TASMANIAN TIN PROSPECTS

PART 1

West Tasmanian Tin Province

by

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TASMANIAN TIN PROSPECTS

PART 1 - WESTERN TASMANIAN TIN PROVINCE

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Cover: Mt. Bischoff Tin Mine, 1922.

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1. SUMMARY

Western Tasmania has been Australia's leading tin-producing area for just over a century. Total production from the Province up to the end of 1988 is estimated at 208,600t of tin, almost all of it from hard-rock exogranitic sources. Of this total, 99,000t Sn (47%) has come from the Renison deposit. Genetically, the tin mineralisation is associated with Devonian granitic intrusions. (Details on the geology are given in Section 3).

Most production has come from a series of world-class cassiterite-sulphide carbonate-replacement deposits: Renison, Mt. Bischoff and Cleveland. For the first time in many years there is only one current producer: Renison, turning out 7,000t Sn annually - a record rate for this huge mine.

Known potential and identified in-situ tin resources, for prospects potentially available to Aberfoyle (i.e. excluding Renison, and Aberfoyle's Queen Hill and Cleveland deposits), total 135,000t Sn. Details are shown in Table 1A. Given the present extremely low level of tin exploration most of the identified prospects are inactive, although covered by exploration tenements.

The largest identified in-situ resource is the Mt. Bischoff deposit at 5.0mmt grading 0.62% Sn (31,000t of contained tin). Because of this resource and the potential to increase it, Bischoff is rated the best tin prospect potentially available to Aberfoyle in Tasmania. The Company is uniquely placed to take advantage of this opportunity, as the deposit lies only 13 km from the now-idle Cleveland mill which was designed to treat Bischoff-type ore.

In the Zeehan and South Heemskirk areas there are prospects with identified tin resources which could enhance the economic viability of Aberfoyle's Queen Hill deposit. The most important of these is the old Oonah Mine which lies only 0.5 km from Queen Hill, and has an ill-defined resource of almost 1mmt @ 0.7-1% Sn in a geological setting very similar to that of the Queen Hill orebody. Although indications are that a substantial part of this mineralisation occurs as stannite, the exact amount has never been determined. The property is not well tested and has excellent potential for hosting a much larger resource of economic-grade, and probably cassiterite-bearing, ore. The ML holder, CRA, has been trying to get rid of Oonah for some time and Aberfoyle is urged to acquire it as soon as possible.

At South Heemskirk several pipe-like bodies of cassiterite-stannite-sulphide mineralisation occur within the Heemskirk Granite. These have potential to produce at least 1-1.5mmt of tin ore grading around 0.5-0.6% Sn with significant Zn, Cu and Ag credits. This potential ore occurs in four open-cuttable bodies individually up to 0.5mmt in size. However, there are strong indications that several more of these bodies exist on the property, which lies 10 km WSW of Zeehan. The South Heemskirk bodies are potential feed to any tin mill built for mining operations at Queen Hill.

Stonehenge is a conceptual tin prospect on the southern margin of the Queen Hill Consolidated Lease. Two large untested magnetic anomalies occur within dolomitic units of the Oonah Formation. The geophysical and geological setting is similar to that at Queen Hill. There is little tin at surface, but strong indications of tin potential at depths in excess of 300m.

In the north of the State, the important Moina F-Sn-W-Au skarn deposit contains a minimum of 26.5mmt @ 0.15% Sn, in a resource grading 18% CaF_2, 0.1% W and 0.1-0.4 g/t Au. On paper, this is a contained resource of 40,000t Sn (and nearly 200,000 oz Au). The complex metallurgy of the mineralisation has stopped development to date, but it may be timely to review this situation in the light of recent metallurgical research.

In the Renison area there are several important tin prospects. The most significant of those potentially available to Aberfoyle are Razorback and Grand Prize. These are basically Renison-style carbonate-replacement occurrences in which ore-grade cassiterite mineralisation has been outlined, with significant potential for more. Razorback has a known resource of 365,000t @ 0.72% Sn near-surface within an incompletely-tested large talc-carbonate unit. This property lies only 11 km by good road from Zeehan and is available from the ML holder - CRA.

Grand Prize is a complex property 1.5 km north of Razorback. There are ore-grade drill intersections and a rough tonnage potential estimate of 0.9 mmt @ 0.8% Sn and 0.7% Cu. This mineralisation lies at depths of 200-350m below adjacent plain level in the major Grand Prize Fault structure, but there is more-significant potential in and around the fault at greater depths.

The bulk of the other tin prospects individually listed in the body of the report are skarns of various types around the Heemskirk and Meredith granites. Although many of these systems are large and contain a lot of tin, they are geologically and metallurgically complex. They are not as economically or geologically attractive as the carbonate-replacement deposits. While most of the skarns are incompletely tested and quite prospective, they are not rated as highly as the prospects listed above.

The best of the skarns are the St. Dizier deposit (reportedly 5mmt @ 0.5% Sn), on the northern margin of the Heemskirk Granite, and Mt. Lindsay on the southern side of the Meredith Granite.

There are several areas in Western Tasmania with significant grassroots tin potential. These include :

a) The Balfour prospect in the Rocky Cape Block, which shows some features of the larger tin mineralising systems such as Mt. Bischoff, and could conceivably be the surface manifestation of such a system at depth.

b) The carbonates in the Huskisson Syncline warrant systematic exploration for carbonate-replacement deposits, at greater distances from the Meredith Granite than most of the exploration carried out to date.

c) There are extensive sulphidic and stanniferous metasomatic alteration zones to the east and south of Renison, and on the NW margin of the Heemskirk Granite. These areas are incompletely tested and exploration here would have some chance of locating tin deposits of carbonate-replacement type.

In all the areas with grassroots potential, and in the Western Tasmanian Tin Province as a whole, it is considered detailed gravity data could be used to benefit tin exploration by determining the sub-surface shape of the granite intrusions. Also, greater use could be made of modern EM techniques to locate cassiterite-sulphide bodies. These ideas are expanded upon in Section 4.

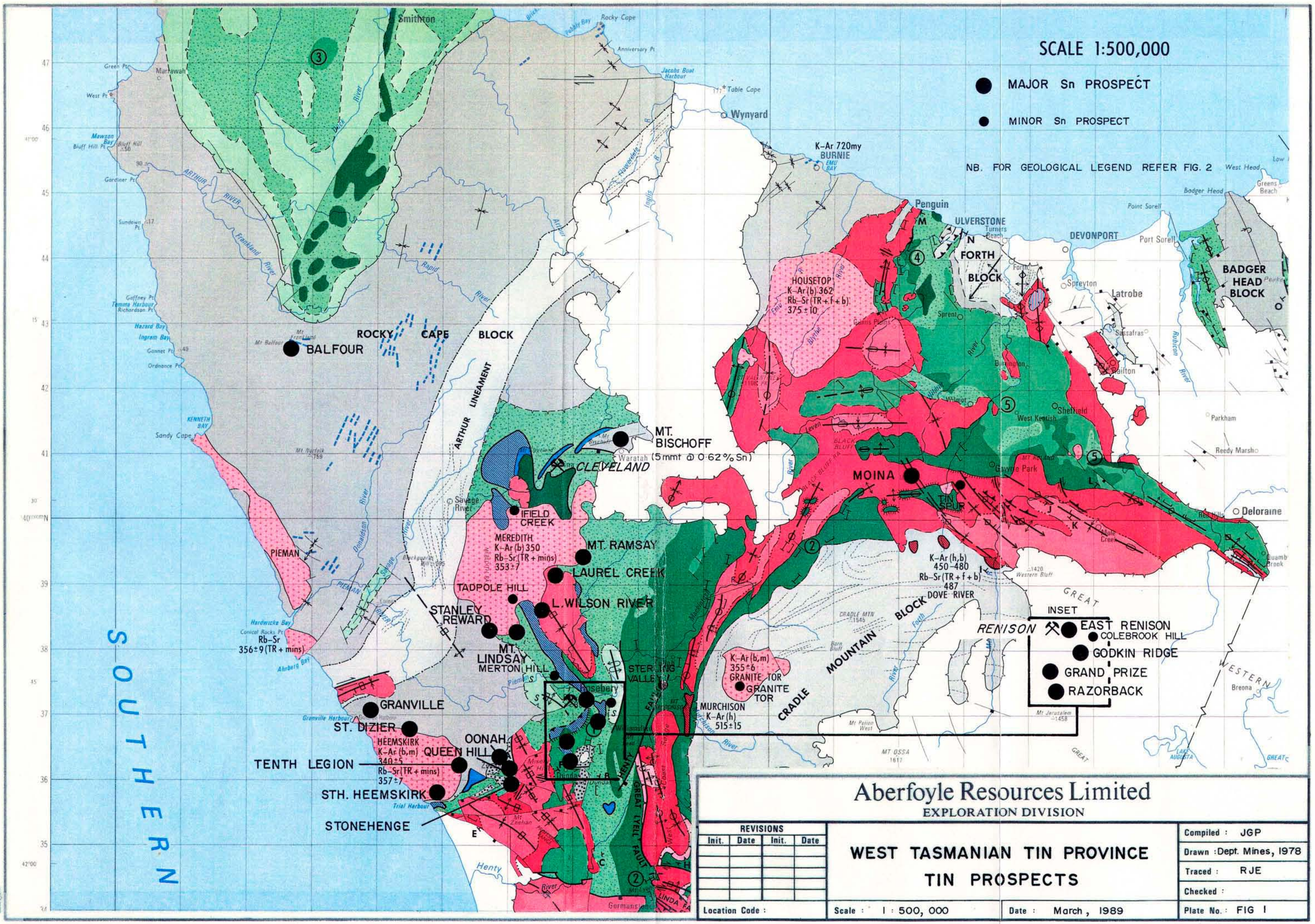
TABLE 1A

IN-SITU TIN RESOURCES - WESTERN TASMANIAN TIN PROVINCE

(excluding Renison, Queen Hill and Cleveland Deposits)

Prospect	Resource	Contained Tin	Comments
MT. BISCHOFF	5,002,000t @ 0.62% Sn. In-situ geological resource @ 0.2 & 0.3% Sn cut-off. (Metals Ex 1983)	30,650t Sn	Dolomite-sulphide (carbonate-replacement), and porphyry ore.
MT. LINDSAY	208,000t @ 0.83% Sn. "Potential reserves" (Aberfoyle 1970)	1,725t Sn	Contact skarn.
RAZORBACK	365,000t @ 0.72% Sn. In-situ geological resource (CRA 1980)	2,630t Sn	Carbonate-replacement sulphide ore.
GRAND PRIZE	900,000t @ 0.8% Sn, 0.7% Cu. Approx. tonnage and grade potential (GFEL 1984)	7,200t Sn	Carbonate-replacement sulphide ore in fault zone. Figures v. approx. estimate only.
EAST RENISON Pieman Tin Vein	430,000t @ 1.0% Sn, 0.2% Cu, 0.3% Zn, 8 g/t Ag.	4,300t Sn	Metallurgically complex vein mineralisation. Figures are of highly questionable validity.
Salmons Vein	830,000t @ 0.2% Sn, 3.2% Pb, 2.2% Zn, 104 g/t Ag, 0.6% Cu. "Probable Resoures" (Comstaff 1984).	1,660t Sn	
OONAH	1,300,000t @ 0.57% Sn. Estimated in-situ resource (CRA 1982)	7,410t Sn	Metallurgically complex sulphide mineralisation with stannite. Figures approximate.
ST. DIZIER	5,000,000t @ 0.5% Sn. (Renison 1982?)	25,000t Sn	Contact skarn. Metallurgically complex. Reliability of estimate unknown.
TENTH LEGION	900,000t @ 0.4-0.5% Sn. "Possible Resource" (CRA 1982?)	4,000t Sn	Magnetite skarn. Figures of highly questionable validity.
SOUTH HEEMSKIRK			
Sweeneys	500,000t @ 0.6% Sn, 1.9% Zn, 37 g/t Ag.	3,000t Sn	Endogranitic bodies of complex cassiterite-stannite-sulphide mineralisation. Figures approximate.
Anomaly 1	400,000t @ <0.6% Sn	2,000t Sn?	
Globe	100,000t @ 0.4% Sn? "Rough resource estimates" (GFEL 1983 & 84).	400t Sn?	
MOINA	26,500,000t @ 0.15% Sn, 18% CaF_2, 0.1% W, <0.4 g/t Au. Indicated in-situ geological resource (Comalco 1979).	39,750t Sn*	Metallurgically-complex wrigglitic magnetite-fluorite skarn. Tonnage figures probably conservative.
	2,800,000t @ 0.18% Sn, 0.07% W, (+CaF_2+Au) Estimated in-situ resource (Shell 1981)	5,040t Sn	Retrograde ditto.
TOTAL		135,000t Sn	

*Although the Moina contained tin resource is larger (on paper) than that at Mt. Bischoff, it is not nearly as well defined. Also, if the Moina grade (0.15% Sn) was applied to Bischoff, the contained tin resource at the latter would probably exceed 100,000t Sn. The two resources are not comparable.


SCALE 1:500,000
MAJOR Sn PROSPECT
MINOR Sn PROSPECT
NB. FOR GEOLOGICAL LEGEND REFER FIG. 2
Smithton
Rocky Cape
Wynyard
K-Ar 720my
BURNIE
Penguin
ULVERSTONE
DEVONPORT
Port Sorell
FORTH BLOCK
BADGER HEAD BLOCK
Latrobe
Deloraine
HOUSETOP
K-Ar (b) 362
Rb-Sr (TR + f + b)
375 ± 10
BALFOUR
ROCKY CAPE BLOCK
ARTHUR LINEAMENT
MT. BISCHOFF
(5 mmt @ 0.62% Sn)
Waratah
CLEVELAND
MOINA
TIN SPUR
IFIELD CREEK
MEREDITH
K-Ar (b) 350
Rb-Sr (TR + mins)
353 ± 7
MT. RAMSAY
LAUREL CREEK
TADPOLE HILL
L. WILSON RIVER
STANLEY REWARD
MT. LINDSAY
MERTON HILL
STERLING VALLEY
PIEMAN
Rb-Sr
356 ± 9 (TR + mins)
K-Ar (h,b)
450-480
Rb-Sr (TR + f + b)
487
DOVE RIVER
CRADLE MOUNTAIN BLOCK
K-Ar (b,m)
355 ± 6
GRANITE TOR
MURCHISON
K-Ar (h)
515 ± 15
INSET
RENISON
EAST RENISON
COLEBROOK HILL
GODKIN RIDGE
GRAND PRIZE
RAZORBACK
GREAT WESTERN
GRANVILLE
ST. DIZIER
HEEMSKIRK
K-Ar (b,m)
340 ± 5
Rb-Sr (TR + mins)
357 ± 7
OONAH
QUEEN HILL
TENTH LEGION
STH. HEEMSKIRK
STONEHENGE
GREAT LYELL FAULT
SOUTHERN
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EXPLORATION DIVISION
REVISIONS
Init. Date Init. Date
WEST TASMANIAN TIN PROVINCE
TIN PROSPECTS
Compiled : JGP
Drawn : Dept. Mines, 1978
Traced : RJE
Checked :
Location Code :
Scale : 1 : 500, 000
Date : March, 1989
Plate No. : FIG 1

HOLOCENE TO LATE CARBONIFEROUS — *Flat-lying Parmeener Super Group with Jurassic dolerite sheets and younger deposits.*

MIDDLE DEVONIAN — *Eugenana cave deposits.*

Angular unconformity attributed to late – Early or early – Middle Devonian orogeny (Tasmania – wide folding).

EARLY DEVONIAN TO EARLY ORDOVICIAN

LATE CAMBRIAN

Stable shelf deposits of Ordovician Gordon Limestone and Silurian – Early Devonian Eldon Group of interbedded quartz sandstone and mudstone.

Usually shallow – marine and terrestrial quartz sandstone and conglomerate, including Owen Conglomerate.

Volcaniclastic usually shallow – water sequences; turbidite quartzwacke / mudstone sequences.

Mathinna Beds of eastern Tasmania: turbidite micaceous quartzwacke / mudstone sequence.

At some localities transitional to underlying rocks (Misery Hill); erosional level, possibly angular unconformity in some areas (Fossey Mountain Trough); angular unconformity, attributed to local fault movements, particularly at margin of Tyennan Block, in the Dial Range and at Adamsfield.

LATE CAMBRIAN TO EARLY CAMBRIAN

Fossiliferous Middle and Late Cambrian usually greywacke – type turbidite sequences, including Dundas Group, (1); unfossiliferous beds, including Crimson Creek Formation of dominantly mudstone, (4); dominantly acid – intermediate volcanic and associated rocks (2); dominantly basic – intermediate volcanic and associated rocks (3).

PRECAMBRIAN

Massive dolomite / limestone sequences, including Smithton Dolomite and Jane Dolomite; quartzite / mudstone of Success Creek Group and correlates. (S).

Angular unconformity attributed to Penguin Orogeny (>720 my), and older Frenchman Orogeny.

PRECAMBRIAN

Metamorphic rocks with structural trend lines shown, of dominantly pelitic and orthoquartzite sequences and amphibolite; sandstone / mudstone sequences (1), with thin dolomite beds and volcanic horizons in some localities (2).

IGNEOUS ROCKS

LATE DEVONIAN

- *Dominantly adamellite.*
- *Dominantly granodiorite.*
- *Hypersthene adamellite porphyry.*

CAMBRIAN

- *Granite.*
- *Coarse grained basic rocks.*
- *Serpentinite and associated rocks.*
- *Dominantly acid – intermediate volcanic rocks.*
- *Dominantly basic – intermediate volcanic rocks.*

PRECAMBRIAN

- *Granite.*
- *Dolerite.*

CAMBRIAN PALAEOGEOGRAPHICAL ELEMENTS

(1) *Dundas Trough,* (2) *Mt Read Volcanic Belt*

(3) *Smithton Trough* (4) *Dial Range Trough*

(5) *Fossey Mtn Trough* (6) *Adamsfield Trough*

All named Devonian Blocks were geanticlines. Cradle Mountain and Prince of Wales Range Blocks constituted the Tyennan Block during earlier Devonian folding and, in the Late Cambrian to Early Ordovician, the Tyennan Geanticline.

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GEOLOGICAL LEGEND

To Accompany FIG. I

WEST TASMANIAN TIN PROVINCE, TIN PROSPECTS

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Location Code :

Scale :

Date : March, 1989

Plate No. : FIG. 2

1511

2. INTRODUCTION

This report completes a commission to outline current tin prospects in Tasmania. Part 2 dealt with the NE Tasmanian Tin Province. This volume deals with prospects in the major West Tasmanian Tin Province.

The report lists specific tin occurrences and discrete prospective areas, considered to have the most significant tin potential. Where possible, the exact nature of this potential is spelt out. Although most tin prospects were reviewed, in a tin province of this stature it is impossible to research every occurrence or to view even half the data from the enormous amount of tin exploration carried out over the years. The author therefore apologises for any omissions. (Note: properties already held by Aberfoyle were not reviewed).

There has been no attempt to conduct the assessment from a conceptual viewpoint, although some ideas in this regard are given in Section 4. In the current situation where little tin exploration is being done and almost all tin properties are potentially for sale or JV at 'bargain' prices, it would seem sensible to concentrate on acquiring deposits and prospects already found, but undeveloped or inadequately tested, rather than conduct pure grassroots exploration.

To a surprising extent, many of the listed prospects retain untested potential because the holders allowed their exploration decisions to be guided by the short-term tin price rather than the technical merits of the properties. After the tin price collapse in 1985, Renison Goldfields departed several first-class prospects having done enough excellent work to outline the best targets, but before these were fully tested. Examples of this are Grand Prize, South Heemskirk and Stonehenge, amongst others.

Alluvial tin deposits in Western Tasmania have contributed less than 1% (<2000t) of total tin produced. Although no alluvial prospects are listed in the report, they do exist. The Laurel Creek area at the northern end of the Huskisson Syncline has been described by Goldfields as "a classic Malaysian alluvial tin situation". There would appear to be potentially several tens of millions of m^3 of cassiterite-bearing gravels here, in an area that is unfortunately remote and heavily vegetated (see Section 7.3).

3. GEOLOGY

The geological setting of the Western Tasmanian Tin Province is shown in Figure 1. Its eastern limit is defined by the Tamar Fracture Zone which divides it from the NE Tasmanian Tin Province (see Figure 3).

Tin mineralisation in Western Tasmania is genetically and spatially associated with mid to late Devonian biotite granite intrusions, the most notable being the Meredith and Heemskirk granites. Other important plutons, although poorly exposed, are the Pine Hill Granite at Renison and the Dolcoath Granite at Moina.

Recent gravity work has shown that the outcropping plutons are linked at depth and that Devonian granite underlies a large part of Western Tasmania (see Figure 3). Interpretation of the gravity data indicates that most of the tin occurrences lie within 1 km of the buried granites (Collins and Williams 1986). In particular, the data indicates there is a buried granitic ridge at shallow depth extending from the Heemskirk Granite near Zeehan to the Granite Tor massif east of Tullah. This ridge appears to be associated with some of the most significant tin deposits and prospects in Western Tasmania, including the Queen Hill and Renison deposits, and prospects such as Oonah, Razorback, Grand Prize, East Renison, Godkin Ridge and Colebrook Hill. It is also responsible for the tin mineralisation on the Henty Fault in the Sterling Valley. See Figure 1.

In detail, the most important deposits - Renison, Mt. Bischoff, Queen Hill and Cleveland, are apparently associated with smaller granitic cupolas and dykes, peripheral to the principal intrusions. These features are presumably volatile-rich late-stage differentiates. At both Queen Hill and Cleveland the causative intrusions do not outcrop, and at Bischoff and Renison their surface expression is minimal.

The Province is characterised by an abundance of tin occurrences reflecting a diverse range of mineralisation styles, host rock lithologies and mineral associations. These include:

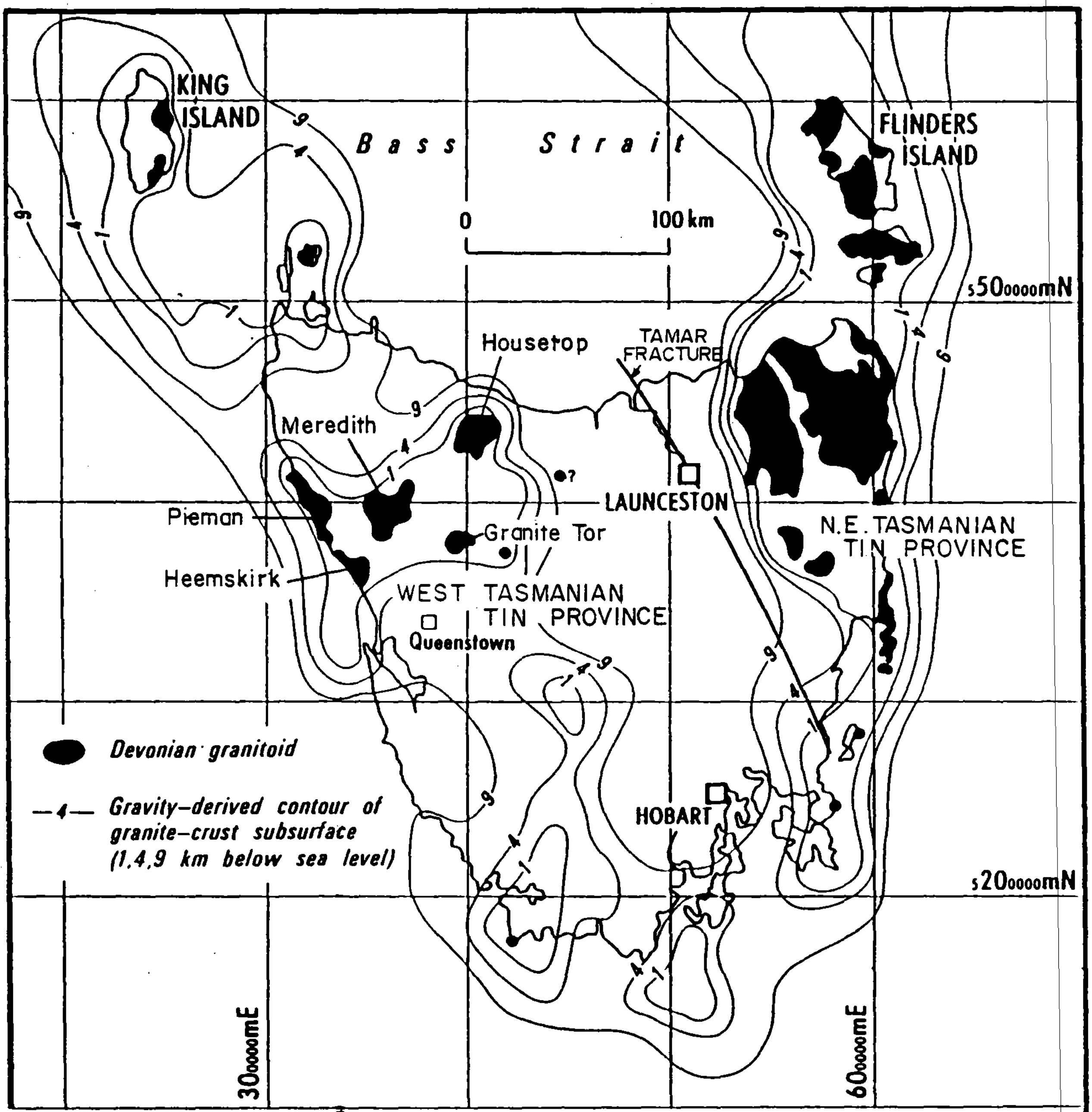
1. Sulphide-cassiterite carbonate-replacement type (Mt. Bischoff, Renison).

2. Magnetite-dominated replacement skarns, with complex tin mineralogy (St. Dizier, Mt. Lindsay, Moina).

3. Fault and structurally-hosted cassiterite-stannite vein and sulphidic carbonate-replacements (the Federal-Bassett ore at Renison, Grand Prize, Oonah, Salmons/Pieman Tin Veins).

4. Endogranitic cassiterite (±stannite) - sulphide pipes, sheets and disseminations, of basically greisen-style (South Heemskirk, Tadpole Hill, porphyry ore at Mt. Bischoff).

Most tin occurrences are of types 1 and 2, but type 3 is also an important category.



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CONTOURS OF GRANITE -CRUST SUB-SURFACE

Scale : As shown

Date : March, 1989

Compiled : JGP

Drawn : after Leaman et al,'80

Traced : RJE

Checked :

Plate No. : FIG 3

1511

The world-class carbonate-replacement bodies of type 1 are the most notable feature of the Western Tasmanian Tin Province, and have produced the bulk of the tin to date. Because of their size, grade (around 1% Sn), and metallurgical amenability, they are demonstrably the most attractive targets for exploration. The Renison deposit, with a total mineable resource of around 50mmt @ 1% Sn (L.A. Newnham pers comm. 1983), is the largest of these bodies anywhere in the world.

In detail, the carbonate-replacement bodies comprise conformable lenses of massive or semi-massive cassiterite-bearing pyrrhotite, or less commonly, pyrite. These form at some distance from the granites - generally from several hundred metres up to 1 km vertically above the intrusions.

The skarns of type 2 occur adjacent to the granites, and are characterised by complex mineralogy, with much of the tin occurring in minerals other than cassiterite (such as stannite and silicates), and with complex geology due to zonation patterns complicated by retrograde overprinting. The grade tends to be a little over half that of the carbonate-replacement bodies (around 0.6% Sn), and this, combined with the features outlined above, makes them generally less-attractive to explorers.

Tin mineralisation of all exogranitic types is hosted by a variety of sedimentary formations ranging in age from Upper Proterozoic to Siluro-Devonian. These rocks form part of the basement, infill and cover of the Dundas Trough (Brown 1982). The principal tin hosts are dolomites and limestones of sequences from the Proterozoic/Cambrian transitions, viz:

A. The Oonah formation (Queen Hill, Mt Bischoff, St. Dizier)
B. The Success Creek Group (Renison, Stanley Reward).
C. The Crimson Creek Formation (Cleveland, Mt. Lindsay, East Renison.
D. Dundas Group (Grand Prize, Godkin Ridge).

Tin mineralisation also occurs in the Ordovician Gordon Limestone (Moina, Laurel Creek); and Siluro-Devonian carbonate-bearing sediments of the Amber Slate and Crotty Quartzite formations (Merton Hill, Little Wilson River, Laurel Creek).

The tin-mineralised systems display a zonation characterised (in general terms) by complex sulphide assemblages (Pb-Zn-Ag ±stannite) in the upper and outer (cooler) parts of the system furtherest from the causative intrusion; and pyrrhotite-pyrite-cassiterite mineralisation in the (hotter) inner and deeper parts of the system closer to the intrusion. Thus the Zeehan Pb-Ag-Zn field is now recognised as being largely (but not wholly) genetically associated and centred on the Queen Hill tin-mineralised system (Collins & Williams 1986).

The author would like to make two points (based on his own experience) about the geology of the tin systems in Western Tasmania, which haven't received much attention in the published literature:

1. Proterozoic/Cambrian precursor event?

Some of the biggest tin systems (eg: Mt. Bischoff, Renison) display features that suggest there was some syn-depositional or early diagenetic alteration-sulphidisation event, well before any Devonian granite-related tin-mineralising episode. This is very evident at Mt. Bischoff and has been remarked on by the majority of geologists who have worked on the deposit in the last 10 years. These features are:

a) The sediments at Bischoff are fine-grained, well-bedded and generally indicative of low-energy sedimentation. But they are characterised by a ubiquitous and high level of soft-sediment disruption. This seems to be restricted to the immediate deposit area. The inference is that the local sedimentary environment was highly tectonically active.

b) The sediments are to a large extent composed of ultra-fine-grained sericite, dravite and pyrrhotite (the latter averages 5-15%). The sulphides and the tourmaline are bedded (the ´pyjama siltstone´ of CRA).

c) The sediments also contain abundant vein and fracture sulphides with tourmalinised selvages. This sulphide is predominantly pyrite. Petrological evidence shows some of the veins are of sweat-out type, and that some of the veining and associated tourmalinisation occured while the sediments were still unconsolidated (Purvis 1979).

d) At Bischoff this tourmalinisation and sulphidisation is confined to the upper 300m of the flat-lying sedimentary pile. The sediments below contain little of either. More-importantly, the Devonian porphyry dykes are only sulphidic above the point at which they enter the sulphidic and tourmalinitic sedimentary sequence.

2. Gold.

The big Devonian tin systems such as Mt. Bischoff and Renison contain no gold. Although the traces present in the Mt. Ramsay skarn and at Stanley Reward (and the possible occurrence at South Heemskirk), show that it is not impossible to get low levels of gold in some of the Devonian systems, significant gold only occurs with tin mineralisation where the granites have intruded the auriferous rocks of the Mt. Read Volcanics and their associated sediments. These rocks contain widespread gold values derived from Cambrian syn-volcanic mineralisation.

The author contends that such gold-tin mineralisation is a Cambrian/Devonian ´hybrid´, with the gold probably leached from the volcanics by the action of granite-related fluids or some other mechanism and redeposited together with the ´Devonian´ metals. Examples of such Sn-Au mineralisation are along the Henty Fault in the Sterling Valley and around the Dolcoath Granite in the Moina area.

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4. GRASSROOTS EXPLORATION POSSIBILITIES

In recent years the government gravity surveys have begun to provide a picture of the sub-surface morphology of the granite intrusions. This is a major advance and could prove to be crucial in the search for tin bodies.

The major carbonate-replacement deposits all appear to be related to subsidiary late-stage intrusives peripheral to the main plutons (eg: Cleveland and Mt. Bischoff, located along the northern margin of the Meredith Granite). Detailed gravity surveying and modelling of the buried granite surface to try and determine the location of such non-outcropping peripheral cupolas or dykes, could pay signficant dividends. This potentially represents a way of focussing surface exploration to a greater extent than merely surveying large tracts of carbonate-bearing sediments close to granites.

Although the margins of all the major outcropping granites, and the ground to the east and south of Renison, are obvious areas where such an approach could be worthwhile, the Company might like to look specifically at the Huskisson Syncline on the SE margin of the Meredith Granite. Ths large feature contains Gordon Limestone and other carbonates. While the western limb has been partly explored (mainly for skarn-style mineralisation where the carbonates contact the granite), the eastern limb and the body of the syncline has hardly been looked at, although carbonates are very extensive here (see Figure 7-4).

A detailed gravity survey of the Huskisson Syncline may be able to delineate any granitic cupola, dyke or ridge, projecting at depth up into the carbonate-bearing sequence, both along the fold limbs and nearer the broad fold axis. Surface exploration in this latter zone has been hindered by cassiterite-bearing Tertiary gravels and thick vegetation.

Another area where gravity may be of assistance is at Balfour in the Rocky Cape Block, where there are some indications for significant tin potential at depth. A buried granite is postulated here.

