894001

OPEN FILE

MICROFILMED
FICHE No.013208-09

PASMINCO EXPLORATION

DIAL RANGE EL 9/92
ANNUAL REPORT

FOR THE YEAR ENDING
JUNE 1994

MINES
FILE REF. EL9/92
- 1 AUG 1994
DOC. REF.
OFFICER | FOR ACTION | FOR INFO.
SEE LETTER
FOLIO 61
DATE

AUTHOR: FG FitzGerald

DATE: July 1994

REPORT No.: T94-5

SUBMITTED TO: Regional Exploration Manager - Tasmania

DISTRIBUTION: Mineral Resources Tasmania - Hobart

Pasminco Exploration - Burnie
- Melbourne
- Rosebery

SUBMITTED BY:

ACCEPTED BY:

BURNIE
JULY 1994

94-3592

894002

CONTENTS

894003

LIST OF FIGURES

LIST OF APPENDICES

LIST OF TABLES

1 SUMMARY

The results of a relatively low key exploration program undertaken during 1993-94 on the Dial Range EL 9/92, building on the work completed during the first year of tenure, have re-defined the exploration potential of the area.

The initial focus of exploration within the tenement was on the potential for the occurrence of volcanogenic polymetallic massive sulphide (Rosebery-Hellyer style) or Cu-Au rich (Mt Lyell style) mineralisation associated with the Cambrian volcanic formations and iron-stones in the area. The Lobster Creek Volcanics are petrographically and chemically similar to the main suite of felsic volcanics within the Mt Read Volcanics of Western Tasmania, however they appear to be all intrusives of dioritic composition that are not associated with widespread hydrothermal alteration. The extent of the Lobster Creek Volcanics, which were emplaced into the "early Cambrian" formations (Motton Spilite-Barrington Chert and Cateena Group-Megabreccia units) appears to be restricted by intrusion of the Devonian Housetop Granite at relatively shallow depths (<1km). It is concluded that the potential for the Lobster Creek Volcanics and related lithologies in the Dial Range area to be associated with significant volcanic hosted massive sulphide mineralisation is relatively low.

The Iron Cliffs massive limonite deposit does not appear to represent the gossanous cap to a massive sulphide deposit. Field investigations and geochemical sampling indicate that the ironstone probably formed by structurally-controlled replacement of the Proterozoic Burnie Formation and part of the adjacent Cambrian lithicwacke unit. Minor base metal mineralisation associated with barite-silica veins at the Iron Cliffs appear to post date the formation of the ironstone and maybe related to a late brittle-ductile deformation event. The spatial association of the ironstone with roof-forms in the Devonian Housetop Granite suggests a possible genetic association with magmatic fluids.

Recent studies of the role of granites in the formation of base metal±Au mineralisation in districts such as Cloncurry and Central Colorado have focussed some attention on the potential for similar style mineralisation in the Dial Range tenement. The Housetop Granite is anomalously dense, magnetic and radiometric in comparison with the other Devonian granitoids in Tasmanian. Several Fe±W±Sn skarn deposits, including Kara, Redwater, Hampshire, Highclere and Natone, are associated with phases of the Housetop Granite. The

potential for the Granite to be associated with economic base metal rich skarn, manto and metasomatic replacement deposits should be investigated.

Exploration expenditure during the twelve months to June 1994 on EL 9/92 was **$22 223,** bringing the total expenditure on the tenement since its inception, on 24 June 1992, to **$155 315.**

2 INTRODUCTION

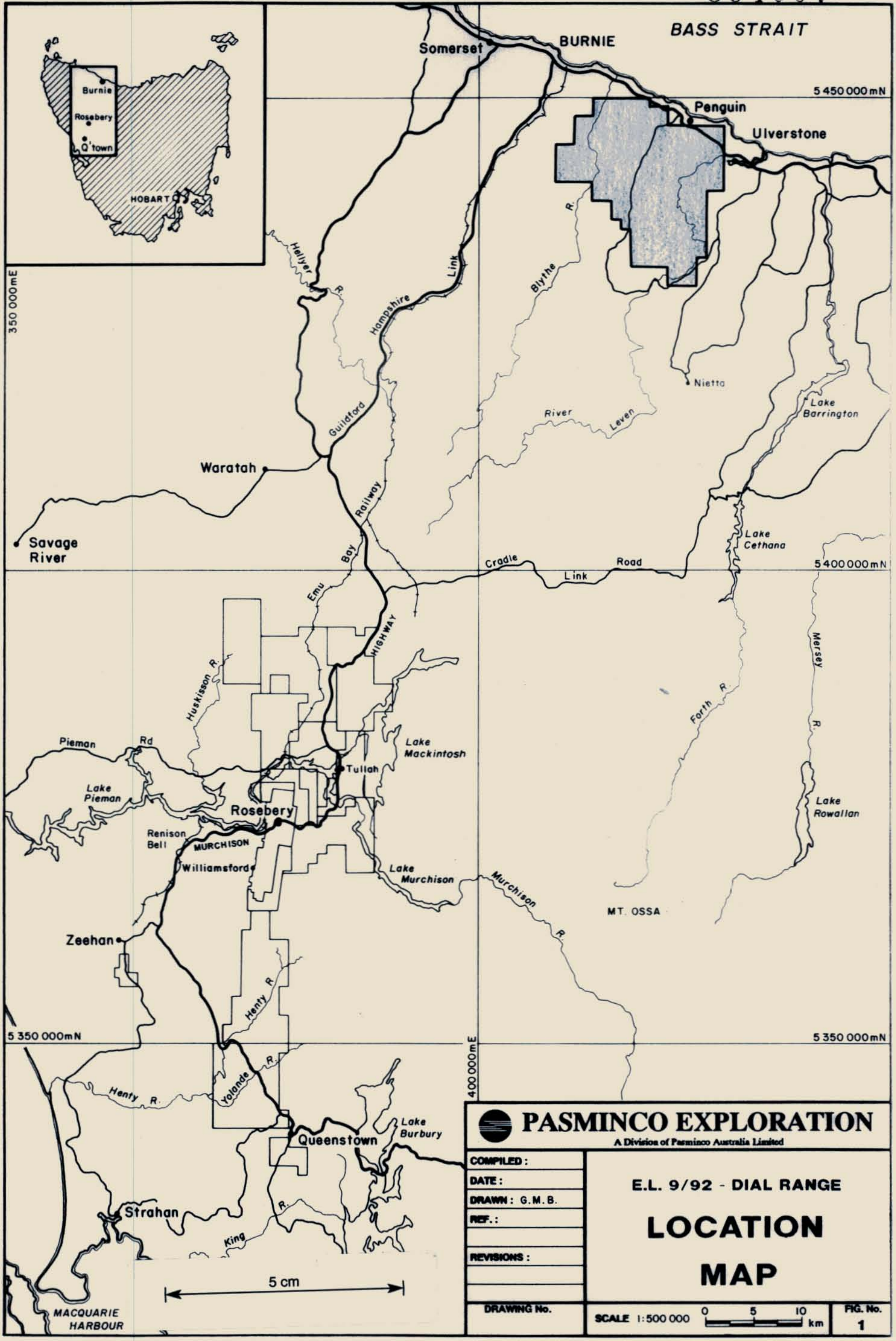
This is the second Annual Report for Exploration Licence 9/92, in the Dial Range area of northwestern Tasmania. The report details work undertaken during the period July 1993 to June 1994. Field activities during this period have been quite limited, following a re-assessment of the exploration potential of the area, based on the results from the 1992–93 program. Work has been restricted to: low key mapping and sampling along the Iron Cliffs prospect; lithogeochemistry of the principal volcanic units and preliminary processing and interpretation of the airborne radiometric data. In addition, new geological models for styles of economic mineralisation other than VHMS, have been investigated.

The tenement, which covers an area of 220km^2, is located 10km SE of Burnie, stretching south from Sulphur Creek and Penguin on the NW Coast to South Riana – Gunns Plains (See Figure 1). The topography of the area is dominated by the north–trending Dial Range, a heavily timbered and rugged range of hills up to 681m in elevation, which occur through the central and eastern part of the licence. Away from the Dial Range, a Tertiary basalt plateau has been deeply dissected by several major north–trending drainages, especially the Leven, Blythe and Emu River systems.

The area is well served with access from a network of secondary roads and country lanes south of the Bass Highway.

Most of the land is used for agriculture, outside the Dial Range and steeply incised valleys, with intensive cropping and grazing being the principal activity. Pasminco is sensitive to the commercial interests of the land holders and all exploration has been undertaken in close co-operation with them to minimise any disruption of their activities.

894007



PASMINCO EXPLORATION
A Division of Pasminco Australia Limited

COMPILED :
DATE :
DRAWN : G.M.B.
REF. :
REVISIONS :
DRAWING No.

E.L. 9/92 - DIAL RANGE

LOCATION MAP

SCALE 1:500 000 0 5 10 km

FIG. No. 1

3 TENURE

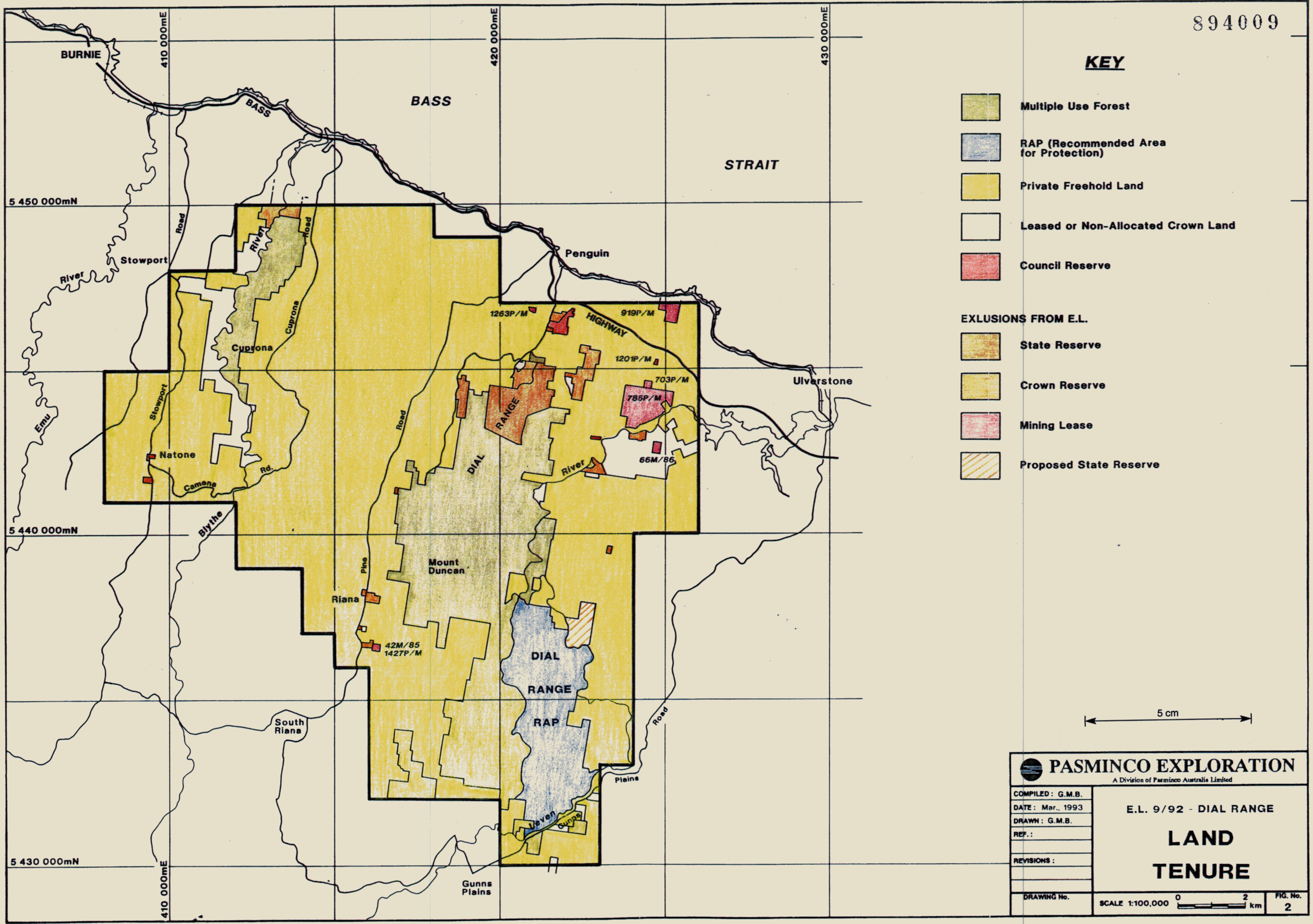
Exploration Licence 9/92 was issued to Pasminco Australia Limited on 25 July 1992, for a period of 12 months. The licence was renewed in 1993 for a further year. The area of the tenement is 211km^2. The schedule of the licence area is given in AMG coordinates in Appendix A. Pasminco Exploration, a division of Pasminco Australia Limited manage all exploration undertaken on EL 9/92.

The licence area excludes the following Reserves and Leases (see Figure 2):

- i Mt Montgomery State Reserve – 229ha
- ii Ferndene State Reserve – 36ha
- iii Mining Leases – 200ha
- iv Crown Reserve – 3km^2
- v Proposed Sith Cala State Reserve – 0.8km^2

The land tenure of the area comprises predominantly Private Freehold Land and State Forest, as Multiple Use Forest and Recommended Area for Protection (the Dial Range RAP) (see Figure 2). Small areas of Leased or Non-allocated Crown Land are also included in the tenement.

Pasminco has lodged an application for the renewal of EL 9/92 for a further 12 month period from 24 July 1994.



894009
KEY
Multiple Use Forest
RAP (Recommended Area for Protection)
Private Freehold Land
Leased or Non-Allocated Crown Land
Council Reserve
EXLUSIONS FROM E.L.
State Reserve
Crown Reserve
Mining Lease
Proposed State Reserve
5 cm
PASMINCO EXPLORATION
A Division of Pasminco Australia Limited
COMPILED : G.M.B.
DATE : Mar., 1993
DRAWN : G.M.B.
REF. :
REVISIONS :
DRAWING No.
E.L. 9/92 - DIAL RANGE
LAND
TENURE
SCALE 1:100,000
0 2 km
FIG. No.
2
410 000mE
420 000mE
430 000mE
5 450 000mN
5 440 000mN
5 430 000mN
BURNIE
BASS
STRAIT
BASS HIGHWAY
Penguin
Ulverstone
Stowport
Cuprona
Natone
Riana
South Riana
Gunns Plains
Mount Duncan
DIAL RANGE
DIAL RANGE RAP
Emu River
Blythe
Camena Rd.
Cuprona Road
Stowport Road
Pine Road
Plains Road
Leven
Gunns
River
1263P/M
919P/M
1201P/M
703P/M
785P/M
66M/86
42M/85
1427P/M

4 REGIONAL GEOLOGY

The geology in the region of the Dial Range tenement spans a large part of the geological record, present in Tasmania (see Figure 3). The published geology sheets (Sheffield, Devonport & Burnie) date from mapping in the late 1950's and 1960's by the Geological Survey of Tasmania (Jenning's et al, 1959, Burns, 1963 and Gee, 1967). Whilst these map sheets, and accompanying explanatory notes, are dated and clearly require some revision, especially of the stratigraphy (FitzGerald, 1993), they still provide a very useful framework to understand the geology of the region.

