dolomite rests directly on the "older" Precambrian (Spry, 1962).

4.5 King Island

The King Island scheelite deposit at Grassy occurs in a thin (200 m) sequence of dolomitic siltstone and shales which overlie unconformably "younger" Precambrian sandstone-siltstones which in turn in the western part of King Island overlie Precambrian quartzites and quartz muscovite schists intruded by a 700 My granite.

4.6 Structure of the Rocky Cape Group

Detailed analysis of structure has been made at the northern part of the west coast, Pieman Heads, Rocky Cape and Burnie and the Badger Head Geanticline. Regional syntheses have not been published and the compilation shown as Figure 7 is based on available regional geology and geophysics.

4.6.1 Detailed Structure: Most of the detailed structural work has been the subject of post-graduate theses and time has been insufficient to research this data. The following resume provides an indication of the variation in structure from west to east.

On the northern part of the Tasmanian west coast at Bluff Hill Point rocks of the Rocky Cape Group show two phases of open upright folds, each with a cleavage. This compares with the two phases seen on the north coast west of Rocky Cape as shown by dome and basin folding. However, east of Rocky Cape only one phase is present and this produced a slaty cleavage and high angle thrusts. These folds are tight and asymmetrical adjacent to the Keith Metamorphics and become more broad and symmetrical to the immediate west (Lennox, 1980). Regional structure is shown on Figure 7; the compilation by Professor S.W. Carey is not available at the time of writing. In the Burnie Formation the folds are nearly recumbent with overturning to the east. Progressive deformation

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occurred in the main phase with two later phases on different axes. Synorogenic dolerite sills were intruded.

- 4.6.2 Regional Structure: The regional structure as shown on Figure 7 has been compiled without aerial photo interpretation data. The distribution of aeromagnetic and electromagnetic trends has influenced the selection of structure-rock units.

The interpretation of the Rocky Cape Group given by Gee (1965) is shown as Figure 5. Gee indicates that a major anticline (Rocky Cape Anticline) passes east to a syncline, at least part of which is sheared along the Arthur Lineament. This roughly accords with the general interpretation of the structure of the "younger" Precambrian of north west Tasmania made herein.

The structure is interpreted as a series of broad domal geanticlines on varying trends separated by tight synclinal zones which are commonly sheared (Figure 1). These domes are seen as being very broad in the NW and becoming smaller in the SE where the older rocks in the cores of the domes are buried more deeply below thick accumulations of lower Palaeozoic rocks; the age of folding is uncertain but is probably middle or late Devonian.

The Devonian Pieman granite occurs in the core of the Sandy Cape Geanticline, the Meredith Granite in the core of the Meredith Dome and the Heemskirk Granite in the core of the Heemskirk Dome.

Tin mineralization at Mt. Bischoff, Cleveland, Renison Bell, Zeehan-Heemskirk and Balfour occurs in the youngest part of the succession within the condensed sequence of dolomite-ironstone-volcanics that accumulated over a narrow interval in the late Proterozoic. The Magnet lead-zinc and Zeehan

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silver-lead deposits also appear to lie in this final phase of the Proterozoic. This sequence is preserved in the tight inter-dome synclines and because these domes are buried more deeply in the south east area a greater proportion of the sequence is preserved in the area between Cleveland and Zeehan.

4.6.3 Penguin Movement: Williams (1975) noted that the Success Creek Group near Renison Bell have a more simple deformation pattern than the underlying Oonah Quartzite and Slate. On this basis the Success Creek Group is placed in the Eocambrian and separated from the Rocky Cape Group by the Penguin Movement. However, differential complexity of structure would need to be demonstrated on a regional basis before this was a sufficient condition for distinction. The reported landscape unconformity of Brown (1980) between the Success Creek Group and the Oonah Quartzite and Slate is more convincing, but more substantive proof is needed before correlation of the Success Creek Group with the upper sequences of the Rocky Cape Group can be rejected. The position of the Smithton Dolomite remains enigmatic; even though transgression across part of the lower Rocky Cape Group appears to be indicated, the Smithton Dolomite could be a facies equivalent of, for instance, the Success Creek Group.

4.6.4 Arthur Lineament: This structure is regarded as a fundamental lineament which influenced basin margin position and provided a locus for the eruption of volcanics and accumulation iron rich/sulphur rich sediment; it may also have influenced base metal accumulation. The lineament became the site of downwarping and eventually syncline formation between domal regions. Thrusting from the west resulted in regional metamorphism of the upper parts of the downwarp accumulations in late Proterozoic to Eocambrian time.

4.7 Tectonic Development of the Rocky Cape Group

After metamorphism of the older Precambrian the Tyennan-Forth Geanticline appears to have provided a provenance for sediments shedding into a deepening basin lying to the north east. This basin, the Rocky Cape Trough, may have been flanked to the west by a similar "older" Precambrian nucleus, if a refit of Gondwanaland and Antarctica of the type envisaged by Solomon and Griffiths (1974) is accepted. Sands and muds accumulated in the marine basin and formed impure sandstone and laminated mudstone/siltstone with numerous sedimentary structures. These constitute the lower, thick sequence of the Rocky Cape Group. Sands became more abundant in the middle sequence with carbonaceous debris accumulating in the sands derived from reactivation of the source areas. In the later stages of accumulation, basin subsidence waned and a new tectonic regime was initiated, particularly along a hinge zone extending from Ulverstone to Wynyard on the north coast to Zeehan and Pieman Heads on the West Coast.

Along this hinge zone mild volcanic activity was initiated. Basaltic and spilitic lava and pyroclastics accumulated in the basin, together with dolomite and dolomite siltstone under increasingly saline conditions. Carbonate facies and sulphide facies ironstone accumulated along the hinge line. Evidence suggests that Proterozoic sedimentation was closed by the Penguin Movement which occurred prior to the Eocambrian sedimentation.

The Penguin Movement is manifest in particular by the Arthur Lineament which is regarded here as a thrust syncline with a west block over thrust on an east block coupled with resulting metamorphism. It is therefore proposed that the Keith Metamorphics are of "younger" Precambrian and correlate with the Corinna Sequence and possibly parts of the Balfour and Mt. Bischoff Sequences.

It should be noted that these correlations are "forced" correlations based on the writer's best fit interpretation of the data to hand. The correlations differ to those published by Spry (1962) in many details. The general interpretation of domes separated by tight downfolds leads to the conclusion that much of the upper Proterozoic seen along the Arthur Lineament may correlate with the Eocambrian phases. If the suggested correlations are correct, other areas of Eocambrian rocks elsewhere in the north and west of Tasmania may have potential for tin and base metal mineralization but consideration of such targets is beyond the scope of this report.

#### 5 LEAD-ZINC-COPPER IN THE YOUNGER PRECAMBRIAN

Western Tasmania is a well known Cu-Pb-Zn-Sn province. Cu-Pb-Zn production is won from the Cambrian volcanics and although the "younger" Precambrian yielded significant silver-lead from Zeehan in the late 1800's and from the Magnet Mine, Waratah production of base metal, except for tin, from the Precambrian has been negligible; some small showings of copper and very few of lead-zinc occur in the "older" Precambrian of Tasmania.

Production figures are:

<u>Metal</u>	<u>Zeehan Field (Both &amp; Williams (1968))</u>	<u>Magnet Mine (Cox, 1975)</u>
Lead t	200,000	37,993
Silver kg	837,000	248,000
Zinc t	2,700	n.a.

In contrast, the "younger" Precambrian and Eocambrian is host to significant tin deposits including Mt. Bischoff, Renison Bell, Balfour, Cleveland and other showings. The rocks also host the Savage River magnetite mine.

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5.1 Zeehan (Ag-Pb)

Silver-lead was discovered in Zeehan in 1882 but development proceeded only when the great Australian silver boom took off. This reached a peak in 1894, then decline set in and most mines were abandoned by 1913; the Oceana Mine reopened in 1954 and closed in 1960 and production stopped at the Montana Mine in 1958. Zinc production commenced in Tasmania in 1919 when 290 t were produced from the Zeehan field. Numerous fissure vein lead-zinc occurrences occur in rocks of Precambrian to Devonian age along two principal trends (NNW and NNE) in an area of complex geology. Galena ore assayed 2200 g Ag/t and 70% Pb. Total production from the Zeehan field was approximately 200,000 tons Pb, 837,000 kg Ag and 2,700 tons Zn (Both and Williams, 1968).

King (1961) concluded from a study of the Zeehan field that the bulk of silver-lead ores came from Precambrian or early Cambrian quartzite particularly where accompanied by spilite. Silver values were invariably highest in lodes associated with spilite and this relationship probably contributed to the more extensive development in spilite associated rocks. Some 84% of total lead production to 1919 came from the spilite associated rocks (King 1961). Lodes/mineralized fractures mainly occurred adjacent to faults and metal values were unpayable below 100-200 m depth. Since 1900 intensive exploration has failed to discover significant silver-lead ores.

The Oonah Formation is the principal host to silver-lead mineralization. Alternating white weathering, pale grey, sacchroidal quartzite, thin bedded micaceous quartzite and siltstone and laminated green, grey or black shale are most common. Spilitic lava and pyroclastic rock near Zeehan occurs in the upper part of the sequence. At Zeehan and Renison Bell anticlinal folds plunge south east below Cambrian and younger formations. The upper part of the sequence near Zeehan includes dark grey and black shale or slate, micaceous siltstone and fine quartzite.

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Bedded limestone and dolomitic limestone occur near the Comstock and Oonah mines, the Zeehan Western Mine, the Zeehan-Montana and the No. 4 Queen Shaft (King, 1961). Where lodes are in limestone they are either narrow and tabular or wider disseminated low-grade deposits.

A mineral zoning outwards from the Devonian Heemskirk granite has been noted (Blissett 1962, Both and Williams, 1968). Tin ores occur in and close to the granite with lead ores to the east being zoned into an inner zone galena-sphalerite-pyrite ore in a quartz gangue and an outer zone of galena-tetrahedrite-pyrite-sphalerite in a siderite gangue. Manganese is commonly associated with siderite gangue and manganese gossans assaying 10% Mn occur. The zoned sequence of (1) Cassiteritic; (2) Pyritic; (3) Sidero-pyritic; (4) Sideritic closely parallels the detailed paragenetic mineral sequence (Both and Williams, 1968).

The lodes vary in strike from NW to NE and are truncated by at least two post-ore thrust faults. At Oonah the thrust fault moves the Oonah Mine pyrite-stannite-galena lode into contact with the sideritic-galena lode of Montana and Western properties. At depth in the Western Mine the lodes are more pyritic-chalcopyritic and compare more with the Oonah-Queen groups.

#### Discussion

The silver-lead-tin deposits of the Zeehan district are generally ascribed to a Devonian Tabberrabberan mineralizing episode. The zoned relationship of minerals in fissure lodes to the Heemskirk Granite appears to support this genesis and classification as perhaps "Andean type". However, the host sequence is highly deformed and in some cases the "lode" appear to be of assay cut-off disseminated sulphide style. The Zeehan-Montana mine was the most productive in the district (0.217 Mkg Ag, 50,000 t Pb). In this mine the ore was of irregular lenses and bands of galena, with sphalerite and pyrite in a gangue largely of siderite. Clearly shoots of high grade silver-lead

were mined but it is possible that stratabound disseminated lead-zinc occurs in the intensely folded and shattered alternating slate, siltstone quartzite and spilite of the upper Oonah Formation.

Possibly the Oonah Mine - Bradshaws prospects warrant review because at Bradshaws the 10 m wide lenses of pyrite appear to grade into the host sequence and may show a zoned relation to the galena lode-stannite lode at Oonah. The sulphide in the Queen Hill black shale in contact with volcanics appeared to be syngenetic pyrite - again a lead lode lies close.

5.2 Mt. Bischoff (Sn) Magnet (Ag-Pb-Zn)

An anticline of grey, thin bedded quartzite, dark gray shale and an upper bed of pale grey dolomite (60 m thick) is flanked by ? conformable Cambrian tuff, volcanics, mudstone and chert at Waratah (Figure 9). The clastic rocks are directly comparable in lithology and metamorphism with the "younger" Precambrian rocks at Balfour and probably lie in the upper part of the Rocky Cape Group.

The sequence at Mt. Bischoff is:

Upper shales and quartzite	300 m
Dolomite and dolomitic shale	} 0 - 60 m
with tin bearing massive sulphide	
Shales	0 - 10 m
Lower quartzite, shale and siltstone	} 300 m

Quartzite beds are up to 5 m thick but are laterally discontinuous and abrupt facies changes are typical of the sequence. The dolomites show local transitions to dolomitic shale.

Tin is found as cassiterite mainly in the quartz porphyry dykes and silts that centre on the summit of Mt. Bischoff and as tin bearing sulphide in the quartzite-shale-dolomite.

The tin area is surrounded by four occurrences of lead-zinc-fluorine which have been regarded as the result of metal zoning about Mt. Bischoff (Figure 9). Fluorine-zinc occurs to the south while lead-zinc occurs at Persic, Fawknars Tunnel and in Magnet in the Eocambrian pyroxenite-spilite-gabbro sequence and at Silver Cliffs and the Six O's workings in the Precambrian laminated siltstone.

Erosion of tailings from the Magnet Mine has affected the patterns of lead-zinc values in drainage samples along the Arthur River. The mine occurs at the west end of the Waratah high and produced to 1940 about 0.63 Mt of ore grading 5.7% Pb, 7% Zn, 350 g Ag/t; along strike to the east are the similar but smaller deposits at Fawknars Tunnel and Persic. The mineralization occurs in an Eocambrian basic sequence which overlies marine shale and chert and greywacke sandstone and interbedded shale and underlies spilite, pelite and chert. The basic sequence of porphyritic to amygdaloidal spilite or albite dolerite has been deuterically altered to spherulitic quartz-chlorite rocks with increased alteration and carbonation towards the ore zone.

The Magnet Mine ore zone has a strike length of 90 m, a width of 5.5 m and a depth of + 365 m. It is parallel to the strike of the spilites and occurs near the base of the sequence. Mineralization is of sphalerite and galena with lesser arsenopyrite, pyrite, boulangerite, pyrargyrite, tetrahedrite and traces of chalcopyrite with abundant manganosiderite and ferrian dolomite (ankerite) deposited in the closing stages of mineralization. The sequence has been traced from the Magnet Mine to the Cleveland Mine area; fossils are not known to occur (Cox, 1975).

### Conclusion

The origin for the Magnet Mine silver-lead-zinc is generally ascribed to the Eocambrian mafic suite or to Devonian hydrothermal mineralization. However, the base metal sulphide occurs very close to the tin bearing clastic-dolomite sequence at Mt. Bischoff which also carries minor Pb-Zn-F. The silver-lead-zinc occurrences are possibly of an ophiolite related origin and it is postulated that the mineralization may be related in time and space with the Ag-Pb-Zn mineralization at Zeehan. Indeed it is possible that the mafic rocks are of late Precambrian age and are a facies variant of the amphibolites found in the top of the "younger" Precambrian-Eocambrian. The tin mineralization is generally regarded as being of replacement and quartz porphyry associated type but the opinion of Knight (1975) that a syn-sedimentary origin is also likely has support on the basis of the postulated regional correlations. Furthermore Cox (1975) describes a complex folding history in the Magnet Mine sequence that may well correlate with the "younger" Precambrian rather than the more simple style characteristic of the Cambrian.

### 5.3 Cleveland Tin Mine

The Cleveland Tin Mine shows mineral zoning with a zone of pyrrhotite-sphalerite-arsenopyrite-carbonate flanking cassiterite-chalcopyrite zones. The mineralization occurs in unfossiliferous rocks of either "younger" Precambrian or Eocambrian age. The sequence is of basic volcanics in the east, lode bearing grey argillite and of mica sandstone in the west. The lode bearing argillites are fine grained, poorly bedded and have few sedimentary structures and lack cleavage. Cherts are well bedded, with carbonate or actinolite rich layers and jasper coloured near tin lodes. Sulphide rich layers average 20% sulphide. The structure is simple with the ore lying in a NW dipping sequence and Ransom and Hunt (1975) consider that the ore

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lenses are discrete original sedimentary units. The sequence is continuous with that at the Magnet Mine, Waratah which appears to be conformable with a "younger" Precambrian sequence (see Section 5.2).

5.4 Other Occurrences Cu-Pb-Zn

5.4.1 Balfour - Murray's Reward: Just east of the tin mineralization at Balfour a well defined lode 2 to 3.5 m wide and 1,000 m long includes a shoot from which a small tonnage (1,286 tons) of high grade copper ore (25-30% Cu) has been mined.

Chalcopyrite and pyrite occur in a gangue of quartz, chlorite, sericite and dolomite. The main producers have been the Central Mine (203 tons of ore) and the Murray's Reward (6,177 tons of ore). Mike Porter resampled selected core from the 34 holes drilled by ACI but tin assays were all sub-economic. ACI drilling established a body 220 m x 220 m x 5 m averaging 0.8% Cu.

It remains uncertain whether Murray's Reward workings are restricted to a particular formation in the Rocky Cape Group but it is possible that the copper sulphides correlate in time with the Mt. Bischoff massive sulphide mineralization in dolomite. (A review of the ACI data has not been undertaken).