It should be noted that tin explorers to date have relied on Gradient Array IP and VLF or Max-Min EM, to locate cassiterite-sulphide bodies. Almost no UTEM or Sirotem surveys have been done. In some areas it could be potentially rewarding to run the modern EM systems over known prospective units. The exposed carbonates on both limbs of the Huskisson Syncline would be prime targets for such an approach.

5. TIN IN THE ROCKY CAPE BLOCK

5.1 INTRODUCTION

The only tin occurrence of any significance in the Rocky Cape Block is at Balfour. This is detailed in the next sub-section.

Traces of tin are widespread in drainages in the western half of the Rocky Cape Block. The two principal groups of anomalies are in the general vicinity of Balfour and around the mouth of the Pieman River. However, most or all of these anomalies have been attributed to reworking of Tertiary gravels containing cassiterite derived from Balfour or the Pieman Granite. The latter, in the SW corner of the Rocky Cape Block, has known weak tin-tungsten mineralisation associated with it. The drainage of the Arthur River contains tin brought down from the Bischoff deposit.

There are occurrences of stratiform banded magnetite and pyrite within shale units to the W and NW of Balfour in the Temma-Nelson Bay area. Exploration work by CRA-Geopeko showed that while these occurrences contain some base metals they are poor in tin.

The dolomites, cherts and basic volcanics of the Smithton Trough in the northern part of the Rocky Cape Block, were covered by detailed stream sediment sampling programmes by CRA in 1982-83 and Mineral Holdings in 1987. No anomalous tin or tungsten values were obtained.

5.2 BALFOUR

The tin occurrence at Balfour, on the western side of the Rocky Cape Block, was discovered over 100 years ago. Extensive sluicing of eluvium and decomposed outcrop of cassiterite-bearing quartz veins in Proterozoic sediments, has taken place in shallow workings centred on Specimen Hill. Total recorded production is 177t of tin and working continued as late as 1983 when 15t Sn was produced from ground averaging around 1000g Sn/m^3.

The rocks hosting the Balfour mineralisation are of Upper Proterozoic age and part of the Rocky Cape Group. They comprise a lower (western) unit of thinly-bedded tourmalinitic sericitic siltstones and quartzose sandstones - the Specimen Hill Siltstone; and an upper (eastern) unit of chloritic shales - the Balfour Slate. The sediments strike north and dip east. Apart from weak regional effects, there is no obvious metamorphism of the rocks.

Tin mineralisation is confined to the Specimen Hill Siltstone and mainly occurs as cassiterite-wolframite-sulphide bearing quartz veins. The sulphides are pyrite and arsenopyrite with lesser sphalerite, chalcopyrite, pyrrhotite and tetrahedrite. Minor cassiterite also occurs disseminated in the tourmalinised sediments in conjunction with fine pyrrhotite, which is sufficient to cause several magnetic anomalies on and around Specimen Hill.

The quartz veins are irregular and impersistent, average 10-50mm in width and are spaced approximately 1-5m apart. The majority of veins strike NW and dip steeply W. The main mineralised zone at Specimen Hill covers an area of 400m x 200m. Local structure is dominated by a set of strong NNW-trending faults which cut across the Specimen Hill area.

Tourmaline content varies throughout the Specimen Hill Siltstone unit but is generally concentrated in the argillaceous beds. Some strong tourmalinisation occurs in breccia zones within the sediments. A tourmaline-rich zone cross-cuts the bedding on Specimen Hill, suggesting an epigenetic emplacement.

CRA geologists generally favoured a syngenetic origin for the tourmaline, while Geopeko considered it preceded the mineralised veining and was probably an alteration event associated with it. The tin mineralisation is generally conceded as being of Devonian age and related to a postulated granitic intrusive at depth. However, the nearest known Devonian granite (the Pieman or Interview River Granite), outcrops 20 km to the SW of Balfour.

At Peter's Ridge, 250m NE of Specimen Hill, there is a second significant zone of mineralisation where the veins cut pyritic quartzite beds at the top of the Specimen Hill Siltstone. Here, there are pods of massive cassiterite up to 3m x 0.3m in size with a yellow clay type of hydrothermal alteration in the sediments stratigraphically below them. Simpson (1982) remarked on the cherty appearance of the quartzites.

The sequence appears devoid of carbonate lithologies. The only known carbonate in the area is a pyritic quartz-dolomite unit in the Balfour States which hosts the Cu mineralisation at the Murrays Reward prospect, 1 km E of Specimen Hill. Drilling here by ACI (1969-73), delineated a resource of 542,000t @ 0.8% Cu on the eastern margin of the tin mineralisation. Murrays Reward is part of a zone of Cu mineralisation that can be traced for 20 km parallel to the NNW-trending regional strike. It is not clear if the mineralisation and the hosting quartz-dolomite unit are conformable or not, but the best Cu values occur locally in narrow en echelon shear zones within the trend (Weir 1984).

Balfour has been explored by BHP (1963-64) who drilled 6 diamond drill holes, and the CRA-Geopeko JV (1979-82) who drilled 11 holes. At least 7 of these holes were less than 100m deep. The explorers also completed geochemical, magnetic, IP and DIGHEM surveys.

Results of this work were surprisingly poor given the strong geochemical response of the exposed mineralisation. The drill holes intersected generally low-grade tin values with few exceeding 0.15% Sn. The occasional higher values were all related to strongly quartz-veined intervals, giving intersections up to 1.83m @ 1% Sn, 1.9m @ 0.54% Sn and 5.5m @ 0.23% Sn (all in DDB 1).

The drilling confirmed that the amount of quartz veining sub-surface is quite low. Two holes (DDB 14 and 16) showed the veins had an average grade of 1.2% Sn and 0.7% W, but that there was on average only 30mm of vein material/10m.

There has been no exploraton of the property since 1982. The main mineralised area is held under a patchwork of small Mineral Leases owned by various individuals and covering about 3.5 km^2. The ML's are surrounded by ELA 53/88 held by Soloriens Mining Pty. Ltd.

Potential: Balfour is an extensive tin-mineralised system in which no resource potential has been identified to date. It is not well explored.

Geologically, there are some similarities between Balfour and the big tin systems elsewhere on the West Coast. Tourmalinitic sericitic siltstones identical to those of the Specimen Hill Siltstone, are found in the footwall host sequences at both Mt. Bischoff and Renison, where (like Balfour), they are characterised by abundant fine disseminated pyrrhotite. Most geologists consider such tourmalinisation and sulphides to be part of Devonian granite-related tin mineralisation.

Exploration to date at Balfour has been primarily aimed at delineating a large low-grade open-cuttable mineralised vein swarm deposit. The potential for sulphide-hosted carbonate-replacement tin mineralisation is very real and has not been well tested. The non-discovery of carbonates in the sequence to date is a major negative feature, but their possible existence cannot be ruled out on the amount of work done to date. The top of the Specimen Hill Siltstone unit would seem to be the most prospective position for possible carbonate-replacement mineralisation.

No UTEM or similar modern ground-based EM system has been tried on the property, nor has deep drilling been attempted. Recent roading developments have markedly improved the access and changed the complexion of exploration in this once-remote area.

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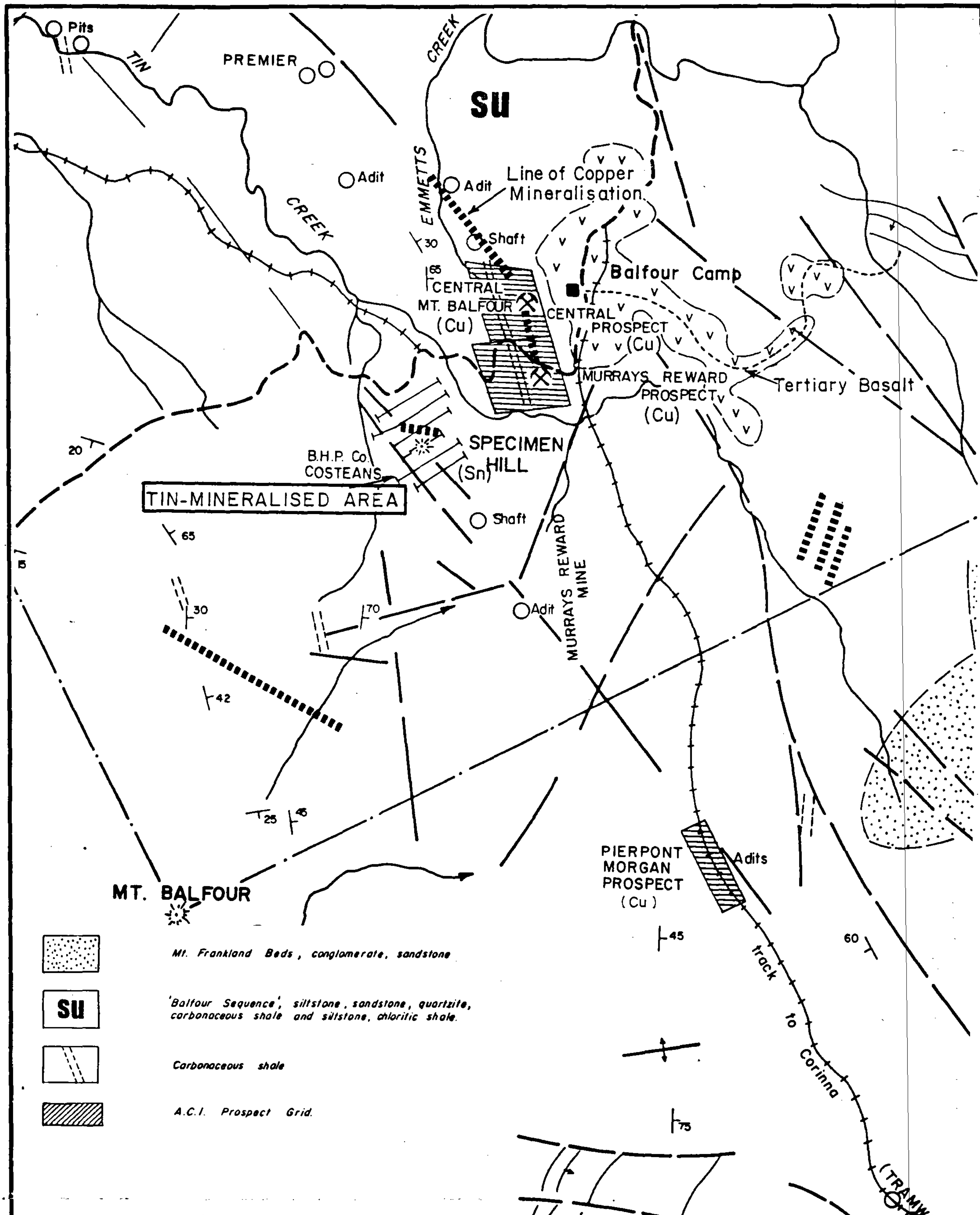

Aberfoyle Resources Limited

EXPLORATION DIVISION

REVISIONS				NORTH WEST TASMANIA	Compiled : JGP
Init.	Date	Init.	Date	BALFOUR TIN PROSPECT	Drawn : from Cominco, 1975
					Traced : JLR
					Checked :
Location Code :				Scale : 1 : 25,000 — Date : March, 1989	Plate No. : FIG 5-1

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6. THE MT. BISCHOFF DEPOSIT

6.1 INTRODUCTION

Mt. Bischoff is one of the largest of the Western Tasmanian tin systems. On the basis of contained tin, as well as the sheer geological size and strength of the mineralising system, it is probably only out-ranked by Renison. In the author's opinion Mt. Bischoff is the most attractive tin prospect (available or potentially available to Aberfoyle) in Tasmania.

From Aberfoyle's viewpoint an important added attraction is that the deposit lies only 13 km NE of the Company's now-idle Cleveland mill.

The Mt. Bischoff deposit was discovered in 1871 and was worked both open-cut and underground until 1947 when major hard-rock mining ceased. It was one of the world's largest individual tin producers for almost 50 years - from 1874 to 1921. In that time it produced 55,210t Sn from an estimated 4.748 million tonnes of ore with an average recovered grade of 1.16% Sn (Turner et al in press).

Much of this ore was in the form of rich, easily-worked eluvial and deeply oxidised material. Mining petered out as the metallurgically-difficult sulphide-hosted ore, and the extremely hard topazised porphyry ore, became predominant. Total production from the deposit is estimated at about 62,000t Sn, including about 1000t Sn from adjacent alluvials (Turner et al in press). A further 30,000t Sn is estimated to have been lost in tailings from the inefficient mining operations and discharged into the Waratah River (Groves et al 1972).

Since mining ceased Mt. Bischoff has seen some intensive exploration, mainly by Comstaff (a JV grouping with Anglo-American as the principal) in the period 1964-70; and CRA-Metals Exploration from 1978-83. In this time over 200 diamond drill holes have been put down and detailed metallurgical, mining and feasibility studies have been done, most recently and comprehensively by Metals Exploration.

The latest in-situ resource estimate (Metals Ex 1983) is as follows:

Dolomite-sulphide ore	:	1,480,000t @ 0.97% Sn (0.3%Sn cut-off).
Quartz porphyry ore	:	3,522,000t @ 0.47% Sn (0.2%Sn cut-off).
Total		5,002,000t @ 0.62% Sn (30,650t Sn)

Tin is the only metal of economic value although there are potentially-recoverable amounts of fluorite and topaz.

The deposit is currently owned by Metals Exploration (85%) and Comstaff-Preussag Australia (15%). CRA is entitled to a royalty (amount unknown) on profits from any future mining operation. The property is held under Retention Licence No. 8807 of 4 sq. km.

The author spent 4 months in 1978 working on Mt. Bischoff in the initial stages of the CRA-Metals Exploration evaluation programme.

6.2 GEOLOGY

General

The Mt. Bischoff tin deposit occurs within an inlier of Upper Proterozoic sediments correlated with the Oonah Formation by Brown (1986). It lies 8 km NE of the Devonian Meredith Granite and 13 km NE of the Cleveland tin deposit. The inlier is flanked to the S and E by Tertiary sheet basalts, and to the N and W by Cambrian sediments and basic volcanics.

The host sediments comprise thinly-bedded shales, siltstones and quartzose sandstones (´quartzites´), and include an irregular lensoid unit of dolomite and associated dolomitic shale, locally up to 60m thick. Much of the tin mineralisation is concentrated in this dolomite unit. In the deposit area the finer sediments contain significant amounts of sericite and tourmaline (dravite). This tourmaline occurs both in bedded form and in association with quartz-carbonate-sulphide veins.

The sediments also contain up to 20% ultra-fine-grained pyrrhotite as bedded disseminations, thin graded laminae, and as clasts and ´slugs´ of massive pyrrhotite. Petrological evidence suggests the pyrrhotite has replaced earlier (syngenetic?) pyrite (Purvis 1979).

The sediments are intruded by a series of large interconnected Upper Devonian quartz-feldspar porphyry dykes and sills. The age dating of these dykes (349 my) is very similar to the nearby Meredith Granite (353 my) (Turner et al in press). The dykes are centred on the deposit and are exposed in an area of 2.7 km x 1.7 km. In the vicinity of the deposit the porphyries are topazised, sericitised and mineralised. They are traditionally considered to have been genetically associated with the tin mineralisation.

Structure

The local deposit environment appears to have been one of active tectonism. Pre-consolidation deformation features, including slumping, are ubiquitous in the host sediments, as is evidence of later tectonic brecciation. Structure is dominated by a large ENE-trending anticlinorium whose axis passed through the summit of Mt. Bischoff and the deposit. On the flanks of this dome the sediments are complexly folded, but dips are generally sub-horizontal in the deposit area and broadly parallel to the ground surface. Because of this dip, it is clear that a considerable amount of the dolomite-hosted mineralisation has been eroded off (see Figures 6-3, 6-4).

Jannink (1980) describes six major post-porphyry NE-trending faults which form a 300m-wide graben through the central deposit area. The significance of this structure is not known.

Mineralisation

Almost all the mineralisation lies within a radius of 1 km of the summit of Mt. Bischoff. (See Figure 6-1). Zoning is apparent with several Pb-Zn-Ag occurrences distributed around the periphery of the tin-mineralised area.

There are four ore types :

1. Fine grained sulphide-hosted cassiterite in stratabound pyrrhotite-rich lenses within altered dolomite. This ore type is similar to the stratabound replacement ore at Renison.

2. Sulphide-hosted and free crystalline cassiterite as disseminations and fracture-fillings in topazised quartz-feldspar porphyry dykes.

3. Crystalline cassiterite in quartz-carbonate-fluorite fissure lodes.

4. Fine grained cassiterite and minor stannite in quartz-carbonate-fluorite-sulphide veins, fracture-fillings and disseminations, within the pyrrhotitic and tourmalinitic host sediments.

Historically, most production has come from ore-type 1, especially where it was deeply oxidised. Metals Exploration call this type ´dolomite sulphide lode´ or ´DSL´, and it has a primary grade around 1% Sn. The current resource estimate includes 1.5 mmt of DSL grading 1% Sn.

The dolomite sulphide ore (DSL) occurs in lenses in the lower part of the dolomite horizon (see Figures 6-3, 6-4). The three largest worked ore bodies were oxidised sulphide bodies at Brown Face, White Face and Slaugheryard Face, with smaller bodies at Gossan and Happy Valley faces (Turner et al in press. See Figures 6-1, 6-2, 6-3, 6-4). Brown Face was the most productive single orebody at Mt. Bischoff, yielding over one third of the total tin produced (Langsford 1982).

The DSL comprises finely-banded pyrrhotite (with minor pyrite, arsenopyrite, sphalerite, chalcopyrite and cassiterite), in a gangue of quartz, talc, serpentine, fluorite and carbonate (dolomite, siderite, ankerite, magnesite). DSL contains on average:

quartz-carbonate	40%	pyrrhotite	21%
talc-serpentine	35%	pyrite	3%

as well as:

1% Sn	0.2% Sn	160 ppm Pb
1% F	500 ppm Cu	70 ppm W (as scheelite)
0.25% As	200 ppm Bi	1.5 ppm Ag

Studies carried out by Metals Exploration showed that there is a positive correlation between pyrrhotite content and tin content in DSL, whereas in the porphyry ore the tin content is not directly related to the sulphide content. In both these major ore types approximately 4-5% of the total tin occurs as stannite (i.e. 200-500 ppm Sn).

A notable feature of the DSL is that it is occasionally almost totally devoid of tin, (average <15 ppm Sn). Such barren patches are mesoscopically indistinguishable from adjacent ore-grade DSL with which the barren zones are often in abrupt contact. It is possible that these barren zones are the result of hydrothermal depletion as even non-sulphidic rocks at Mt. Bischoff contain >15 ppm Sn.

Less production has come in the past from the porphyry ore of ore type 2, but it is the dominant ore type in the present resource, totalling 3.5 mmt @ 0.5% Sn. Most of this resource lies in the Stanhope-White Face dyke which averages 15-20 m wide (see Figure 6-2).

Mineralised porphyry is variably topazised and sericitised. It contains disseminated and fracture-filling pyrite (5-20%), much less pyrrhotite, and minor arsenopyrite and sphalerite. On average, porphyry ore contains :

0.5% Sn	700 ppm Zn	190 ppm Pb
0.4% F	300 ppm Cu	40 ppm W (scheelite)
0.08% As	60 ppm Bi	2.2 ppm Ag

The mineralised fissure lodes (ore type 3) historically produced less tin than the porphyry ore although in places they were exceedingly rich, containing lenses of massive cassiterite. The lodes occupy NNW-trending vertical to steeply-dipping faults which cut both the host sediments and porphyry dykes. They carry cassiterite and lesser wolframite, with trace amounts of stannite, galena and bismuthinite. The main lodes were the Queen, North Valley, Wheal-Giblin and Thompsons. Typical of these, the Queen Lode averaged 0.7m wide, and was worked over a length of 350m and to a depth of 107m, with grades of +3% Sn (Turner et al in press).

There was only very minor production from the sediment-hosted mineralised veins and fractures of ore type 4. The veins are highly variable in thickness and frequency. They contain pyrite, arsenopyrite and cassiterite, with lesser pyrrhotite, sphalerite and chalcopyrite. The gangue minerals are quartz (often amythyst) - carbonate (siderite, ankerite or dolomite) - fluorite $\pm$ tourmaline. There is petrological evidence that some of the veins are of sweat-out type with constituents remobilised from the sediments, and that some of the veining and associated tourmalinisation occurred while the sediments were still unconsolidated (Purvis 1979).

The potential of this mineralisation style can be gauged from the result in the first hole put down by Metals Ex (MBD 1), which was drilled into sediments in the immediate footwall of the main dolomite horizon. MBD 1 intersected a 200m true width of veined sediments averaging 0.15% Sn. This tin was shown to be largely in the quartz-carbonate-sulphide veins, although the tourmalinitic and pyrrhotitic host sediments contained tin in the order of 50-200 ppm - principally as stannite with lesser cassiterite (Purvis 1979). The veins averaged 3-20 mm in width and occupied 4% by volume in the top of the hole, decreasing to 1% 300m stratigraphically further down.

Langsford (1982) quotes a hole below Brown Face which intersected 75m of veined sediments averaging 0.15% Sn.

It is a feature of the deposit that almost all the tin mineralisation occurs in the uppermost 200-300m of the stratigraphy. Both the porphyry dykes and the sediments become unaltered and barren with depth. A hole (MBD 5) drilled to almost 1000m in the central part of the deposit in 1979, ran out of the tourmalinised and mineralised zone about 300m below surface. There was no obvious increase in metamorphic grade with depth and the hole bottomed in sediments similar to those in the upper part of the hole.

6.3 RESOURCE

The most up to date figures for the geological in-situ resource were calculated by Metals Exploration in 1983 at the completion of their exploration programme, and are shown in Table 6A.

These calculations were done using 40m-spaced sections, and level bases. Drill hole spacing was 20m x 20m in the DSL and 40m x 40m in the porphyry ore. Because of the numerous revisions by Metals Ex of their resource calculations, it is not clear to what RL limit the quoted resource extends and whether there may be additional resources below this limit.

No resource calculations were attempted for fissure lode or veined sediment mineralisation.

TABLE 6A

MOUNT BISCHOFF PROJECT - GEOLOGICAL RESERVES

JUNE 1983

	MEL JUNE 1983 RESERVE					
	DOLOMITE SULPHIDE ORE (0.3% Sn Cut Off)			PORPHYRY ORE (0.2% Sn Cut Off)		
	TONNES	%SN	TONNES SN	TONNES	%SN	TONNES SN
Drill Indicated						
Proven	53,400	1.12	598			
Probable	1,053,800	1.05	11,065	3,325,500	0.47	15,630
Possible	221,300	0.76	1,682	76,300	0.50	381
TOTAL DRILL INDICATED	1,328,500	1.00	13,345	3,401,800	0.48	16,011
Non Drill Indicated						
"Possible"	99,200	0.52	516	120,100	0.33	396
Slaughteryard Face	42,000	0.91	382			
TOTAL NON DRILL INDICATED	141,200	0.64	898	120,100	0.33	396
TOTAL DRILL INDICATED + NON DRILL INDICATED	1,479,700	0.97	14,243	3,521,900	0.47	16,407
GRAND TOTAL ALL CATEGORIES:	**5,001,600t @ 0.62% Sn (30,650t Sn)**					

6.4 METALLURGY

Metals Exploration carried out very extensive and detailed metallurgical testwork, some of which was undertaken by Aberfoyle's Burnie laboratory. This work showed that the Mt. Bischoff ore types are basically similar to Cleveland ore and a Cleveland-type circuit would yield recoveries of 65-75% of the tin, depending on the ore type, with DSL ore giving slightly better recoveries than porphyry ore.

The studies showed that an overall concentrate grading 40-45% Sn could be produced by a Cleveland-type circuit. The concentrate would also contain :

5-10% Fe	1000 ppm As	300 ppm Pb
1- 2% S	600 ppm Cu	300 ppm Bi
3000 ppm W	400 ppm Sb	200 ppm Zn
		(Motteram 1982)

Problems would include the fineness of the tin (see below), clean elimination of the sulphur, and suppression of talc in the DSL ore. The mineralogical compositions of the DSL and porphyry ore vary considerably, and this metallurgical variability is one of the most notable characteristics of the Mt. Bischoff deposit.

The testwork showed that a fine grind would be required to liberate the cassiterite. In porphyry ore cassiterite ranges from 20um to 200um in size and is generally in association with quartz. 75% of the tin in the porphyry ore was liberated with a 50um grind. Some of the DSL ore (that found overlying porphyry dykes) contains major amounts of talc. Cassiterite in the DSL is associated with both pyrrhotite and talc, that associated with pyrrhotite averaging 50um while that associated with talc is considerably coarser. 70% of the tin in DSL ore was liberated with a 105um grind. Some minor stannite (4-5% of the total tin) is present in both porphyry and DSL ore.

6.5 MINING STUDIES

Metals Ex carried out several feasibility studies using a variety of mining parameters, pit configurations and resource calculations. These studies are too voluminous to be detailed here. The reader is referred to Metals Exploration reports in the period 1980-83.

Most of the mining studies are not directly applicable to the present resource calculations, being based on earlier resource estimates which involved markedly lower tonnages and slightly higher grades. However, an indication of what may be feasible can be derived from the figures given by Jannink (1980), who calculated mill feed tonnages and grades for a combined open pit/underground operation, with allowances for pillars, waste and mining dilution.

Comparing his diluted mill feed and geological resource figures, and then applying the same factors to the current (1983) resource, the figures are :

	Geological Resource	Mill Feed
DSL Ore	: 1,480,000t @ 0.97% Sn	1,806,000t @ 0.79% Sn
Porphyry Ore	: 3,522,000t @ 0.47% Sn	3,201,000t @ 0.40% Sn
Total	5,002,000t @ 0.62% Sn	5,007,000t @ 0.54% Sn
Contained tin :	30,650t Sn	27,040t Sn

The Metals Ex studies showed that all the DSL ore is amenable to open pit mining at an overburden ratio of 4 or 5:1 (See Figure 6-5). However, only approximately 270,000t of the porphyry ore would lie within this pit and the remainder would have to be mined underground from a decline in the pit floor. Metals Ex envisaged a 300,000 tpa operation, using an ore stockpile to blend the metallurgically-variable ore types and maintain uniformity of mill feed.

Patchy argillic alteration of the host sediments adjacent to porphyry dykes and an intense weathering profile, have combined to render some of the mineralised rocks soft and friable. This feature of the Bischoff deposit was widely exploited by the early miners and would have some bearing on mining costs even today.

6.6 POTENTIAL

At 5.00 mmt @ 0.62% Sn, Mt. Bischoff is the second largest* undeveloped tin deposit in Tasmania. Given that one third of this resource is open-cuttable, including all 1.48 mmt of high grade DSL ore grading 1% Sn, the deposit should be close to economic at the current tin price of $A11,000/tonne.

However, in their recently-released 1988 annual report, Metals Exploration take a pessimistic view of the property and state: "under current tin market conditions development of the Mt. Bischoff reserves is not feasible".

Of critical importance is the presence of Aberfoyle's Cleveland mill only 18 road km from Mt. Bischoff. The Cleveland mill will shortly become idle and would be ideally and logically placed to treat Bischoff ore, which is essentially of the same type as the ore for which the mill was originally designed.

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*Aberfoyle's Queen Hill deposit is the largest.

If Mt. Bischoff could be spared the cost of building a new mill then this must have a major positive impact on the deposit's viability. Aberfoyle appear uniquely placed to take advantage of this situation and for this reason the Mt. Bischoff deposit is rated the best tin prospect potentially available to Aberfoyle in Tasmania.

In the main deposit area there may be potential to add more ore to the resource delineated by Metals Ex. This is mainly dependant on the limits applied to their latest calculations, particularly the RL. Such details were not clear in the open file data examined.

Additionally, the potential for ore reserves in the mineralised fissure lodes and veined sediments has not been addressed by Metals Ex, even though significant amounts of both potential ore-types lie within the limits of their proposed open cut. This material would have to be removed in order to mine the open-cuttable DSL and porphyry ore blocks. It appears that Metals Ex have regarded this mineralised material as overburden.

The mineralised veined sedimentary material may well be amenable to some form of ore-sorting or pre-concentration. As detailed earlier, huge thicknesses of these veined host sediments averaging around 0.15% Sn, are present at Bischoff.

Of significance is a possible second 'buried' mineralised dolomite horizon described by Jannink (1980), lying 100m below the main dolomite horizon in the SW corner of the deposit area. Jannink was uncertain whether this buried horizon was in fact a downfaulted or folded repetition of the main dolomite, and this is not clarified in later reports.

Drill holes into this buried horizon intersected tin values up to 7.8m @ 0.69% Sn. Despite these encouraging results, no attempt seems to have been made to systematically trace out and test this dolomite, and the current ore resource does not include any mineralised material from it due to the insufficient drill hole information. Clearly, this buried dolomite offers potential to increase the amount of DSL ore.

From a purely exploration viewpoint, the great size and strength of the mineralising system at Mt. Bischoff is reminiscent of the Renison deposit. At Renison, a large-scale drilling programme in the late 1970's and early 1980's led to a three-fold increase in the already well-identified resource.

At Bischoff, work has understandably concentrated on the exposed deposit area and a thorough systematic search of the whole mineralised system has not yet been undertaken. Metals Ex carried out some exploration around the fringes of the main mineralised area but repeatedly diverted funds from this work to further infill drilling of the deposit.

Some of this prospective ground would lie within EL 46/88 held by Shell Australia, which surrounds Metals Ex's RL 8807. A substantial part of this ground is covered by Tertiary basalt. The tin-bearing alluvium and mine residues shed into the Waratah River lie mainly within EL 25/86 held by Placeco (Aust) Pty. Ltd.