The oldest rocks exposed in the area are Proterozoic metasediments. They have been assigned to a younger and an older sequence, largely on the basis of metamorphic grade and intensity of structural deformation (eg. Burns, 1964). The latter, the Ulverstone Metamorphic Complex, is comprised of poly–deformed greenschist facies meta quartzite, mica schist and stretched pebble conglomerate, structurally concordantly overlying the Forth Metamorphic Complex comprised of higher grade meta–quartzite, garnet–albite–kyanite (?) schists and amphibolite. The inferred younger sequence, the Burnie Formation, is composed of relatively un–metamorphosed poly–deformed turbiditic quartz wackes and mudstones, which structurally overlie the Ulverstone Metamorphic Complex. Turner (1989) has suggested that the two sequences may not necessarily be significantly different in age, since the shallow–dipping thrust which separates them may have juxtaposed rocks from different tectonic environments.

During the Eo–Cambrian to early Ordovician a series of sediments, volcanics and intrusives were deposited or emplaced in a tectonically active belt, called the Dial Range Trough (Burns, 1964). Burns described the Trough as a meridional belt, approximately 5km wide on the north coast increasing in width to the south where it appears to be continuous with the Dundas and Fossey Mountain Troughs. The stratigraphic relationship between the different units is complicated by inferred structural repetition along multiple thrust faults. In fact the original architecture of the Dial Range Trough has been largely obscured by later deformations. Crawford (in FitzGerald, 1993) suggests that the trough developed following uplift and collapse of a passive continental margin to form a foredeep during a mid–Cambrian tectonic collision event.

894011

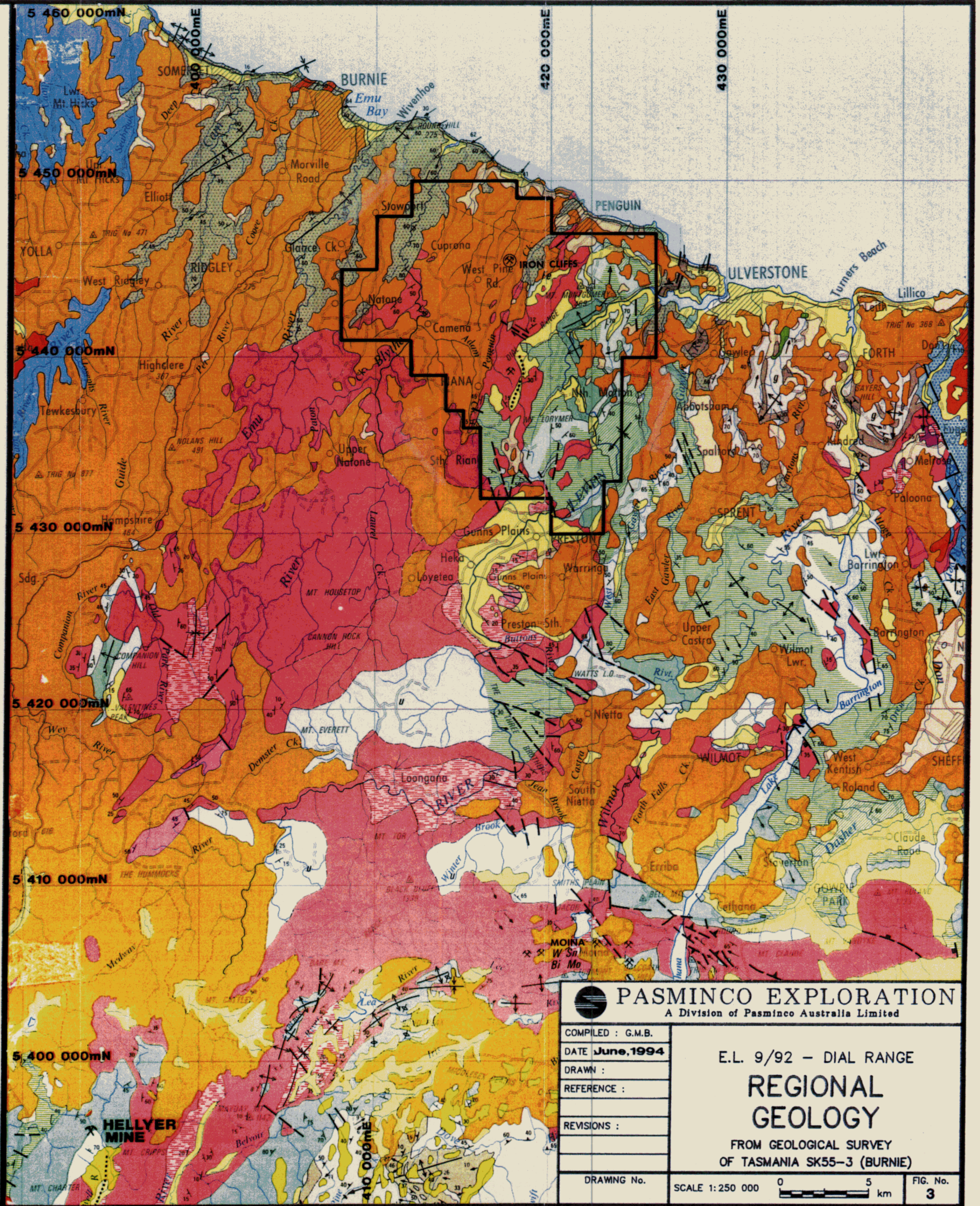
LEGEND

HOLOCENE	u	Alluvium, sand, gravel and talus.
PLEISTOCENE		Till, fluvioglacial, periglacial and associated deposits.
		Errosional surface.
TERTIARY	u	Non–marine sequences (light); marine limestone (dark); basalt and related igneous rock types (orange).
		Low angle unconformity.
TRIASSIC	u	Fluvio–lacustrine sequences of sandstone, siltstone, mudstone (light) with carbonaceous sequences indicated (dark). Fresh water sequence with some coal measures.
PERMIAN	u′	Upper glacio–marine sequence of pebbly mudstone, pebbly sandstone and limestone. Fresh water sequence with some coal measures.
UPPER CARBONIFEROUS		Lower glacio–marine sequence of pebbly mudstone, pebbly sandstone, minor limestone, Tasmanite oil shale and basal tillite.
UPPER – MIDDLE DEVONIAN		Terrestial cavern fillings.
		Unconformity attributed to Tabberabberan Orogeny.
LOWER DEVONIAN – SILURIAN	u	Some quartzwacke sequences (dark) and siltstone–shale sequences (light) indicated; Devonian limestone–siltstone (horizontally lined over–print).
ORDOVICIAN	u	Limestone sequence. Siliceous terrestrial conglomerate, marine quartzwacke and siltstone.
		Unconformity in northern Tasmania and parts of western Tasmania attributed to Cambrian movements; apparent conformity in Adamsfield region and parts of western Tasmania.
CAMBRIAN	u	Middle–Upper Cambrian fossiliferous usually greywacke turbidite sequences (horizontally lined overprint); acid with intermediate volcanic and associated rocks dominant (dark), and horizon with fossiliferous Upper Cambrian shallow water deposits (vertically lined overprint); basic–intermediate volcanic and associated rocks dominant (diagonally lined overprint); probably Cambrian unfossiliferous usually greywacke turbidite sequences (light); probably Cambrian unfossiliferous orthoquartzite sequence (dotted).
		Usually unconformity attributed to Penguin Orogeny but apparent conformity at Smithton and Pieman River.
PRECAMBRIAN	u, u′	Comparatively unmetamorphosed sequences. Mudstone–sandstone sequences (u′) – dominantly mudstone (light), dominantly orthoquartzite (dark), quartzwacke turbidite successions (small dot over–print), conglomerate (large dot over–print); dolomite (horizontally lined over–print); basalt lava (vertically lined over–print).
	u	Metamorphic rocks. Pelitic sequences (dark); metaquartzite sequences (light) with some platy quartzite units indicated (vertically lined over–print); amphibolite (diagonally lined over–print). Garnet bearing rocks are indicated (g).

5 cm

IGNEOUS ROCKS

TERTIARY	Basalt and related rock types.
JURASSIC	Dolerite and related rock types.
LOWER CARBONIFEROUS – UPPER DEVONIAN	Dominantly adamellite–granite.
CAMBRIAN	Serpentinite, peridotite and associated rocks.
	Acid with intermediate volcanic and associated rocks.
	Basic–intermediate volcanic and associated rocks.



PASMINCO EXPLORATION
A Division of Pasminco Australia Limited

COMPILED : G.M.B.
DATE June, 1994
DRAWN :
REFERENCE :
REVISIONS :
DRAWING No.

E.L. 9/92 – DIAL RANGE

REGIONAL GEOLOGY

FROM GEOLOGICAL SURVEY OF TASMANIA SK55–3 (BURNIE)

SCALE 1: 250 000 0 5 km

FIG. No. 3

The Dial Range Trough fill comprises mixed sequences of orthoquartzites, volcaniclastic sandstones and mudstones, cherts, mudstones and carbonates, serpentines, tholeiitic basalts, felsic to intermediate volcanics and intrusives (see Figure 3). Previous workers have subdivided these into a number of groups and formations including the Motton Spilite, Barrington Chert, Cateena Group, Radfords Creek Group and Lobster Creek Volcanics (see Burns, 1964). However, recent work (FitzGerald, 1993) suggests that many of these subdivisions overlap.

These sequences have been correlated with, or inferred to be equivalent to, different parts of the Eo-Cambrian to Cambrian sedimentation and volcanism in Western Tasmania, including the Success Creek Formation, Crimson Creek Formation, Dundas Group and Mt Read Volcanics. These relationships are summarised in Table 1.

These sequences are unconformably succeeded by a late Cambrian to early Ordovician sedimentary assemblage, correlated with the Denison Group. They include: basal mudstones, sandstones and minor chert conglomerate (Gnomon Mudstone); quartzite and vein quartz pebble to boulder conglomerate (Duncan Conglomerate) and marine quartzose sandstone, with minor conglomerate and shales (Moina Sandstone), at the top. Local angular unconformities occur throughout the Denison Group, indicative of continual uplift of the Precambrian basement, from which most of the detritus was derived.

During the ensuing marine transgression limestone, dolomite and mudstone (Gordon Group) was deposited during the Ordovician, succeeded by shallow marine quartz sandstone, mudstone and minor limestone of the Siluro-Devonian Eldon Group. This period of sedimentation ended with a major polyphase deformation (the Tabberabberan Orogeny) in the middle-late Devonian. Syn to post-kinematic granitiods were emplaced, intruding rocks from Precambrian to early Devonian in age. The partially eroded Housetop Granite forms the largest such body in the Dial Range area. Recent geophysical interpretations suggest that much of the underlying stratigraphy in the area of EL 9/92 has been stoped-out by the granite (Leaman in FitzGerald 1993).

TABLE 1.

STRATIGRAPHIC RELATIONSHIPS DIAL RANGE AREA & WESTERN TASMANIA

AGE	DIAL RANGE AREA	WESTERN TASMANIA	REFERENCE
Early Ordovician -Late Cambrian	Moina Sandstone Duncan Conglomerate Gnomon Mudstone	Owen Conglomerate	Banks, 1989
Late Cambrian	Radfords Creek Croup including: Kerrison, Wilsonia, Applebee Volcanics	Tyndall Group- Southwell Subgroup Upper Dundas Group	Crawford, 1993* Brown, 1989
Late middle-early late Cambrian	Lobster Creek Volcanics	Mt Read Volcanics	Crawford, 1993*
Late middle Cambrian	Cateena Group including Beecraft & Teatree Point Megabreccias	Lower Dundas Group	Brown, 1989
Eo-Cambrian	Motton Spilite	Crimson Creek Formation	Brown, 1989
Eo-Cambrian	Barrington Chert	Success Creek Croup	Jennings et al, 1959
Upper Proterozoic	Burnie Formation	Oonah Formation	Turner, 1989
Precambrian ?	Ulverstone Metamorphics Forth Metamorphics	?	

*Crawford: Appendix C in FitzGerald, 1993

834013

The last part of the geological record preserved in the Dial Range region consists of terrestrial sands, gravels, silts and clays, which are locally indurated and deposited in deep leads during the Tertiary (Burns, 1964). These are overlain by Tertiary olivine basalt lava flows, which forms an extensive cover of the prospective Palaeozoic sequence in the area. The rich agricultural land is largely developed on soil derived from these basalts. Finally, widespread Quaternary talus and scree deposits, forming predominantly from the Denison Group siliciclastic rocks, and fluviatile alluvium complete the sequence.

5 PREVIOUS EXPLORATION

A comprehensive account of the previous prospecting and mineral exploration activities over the area within the Dial Range tenement was given in last year's Annual Report (FitzGerald, 1993). Briefly, the area has been extensively prospected during the period from the middle of last Century to the early part of this Century, during which time numerous base metal and ferruginous occurrences were discovered (see Figure 4). Very little production was recorded from any of these prospects, the most significant being the iron stones in the Penguin Creek.

Modem exploration, which commenced in the late 1960's, has targeted a range of metals and styles of occurrence from: volcanic hosted massive sulphides; skarns; iron ore; gold and platinoids. Very little significant mineralisation has been discovered as a result of this activity. Perhaps the most important was the Geopeko-Pennzoil copper and tin mineralisation discovered by drilling in the Dial Mine area (Herrmann, 1985). The best drill intersection was 20m at 0.7% Cu (see Table 2).

Exploration by Pasminco during the initial year of tenure on the current licence was focussed on the potential for the Cambrian Lobster Creek Volcanics' to host poymetallic, possibly gold-rich, massive sulphide mineralisation, similar to the Mt Read Volcanics ore deposits. Work included: re-locating, mapping and sampling all old prospects; reconnaissance geology, including petrography to establish a Cambrian volcano-stratigraphy; and a high resolution helicopter-bome magnetic and radiometric survey over the entire tenement (FitzGerald, 1993).

The results of this program were disappointing, with no evidence for significant VHMS mineralisation or gold enriched ironstones. Further more the Lobster Creek Volcanics all appear to be dioritic intrusives emplaced late in the Cambrian and thus not directly analogous to the Mt Read Volcanic host rocks. Finally, the Devonian Housetop Granite appears to under-lie the geology of the whole area at quite shallow depth (0-3km), and may be spatially **and** genetically related to most of the mineral showings that are known.

Table 2.