BHP drilled a magnetic anomaly at Specimen Hill for tin mineralization. Recent resampling of core indicates the presence of minor zinc -

BHP 5 Vertical 3m 0.26% Sn, 2.98% Zn, 70 g Ag/t,  
0.24% Pb - quartz vein  
25m 0.27% Sn, 0.73% Zn, 10 g Ag/t -  
pyritic shale and quartz

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5.4.2 Couta Rocks, SW Marrawah NW Coast: Pluton  
Exploration N.L. described traces of chalcopyrite, pyrite azurite and malachite disseminated in a honeycomb quartz vein up to 1.2 m wide and 180 m long with a steep W dip in graded sandstones, greywacke phyllite and black pyritic slate. A flooded shaft is present.

ANZECO inspected this occurrence in 1972 and reported galena and sphalerite in the veins. This occurrence is in the lower Rocky Cape Group.

5.4.3 King Island: Minor lead and zinc have been won from quartz veins in the Precambrian rocks, together with minor amounts from King Island scheelite. Details have not been researched but Geopeko are likely to have investigated the occurrences and data should be sought from them.

5.4.4 EL 1/73 Copper Reward - Silver Reward: CRAE  
examined old workings located to the east of the Pieman granite. Three copper workings are aligned over an interval of 300 m within finely banded siliceous siltstone. Chip samples across the central occurrence of a chalcopyrite-pyrite vein 0.3 m wide gave background Pb, Zn, Sn (Porter 1977) -

<u>Sample</u>	<u>Cu</u>	<u>Pb</u>	<u>Zn</u>	<u>Au</u>
189406	15.3%	32 ppm	130 ppm	0.1 ppm

The vein is oriented 270°/vert. in siltstone 290°/60°N. Chip sampling of the siltstone returned background base metal values. An ACI grab sample returned 11.5% Cu, 60 g Ag/t, 1 g Au/t. Some 200 m to the north, collapsed workings are on a 2 m wide zone of quartz veins in siltstone; part of the veins carry pyrite and chalcopyrite. A similar pit with quartz veins occurs 250 m south of the central occurrence (Porter 1977). A small

pit, 500 m north west, contains gossanous quartz which assays 15 ppm Pb, 15 ppm Zn, 1350 ppm Cu (Porter 1977).

West of the old copper workings Porter (1977) describes a mound of red clay soil with blebs of pyrite 50 mm long at the contact of the Pieman granite which assays 240 ppm Pb, 70 ppm Zn, 95 ppm Cu.

ACI report that the Silver Reward shaft, located immediately south of the copper workings was sunk on argentiferous galena in a vein concordant with siltstone. The vein was about 0.6 m wide. Three grab samples gave an average of 40.8% Pb, 485 g Ag/t, 0.6 g Au/t.

EL 1/73 is currently held by Interview Mining and Associates Pty. Ltd. and covers 44 km<sup>2</sup>.

The workings are not associated with a magnetic anomaly, panned concentrate samples are not anomalous in Pb/Zn, bedrock exposure is moderate and evidence of syngenetic/stratabound mineralization appears to be lacking. It is concluded that the potential for economic base metals is low.

#### 5.5 Savage River Magnetite Deposit (Coleman, 1975)

Vertical, discontinuous lenses of massive and rhythmically layered magnetite-pyrite occur within a vertically foliated basic volcanic succession up to 1 km thick. Original reserves were about 100 Mt with 55% concentrate recovery grading 69% Fe, 1.00% SiO<sub>2</sub> and 0.04% TiO<sub>2</sub>.

The deposit occurs in the Keith Metamorphics. At the Central deposit quartz-actinolite, quartz-chlorite and quartz-sericite schist are host to mineralized amphibolite and smaller dolomite-magnetite pyrite lenses. Pyritic

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graphite schist crops out 500 m to the east of the main mineralization. Pillow basalt, gabbro and ultramafic rocks of both concordant and discordant form have been generally altered to actinolite-chlorite-albite-epidote assemblages although unshered amphibolite and gabbro is also present. Minor andesitic tuff and cryptocrystalline cherts are present as disrupted beds up to 0.1 m thick. Impure silicified dolomite and magnetite with interbedded green schist are conformably associated with mineralization. (This same relationship is also seen at Long Plains to the south and Keith River to the north).

The axial planes of folds parallel the Arthur Lineament and folded quartzite beds have been boudinaged. The discontinuous pods of amphibolite possibly represent the metamorphic equivalents of the Cooe dolerite (c. 700 My) which was intruded syntectonically with the Penguin Orogeny. Post metamorphic Tabberrabberan broad open folds trend north west. En echelon faults with net slips of 100 m make mining complex.

Mineralization: Ore lenses are of magnetite-pyrite-minor chalcopyrite with trace sphalerite and ilmenite-rutile intergrowths and are up to 20 m thick. Gangue minerals include tremolite, actinolite, dolomite, quartz antigorite and chlorite. Weathering is up to 80 m deep and remnant magnetite is surrounded by martite and later limonite. Bornite chalcocite, covellite and native copper are present in the zone of secondary enrichment.

Conclusion: The conformable interbedded nature of the pyrite-magnetite reflects syngenetic mineralization associated with mafic volcanism. It is postulated that the sequence correlates with the upper part of the Rocky Cape Group. The occurrence of an iron oxide/sulphide facies is associated with the initial genesis of a wide spectrum of massive sulphide deposits under exhalative alternating Eh/pH and oxygen/sulphur fugacities.

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6 REGIONAL GEOCHEMICAL SURVEYS

The "younger" Precambrian of NW Tasmania has been almost completely covered for anomalous base metals by stream sediment sampling:

Major geochemical surveys have included -

- . EL 12/65 Pickands Mather south of the Arthur River; target - NW area of Tasmania, Rocky Cape Group.
- . EL 48/70 and EL 49/70 ACI, Consolidated Goldfield, Mt. Lyell and Renison south of the Thornton River to Granville Harbour; target Rocky Cape Group.
- . EL 6/72 ANZECO, north of the Arthur River to the north coast; target - Smithton dolomite and associated Cambrian rocks.
- . EL 1/77 CRAE undertook a helicopter borne panned concentrate and stream sediment sampling programme throughout NW Tasmania.

Minor surveys have included -

- . CRAE, 1971 Arthur River and catchment areas.

The quality of sample collection and assay procedures for these surveys appears to be satisfactory. Contamination of samples, principally along the banks of the Arthur and Pieman Rivers, as the result of erosion of tailings from mine sites requires the screening of high metal values. Extensive Tertiary gravels and Recent sands along the west coast complicates interpretation of the significance of metal values and must raise some doubts about the sensitivity of the stream sediment surveys. Sampling appears to be most sparse in the prospective Keith Metamorphics area north of Savage River.

6.1 EL 12/65 Pieman Project

Pickands Mather's extensive stream sampling programme of NW Tasmania and follow up on selected prospects is reported in Hobart only on plans and sections as listed in Appendix 10.3.

The geochemical survey was conducted by geologists who prepared reconnaissance geology maps as the survey progressed. The most anomalous Cu-Pb-Zn values obtained by the geochemical survey have been selected from the many thousand assays and are tabulated as Appendix 10.2. These values will serve to select areas for further follow-up; locations will need to be recovered on the Pickands Mather plans. During subsequent work, ACI produced a plot of parts of the Pickands Mather data and followed up anomalous results (see below).

Pickands Mather investigated the following areas in detail -

1. Roaring Mag - 3 diamond drill holes
2. Lynch Creek - surface survey
3. Airport - surface survey
4. North Queen River - surface survey
5. North Heemskirk - 4 diamond drill holes drilled magnetite and assayed Cu-Pb-Sn. Tin values have been rechecked.
6. Temma - 2 diamond drill holes
7. Nelson River - surface surveys
8. Copper King - surface surveys

Savage River Pipe Line: Pickands Mather also collected sub-soils along the route of the slurry pipe line from Savage River to Port Latta on the north coast of Tasmania at 150 m intervals. A plan of these results was inspected and the best values were noted as:

<u>Coord</u>	<u>Cu</u>	<u>Zn</u>	<u>Pb</u>	<u>ppm</u>
N 675220	125	100	40	sediment with iron bands
N 675158	35	30	120	fault
S 675032	120	45	10	unmetam. Precambrian
S 675144	15	3000	90	" "
N 938-E334	"	"	"	amphibolite dyke
S 675122	110	55	150	unmetam. Precambrian
S 795163	70	140	250	Tertiary basalt

Presumably Pickands Mather checked the 3000 ppm Zn value but no details of follow-up are reported.

North Heemskirk: Of the four holes drilled by Pickands Mather at the North Heemskirk magnetite-pyrrhotite zone the following values are noted:

H 102 n.a.  
 H 103 Pb- n.a., Ag - tr, Zn max 500 ppm  
 H 104 Pb- n.a., Zn  
 H 101 Pb 50 ppm, Zn 64-67 m, 2300 ppm  
 Only selected parts of the core were assayed.

It is concluded that Pickands Mather did not follow-up significant base metal anomalies on a systematic basis.

#### 6.2 EL 48/70 and EL 49/70, West Coast Tasmania

ACI in joint venture with Consolidated Goldfields, Mt. Lyell and Renison conducted an extensive investigation in 1971/72 of the Rocky Cape Group between the Thornton River, north of Sandy Cape to Granville Harbour. A stream sediment sampling programme for Sn, As, Cu was designed to test for tin associated with the three Devonian granite bodies. ACI used the Pickands Mather results to survey for Ni, Pb, Zn. Detailed work was conducted on areas of known mineralization within the coastal area at Interview River Sn-W, and at Copper and Silver Reward workings in the headwaters of the Interview River (E 332000 N 5397000); also included were the Chimney Creek aeromagnetic anomaly, Rupert Point aeromagnetic anomaly and areas at Pieman Heads and north of Granville Harbour.

ACI subdivided the Rocky Cape Group into -

Top	Surprise Creek Beds
	Interview Siltstone
	Lagoon River Quartzite - massive recrystallized quartzite
	Chimney Creek "Hornfels" (adjacent to the Pieman Head granite)

## Bottom Pedder River Siltstone

The Chimney Creek "Hornfels" is recognised west of the Pieman Heads Granite as a unit which ACI regarded as containing minor acid volcanics of rhyolite type; the basis for this identification is suspect.

ACI plotted Pickands Mather stream sediment results in EL's 48/70 and 49/70 for Ni, Pb, Zn (Figure 7 of ACI Report Q 42/1, plans). ACI did not further evaluate the lead-zinc anomalies and only resampled the area of the Silver Reward workings where stream sediment values were less than 10 ppm Zn and Pb. Inspection of ACI's Pb-Zn plot of Pickands Mather data gave anomalous values from north to south as follows:

	<u>Location (Figure 7)</u>	<u>Pb</u> (ppm)	<u>Zn</u> (ppm)	<u>Co-ordinate</u>	
				E	N
Pb	Headwaters of Pedder River	520		327	541.5
	Creek South of Sandy Cape	410		319	541
	Donaldson Rv., North bank of Pieman	230		337	539.1
	" "	140		"	"
	" "	300		"	"
	" "	200		"	"
	Delville Ck, south bank of Pieman	550		338	538.7
Zn	South tributary Pieman Rv.	20	2340	332	538.8
	North tributary Pieman Rv.	-	3300	328	538.8

	<u>Location (Figure 7)</u>	<u>Pb</u>	<u>Zn</u>	<u>Co-ordinate</u>	
		(ppm)	(ppm)	E	N
Zn	Hoyle Creek	-	6050	335.1	537.2
	Duck Creek	-	410	335.1	537.5
	N. of Gourlays Ck, Granville Harbour	-	1500	335.1	537.1
Pb/	South Bank Pieman Rv.	50	1680	343	538.4
Zn	North Bank Pieman Rv.	470	60	338	539

The results of prospect investigation were as follows:

Interview River Tin-Tungsten: quartz-tourmaline-wolframite veins up to 0.6 m wide occur in the Pieman Heads granite at Cooneys workings and Kenny's workings. The veins are restricted to a zone less than 10 m wide, along 1 km strike; exposure is poor. Bulkable grade is less than about 0.5%  $WO_3$  (Porter, 1977). Total production has probably not exceeded 5 long tons of 65%  $WO_3$ . Stream sediment sampling by ACI gave -80 mesh tin values of 200-400 ppm Sn with isolated 1000 ppm Sn. Values upstream of up to 200 ppm were taken to indicate redistribution by Tertiary erosion.

Chimney Creek anomaly: a ground magnetic anomaly coincides with laterite developed at the contact between the Lagoon River Quartzite and the Interview Siltstone. Soil and rock geochemical data gave non-significant results (max. 10 ppm Pb, 70 ppm Zn, 20 ppm Cu); assays of laterite were similarly low valued.

The Rupert Point magnetic anomaly was not explained by ACI.

The ACI consortium does not appear to have been interested in lead-zinc investigations and several base metal anomalies have not been field checked.

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6.3 EL 6/72 North West Tasmania

The Australian and New Zealand Exploration Company conducted a geological and stream sediment sampling programme in NW Tasmania in May 1972. Anzeco stream sediment sampled north of the Arthur River in areas of the Smithton Dolomite on the basis that these rocks correlated with the tungsten bearing carbonates on King Island. Samples were panned to a rough concentrate and analysed for copper, lead, zinc, molybdenum tin and chromium. Tungsten and molybdenum values were low. Concentrates were examined with a UV light with negative results. A summary of the results obtained is as follows:

Tungsten: 4 values above 98 ppm W - Arthur River south of Edith Creek. Anzeco did not regard these significant but did note the presence of minerals typical of a contact metasomatic-hydrothermal deposit type.

Molybdenum: anomalous values of 10 ppm Mo occur south of the Roger River, SE of Trowutta in a pyritic black shale area and in the Salmon River. Threshold Mo values were taken as 4 ppm.

Tin: gravels with cassiterite were included in the sampling and weight the result. A lesser valued population away from the Arthur River occurs in the Roger River east of Trowutta in an area of black shale, siltstone and dolomite.

Copper: anomalies were not explained.  
NRK 55 Cu 90 Pb 60 Zn 90 Cr 1.29% ppm or %  
NRK 63 100 60 65 2600

Lead: Anomalous values were taken above a threshold of 58 ppm. The best values of samples draining the Salmon River area dolomites are:  
NRK 30 Cu 10 Pb 75 Zn 35 Cr 2.27% ppm or %  
39 10 60 650 24.8  
43 25 60 510 22.4  
55 90 60 90 1.29

Lead Samples draining dolomite and Cambrian volcanics  
(cont) in the Trowutta area -

NRK 63	Cu 100	Pb 60	Zn 65	Cr 2600	
64	70	400	670	2.4%	N 934000 E 315000
70	20	300	150	0.52%	N 940000 E 316000

(Stream cuts road to Trowutta)

One sample from the Duck River area near Smithton  
in a dolomitic area:

NRK 45	20	60	300	11.8%
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Anzeco did not explain the anomalous lead other  
than relating the values to high background in  
the Smithton Dolomite or possible quartz-galena  
veins.

Zinc: High zinc values correspond to high chromium values  
but Anzeco did not check out the high values. Best  
values are -

NRK 13	Cu 720	Pb 720	Zn 2900	Cr 7900	Arthur River
NRK 25	15	20	1200	26.7%	Salmon Rv.
26	15	20	1200	30.3%	" area "
27	15	20	1400	28.2%	" "
28	20	20	1300	33.4%	" "
29	15	20	1100	33.1%	" "

Anzeco explained away the zinc anomalies as being  
derived from chromite.

Chromium: about half of the concentrates carry values of  
+1% Cr. Alluvial chromite and cassiterite has  
been investigated at Hawkes and Lovells Creek  
near Salmon River and in the swamps at Montagu  
and the Welcome River but no economic deposits  
have been established. "Gossan AL3" after pyritic  
limestone and chert collected in Faheys Lane at  
Irishtown contained only trace Cu,W,Ni,Cr,Co,Zn,Pb.

Conclusion: The best lead values are from streams south of Trowutta draining mainly Cambrian volcanics and Smithton Dolomite. Anomalous zinc values occur in the Salmon Creek area and are confirmed by the anomalous zinc value collected during CRAE survey (Figure 7).

6.4 The Upper Arthur River Geochemical Survey (CRAE 3787)

CRAE undertook reconnaissance and follow up geochemical survey in 1971 of the Arthur River and tributaries in the area of the Keith metamorphics. Bulk 5 kg drainage samples were collected over intervals of 50 m in the tributaries of the Arthur River (Figure 10).

The initial drainage survey returned -80 mesh values as follows:

	<u>Zn</u>	<u>Pb</u>	<u>Cu</u> ppm
. Anomalies	500 - 5000	100 - 300	100 - 200
. Background in			
Keith Metamorphics	10 - 20	3 - 20	1 - 10
. Overlying Permian	10 - 100	3 - 20	1 - 10

In anomalous areas weathered bedrock soils were collected at 30 m intervals along tracks and lines. Marginally anomalous soil sample values (e.g. 210558, Pb 130 ppm, Zn 330 ppm, Cu 63 ppm) were obtained in a background of 10-20 ppm Pb/Zn in the Keith Metamorphics about 1 km east of the old Victory Mine. Detailed drainage samples upstream from the highly anomalous value in the Arthur River (and in the area of the above anomalous soil values) were at background levels.