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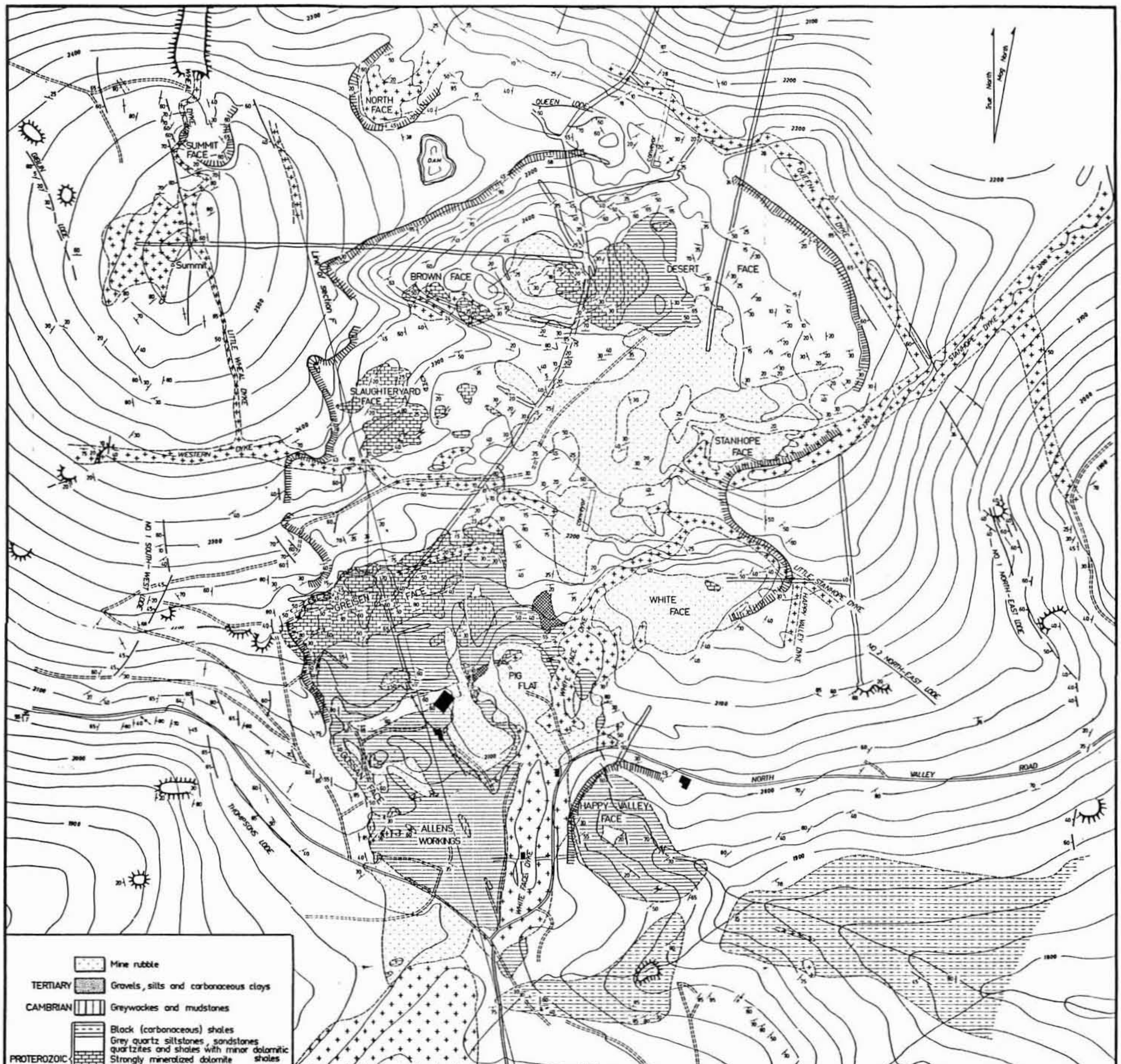

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NORTH WEST TASMANIA

MT. BISCHOFF TIN MINE
PLAN OF WORKINGS

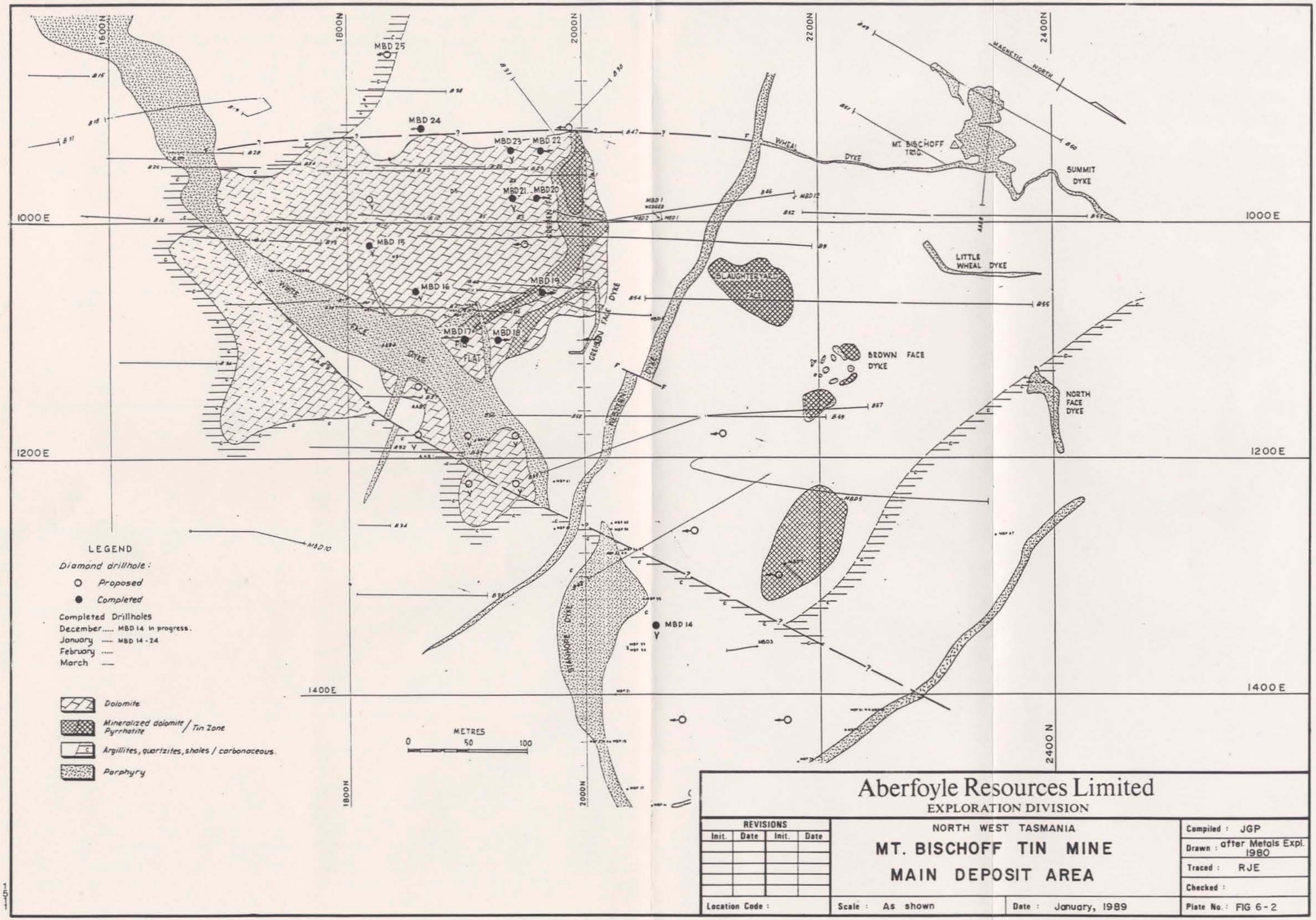
Compiled : J.G.P.
Drawn : from Groves, 1972
Traced : JLR
Checked :

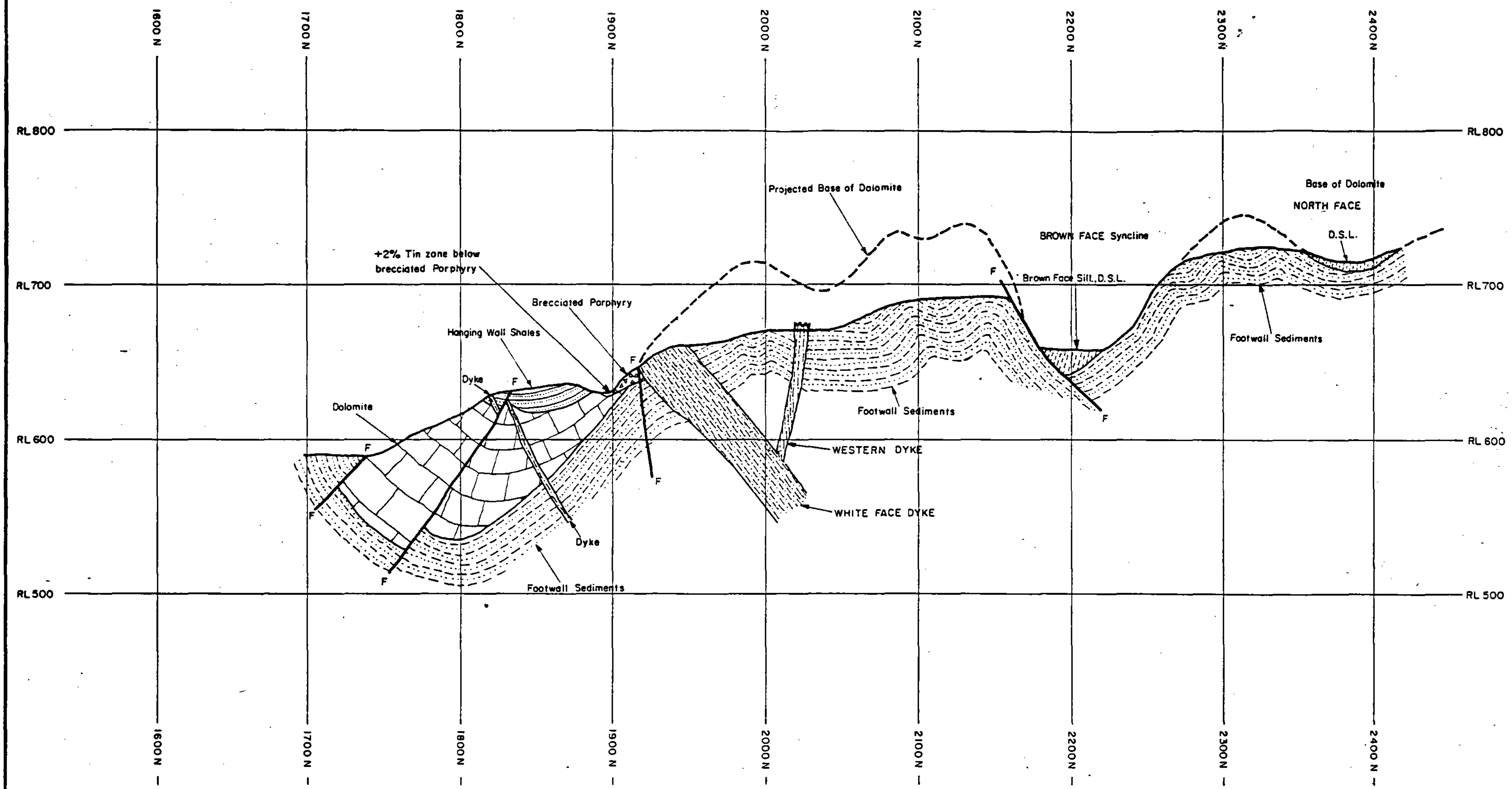
Location Code :

Scale : As shown

Date : March, 1989

Plate No. : FIG. 6-1


1600N
1800N
2000N
2200N
2400N
1000E
1200E
1400E
MAGNETIC NORTH
MBD 25
MBD 24
MBD23
MBD 22
MBD21
MBD20
MBD 15
MBD 16
MBD19
MBD17
MBD18
MBD 14
MBD10
MBD 1 WEDGED
MT. BISCHOFF TRIG.
WHEAL DYKE
SUMMIT DYKE
LITTLE WHEAL DYKE
SLAUGHTERYARD FACE
BROWN FACE DYKE
NORTH FACE DYKE
GREISEN FACE DYKE
WHITE FACE DYKE
NORTHERN DYKE
STANHOPE DYKE
FLAT
LEGEND
Diamond drillhole :
Proposed
Completed
Completed Drillholes
December..... MBD 14 in progress.
January ---- MBD 14 - 24
February ----
March ----
Dolomite
Mineralized dolomite / Tin Zone
Pyrrhotite
Argillites, quartzites, shales / carbonaceous.
Porphyry
METRES
0 50 100
Aberfoyle Resources Limited
EXPLORATION DIVISION
REVISIONS
Init. Date Init. Date
NORTH WEST TASMANIA
MT. BISCHOFF TIN MINE
MAIN DEPOSIT AREA
Compiled : JGP
Drawn : after Metals Expl. 1980
Traced : RJE
Checked :
Location Code :
Scale : As shown
Date : January, 1989
Plate No. : FIG 6-2



D.S.L.

Quartz Porphyry Dyke.

Footwall Sediments.

Hanging Wall Sediments.

Dolomite.

0 50m 100m 150m 200m

Aberfoyle Resources Limited
EXPLORATION DIVISION

REVISIONS			
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Location Code :

NORTH WEST TASMANIA

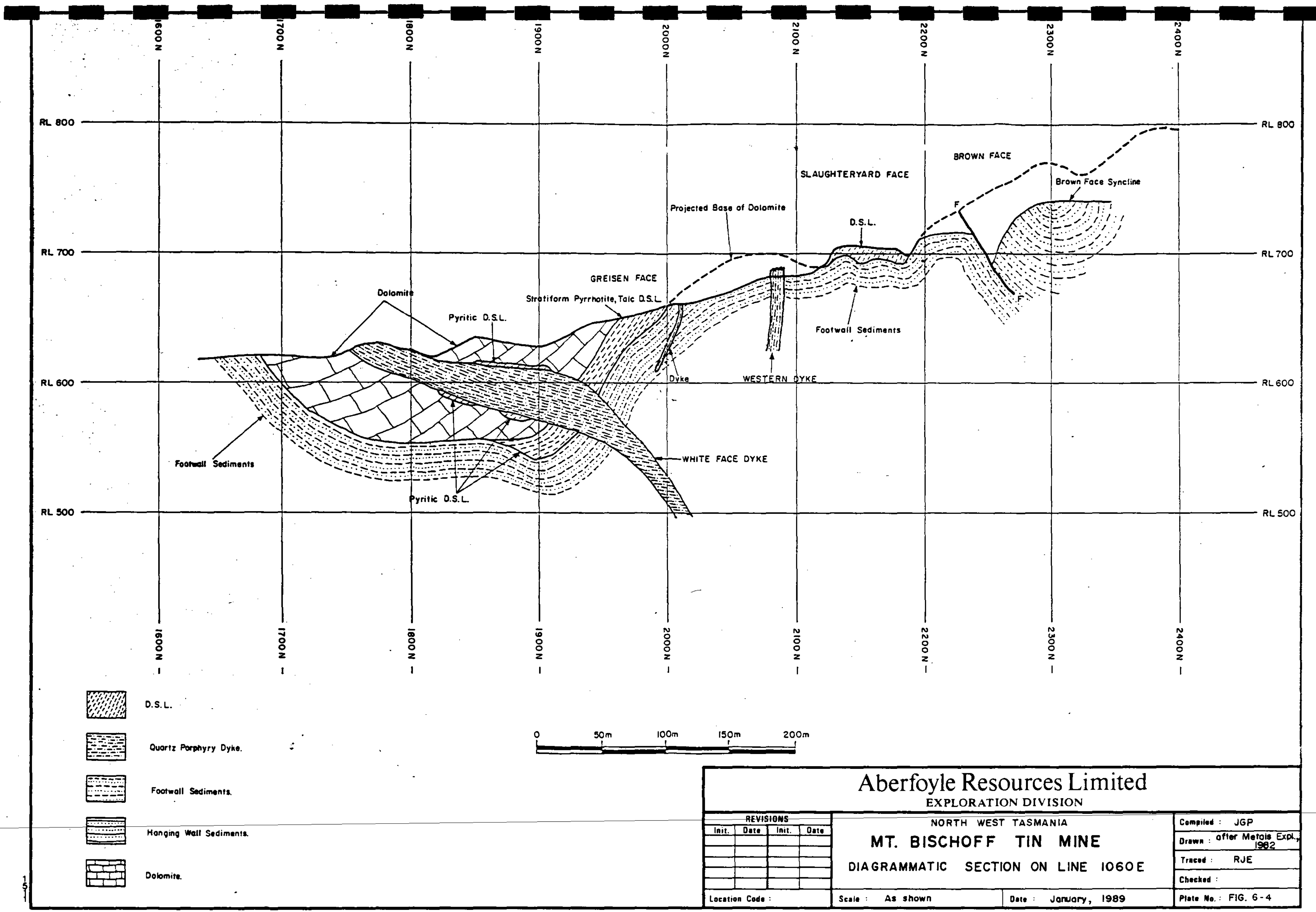
MT. BISCHOFF TIN MINE

DIAGRAMMATIC SECTION ON LINE 1160E

Scale : As shown

Date : January, 1989

Compiled : JGP
Drawn : after Metals Expl., 1982
Traced : RJE
Checked :
Plate No. : FIG. 6-3


1600 N
1700 N
1800 N
1900 N
2000 N
2100 N
2200 N
2300 N
2400 N
RL 800
RL 700
RL 600
RL 500
BROWN FACE
SLAUGHTERYARD FACE
Brown Face Syncline
Projected Base of Dolomite
F
D.S.L.
GREISEN FACE
Dolomite
Stratiform Pyrrhotite, Talc D.S.L.
Pyritic D.S.L.
Footwall Sediments
Dyke
WESTERN DYKE
WHITE FACE DYKE
Footwall Sediments
Pyritic D.S.L.
D.S.L.
Quartz Porphyry Dyke.
Footwall Sediments.
Hanging Wall Sediments.
Dolomite.
0
50m
100m
150m
200m
Aberfoyle Resources Limited
EXPLORATION DIVISION
REVISIONS
Init.
Date
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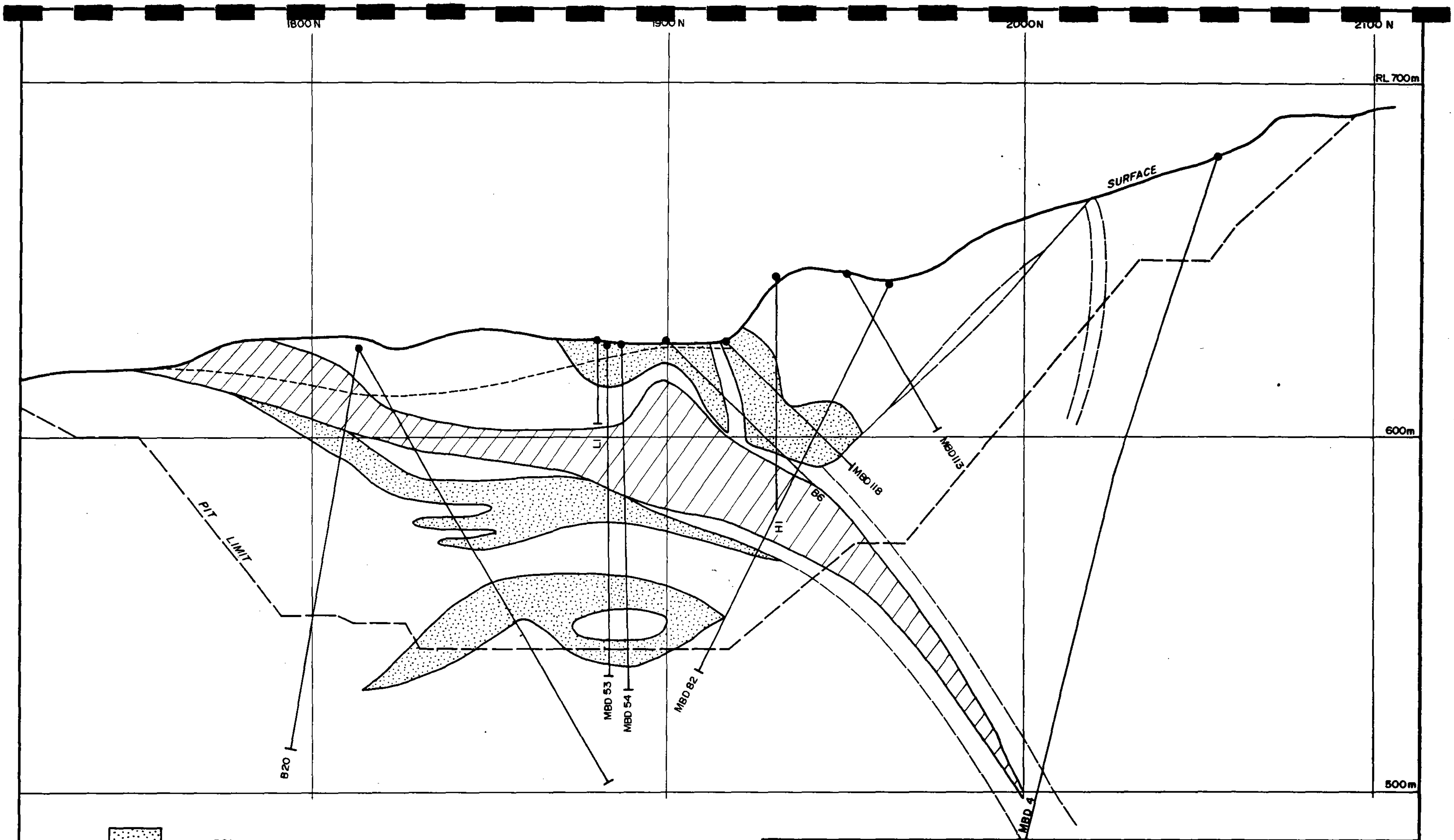
Date
NORTH WEST TASMANIA
MT. BISCHOFF TIN MINE
DIAGRAMMATIC SECTION ON LINE 1060E
Compiled : JGP
Drawn : after Metals Expl., 1982
Traced : RJE
Checked :
Location Code :
Scale : As shown
Date : January, 1989
Plate No. : FIG. 6-4



DSL

PORPHYRY 0·2% A.C.O.

PORPHYRY CONTACTS

LIMIT OF RIPPABILITY

Aberfoyle Resources Limited
EXPLORATION DIVISION

REVISIONS			
Init.	Date	Init.	Date

NORTH WEST TASMANIA

MT. BISCHOFF TIN MINE

CROSS SECTION 1080 m E - SHOWING PROPOSED OPEN PIT

Compiled : JGP
Drawn : after Metals Expl., 1983
Traced : RJE
Checked :

Location Code :
Scale : 1 : 1000
Date : January, 1989
Plate No. : FIG. 6-5

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7. SKARNS AROUND THE MEREDITH GRANITE

7.1 INTRODUCTION

There are numerous occurrences of stanniferous skarns around the margins of the Upper Devonian Meredith Granite. The most significant of the skarns is at Mt. Lindsay. Only the more important stanniferous skarn occurrences, which include Wilson River (Laurel Creek), Stanley Reward/Livingston Creek and Mt. Ramsay, are detailed here.

The skarns are hosted by a variety of lithologies, but occur principally in sediments of the Cambrian Crimson Creek Formation in the Dundas Trough. The location of all skarns is shown in Figure 1. Generally, the occurrences are characterised by spectacular and extensive skarn development, but restricted and/or weak tin mineralisation. Mt. Lindsay is far and away the strongest tin-mineralised system. The skarns are geologically (and metallurgically) extremely complex and difficult to explore. They also occur in some of the more rugged and inaccessable terrain on the west coast.

While none of the known skarns appear to have outstanding tin potential, they have not yet been tested to best effect either. However, the margin of the Meredith Granite remains one of the more-prospective areas for tin exploration. Both the Bischoff and Cleveland deposits appear associated with the intrusion, specifically with volatile-rich late-stage porphyry cupolas and dykes around its margin.

7.2 MT. LINDSAY

Mt. Lindsay is the largest and best known of the skarns around the Meredith Granite. It lies on the southern margin of the granite, 15 km NW of the Renison Mine (see Figure 7-1). The area is rugged and heavily vegetated but lies only 2 km north of the Pieman Road. The skarn was found in 1901 and some small-scale mining was undertaken up to 1923, producing at least 77t Sn (King 1963), mainly from eluvial concentrations.

The property has had a long history of exploration and over 50 drill holes have been put down. Much of this work was done by Aberfoyle, who held the ground from 1961 to 1985. After 1972 the exploration was carried out by a JV comprising Aberfoyle-Renison-Goldfields-Paringa, which spent over $1.1 million.

The skarns are geologically very complex and despite the major exploration effort there is no clearly defined resource at Mt. Lindsay. In 1970 Aberfoyle quoted "potential reserves" of 208,000t @ 0.83% Sn near surface within the Main Ore skarn in the vicinity of the old Mt. Lindsay Mine. At the completion of the JV programme in 1984, Goldfields acknowledged that the property had potential for ´moderate tonnages of marginal grade tin ore´, but that this material would likely be contained in numerous small irregular bodies.

The old Mt. Lindsay Mine area is now held under ML´s by several individuals, while the rest of the property was recently tendered.

The skarns are hosted by sediments of the Cambrian Crimson Creek Formation, comprising basic tuffs, tuffaceous sandstone, siltstone and shale, with minor chert and limestone. The latter contain the skarns and tin mineralisation. The sediments in the vicinity of the skarns have been converted to hornfels. The sediments strike NW-SE, dip 80^{o} SW and lie on the western limb of the Huskisson Syncline. The area is traversed by numerous faults, including E-W trending flatly-dipping faults which appear to have had a controlling influence on skarn formation and mineralisation.

There are three principal parallel skarn horizons: Main Ore, No. 1 and No. 2 (see Figure 7-2). The Main Ore horizon contains the old Mt. Lindsay Mine area where Aberfoyle defined their resource. These horizons are from 2 to 2.4 km long, up to 50m thick and dip 80^{o} SW. They terminate against altered Meredith Granite at the NW end and at depth, and run out into unaltered limestone to the SE. Because the granite dips gently SE beneath the horizons, the outer limit of skarn formation is only about 200m from the granite contact (see Figure 7-3).

The skarn assemblage includes magnetite, pyrrhotite, amphibole, ilmenite, ilvaite, danalite, vesuvianite, garnet, siderite, sphene, k-feldspar; lesser pyrite, fluorite, quartz; and patchy minor cassiterite, scheelite, chalcopyrite and arsenopyrite. The skarns are complexly zoned, due partly to extensive late-stage retrograde hydrothermal alteration of the primary skarn assemblage. This alteration sequence has formed tin-poor pyrrhotite/pyrite-rich skarn close to the granite, and cassiterite-rich poorly-sulphidic magnetite skarn near the skarn/carbonate contact furtherest from the granite. (see Figure 7-3).

Tin values average around 0.8% Sn in the magnetite-rich outer zone of No. 2 horizon (zone 1A of Kwak 1982), and in the cassiterite-bearing patches formed beneath the flat-lying faults in the Main Ore horizon (the strongest known mineralisation, in the vicinity of the old Mt. Lindsay Mine, is one of these patches). Elsewhere, tin values (mainly in silicates) range from 0.02 - 0.2% Sn, with the lowest values in the highly-sulphidic zone 2D skarn against the granite contact. Stannite is uncommon and mainly found in late-stage veins with chalcopyrite. Scheelite distribution is erratic.

The best drill intersections were in the zone at the old Mt. Lindsay Mine :

Hole ML1	16m @ 0.77% Sn
ML2	26m @ 0.66% Sn
ML3	15m @ 1.75% Sn

Also elsewhere: Hole ML9 12m @ +1.40% Sn (Main Ore horizon)
ML38 23m @ 0.80% Sn, 0.16% Cu (No. 2 horizon)

Tungsten values are low (average 0.02% WO_3), with the best intersection being : ML33 10m @ 0.27% WO_3 (Main Ore horizon)
ML37 4.5m @ 0.21% WO_3 (No. 2 horizon)

The skarns also contain F, Cu, Zn, As, Pb, Bi, Be and Ag but there are few figures quoted in the available data. Using figures supplied by Kwak (1982) for holes in the No. 2 horizon, averages are : Cu 670 ppm; Zn 450 ppm; Bi 220 ppm; As 100 ppm; Pb 40 ppm; Ag 5 ppm. Adjacent to the skarns, the non-carbonate sediments have been converted to hornfels which contain up to 15% sulphides - principally pyrrhotite and pyrite. Tin values in the hornfels are very low although Cu, Zn and Pb values can be strongly anomalous.

Potential: The stanniferous skarn system at Mt. Lindsay is very large and contains a lot of tin. Because of this, it must be rated as having some potential to produce economic tin ore in the future. However, it is clear from past experience that any ore at Mt. Lindsay will take a major exploration effort to define it due to the geological complexity of the property.

It is an indication of this complexity that so much exploration should have been done at Mt. Lindsay for so little tangible result. After almost 25 years of constant exploration and the expenditure of well in excess of $2 million in today's terms, the nett result is a 'potential' resource of only 208,000t @ 0.83% Sn at shallow depth in the vicinity of the old Mt. Lindsay Mine, outlined by Aberfoyle in the early stages of the exploration programme.

Goldfields (Roberts 1984) acknowledge there is potential for more ore beneath Aberfoyle's 'potential' resource at the Mt. Lindsay Mine. However, they merely say that such a zone, if present, would contain less than 1 million tonnes. They did no drilling to test this possibility. The zone is about 90m long and 15m wide, but is limited in depth by the granite contact, approximately 200m below surface. As Roberts points out, given the pattern of skarn zonation at Mt. Lindsay it is unlikely that the mineralised zone would extend down close to the granite, which further limits the potential tonnage.

Goldfields (Roberts 1984) conclude that there is still room within the skarn horizons for moderate tonnages of cassiterite mineralisation. Such mineralisation will be present as small irregular discontinuous lenses, either at the outer margins of the skarn or in association with faults within it. In their opinion such lenses would be difficult to find, expensive to mine, and with a 'natural average' grade of about 0.8% Sn, only marginally economic at best.

It would seem possible that Goldfields were a little harsh on the property in reaching these conclusions. Exploration to date has very much concentrated on locating a large body, or bodies, of ore. There appears to be potential to put together a resource grading around 0.8% Sn in several small separate bodies of mineralisation. As pointed out by Roberts (1984) there are three possible sites where such bodies of moderate to high grade cassiterite mineralisation might be found at Mt. Lindsay:

1. In sulphide-rich retrograde assemblages associated with faults.

2. In sulphide-rich retrograde assemblages at the skarn/carbonate contact.

3. In magnetite-rich, sulphide-poor early formed assemblages at or near the skarn/carbonate contact.

7.3 WILSON RIVER (Laurel Creek East/West, Little Wilson River)

These skarn occurrences lie on the SE margin of the Meredith Granite, centred about 10km NE of Mt. Lindsay. The Laurel Creek skarns are currently vacant ground, while those at Little Wilson River lie mainly within EL 9/86 held by Pioneer Resources. The prospects were discovered by Renison Limited in 1981 during regional work on their EL 17/77 in the Huskisson Syncline.

The geology of the area is dominated by the large northerly-trending Huskisson Syncline comprising faulted and folded Cambrian to Devonian sediments, intruded by a remobilised ultramafic complex along the Cambro-Ordovician boundary. The Laurel Creek skarns occur where the broad northern nose of the syncline abuts the granite, and the Little Wilson River occurrence lies on the western edge of the syncline (see Figure 7-4).

In detail, the local stratigraphy comprises Cambrian sediments of the Crimson Creek Formation and serpentinised Cambrian ultramafics; overlain by Ordovician Gordon Limestone (the principal skarn host); in turn overlain by Siluro-Devonian sandstones, siltstones and shales, containing minor calcareous units.

Renison commenced exploration in the area in 1977, in a search for both exo- and endo-granitic tin bodies along the rugged and remote granite contact zone between Parsons Hood and Mt. Ramsay. Because of the lack of access all work was helicopter-supported.

In 1978 an airborne survey outlined several significant coincident Input EM/magnetic anomalies along the northern and western margin of the Huskisson Syncline, where the sediments contact the granite. Follow-up stream sediment sampling in 1980-81 detected Sn, W and As anomalies, and geological mapping located several stanniferous skarn outcrops. The Laurel Creek East and West grids, and the Little Wilson River grid, were established to cover the anomalous areas (see Figure 7-4).

At Laurel Creek, surface surveys (including IP and magnetics), conducted between 1981-83, indicated at least 6 magnetite-dominated sulphide-poor skarns were present in an altered contact zone at least 5 km long. Geochemical bedrock sampling, although hindered by deep alluvium, located several anomalies up to several thousand ppm Sn over the skarns. The best anomalies (Anomaly A at Laurel Creek West - a 1000m long skarn zone, and Anomaly F at Laurel Creek East - a 1500m long skarn), were selected for drilling (see Figure 7-5).

At Little Wilson River, the results were similar with several magnetite-rich sulphide-poor stanniferous skarns indicated beneath alluvial cover, the most prospective being on the margin of the Gordon Limestone close to its contact with the granite (Anomalies 1, 2 & 3 - see Figure 7-6). However, soil geochemistry over these anomalies was only mildly anomalous and Renison stopped work here in early 1983 (leaving Anomalies 4 & 5 unsampled).

Five short diamond drill holes (average depth 95m) were put down in early 1984 - 3 holes at Laurel Creek East and 2 at Laurel Creek West. All holes suffered from being too shallow, and experienced troubles with weathering and the unexpected depth of the alluvium (up to 55m). The holes at LC East intersected massive magnetite skarn up to 20m thick on the contact between Gordon Limestone and the granite, with a best intersection of 8.5m @ 0.35% Sn (0.07% acid soluble), and 0.17% WO_3 (hole WR2).

The one hole (WR4) into Anomaly A at Laurel Creek West intersected a 7m thick zone of magnetite-sulphide skarn, again on the contact between Gordon Limestone and the granite. The best zone within the skarn assayed: 3.4m @ 0.3% Sn (<0.01% acid soluble), and 0.18% Cu. A hole into anomaly B at the north end of Laurel Creek West (see Figure 7-7), intersected a 20m mixed zone of skarn and calc-silicate on the granite contact, representing altered calcareous horizons within Crotty Quartzite. The hole (WR5) produced a best result of 7m @ 0.65% Sn (0.14% acid soluble).

Petrological examination of the mineralised material in the holes detected no cassiterite, although ludwigite-hulsite and ilvaite, both capable of holding tin in their crystal lattices, were identified. Renison were very discouraged by the petrographic results and gave the indicated difficult metallurgy, plus the unexpected thinness ofthe skarn zones, as reason for quitting the property in late 1984: "Any economic potential the skarns may have possessed is virtually eliminated by their complex tin mineralogy" (Cartwright 1984).

Potential: Wilson River is another of Renison's 'unfinished' projects. After excellent work in locating and defining the Laurel Creek skarns, the drill testing was rushed and less than totally effective, generally because the holes were too shallow. Of the five holes put down, one (WR3) missed the target skarn zone completely going direct from alluvium into granite, and another (WR4) only just clipped the oxidised cap on the skarn zone beneath the alluvials.

Thus the 1000m-long Anomaly A skarn at West Laurel Creek was tested by only one partly-effective hole (WR4), and the 1500m-long Anomaly F at East Laurel Creek was only effectively tested in two places (WR1&2). This testing was inadequate for such large skarns.

Renison also appear to have been too ready to accept the adverse petrological reports on the mineralisation, even though these were only of a preliminary nature being based on relatively few samples, some of which were strongly oxidised and largely composed of geothite and ferruginous clays. The petrologist's conclusion that the tin was more likely tied up in silicates than cassiterite, is not supported by the acid-soluble assays which suggest the opposite. While it is likely that the tin mineralogy in such contact skarns will be complex, this is far from proved in the case of the Laurel Creek skarns - Renison inferred a lot from rather inconclusive data.