MINERAL EXPLORATION HISTORY EL 9/92 DIAL RANGE AREA

General

1860–1910	Early prospecting, discovery of numerous of small base metal shows, mostly small scale to no production apart from 1331t of copper ore from the Copper King Mine and 40 000t of haematite from Penguin Creek.
1910–1960	Intermittent prospecting, results in further minor discoveries

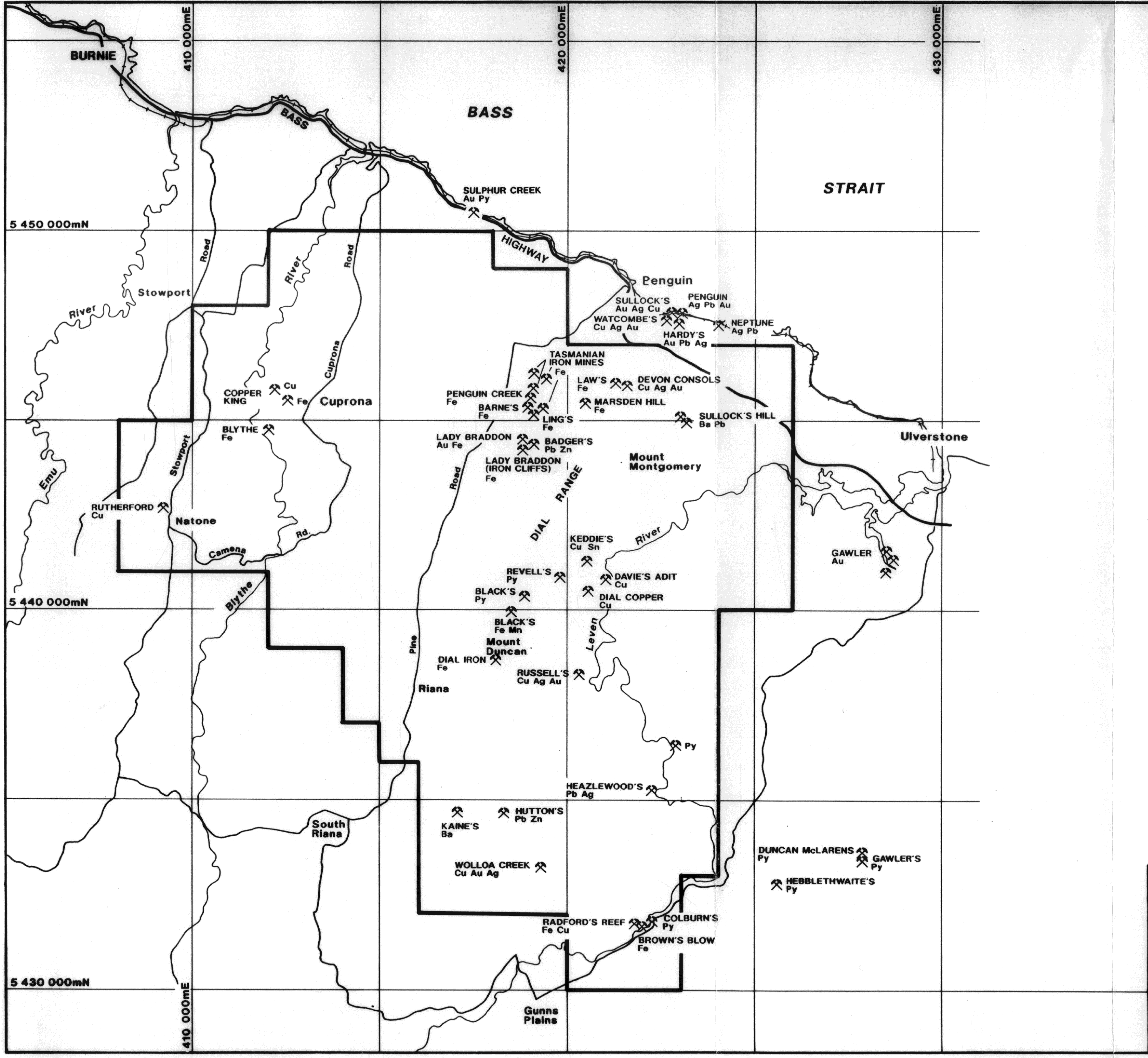
Dial-Leven Area

1960	Mines Department investigated Iron Cliffs occurrence; including drilling 2 short holes, total 123m, no significant mineralisation
1972–73	EL 9/72, 104km^2, Tasminex undertook reconnaissance investigations of old mineral showings with generally disappointing results.
1973–1985	EL 24/73, 106km^2, Pennzoil-Geopeko JV, extensive exploration including mapping, rock and soil geochemistry, VLF-EM, IP, MIP, Turam EM, SP, aeromagnetic surveys and drilling 10 holes, total 1506m. Most effort focussed in Dial Mine area, where encouraging but sub-economic Cu and Sn mineralisation found, best intersection: 20m at 0.7% Cu.
1986–1988	EL 46/86, 93km^2, Derwent Minerals reassessed previous exploration results and limited sampling of old workings, but proposed further instigations not undertaken.

Natone - Cuprona Area

1958–1962	BMR covered area with aeromagnetic surveys and ground follow-up.
1960 - 1965	Mines Department investigated Blythe River - Cuprona iron occurrences, including drilling 4 holes, total 286m, intersecting sub-economic mineralisation.
1968–1972	EL's 13/68, 14/68 Minops investigated the iron occurrences at Natone and Blythe River including magnetics, IP, auger drilling and 4 diamond drill holes, total 506m. Intersected low grade skarn mineralisation with minor Cu.
1969–1974	EL 1/69, Tasminex - ANZECO JV. Early base metal exploration within current EL 9/92 focussed on Natone ironstone and Rutherfords copper prospect, including soil and rock geochemistry, mapping, magnetics, costeaning and shallow percussion drilling 5 holes, total 106m, intersected Cu mineralisation in quartz vein: best assay 4.5m at 0.5% Cu, costean 1.5m at 6.0% Cu.
1977–1985	EL 8/77, 316km^2 Comalco-Shell-CRA JV. Extensive exploration including: mapping; stream, rock, soil geochemistry; aeromagnetic and airborne INPUT EM surveys; SP, IP max-min EM, SIROTEM, gravity; drilling 2 diamond and 1 percussion holes intersecting a "barren" skarn at Natone and "basalt hill" at Cuprona respectively.
1986–1989	EL 30/86, 43km^2 CW Davis undertook stream geochemistry, mapping, rock chip sampling and drilling 28 holes total 252m with an airtrack rig. Identified potential resource of 1.2mt haematite at Blythe River ironstones.

894017



PASMINCO EXPLORATION

A Division of Pasminco Australia Limited

COMPILED : F.G.F.
DATE : June,1994
DRAWN : G.M.B.
REF. :
REVISIONS :
DRAWING No.

E.L. 9/92 - DIAL RANGE

PROSPECT LOCATIONS

SCALE 1:100,000 0 2 km

FIG. No. 4

6 WORK UNDERTAKEN JULY 1993 - JUNE 1994

6.1 Introduction

Field-based exploration during 1993-94 has been quite limited, partly because of the relatively disappointing results from the first year's exploration and partly due to major commitments by Pasminco on other exploration projects in Western Tasmania. Work during the current period on EL 9/92 has focussed on three separate aspects of the geology and mineral prospecting of the tenement:

i Investigation of the Iron Cliffs ironstone prospect, near Ferndene, in particular whether this could be a gossanous cap to a base ± precious metal-rich massive sulphide deposit.

ii Lithogeochemical analyses of the principal Cambrian volcanic lithologies to aid in correlation with other units in Tasmania, and to assess the style of subsequent alteration.

iii A preliminary study of the Devonian Housetop Granite in relation to its potential to produce base ± precious metal-rich skarn-manto and replacement-style mineralisation.

6.2 Iron Cliffs Prospect

The Iron Cliffs workings, also known as Lady Braddon Mine, comprise a number of old adits and trenches developed last Century along a line of limonitic outcrops, which in places form very prominent cliffs up to 15m high on the east bank of McBrides Creek in the Ferndene State Reserve.

Ever since their discovery, these ironstones have been the subject of strong debate regarding their origin. Many workers (eg. Reid,1923, King, 1958 & Burns, 1961) have concluded the ironstones are the result of selective replacement of the country rock by epigenetic oxidising fluids and are thus part of the suite of massive hematitic ironstones that occur further north on Penguin Creek and at Blythe River and Cuprona. Others, including Twelvetrees, 1903, Thomas and Henderson, 1943 and Hughes, 1953, have suggested that the limonite represents a gossanous cap to a massive sulphide body. They cite differences in the Fe: Si ratio, P and

Pasminco Exploration

Melbourne

5 cm

REVISIONS			
Init.	Date	Init.	Date

Map Projection: TMAMG55

Geodetic Datum: AGD66

Location Code:

TASMANIA

DIAL RANGE MAGNETICS

CD, Mag Pseudo, Sun NS 0 70

dial_range_mag_cd_ns_dcos.alg

Scale: 1:100000

Date: 18-5-1994

Compiled: AMR

Printed: HPXL A3

Traced:

Checked:

Plate No.

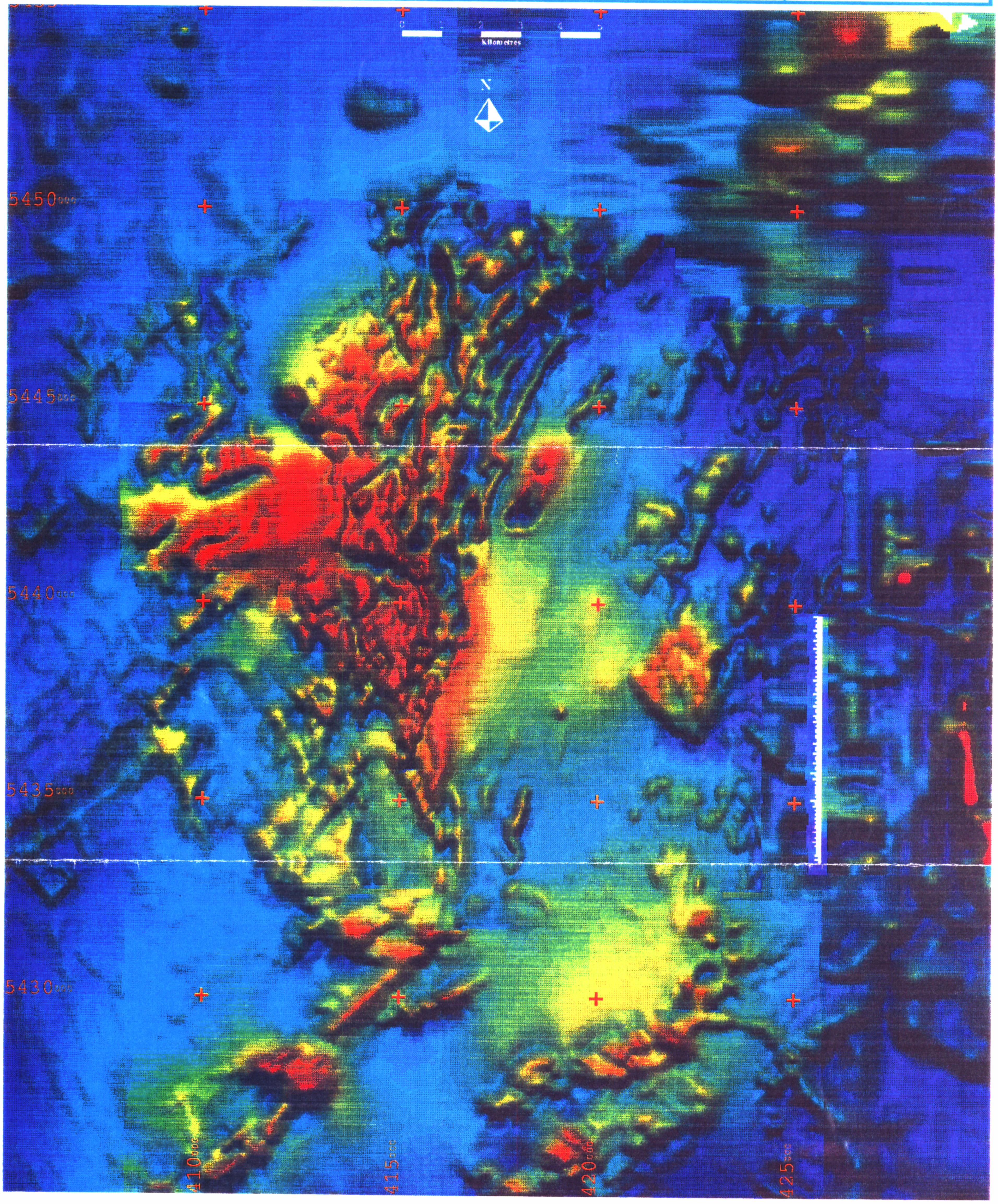


Figure 11

69019

Pasminco Exploration Melbourne			5 cm
REVISIONS Init. / Date / Init. / Date	TASMANIA DIAL RANGE RADIOMETRICS		Compiled: AMR
			Printed: HPXL A3
	Rad K Pseudocolour		Traced:
Map Projection:TMAMG55 Geodetic Datum:AGD66	dial_range_rad_k_pseudo.alg		Checked:
Location Code:	Scale: 1:100000	Date: 18-5-1994	Plate No.