Microprobe analysis of the initial anomalous soils showed very fine lead, zinc and copper sulphide and it was concluded that the samples were contaminated by sampling Arthur River alluvium too close to the confluences. Two samples of specifically Arthur River sediment were collected and returned values of:

	<u>Zn</u>	<u>Pb</u>	<u>Cu</u>	ppm
Bank alluvium	730	630	310	
Recent flood alluvium	3600	250	270	

A drainage sample collected below the Magnet Mine workings draining 6 km<sup>2</sup> returned 7500 Pb, 31000 Zn, 260 Cu, 200 Ag (ppm). It seems likely that erosion of slimes and dump material from the old workings at Mt. Bischoff and Magnet Mines is responsible for the strong anomalies along the Arthur River.

7 REGIONAL GEOPHYSICS

Three major exploration surveys of NW Tasmania have been undertaken. In 1956 Rio Tinto Australia exploration flew an aeromagnetic survey and in 1974 Esso flew an INPUT (EM and magnetic) survey (Figures 11 a,b,c). Details of the aeromagnetic survey for the Consolidated Syndicate (ACI etc.) do not appear to be available. The Rio Tinto survey appears to be unreported and anomalies do not appear to have been rated or followed up except in areas of Cambrian rocks. Esso have reported in detail. The Bureau of Mineral Resources also flew the region at high altitude (3000 m) in 1966.

Rio Tinto Australian Exploration in joint venture with EZ flew EM surveys over specific areas including the Savage River area and an area along the Pieman River north of Zeehan covering the Oonah Formation; this data has not been viewed by the writer.

7.1 Rio Tinto Aeromagnetic Survey

The majority of linear magnetic trends in north west Tasmania correlate with rock formations, particularly volcanics and amphibolite and magnetite-pyrite zones. Discordant magnetic features are also present. These are best known in the Balfour area where the trend of anomalies follows the fold axis and transects bedding at Specimen Hill. However, the magnetic anomaly seen

at Balfour may well relate to a similar anomaly at Temma which is caused by magnetite-pyrrhotite conformable within the Nelson River siltstone and quartzite. En echelon anomalies may well be locally discordant but relate regionally to specific rock formations or groups of formations. The strongest magnetic anomalies occur in the Pieman River - Savage River area where the Bernafai Volcanics and nearby amphibolite are the direct cause. These anomalies follow the NW strike of the Keith Metamorphics along the Arthur Lineament. The amphibolite is intimately associated with magnetite-pyrite at the Savage River magnetite deposit. Some areas are of flat-intensity. The central part of the Rapid Rv. and the Arthur River in the area of the Rocky Cape Anticlinorium are unresponsive. These flat domains appear to reflect the siltstone and sandstone of the lower upper Proterozoic. Flat areas also occur in the Smithton Trough west of the magnetic lavas. Specific anomalies are discussed elsewhere in this report.

## 7.2 EL 2/73 Pieman River - Arthur River

Esso Minerals Enterprises Australia Inc. explored for base metals south of the Arthur River using a helicopter supported geological and fixed wing INPUT survey. This failed to produce encouragement and Esso terminated the exploration licence. Esso do not report any assay data and it seems that geochemical samples were not collected.

The INPUT survey gave clean data collected at a terrain clearance of 120-180 m and anomalous EM responses were distributed within distinct zones:

1. Western belt, Johnson Bay to just south of Ordnance Point along the west coast and inland about 10 km from the tip of Sandy Cape.
2. Ahrberg Bay NNE between Donaldson and Savage River then crossing the Donaldson River. The zone swings NNW just north of the Rapid River. The zone is 100 km long and 5-10 km wide ("graphitic slates").

3. A broad central zone containing very few anomalies separates the two anomalous zones. In-fill flying of the Balfour Trend did not detect anomalous EM response.
4. Eastern broad zone of low to moderate amplitude near the headwaters of the Donaldson and Savage Rivers along the Arthur Lineament and to the east.

Aeromagnetic surveys, prior to the Esso survey had been flown by Rio (Tinto) Australia Exploration and by Compagnie Generale de Geophysique for the Consolidated Syndicate. Esso found a good comparison between the Geoterrex survey (for Esso) and the earlier surveys.

Two major aeromagnetic trends are evident:

Arthur Lineament from Ahrberg Bay to the Arthur River - Keith River area. This zone was also detected by the BMR aeromagnetic survey which shows the zone to bifurcate just west of Waratah with a high amplitude portion trending north east to cross the coastline between Penguin and Ulverstone and a weaker portion continuing NNE to cross the coast at Wynyard. Iron-rich amphibolite locally with magnetite, basalts and dolerite dykes correspond with the anomalies.

Esso followed up the survey results on the ground in four areas:

- (a) Balfour to Lagoon River: The copper showings along the Norfolk Ranges extending south of Murray's Reward are coincident with an aeromagnetic trend of 50-200 nT and a topographic low. Sheared slate and banded siltstone occur between two quartzite ridges of the Norfolk Range but the origin of the aeromagnetic anomaly was not established. Esso abandoned work on the basis that the mineralization was "not a suitable target for stratiform reduzate mineralization".

- (b) Arthur Lineament: The mafic volcanics in the north east and far south of the licence area have a distinct magnetic response but geological reconnaissance and detailed work over INPUT anomalies showed a lack of chlorite, silica alteration and hydrothermal mineralization and restricted sedimentary basins within or adjacent to an ophiolite sequence. Esso concluded that the environment was poor for pyrite-chalcopyrite mineralization.
- (c) Black Slates: containing pyrite and graphite were examined but the absence of visual base metal mineralization or prospects was taken to eliminate further potential.
- (d) Pieman Heads: Airborne magnetic and INPUT anomalies occur around the margins of the granodiorite at Pieman Heads. At Rupert Point north of the mouth of the Pieman River grey and black carbonaceous slates, green chloritic phyllite, grey, white and pink quartzite and conglomerate are metamorphosed by coarse grained biotite granodiorite. Disseminated pyrite and traces of chalcopyrite occur. A small dolomite outcrop does not contain sulphide. The magnetic response is coincident with black slate in contact with granodiorite but the specific cause was not identified. At Conical Rocks south of the Pieman River INPUT anomalies again relate to pyritic black graphitic slates lacking obvious base metals. Esso downgraded the area because of low skarn related base metal potential.

Conclusion: The Esso geophysical data is of value but the basis for Esso's withdrawal without, it seem, conducting any geochemical surveys is questionable.

## 8. GENERAL BASE METAL EXPLORATION BY CRAE

The follow-up to the Rio Tinto Australian Exploration aeromagnetic survey in 1956 appears to have been largely restricted to Cambrian rocks rather than the "younger" Precambrian. Recent work in the Precambrian by CRAE has centred on the old Victory Mine along the Arthur River, a helicopter borne panned concentrate sampling programme and general tin exploration in joint venture with Geopeko. Whilst exploration has been mainly for tin and tungsten, base metals have also been assayed and the lead-zinc results are reassessed below.

### 8.1 Rio Tinto Australian Exploration Pty. Ltd.

SPL's 302 and 311 covering about 7800 km<sup>2</sup> in NW Tasmania were taken to enable general exploration by Rio Tinto. A series of geological maps were prepared by J. Rattigan from aerial photos and 1 ml:1 inch topographic series maps in 1956. These maps are available on open file in Hobart but the data has been superceded by published work. Campana and King (1960) conducted regional studies sponsored by Rio Tinto and EZ.

### 8.2 Keith River Ironstone

In 1971 CRAE explored a portion of EL 43/70 in a joint venture arrangement with Mineral Holdings Aust. Pty. Ltd. and Tomic Exploration Pty. Ltd. The prospect extends south west along strike from the Victory Mine located on the north bank of the Arthur River 2 km upstream from the junction of the Keith River (Figure 12). A lenticular gossan occurs within the Precambrian Keith Metamorphics which comprise metamorphosed siltstone, dolomite, siltstone and quartzite. CRAE mapped an anticline and syncline of poorly exposed bedrock in the gossan area (Figure 13). The sequence including the sulphide horizon shows marked facies changes along strike and down dip. Extensions to the main gossan area were found along strike using geochemical survey lines. All gossan areas were sampled on a grid of at least 180 m x 15 m and samples were assayed by Zinc Corporation.

Weathered bedrock soil geochemistry revealed anomalous copper values along the "central limb" of the fold with some contours enclosing + 1000 ppm Cu. Several samples returned zinc values up to 800 ppm Zn. Nickel does not exceed 600 ppm.

The 5 km long gossanous zone is of intercalated quartzite and laminated siltstone with lenses of iron oxide; bleaching of the siltstones is proportional to the number of ferruginous bands. Magnetite and specular haematite occur in the siltstone as fine grains. Magnetite and cellular oxide are most common on the "eastern" limb of the mapped anticline. The oxide is generally limonite but pyrite is present and a primary banded pyrite-magnetite association is evident. Some continuous outcrops of iron oxide up to 30 m thick contain only minor siltstone or quartzite bands. Bands of angular quartz grains occur in the ironstone.

Exposures of gossan in the old Victory copper mine workings occurred outside the joint venture where soils carry values of 100 to 500 ppm for both Cu and Zn. Assays of surface gossan range from 500 to 700 ppm Cu but no copper minerals occur in the ironstone at surface. McNeil (1960) reports on Waller's 1910 survey of old adits (now collapsed) with a belt of white crystalline dolomite at the contact between pyroxenite and laminated quartz schist. Copper ores included malachite and chalcopyrite in haematite.

CRAE used two diamond drill holes to test the zone of oxidation. Sulphide sections were split and sampled in 3 m lengths.

KR1 243 m N 10520 E 10680, 143° magnetic, -60°

Core recovery 65%

<u>Length (m)</u>	<u>Lithology</u>
0 - 57	Decomposed amphibolite, quartzite and siltstone
57 - 91	Medium grained amphibolite
91 - 112	Laminated siltstone with pyrite and magnetite bands and disseminated pyrite, trace cp
112 - 133	Friable, green laminated siltstone with 10-60% fine pyrite, sulphur content increases to 20%, zinc assays up to 1560 ppm, lead 815 ppm, increasingly dolomitic to grey dolomite with up to 30% bands of pyrite
133 - 158	Laminated dolomitic siltstone
158 - 162	Dark green amphibolite (with sub-rounded quartzite pebbles at base?)
162 - 183	Pale green bedded siltstone with calcite veins
183 - 199	Grey bedded sandy siltstone/sandstone
199 - 243	Quartzite/sandy siltstone

<u>Assays</u>	<u>Max</u>	<u>Min</u>
Fe	24.12%	4.4%
S	22.06%	1.12
Pb	180 ppm	20 ppm
Zn	1560 ppm	64 ppm
Cu	815 ppm	25 ppm
Ni	165 ppm	30 ppm
Co	140 ppm	20 ppm
Ag	2.5 ppm	tr
Au	tr	tr

High values are in the dolomitic zone.

KR2 166 m N 10270 E 10110, 300° mag -60°, core recovery 82%

Objectives to test gossan after unsatisfactory core recovery in KR 1 which was terminated at a depth below which no sulphide intersections could be expected. Hole tested "central" limb of fold below a soil anomaly 60 ppm Pb, 106 ppm Zn and 3000 ppm Cu on line E 10000.

Termination: Terminated when in the absence of base metal mineralization KR2 had reached a depth below which economic mineralization would have been too narrow.

Lithology: Upper - grey quartzite (1-13.5 m thick) altering green, grey and pale siltstone and sandy siltstone of similar thickness. No amphibolite.

<u>Core length (m)</u>	<u>Lithology</u>
62 - 68	Bedded siltstone with magnetite pyrite
68 - 80	Bedded siltstone with some massive pyrite bands up to 70 mm thick, strongly banded alternating magnetite and pyrite
80 - 101	Variably bedded to unbedded siltstones low pyrite content
101 - 128	Quartzite, trace pyrite
128 - 129	Grey-black laminated siltstone
129 - 142	Dark green siltstone with calcitic lenses parallel to bedding, no sulphide
142 - 147	Pale green dolomitic (30%) siltstone, no pyrite
147 - 166	Poorly laminated siltstone with slate

Minor chalcopyrite and pyrrhotite is common but sub-economic. Core was tested by UV light but no scheelite was detected.

Assays: Assays of Pb, Zn, Cu, Ni, Co were all less than 520 ppm. Ag 1 ppm Au - tr.

Drill hole results: The lack of correlation between KR 1 and KR2 stratigraphy was ascribed (in report 3793) to facies change. The sulphides form a discontinuous lenticular stratiform pyrite-magnetite occurrence mainly in siltstone or dolomitic siltstone.

Conclusion: The surface values of copper in soils have not been explained and it is possible that KR2 was stopped prematurely before the target zone was intersected. However, the structural interpretation is valid based on angle of bedding to core axis. Hence, the anomalous copper at surface appears to be the result of minor secondary enrichment of the type also found at Savage River.

8.3 Lyons River Copper Occurrence EL 43/70 (CRAE 3788)

CRAE evaluated a copper occurrence 4 km to the south west of the Keith River pyrite-magnetite ironstone in EL 43/70 held by Mineral Holdings Australia Pty. Ltd. and Tomic Exploration Pty. Ltd. (Figure 12). The sequence in Lyon River from south to north is:

- . Grey phyllite and chlorite schist
- . Magnesite and dolomite lenses 12 m thick
- . Grey dolomitic slate, weakly magnetic and with trace pyrite, 20 m
- . Green silicified pyritic shale with bands of grey-green magnetic slate with pyrite, 30-40 m
- . Grey phyllite and slate, ? 300 m
- . Brecciated and silicified dolomitic slate with pyrite present in bands parallel to bedding (includes one small patch of pyrite) 6 m
- . Grey phyllite and chlorite schist

Two drainage samples collected from small streams draining the sulphide horizon adjacent to the Lyons River returned background values. Gossans, of the type seen on Keith Rv. prospect are not present at Lyons River. The bed of the Lyons River is about 300 m below the base of Tertiary extrusive and is below the zone of gossan development.

8.4 Atlas Leases (CRAE 3792)

CRAE currently holds 2550 km<sup>2</sup> in the eastern part of EL 1/77 which is not included in the Geopeko joint venture. In this area six contiguous leases (1271 (north) 1167, 1165, 1166, 1164) were taken for lead and silver in 1892 (Figure 12, 14). CRAE originally investigated the area in 1971 when it was held by another party. At this time a bulldozer scrape was needed to expose the main gossan zone over a width of 100 m in an area of old adits, with reported galena.

This exposed a sequence of "younger" Precambrian rocks with thin bands of cellular gossanous material parallel to bedding in sandy siltstone, and shale. The trench contained 50 m slightly micaceous shale with 3 m cellular red-brown gossanous 4 m black gossan bands up to 0.6 m in yellow banded limonite; 6 m yellow ferruginous siltstone with 0.6 m grey dolomite and black cellular gossan with white quartz lenses; 10 m ferruginous siltstone with some ironstone; 5 m quartzose sandy shale; 5 m cream sandy siltstone.

SE of the workings dolomite with gossan occurs in the bed of the creek. Similar rocks occur in adit No. 3. A UV light test showed that scheelite is not present.

Mike Porter reports a sharp aeromagnetic anomaly coincident with the leases but the Rio Tinto survey appears to be "flat" in this area. Two types of gossan occur. Best assays are as follows:

. Red-brown rarely cellular	Pb 16300	Zn 5100	Cu 330	Ag tr	ppm
. Black cellular	1730	4400	290	tr	
. Soil samples north leases (max.)	180	115	30	54	
. " " south occurrence (west of lease 1164) (max.)	330	400	45	tr	
. North of costean	3000	510	130	tr	

CRAE took no further interest based on low metal contents.

This area was later acquired by CRAE as part of EL 1/77 but it does not form part of the Geopeko joint venture area. This property requires further evaluation in view of the apparently stratabound character of the gossans.

#### 8.5 EL 1/77 Rocky Cape Region

CRAE holds EL 1/77 in north west Tasmania (Figure 14). This area covers out stratigraphic equivalents of the sequences which host the "younger" Precambrian to Eocambrian tin deposits at Mt. Bischoff and Renison Bell and possibly the Eocambrian Cleveland ore body. At Balfour similar rocks to those at Mt. Bischoff contain tin associated with some stratabound disseminated pyrrhotite. Because of the indicated potential in the general region for stratabound tin associated with pyrrhotite/magnetite CRAE conducted a panned concentrate and stream sediment sample (-80 mesh) survey at a density of one sample/50 km<sup>2</sup> and follow up at one sample/10 km<sup>2</sup>.

Three distinct groups of base metal anomalies are obvious:

- . Associated with Devonian Pieman Granite
- . Associated with the Balfour-Temma-Nelson Bay siltstone quartzite
- . Associated with the Lower Cambrian carbonate and Middle Cambrian basic volcanics and sediments

Lead-zinc anomalies are largely associated with anomalous tin and tungsten but anomalous zinc was obtained in catchments draining Eocambrian basic volcanics and dolomite south of Smithton. The most anomalous lead-zinc results and other areas of possible interest are recorded below.