The drilling showed the alluvium covering the skarns and host carbonate units was much deeper than expected - in the range of 15-55m. This calls into question much of the 'bedrock' geochemical sampling done by Renison, which they used both to direct their drilling at Laurel Creek and to write off Little Wilson River. Some of the geochemical 'anomalies' were probably cassiterite in the alluvium and many areas of geochemical 'lows' were probably from barren sections of the gravels, completely unrepresentative of the bedrock values.

The sizeable contact skarns in the Wilson River area are insufficiently tested and retain potential to host tin deposits. Conceptually, the Huskisson Syncline is still an attractive area for grass roots tin exploration, particularly the belt of Gordon Limestone and other calcareous units which rim the margin of the syncline. Although Renison have partially explored the western limb (at Merton Hill and Little Wilson River), and the northern fold nose (at Laurel Creek), the eastern limb lay outside their tenements and has not been systematically explored as far as the author can determine. (See Figure 7-4).

Approaches that could be tried include a modern EM survey over the carbonate belts. Renison relied on Gradient Array IP to outline sulphidic parts of the skarns, but EM would probably be more effective particularly given the deep alluvium over the zones of interest. Geochemistry is definitely ruled out by the stanniferous gravels (see below). The new regional gravity data may be worth consulting to see if it provides details on the sub-surface shape of the granite in this area, e.g.: whether there are any granitic ridges, dykes or peripheral intrusions within the actual syncline.

It is worth noting that the Wilson River area may contain the largest potential alluvial tin resource on the West Coast. Renison estimated the volume of stanniferous alluvials at Laurel Creek to be one million m^3 for each metre of depth, and described it as "a classic Malaysian alluvial tin situation" with the alluvium filling limestone valleys adjacent to a tin granite (Roberts & Martin 1982).

Given the depth of alluvium shown by the drilling (15-55m), the inference is that there may be several tens of millions m^3 of tin-bearing gravels present. Although Renison intended testing the gravels they never actually did so. (see Figure 7-7).

7.4 STANLEY REWARD - LIVINGSTONE CREEK

These two geologically identical tin occurrences lie 1 km apart on the southern edge of the Meredith Granite, about 3 kms west of the Mt. Lindsay skarn and adjacent to the Pieman Road (see Figure 7-1). The prospect is presently held under EL 53/70 (3.3 sq. km) by Valley Exploration, who have applied for a Consolidated ML over the EL area. Because of this, the results of work done on the property since 1982 (if any), are not available. Most exploration was done by Aberfoyle 1963-70, and by CSR in a JV with Valley in the period 1973-82.

The prospects comprise ferruginous gossans outcropping through Tertiary gravels which overlie a 200m thick unit of dolomite of the Success Creek Group. The gossans occur on the contact of the dolomite with the Meredith Granite, and represent oxidised stanniferous magnetite-sulphide contact skarn outcrops. The Stanley Reward gossan is 100m long and up to 20m wide. The Livingstone Creek gossan is 240m long and up to 35m wide.

The gossans and adjacent tin-bearing gravels were located by prospectors in 1895, who tested both gossans with adits and shafts. Ellis (1982) reports the Stanley Reward gossan was reputedly worked from shafts up to 150m deep, but there is no record of production to substantiate workings on this scale.

Aberfoyle chip sampling of old adits through the gossans showed they contain patchy but highly significant tin values, particularly in the Stanley Reward gossan. Best results were as follows :

Stanley Reward gossan:

8.7m @ 0.61% Sn	10.7m @ 1.13% Sn
15.2m @ 0.78% Sn	9.4m @ 1.96% Sn
4.6m @ 0.91% Sn	9.1m @ 1.34% Sn

Livingstone Creek gossan:

18.3m @ 0.17% Sn	3m @ 0.37% Sn	)
	3m @ 0.30% Sn	)surface chip samples
	3m @ 0.29% Sn	)

Although drilling was proposed to test the Stanley Reward gossan this was apparently not done. CSR later drilled one hole through the Livingstone Creek gossan for a result of 12.5m @ 0.35% Sn.

The main alluvial workings were at the confluence of Livingstone Creek and the Stanley River, immediately south of the Stanley Reward gossan. King (1963) quotes production as 81t Sn. The tin was won from a Tertiary gravel deposit up to 7m thick which extends 2km upstream along Livingstone Creek to the Livingstone Creek gossan. Work by RTAE and Aberfoyle prior to 1970 indicates up to one million m^3 of gravel of unknown grade in this deposit. (Note: Ellis (1982) quotes the grade of the gravels as approximately 0.1% Sn, or but this figure is an error and based on a single sample of the gravels).

Geologically, the area comprises a western sequence of quartzite, siltstone, shale and minor dolomite, of the Precambrian Oonah Formation. This is unconformably overlain to the east by a 300m wide belt of poorly-exposed massive dolomite, dolomitic siltstone and chert of the Eocambrian Success Creek Group. These sediments are regarded as equivalents of the units which host the Renison tin deposit, 16 km along strike to the SE (Brown 1980, MacNamara 1980).

The dolomitic sediments dip and face NE, and strike NW parallel to the Devonian Meredith Granite contact along their eastern side. Evidence from drilling indicates the granite contact dips SW and cuts off the dolomite at depths around 100-300m below surface. To the south of the Stanley Reward gossan there is a thin wedge of Crimson Creek Formation volcanomict sediments between the dolomite and the granite. To the north, the Success Creek Group sediments pinch out immediately NW of the Livingstone Creek gossan. Overall, the dolomitic units have a strike length of 3 km in close proximity to the granite in this area. (See Figure 7-1).

The dolomite and other sediments (including units of the Oonah Formation) have been variably metasomatised by the granite to forsterite marble, calc-silicates and biotite or cordierite hornfels. They contain patchy disseminated and banded magnetite, pyrrhotite and pyrite. Apart from the gossans, known mineralisation in these rocks comprises very low tin and copper values with rare traces of gold (best drill hole intersections: 5m @ 0.24% Sn; 3m @ 0.185 g/t Au). Few tin values exceed 0.1%.

Up to 1982, CSR drilled 9 diamond drill holes into the property and covered it with bedrock geochemistry, magnetics, IP and EM (VLF and Input). Drilling was concentrated (6 holes), without success, on a patchy combined geochemical (Sn/Cu) and geophysical (IP/magnetic), anomaly zone within the body of the dolomite extending to the SE of the Stanley Reward gossan (see Figure 7-8).

Three short holes (max. length 70m) were drilled at the Livingstone Creek gossan but only one of these (LC2) actually tested its target, intersecting 12.5m @ 0.35% Sn, 0.1% Cu. The other two holes intersected granite. This work indicated granite cuts off the gossan at shallow depth at its northern end, but that the gossan zone is open at depth to the south.

Later geochemical and geophysical work indicated the contact skarn zone represented by the two gossan occurrences could be essentially continuous beneath the Tertiary gravels along the 1000m interval between them. Jacro augering through the gravels between the gossans in 1981-82 delineated Sn-Cu-Zn-Pb anomalies along the eastern dolomite/granite contact, with coincident peak values of 880 ppm Sn, 520 ppm Cu. IP/magnetic responses strongly suggest there is a buried east-dipping mineralised zone between the gossans, which is broadly coincident with the geochemical anomaly zone (Ellis 1982).

It should be noted that (up to 1982 at least) CSR did not at any stage attempt to drill test the Stanley Reward gossan outcrop. The nearest drill hole to the gossan was 150m to the south.

Potential: For the period for which it can be reviewed (to late 1982), CSR's work is of a low standard. Why they never drilled the Stanley Reward gossan is beyond comprehension. Their attempts to test the Livingstone Creek gossan were ineffectual. They considered the contact skarn occurrences had restricted tonnage potential, but they should have at least tested these assumptions.

CSR's stated intention was to test the dolomite unit for Renison-style carbonate-replacement bodies which they considered would be sited at a little distance from the granite. Their drilling indicates there is little tin mineralisation in the bulk of the principal dolomite unit, a result in accordance with Renison drilling in the same unit along strike immediately to the SE.

CSR's drilling could have been better directed. The holes were all drilled westwards away from the granite towards the Oonah Formation and only SRD6 went through the eastern granite/sediment contact. If the holes had been drilled eastwards they could have tested both CSR's principal target and the prospective mineralised eastern contact of the sediment belt.

The fact remains that the best tin mineralisation known on the property is in the contact skarn gossans which were untested as at 1982. The mineralogy of the tin mineralisation is unknown. Although the granite will limit the depth extent of the mineralised contact skarn zone, the indications are that the zone has a width up to 35m and may have a total length of 1300m, most of it beneath the gravel cover. Clearly, the tonnage potential is sufficient to warrant testing. Whether CSR did this testing after 1982 is unknown.

7.5 MT. RAMSAY

The Mt. Ramsay skarn lies on the eastern margin of the Meredith Granite, 14 km SSE of the Cleveland deposit. The mineralisation was discovered before the turn of the century as a bismuth-gold-copper prospect. A shaft and adit were put in but there was no production. In 1918, average values for the exposed mineralisation of 4.6 g/t Au and 0.15% Bi were recorded.

In 1979 Comstaff, following up two Input EM anomalies detected by an aerial survey in 1975, rediscovered the old workings. (The EM anomalies were traced to carbonaceous rocks 400m further east). Comstaff drilled seven diamond drill holes into the skarn in 1981-82, with a best intersection of 0.19% Sn over 12.3m.

The Mt. Ramsay skarn is part of a zone of patchy sulphidic skarn development that extends for 6 km along the eastern margin of the Meredith Granite. The whole zone was investigated by Comstaff who drilled several of the occurrences, but the mineralisation encountered was weaker than the Mt. Ramsay skarn.

Comstaff ceased work in 1983. In 1987-88 Pan Australian Mining examined the skarn for its tungsten and gold potential, but concluded this was insignificant. The area was tendered in July 1988 but there were no takers and the ground is currently free.

The Mt. Ramsay skarn occurs in sediments of the Cambrian Crimson Creek Formation. The rocks are dominantly volcanomict sandstone, siltstone and argillite of basic to intermediate volcanic provenance. Within this sequence there are units of pelitic sediments, including pelitic chert, carbonaceous shale and impure carbonates. The latter include calcareous pelites and argillaceous limestone. These carbonates are now altered to calc-silicate or skarn and contain the tin mineralisation.

The Meredith Granite in this area is a coarse-grained unaltered biotite granite. On the sediment contact there is a thin marginal intrusive phase of highly greisenised porphyritic biotite microgranite.

The Mt. Ramsay skarn is 700m long, averages 50-100m wide, and extends to a depth of at least 220m. It trends NNW-SSE and sits in an embayment in the granite margin, abutting the granite at its northern end and along its western side (see Figure 7-9). The southern end of the skarn zone is cut off by a major E-W fault, although there is geochemical and geophysical evidence that it may continue into the downthrown (?) block on the southern side of the fault. The granite/sediment contact is complex, with local ridges and embayments in the granite margin and tight isoclinal folding in the altered sediments. The banded skarn dips near vertically.

The skarn assemblage comprises garnet (andradite/grossularite) - vesuvianite-diopside-ferrohastingsite. Fluorite and calcite are common interstitial minerals. Massive, banded and disseminated magnetite and pyrrhotite occur, particularly in association with the ferrohastingsite. Pyrrhotite content ranges up to 30%, with minor pyrite, chalcopyrite, arsenopyrite, bismuthinite and gold. Pigott (1983) states: "The rock suite represents a multi-stage replacement calcic Sn-F skarn derived from an impure argillaceous limestone". The adjacent sediments have been converted to hornfels.

The tin mineralisation intersected by the Comstaff drilling was quite weak. The best intersections were:

13.3m @ 0.19% Sn	(hole CAF 1)
11.3m @ 0.13% Sn	(hole CAF 1)
7.2m @ 0.16% Sn	(hole CAF 7)

The highest tin values are found at the southern end of the skarn (i.e. furtherest from the granite), and coincide with zones rich in ferrohastingsite which Comstaff considered indicative of retrograde alteration.

Of importance is a comment by Green (1982) that no cassiterite was identified by Comstaff, although stanniferous sphene was possibly identified. Whether this statement is based on petrological evidence is not known.

The skarn is also anomalous in F, Cu, WO_3, As, Au and Bi, but the drilling showed none of these are of economic significance. The best gold intersection was 4.75m @ 0.157 g/t Au in CAF 1.

250m east of the main skarn, Comstaff hole CAF 6 intersected two calc-silicate altered and sulphidic carbonate units, each 20m wide and over 300m long (see Figure 7-9). Although tin values in the hole were low, ground PEM and Sirotem surveys delineated a "more massive" conductor north of the hole within the calc-silicate units (Pigott 1983). This target was not drilled.

Potential: It is obvious Comstaff left the Mt. Ramsay skarn and surrounding area incompletely tested. Although the geologists recommended further drilling, especially to locate the prospective possible southern extension of the skarn, this was not done.

Mt. Ramsay is a fairly typical magnetite-dominated contact skarn in which only weak and erratic tin mineralisation has been encountered to date. The indication that a significant proportion of the tin may be silicate-hosted is cause for concern.

The possibly more-prospective outer zone of the skarn, close to the skarn/marble contact, has been faulted off. To the south of this fault, (away from the granite), there is a zone of no outcrop but the possible sub-surface extension of the skarn is suggested by a Sn-As soil anomaly and PEM/magnetic anomalies.

While there are still untested targets with potential for tin mineralisation at Mt. Ramsay, this potential cannot be given a high rating on present evidence. However, the presence of several carbonate units within the Crimson Creek Formation marks Mt. Ramsay as one of the more-prospective sectors of the granite margin.

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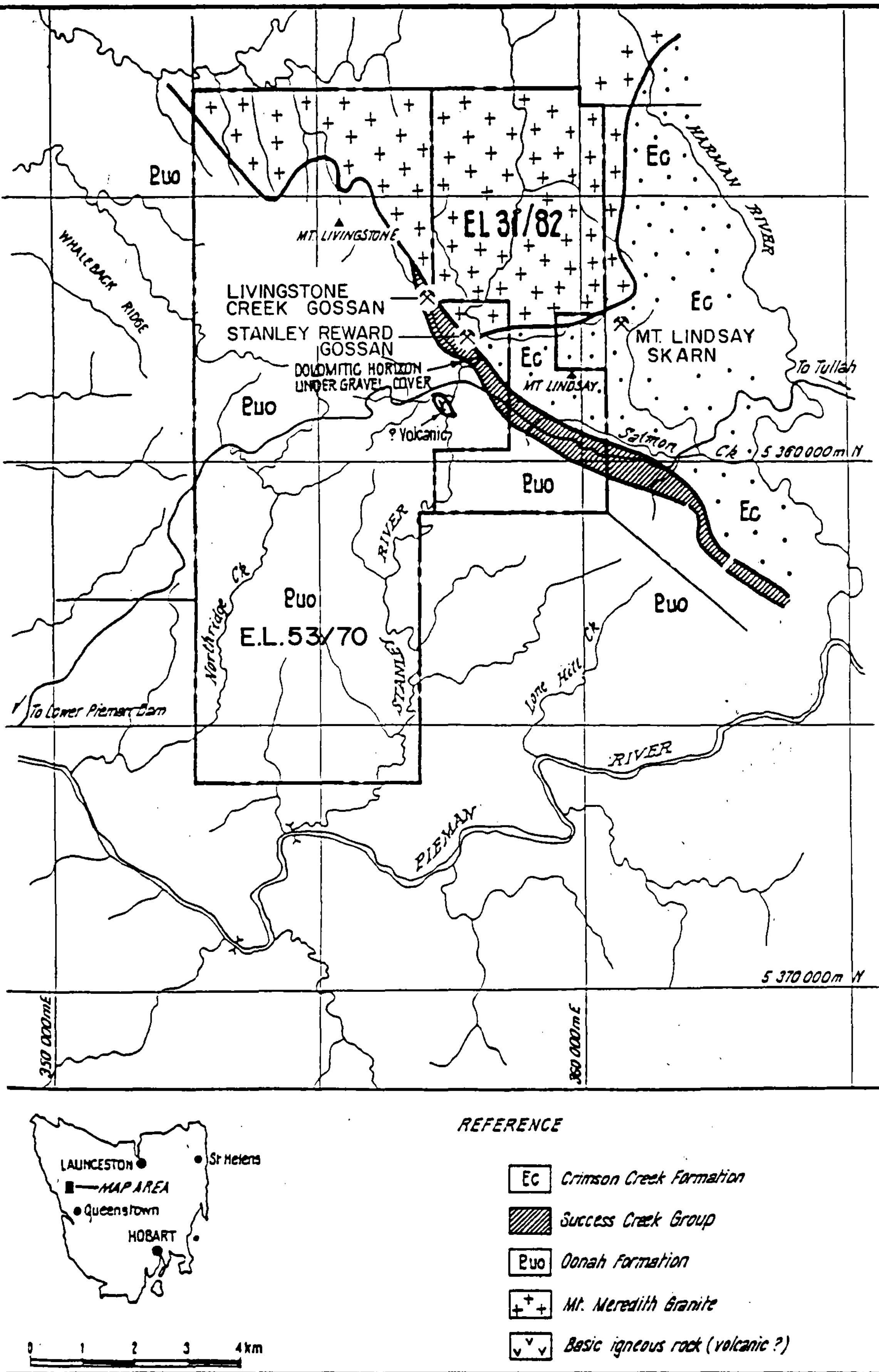

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EXPLORATION DIVISION

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				GEOLOGICAL SUMMARY	Traced : RJE
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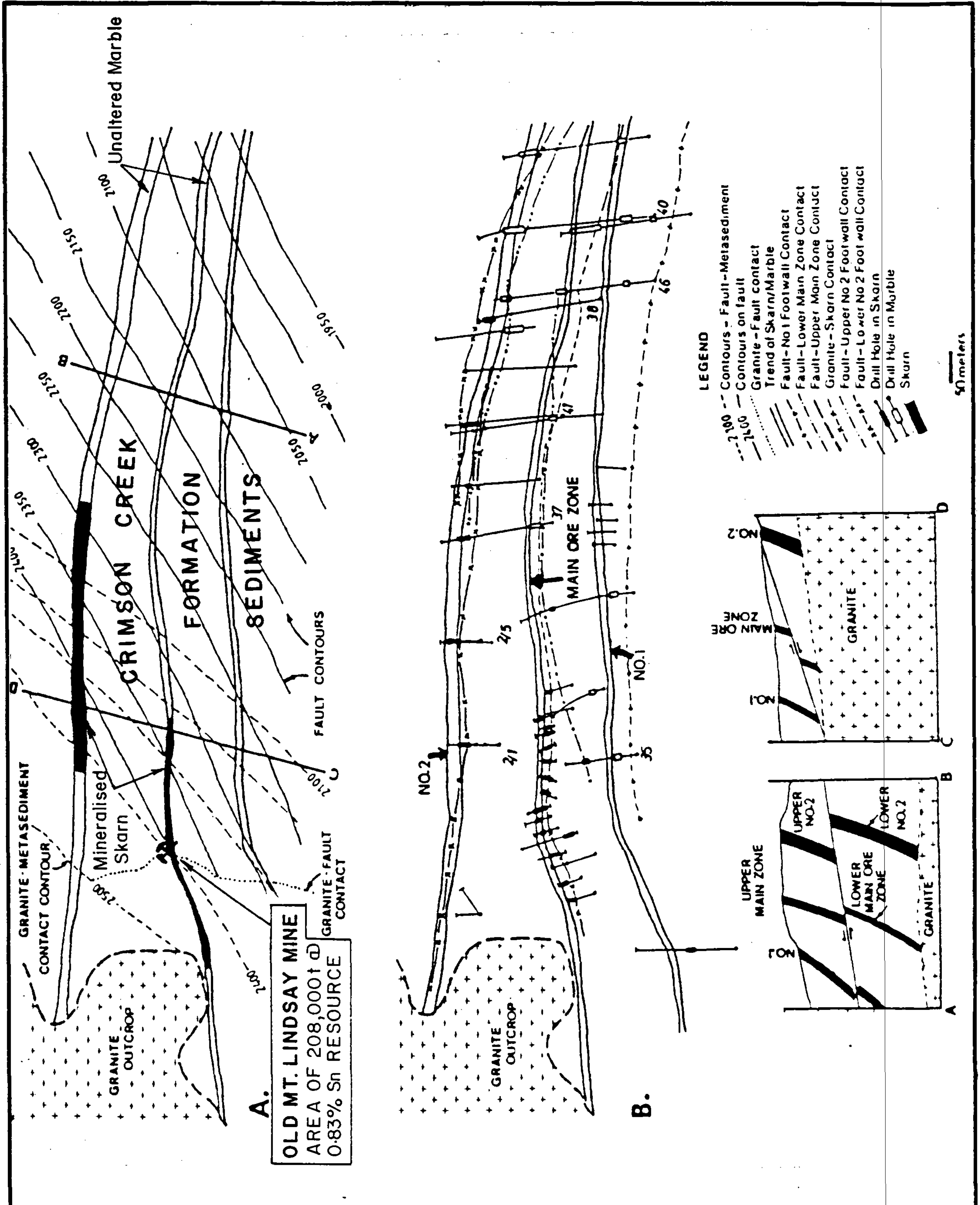
Location Code :				Scale : As shown / Date : February, 1989	Plate No. : FIG. 7-1

1511



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NORTH WEST TASMANIA

MT. LINDSAY

GENERALISED GEOLOGY

REVISIONS			
Init.	Date	Init.	Date

Location Code :

Scale : As shown

Date : February, 1989

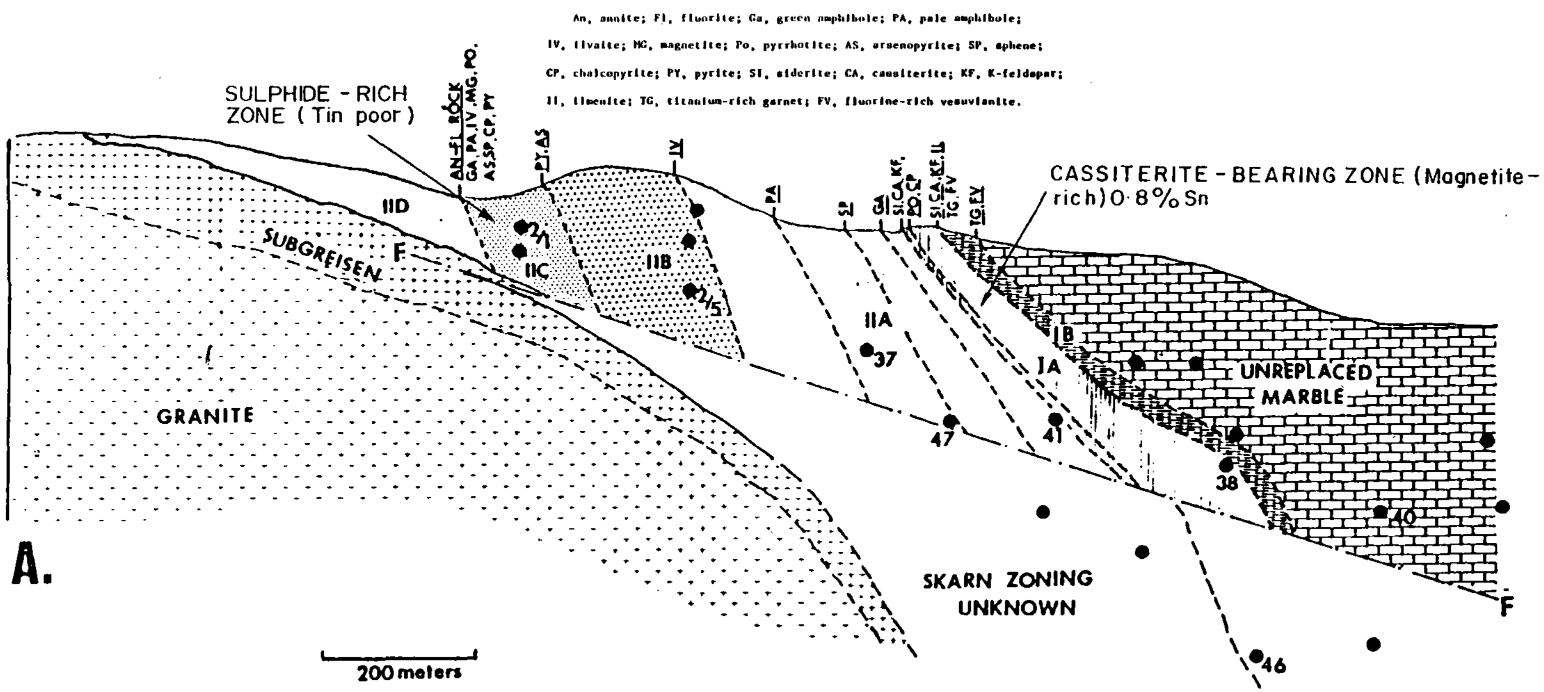
Compiled : JGP

Drawn : from Kwak, 1982

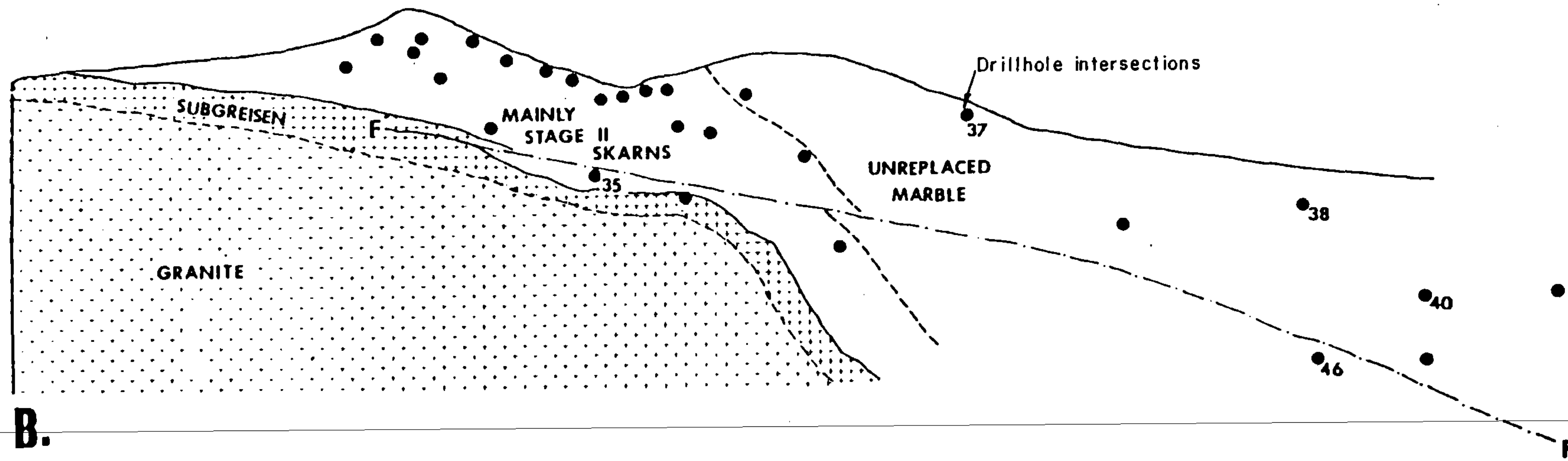
Traced : JLR

Checked :

Plate No. : FIG 7-2



ZONING & DRILLHOLES IN THE No.2 SKARN



ZONING & DRILLHOLES IN THE MAIN ORE ZONE SKARN

Aberfoyle Resources Limited
EXPLORATION DIVISION
NORTH WEST TASMANIA
MT. LINDSAY
GENERALISED SECTIONS

REVISIONS			
Init.	Date	Init.	Date

Location Code :
Scale : As shown
Date : March, 1989
Compiled : JGP
Drawn : from Kwak, 1982
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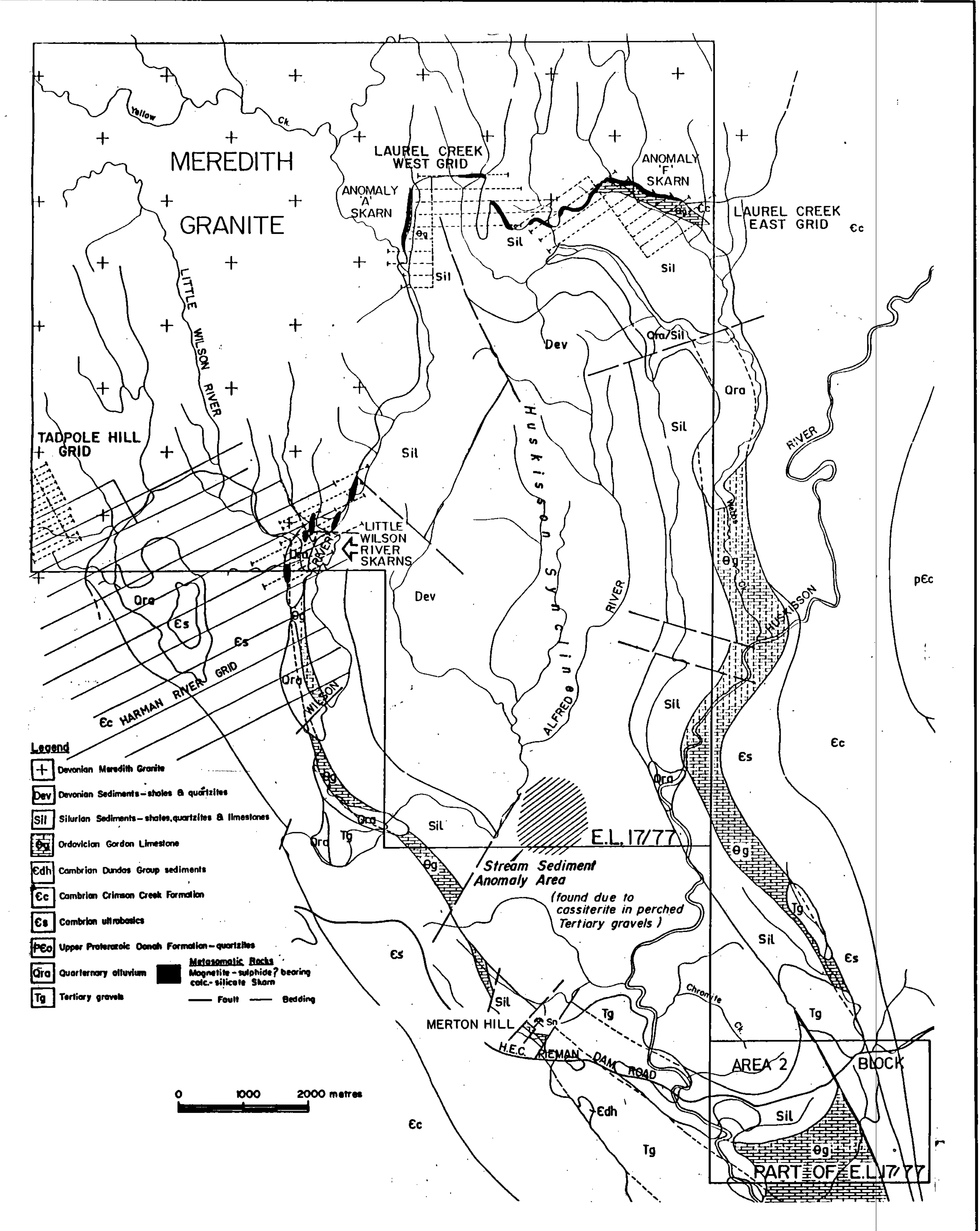