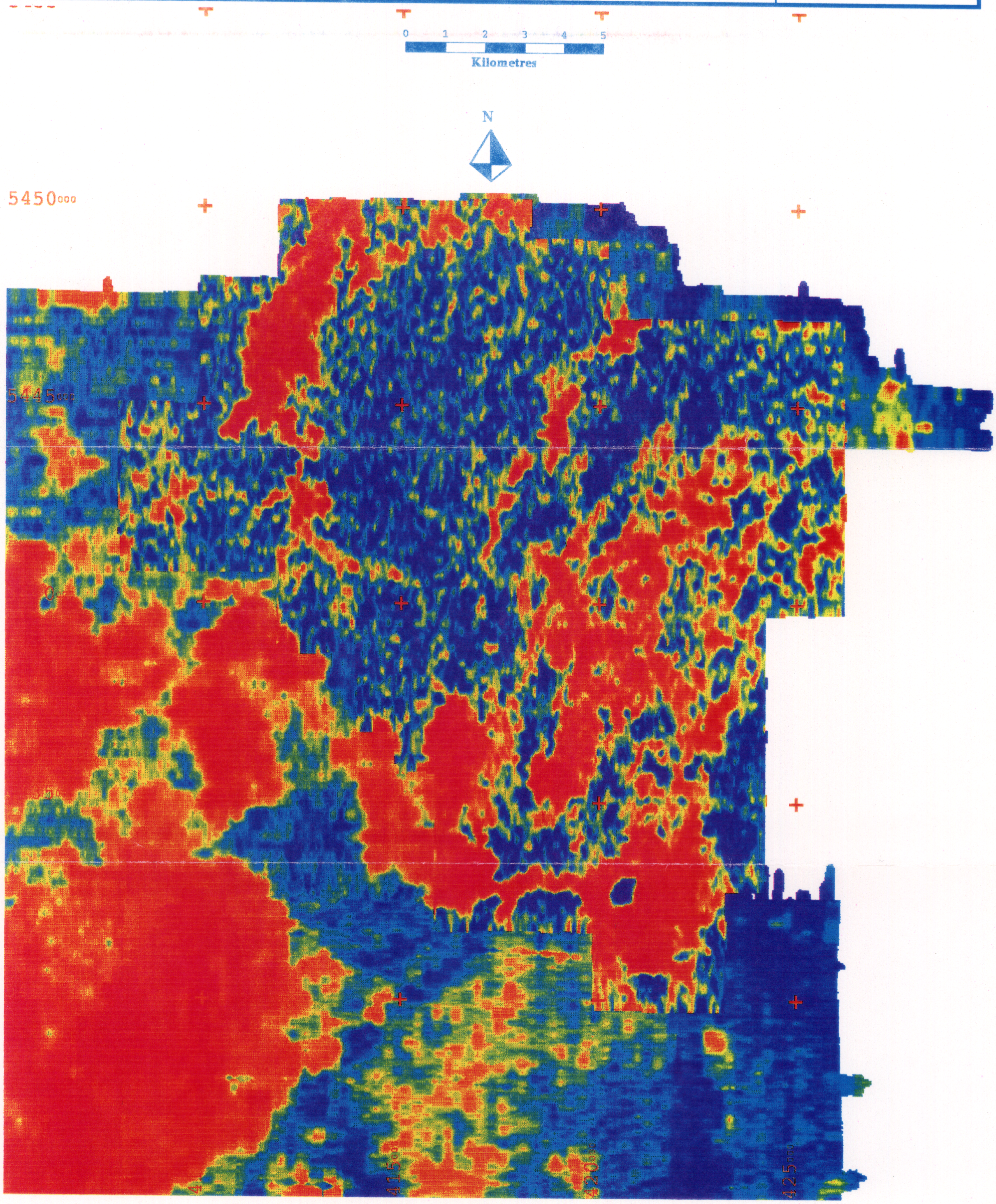


Figure 12

894020

Pasminco Exploration

Melbourne

5 cm

REVISIONS			
Init.	Date	Init.	Date

Map Projection:TMAMG55
Geodetic Datum:AGD66
Location Code:

TASMANIA
DIAL RANGE RADIOMETRICS & MAGNETICS

CD, Rad TC as Pseudocolour, Mag as Sun NS 0 70

dial_range_rad_tc_mag_cd_ns.alg

Scale: 1:100000

Date: 18-5-1994

Compiled: AMR
Printed: HPXL A3
Traced:
Checked:
Plate No.

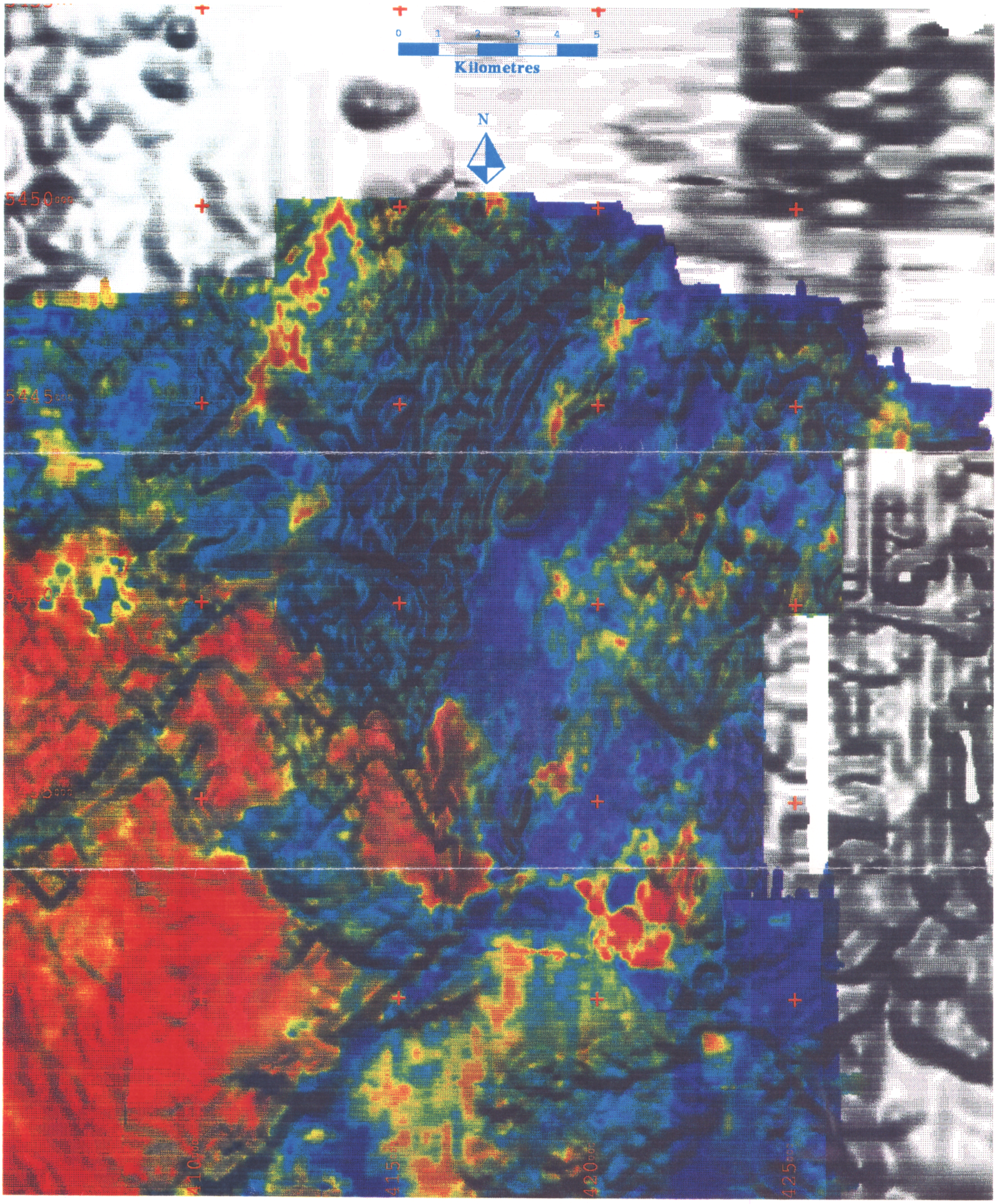


Figure 13

894021

S content compared to hematitic bodies, and the presence of minor amounts of Cu, Pb, Ag and trace Au as evidence that the limonite is after sulphides.

The Mines Department drilled two short diamond drill holes to test this concept in 1960, holes DD1 (252ft) and DD2 (155ft), reported in Burns (1961). Herrmann (in FitzGerald, 1993) examined the skeletal core that remains in the Mines Department core shed and sampled sections of this for analysis. The assay results, which were reported in FitzGerald (1993) are presented in Table 3. Herrmann concluded that there was evidence to support both genetic models for the ironstone. The limonite, which is massive, concretionary, botryoidal and stalactitic in outcrop, appears to pseudomorph specular hematite in places in the drill core, similar to the observation made by King (1958). However, the occurrence of massive barite veins, minor pyrite and sporadic elevated Cu, Pb, Zn and Ag values (see Table 3) suggest a possible association with massive sulphides. If the ironstone is a gossan then the depth of oxidation is quite remarkable in Tasmania, given that neither drill hole nor the deepest workings were able to penetrate the base of oxidation, at least 75m beneath the present surface.

The Iron Cliffs prospect area was briefly inspected and sampled during 1993–94 (see Figure 6). If sufficient encouragement to support the gossan model was found it was proposed to drill a hole to at least 300m depth to test for sulphide mineralisation.

Key observations to come from this field examination are as follows:

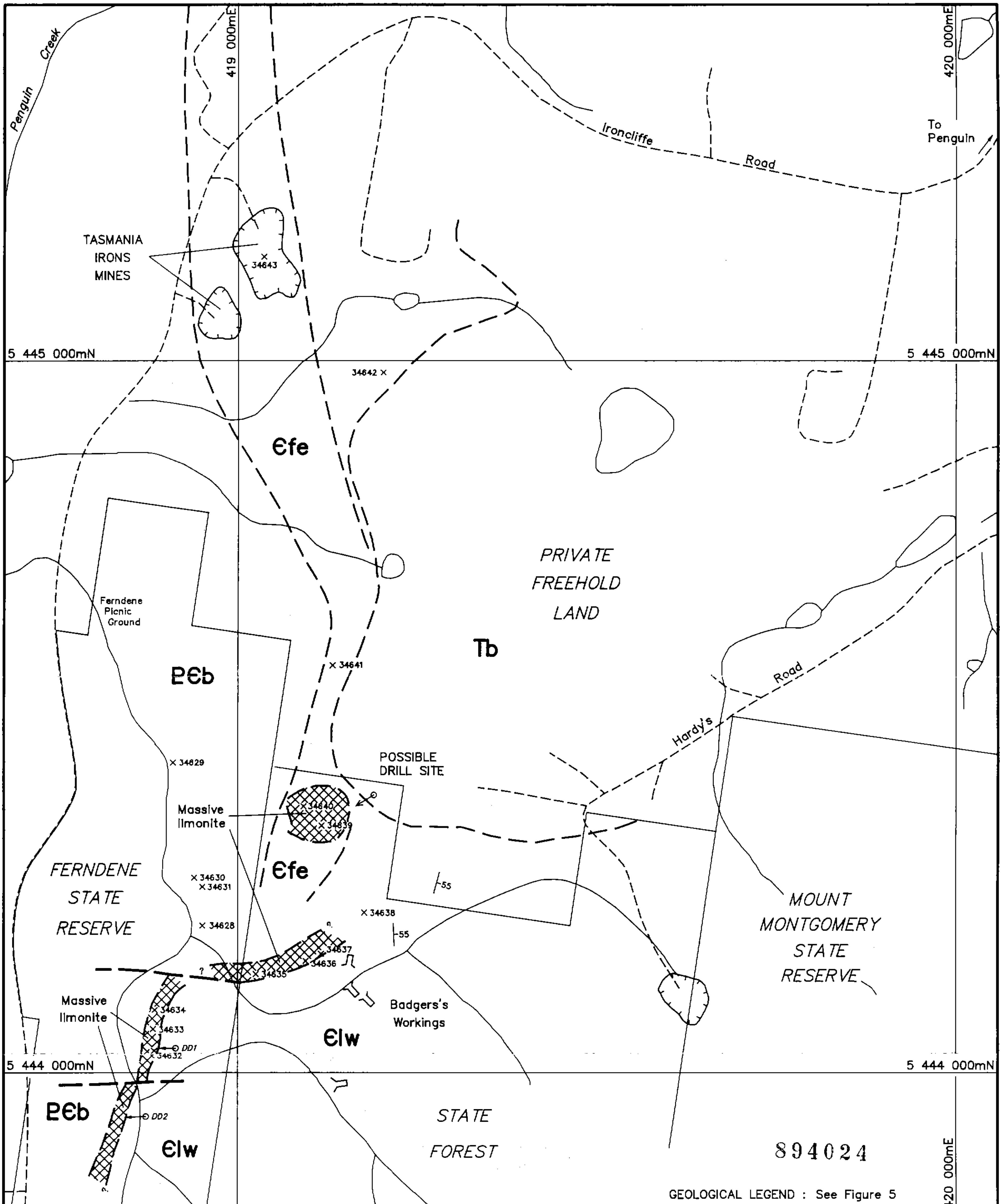
- i The most prominent part of the Iron Cliffs outcrop occurs within the Ferndene State Reserve, which is excluded from the tenement.
- ii The ironstone is mostly hosted within sandstones and siltstones of the Proterozoic Burnie Formation, however part of the adjacent inferred Cambrian lithicwacke and conglomerate is also very iron–rich.
- iii There is a progression from: incipient iron oxides developed along fractures in the Burnie Formation, 50–100m west of the ironstone; to a crackle breccia with iron oxide fill; to pervasive iron oxides immediately adjacent to the massive ironstone, all indicative of open–space fill and replacement of the host Burnie Formation.
- iv The limonitic ironstones can be traced semi–continuously in outcrop and float to the north, where it appears to become part of the Penguin Creek hematitic ironstone

Table 3

IRON CLIFFS DRILL CORE ASSAY RESULTS

Sample No.	Location	Cu	Pb	Zn	Ag	Au	Mn	As	Sn	Ba	Sb	Description
					(all in ppm, unless otherwise shown)							
34578	DD1 12	179	391	47	2	<0.008	57	1200	7	58	55	Qtz+50% limonite after hematite?
34579	DD1 63.5	97	63	341	<1	<0.008	780	100	31	293	<3	Fracture vein qtz; 60% limonite, gossanous?
34580	DD1 95	13	<3	106	<1	<0.008	1120	–	6	4405	13	90% compact limonite after hematite?
34581	DD1 109	53	171	91	<1	<0.008	965	–	–	–	–	90% compact limonite, vuggy, after hematite?
34582	DD1 110–120	55	25	60	2	0.012	730	42	<3	12.0%	30	Qtz +60% limonite, after hematite?
34583	DD1 130–132	21	15	15	<1	0.017	74	8	–	–	–	Fragment of barite veins 100%
34584	DD1 210	13	<3	31	<1	<0.008	3650	7	5	3757	<3	Fine grained sandst (Burnie FM),5% carb veinlets
34585	DD2 8.8–9.3	21	17	58	<1	<0.008	3.21%	16	8	525	10	90% barite
34586	DD2 74–81	74	27	107	<1	<0.008	925	–	4	701	36	Massive compact limonite, minor qtz

834023



GEOLOGICAL LEGEND : See Figure 5

PASMINCO EXPLORATION
A Division of Pasminco Australia Limited

COMPILED : F.G.F.	E.L. 9/92 – DIAL RANGE
DATE : June 1994	SKETCH MAP OF THE
DRAWN : G.M.B.	**IRON CLIFFS PROSPECT AREA**
REFERENCE :	
REVISIONS :	
DRAWING No.	SCALE 1:5000 (0–100 m) — FIG. No. 6

894025

bodies.

v The intensity of fracturing and shearing increases towards the ironstone. Herrmann (op cit) suggested that the "hangingwall" rocks intersected in DD2 are a cataclasite composed of sheared and deformed volcanic and lode material.

On the basis of these observations, and taking account of the previous workers' information it was decided not to drill a hole to test the Iron Cliffs prospect at depth. Although most of the ironstone lies within the Ferndene State reserve, a small portion could be tested by a drill hole located on the edge of private freehold land, accessed off Hardy's Road (see Figure 6). The weight of evidence seems to support the thesis that the ironstones are epigenetic in origin, post Cambrian replacement principally of the Burnie Formation close to it's structural contact with the Cambrian volcaniclastic suite and part of the Penguin Creek ironstone bodies. The spatial association of barite–silica veins and minor base metal mineralisation maybe coincident as they appear to post–date the ironstone formation, being localised along brittle fault structures, such as observed at the adjacent Badger's workings by Burns (1961). As to why this part of the Penguin Creek hematitic ironstones should be limonitic, there is no immediate answer.