8.5.1 Nelson Bay - Temma: The Arthur Rv. and Nelson Bay Rv. returned anomalous tin values (400 ppm to 1.1% Sn) coincident with an aeromagnetic anomaly over siltstone and quartzite. Sporadic high Pb-Zn values are found adjacent to or coincident with tin anomalies.

051

216052

<u>Panned conc.</u> <u>Sample No.</u>	<u>Pb</u>	<u>Zn</u>	<u>Sn</u>	<u>W</u>	<u>Mn (ppm)</u>	
188513	10	18	1700	10	80	Alert Rv.
14	15	160	1.1%	85	310	-
15	10	45	390	40	190	
16	3170	8	160	10	790	Nelson Bay Rv.
20	10	190	1350	70	270	-
24	20	240	2200	270	490	Thornton Rv.
Background	5-20	5-30	-	-	-	

8.5.2 NE Frankland River: A group of anomalies in the area from Smithton to NE of the Frankland River carry anomalous zinc values; they generally drain areas of Cambrian sequences, particularly lavas.

<u>Panned conc.</u> <u>Sample No.</u>	<u>Cu</u>	<u>Pb</u>	<u>Zn</u>	<u>Mn (ppm)</u>	
<u>Smithton -</u> <u>Balfour</u>					
188502	8	270	45	170	Gayfish Ck
188506	25	15	1500	1.39%	Copper Ck Duck Rv.
188508	75	5	610	690	Duck Ck. Roger Rv.
188509	15	8	670	770	Duck Ck.
188511	12	5	860	1000	Duck Ck. alluvial, tidal
188556	42	20	240	790	N. trib Arthur Rv. (? contam)
188557	38	18	300	560	S. trib Arthur Rv. (?contam)
188558	38	12	180	420	N. trib Arthur Rv. (?contam)

8.5.3	<u>North of Waratah</u>	<u>Cu</u>	<u>Pb</u>	<u>Zn</u>	<u>Mn</u>	
	188607	48	5	160	3080	E. tributary of Arthur Rv.
	188608	10	5	70	320	" "

A basic rock sample collected from the site 188608 assayed -

189017	270	75	290	1200	(Au,W,Sn - tr)
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8.5.4	<u>West Coast, Pieman Granite</u>	(all are associated with anomalous tin values)				
	188611	190	60	140	670	Granite, Small Ck.
	188617	5	22	180	600	" "
	188621	81	15	750	1620	Pieman Heads south bank
	188625	5	5	260	240	N. Granville Harbour

CRAE followed up the 750 ppm Zn value at Pieman Heads but of 30 rock samples collected no values of lead or zinc exceeded 100 ppm. A black pyritic siltstone assayed 45 ppm Pb, 30 ppm Zn.

8.5.5	<u>Salmon River</u>					
	188552	12	12	380	430	Salmon Rv.
	188681	32	5	410	617	Basic volcanic location unknown

Drainage samples are anomalous in Zn only in areas of the Cambrian basic volcanics and generally reflect anomalous zinc in panned concentrates from the volcanics. Subsequent follow-up work by CRAE showed that four samples of laminated siltstone and black siltstone below the Bryant Hill quartzite assayed less than 50 ppm for Cu, Pb, Zn.

- 8.5.6 Balfour: At the Balfour tin deposit Cu-Pb-Zn values are slightly elevated in soil samples which carry elevated Sn-W values.

<u>Sample</u>	<u>Cu</u>	<u>Pb</u>	<u>Zn</u>	<u>Mn</u>	<u>Sn</u>	<u>W ppm</u>	
189142	6500	580	560	50	3300	1.14%	massive banded py sulphide with white quartz between Specimen Hill & Tin Ck.
189141	570	130	270	30	1.8%	140	sulphide from Eric's pit 50 m W of Tin Creek

As noted in Section 5.4.1 values of up to 2.98% Zn have been cut in a vertical drill hole over 3 m in quartz vein.

- 8.5.7 Alert Creek: A sample of red, magnetic, decomposed rock collected from 3 tree roots over 10 m in a magnetic anomaly at Nelson Bay in a creek just south of the Arthur River returned anomalous lead values.

188689      110 220 90 40 10 ppm

- 8.5.8 Norfolk Ranges: Linear magnetic anomalies extending south of Balfour lie along strike to the Murray's Reward copper workings and roughly coincide with copper workings along the Norfolk Ranges. The lagoon, Norfolk and Hazleton magnetic anomalies are coincident with rocks similar to those at Balfour. At Hazleton grid survey showed IP anomalies with up to 56 m sec (2.5 x background), in a low resistivity (350 ohm. m) zone coincident with a 400 nT anomaly and parallel to but offset from the line of old copper-pyrite workings. A sequence of quartzite and finely laminated black and yellow and black and white siltstone is present. Fourteen soil samples collected along a line across the best IP/magnetic response gave best values of Pb 22, Zn 60, Cu 18, Ag 1, Sn 10, W 15 ppm. Rock samples gave high copper values (up to 6.7% Cu

from sulphide 35 m from the South Mine shaft at Hazleton). Otherwise Pb/Zn values were less than 100 ppm and tin was low with a maximum of 28 ppm Sn in sulphide from an old copper mine. Gossanous rock within the Hazleton magnetic anomaly gave anomalous copper (e.g. 850 ppm Cu) but background Pb/Zn.

8.5.9 Leigh River: lenses of spilites and accompanying carbonate give a broad ground magnetic anomaly of up to 2000 nT. A soil traverse returned weakly anomalous copper values in an area of limonitic siltstone.

189157 Pb 10, Zn 55, Cu 350, Mn 650, Sn 4, W 10 ppm

8.5.10 Temma-Nelson Bay Area: Ground survey of the aeromagnetic anomalies in this area showed sharp intense peaks of (+ 1000 nT) up to 150 m wide and broad zones of 150 nT about 1 km wide. The intense peaks have been traced for 2.5 km just east of Temma east of Gannet Point and at the Nelson Bay Rv. prospect.

At the Temma prospect 3 km E of Temma Pickands Mather drilled two holes beneath a magnetic anomaly. Best values in a subsequent CRAE auger soil traverse of 4 samples across the drill site gave Pb 50 ppm, Zn 50 ppm, Cu 42 ppm in an area of finely laminated silicious siltstone and red ferruginous shale in an area of dune sand. The hole intersected 20 m of 0.09 - 0.1% Sn within a banded magnetite unit in a sequence of finely laminated mudstone and siltstone in a talc-ferromagnesian (chlorite) gangue. A second hole to the north cut 2.5 m of spongy pyrite with only minor magnetite.

055

216056

CRAE resampled part of the core obtained by Pickands Mather in hole T 301 and T 302. Assays of side ground core were:

Hole No.	Core Length	Pb	Zn	Cu	Mn (ppm)
T 301	62 - 96m	20-28	240-570	48-770	2900-1.9%
	Magnetite horizon overlain and underlain by shale and siltstone				
T 302	35 - 48m	32-190	200-410	45-1550	790-1600
	Massive spongy pyrite with intercalated shale and siltstone				

(Tin values were all less than 250 ppm).

An old dump 200 m west of the second hold contains lumps of massive fine grained banded galena and magnetite quartzite; samples assayed as follows:

Sample No.	Cu	Pb	Zn	Mn
189409	4400	1.2%	45	1.23%
189419	9600	330	25	2.6%
189416	880	22.7%	22	1.66%

An outcrop of non-magnetic oxide occurring in the centre of the magnetic high to the east of the Temma lead occurrence assayed:

189417	310	1200	250	230
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A chip sample over 30 m within siltstone in pits in the Temma prospect to the south west of the main Temma magnetic high gave:

189418	15	470	22	250
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The source of the aeromagnetic anomaly 2 km east of Gannet Point and Hazard Bay is not exposed. Seven auger soil samples collected across the anomaly largely failed to penetrate dune sand; all metal values are less than 100 ppm.

Conclusion: A field visit is needed to assess the lead-copper potential. The area has not been adequately bedrock sampled and shallow Jacrow drilling and IP at 10 m centres on 2 - 3 lines across the lead occurrence is required to determine the potential for base metals.

8.5.11 Granville East and West: Along the north contact of the Heemskirk Granite a series of narrow intense magnetic peaks reflect conformable massive magnetite-pyrite quartzite beds in a sequence of greywacke quartzite phyllite and schist. Dolomitic siltstone and dolomite, where the magnetic trend cuts the west coast, are overlain by black shale and underlain by phyllite and quartz sandstone.

Of 117 rock samples from the area, the best assays are:

<u>Sample No.</u>	<u>Pb</u>	<u>Zn</u>	<u>Cu</u>	<u>Ag</u>	<u>ppm</u>
716255	85*	8	5	1	Weathered siltstone
716284	28	130*	870*	2	Weathered schist
716235	30	25	60	3*	Brown soil

\* Best value obtained

Sample 716255 is located on the west flank of the eastern magnetic anomaly at Granville East.

Sample 716284 is located in the northern magnetic anomaly at Granville West, 700 m NE of a 20 ppm bedrock tin anomaly.

057

8.5.12 Ahrberg Bay: A strong aeromagnetic anomaly had been covered by a number of traverses by Renison-ACI in 1974 but not followed up. A strong magnetic anomaly (3000 nT) is present adjacent to olive coloured siltstone but no source to the anomaly was detected by CRAE and the area is almost completely covered by Tertiary basalt and gravels. CRAE detected a second anomaly (2500 nT) coincident with the Bernafai Volcanics. Results given in CRAE 9927 for Cu, Pb, Zn are as follows:

<u>Sample No.</u>	<u>Pb</u>	<u>Zn</u>	<u>Cu (ppm)</u>	<u>Rock Type</u>
716285	5	30	18	Grey green shale with quartz, haematite
716286	20	50	100	Siltstone
716287	5	75	95	Siltstone
716288	10	70	410	Schistose siltstone
716289	5	65	130	Bernafai volcanics
716290	5	2	10	Delville chert/schist

8.5.13 Blackwater Rivulet: CRAE sampled Tertiary gravel and probable Eocambrian basic volcanics, silty sandstone, chert and siltstone greywacke in an area due north of Balfour. The best results of 14 samples are Cu 25 ppm, Pb 25 ppm, Zn 100 ppm.

8.5.14 Frankland River: The aeromagnetic anomaly is caused by basic lava and pyroclastics in a sequence of green to red shales which are tuffaceous in part with some chert bands.

Soil sample traverses across the anomaly show two lines are anomalous with low values in copper.

U58

<u>Sample</u>	<u>Line</u>	<u>Position</u>	<u>Cu</u>	<u>Pb</u>	<u>Zn (ppm)</u>
717538	N 7800	E 9860	250	5	55
39		9840	130	10	50
40		9820	230	5	65
41		9800	180	5	75
42		9780	460	10	75
43		9760	120	10	50
717589	N 9100	E 9660	150	5	28
590		9640	95	5	32
591		9620	140	5	25
Background		Approx	50	5	50
Best Zn value			-	-	140

Tin values were insignificant and tungsten (40, 110 ppm) are marginally anomalous. The anomalous copper coincides with basic volcanics.

059

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APPENDIX I

OPEN FILE DATA ASSESSMENT CONDUCTED IN HOBART

064

10.1 OPEN FILE DATA ASSESSMENT CONDUCTED IN HOBART

Exploration reports covering work on exploration licences abandoned more than five years ago are filed on a quadrangle basis at the Mines Department in Hobart.

A listing of reports based on quadrangles is available. This was scanned for reports considered to be relevant for review of the lead-zinc potential in NW (and NE) Tasmania.

The following reports were examined with the more important referred to in the References section of this report herein.

- 20/2 20/3 20/4 20/5
- 21/3 21/4
- 26/2
- 27/1 27/2
- 28/1 28/2 28/10
- 30/18 30/39
- 31/2 31/6
- 32/32 32/35 32/36 32/37 32/47
- 33/11 33/15 33/16
- 34/1 34/2 34/3 34/4 34/5 34/6 34/7 34/8 34/9 34/10 34/11
- 34/12 34/15
- 35/17
- 36/18
- 40/4 40/6 40/7
- 41/8 41/19 41/20 41/21 41/23 41/24 41/27 41/28 41/29
- 41/30 41/42 41/43 41/48
- 42/1 42/6 42/7
- 43/6 43/13
- 44/19 44/20
- 50

APPENDIX II

PICKANDS MATHER STREAM SEDIMENT GEOCHEMISTRY

SELECTED ANOMALOUS VALUES TAKEN FROM THE  
GEOCHEMICAL LEDGER ON OPEN FILE

(P.J. LEGGE)

10.2 PICKANDS MATHER STREAM SEDIMENT GEOCHEMISTRY  
SELECTED ANOMALOUS VALUES TAKEN FROM THE  
GEOCHEMICAL LEDGER ON OPEN FILE

<u>Sample No.</u>	<u>Cu</u>	<u>Pb</u>	<u>Zn (ppm)</u>	
770236	40	1000	3900	Top of Sophia
785036	70	3300	320	Stirling Valley
785409	30	155	260	Murchison
785426	20	780	320	"
785427	20	1860	750	"
660050	30	1050	122	
660051	2240	10	15	
665024	50	250	10	
666064	5	10	7700	
670060	160	285	160	Arthur Rv. south side tributaries
670062	250	320	1600	" " "
670159	270	325	3000	Arthur Rv. (example)
670414	45	10	1200	Natone Area
670415	45	20	840	" "
670416	40	5	1000	" "
670472	50	-	290	Tributary of Stephens Rivulet
670473	70	5	350	" "
670407	75	85	290	Dobson's Creek
670547	180	-	350	Top of Stephens Rivulet
670651	30	5200	130	Pyramid Ck.-Oceana Mine
670661	85	4800	30	MacLean Ck. near Swansea Mine
670665	25	3100	130	" "
670694	10	180	45	Trib. of parting ck.
670695	10	7800	18	? Bartnett Ck. contaminated?
670698	10	990	4500	? Bartnett Ck.
680080	200	320	380	?
680082	260	490	600	?
680068	220	400	330	?
680145	115	105	1680	Pyritic black shales
680146	180	375	370	" " "

10.2 PICKANDS MATHER STREAM SEDIMENT GEOCHEMISTRY

Selected anomalous values taken from the geochemical ledger on open file (P.J. Legge)

<u>Sample No.</u>	<u>Cu</u>	<u>Pb</u>	<u>Zn</u>	
770236	40	1000	3900	Top of Sophia
785036	70	3300	320	Stirling Valley
785409	30	155	260	Murchison
785426	20	780	320	"
785427	20	1860	750	"
660050	30	1050	122	
660051	2240	10	15	
665024	50	250	10	
666064	5	10	7700	
670060	160	285	160	Arthur Rv. south side tributaries
670062	250	320	1600	" " " " "
*670159	270	325	3000	Arthur Rv. (example)
670414	45	10	1200	Natone Area
670415	45	20	840	" "
670416	40	5	1000	" "
670472	50	-	290	Tributary of Stephens Rivulet
670473	70	5	350	" " " "
670407	75	85	290	Dobson's Creek
670547	180	-	350	Top of Stephens Rivulet
670651	30	5200	130	Pyramid Ck. - Oceana Mine
670661	85	4800	30	MacLean Ck. near Swansea Mine
670665	25	3100	130	" " " "
670694	10	180	45	Trib. of parting creek
670695	10	7800	18	? Bartnett Ck, contaminated?
670698	10	990	4500	? Bartnett Ck.
680080	200	320	380	?
680082	260	490	600	?
680068	220	400	330	?
680145	115	105	1680	Pyritic black shales
680146	180	375	370	" " "
680162	165	485	260	? " " " ? bank sample
680861	510	560	50	
680865	250	200	75	
680887	40	220	35	
690072	155	10	85	
690122	660	500	95	
690159	1050	160	60	
690254	15	5	350	Toft Rv. area
690419	130	330	1200	
690515	30	630	80	
690622	500	225	55	Linda Ck.
690630	145	260	80	
690859	110	280	40	
785426	20	1860	750	
692096	5	10	3300	
770136	40	1000	3900	
775093	1100	1200	520	
775132	280	2010	210	
775145	650	150	55	
775151	500	440	200	
775169	1200	420	340	
775216	2000	1200	1000	
775273	350	440	60	

PICKANDS MATHER STREAM SEDIMENT GEOCHEMISTRY (cont.)

<u>Sample No.</u>	<u>Cu</u>	<u>Pb</u>	<u>Zn</u>	
775307	120	1650	40	
775369	800	1540	100	
775578	1200	390	2500	
776200	600	50	420	
776259	950	350	340	
776288	180	400	550	
776283	30	50	2090	
776595	800	500	260	
776694	25	600	50	
776742	140	1000	185	
777063	250	520	450	
777223	800	400	250	
777304	485	400	140	
777327	950	370	65	
777327	956	370	65	CxCu 380
777339	125	230	870	
777368	500	300	75	CxCu 450
780112	1	-	6050	N of Hoyle Ck, stream draining PE quartzite
780170	175	20	580	Hoyle Ck, north bank
785036	70	3300	320	
785258	20	290	110	Pine Ck.
781263	20	400	1000	?
785534	25	300	400	
785747	35	60	1100	
785769	260	60	1000	
785926	430	400	60	
790172	15	20	2340	

Samples collected from the Arthur River commonly exceed 300 ppm Pb and 2000 ppm Zn but where designated Arthur Rv. on the sample sheets they are excluded because of contamination from the Magnet Mine.