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EXPLORATION DIVISION

REVISIONS				NORTH WEST TASMANIA	Compiled : JGP
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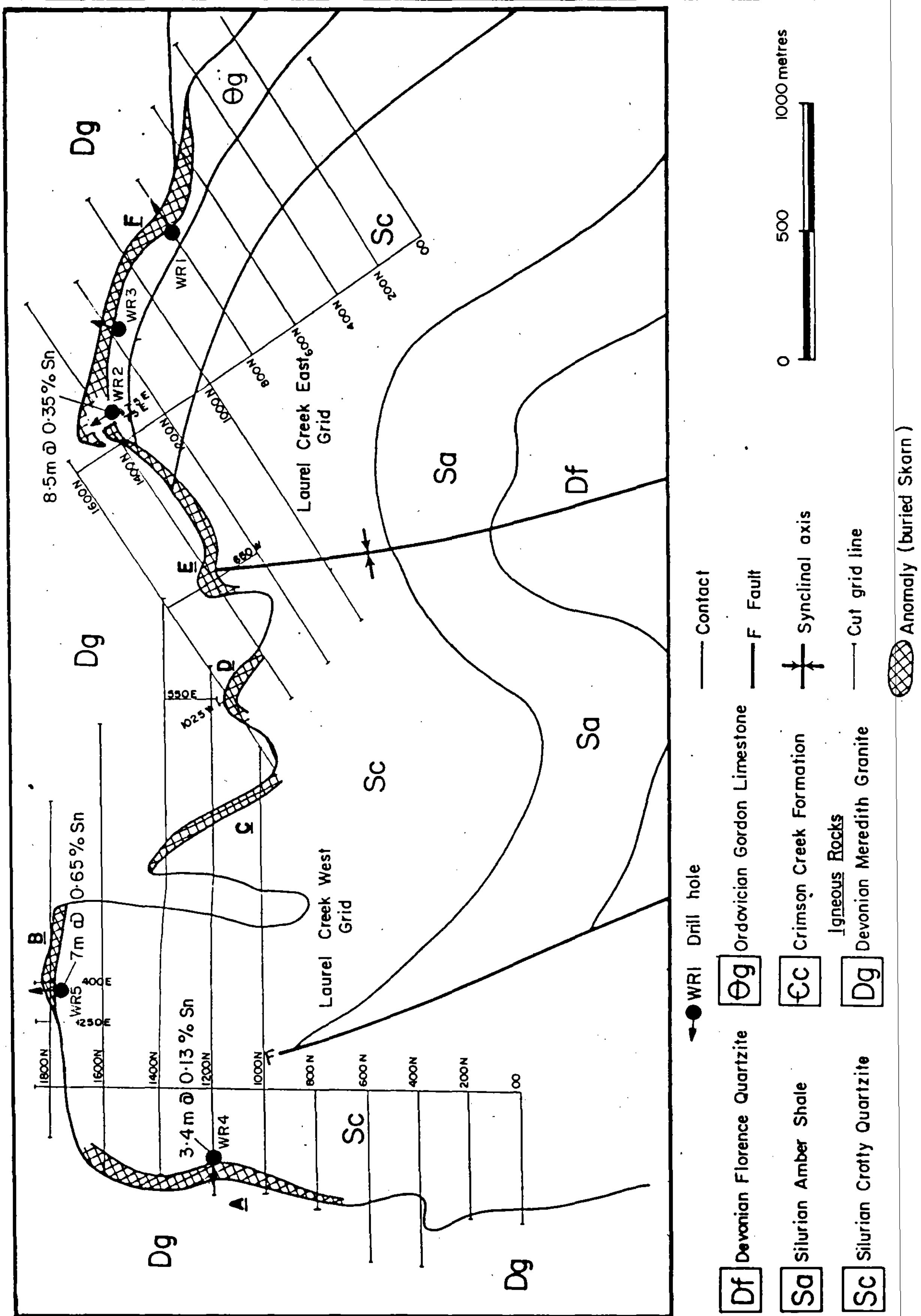
Location Code :				Scale : As shown / Date : February, 1989	Plate No. : FIG. 7-4



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REVISIONS			
Init.	Date	Init.	Date

NORTH WEST TASMANIA

LAUREL CREEK GRIDS

INTERPRETIVE GEOLOGY & ANOMALY LOCATION

Compiled : JGP

Drawn : after RGC, 1982

Traced : RJE

Checked :

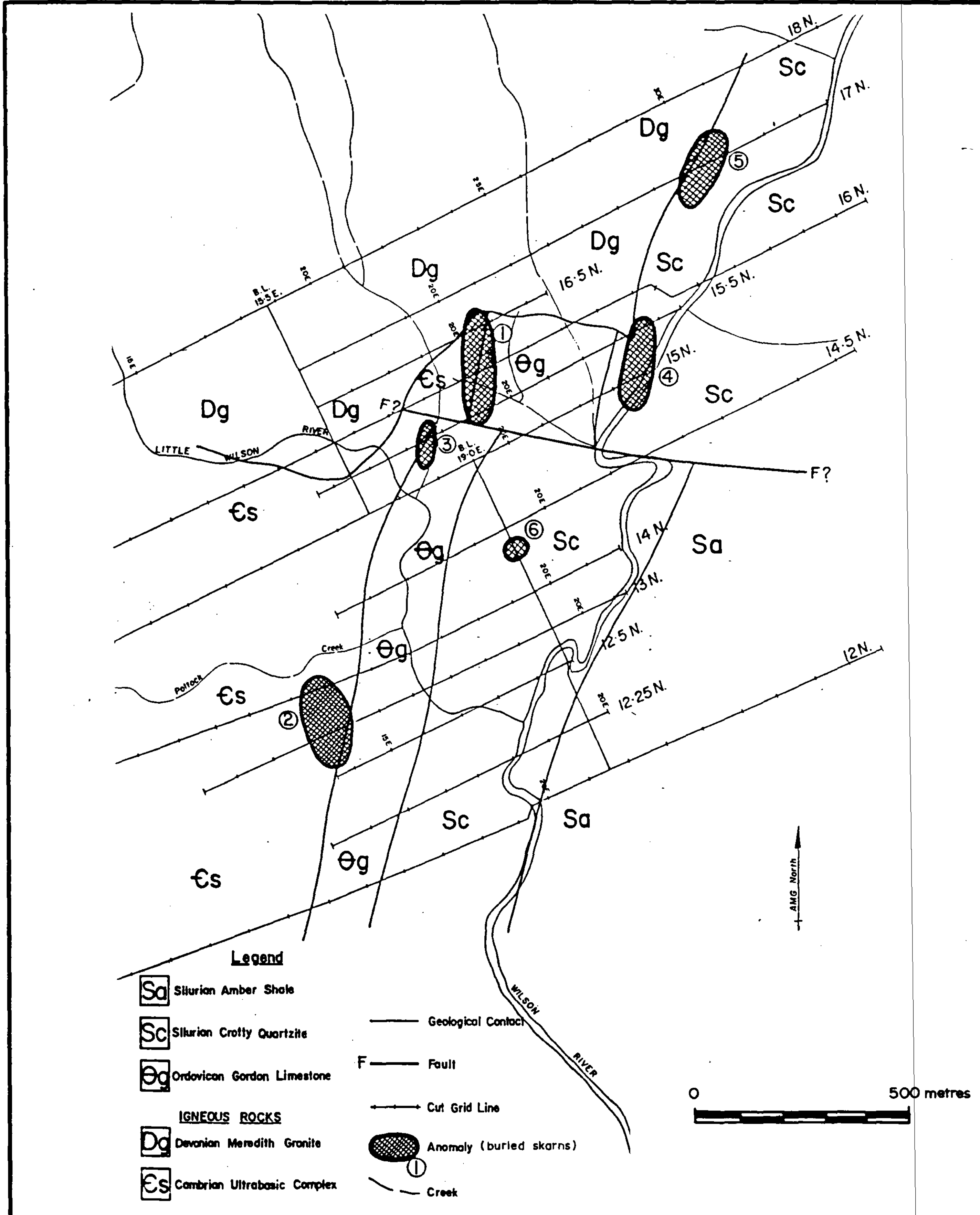
Location Code :

Scale : As shown

Date : February, 1989

Plate No. : FIG. 7-5

151



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NORTH WEST TASMANIA

LITTLE WILSON RIVER

INTERPRETIVE GEOLOGY & ANOMALY LOCATION

REVISIONS			
Init.	Date	Init.	Date

Location Code :

Scale : As shown

Date : February, 1989

Compiled : JGP

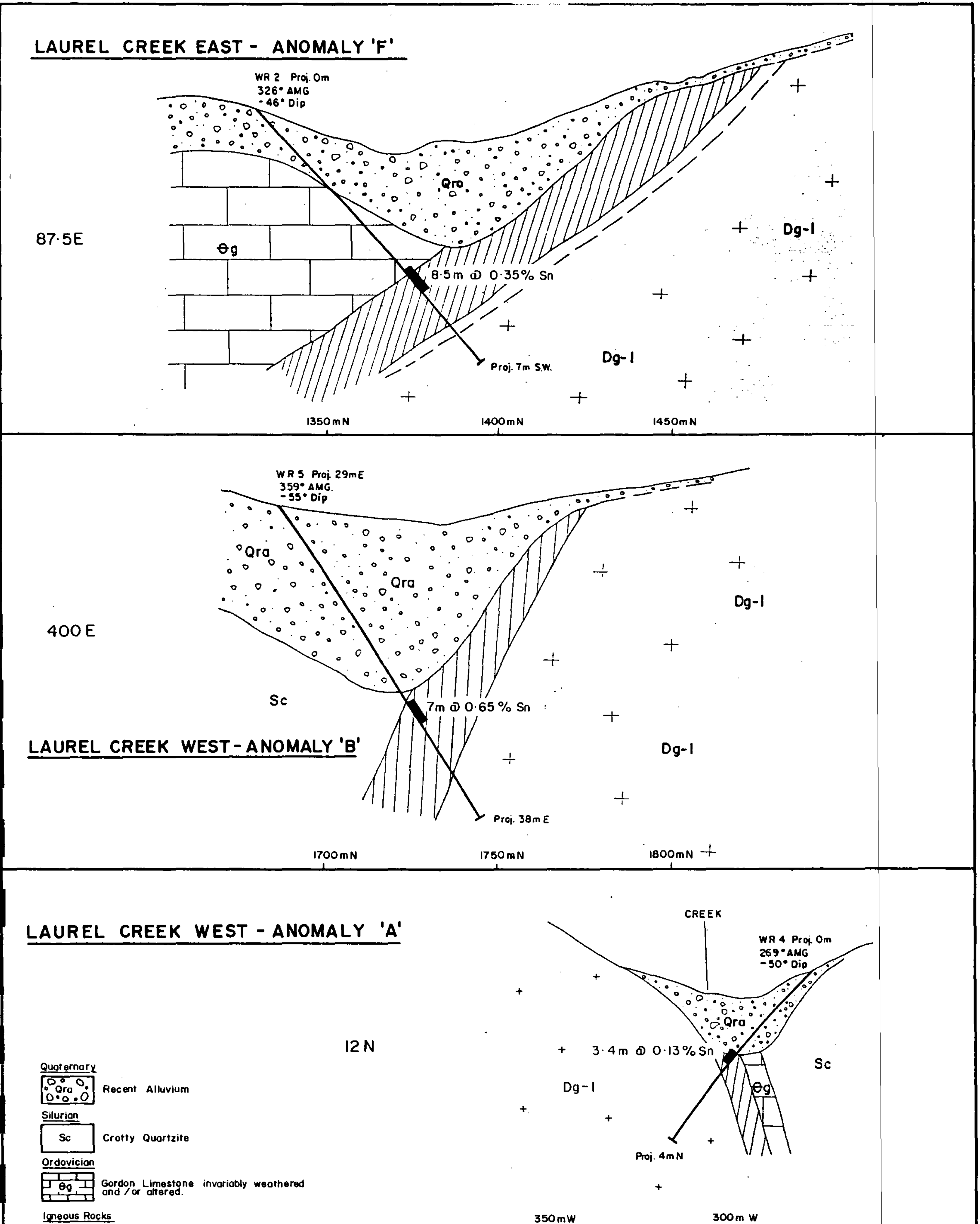
Drawn : after Renison, 1982

Traced : RJE

Checked :

Plate No. : FIG. 7-6

1
5
1
1



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REVISIONS			
Init.	Date	Init.	Date

Location Code :

NORTH WEST TASMANIA
LAUREL CREEK GRIDS
CROSS SECTIONS

Scale : 1: 1000
Date : February, 1989

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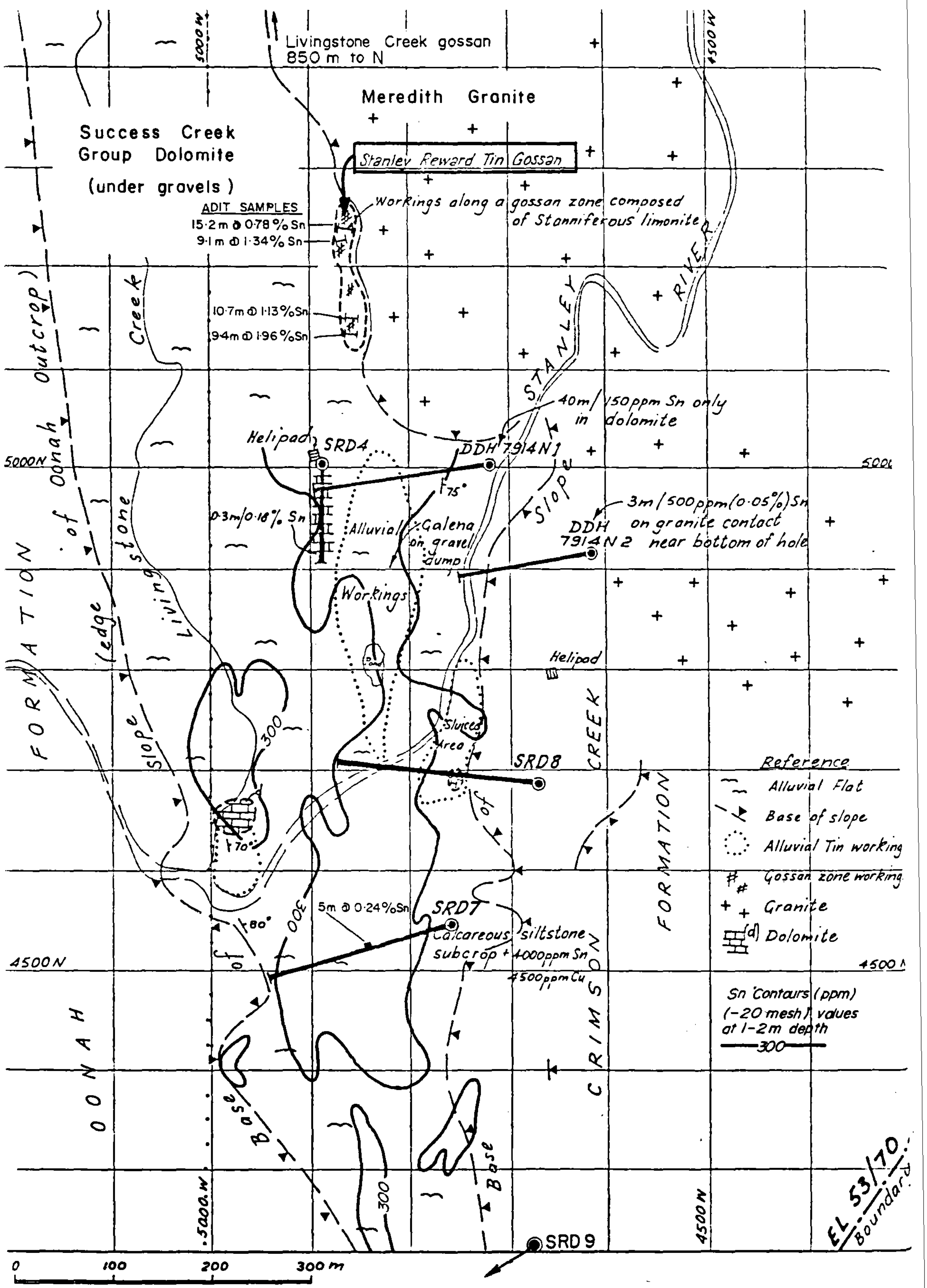
Plate No. : FIG. 7-7



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REVISIONS			
Init.	Date	Init.	Date

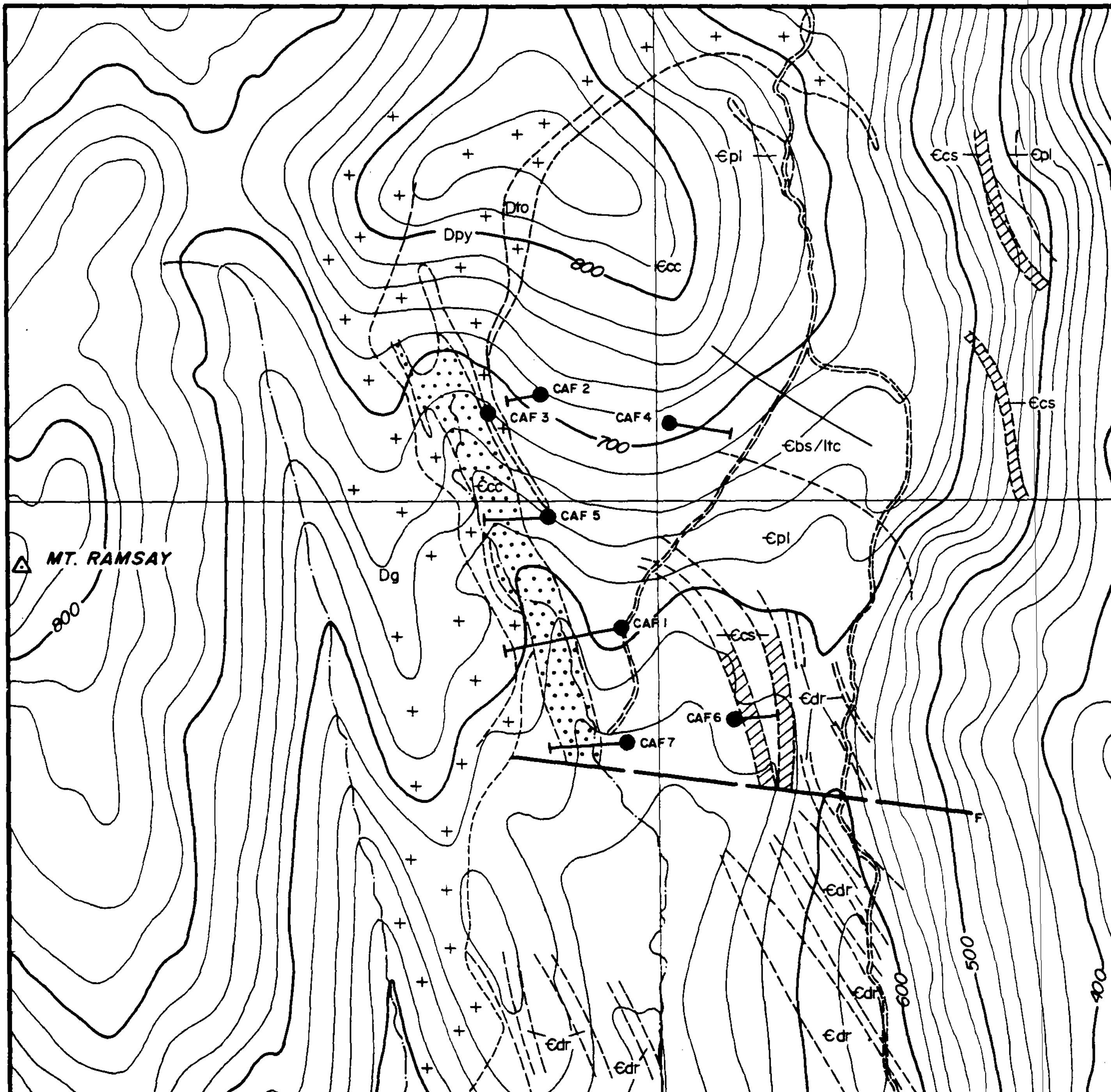
NORTH WEST TASMANIA

STANLEY REWARD AREA
TIN OCCURRENCES

Compiled : JGP
Drawn : after MacNamara, '82
Traced : RJE
Checked :

Location Code :
Scale : As shown
Date : March, 1989
Plate No. : FIG. 7-8

1511



CRIMSON CK. FORMATION	€cc	Basic intermediate volcaniclastic lithicwacke sandstone (ltc) siltstone (ss), argillite (ar) with tuffaceous, feldspathic & quartzofeldspathic sandstones (tu, sa, fs) includes minor calc-pelite (cs) and minor pelite units (pl) & minor basalt (bs)
IGNEOUS		
DEVONIAN (Meredith Granite)	+ Dpy	Porphyritic granite adamellite
	Dbgf	Biotite-quartz-feldspar equicrystalline granite
	+ Dgs,to	Altered granite, greisen (gs) tourmalinised (to)
	Dg +	Undifferentiated granite
CAMBRIAN	€dr	Basalt, microdiorite flows and shallow intrusives
	⁙	Skarn assemblage developed
	///	Calc-silicate alteration

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REVISIONS				NORTH WEST TASMANIA	Compiled : JGP
Init.	Date	Init.	Date	MT. RAMSAY SKARN	Drawn : after Comstaff, 1983
					Traced : RJE
					Checked :
Location Code :				Scale : 1:1000 — Date : February, 1989	Plate No. : FIG. 7-9

8. RENISON AREA

There are numerous tin occurrences in the general area of the Renison Mine. These occur in a variety of geological settings, host rocks and mineralisation styles. Many of the showings now lie within the recently-enlarged Renison Mine Lease. Of those outside the Mine Lease the most significant include the old Razorback tin mine, Grand Prize, Godkin Ridge, and the Salmons & Pieman veins (East Renison Area).

8.1 RAZORBACK MINE

The defunct Razorback tin mine is located near the old township of Dundas, 7 km south of the Renison Mine and 11 km by road from Zeehan. It is held by CRA (80%) and Paringa (20%) under a series of ML's totalling 159 ha, valid until 1998. The ML's are flanked on three sides by EL 101/87 held by Renison Limited, while to the north the ground is vacant. There has been no work done at Razorback since early 1982 and for some time CRA have been quietly seeking to divest themselves of the property. Geologically, Razorback is a Renison-style pyrrhotite-hosted carbonate-replacement deposit.

Razorback was discovered in 1909 and some 50t of tin was produced before Placer commenced systematic drilling in 1964. They drilled 40 holes and drove exploratory adits. They withdrew in 1966 after outlining resources of 195,000t @ 0.83% Sn (oxide ore), and 394,000t @ 0.86% Sn (sulphide ore).

In 1973 Minops redefined the resources as 325,000t @ 0.74% Sn (oxide ore) and 374,000t @ 0.85% Sn (sulphide ore). In 1975 they commenced a 180tpd opencut mining operation in the oxide ore. This operation was mis-managed and ran at a loss, with recoveries in the mill averaging only 35-40%. The operation shut down in 1978 after mining 180,000t at a grade of 0.6% Sn, for production of approximately 400t Sn. Later that year Minops drilled 7 largely-unsuccessful exploration holes to test for extensions of the mineralisation.

In 1979 CRA entered into a JV on the property and carried out exploration until 1982. They resampled the old core, drilled 5 new holes and did geophysical surveys, including airborne DIGHEM and a limited amount of ground PEM follow-up. CRA recalculated the resource at 365,000t @ 0.72% Sn (all sulphide ore), with possible extensions of 130,000t at similar grade (Purvis 1980). In addition, the tailings from the Minops operation were estimated to contain 180,000t @ 0.35% Sn.

The vertically-dipping, NW-striking sequence at Razorback comprises Cambrian Dundas Group sediments and a Cambrian serpentinite unit (see Figure 8-1). The local stratigraphy is as follows :

Top

HODGE SLATE - black, dolomitic, carbonaceous shale
RED LEAD CONGLOMERATE - polymict, mafic volcaniclastic conglomerate
BASIC TUFF - to 4m thick, marks position of 'Razorback Shear'
TALC CARBONATE - ferruginous dolomite-ankerite-talc rock
SERPENTINITE

Bottom

Historically, the serpentinite has been regarded as an intrusive (e.g. Blissett et al 1961, Brown 1980 and 1986), and the talc-carbonate its carbonatised margin. The author, when he worked on the property for CRA between 1978 and 1981, identified features of both units that were not consistent with these established ideas. He considered both the serpentinite and talc-carbonate were layered units, the former possibly a flow and the latter possibly an altered tuffaceous sediment associated with it.

The talc-carbonate is the principal mineralised unit and its size is an important feature of the property: it is up to 100m thick, over 500m long and 350m deep. It is open sub-surface to the north and south, and at depth.

The tin deposit occurs mainly within the talc-carbonate, but also within the basic tuff and Red Lead Conglomerate. It straddles the minor unconformity identified by the author (Purvis 1978 & 1980) at the base of the Red Lead Conglomerate. This unconformity is sheared in the deposit area and has been described in the past as a major strike fault (the Razorback Shear), and the channelway for the mineralising fluids (Blissett et al 1961).

On the basis of observations made while logging the drill core, the author questions the existence of the 'Razorback Shear', and considers the controls on the mineralisation at Razorback are unknown. While the mineralisation is generally concentrated on or close to the unconformity, it can occur up to 40m from it in both the talc-carbonate and the conglomerate, and the intervening rock, including the unconformity, can be barren.

The deposit itself is a south-plunging, vertically-dipping body of disseminated and massive pyrrhotite up to 19m thick and 130m long, extending to 140m below the floor of the old Minops open cut (see Figure 8-3). The established resource of 365,000t @ 0.72% Sn, which is reliably based on bulk and channel sampling in the underground adits, extends to 100m below the open cut and varies in width from 5 to 19m. The extension to 140m depth is not as well defined, being based on drilling which includes unsurveyed holes put in by Placer in 1965.

The mineralisation comprises cassiterite and minor stannite, in association with pyrrhotite and minor pyrite, arsenopyrite, chalcopyrite, sphalerite and galena. The most common gangue minerals are quartz and wollastonite. Silver values are significantly higher than in most tin occurrences of this type, with some of the ore-grade tin intersections averaging over 50g/t Ag. Tungsten values are generally <40 ppm.

Potential: The known ore lens at Razorback is reasonably well defined although there is scope, particularly in its depth extensions, to increase the resource to perhaps as much as 600,000t at the same grade (0.7% Sn). In this context it should be noted that the adit sample results are significantly better than intersections in drill holes in the same area, suggesting the drilling elsewhere can be taken as understating the resource present.

However, the attraction of Razorback for a major such as Aberfoyle is the poorly-tested status of the huge talc-carbonate unit. A major carbonate host so close to the Renison Mine and already containing ore-grade Renison-style mineralisation, must be rated highly as a prospect.

CRA did some drilling in the talc-carbonate around the known deposit which showed that (sub-economic) tin mineralisation is present within it to depths of at least 375m below surface and 200m south of the deposit. The unit and mineralisation is open beyond these limits but has not been tested. It is also open to the north at depth. Indications from the drilling are that the thickest part of the talc-carbonate, in which the known deposit and better mineralisation lies, plunges very steeply to the south.

There is over 1 km of untested serpentinite/sediment contact between the southern-most drill hole and the southern boundary of the ML's. Although this area has been covered by magnetics and aerial EM, the proximity of the serpentinite to the prospective position on the sediment contact largely renders geophysics ineffective by masking any response due to mineralisation. The contact zone is extensively covered by laterite scree from the serpentinite, but it is likely that any talc-carbonate in this area does not outcrop anyway.

8.2 GRAND PRIZE

The Grand Prize tin prospect is located in rugged country 5.5 km south of the Renison mine, and 1.5 km NW of the Razorback deposit. (See Figure 8-1). The prospect was found about 1890 and a shaft was sunk to 70m. Further underground development was carried out spasmodically between 1927 and 1946. Between 1941 and 1972 local syndicates produced a total of 20t of tin from ore grading around 0.8% Sn.

Between 1962 and 1971, the property was drilled by the Mines Dept. (3 holes), Placer (2 holes) and Gippsland Minerals (2 holes). The Placer work from 1964-66 included 375m of new underground development and comprehensive sampling.

In 1979 Renison limited optioned the property from Minops Pty. Ltd. who held it under a series of ML's. Renison already held the surrounding area under EL 42/71. Between 1979 and 1986 Renison drilled 16 holes at Grand Prize, some of which tested the mineralisation at depths of 500m below surface. The ML's were cancelled in 1985 and the prospect was incorporated into the EL which had been the subject of comprehensive exploration for many years, much of it on tin indications in the general area around Grand Prize. The EL expired in 1987 and Grand Prize is currently vacant ground, although Mines Department Exempt Area SR 1987 No. 216 flanks the prospect immediately to the west and north.

Towards the end of the Renison programme, Komyshan & Roberts (1984) made an 'approximate tonnage potential' calculation of 900,000t @ 0.8% Sn and 0.7% Cu for the known mineralisation on the Grand Prize structure.

The stratigraphy that hosts the mineralisation at Grand Prize is the same as at Razorback: Cambrian sediments of Lower to Middle Dundas Group, overlying basic and ultrabasic igneous rocks. Stanniferous Devonian granite outcrops at Pine Hill 4 km NE of Grand Prize.

The sediments are undeformed mudstone, siltstone, grit and conglomerate. There are few carbonate-bearing units. Those present include: carbonate at the top of the serpentinite unit (the mineralised position at the Razorback Mine to the south); carbonate cobbles and matrix in the Red Lead Conglomerate; calcareous greywackes in the Brewery Junction Fm; dolomite beds in the Comet Fm; and carbonate-cobble conglomerate in the Fernflow Fm at the top of the sequence.

Tin mineralisation at Grand Prize is controlled by large faults, the principal structure being the 15-30m wide, NNW-trending and west-dipping Grand Prize Fault, which is mineralised along a length of at least 1 km. It is paralleled 100m to the east by another important but smaller mineralised structure, the Grand Reward Fault (see Figures 8-4, 8-5, 8-6). Generally, the sediments dip 50^{o}S and strike ENE at right angles to the Grand Prize Fault. However, south of the large E-W striking and north-dipping Nevada Fault, the sediments strike NW and dip SW.

Tin mineralisation occurs both in the fault zones and as replacements in favourable units (predominantly the Red Lead Conglomerate), adjacent to the faults. The mineralisation in the faults is strongly influenced by the lithology forming the walls of the fault zone. The mineralisation is erratic and generally low-grade, but improves with depth. The four deepest drill hole intersections on the Grand Prize Fault are :

3.2m	horizontal width	@	0.82% Sn, 0.8% Cu	Hole S947A
2.0m	horizontal width	@	0.87% Sn, 0.78% Cu	Hole GP6
2.8m	horizontal width	@	0.65% Sn, 0.27% Cu	Hole GP7
1.9m	horizontal width	@	0.94% Sn, 0.87% Cu	Hole GP3A

Using these intersections, and taking a block from 50m north of GP7 to 50m south of GP6 (700m length), between 1900m and 2050m RL (200-350m below plain level), with a mean horizontal width of 2.5m and a S.G. of 3.5, Komyshan and Roberts (1983) calculated the tonnage potential of the Grand Prize Fault as 0.9 million tonnes of approx. 0.8% Sn & 0.7% Cu. The mineralised zone is open to the north, south and at depth.

The best intersection on the Grand Reward Fault was in hole S969 at a depth of 350m below surface: 3m @ 5.2% Sn.

The mineralisation comprises cassiterite, averaging 50-200 um in size, in association with sulphides, principally pyrite and pyrrhotite, but also chalcopyrite, sphalerite, galena and arsenopyrite. The sulphides are occasionally semi-massive. There are minor values (<200 ppm) of tungsten and bismuth, and trace stannite (1-2% of total tin). Gangue minerals include actinolite, tremolite, talc, chlorite, tourmaline, siderite and phlogopite.

In the oxidised zone, which extends to depths of 200m, the mineralisation comprises iron oxides and pyrite in quartz-chlorite-clay-filled breccia and pug, with some quartz-carbonate-actinolite-pyrrhotite veining. Although tin grades in the oxidised material are generally around 0.1 - 0.2% Sn, there are some higher grade zones. The old Grand Prize Mine is one of these, comprising a 2-6m wide zone of erratically-mineralised oxidised breccia in the upper part of the Grand Prize Fault. The early work by Placer and others in the vicinity of the old mine was not encouraging and Renison paid it no attention during their programme. However, it is worth noting that the fault provides difficult drilling conditions and many of the early drill holes had very poor recoveries in the oxidised mineralised zone.

Alteration and replacement mineralisation in the carbonate-bearing Red Lead Conglomerate is dominated by boron metasomatism expressed as axinite or schorl, in association with actinolite-chlorite-phlogopite, with pyrrhotite the dominant sulphide and minor chalcopyrite. Although the tin mineralisation in the Red Lead Conglomerate is low grade and extensive (e.g. 179m @ 0.1% Sn in hole S764), there is a noticeable increase in both grade of the mineralisation and strength of alteration with depth and proximity to the fault.

The genetic model for Grand Prize, proposed by Komyshan and Roberts (1983), is :

1. Intrusion of a Devonian tin-granite at depth.

2. Hydrothermal stanniferous fluids expelled from the granite ascending up both the Grand Prize and Grand Reward faults, forming stanniferous-sulphide mineralisation as they went.

3. On reaching the Red Lead Conglomerate the fluids mineralised it with decreasing intensity away from the faults. The conglomerate acted as a ´sponge´ absorbing the fluids and letting little tin escape upwards.

The pattern of boron metasomatism and weak hornfels development that accompanies the mineralisation supports this view, as does the pattern of mineral zoning with tin values strengthening with depth and elevated Pb/Zn values associated with the tin mineralisation in the higher parts of the fault. However, the mineralisation at the Grand Prize Mine itself is an anomaly in this model as it occurs in the upper part of the fault where it intersects sediments high up in the local Dundas Group sequence.