6.3 Lithogeochemistry

Crawford (in FitzGerald, 1993) recommended that certain samples from his petrographic study should be analysed for major and trace elements to assist in the interpretation of petrographic affinities and lithological correlation. A suite of 21 samples collected either by Herrmann last year, or Geology Honours student Rebecca Sproule this year were submitted for whole rock analysis (by XRF) and trace elements (Ni, Cd, Co by AAS and Y, Zr, Nb, V, Cr, Rb and Sr by XRF) to Analabs. Assay results are presented in Appendix C and sample locations are shown on Figure 7 and in Appendix B. The lithogeochemical work can be considered as three separate studies: geochemical affinities of the Motton Spilite; geochemical correlations within the Cambrian volcanic suite and the extent of hydrothermal alteration of these volcanics.

6.3.1 MOTTON SPILITE

Crawford (op cit) described all the Motton Spilite thin sections samples as tholeiitic metabasalts. He suggested that they were typical of mafic volcanism associated with the Eo-Cambrian rifted passive margin and that they would overlap compostionally with the fields for the Crimson Creek Formation and Smithton tholeiites. He went on to postulate that the Barrington Chert, which is spatially associated with the Motton Spilite over much of Northern Tasmania, is a correlate of the cherty hematitic siltstones and associated rocks of the Success Creek Group, which underlies the basalts in the Smithton Trough.

Figure 8 is a ternary plot of Ti–Y–Zr as a discrimination diagram for the Motton Spilite samples. Superimposed on this diagram are fields for different tectonic environments presented in Brown (1989). It can be seen that all of the Motton Spilites form a tight cluster within the field ascribed to low potassium ocean floor basalts. The only exception to this is sample number 34616, which falls within field D, ascribed to within plate basalts, such as Crawford predicted. However, sample 34616 is not Motton Spilite, rather it is from a strongly magnetic basaltic dyke which has been cut by a coarse grained "gabbroic" dyklet intersected in drill core from hole DDH7 (94.7m) drilled by Geopeko at the Dial Mine prospect.

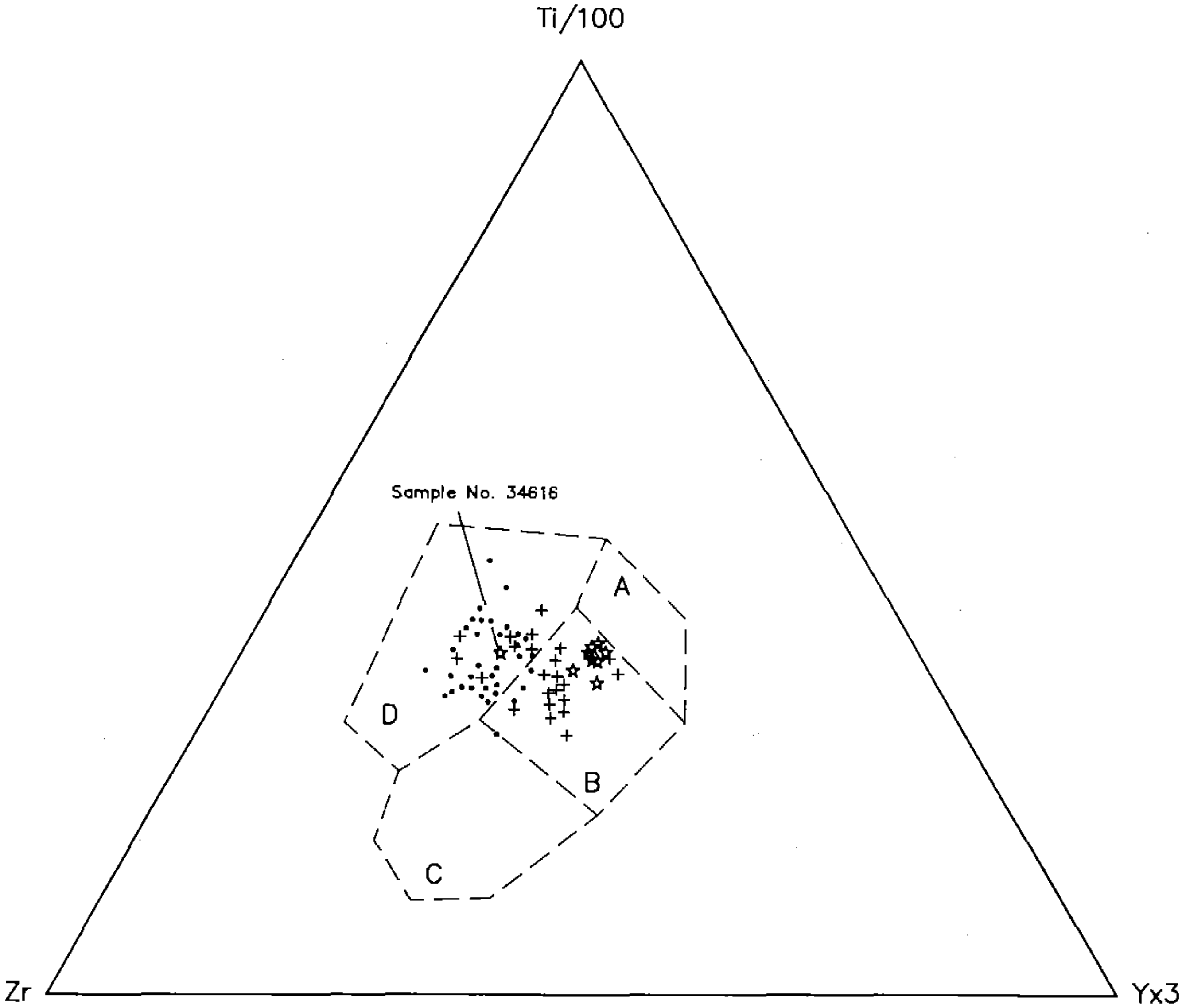
Superimposed on Figure 8 are samples from basaltic lavas of the Crimson Creek Formation and Smithton Basin, and basaltic lavas from the Cleveland–Waratah area, presented in Brown (1989). It is apparent that the Motton Spilite samples more closely resemble the latter suite, as Brown concluded, having Ocean Floor Basalt affinity. The samples also coincide with Suite V, the Miners Ridge basalts in Crawford et. al., (1992).

It is interesting that the basaltic rock in DDH7, which Crawford described as lower greenschist facies, quenched, "evolved" metabasaltic lava flow, correlated with the Motton Spilite, is Geochemically more like the Crimson Creek Formation and Smithton Basin basalts. Herrmann (op cit) described this mafic rock in DDH7 as an intrusive overlain by a sequence of pyritic sediment breccias and altered dykes of probable Lobster Creek Volcanics and underlain by a thick (>80m) sequence of dolomitic siltstones, limestones, chert, pyritic siltstone and lithic siltstone–sandstones. A sample of the sediment breccia (sample No. 34603, DDH7–77.5m) was petrographically described by Crawford (op cit) as a strongly hydrothermally altered (carbonate–sericite–pyrite ± chlorite) coarse sandstone composed of clasts derived

894027

E.L. 9/92 – DIAL RANGE

Ti–Y–Zr DISCRIMINATION DIAGRAM FOR MOTTON SPILITE



KEY

•	Crimson Creek Formation, Smithton Basin basalts	A & B	Low K tholeiite
+	Basalts from Cleveland – Waratah	B	Ocean floor basalt
☆	Motton Spilite – Dial Range	B & C	Calc–alkali basalt
		D	Within plate basalt

Figure 8

from siltstone, dolomite, chert and basic volcanics of the "passive margin sequence" (pre Mt Read Volcanics). Based on the geochemistry of samples 34616 and 34603 (see Figures 9 & 10) this mafic rock and sediments included in the Cateena Group may possibly be correlated with the Crimson Creek Formation and Smithton Basin sequence.

6.3.2 LITHOGEOCHEMICAL CORRELATIONS

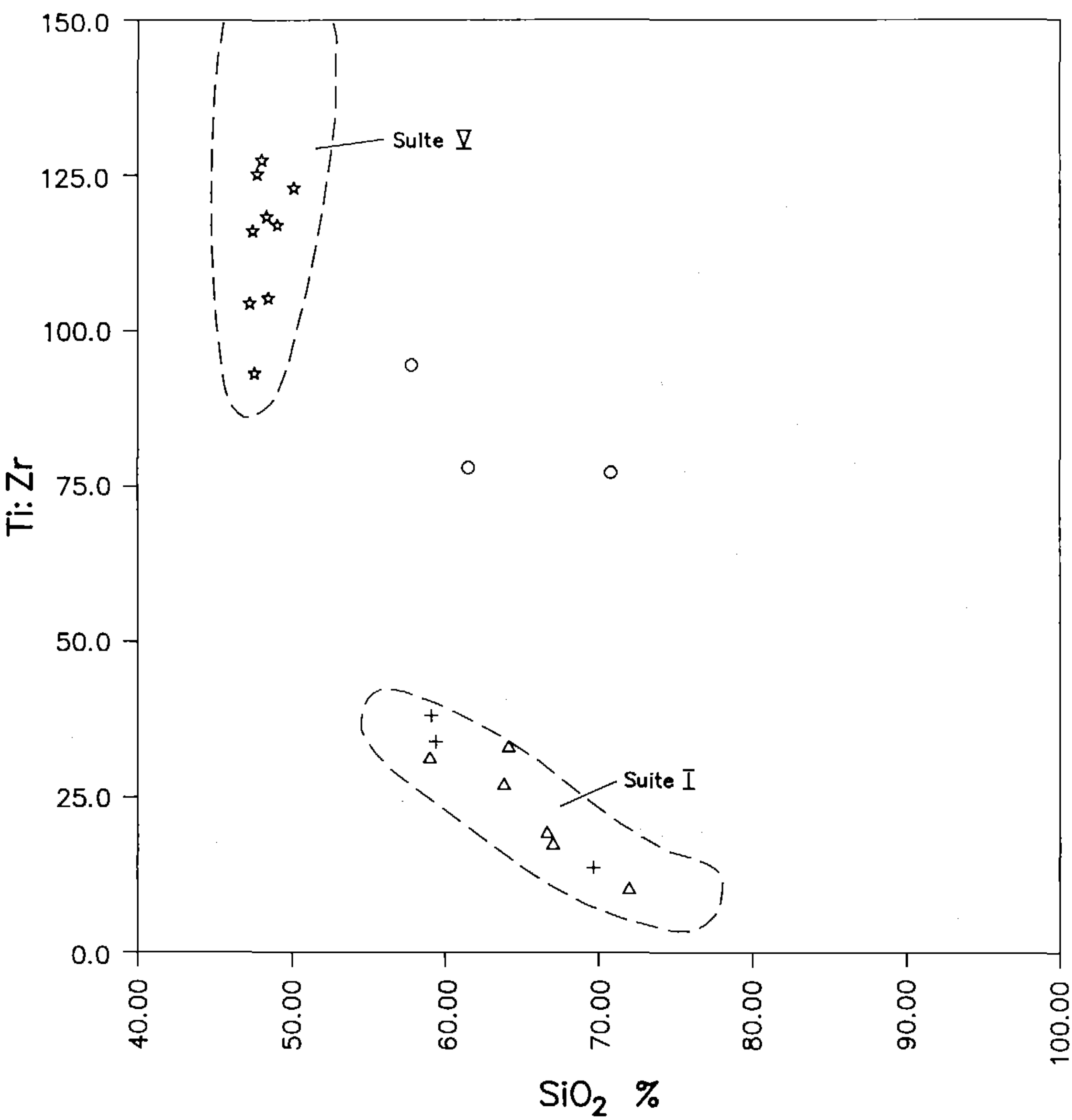
Based on experience from studies of the lithogeochemistry of the Cambrian Mt Read Volcanics in Western Tasmania it was decided to prepare plots of Ti/Zr against SiO2 (Figure 9) and TiO2 against Zr (Figure 10) for the Dial Range samples. The results are useful as three distinct associations or fields become evident. The Lobster Creek Volcanics form a distinctive group which coincides quite closely with Suite I of the Mt Read Volcanics, as given in Crawford et. al., (1992), (see Figures 9 and 9a). This confirms Crawford's conclusion from his petrographic study last year, that the Lobster Creek Volcanics are correlates of the Mt Read Volcanics. The Suite I volcanics are calc-alkaline in composition and indicate a magmatic evolution from transitional medium to high K rocks, to strongly enriched shoshonitic rocks. They include the Central Volcanic Complex, Eastern Sequence, Tyndall Group, the intrusive quartz-feldspar porphyries and granitoids and the andesitic lavas of the Que-Hellyer footwall sequence.

However, Crawford's observation last year, which is in accord with field mapping, that the Lobster Creek Volcanics are all intrusives of dioritic composition appears to significantly reduce their potential to be associated with volcanic hosted massive sulphide deposits of the Rosebery and Hellyer style. It is interesting to note that the three samples of Radfords Creek Group, which although not primary volcanic rocks, also plot within the same field as the Lobster Creek Volcanics. This strongly supports Crawford's conclusion, from his petrographic study, that the Radfords Creek Group rocks are composed of volcanic detritus derived from Mt Read Volcanic-type lithologies, which are quite similar to the Kerrison, Wilsonia and Applebee Volcanics units of Burns (1964) and quite different to the inferred older Cateena Group and the Megabreccia units.