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PICKANDS MATHER - ROCK ANALYSES

<u>Sample No.</u>	<u>Cu</u>	<u>Pb</u>	<u>Zn</u>	<u>Ag</u>	<u>ppm or %</u>
670686	55	5.2%	10%	2	Grieve Siding Mine
670687	15	990	360	-	Chevron Creek
670689	7350	5.2%	10%	80	Swansea
670690	9.25%	8700	3840	10	
670693	250	7800	48%	10	
690227	145	160	2970	-	?
780105	450	1.95%	10		Rock Pieman River

Stirling Valley - ?rock

778483	25%	7000	6.4%	5	
778537	6500	50	2600		Tuff with sulphide

Stirling Valley Soil

779142	5	2000	30		
779145	7	5500	55		
779231	150	4000	700		

## 10.3 LIST OF PICKANDS-MATHER PLANS (As kept on open file in Hobart)

*Pickands Mather & Co. International*

Incorporated in U.S.A.

*North-West Tasmania Exploration**24 Marino Terrace,**P.O. Box 577**Burnie, Tasmania**Phone 31 1177*

20th June 1967

Mr. J.C. Symons,  
Director,  
Department of Mines,  
G.P.O. Box 124B,  
HOBART, TAS

4456/b7

Dear Sir,

To comply with conditions under Section 15B (3) of the Mining Act, we are sending under separate cover the following geological, geochemical, and geophysical plans and sections pertaining to our Exploration Licence No. 12/65.

Roaring Meg

Geology Plan	1" = 400'
Drill hole line geological plan	1" = 50'
Drill Hole Sections -	
RM-200 & RM-201	1" = 50'
RM-202	1" = 50'
Vertical Magnetic Contour plan	1" = 200'
Electromagnetic profiles -	
In-line	1" = 200'
Broadside	1" = 200'
Induced Polarization -	
Lines 46+00E, 54+00E, 90+00E	1" = 300'
Soils assay sheets -	
Cu, Pb, Zn, Ni & As	1" = 400'

Lynch Creek

Geology plan	1" = 400'
Vertical Magnetic Intensity Plan	1" = 200'
Induced Polarization -	
Line 144+00S	1" = 300'
Soils assay sheets -	
Cu, Pb, Zn, Ni & As	1" = 400'

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Albion

- Electromagnetic profile -  
In-line 1" = 200'
- Induced Polarization -  
Line 44+000 1" = 300'
- Soils assay sheets -  
Cu, Pb, Zn, Ni & As 1" = 400'

North Queen River  
Queen River

- Geology plan 1" = 200'
- Soils assay sheets -  
Cu, Pb, Zn & Ni 1" = 200'

North Saskatchewan  
North Saskatchewan

- Geology plan 1" = 400'
- Drill Hole Sections -
  - R-101 1" = 50'
  - R-102 1" = 50'
  - R-103 1" = 50'
  - R-104 1" = 50'

- Vertical Magnetic Contour plan 1" = 200'
- Electromagnetic profiles -
  - In-line 1" = 200'
  - Broadside 1" = 200'
- Induced Polarization -  
Line 62+000 1" = 300'
- Soils assay plans -  
Cu, Pb, Zn & Sn 1" = 200'

Temma

- Geology plan 1" = 100'
- Drill Hole Sections -
  - T-301 1" = 50'
  - T-302 1" = 50'
- Vertical Magnetic Contour plan 1" = 100'
- Electromagnetic profiles -  
Broadside 1" = 100'
- Soils assay sheets -  
Cu, Pb, Zn, Ni, As 1" = 100'

Wilson River

Nelson River

- Geology plan 1" = 100'
- Drill Hole Section -  
W-301 1" = 50'
- Vertical Magnetic Contour plan 1" = 100'
- Electromagnetic profiles -  
Broadside 1" = 100'
- Soils assay sheets -  
Cu, Pb, Zn, Ni & As 1" = 200'

Copper King  
Copper King

Geology plan 1" = 200'  
Soils assay sheets -  
Cu, Pb, Zn, & Ni 1" = 200'

Stream Sediment Maps

Stream sediment sample location maps and accompanying overlay sheets for the following -

Sheet	Scale
Sierra River	1" = 1 mile
Conical Rocks	1" = 1 mile
Sandy Cape	1" = 1 mile
Sophia	1" = 1 mile
Trouette A	1" = 1 mile
B	1" = 1 mile
C	1" = 1 mile
D	1" = 1 mile
W. L. C. { Salmon River	1" = 1 mile
D { Frankland	1" = 1 mile
Valentines Peak B	1" = 1 mile
D	1" = 1 mile
Strahan B	1" = 1 mile
D	1" = 1 mile
Lyell A	1" = 1 mile
C	1" = 1 mile
D	1" = 1 mile
Burnie	1" = 1 mile
Preclenna	1" = 1 mile
Henrietta	1" = 1 mile
Watone	1" = 1 mile
St. Valentine's Peak 1/5	1" = 30 chains
Magnet 3/7	1" = 30 chains
4/6	1" = 30 chains

Water Mill Logs

H-101, H-102, H-103 & H-104  
RM-201, RM-202, RM-203, RM-204, RM-205 & RM-206  
T-301 & T-302  
R-401.

Yours very truly,  
PICKANDS WATNER & CO. INTERNATIONAL

*G.M. Bainbridge*  
G.M. BAINBRIDGE

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LIST OF TABLES

<u>Table No.</u>	<u>Title</u>
1	Subdivision of the Rocky Cape Group in the Arthur River - Rapid River Area (see Section 4.3.1)
2	Stratigraphic Correlation in Selected Mine Areas, W. Tasmania (see Section 5.3)

LIST OF FIGURES

<u>Figure No.</u>	<u>Title</u>
1	✓ North West Tasmania. Structural Interpretation of "Younger" Precambrian
2	✓ Distribution of the Precambrian Rocks of Tasmania
3	✓ Geology of the Burnie Sheet 1:250 000 (Tas. Mines Department)
4	✓ Rocky Cape Group - Geological Plan Bluff Point - Trowutta Area (Longman and Matthews, 1962)
5	✓ Projected Profile of the "Younger" Precambrian N.W. Coast, Tasmania (D. Gee, 1965)
6	✓ Regional Cross Section of Structure and Tectonic Environment of the "Younger" Precambrian N.W. Tasmania
7	✓ Structural Trends and Mineral Occurrence in the "Younger" Precambrian of N.W. Tasmania
8	✓ Zeehan Geology Ag-Pb-Zn (from Blissett, 1962)
9	✓ Mt. Bischoff - Plan of Pb-Zn Occurrence
10	✓ Arthur River Anomalies N.W. Tasmania. Drainage Sampling Pb-Zn-Cu (Tv 43)
11	(a) ✓ Major Aeromagnetic Surveys in Tasmania I
	(b) ✓ Major Aeromagnetic Surveys in Tasmania II
	(c) ✓ Electromagnetic (Airborne) Surveys in Tasmania

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LIST OF FIGURES

(cont.)

<u>Figure No.</u>	<u>Title</u>
12	✓ EL 43/70 N.W. Tasmania. Geological and Geochemical Plan (Tv 45)
13	✓ Keith River Prospect. Geology, Geochemistry and Drill Hole Locations (Diagrammatic Plan)
14	✓ Rocky Cape EL 1/77 Prospect Locations (Tv 10)

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TABLE 1

Subdivision of the Rocky Cape Group in the Arthur River -  
Rapid River Area (after Longman and Matthews, 1961)

SMITHTON DOLOMITE

Smithton Dolomite

-----

Rapid River Dolomite - interbedded grey-white dolomite, chert  
cherty slate and chert breccia with mica  
on bedding planes

---- (?unconformity-disconformity)-----transgression----

ROCKY CAPE GROUP

- . Bryant Hill Quartzite (? 600 m) well sorted quartzite, minor lenses of conglomerate, restricted outcrop conformable-gradational.
- . Siltstone sandstone and greywacke (? 600 m) - Salmon River area conformable.
- . Black siltstone and slate (300 m) - strongly contorted, apparently baked rock, fine quartz and sericite, graphite or carbon, iron oxide, cubic pyrite disseminated throughout or in layers with quartz. Ripple marks. Interbedded with black shale and slate are sandstone and greywacke and fine grained schist. Carbonate band present in black shale/slate.
- . Grey siltstone and quartzite (? 1500 m) - impure quartzite - greywacke sandstone in laminated argillite and siltstone. Intraformational slumps, festoon current bedding, sole marks, siltstone pellets, pyrite nodules. (? Balfour, Mt. Bischoff, Interview River correlate).
- . Neasy Formation (? 1500 m) - conformably and gradationally overlies the Keith Metamorphics, shale, slate quartzite, no schist but phyllite present. Dip west 30 to 50°.

-- conformable? -----

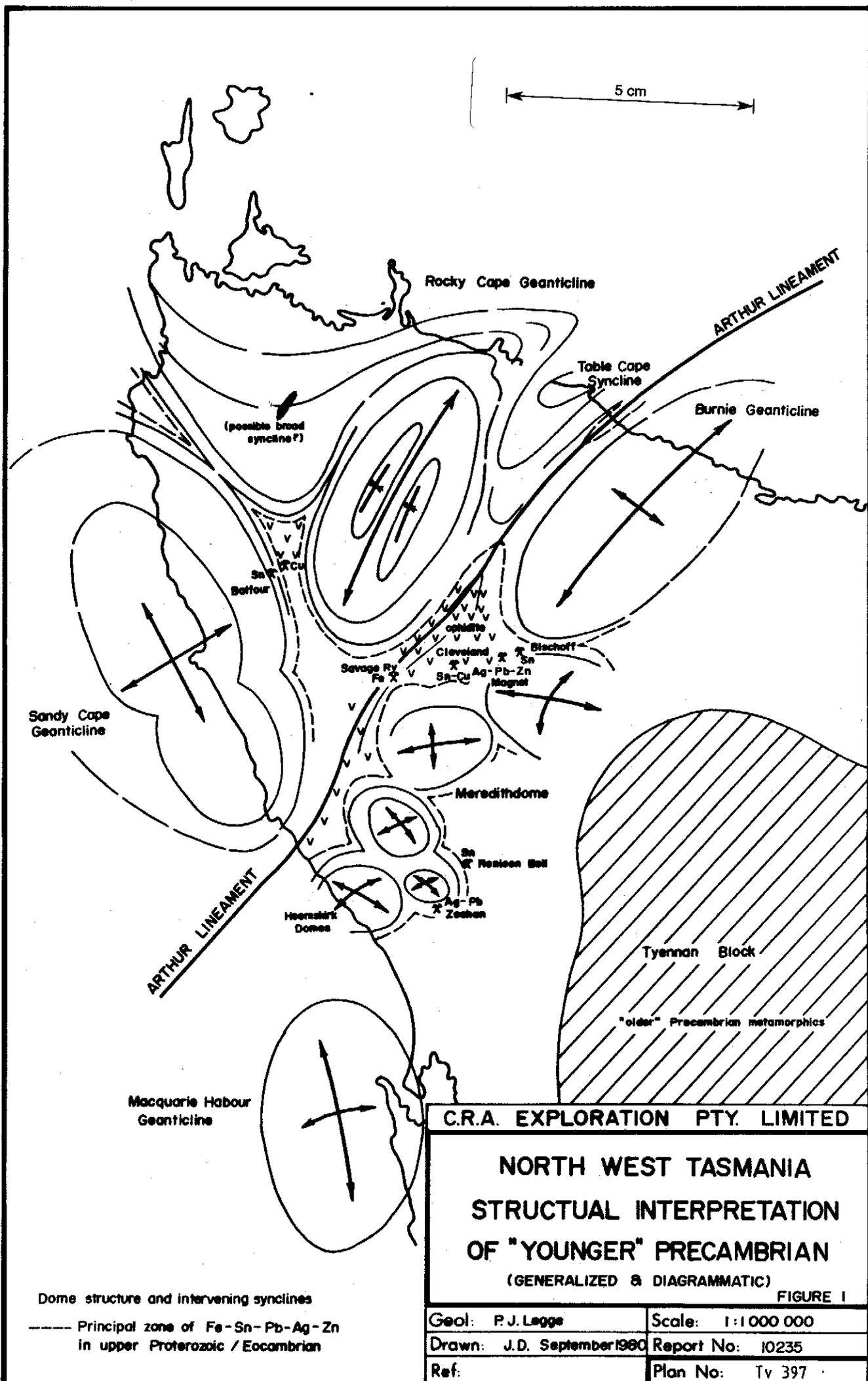
KEITH METAMORPHICS

TABLE 2

Stratigraphic Correlations in Selected Mine Areas, W. Tasmania

<u>CLEVELAND</u> (Ransom & Hunt, 1975)	<u>MAGNET</u> (Cox, 1975)	<u>MT. BISCHOFF</u> -
Upper Precambrian-Lower Cambrian not correlated with Cambrian elsewhere	Cambrian but unfossiliferous	Upper Precambrian
. <u>Basic Volcanic Unit</u> Basalt & tuff & shale serpentinite	. <u>Deep Creek Basic Volcanics</u> - Basalt, tuff, shale, serpentinite - Ag-Pb, Zn	Upper shale and quartzite (? 300 m)
. <u>Argillite</u> - Variegated argillite chert sulphide, sandstone, carbonate - Tin	. <u>Halls Formation</u> Marine shale and chert	Dolomite and dolomite shale (80 m)
. <u>Mica-sandstone</u> Thick bedded, graded, feldspathic	. <u>Crescent Spur Group</u> (180 m) Mica sandstone with shale and chert . <u>Magnet Creek Sandstone</u> Massive greywacke and shale	Quartzite, shale, siltstone (+ 300 m)
?	?	
<u>RENISON BELL</u> (Newnham, 1975) Cambrian <u>Dundas Group</u> <u>Crimson Creek Group</u> . Crimson Creek Argillite (1000m) siltstone, mudstone, sandstone and tuff, turbidity structure . Dolomite, intermediate to felsic tuff, mass sulphide, tin (138m) . Quartzite, shale, mudstone, minor carbonate (500 m) ----- unconformity ? ----- ? -----	<u>ZEEHAN REGION</u> (Both & Williams, 1968) <u>Crimson Creek</u> . Spilitic tuff . Greywacke . Grey-red mudstone . <u>Success Creek Group</u> ----- conformity -----	
(Note: Newnham is the only author to suggest time equivalence of the Oonah and Success Creek)	<u>Oonah Formation</u> Quartzite + lava, dolomite mica quartzite siltstone, black shale	

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Dome structure and intervening synclines  
 ----- Principal zone of Fe-Sn-Pb-Ag-Zn  
 in upper Proterozoic / Eocambrian

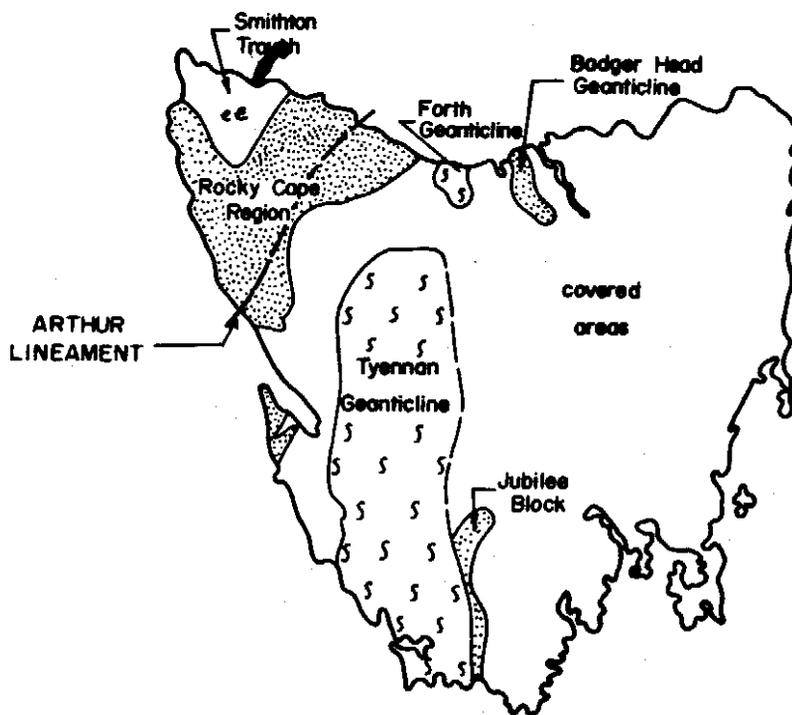
**C.R.A. EXPLORATION PTY. LIMITED**

**NORTH WEST TASMANIA**  
**STRUCTURAL INTERPRETATION**  
**OF "YOUNGER" PRECAMBRIAN**  
 (GENERALIZED & DIAGRAMMATIC)

FIGURE 1

Geol: P.J. Legge	Scale: 1:1 000 000
Drawn: J.D. September 1960	Report No: 10235
Ref:	Plan No: Tv 397

078



5 cm

0 60 km

"older" Precambrian metamorphosed  
 "younger" Precambrian

C.R.A. EXPLORATION PTY. LIMITED	
DISTRIBUTION OF THE PRECAMBRIAN ROCKS OF TASMANIA	
FIGURE 2	
Geol: P.J. Legge	Scale: As shown
Drawn: J.D. Sept. 1980	Report No: 10235
Ref:	Plan No: Tv 393