Potential: Grand Prize is an important but complex prospect, difficult to test. Many of the Renison drill holes failed to intersect their targets despite being carefully directed. Renison gave up exploration on the property because they considered that the mineralisation discovered was too thin, too low grade and too deep, to be economic (Komyshan 1985). They concluded that larger thicknesses of similar or better grade mineralisation needed to be found at or above their drilling limit (1900m RL - about 350m below plain level and 500m below local surface).

However, they also concluded that potential for such mineralisation did exist: "it is quite possible that grades and thicknesses will improve both locally around the current depth limit of drilling and at depth" (Komyshan & Roberts 1984). They identified the best drilling targets as :

1. The Grand Prize and Grand Reward faults in contact with or below their contact with the Red Lead Conglomerate.

2. The Grand Prize Fault at depth beneath the mine workings.

Despite Renison´s recognition of these targets, they never actually tested them.

Renison were slow to recognise the potential in the Grand Prize area of the horizon mineralised at Razorback (the carbonate unit on top of the serpentinite and below the Red Lead Conglomerate). By analogy with Razorback, the intersection of the Grand Prize Fault with this carbonate is the most prospective position at Grand Prize for tin mineralisation.

Renison concentrated on the Red Lead Conglomerate as the major potential host for tin, but as seen at Razorback it is the carbonate unit at the base of the conglomerate which is the better host, as there is too much non-carbonate material in the conglomerate.

Renison belatedly directed some attention at the carbonate unit in the last two years of their programme, but concentrated on it at the northern end of the property (i.e. the end furtherest away from Razorback), where it was thin and unmineralised, although they never managed to intersect it close to the fault as they intended.

Hole GP9 was put down in 1985 to test the more-prospective southern extension of the carbonate unit, at depth in the block south of the Nevada Fault, but failed to intersect it.

Geologically, Grand Prize and Razorback should be explored together as they are both apparently associated with the same mineralising system. The zone between Razorback and the south end of Grand Prize has not been looked at for 25 years. It was previously held by CSR (EL 15/76) who did nothing on it and the ground is now vacant.

There is no doubt that the best potential for tin mineralisation at Grand Prize lies at depth where the Red Lead Conglomerate and underlying carbonate unit intersect the Grand Prize Fault. Although deep, this potential is substantial and yet to be adequately tested.

8.3 EAST RENISON (Salmons/Pieman Veins etc.)

This area lies astride the Murchison Highway immediately NE of the Renison Mine Lease - the Salmons/Pieman vein system is 2.5 km from the Renison deposit (see Figure 8-7). The area was recently pegged by Renison Limited as EL 45/88. For 25 years prior to this the ground had been held by Comstaff under EL 5/63. It is possible Renison may eventually incorporate the area into their Mine Lease.

A series of tin-base metal veins were discovered in the Exe River area NE of Renison, about the turn of the century. King (1963) quotes production as 21 tons tin. The veins included Exe Pty, Exe River, Fentons, Pieman Tin and Salmons Lead.

The area comprises a western sequence of Cambrian Crimson Creek Formation sediments (generally volcanomict siltstone and sandstone); a thin central zone of serpentinite and associated talc-carbonate, gabbro and tholeiite; and an eastern sequence of Cambrian Dundas Group sediments (carbonaceous and partly calcareous/dolomitic, shale, siltstone and sandstone). The rocks strike northerly, dip almost vertically and face east.

The mineralised veins lie in both the central mafic belt and the Dundas Group sediments. The principal Salmons/Pieman vein system comprises at least three sub-parallel veins in a zone 30-100m wide. It is intimately associated with a thin talc-carbonate unit (see Figure X). In the southern part of the system the arcuate Salmons Vein strikes NE and N, dips steeply W and averages 3.6m in width. It comprises pyrite-arsenopyrite-galena-sphalerite in siderite-quartz gangue, with average grade around 3% Pb, 2% Zn and 100g/t Ag. There are minor values of copper (0.6%) and tin (0.2%), with the latter occurring as stannite in sphalerite and as ultra fine-grained cassiterite (2-30um).

The Pieman Tin Vein at the northern end of the system dips 75° E, strikes NW and varies in width from 0.5m to almost 4m. The vein comprises cassiterite of 100-200um size, with arsenopyrite and minor sphalerite, in quartz gangue. Overall grade is around 1% Sn. The higher tin grades are often found where the vein intersects the talc-carbonate unit.

The area is underlain by the Devonian Pine Hill Granite which also underlies the Renison Mine. The mineralisation in the Salmons/Pieman vein system lies in the outer part of the metasomatic aureole 550-1100m above the granite. The plunge of mineralisation in the Pieman Tin Vein is steeply north, while the plunge in Salmons Vein is shallowly southwards. (See Figure 8-9).

Comstaff focused on the area between 1970-74, following up tin and base metal stream sediment anomalies with ground surveys and drilling several holes without success. From 1974-79 Comstaff were inactive at East Renison which led to an interesting turn of events.

In the mid-1970's Renison Limited became aware that the important mineralised Federal-Bassett structure in the Renison Mine was trending at depth towards the Comstaff ground, and could possibly pass into it. Renison are believed to have initiated moves that saw the East Renison area become a Mines Department Reserve. When the Reserve was later withdrawn Renison applied for the ground and were initially granted it, but a protest from Comstaff saw the decision overturned and the area returned to EL 5/63 in 1979.

The nett result of all this skirmishing was that from 1979-84 Comstaff undertook an intensive exploration programme at East Renison, drilling 50 diamond drill holes totalling 18,300m. Inexplicably, it was the restricted potential of the Salmons/Pieman vein system, and not the significant possibilities for more Renison-style orebodies, which was the focus of their attention. Only three holes tested the stratigraphy at depth, with two going right down to the granite 1000m below surface.

These deep holes encountered extensive metasomatic alteration extending 700m from the underlying granite, including weak pyrrhotitisation, skarns and fracture-controlled mineralisation, but there were no associated tin values (Zetetic 1985). However, the holes were sited on the <u>eastern</u> side of the property - well away from the Federal-Bassett structure (see Figure 8-8).

Comstaff concluded "the important Bassett/Federal structure has not been unequivocally identified in the Comstaff ground", and, re the search for Renison-style mineralisation in the area: "such a target cannot be written off as unworthy of further consideration" (Zetetic 1985). These conclusions are hardly surprising given their cursory and ill-directed search for both targets.

Potential: The standard of much of Comstaff's work in Western Tasmania is very poor, especially their data presentation, but the East Renison project sets new lows. Their resource calculations in particular are unrealistic, and display a measure of inexperience and perhaps incompetence by those involved.

For example, one 'possible resource' block on the Pieman Tin Vein measures 270m deep x 65m wide and is based on a single drill hole near the bottom of the block. Generally, the resource blocks are rectangular with one axis much longer than the other and the drill holes that define them are not centrally placed within the block. Frequently tonnes are quoted to 3 decimal places, (e.g. 45,178.656t), with tin grades sometimes quoted to 4 decimal places (e.g. 96,450t @ 0.4185% Sn). The resource calculations were also done using a $US35 cut-off, which is meaningless.

While there are resources of tin and base metals in the Salmons/Pieman vein structure, the mineralisation is thin, steeply-dipping and generally of low to moderate grade when bulked to a mineable width. It is also metallurgically complex - a major adverse factor which Comstaff virtually chose to ignore. Comstaff's figures for 'Probable Resources', although of questionable validity, give some idea of the scale of resources involved:

Pieman Tin Vein: 430,000t @ 1.0% Sn, 0.2% Cu, 0.3% Zn, 8g/t Ag.
Salmons Vein: 830,000t @ 3.2% Pb, 2.2% Zn, 104g/t Ag, 0.6% Cu, 0.2% Sn.
(Thynne 1984. Note: figures based on a 2m minimum width).

Comstaff carried out detailed economic feasibility studies on these resources, which indicated they were uneconomic.

There is no doubt that the East Renison area has very significant tin potential. The tin and base metal mineralisation in the Salmons/Pieman vein structure is typical of the zoning peripheral to the major Devonian tin systems in Western Tasmania. While probably of little interest by itself, it does serve to confirm that the area lies within the outer margin of the huge Renison mineralised system.

The principal potential is for carbonate-replacement cassiterite-sulphide mineralisation, especially at depth on the western side and southern end of the property, close to the NW-trending Federal-Bassett Fault. This structure was the principal conduit for the mineralisaton at Renison. Its easterly dip brings it close enough to the East Renison ground to form carbonate-replacement mineralisation from fluids that came up the fault and may have debouched eastward, rather than westward to where the Renison deposit formed. (See Figures 8-10, 8-7).

Because of the large throw on the Federal-Bassett Fault any such mineralisation at East Renison will occur within carbonates in the basal western part of the Crimson Creek Formation, rather than in the Success Creek Group which hosts the Renison deposit. Such carbonates are known to occur in the Crimson Creek Formation in this area (e.g. at the top of the Mine Sequence). Proper testing of such targets has yet to be carried out at East Renison.

8.4 GODKIN RIDGE

The Godkin Ridge prospect lies in rugged country 5 km SE of the Renison Mine. It is currently held by Paringa Mining & Exploration under ML 62M/75 of 50 ha. See Figure 8-7.

A zone of disseminated, bedded and veinlet pyrrhotite-cassiterite occurs in weakly metasomatised dolomitic shales of the Cambrian Dundas Group. The zone is conformable and trends NNW. It is at least 400m long and about 130m wide.

Best results from early trenching were up to 3.3m @ 0.88% Sn, and 3m @ 0.33% Sn. Minops put in two short inconclusive diamond drill holes in 1974.

The mineralisation coincides with a NNW-trending zone of shearing containing quartz-po-py-aspy veins with minor cassiterite. This shear zone is broadly aligned along the trend of the Federal-Bassett Fault in the Renison Mine, and may be related to a southward extension of this important mineralising structure. The Devonian Pine Hill Granite outcrops 1.5 km west of the Godkin Ridge prospect.

Data on exploration carried out on the property since 1975, particularly the important work done by the Minops - Comstaff JV around 1980, is not publicly available. On request, Paringa agreed to supply all data on the property. However, this had not been done by the time this report had to be compiled. It is hoped the details on Godkin Ridge can be appended to the report in the near future.

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* Kindly made available by T. Dickson, CRA Exploration.

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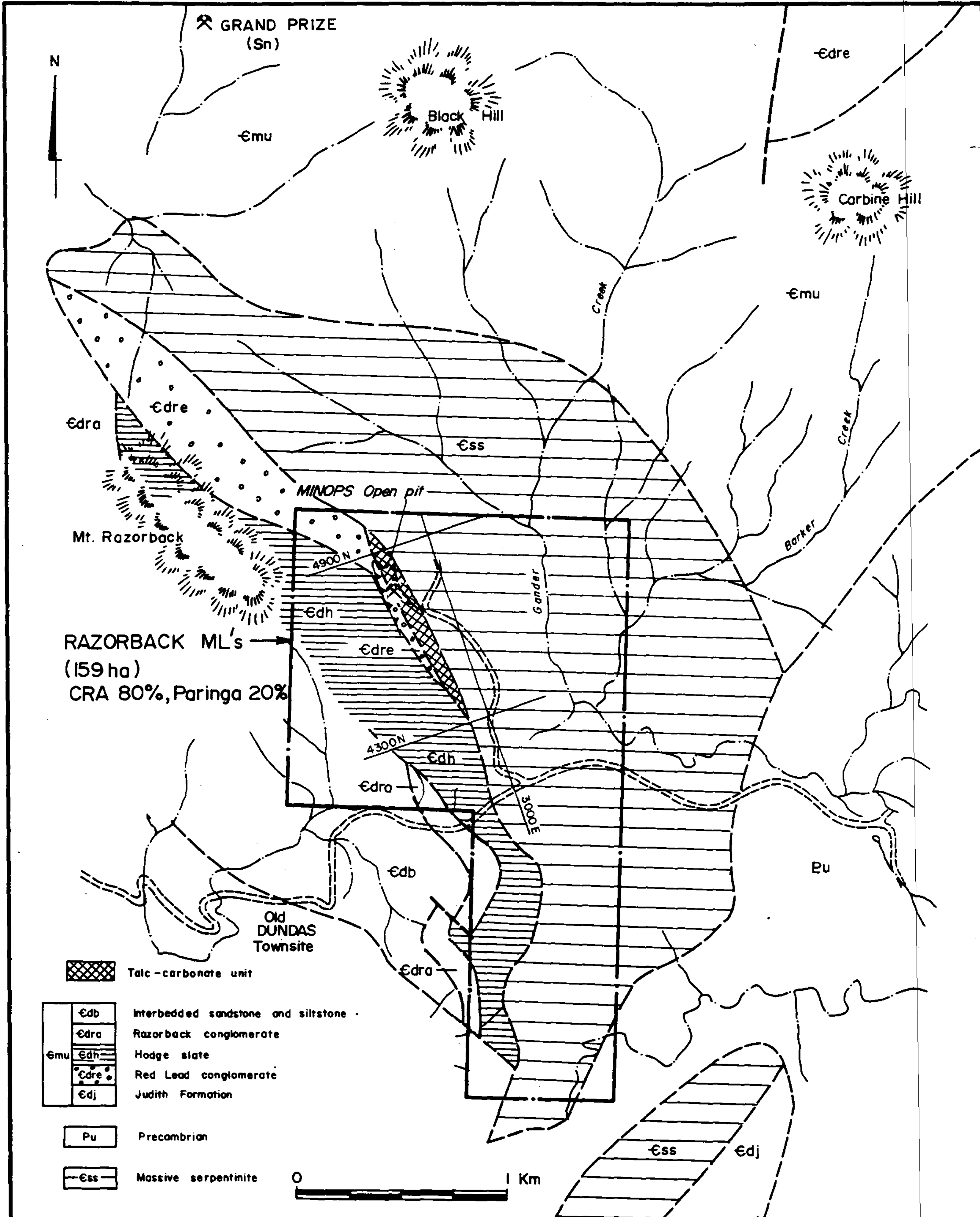

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EXPLORATION DIVISION

REVISIONS			
Init.	Date	Init.	Date

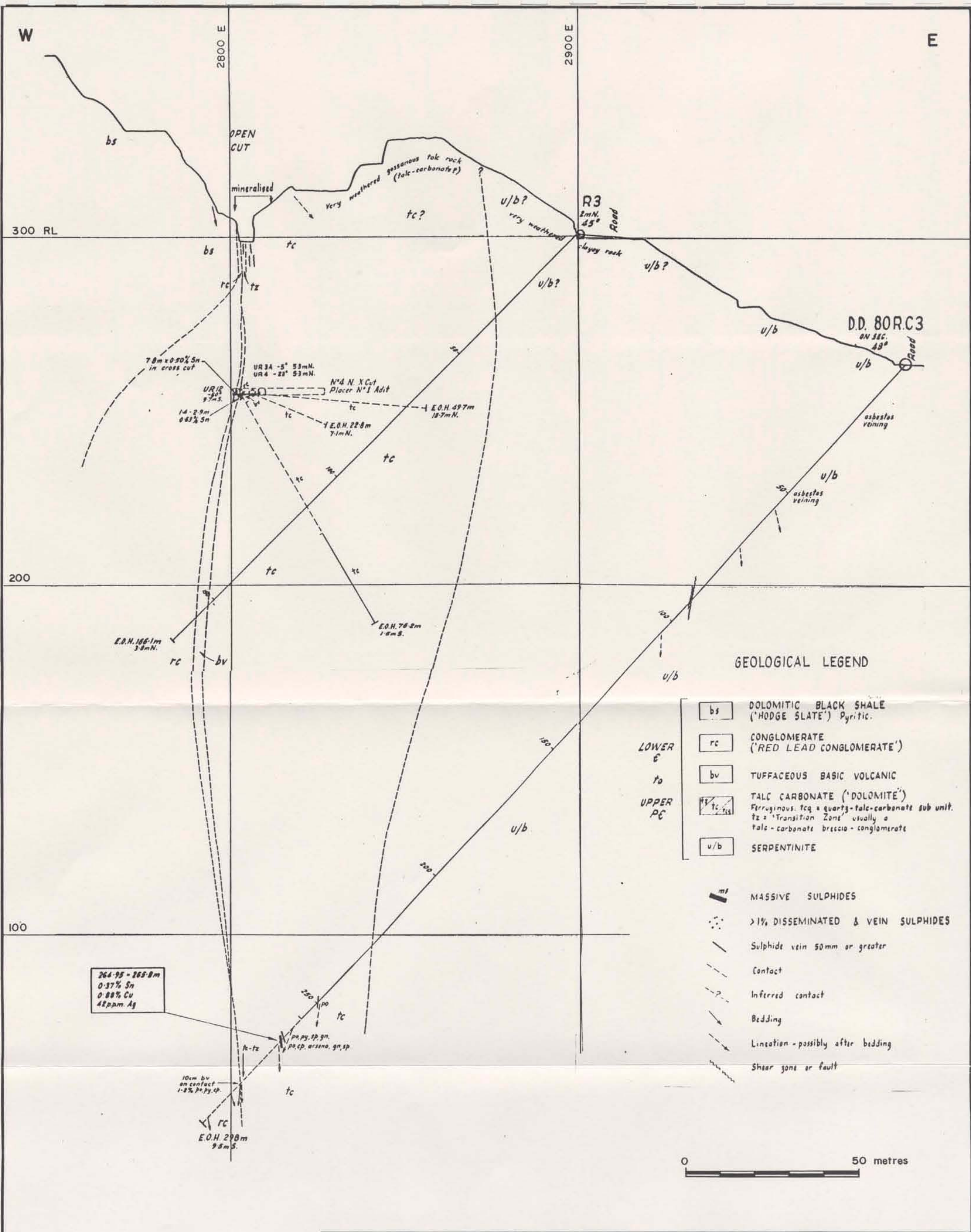
NORTH WEST TASMANIA

RAZORBACK MINERAL LEASES SUMMARY PLAN

Compiled :	JGP
Drawn :	after Brown, 1986
Traced :	RJE
Checked :	

Location Code :	Scale : 1 : 25,000	Date : February, 1989	Plate No. : FIG. 8-1

151



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REVISIONS			
Init.	Date	Init.	Date

Location Code :

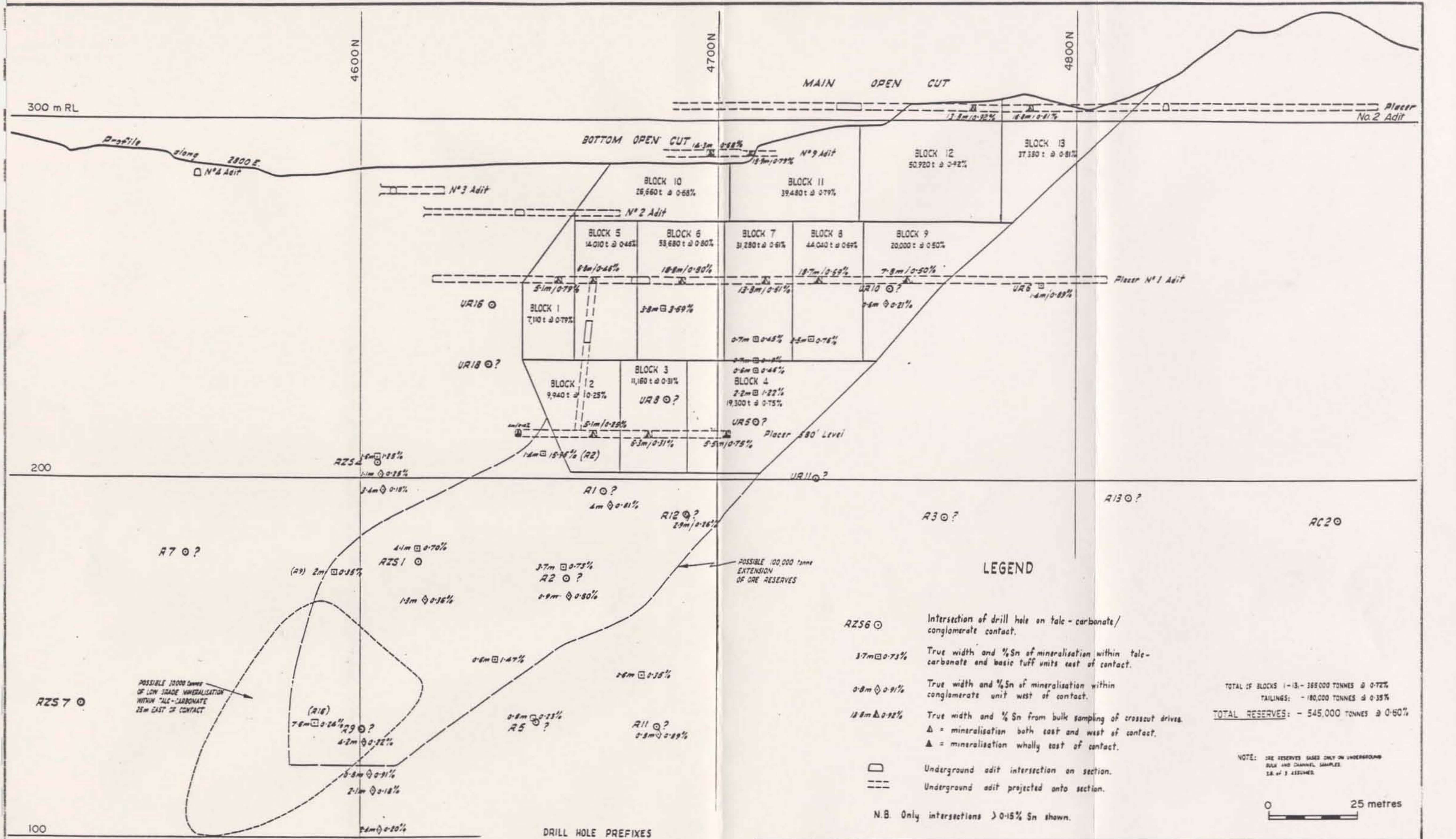
NORTH WEST TASMANIA

RAZORBACK TIN MINE
SECTION 4760 N

LOOKING GRID NORTH (340° MAG. approx.)

Scale : 1 : 1000 | Date : February, 1989

Compiled : JGP
Drawn : JGP, July 1980
Traced : RJE
Checked :
Plate No. : FIG 8-2



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REVISIONS			
Init.	Date	Init.	Date

Location Code :

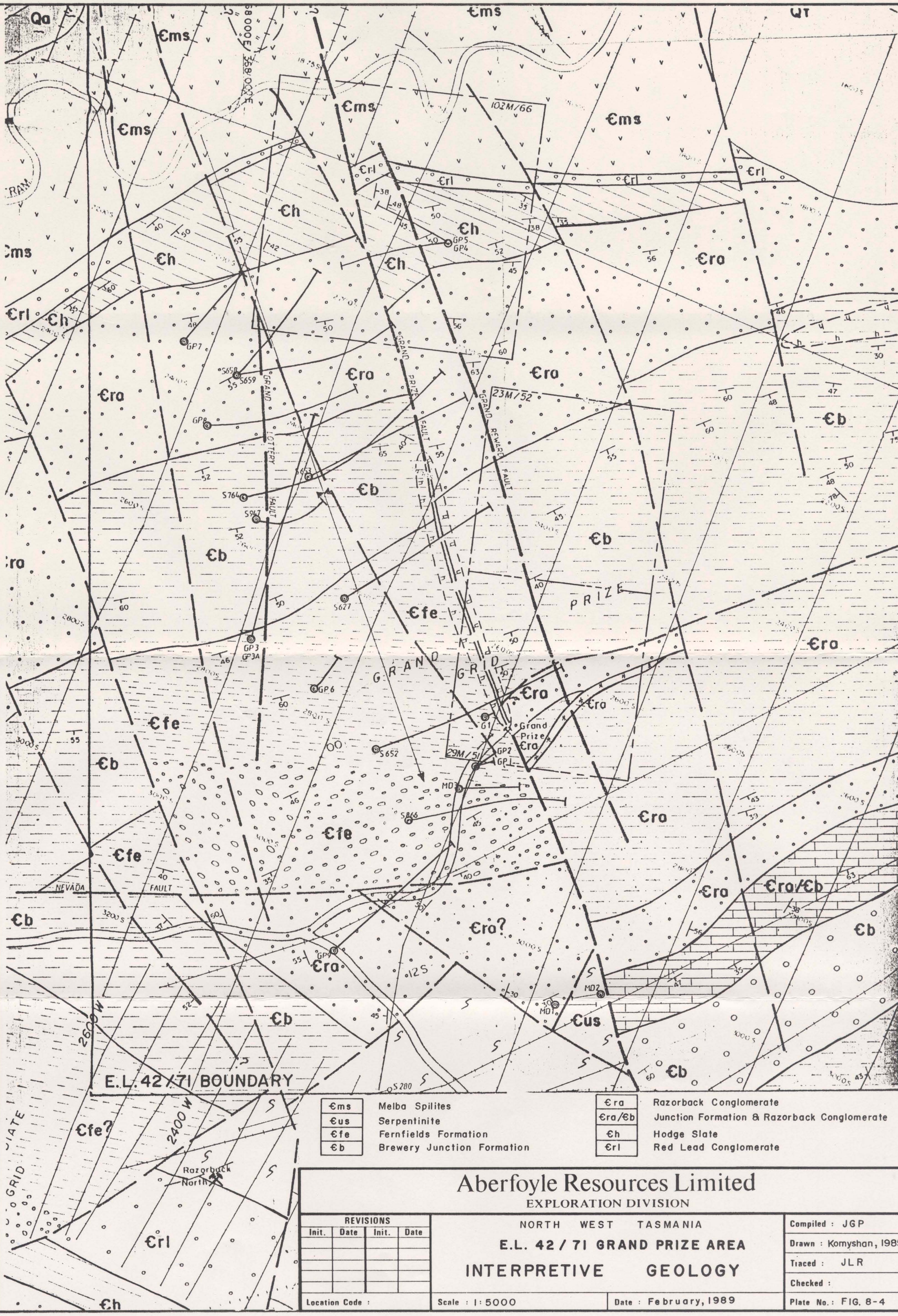
NORTH WEST TASMANIA

RAZORBACK TIN MINE

Longitudinal Section along 2800 East
Ore Reserves

Scale : 1 : 1000 | Date : February, 1989

Compiled : JGP
Drawn : JGP, Sept. 1980
Traced : RJE
Checked :
Plate No. : FIG. 8-3



€ms	Melba Spilites
€us	Serpentinite
€fe	Fernfields Formation
€b	Brewery Junction Formation
€ra	Razorback Conglomerate
€ra/€b	Junction Formation & Razorback Conglomerate
€h	Hodge Slate
€rl	Red Lead Conglomerate

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NORTH WEST TASMANIA

E.L. 42 / 71 GRAND PRIZE AREA

INTERPRETIVE GEOLOGY

REVISIONS			
Init.	Date	Init.	Date

Location Code :

Scale : 1:5000

Date : February, 1989

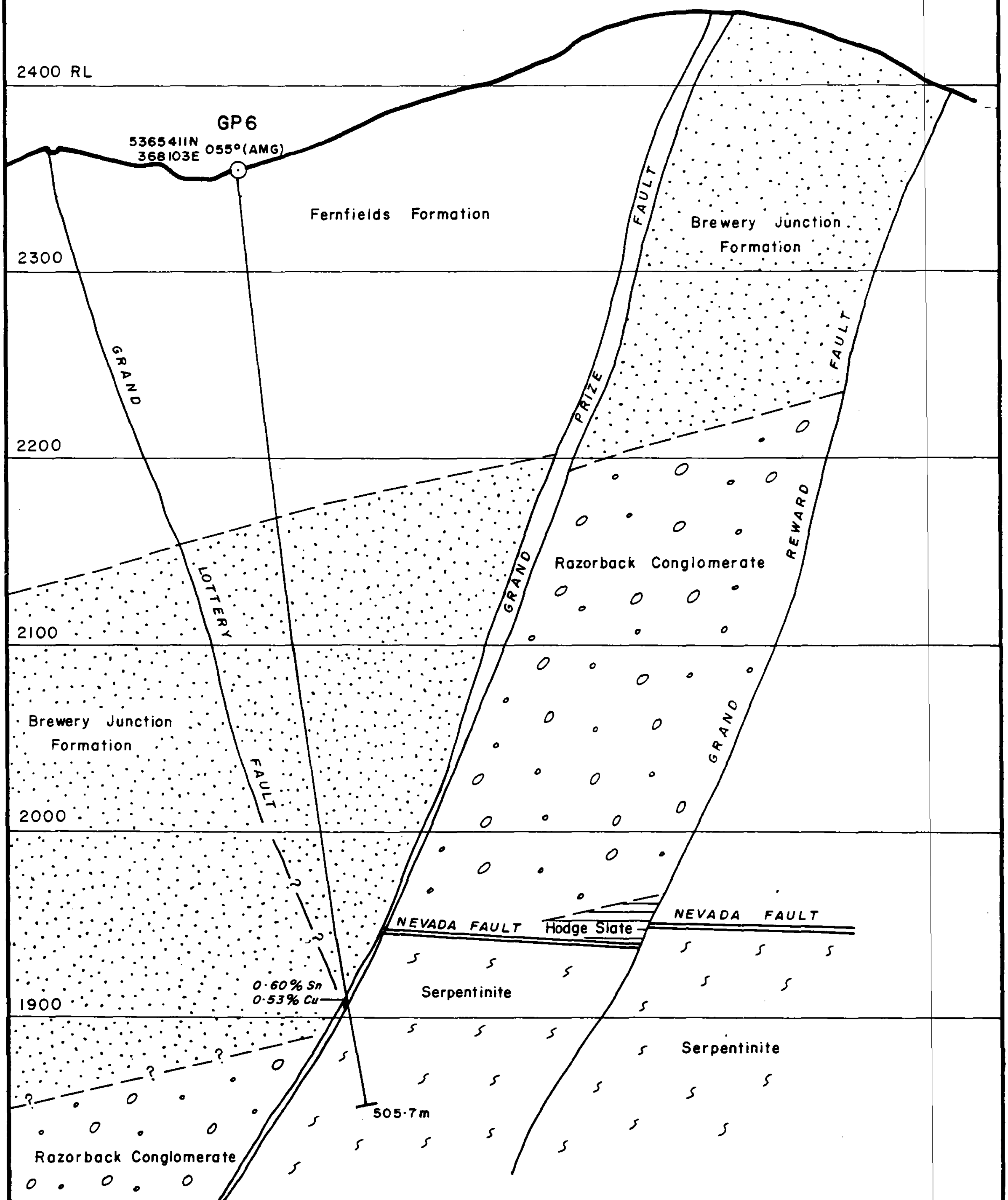
Compiled : JGP

Drawn : Komyshan, 1985

Traced : JLR

Checked :

Plate No. : FIG. 8-4



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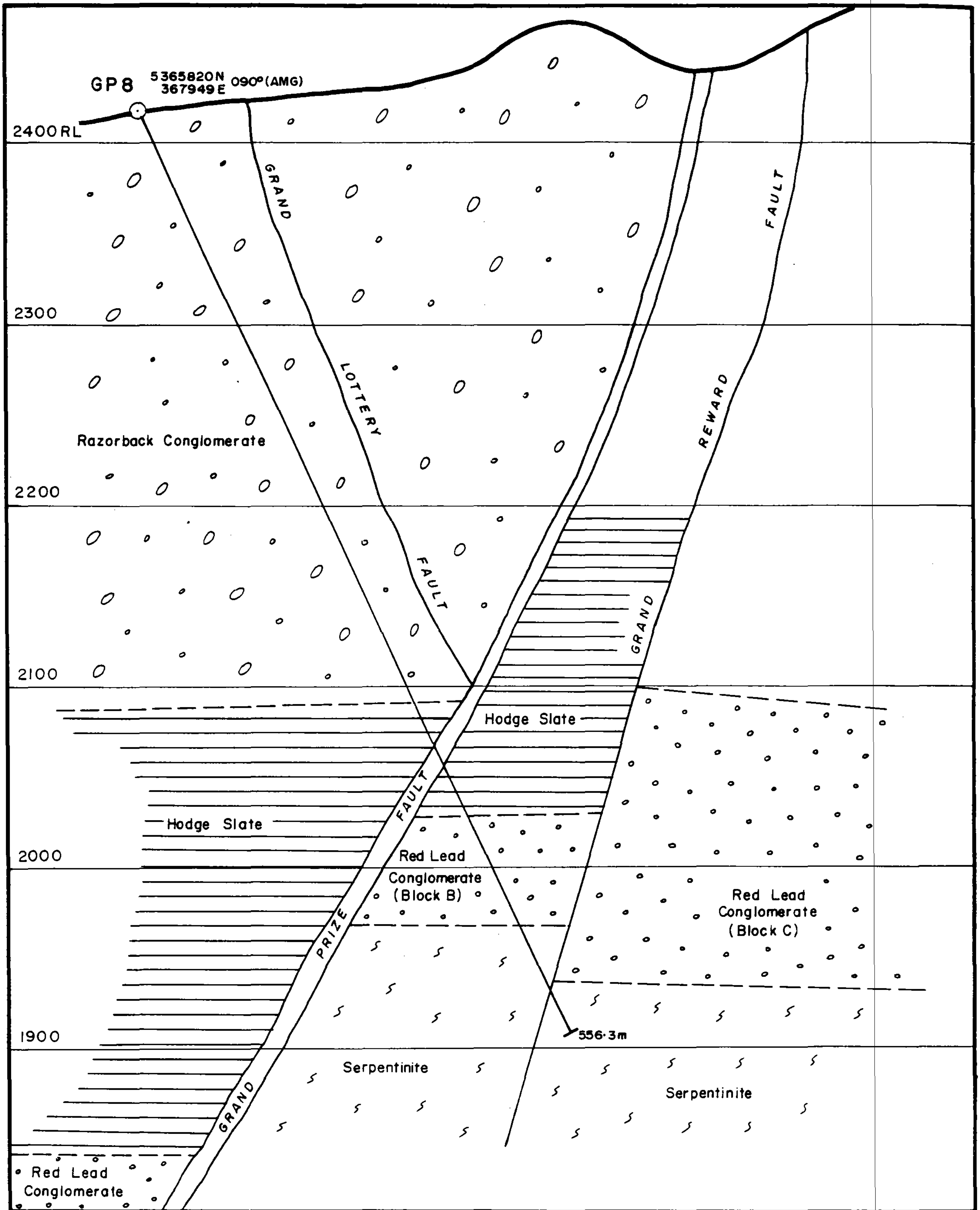
EXPLORATION DIVISION