The three Cateena Group samples appear to form a separate group (see Figures 9 & 10). These samples are not primary volcanic rocks but their grouping, especially sample number 34590, a polymictic pebble conglomerate from Devon Consols, overlaps with the Motton

E.L. 9/92 – DIAL RANGE

Ti/Zr v SiO_2 PLOT



KEY

☆ Motton Spilite

△ Lobster Creek Volcanics

\+ Radfords Creek Group

○ Cateena Group

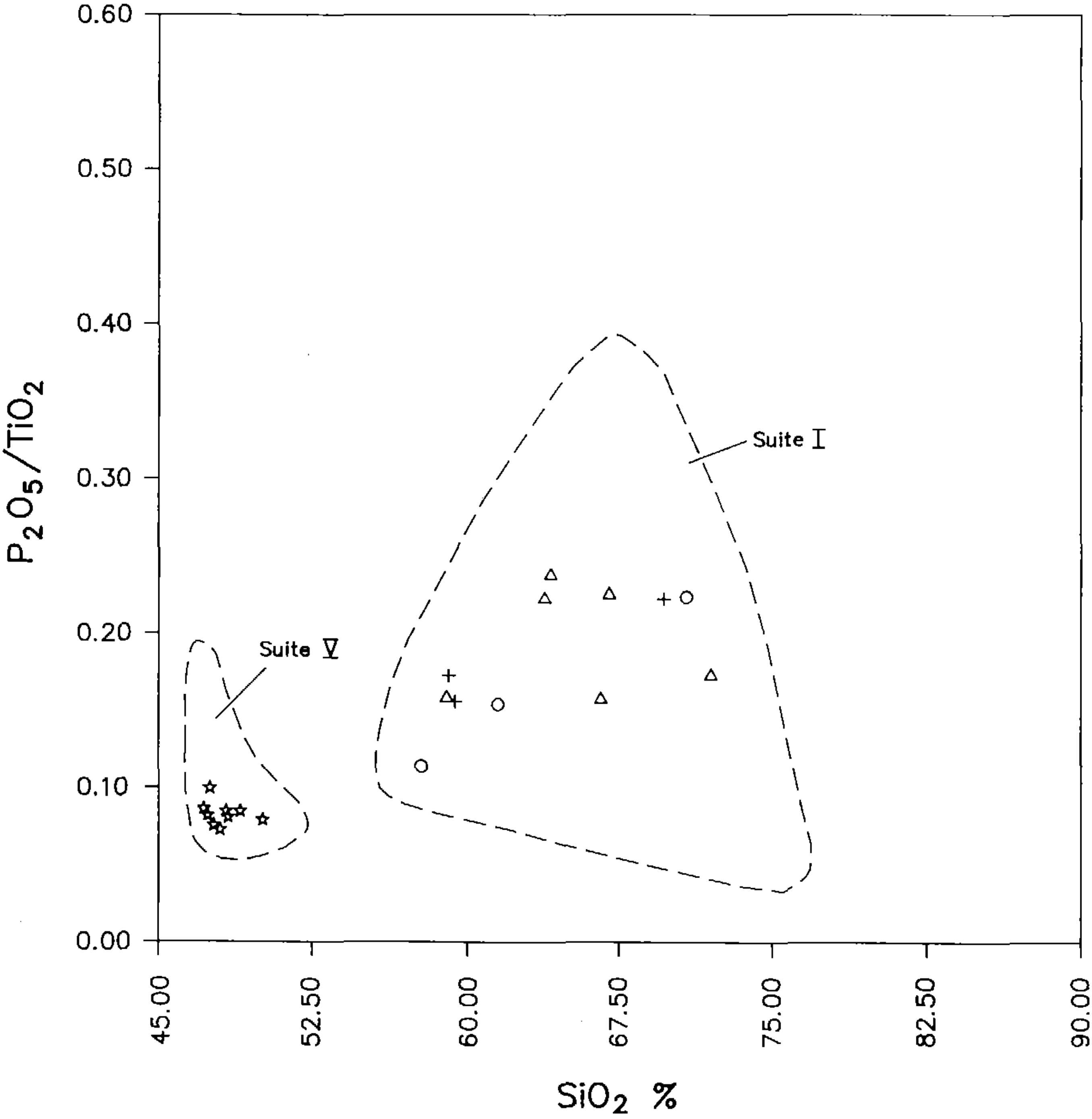
Fields for Suites I and V, Mt. Read Volcanics from Crawford et al (1992)

Figure 9

894030

E.L. 9/92 – DIAL RANGE

P_2O_5/TiO_2 v SiO_2 PLOT



KEY

- ☆ Motton Spilite
- △ Lobster Creek Volcanics
- \+ Radfords Creek Group
- ○ Cateena Group

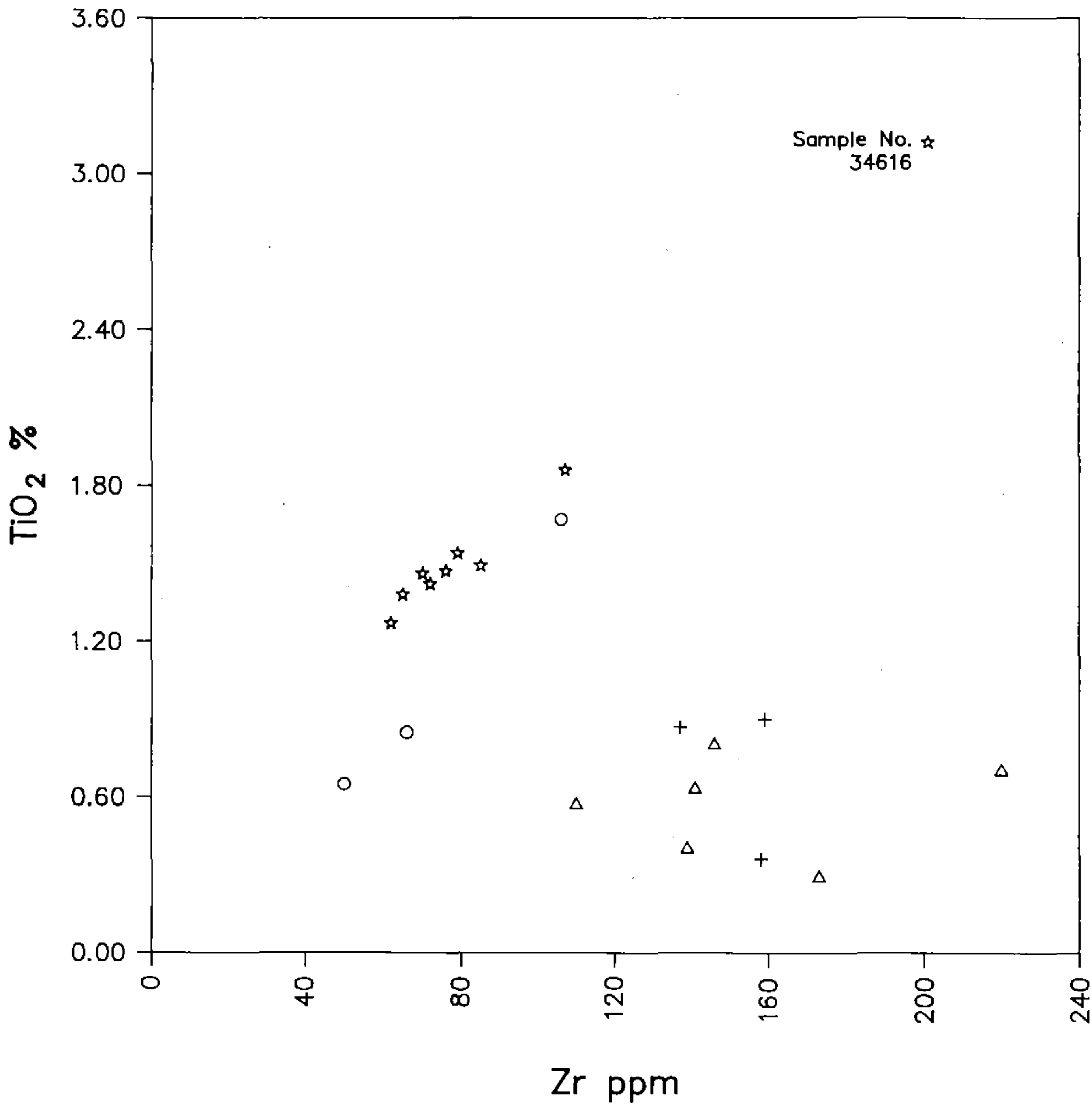
Fields for Suites I and V, Mt. Read Volcanics from Crawford et al (1992)

Figure 9a

894031

E.L. 9/92 – DIAL RANGE

TiO_2 v Zr PLOT



KEY

☆ Motton Spilite

△ Lobster Creek Volcanics

\+ Radfords Creek Group

○ Cateena Group

Figure 10

Spilite. These observations appear to support Crawford's conclusion that the Cateena Group (and the Megabreccia units that are petrographically almost identical) represent early Cambrian deposits from the uplift and collapse of a passive margin to form a foredeep, with detritus derived from the Eo-Cambrian thoeiitic basalts, cherts, carbonaceous siltstones and dolomites, such as in the Smithton Trough.

6.3.3 HYDROTHERMAL ALTERATION

A few brief comments can be made about the relative intensity and style of alteration of the Cambrian volcanic units. Crawford (in FitzGerald, 1993) described a range of alteration associated with the Cambrian volcanic and related lithologies ranging from prehnite–pumpellyite to lower greenschist facies metamorphism to moderate–strong hydrothermal alteration assemblages including:

- i chlorite±hematite±pyrite (eg. 34589, 34590)
- ii sericite–carbonate±pyrite±hematite (eg. 34533, 34603)
- iii silicification (eg. 34605)

It is interesting that the most intensely altered rocks (Alteration Indices of 96 & 88) are samples of the Cateena Group conglomeratic sandstones from the Devon Consols area (sample nos. 34590 & 34589). Herrmann (in FitzGerald, 1993) mapped and sampled rocks around this old prospect, including the main adit. He concluded that the patchy hematite–pyrite–chalcopyrite±Ag and Au(?) (Hughes, 1953) is probably fault-related, similar in style and setting to the mineralisation at Wolloa Creek. Burns (1964) suggested that the mineralisation at Devon Consols might be related to the same generation of SE trending late dextral faults that contain minor sulphide mineralisation at the Iron Cliffs and Badger's prospect.

The Lobster Creek Volcanics are not strongly hydrothermally altered. Alteration Indices (100 (MgO+K2O)/(MgO+K2O+CaO+Na2O) range from 35 to 61 compared to >85 in the Rosebery–Hercules host and footwall sequence. This is in accord with Crawford's (op cit) observations, which related the observed alteration, especially of the groundmass in thin sections to low grade regional metamorphic assemblages. This reinforces the conclusion that the Lobster Creek Volcanics are unlikely to be associated with significant volcanic hosted massive sulphide mineralisation.

6.4 The Housetop Granite

Leaman (in FitzGerald, 1993) concluded from a study of the high resolution aeromagnetic data flown for Pasminco in 1993 and the extant gravity data, that the Devonian Housetop Granite, which outcrops in the south west part of EL 9/92, dominates the Dial Range region as it extends at relatively shallow depths (average 1km) below the present surface. He noted that at least two lithologies are evident within the granite, both of which are anomalous in relation to the Devonian granitoids in Western Tasmania. Both are much denser than is normal for granites and both are very magnetic, with the marginal and eastern phase being the second most magnetic lithology in the region, after the Tertiary basalt. Figure 11 is an image of the aeromagnetic data as a colour drape with shading from N70°S. The high frequency Tertiary basalt response over the central part of the image can be seen superimposed on the broader sub-surface magnetic high related to Leaman's marginal phase of the Housetop Granite. Leaman went on to conclude that many of the mineral occurrences (see Figure 4) are spatially associated with granite roof forms, suggesting that either the mineralisation is magmatic in origin, or that the Housetop Granite has exploited the same sites of structural weakness that localised any precursor mineralisation.

Collins et. al., (1981) undertook a gamma-ray spectrometer and magnetic susceptibility survey of Tasmanian granitioids. They not only observed that the Housetop Granite was anomalously magnetic (up to 9012 x 10-6 SI units) but also had anomalously high thorium values (30-60ppm Th) when compared to other Tasmanian granitic rocks. The potassium values were also generally higher (3.8-8.5% K2O) compared to other Devonian granites associated with Sn-W mineralisation (eg. Pine Hill Porphyry, Mt Bischoff Porphyry and Meredith Granite).

Figure 12 is colour image of the Potassium channel from the air-borne radiometrics data flown as part of the magnetics survey in 1993. The exposed parts of the Housetop Granite are clearly evident in the south western parts of the area, with very sharp contrasts evident along NE and NW trending linears (also evident in the aeromagnetics, Figure 11 and combined magnetics and total count radiometrics, Figure 13). Further analysis of the radiometrics data is required, especially ratios of the various channels to "normalise" the data sets for vegetation and other cultural and survey features. Such a study is likely to be very useful in defining the extent of near surface different phases of the Housetop Granite in the Dial Range area.

Such a study might be academic if it wasn't for the possible association of the Housetop Granite with a range of potentially economic mineralisation, such as: skarns, mantos and metasomatic replacement bodies. Recent advances in understanding the relationship between granites and Cu–Au metallogenesis, for example in the Cloncurry district of Queensland should be considered for the Dial Range area. The Housetop Granite has produced economic skarn deposits, such as the Kara scheelite–magnetite deposit, as well as a range of other "sub–economic" occurrences such as the skarns and replacement bodies at Hampshire, Highclere, Natone and Redwater, which have been investigated by previous explorers, especially Billiton (Shell) during the 1980's (Ruxton, 1983). The close spatial and possible genetic associations between the Granite and ironstones and Cu ±Sn mineralisation at Blythe River, Cuprona, Penguin Creek, Iron Cliffs and the Dial Mine prospects are other positive exploration indicators for the Housetop Granite.

Additional information about the chemistry of the Housetop Granite (oxidation state, enrichment in volatile elements, temperate of emplacement, salinity of magmatic fluids etc) is required. Different phases within the "batholith" should be outlined. A detailed analysis of the structural architecture associated with the emplacement of the granite and possible fluid pathways within the country rocks is important, as is the distribution of favourable potential trap sites for mineralisation, either physical or chemical (eg. reactive carbonates, reduced carbonaceous rocks or oxidised hematitic rocks). Many of these elements appear to be present within the Dial Range tenement.

6.5 Environmental Disturbance & Rehabilitation

The nature of the relatively low key field program (reconnaissance geological mapping and sampling) undertaken within the Dial Range tenement during 1993–94 has resulted in no environmental disturbance. Permission to access private freehold land has been sought, where necessary.

7 EXPENDITURE

Total expenditure on EL 9/92 for the twelve months ending June 1994 has been **$22 223.** This brings the total expenditure on the licence since it's inception to **$155 315.** A breakdown of the expenditure is given below.

Personnel: salary, wages & oncosts	9 473
Travel & Accommodation	1 377
Assays	1 575
Other contractors	223
Stores & Supplies	259
Vehicles & Equipment	741
Computing	397
Tenement Costs	3 480
Office Running Costs	2 678
Administration Fee	2 020
TOTAL	**$22 223**

8 CONCLUSIONS

Exploration undertaken during the first two years of tenure of EL 9/92 Dial Range have not located any significant mineralisation. However the results of these investigations have helped to re-define the exploration potential of this area. Important conclusions to come from this work are as follows.

i The Lobster Creek Volcanics are petrographically and chemically related to the main phase of felsic volcanism within the Mt Read Volcanics (ie. Suite I of Crawford et. al., 1992).

ii The Lobster Creek Volcanics appear to be all intrusives, of dioritic composition that have intruded all of the "older" Cambrian sequence in the Dial Range area (including Motton Spilite-Barrington Chert, Cateena Group-Megabreccia units).

iii No extensive hydrothermal alteration is associated with the Lobster Creek Volcanics, which are mostly altered to a low grade metamorphic assemblage.

iv The potential for the Lobster Creek Volcanics to be associated with volcanic-hosted massive sulphide mineralisation is now considered to be low.

v The Motton Spilite is chemically similar to basaltic rocks in the Cleveland-Waratah area and **not** basalts in the Crimson Creek Formation and Smithton Basins. This suggests that the tectono-magmatic association of the Motton Spilite is more likely to be with ocean floor basalts rather than within plate basalts of a continental margin.

vi The Iron Cliffs massive linomitic occurrence does not appear to be the gossanous cap of a massive sulphide body. The iron stones appear to have formed by the fracture controlled replacement of the Proterozoic Burnie Formation and part of the adjacent Cambrian lithicwacke unit by epigenetic oxidising fluids. Minor base metal mineralisation associated with barite-silica veining appears to post-date the formation of the ironstone during later brittle-ductile deformation.

vii The Iron Cliffs and other ironstone occurrences (at Penguin Creek, Blythe River etc.), the Cu-Sn mineralisation in the Dial Mine area and many of the minor base metal mineralisation occurrences scattered across the Dial Range area appear to be statially related to post-Cambrian structures and roof forms within the Housetop Granite.

viii The Housetop Granite is not typical of the Devonian grainitoids in Tasmania, being denser and much more magnetic and radiometric (especially Thorium content). The Granite is associated with Fe±W±Sn skarn deposits at Kara, Redwater, Hampshire, Highclere and Natone.