079

216080

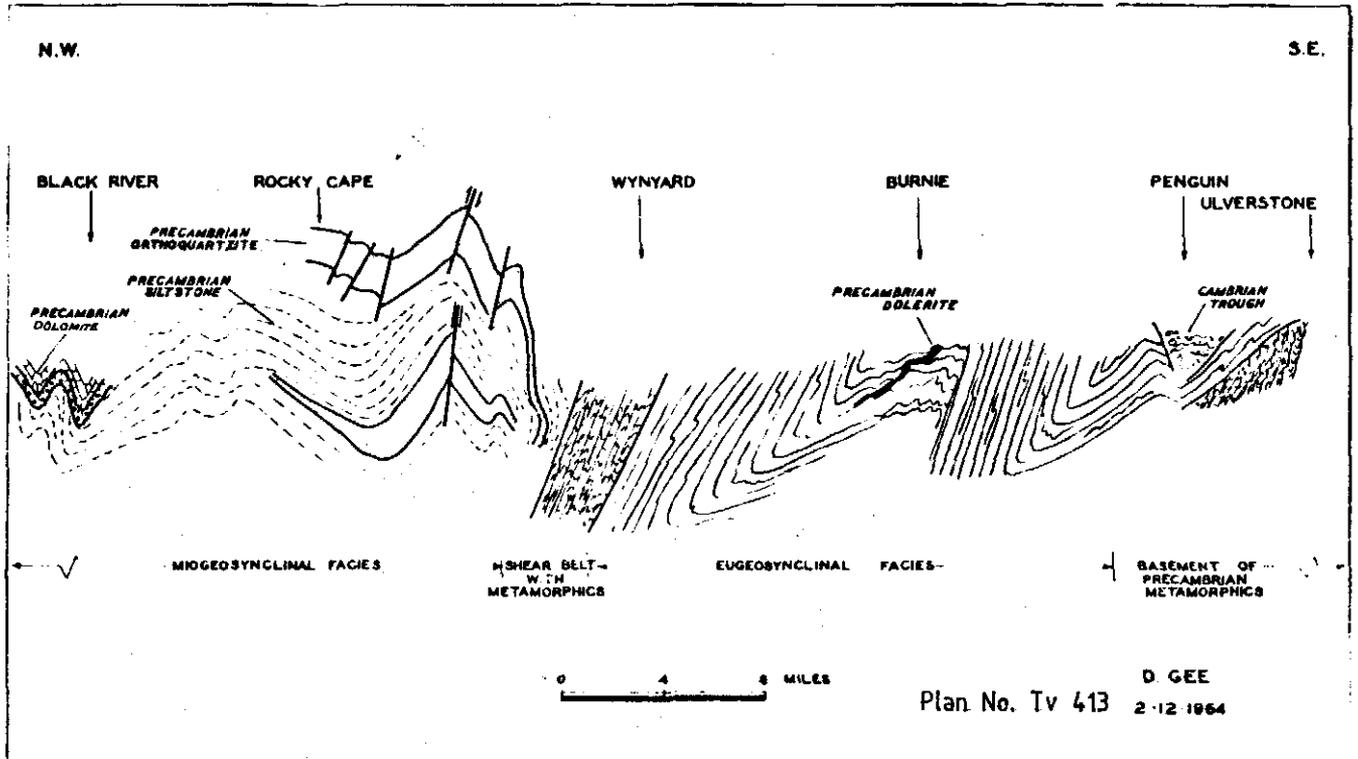


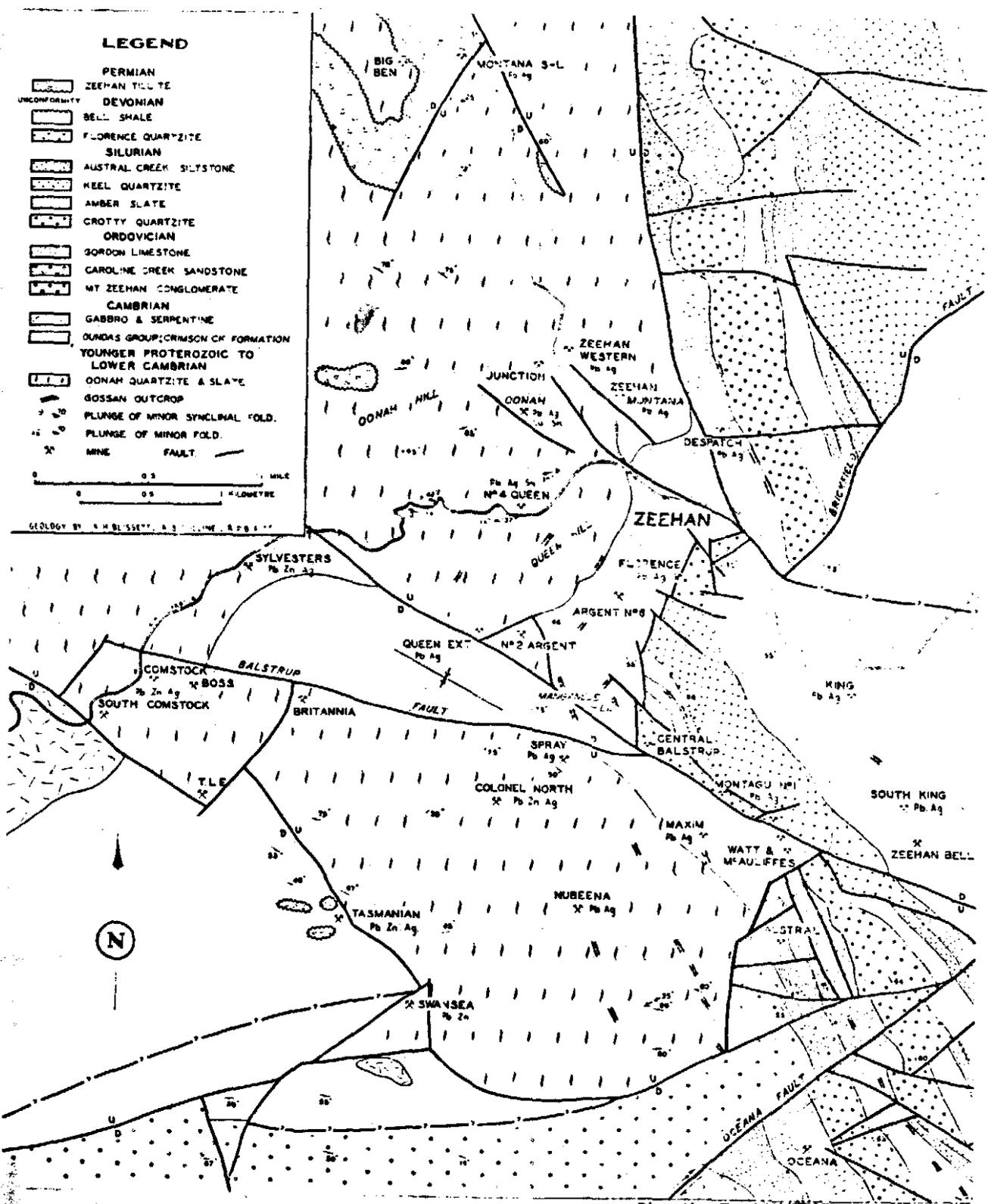
FIGURE 5

080

ZEEHAN GEOLOGY AND Ag-Pb-Zn-Sn OCCURRENCES

(Blissett, 1962)

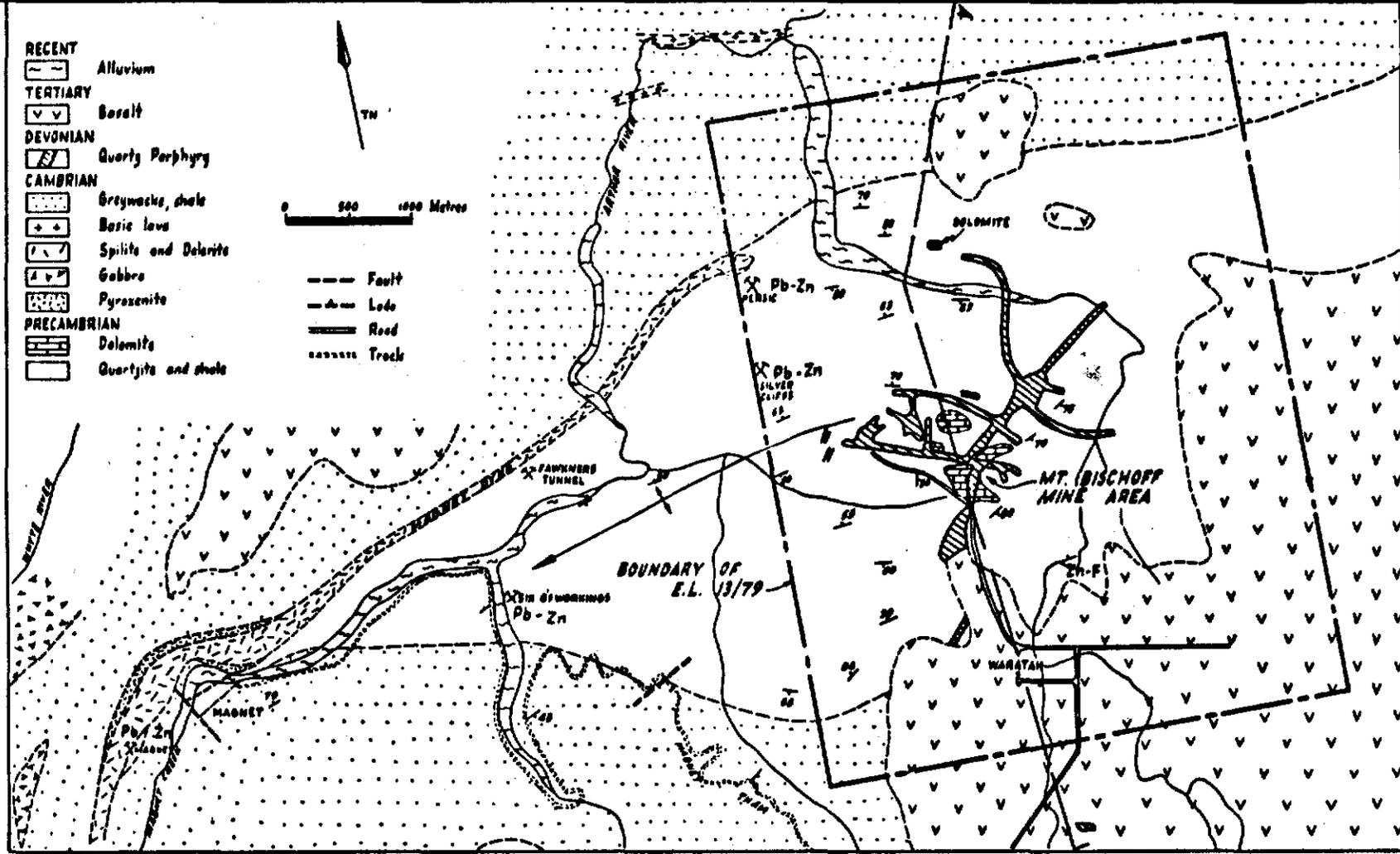
zzzzzz



Plan No. Tv 414

5 cm

FIGURE 8



- RECENT**
- Alluvium
- TERTIARY**
- Basalt
- DEVONIAN**
- Quartz Porphyry
- CAMBRIAN**
- Greywacke, shale
- Basic lava
- Spilite and Dolomite
- Gabbro
- Pyroxenite
- PRECAMBRIAN**
- Dolomite
- Quartzite and shale



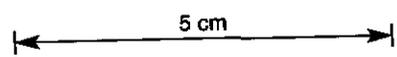
- Fault
- Lode
- Road
- Track

NORTH

SOUTH



SECTION A - B



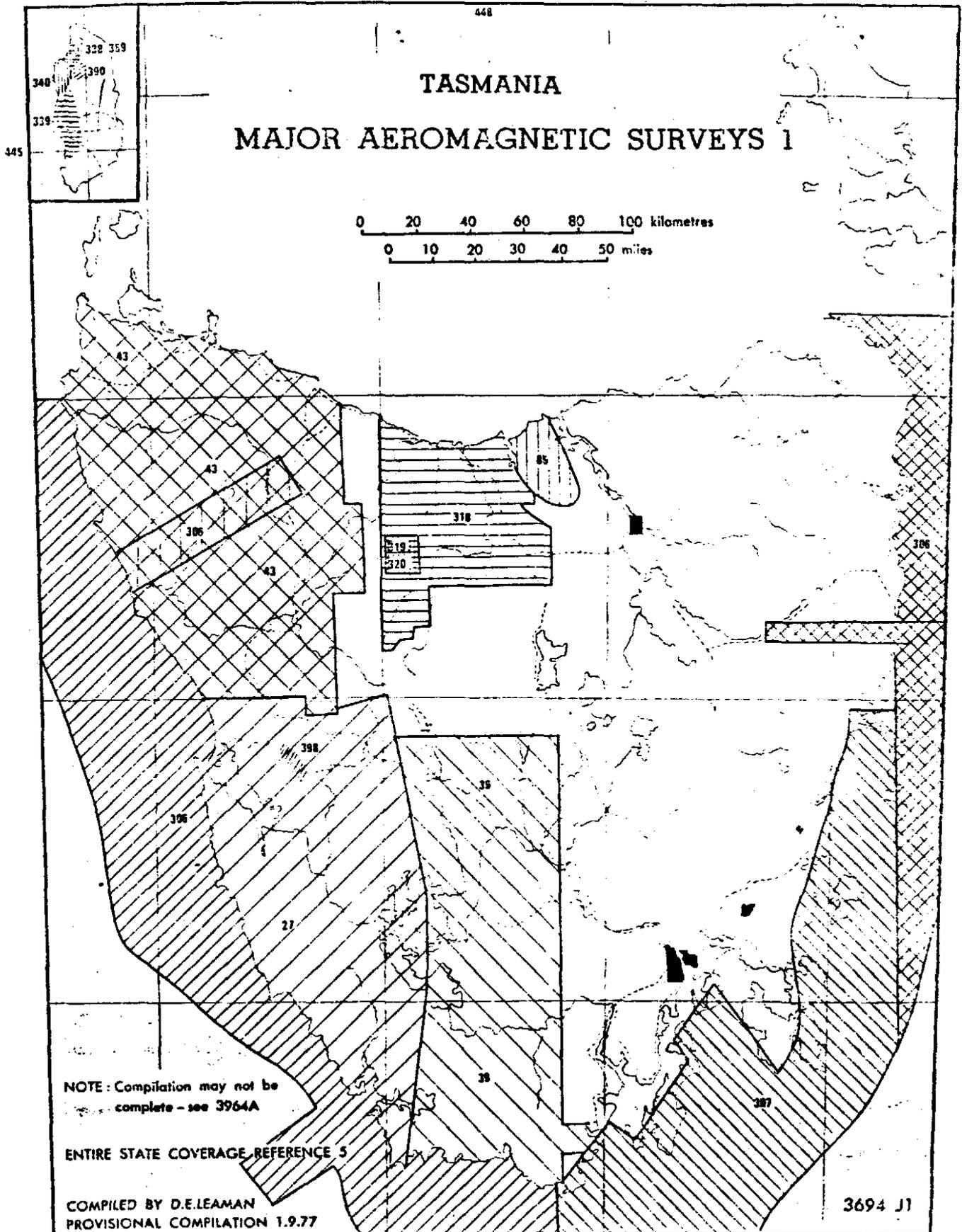
**GEOLOGICAL PLAN**  
**OF THE MT. BISCHOFF AREA**  
 Plan No. Tv 415