REVISIONS				NORTH WEST TASMANIA	Compiled : JGP
Init.	Date	Init.	Date	E.L. 42/71 GRAND PRIZE	Drawn : Komyshan, 1984
				DOWN DIP PROJECTION-GP6	Traced : JLR
					Checked :
Location Code :				Scale : 1:2000 / Date : February, 1989	Plate No. : FIG. 8-5

1511



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REVISIONS			
Init.	Date	Init.	Date

NORTH WEST TASMANIA

E.L. 42/71 GRAND PRIZE

DOWN DIP PROJECTION - GP8

Compiled : JGP
Drawn : Komyshan, 1984
Traced : JLR
Checked :

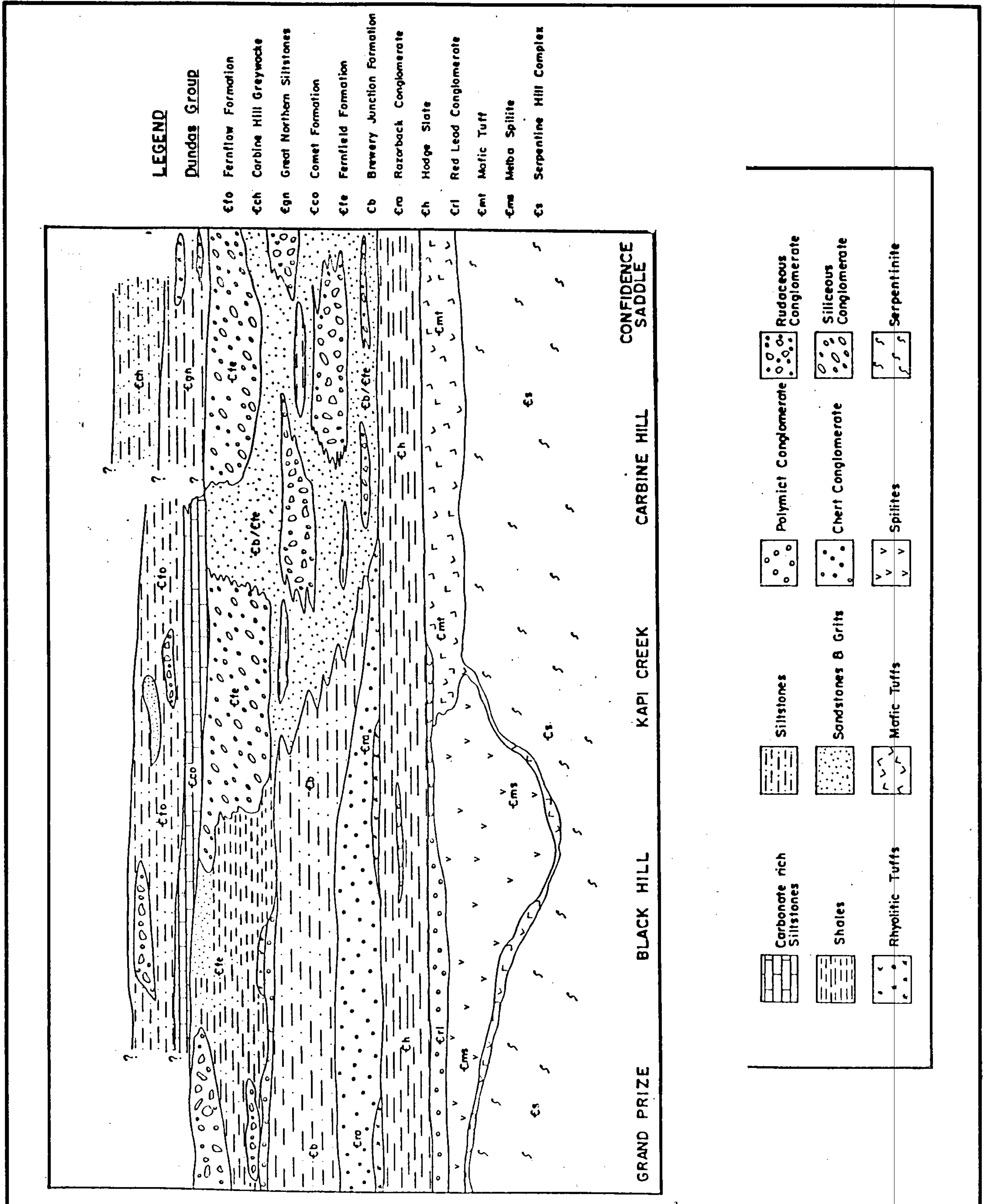
Location Code :

Scale : 1:2000

Date : February, 1989

Plate No. : FIG. 8-6

1511



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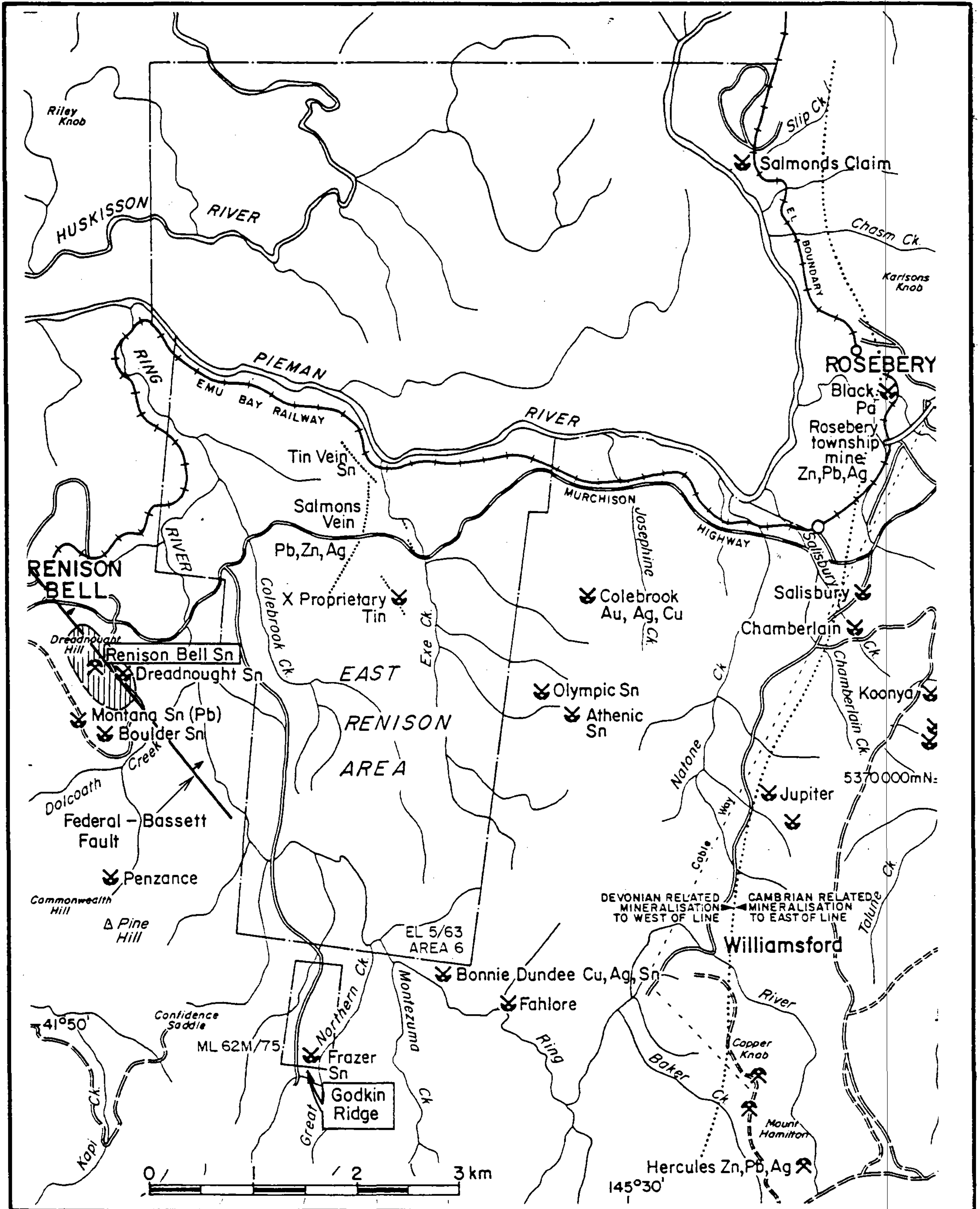
EXPLORATION DIVISION

REVISIONS					
Init.	Date	Init.	Date	**E.L. 42 / 71 GRAND PRIZE** Schematic Representation of Dundas Group Stratigraphy	Compiled : JGP
					Drawn : Komyshan, 1984
					Traced : JLR
					Checked :
Location Code :				Scale : not to scale — Date : February, 1989	Plate No. : FIG.



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REVISIONS			
Init.	Date	Init.	Date

NORTH WEST TASMANIA

EAST RENISON LOCATION

Compiled : JGP

Drawn : after Comstaff, 1984

Traced : RJE

Checked :

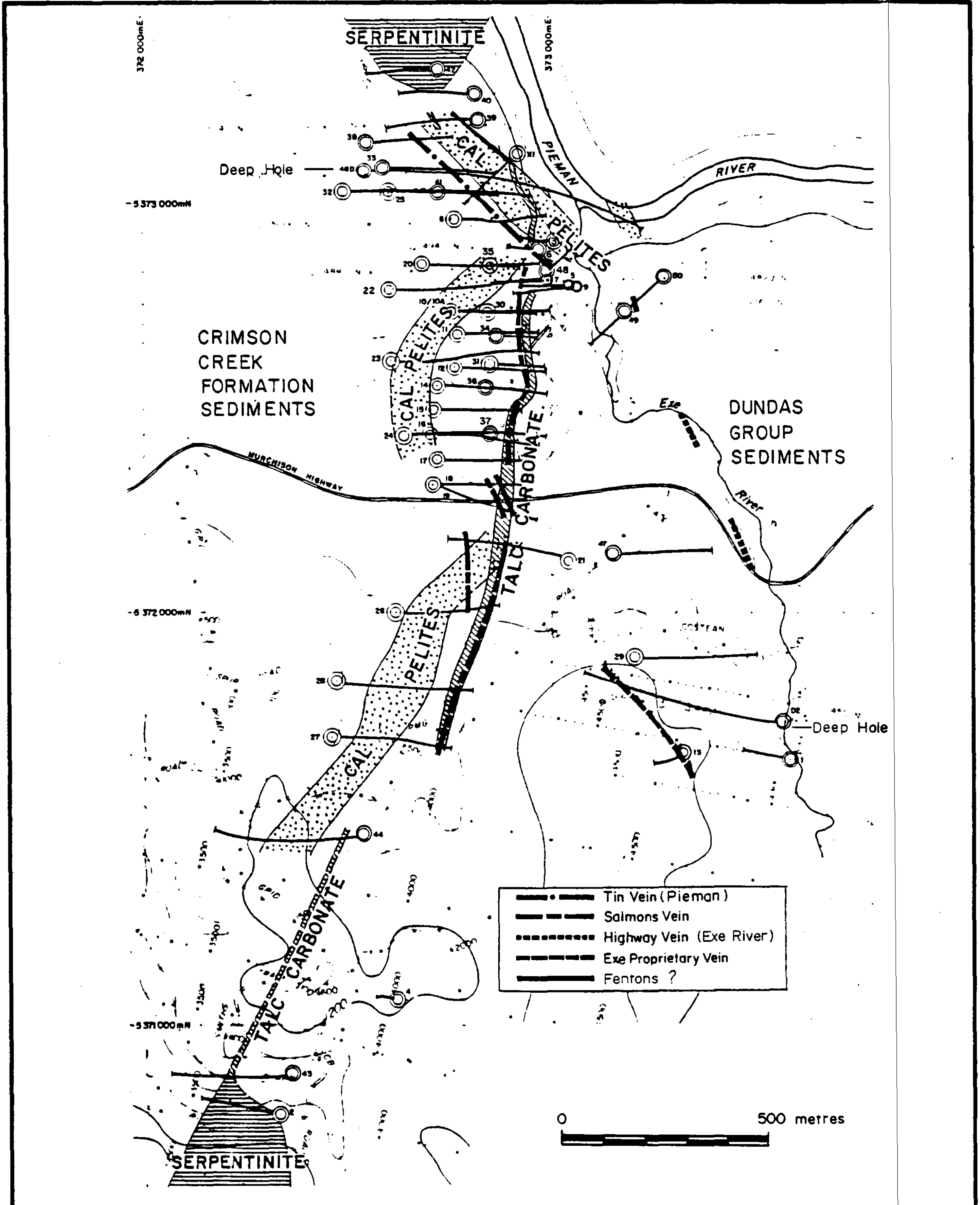
Location Code :

Scale : 1 : 50,000

Date : February, 1989

Plate No. : FIG 8-7

1511



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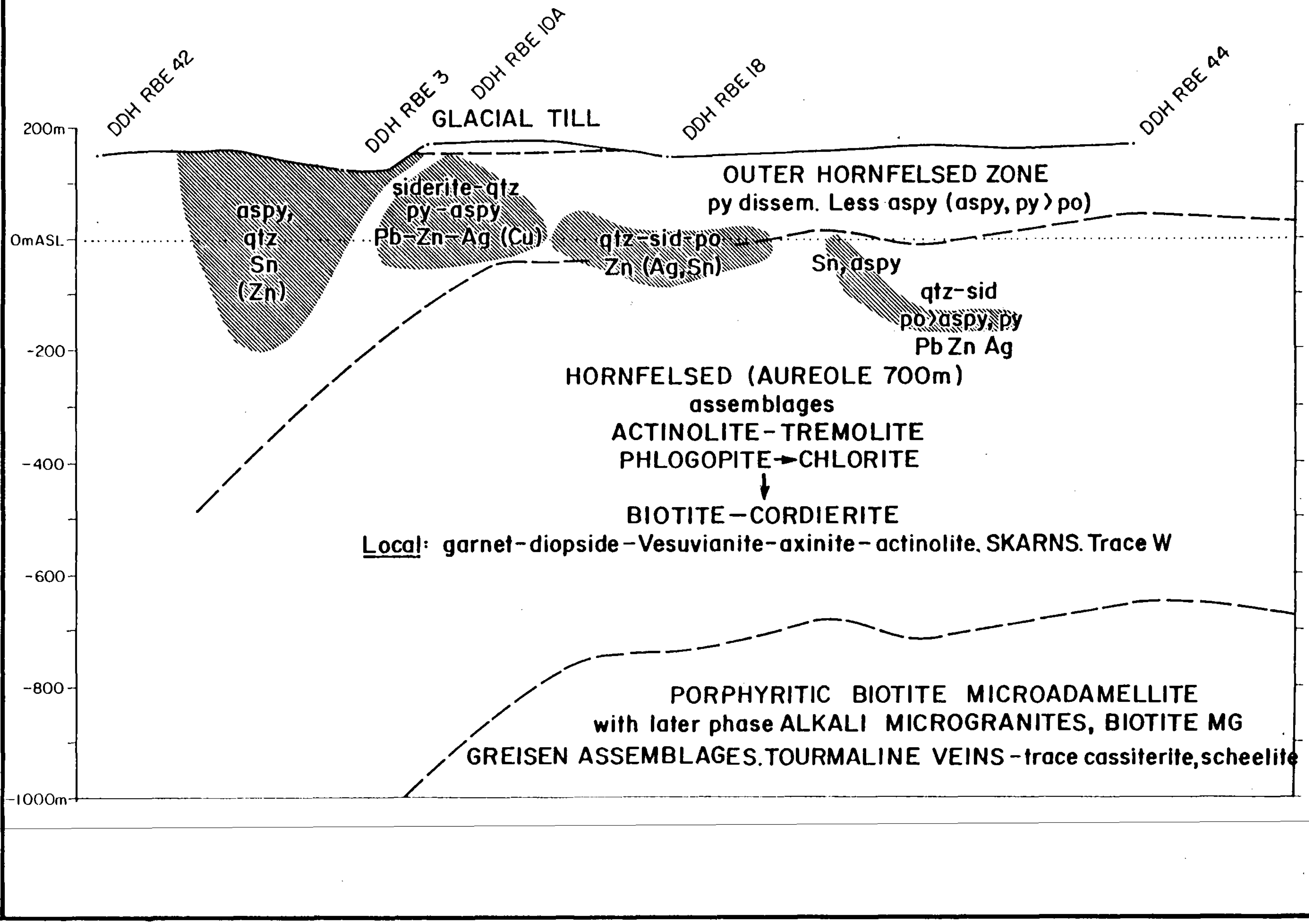
REVISIONS				NORTH WEST TASMANIA	Compiled : JGP
Init.	Date	Init.	Date	EAST RENISON PROJECT	Drawn : after Comstaff, 1984
				E.L. 5/63 AREA 6	Traced : RJE
				FISSURE VEIN SYSTEMS	Checked :
Location Code :				Scale : As shown / Date : February, 1989	Plate No. : FIG. 8-8

1511



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EXPLORATION DIVISION

EAST RENISON PROJECT

EL 5/63 AREA 6

L-S THROUGH TIN & SALMON VEINS ALTERATION & MINERALISATION FEATURES

REVISIONS			
Init.	Date	Init.	Date

Location Code :

Scale : 1:1000

Date : February, 1989

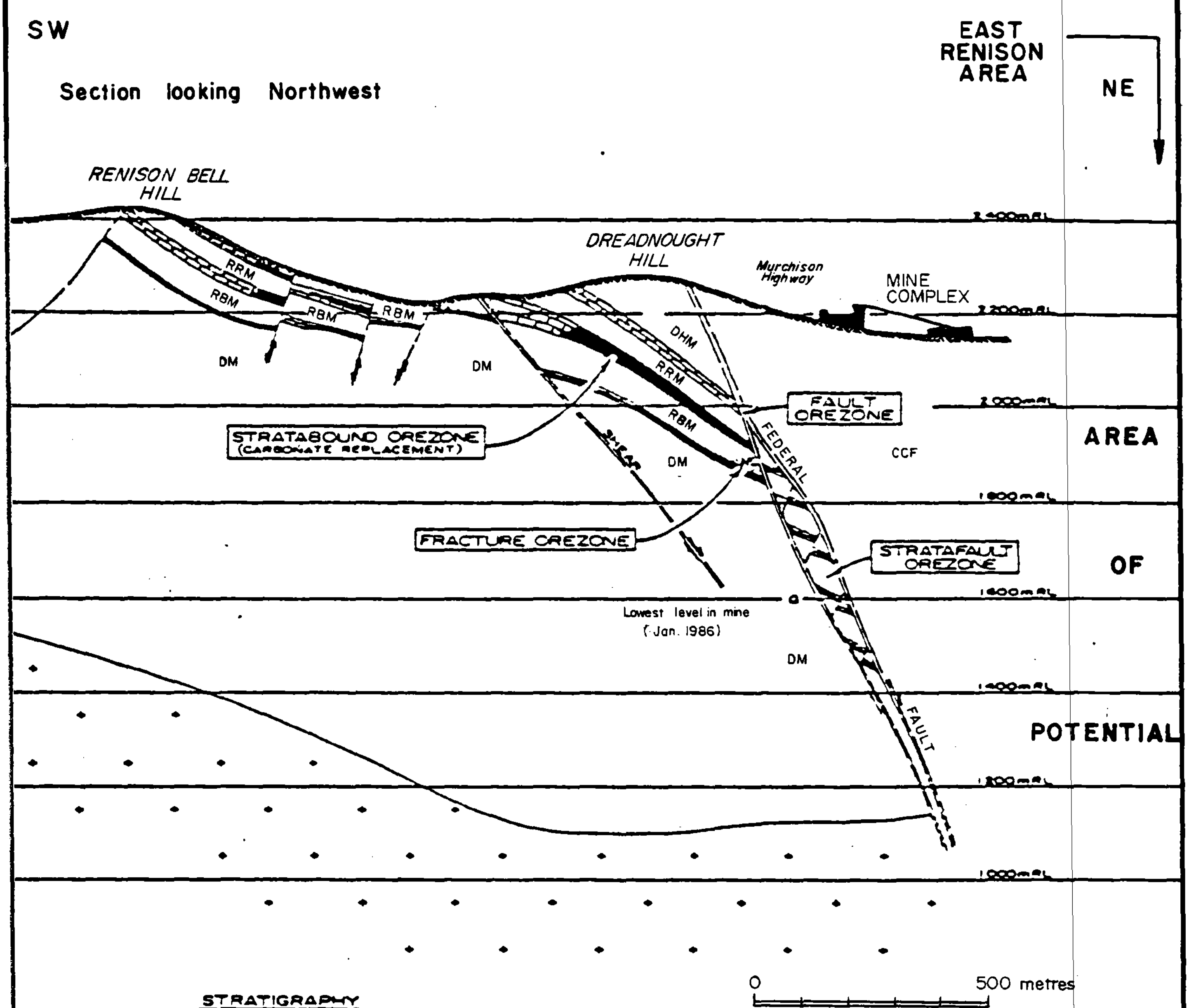
Compiled : JGP

Drawn : after Comstaff, 1985

Traced : RJE

Checked :

Plate No. : FIG. 8-9



STRATIGRAPHY

MIDDLE DEVONIAN	PORPHYRITIC GRANITIC COMPOSITION MINOR INTRUSIVE	
	GRANITE	
? EARLY CAMBRIAN	SERPENTINE HILL MAFIC-ULTRAMAFIC COMPLEX	
? LATE PRECAMBRIAN TO EARLY CAMBRIAN	CRIMSON CREEK FORMATION (CCF) SUCCESS CREEK GROUP	SILICICLASTIC AND VOLCANICLASTIC SEDIMENTS WITH DOLOMITIC HORIZONS OF RENISON MINE SEQUENCE INDICATED. DHM = DREADNOUGHT HILL MEMBER; RRM = RED ROCK MEMBER; RBM = RENISON BELL MEMBER; DM = DALCOATH MEMBER

NOTE: SEMI-MASSIVE TO NEAR-MASSIVE SULPHIDE REPLACING DOLOMITE HORIZONS SHOWN IN BLACK.

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EXPLORATION DIVISION

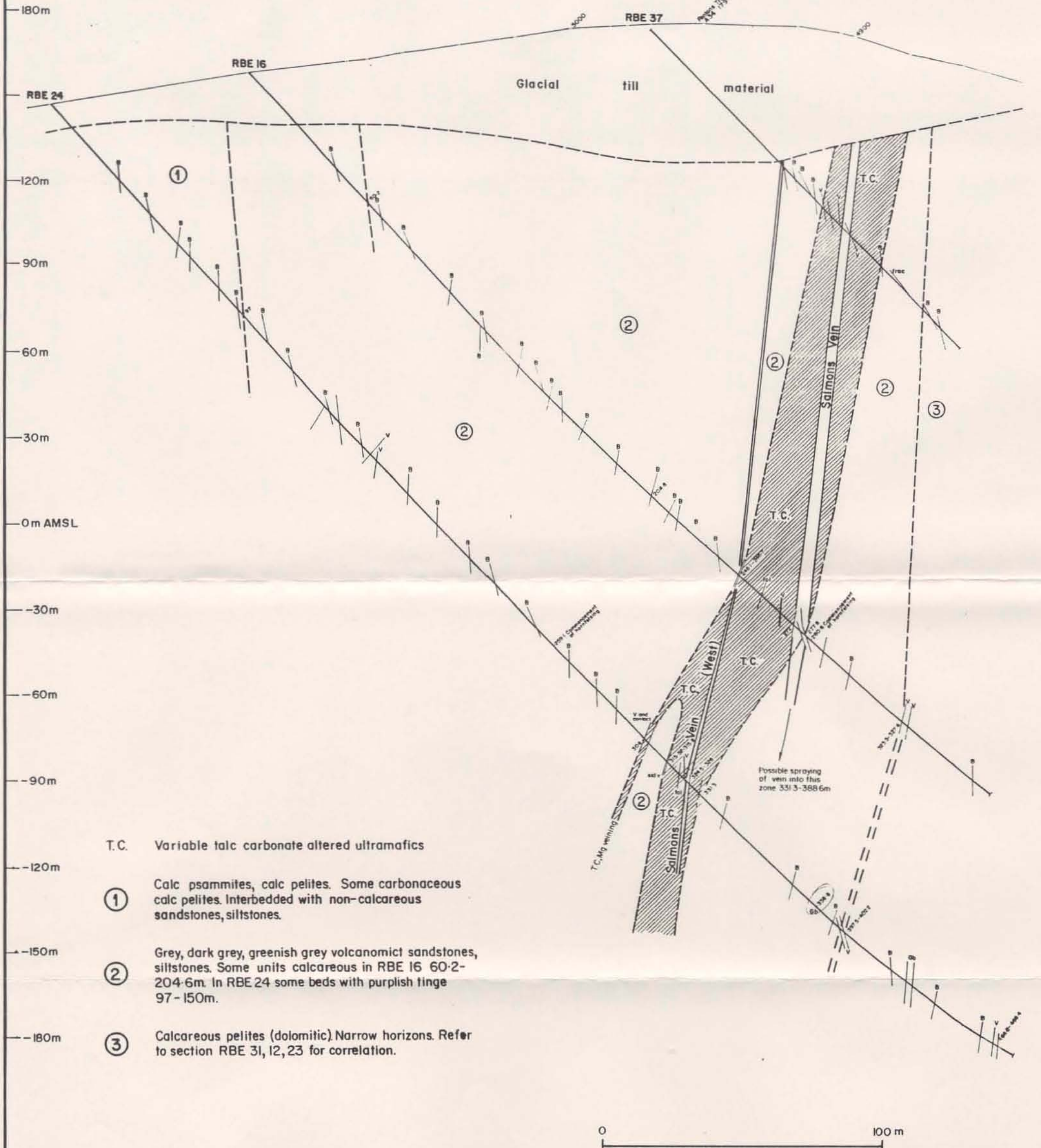
NORTH WEST TASMANIA

SCHEMATIC SECTION THROUGH RENISON MINE AREA

REVISIONS			
Init.	Date	Init.	Date

Compiled : JGP
Drawn : after Morland, 1986
Traced : RJE
Checked :

Location Code :
Scale : As shown
Date : February, 1989
Plate No. : FIG. 8 - 10

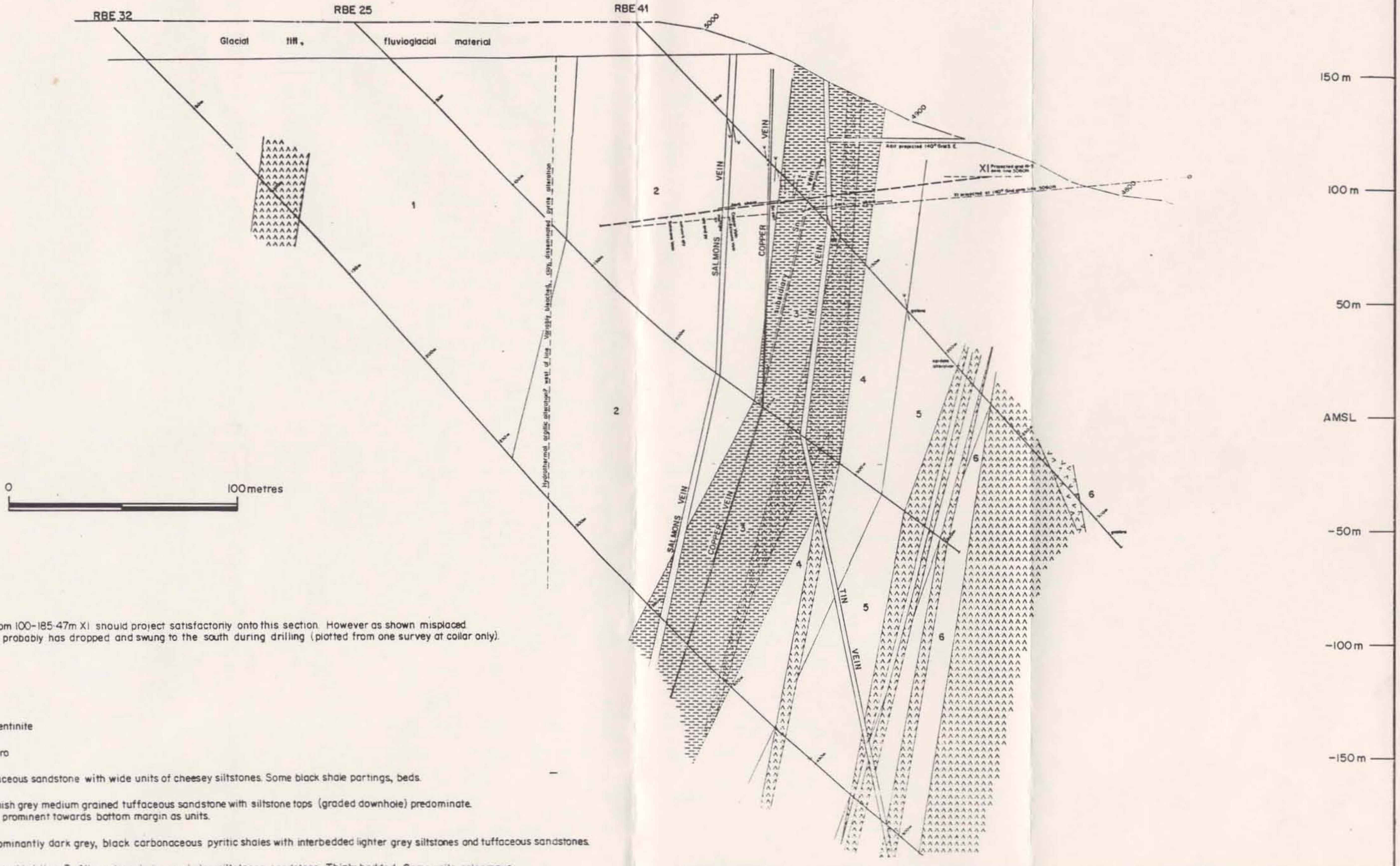


T.C.	Variable talc carbonate altered ultramafics
①	Calc psammites, calc pelites. Some carbonaceous calc pelites. Interbedded with non-calcareous sandstones, siltstones.
②	Grey, dark grey, greenish grey volcanomict sandstones, siltstones. Some units calcareous in RBE 16 60·2-204·6m. In RBE 24 some beds with purplish tinge 97-150m.
③	Calcareous pelites (dolomitic). Narrow horizons. Refer to section RBE 31, 12, 23 for correlation.

Aberfoyle Resources Limited

EXPLORATION DIVISION

REVISIONS					
Init.	Date	Init.	Date	NORTH WEST TASMANIA SALMONS VEIN – RENISON EAST CROSS SECTION ~~GAR GRID~~ - DDH's RBE 24, 16, 37 INTERPRETED GEOLOGY	Compiled : JGP Drawn : after Comstaff, 1984 Traced : RJE Checked :
Location Code :				Scale : As shown / Date : February, 1989	Plate No. : FIG.



NB - From 100-185·47m XI should project satisfactorily onto this section. However as shown misplaced. XI probably has dropped and swung to the south during drilling (plotted from one survey at collar only).