894037

9 RECOMMENDATIONS

The potential for base metal (± gold) skarns, mantos and metasomatic replacement deposits associated with phases of the Devonian Housetop Granite in the Dial Range tenement area should be further investigated. The following program is recommended for 1994–95 to evaluated this potential:

i Compile all available data on the chemistry, petrography and mapped phases of the Housetop Granite and compare this with existing data from other productive belts, such as the Cloncurry district in Queensland, and carbonate hosted sulphide deposits of the Central Colorado belt in USA, and North Mexico. Additional sampling, chemical analyses, isotopes, fluid inclusion studies and petrographic work may be required.

ii Analyse the structural architecture associated with the emplacement of the Housetop Granite using the existing high resolution aeromagnetics and radiometrics data base, and the semi-regional gravity data.

iii Delineate the extent of all potentially favourable host rocks within the pre-Devonian stratigraphy, including carbonate-rich lithologies, carbonaceous units and iron-rich formations.

iv Compile all available stream sediment geochemistry (known to be quite extensive from previous exploration) into a computer data base, which will include geological, (formations, structures, mineral occurrences), geophysical (satellite TM, magnetics, radiometrics, gravity) and cultural (access, land classifications) data as part of a GIS system to highlight anomalous areas.

v If the results of these studies are positive, identify specific sites for initial detailed ground investigations, including geological mapping and systematic geochemistry, leading to possible drill testing in the following year.

10 KEYWORDS & LOCALITY

ACID VOLCANICS, BASIC VOLCANICS, GRANITE, BASALT, CHERT, IRONSTONE, SULPHIDES, BASE METALS, TIN, IRON, THRUST, RIFT, UPPER PROTEROZOIC, CAMBRIAN, ORDOVICIAN, DEVONIAN, TERTIARY, DATA REVIEW, GEOLOGY, GEOCHEMISTRY, GEOPHYS MAGNETICS, GEOPHYS RADIOMETRICS.

BURNIE SK5503, DIAL RANGE, DIAL RANGE TROUGH, IRON CLIFFS.

11 REFERENCES

Brown, A.V., 1989 EoCambrian to Middle Cambrian mafic volcanic rocks in: Burnett, C.F. & Martin, EL Geology and mineral resources of Tasmania. Geol. Soc. of Australia, Special Publ. 15: p61–69.

Burns, K.L., 1961 The Ironcliffs Mine, Penguin. Tasmania Department of Mines Technical report No.5

---., 1963 Devonport Geological Atlas (map sheet 29) 1" to 1 mile series; Tasmania Department of Mines.

---., 1964 Geological Survey Explanatory Report: Devonport 1" to 1 mile series; Tasmania Department of Mines

Collins, P.L.F., Wyatt, B.W., & Yeates, A.N., 1981. A gamma-ray spectrometer and magnetic susceptibility survey of Tasmanian granitoids. Tasmania Department of Mines Report No. 1981/41.

Crawford, A.J., Corbett, K.D., & Everard, J.L., 1992 Geochemistry of the Cambrian Volcanic-hosted Massive Sulphide-rich Mt Read Volcanics, Tasmanian, and some tectonic implications. Econ. Geol. **87** (3), pp 597–619

FitzGerald, F.G., 1993 Annual Report EL 9/92 Dial Range for July 1992–June 1993. Pasminco Exploration unpub. report No. T93–5, June 1993.

Gee, R.D., 1967 Burnie Geological Atlas (map sheet 28) 1" to 1 mile series; Tasmania Department of Mines.

---., 1977 Geological Survey Explanatory Report: Burnie 1" to 1 mile series; Tasmania Department of Mines.

Herrmann, W., 1985 Final Report on EL 24/73 Dial Range; Geopeko TDM Open File No. 85–2491.

Hughes, T.D., 1953 The Dial Range mineral field. Tasmania Department of Mines unpub. report.

Jennings, I.B. et al., 1959 Sheffield Geological Atlas (map sheet 37) 1" to 1 mile series; Tasmania Department of Mines.

King, D., 1958 Iron Cliffs Prospect Penguin. RTAE memo to exploration manager EZ Co.

Reid, A.M., 1923 Iron Cliffs Mine, Dial Range. Report Tasmania Department of Mines unpub.

Ruxton, P.A., 1983 The Natone pyrrhotite-magnetite skarn; Shell Co. of Australia Ltd, TDM Open File No. 83-2041.

Seymour, D.B., 1989 Geological Survey Explanatory Report, Sheet 36 1:50 000 series, St Valentines. Tasmania Department of Mines.

Turner, N.J., 1989 Precambrian, Ch: 2 in : Burrett, C.F. & Martin, E.L. Geology & mineral resources of Tasmania. Geol. Soc. of Australia, Special Publ. 15: p74-83

Thomas, D.E., & Henderson, Q.J., 1943 Manganese deposits in the vicinity of the Dial Range. Tasmania Department of Mines, report unpub.

Twelvetrees, W.H., 1903. Report on the Dial Range and some other mineral districts on the North weest Coast of Tasmania. Tasmania Department of Mines old series publication 211, pp1-27.

APPENDICES

APPENDIX A

Schedule for EL 9/92 Dial Range

EXTENSION AND AMENDMENT OF DESCRIPTION

This licence is extended under the provisions of Section 15F(4) of the Mining Act, 1929, until 24 July 1994.

In accordance with Section 15E(4) of the Mining Act 1929, this licence shall now apply to an area of 211 skm (more or less) as described in the schedule hereunder:

Schedule:

Commencing at a northwest corner at grid co-ordinates 412 000 metres E. 5 450 000 metres N. thence grid east to 418 000 metres E. grid south to 5 449 000 metres N. again grid east to 420 000 metres E. again grid south to 5 447 000 metres N. again grid east to 426 000 metres E. again grid south to 5 440 000 metres N. grid west to 424 000 metres E. again grid south to 5 433 000 metres N. again grid west to 423 000 metres E. again grid south to 5 430 000 metres N. again grid west to 420 000 metres E. aforesaid grid north to 5 432 000 metres N. again grid west to 416 000 metres E. again grid north to 5 436 000 metres N. again grid west to 415 000 metres E. again grid north to 5 437 000 metres N. again grid west to 414 000 metres E. again grid north to 5 439 000 metres N. again grid west to 412 000 metres E. aforesaid again grid north to 5 441 000 metres N. again grid west to 408 000 metres E. again grid north to 5 445 000 metres N. again grid east to 410 000 metres E. again grid north to 5 448 000 metres N. again grid east to 412 000 metres E. aforesaid thence again grid north to the point of commencement.

The area excludes:	299 ha Mount Montgomery State Reserve
	36 ha Ferdene State Reserve
	200 ha Mining Leases
	3 skm Crown Reserves
	.8 skm Proposed Sith Cala State Reserve

Land Tenure

The area comprises:	Private Property
	State Forest - Multiple Use Forest Land
	Dial Range RAP - State Forest
	Crown Land
	Crown Land (Dept. of E & P Approval)

Note: This land tenure table is a guide only.

Exclusions:

As previously shown.

[signature]

MINISTER FOR MINES

Date 15/8/91

APPENDIX B

Lithogeochemistry Sample Locations & Formations

Appendix B

EL 9/92 DIAL RANGE LITHOGEOCHEMISTRY SAMPLE LOCATIONS & FORMATIONS

SAMPLE	AMG E	AMG N	FORMATION	LOCATION
34511	418050	5441350	LCV	Ironcliff Road
34531	417200	5434470	RCG	Kaines Barite Prospect
34533	417200	5434470	RCG	Kaines Barite Prospect
34589	421570	5445800	CAG	Devon Consols
34590	421570	5445800	CAG	Devon Consols
34591	423200	5442900	LCV	Lobster Creek Road
34593	420450	5441610	LCV	DDH6 116m Dial Mine
34595	424300	5433000	LCV	Gunns Plain Road
34596	423750	5447670	LCV	Beecraft Megabreccia
34597	424180	5447590	LCV	Teatree Point
34604	420440	5438220	CAG	Russell's Adit
34612	424320	5433040	MOS	Gunns Plain Road
34613	424370	5433000	MOS	Gunns Plain Road
34616	420320	5441240	MOS	DDH7 94.6m Dial Mine
34621	424300	5434200	MOS	Sproule no. B6
34622	424300	5433800	MOS	Sproule no. B6P
34623	424400	5437200	MOS	Sproule no. F7
34624	424800	5447200	MOS	Sproule no. F20
34625	425400	5447200	MOS	Sproule no. F21
34626	426200	5447200	MOS	Sproule no. F22
34627	427600	5435100	LCV	Sproule no. G1

FORMATION CODE

LVC Lobster Creek

RCG Radfords Creek Group

CAG Cateena Croup

MOS Motton Spilite

APPENDIX C

Assay Results: Lithogeochemistry - Analabs, June 1994

Analabs
Inchcape Testing Services*********************

Inchcape Testing Services (Australia) Pty. Ltd.
ACN 004 591 664

DIAL RA lithogeochem + R Sproule samples.

Phone (004) 316837 | 14 Thirkell St. CODEE TAS 7320 | Fax (004) 318890

ANALYTICAL REPORT No. 111310.60.10222

THIS REPORT MUST BE READ IN CONJUNCTION WITH THE ACCOMPANYING ANALYTICAL DATA

INVOICE TO:
Pasminco Exploration
P.O. Box 886
BURNIE TAS 7320

ORDER No.	PROJECT
1443	3014

DATE RECEIVED	RESULTS REQUIRED
30/05/94	ASAP

No. OF PAGES OF RESULTS	DATE REPORTED	No. OF COPIES	TOTAL No. OF SAMPLES
3	30/06/94	1	21

SAMPLE NUMBERS	SAMPLE DESCRIPTION	ELEMENT/METHOD
Various	RD Prep : GP029 - P5 Chrome Free Bowl	Whole Rock/DX408 Y,Zr,Nb,V,Cr,Rb,Sr/GX401 Ni,Cd,Co/GA103

RESULTS TO
Mr F Fitzgerald
Pasminco Exploration
P.O. Box 886
BURNIE TAS 7320

RESULTS TO

RESULTS TO

REMARKS

Sulphur by method DX408 is not recommended for samples containing significant levels sulphide. Samples with significant sulphide levels should have sulphur checke by method DX613

AUTHORISED OFFICER

Analabs

Analabs Pty. Ltd.

A.C.N. 009 591 884

ANALYTICAL DATA

SAMPLE PREFIX	REPORT No.	REPORT DATE	CLIENT ORDER No.	PAGE
	111310.60.10222	30/06/94	1443	1 OF 3

	SAMPLE No.	Ni	Cd	Co	Y	Zr	Nb	V	Cr	Rb
METHOD		GA103	GA103	GA103	GX401	GX401	GX401	GX401	GX401	GX401
1	34511	<5	<2	<5	19	158	9	33	<5	136
2	34531	<5	<2	25	24	137	8	216	30	63
3	34533	5	<2	21	22	159	8	240	19	93
4	34589	137	<2	83	22	66	5	231	126	30
5	34590	227	<2	120	22	106	7	394	275	13
6	34591	<5	<2	10	27	141	11	106	8	83
7	34593	<5	<2	6	20	139	7	68	7	51
8	34595	<5	<2	15	39	146	13	150	<5	65
9	34596	16	<2	24	20	110	3	199	91	22
[illegible]	34597	<5	<2	<5	22	173	10	20	8	83
11	34604	81	<2	34	18	50	<3	182	194	9
12	34612	38	<2	26	29	79	7	373	90	10
13	34613	30	<2	24	22	62	<3	294	77	9
14	34616	42	<2	46	41	201	14	520	5	36
15	(B6) 34621	49	<2	34	31	85	5	358	105	<5
16	(B6P) 34622	46	<2	30	27	76	6	358	84	<5
17	(F7) 34623	47	<2	30	34	107	4	418	94	<5
18	(F20) 34624	40	<2	26	25	72	3	342	101	8
19	(F21) 34625	48	<2	35	27	70	5	371	104	<5
20	(F22) 34626	65	<2	30	24	65	<3	306	110	7
21	(G10) 34627	<5	<2	<5	35	220	14	125	15	85
22										
23										
24	DETECTION	5	2	5	5	5	3	5	5	5
25	UNITS	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm

Results in ppm unless otherwise specified
— = element not determined

IS = insufficient sample
SNR = sample not received

AUTHORISED OFFICER

804045

Analabs

Analabs Pty. Ltd.