216082

PICURE 0

082

216083



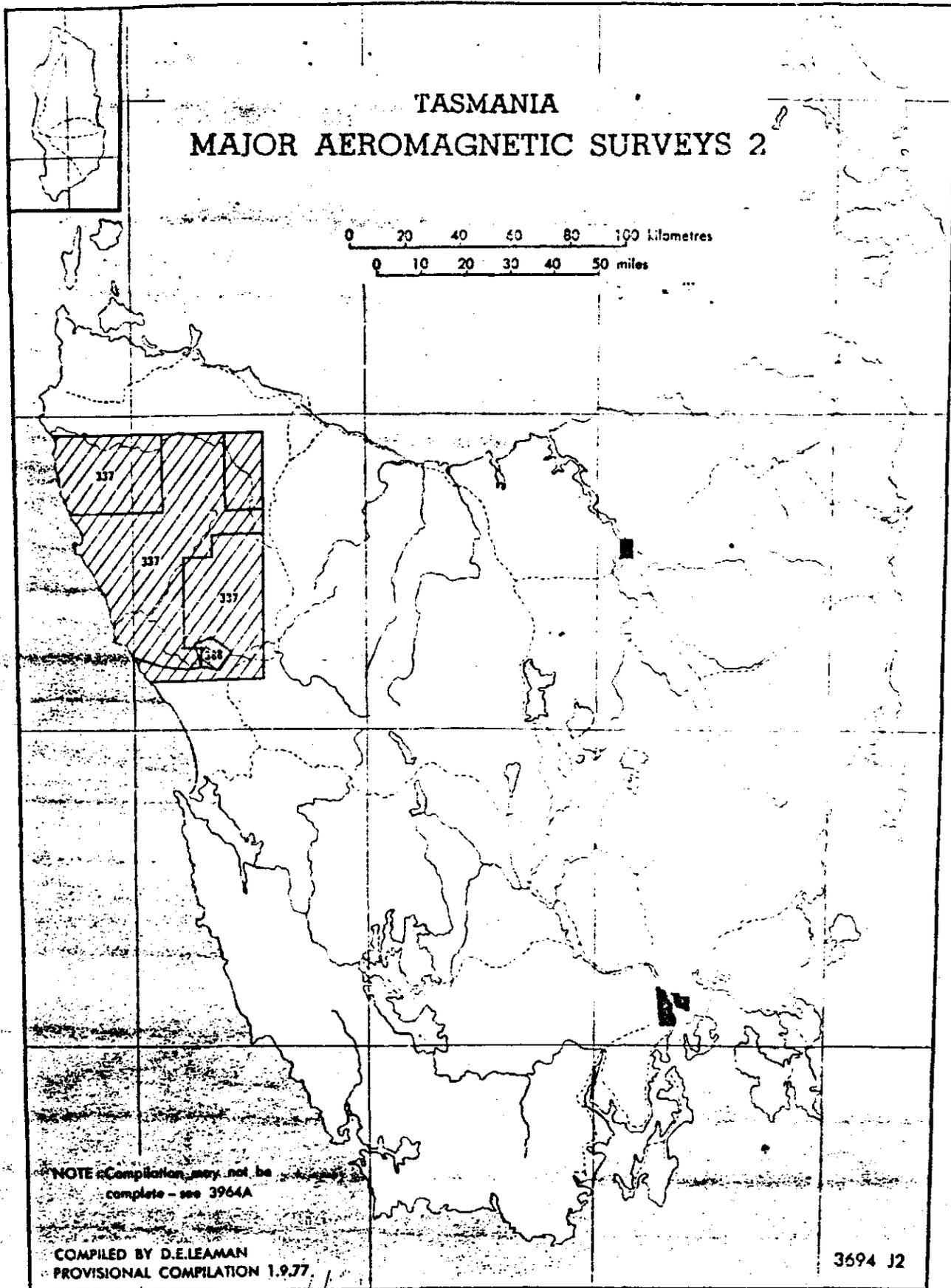
43 - Rio Tinto, 1956

Plan No. Tv 417

5 cm

FIGURE 11a

083



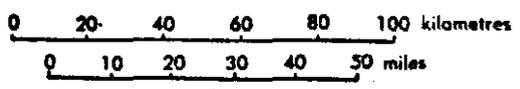
337 Esso - INPUT  
Plan No. Tv 418

5 cm

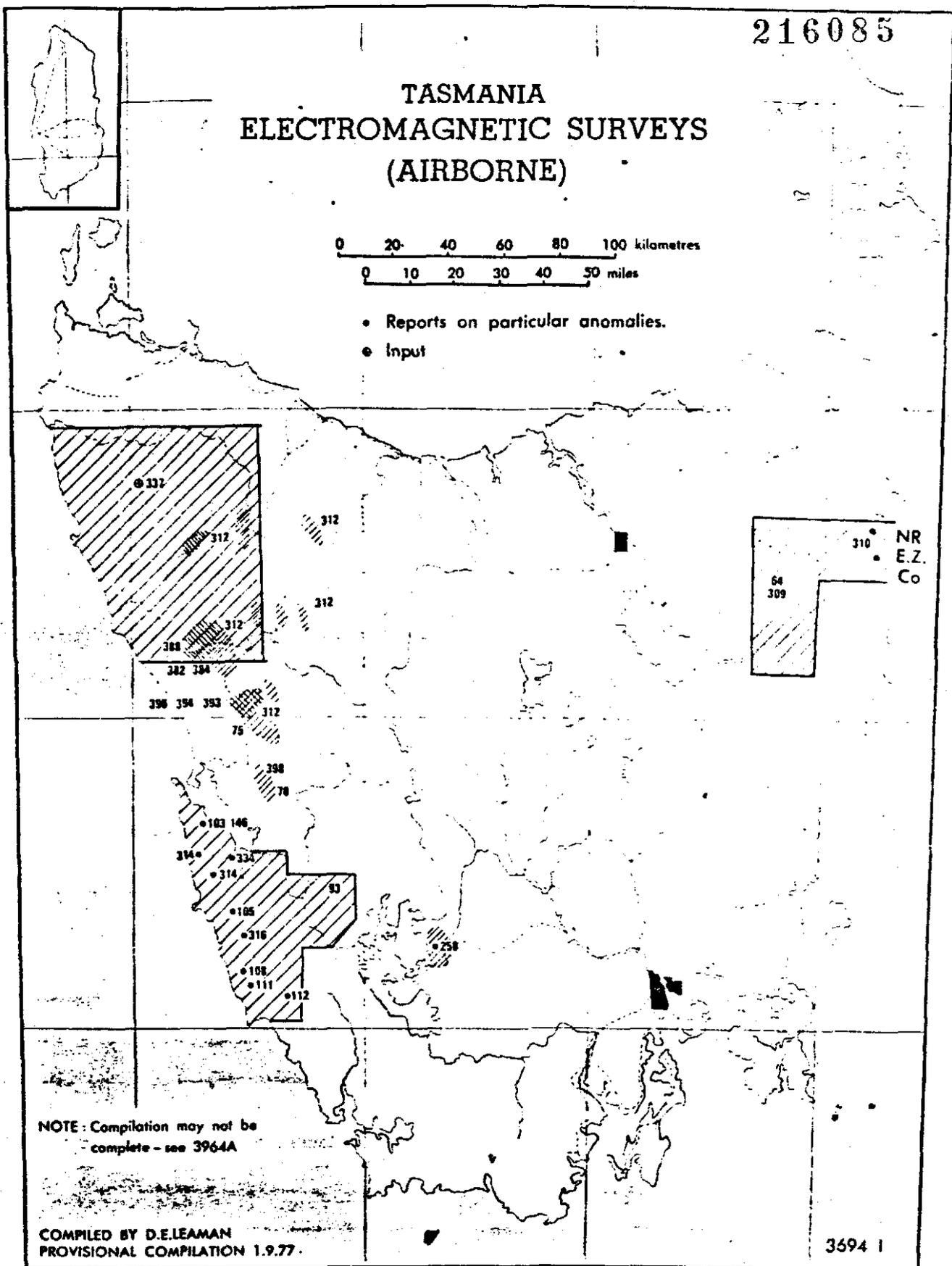
084

216085

# TASMANIA ELECTROMAGNETIC SURVEYS (AIRBORNE)



- Reports on particular anomalies.
- Input



337 Esso - INPUT  
Plan No. Tv 419

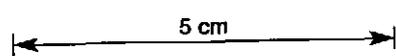
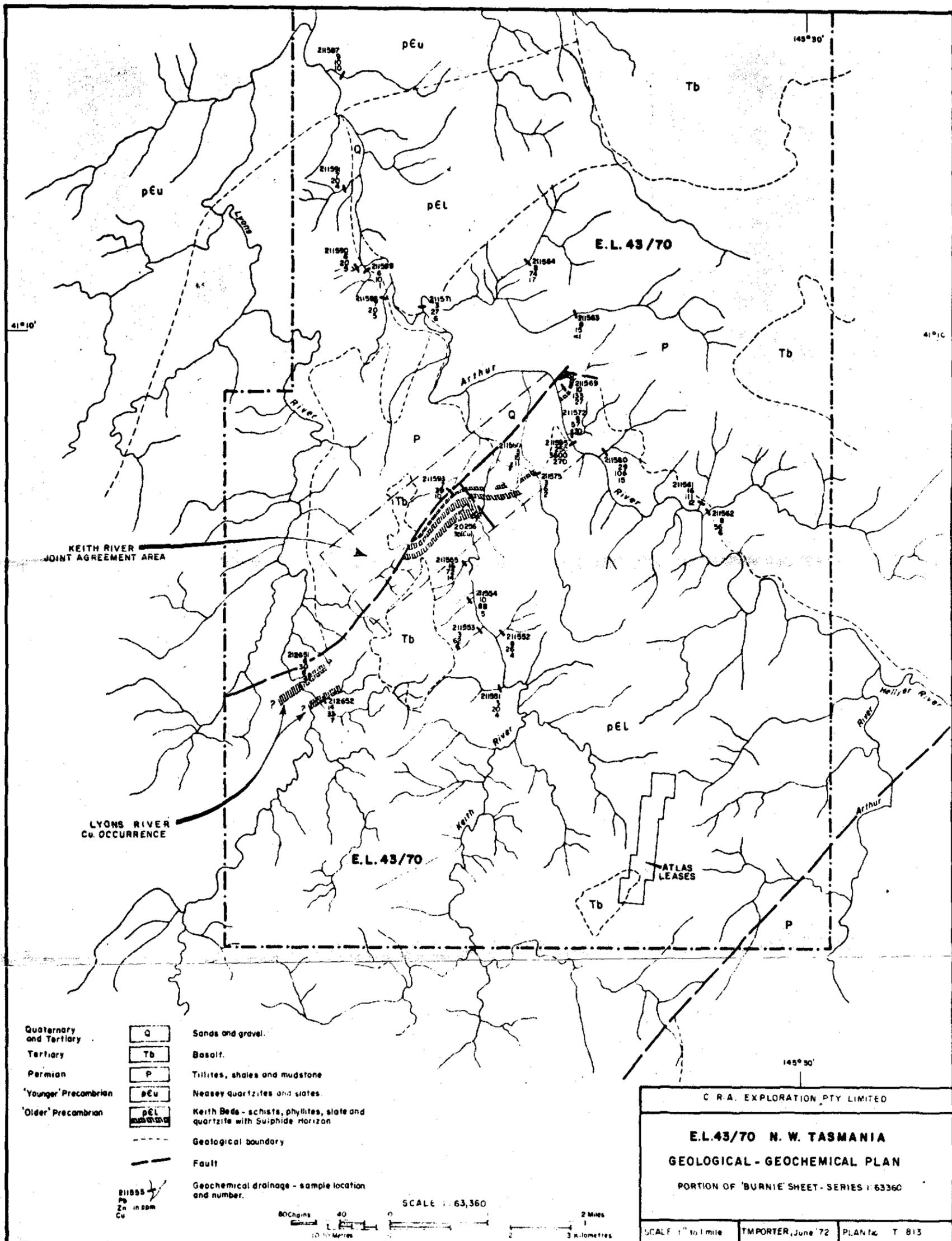


FIGURE IIC



216086

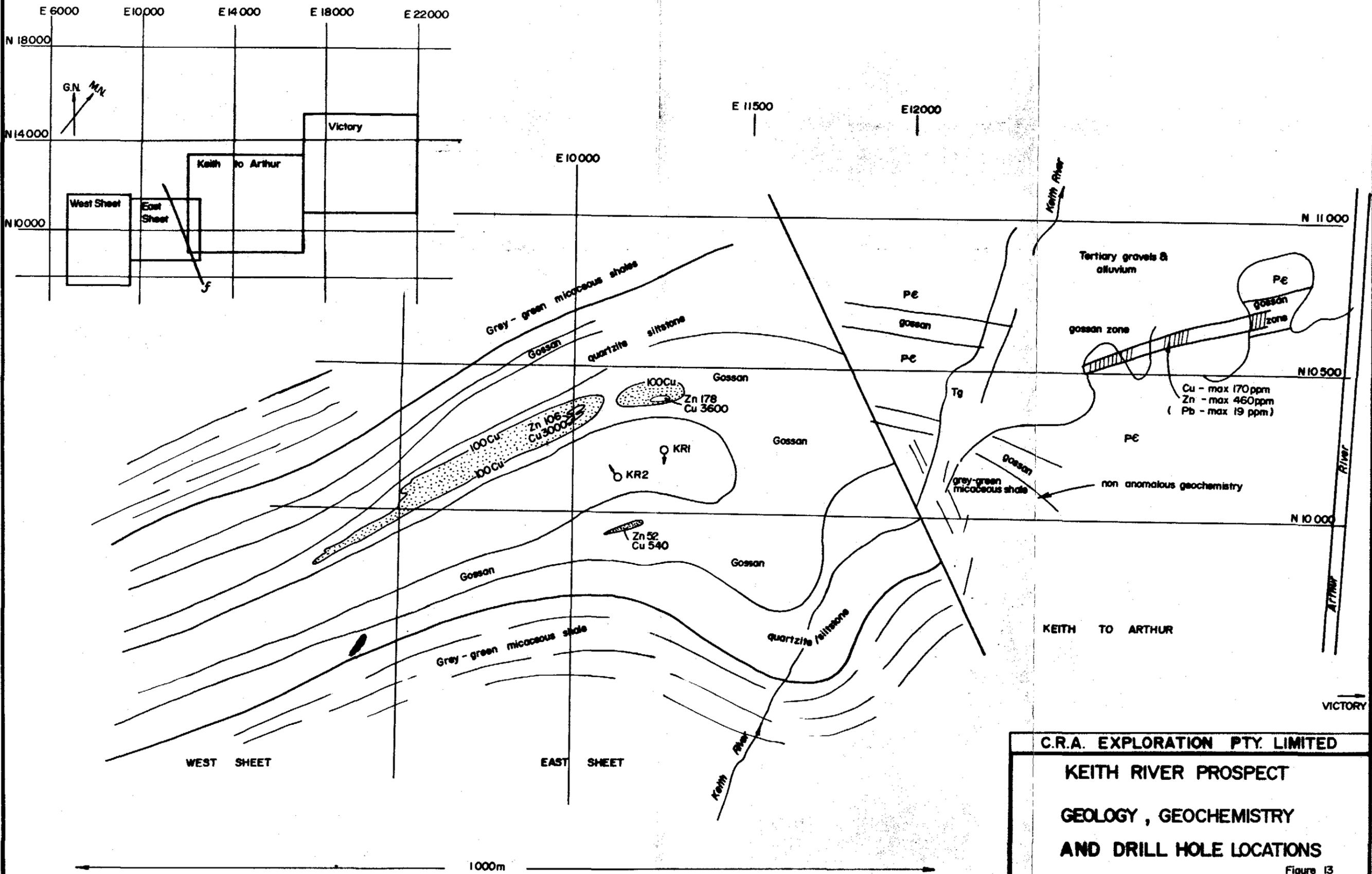
TV.45

5 cm

FIGURE 12

086

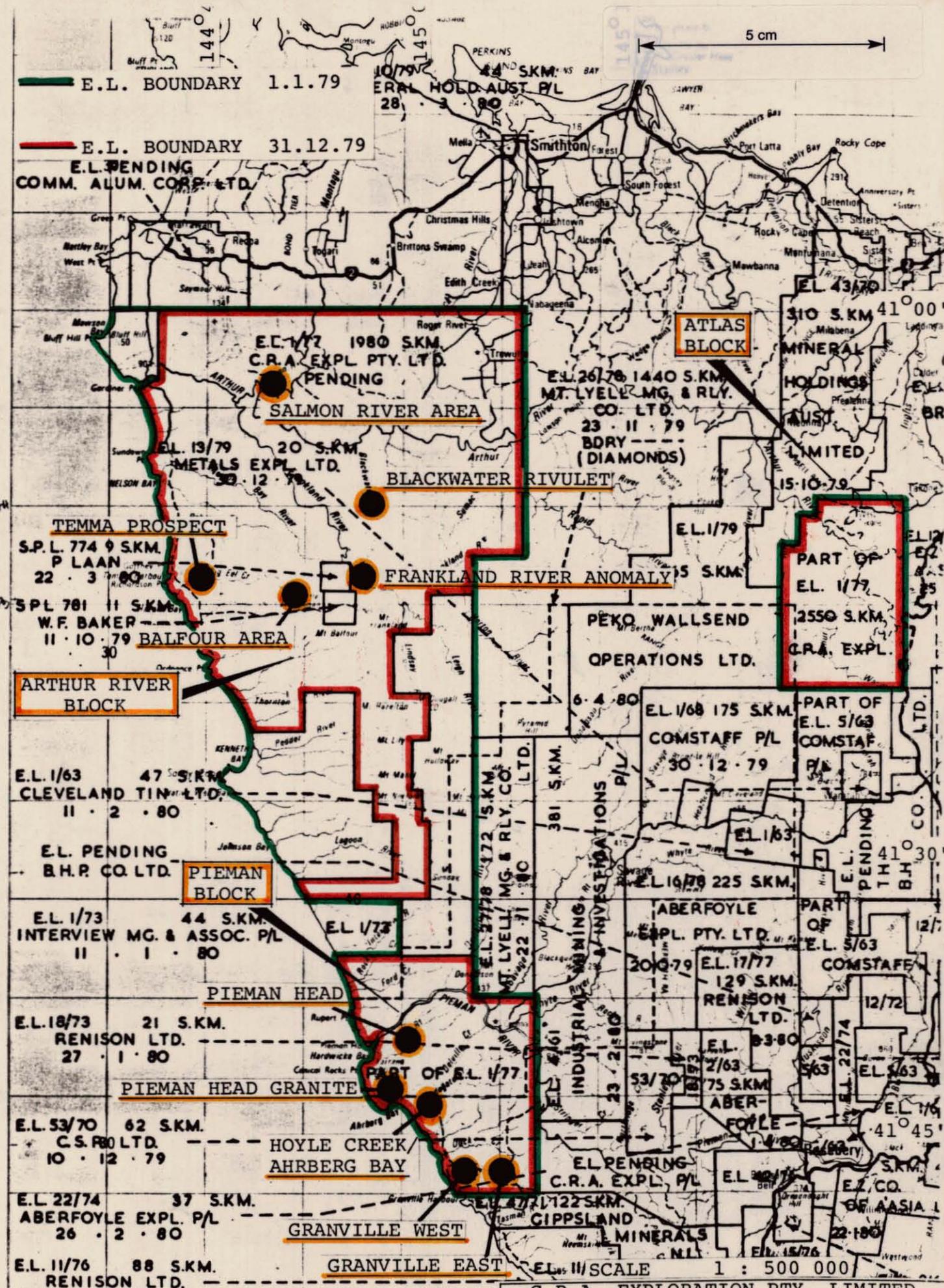
216087



C.R.A. EXPLORATION PTY. LIMITED	
KEITH RIVER PROSPECT	
GEOLOGY, GEOCHEMISTRY	
AND DRILL HOLE LOCATIONS	
Figure 13	
Ref:	Scale: not to scale
Geol: P.J. Legge	Report No: 10235
Drawn: J.D. Sept. 1980	Plan No: Tv. 396