A.C.N. 004 591 664

ANALYTICAL DATA

SAMPLE PREFIX	REPORT No.	REPORT DATE	CLIENT ORDER No.	PAGE
	111310.60.10222	30/06/94	1443	2 OF 3

	SAMPLE No.	Sr	Al2O3	SiO2	TiO2	Fe2O3	MnO	CaO	K2O	MgO
METHOD		GX401	OX408	OX408	OX408	OX408	OX408	OX408	OX408	OX408
1	34511	96	15.80	69.7	0.36	3.03	0.02	0.12	3.46	0.90
2	34531	99	14.86	59.1	0.87	9.06	0.11	2.67	2.07	1.94
3	34533	54	18.02	59.4	0.90	5.45	0.06	2.16	3.11	1.97
4	34589	27	8.16	70.8	0.85	12.99	0.04	0.30	0.63	2.28
5	34590	12	11.10	57.8	1.67	20.19	0.06	0.03	0.27	3.63
6	34591	117	15.96	63.8	0.63	5.82	0.22	1.28	3.10	1.94
7	34593	52	15.22	67.0	0.40	5.05	0.06	0.86	2.07	1.48
8	34595	105	15.16	64.1	0.80	5.54	0.18	0.82	4.64	2.58
9	34596	80	14.63	59.0	0.57	8.36	0.13	2.40	1.39	3.63
10	34597	19	13.23	72.0	0.29	4.45	0.04	0.15	3.50	0.85
11	34604	79	9.91	61.5	0.65	7.79	0.19	4.75	0.22	4.50
12	34612	159	13.59	49.0	1.54	14.05	0.22	9.33	0.37	6.60
13	34613	244	13.85	50.1	1.27	12.53	0.24	8.78	0.43	6.58
14	34616	72	12.46	47.5	3.12	16.59	0.17	3.84	0.47	6.41
15	(B6) 34621	174	13.93	48.4	1.49	13.30	0.19	9.70	0.25	6.51
16	(B6P) 34622	324	13.46	47.4	1.47	13.53	0.22	11.84	0.09	6.68
17	(F7) 34623	161	13.11	47.2	1.86	15.49	0.25	9.40	0.25	6.41
18	(F20) 34624	140	13.11	48.3	1.42	13.73	0.22	9.16	0.22	7.00
19	(F21) 34625	135	13.40	47.7	1.46	14.21	0.25	7.86	0.27	6.99
20	(F22) 34626	189	13.77	48.0	1.38	12.89	0.24	9.05	0.33	7.63
21	(G10) 34627	112	15.52	66.6	0.70	4.89	0.03	0.38	3.75	1.45
22										
23										
24	DETECTION	5	0.05	0.1	0.01	0.01	0.01	0.01	0.01	0.01
25	UNITS	ppm	%	%	%	%	%	%	%	%

Results in ppm unless otherwise specified
-- = element not determined

IS = insufficient sample
SNR = sample not received

AUTHORISED OFFICER

Analabs

Analabs Pty. Ltd.
A.C.N. 009 491 064

ANALYTICAL DATA

SAMPLE PREFIX	REPORT No.	REPORT DATE	CLIENT ORDER No.	PAGE
	111310.60.10222	30/06/94	1443	3 OF 3

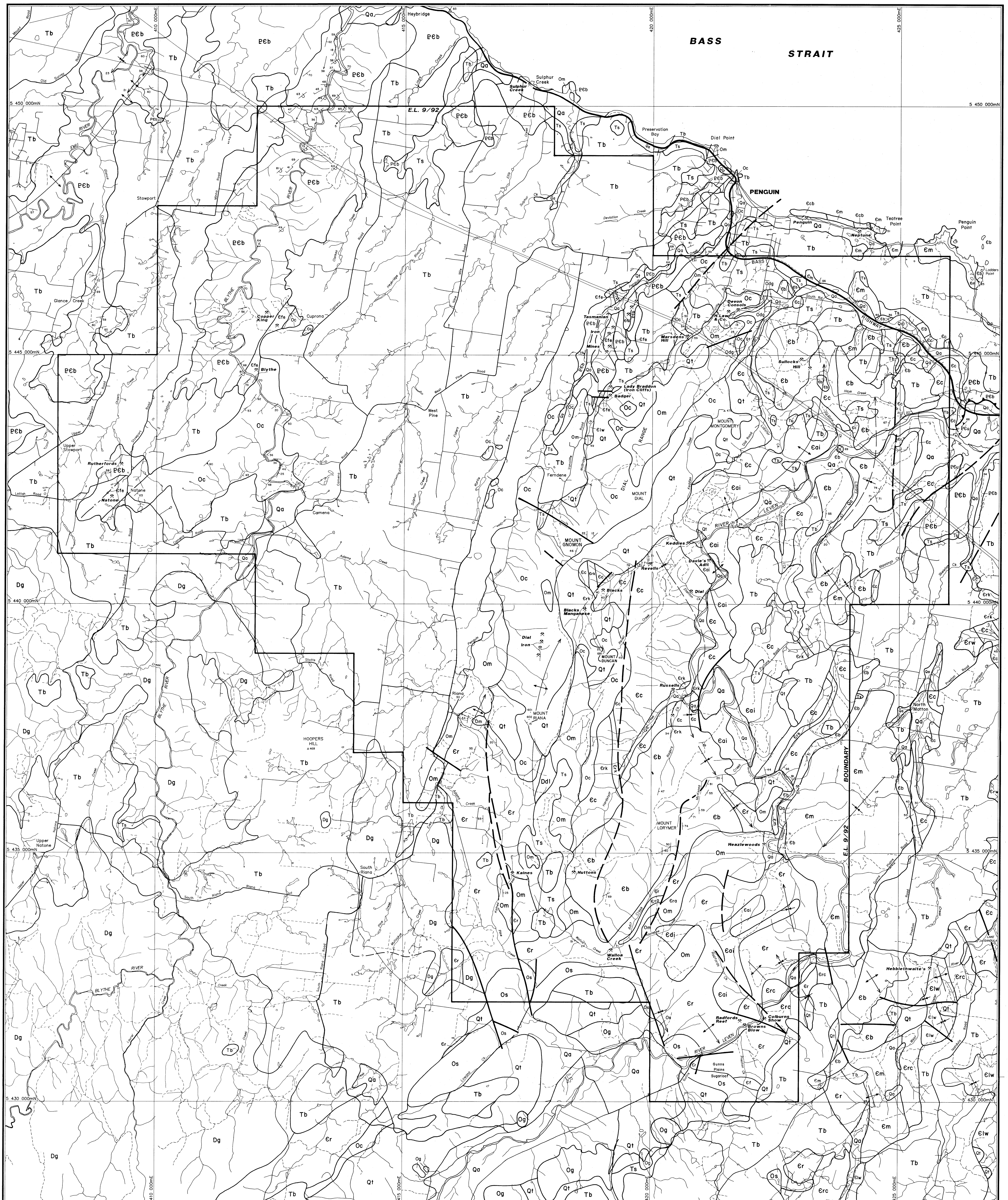
	SAMPLE No.	P2O5	SO3	Na2O	LOI	TOTAL				
METHOD		OX408	OX408	OX408	OM615	OX408				
1	34511	0.083	<0.01	4.22	2.46	100.17				
2	34531	0.153	0.03	2.30	6.79	100.01				
3	34533	0.136	0.01	2.16	6.45	99.87				
4	34589	0.195	0.06	0.08	3.61	100.05				
5	34590	0.186	0.23	0.14	4.92	100.29				
6	34591	0.141	0.16	5.16	1.92	100.19				
7	34593	0.089	0.01	5.59	2.45	100.26				
8	34595	0.188	0.01	3.70	2.31	100.00				
9	34596	0.093	0.17	5.58	4.22	100.19				
	34597	0.047	0.05	3.41	1.91	99.92				
11	34604	0.096	0.37	3.22	6.97	100.20				
12	34612	0.126	0.05	2.97	2.14	100.00				
13	34613	0.103	0.16	3.95	2.45	100.49				
14	34616	0.312	0.91	5.33	3.17	100.33				
15	(B6) 34621	0.120	0.39	3.05	2.83	100.21				
16	(B6P) 34622	0.121	0.21	1.92	3.12	100.11				
17	(F7) 34623	0.160	0.41	3.10	2.58	100.29				
18	(F20) 34624	0.115	0.24	3.68	2.64	99.89				
19	(F21) 34625	0.113	0.20	4.09	3.20	99.83				
20	(F22) 34626	0.105	0.30	3.65	3.01	100.42				
21	(G10) 34627	0.111	<0.01	4.14	2.38	100.01				
22										
23										
24	DETECTION	0.005	0.01	0.05	0.01	0.01				
25	UNITS	%	%	%	%	%				

Results in ppm unless otherwise specified
-- = element not determined

IS = Insufficient sample
SNR = sample not received

AUTHORISED OFFICER

FIGURES



LEGEND

QUATERNARY

Qa	Alluvium
Qt	Talus and scree deposits

TERTIARY

Tb	Basalt lava and pyroclastic rocks
Ts	Terrestrial sand, gravel, silt and clay with rarer indurated equivalents

ORDOVICIAN

Og	Limestone, dolomite, and mudstone (Gordon Group Correlate)

EARLY ORDOVICIAN - LATE CAMBRIAN

Om	Marine quartzose sandstone, shale, minor conglomerate (Moina Sandstone)
Oc	Dominantly quartzite and vein quartz pebble to boulder conglomerate (Duncan Conglomerate)
Odg	Purple mudstone, sandstone, minor chert conglomerate (Gnomon Mudstone)
Os	Undifferentiated sandstone–conglomerate (above)

CAMBRIAN

Єfe	Ferruginous deposits, heamatite and goethite
Єf	Felsic volcanic rocks (including Minnow Keratophyre)

Radfords Creek Group

Єr	Volcaniclastic sandstone and mudstone with horizons of lithicwacke and quartzose conglomerate
Єra	Plagioclase – phyric dacite and volcaniclastics (Applebee Volcanics)
Єrw	Feldspar–phyric felsic lava and volcaniclastics (Wilsonia Volcanics)
Єrk	Feldspar–phyric intermediate lava and volcaniclastics (Kerrison Volcanics)
Єrc	Conglomerate with clasts of chert and less common spilite in a lithicwacke matrix (Sprent Formation)

Cateena Group

Єc	Dominantly mudstone, sandstone, conglomerate, with minor chert
Єcb	Megabreccia with blocks of chert, siltstone, dolomite in a lithicwacke–conglomerate matrix (Beecraft Megabreccia, Teatree Point Megabreccia)
Єci	Conglomerate with mudstone clasts in feldspathic sandstone matrix (Isandula Conglomerate)

CAMBRIAN - Other

Єlw	Lithicwacke, mudstone, minor conglomerate (Gog Range Greywacke)
Єb	Chert, minor mudstone (Barrington Chert)
Єm	Tholeiitic basalt, locally pillowed (Motton Spilite)

PRE-CAMBRIAN

PЄb	Quartzose turbidite sandstone and mudstone (Burnie Formation)
PЄu	Strongly deformed pebble conglomerate and schist (Ulverstone Metamorphics)

INTRUSIVE IGNEOUS ROCKS

DEVONIAN

Dg	Biotite adamellite (Housetop Granite)
Ddl	Tholeiitic dolerite

CAMBRIAN

Єai	Feldspar – horneblende–phyric diorite (Lobster Creek Volcanics)
Єdi	Dacitic feldspar porphyry

SYMBOLS

- Geological boundary – position approximate
- ? Geological boundary – position inferred
- Thrust or reverse fault
- Fault showing relative movement
- Fault unspecified inferred
- 40 Strike and dip of bedding
- 69 Overturned bedding
- 40 Strike and dip of slatey clevage
- Syncline
- Anticline
- Mine or prospect

894052

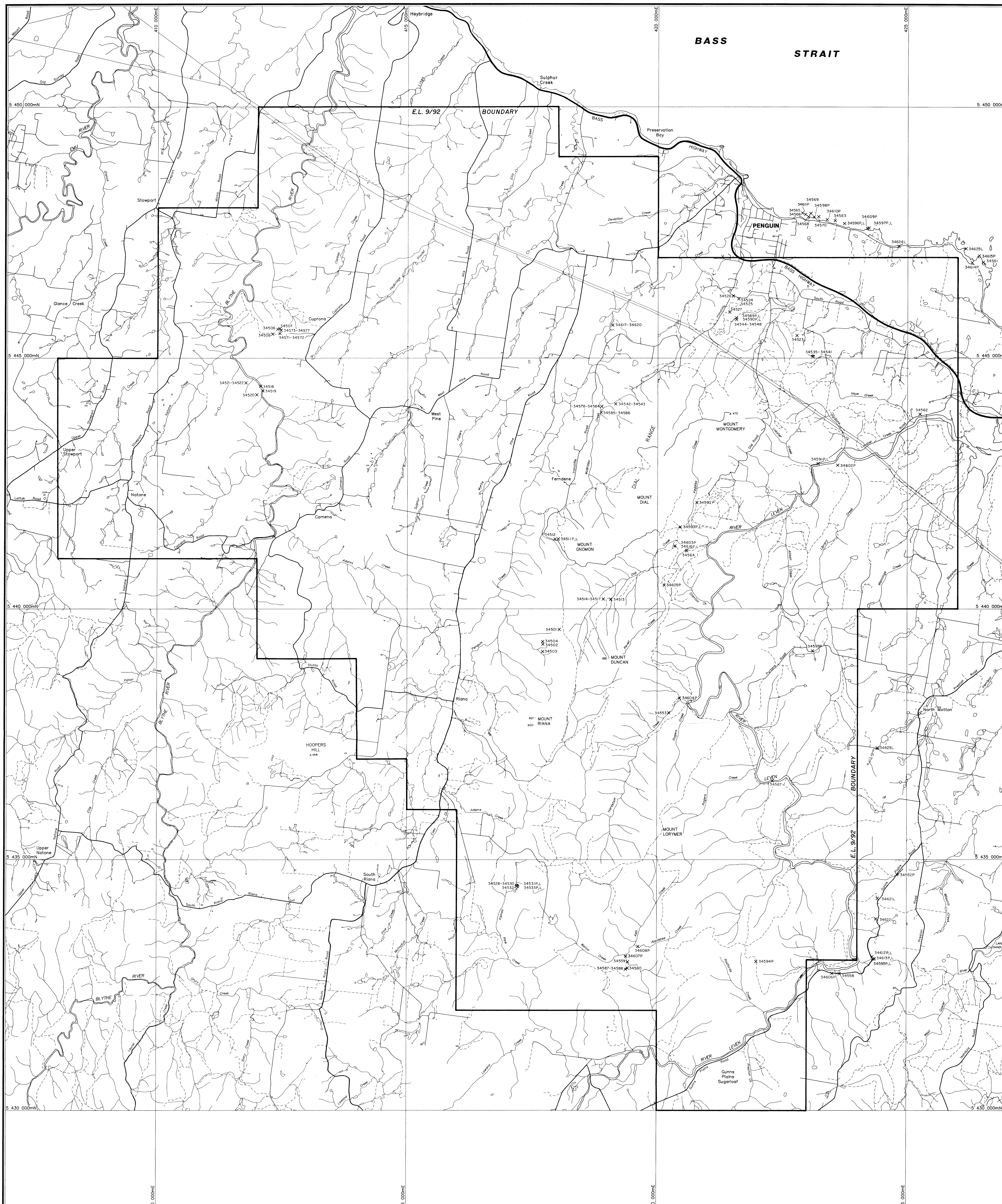
5 cm

Geology modified after :

I. B. Jennings et al (1959), K. L. Burns (1963),
R. D. Gee et al (1967), P. W. Baillie et al (1986)
A. L. Bamford and G. R. Green (1988)

PASMINCO EXPLORATION
A Division of Pasminco Australia Limited

COMPILED : F.G.F.	E.L. 9/94 - DIAL RANGE
DATE : May, 1993	
DRAWN : G.M.B.	
REFERENCE :	GEOLOGY
REVISIONS :	94-3592
DRAWING No.	SCALE 1:25,000 0 500 1000 METRES — FIG. No. 5



LEGEND

- ×34595 Geochemical Analysis Sample Location
- ×34603P Petrography Sample Location
- ×34589L Lithogeochem Sample Location

LEGEND

- ×P– 34570 – PETROGRAPHY SAMPLE LOCATION.
- × – 34504 – GEOCHEMICAL ANALYSIS SAMPLE LOCATION.

894053

5 cm

94-3592

PASMINCO EXPLORATION
A Division of Pasminco Australia Limited

COMPILED :	E.L. 9/92 - DIAL RANGE
DATE : 8-6-'93	**SAMPLE LOCATIONS**
DRAWN : N.W.D.S.	
REFERENCE :	
REVISIONS : F.G.F.	
Updated - June '94	
DRAWING No.	SCALE 1:25,000 (0 500 1000 METRES) — FIG. No. 7