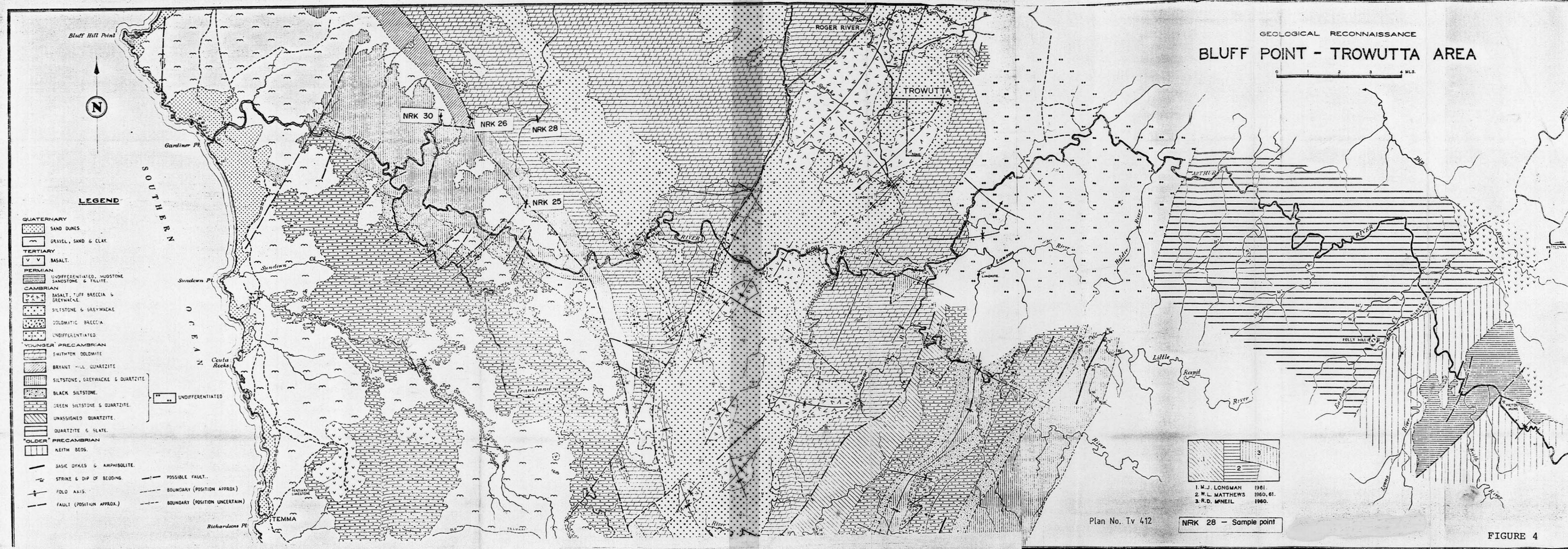
087

216088



C.R.A. EXPLORATION PTY. LIMITED  
 E.L. 1/77 ROCKY CAPE, N.W. TASMANIA  
 PLAN SHOWING PROSPECT LOCATIONS

*[Handwritten signature]*



GEOLOGICAL RECONNAISSANCE  
**BLUFF POINT - TROWUTTA AREA**

0 1 2 3 4 MILES

**LEGEND**

- QUATERNARY
  - SAND DUNES
  - GRAVEL, SAND & CLAY
- TERTIARY
  - BASALT
- PERMIAN
  - UNDIFFERENTIATED, MUDSTONE SANDSTONE & TILLITE
- CAMBRIAN
  - BASALT, TUFF BRECCIA & GREYWACKE
  - SILTSTONE & GREYWACKE
  - DOLOMITIC BRECCIA
  - UNDIFFERENTIATED
- YOUNGER PRECAMBRIAN
  - SMITHTON DOLMITE
  - BRYANT HILL QUARTZITE
  - SILTSTONE, GREYWACKE & QUARTZITE
  - BLACK SILTSTONE
  - GREEN SILTSTONE & QUARTZITE
  - UNASSIGNED QUARTZITE
  - QUARTZITE & SLATE
- OLDER PRECAMBRIAN
  - KEITH BEDS
- BASIC DYKES & AMPHIBOLITE
- STRIKE & DIP OF BEDDING
- FOLD AXIS
- FAULT (POSITION APPROX.)
- POSSIBLE FAULT
- BOUNDARY (POSITION APPROX.)
- BOUNDARY (POSITION UNCERTAIN)



1. M.J. LONGMAN 1981.  
 2. W.L. MATTHEWS 1960, 61.  
 3. R.D. McNEIL 1980.

Plan No. Tv 412

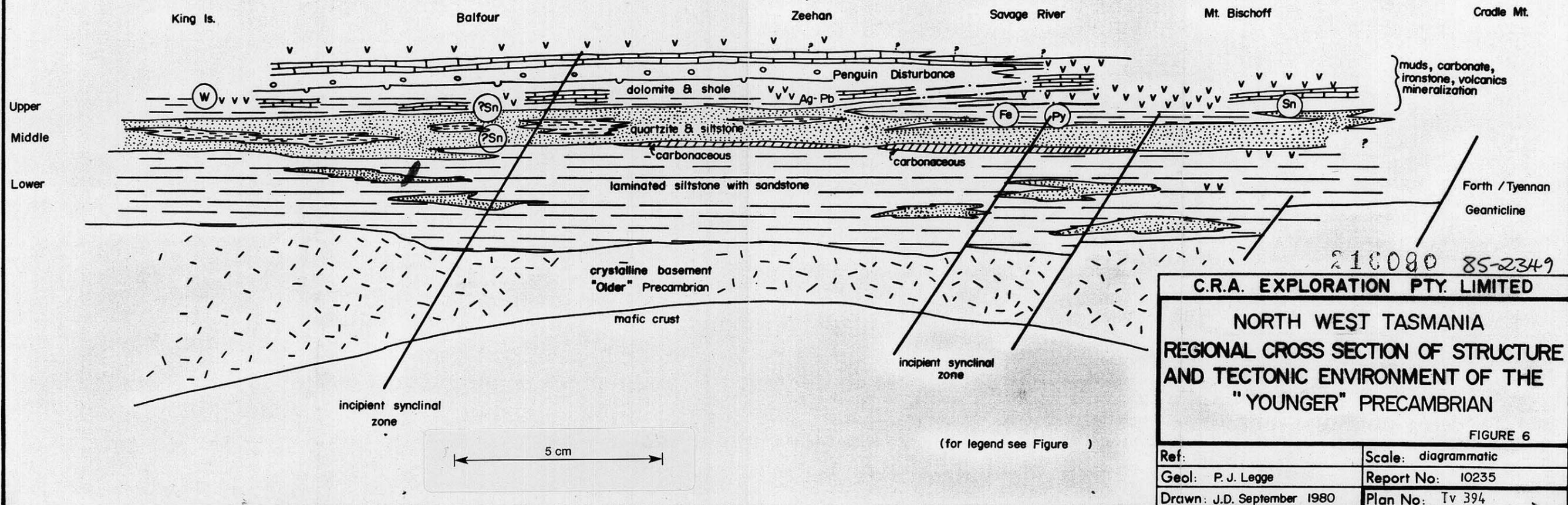
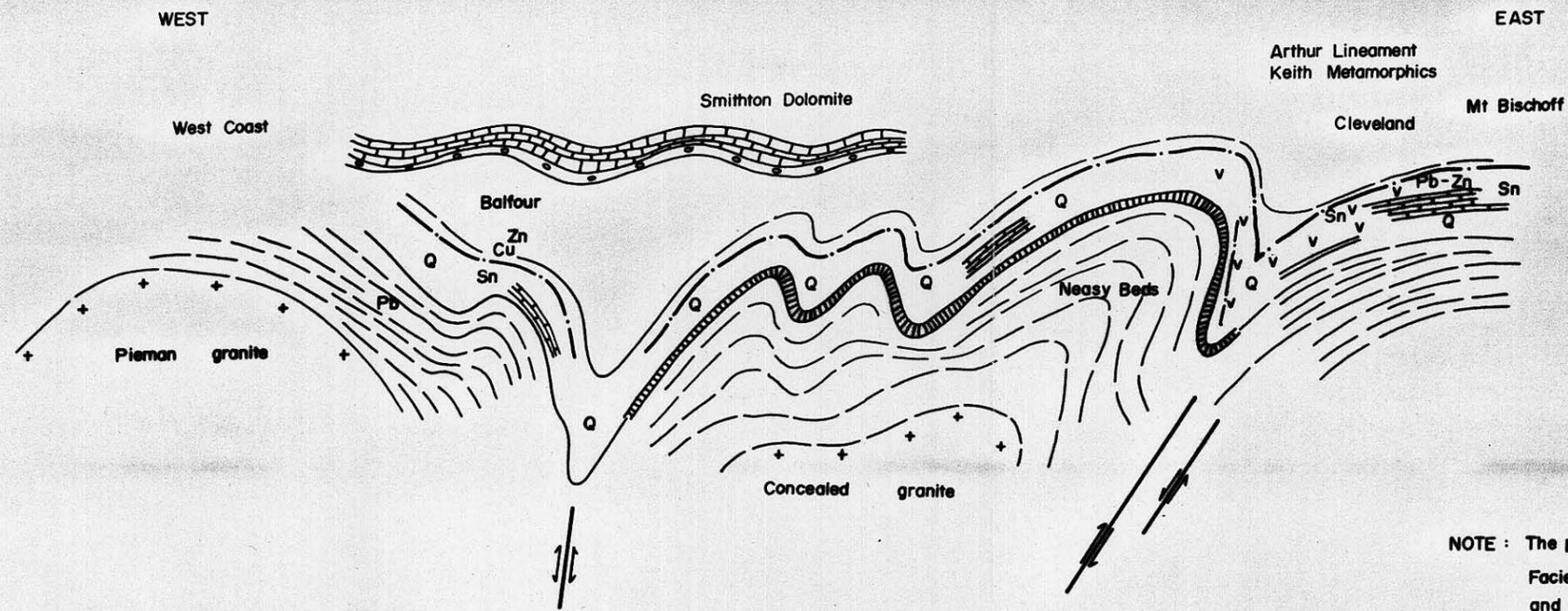
NRK 28 - Sample point

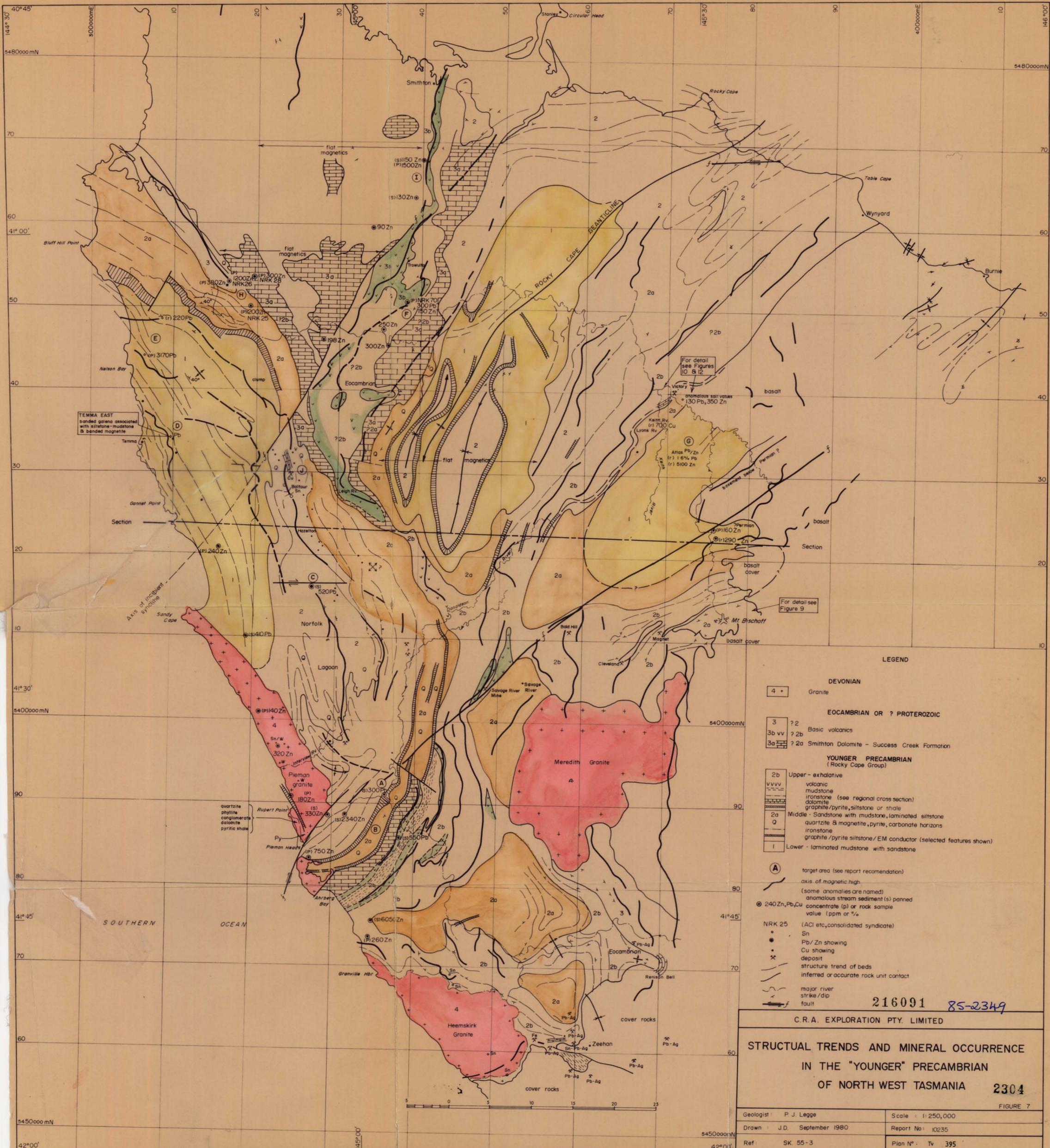
FIGURE 4

85-2349

2302

5 cm





TEMMA EAST  
banded gneiss associated  
with siltstone-mudstone  
& banded magnetite

For detail  
see Figures  
10 & 12

For detail see  
Figure 9

LEGEND

- DEVONIAN**
- 4 + Granite
- EOCAMBRIAN OR ? PROTEROZOIC**
- 3 ? 2 Basic volcanics
  - 3b vv ? 2b
  - 3a ? 2a Smithton Dolomite - Success Creek Formation
- YOUNGER PRECAMBRIAN**  
(Rocky Cape Group)
- 2b Upper - exhalative
    - volcanic mudstone
    - ironstone (see regional cross section)
    - dolomite
    - graphite/pyrite/siltstone or shale
  - 2a Middle - Sandstone with mudstone, laminated siltstone  
quartzite & magnetite, pyrite, carbonate horizons  
ironstone
  - 1 Lower - laminated mudstone with sandstone
- (A) target area (see report recommendation)
- axis of magnetic high  
(some anomalies are named)  
anomalous stream sediment (s) panned
- 240 Zn, Pb, Cu concentrate (p) or rock sample value (ppm or %)
- NRK 25 (ACI etc, consolidated syndicate)
- Sn
  - Pb/Zn showing
  - Cu showing
  - deposit
  - structure trend of beds
  - - - inferred or accurate rock unit contact
  - major river
  - strike/dip
  - fault

216091 85-2349

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STRUCTURAL TRENDS AND MINERAL OCCURRENCE  
IN THE "YOUNGER" PRECAMBRIAN  
OF NORTH WEST TASMANIA 2304

FIGURE 7

Geologist: P. J. Legge	Scale: 1:250,000
Drawn: J.D. September 1980	Report No: 10235
Ref: SK 55-3	Plan No: Tv 395