- V V Serpentinite
- ^^^ Gabbro
- 1 Tuffaceous sandstone with wide units of cheesey siltstones. Some black shale partings, beds.
- 2 Greenish grey medium grained tuffaceous sandstone with siltstone tops (graded downhole) predominate. More prominent towards bottom margin as units.
- 3 Predominantly dark grey, black carbonaceous pyritic shales with interbedded lighter grey siltstones and tuffaceous sandstones.
- 4 Finer bedded than 3. Alternating dark grey shales, siltstones, sandstone. Thinly bedded. Some units calcareous from midway through interval.
- 5 Alternating beds of grey tuffaceous sandstones and calc pelites. Cyclic in part.
- 6 Calc pelites, black shales and tuffaceous sandstones.

Aberfoyle Resources Limited

EXPLORATION DIVISION

REVISIONS			
Init.	Date	Init.	Date

NORTH WEST TASMANIA

PIEMAN TIN VEIN – EAST RENISON

~~GAR GRID~~ – DDH's RBE 32, 25, 41, XI

CROSS SECTION

INTERPRETED GEOLOGY

Compiled : JGP

Drawn : after Comstaff, 1983

Traced : RJE

Checked :

Location Code :

Scale : As shown

Date : February, 1989

Plate No : FIG.

9. ZEEHAN AREA

The prospectivity of the two significant tin properties in the Zeehan area is at least partly due to their proximity to Aberfoyle's Queen Hill deposit. The Oonah ML is almost surrounded by the Queen Hill Consolidated Lease and lies only 400m NW of the Queen Hill orebody. The Stonehenge property lies 2 km SSW of the Severne orebody, just over the southern boundary of the Consolidated Lease. See Figure 9-1.

The author knows little about the Queen Hill system in detail, and is therefore not capable of fully evaluating the significance of Oonah and Stonehenge in the local context. Both properties are potentially-worthwhile additions to the Company's ground holding at Queen Hill. Oonah, in particular, appears to be a tin prospect of real significance.

9.1 OONAH

The old Oonah Pb-Ag-Sn mine lies 1 km west of Zeehan. It is held by CRA Exploration (76%) and Paringa (24%) under ML 35m/72 of 32ha. CRA have for several years been trying to divest themselves of the property.

Between 1888-1925 the Oonah Mine produced 2.05 million oz silver and 12,800t lead from approximately 35,000t of very high grade Pb-Ag and Cu-Sn-Ag ore. Oonah thus ranks in the top four largest of the old Zeehan mines. The amount of tin produced by the mine is not known, but is here estimated at a minimum of 500t Sn from 14,900t of picked Stannite Lode ore grading 5-9% Sn.

Placer and Minops drilled 17 holes on the property between 1963-71. Minops estimated 'total reserves' in the Stannite Lode to a depth of 220m as 674,000t @ 1.1% Sn, 1.25% Cu and 115 g/t Ag. No further work was done until CRA commenced a JV with Minops in 1979. CRA drilled 12 holes totalling 2370m, although only 5 holes were targetted at the Stannite Lode. CRA were active until late 1981, but there has been no work done on the property since that time.

The geology of the Oonah area is the same as at Queen Hill: an Upper Proterozoic to Lower Cambrian sequence of grey shale, quartzite, black shale and vesicular spilitic mafic volcanics. CRA (Roberts in McKay 1980) consider these rocks correlates of the Success Creek Group and distinguish them, on the basis of their (relatively) lesser structural deformation and the presence of the mafic volcanics, from the Oonah Formation quartzites and grey slates which outcrop immediately west of the ML. See Figure 9-2.

Within the Oonah ML the local geology is extremely complex, as is the pattern of mineralisation which tends to be concentrated in black shale lenses marginal to the mafic volcanics, with some in the peripheral parts of the volcanics themselves. The area is highly faulted, including a major NW trending structure known as The Slide, which cuts through the centre of the mineralised zone.

The old mine was developed south of The Slide on two parallel N-striking and 50°E-dipping, conformable mineralised zones about 75m apart: the Galena Lode (Pb-Zn-Ag) and the Stannite Lode (Sn-Cu-Ag). The Galena Lode was reportedly mined out, and all modern exploration has been directed at the tin potential, particularly of the Stannite Lode in the unworked area north of The Slide. South of The Slide this lode has been worked to a depth of 140m.

The Stannite Lode is an irregular, discontinuous, conformable mineralised zone 4-10m wide, averaging 0.5-1% Sn in the better-mineralised areas. It occurs in a lens of brecciated pyritic black shale and lesser quartzite, along the western margin of a large mass of mafic volcanics, generally at a distance of 30-90m from the volcanics. The author is aware this setting is very similar to that of the Queen Hill orebody. See Figures 9-4, 9-5.

The lode comprises semi-massive bands, irregular masses and veins of pyrite-stannite-chalcopyrite, in a gangue of quartz-siderite with minor fluorite. The mineralisation also contains lesser pyrrhotite-cassiterite-galena-tetrahedrite-arsenopyrite-jamesonite-bismuthinite (Blissett 1962). The actual proportion of cassiterite present is not known as <u>no acid-soluble tin analyses have ever been done on the property</u>.

There are similar subsidiary mineralised zones in the adjacent sediments and in places the mineralisation averages 0.2 - 0.3% Sn over widths of 30m. Drill hole intersections on the Stannite Lode are given in Table 9A, and hole locations are shown in Figures 9-2 and 9-3. Tin mineralisation is widespread on the property (even occurring in the volcanics as veins and sulphidic vesicle fillings), and shows a tendency to improve with depth, but the best mineralisation is in and around the Stannite Lode.

The most significant tin mineralisation occurs in a 150-200m long section of the Stannite Lode, between The Slide and about AMG 5 362 600mN. CRA (Odell 1982), estimated there was 1.3mmt @ 0.57% Sn in this zone to a down-dip depth of 300m (250m below surface - the limit of drilling). However, their calculated average thickness of 10m includes some low-grade material (0.2-0.3% Sn), and it would seem probable there is a body of less tonnage but significantly higher grade within this zone. The zone is open at depth and possibly to the north.

Just beyond the SW corner of the ML, (actually just within Aberfoyle's Lease), Bradshaw's Lode comprises overlapping lenses of massive pyrite up to 9m thick, hosted by black shales adjacent to a mafic volcanic lens. The pyrite lenses strike NE and dip SE - into the Aberfoyle and CRA ground. The lenses extend to a depth of at least 40m, and contain minor chalcopyrite and <u>cassiterite</u>, with a reported average grade of 0.3 - 0.4% Sn (Blissett 1962). Some 23,800t of this pyrite was mined between 1905-13 for the production of sulphuric acid. See Figure 9-2.

TABLE 9A

STANNITE LODE INTERSECTIONS - OONAH

Hole No.	Intersection Width (m)	True Width (m)	Sn (%)	Cu (%)	Ag (g/t)
CRA (1980-81):					
OC 1/2	4.45	4.2	0.59	0.61	85
OC 3	4.8	4.8	0.42	0.05	4
OC 4	5.9	5.8	1.75	2.4	193
OC 12	4.2	4.1	0.62	0.2	85
Minops (1970's):					
M1	9.5	8.0	1.12	1.31	114 *
M3	5.5	?	0.4		
M4	5.8	4.8	0.42	1.23	126
M8	10.7	10.0	0.37	0.13	30
M10	5.6	5.55	0.38	0.24	55
Placer (1960's):					
P3	12.05	12.0	0.81	0.63	64 **
P4	7.0	7.0	0.08	0.09	**
P5	12.5	10.0	0.72	0.56	6 **
INTERSECTIONS OUTSIDE THE STANNITE LODE					
OC 10	2.0	1.9	0.94	0.1	107
OC 12	6.0	5.8	0.58	<0.01	2
M 8	3.6	3.4	0.63	0.15	27 ** Galena Lode?
P 2	3.35	2.0	0.65		

* Minops assays
** Placer assays

Note: All drill holes suffered varying amounts of core loss in the mineralised zone.

CRA drilled 3 holes 100-170m along-strike from Bradshaws open cut, but encountered only black shales with extremely low tin values. CRA were inclined to link the Bradshaw's black shale with that hosting the Stannite Lode, but the old workings would suggest the latter is separate and lies further east.

Potential: Oonah is a significant tin prospect with obvious potential to produce economic-grade tin ore. Indications at present are that the resource involved is probably a little less than 1mmt at a grade around 0.7 - 1% Sn. It is not possible to be more specific with the available data. However, the property is not well explored and the tin zone is open at depth and perhaps to the north. It has an excellent capability for hosting a much larger tin resource than that stated above.

A crucial factor will be the mineralogy of the tin mineralisation, of which few details are known although stannite appears to be a major component. It would be a mistake to assume all the tin mineralisation is stannite as zoning changes to cassiterite can be expected, particularly at depth.

The CRA work was very shoddy. The data is inaccurate, inconsistent and badly presented. They never attempted to determine how much cassiterite is present in the mineralisation, and they did no geophysics at all. They also made no attempts to understand the geological controls or zoning of the mineralisation. In fact, with the exception of Robert's excellent mapping in 1980, CRA's geological input on the property was minimal.

The Stannite Lode mineralisation is open at depth below 250m and possibly to the north, but the northern end of the zone is a highly complex area poorly resolved by the drilling there to date. However, an intersection of 6m @ 0.58% Sn in the bottom of hole OC12 in this area would appear to indicate a new zone of mineralisation beneath and west or north-west of the main Stannite Lode. The up-dip projection of this zone places it in the undrilled NW corner of the ML. It should be noted that hole OC12 was stopped while still in this deeper mineralised zone. Although the hole was recommended for deepening, this was not done.

For Aberfoyle, Oonah could potentially have an impact on the economics of the Queen Hill deposit. Given the geological similarities between Queen Hill and Oonah, application of Aberfoyle's knowledge of the Queen Hill system could really pay dividends at Oonah. The property should be acquired by Aberfoyle as soon as possible.

9.2 STONEHENGE

This tin prospect is unusual in that very little tin has been found on it to date. It is a conceptual tin target in which several important indicators suggest significant tin mineralisation may be present at depth. It mainly owes its prospectivity to the fact that it lies on the SW margin of the Queen Hill system.

The Stonehenge area lies 2.5 km SW of Zeehan and 4.5 km east of the Heemskirk Granite. It is currently held by the Duke of Avram under EL 28/88 of 32 km^2. The area contains numerous old Ag-Pb-Zn fissure-lode workings which were worked in the period 1890-1920, the principal producers being the Spray-Nubeena lodes, Grubbs and the Tasmanian. The Spray mine was the deepest at 136m. Zoning is apparent in these lodes, with a decrease in Pb-Zn, increase in As-Sb, and change from siderite to pyrite gangue, with depth.

After Aberfoyle outlined the Queen Hill orebodies in 1980, Renison targetted the Stonehenge area for similar stanniferous sulphide-rich carbonate-replacement mineralisation. Mapping showed the area comprised highly folded, faulted and fractured Oonah Formation sediments (sandstone, siltstone, graphitic shale, spilite), including considerable thicknesses of dolomite and dolomitic siltstone.

A DIGHEM/airmag survey in 1982 delineated a large teardrop-shaped magnetic anomaly within the area of old Ag-Pb workings, and close to the Precambrian/Cambrian boundary (Oonah Formation : Dundas Group). The anomaly was considered by Renison to be similar to the magnetic anomaly over the Queen Hill system immediately to the north (see Figures 9-6, 9-7).

Subsequent ground surveys, including bedrock geochemistry, ground magnetics, VLF EM, EM-37 and Gradient Array IP, showed that the magnetic anomaly had an ill-defined halo of bedrock Pb-Zn anomalism and a coincident low-order Cu anomaly. Sn values on surface were low, but values of 200-600 ppm Sn in mineralised dump material from the old workings suggested Sn values may increase with depth. Ore samples from the lowest level in the Spray mine (100m ASL) gave values to 0.12% Sn (apparently stannite).

Computer modelling of the magnetic anomaly suggested the source was a body about 1 km wide with its top approximately 400m below surface (Komyshan et al 1984). Renison considered this could be indicative of a large pyrrhotite body or a hornfels zone around a granite cupola (the hornfels zone around the Heemskirk Granite extends on surface to within 1 km west of the Stonehenge area).

Hole TH12 (401.5m) was drilled test the magnetic anomaly in 1983, with disappointing results. The hole encountered basemetal - mineralised faults and unmineralised dolomite units. Tin values were all <100 ppm. There was an increase downhole of bleaching, sericitisation and silicification, as well as an increase in Sb and As values (up to 3m @ 0.73% Sb and 0.25% As). There was no magnetic material in the hole to explain the target anomaly.

Although Renison drilled another 5 holes (totalling 1959m) on the property, none of them were targetted at the magnetic anomaly at it remains untested. All these holes were drilled at subsidiary geophysical (EM and/or IP)-geochemical-geological targets to the north of the magnetic anomaly (see Figure 9-5). With the exception of TH16, none of the holes encountered anything of significance, although TH13 did intersect 61m of altered and mineralised dolomite containing 1.5% Pb+Zn and 29 g/t Ag, but <100 ppm Sn.

Hole TH16 was drilled to try and intersect the TH13 altered dolomite unit where it contacted the mineralised Spray lode system. In fact, the hole intersected the Spray lode at -20m ASL, 60m above the dolomite. The lode assayed 3.2m @ 0.07% Sn, 0.5% As, 0.12% Cu, but <200 ppm Pb or Zn, and negligible Ag. The result is further evidence for vertical zoning in the lode, with Pb-Zn-Ag decreasing and Sn-As-Cu increasing, with depth. The hole collapsed before a downhole EM survey could be run.

Renison were discouraged by the poor drilling results and by the indications that any tin potential lay at depths in excess of 300m below surface, and was "probably too deep to explore except by a very expensive programme of stratigraphic drilling" (Roberts 1986). Roberts cited the "current turmoil in world tin markets" as one reason for not undertaking such work, and it is abundantly clear that the falling tin price had more bearing than any technical considerations on the Renison decision to stop work in 1986.

Potential: The features that Renison listed in the early stages of their exploration as highlighting the potential for tin mineralisation at Stonehenge, were still equally as valid at the end of their programme. These features are :

1. Proximity to the Queen Hill system.

2. The presence of a major aeromagnetic anomaly comparable to, although significantly larger than, the Queen Hill anomaly.

3. A thick sequence of dolomitic sediments in the Oonah Formation, which are potential hosts for replacement Sn mineralisation.

4. Presence of numerous large basemetal-Ag veins, with indications that these are zoned and become more stanniferous with depth. This mineralisation could be the outward expression of a granite-related hydrothermal system at depth.

5. Substantial local structural deformation, principally faulting and fracturing, which could provide the plumbing for mineralised fluids.

There is no getting away from the fact that the tin potential at Stonehenge is deep and difficult to explore. However, it could be substantial also - perhaps another Queen Hill deposit. The magnetic anomaly that first attracted Renison to the area because of its similarity to that at Queen Hill, is still untested.

The most obvious exploration targets on the property at this stage are the magnetic anomaly and the area where the altered dolomite units intersect the large mineralised Spray-Nubeena lode system at depth.

Immediately to the SW of the Stonehenge, there is another large aeromagnetic anomaly (see Figures 9-6, 9-7). Renison didn't even bother to detail this anomaly with ground magnetics, although their mapping showed it also occurs over large dolomite units in the Oonah Formation. A panned concentrate sample in the creek draining the anomaly assayed 360 ppm Sn - the only sign of tin in this poorly - exposed area. This anomaly also lies within EL 28/88.

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Stonehenge

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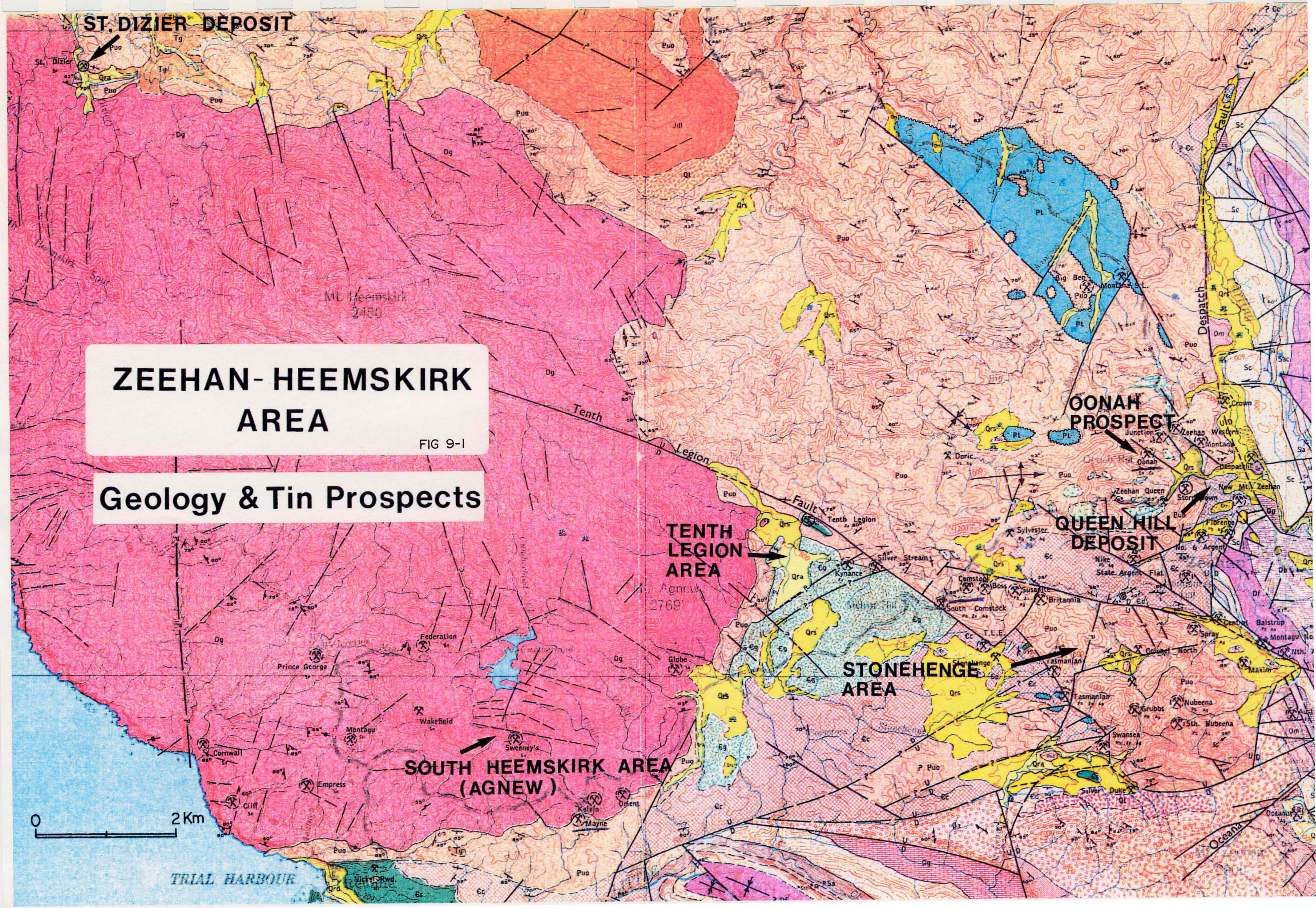
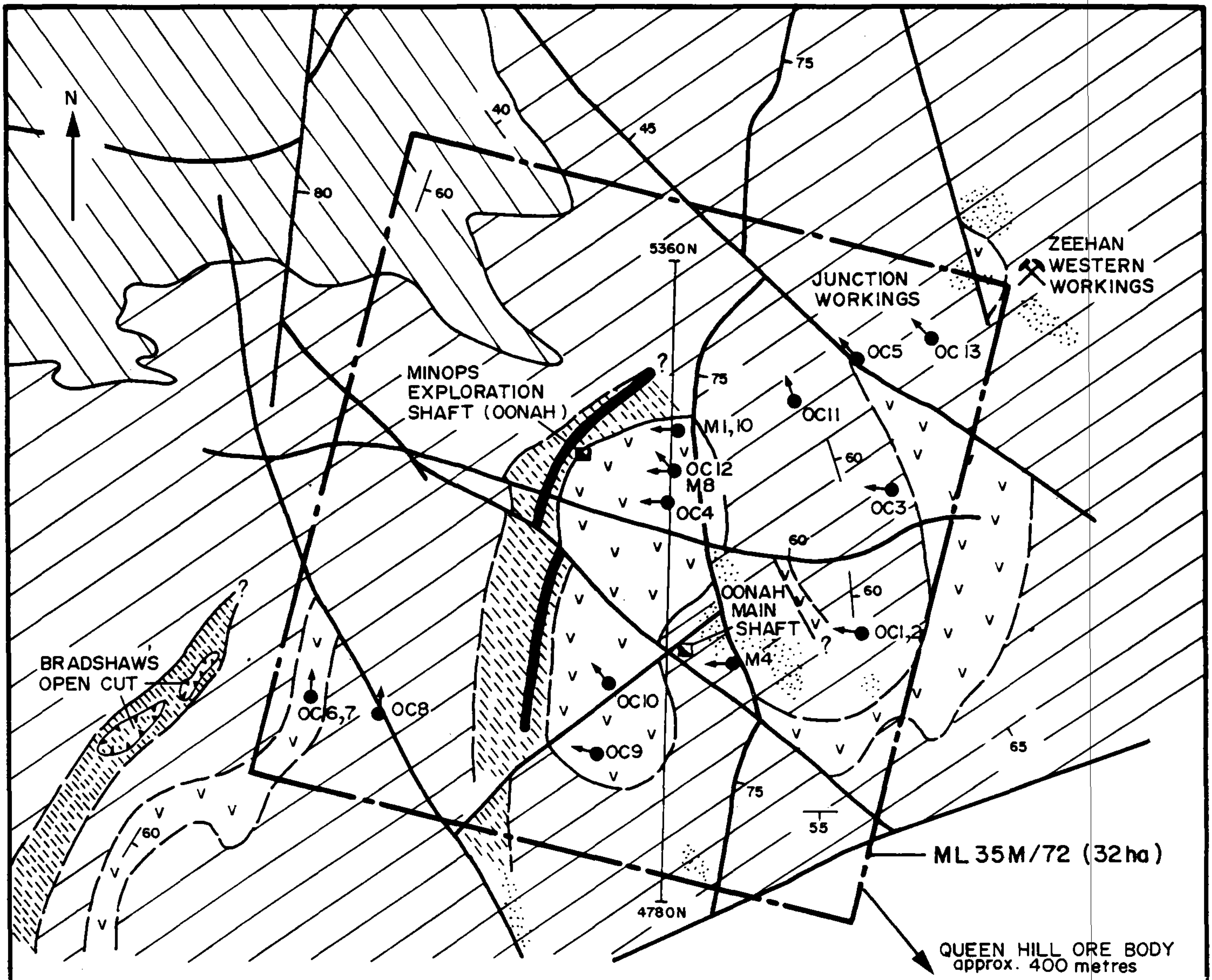
* Kindly made available by T. Dickson, CRAE Manager - Tasmania.



ZEEHAN-HEEMSKIRK AREA
FIG 9-1
Geology & Tin Prospects
ST. DIZIER DEPOSIT
OONAH PROSPECT
QUEEN HILL DEPOSIT
TENTH LEGION AREA
STONEHENGE AREA
SOUTH HEEMSKIRK AREA (AGNEW)
Tenth Legion Fault
Despatch Fault
TRIAL HARBOUR
0
2 Km



CAMBRIAN TO PROTEROZOIC ROCKS

SILTSTONES & SHALES
Grey shales interbedded with siltstones similar to Oonah Quartzite (see below)

BLACK "SHALES
Host to "Stannite Lode" at Oonah and host to Sn mineralisation at Queen Hill

VESICULAR VOLCANICS
Acid to intermediate ? lavas and tuffs, commonly pumiceous

STRUCTURAL DISCONTINUITY ?

PROTEROZOIC SEDIMENTS
Oonah Quartzite and Slate

Roads
Tracks
Creeks
Mine dumps, fill
Base Line
Lease Boundary
Geological contact: approx; indefinite, doubtfull } *Mostly from air-photo interp.*
Strike and dip of beds
Structural trend
Fault with dip (from air-photo interpretation)

Surface trace of Stannite Lode

Drill holes :-
OC – CRA, 1980-82
M – MINOPS, 1970's

Scale 1:6000 (Approx.)

0 100 200 300 Metres

Aberfoyle Resources Limited

EXPLORATION DIVISION

REVISIONS			
Init.	Date	Init.	Date

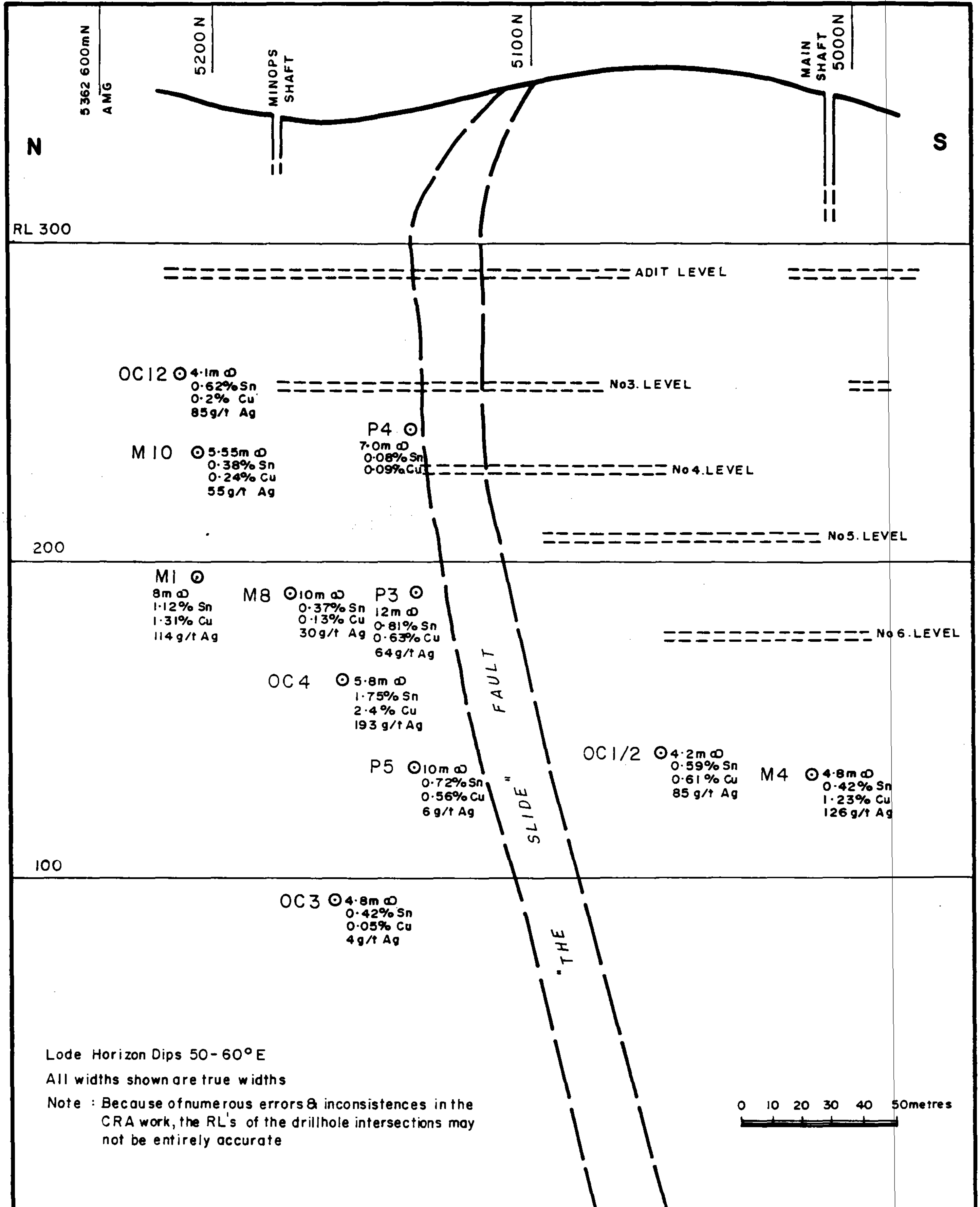
WESTERN TASMANIA

OONAH PROSPECT
GEOLOGY

Compiled : JGP
Drawn : after CRA, 1980
Traced : RJE
Checked :

Location Code :
Scale : As shown
Date : March, 1989
Plate No. : FIG 9-2

1511



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NORTH WEST TASMANIA

OONAH PROSPECT

LONGITUDINAL PROJECTION, STANNITE LODE

REVISIONS			
Init.	Date	Init.	Date

Location Code :

Scale : As shown

Date : March, 1989

Compiled : JGP

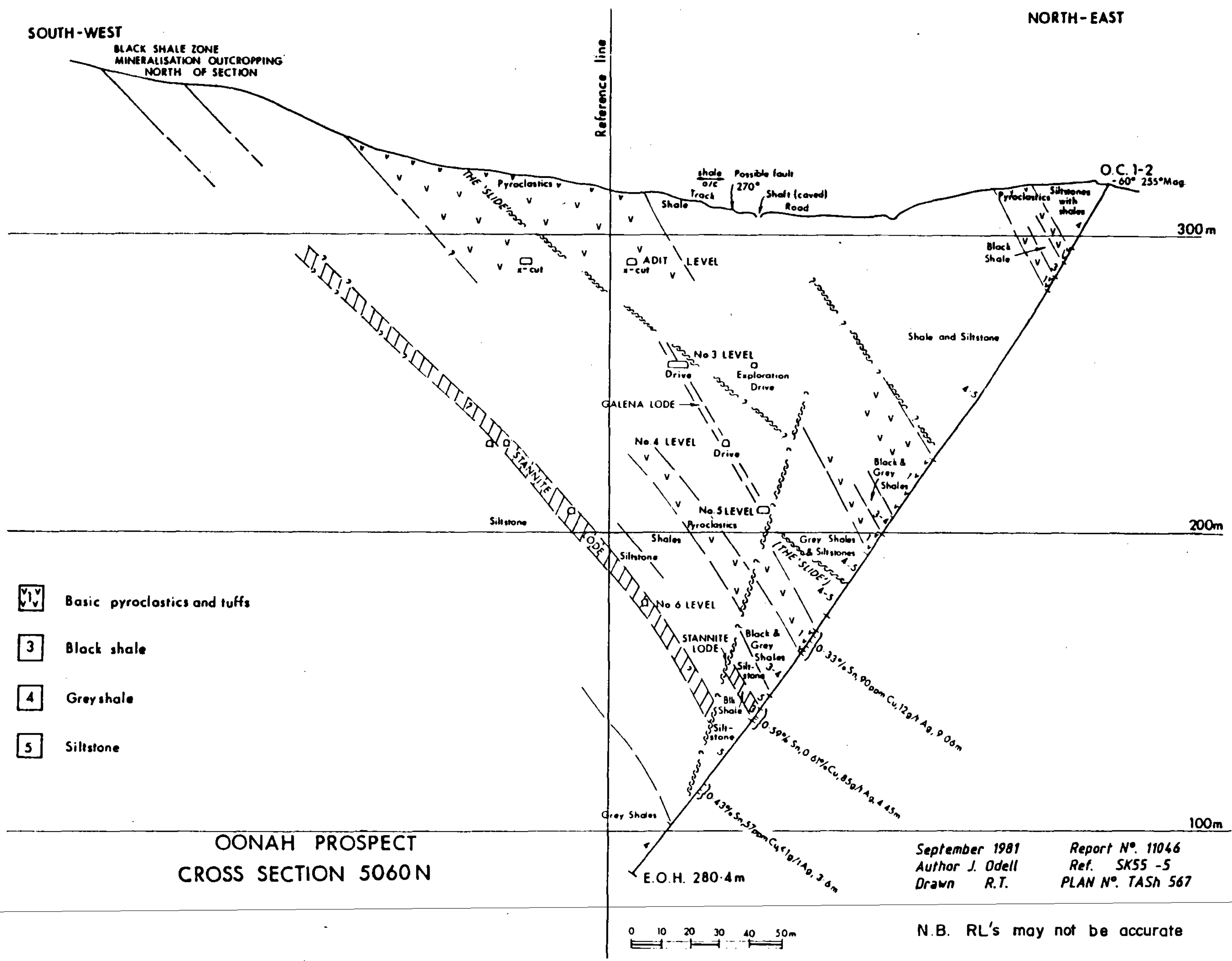
Drawn : After CRA 1980

Traced : JLR

Checked :

Plate No. : FIG. 9-3

1511



OONAH PROSPECT
CROSS SECTION 5060N

September 1981
Author J. Odell
Drawn R.T.

Report N°. 11046
Ref. SK55 -5
PLAN N°. TASh 567

N.B. RL's may not be accurate

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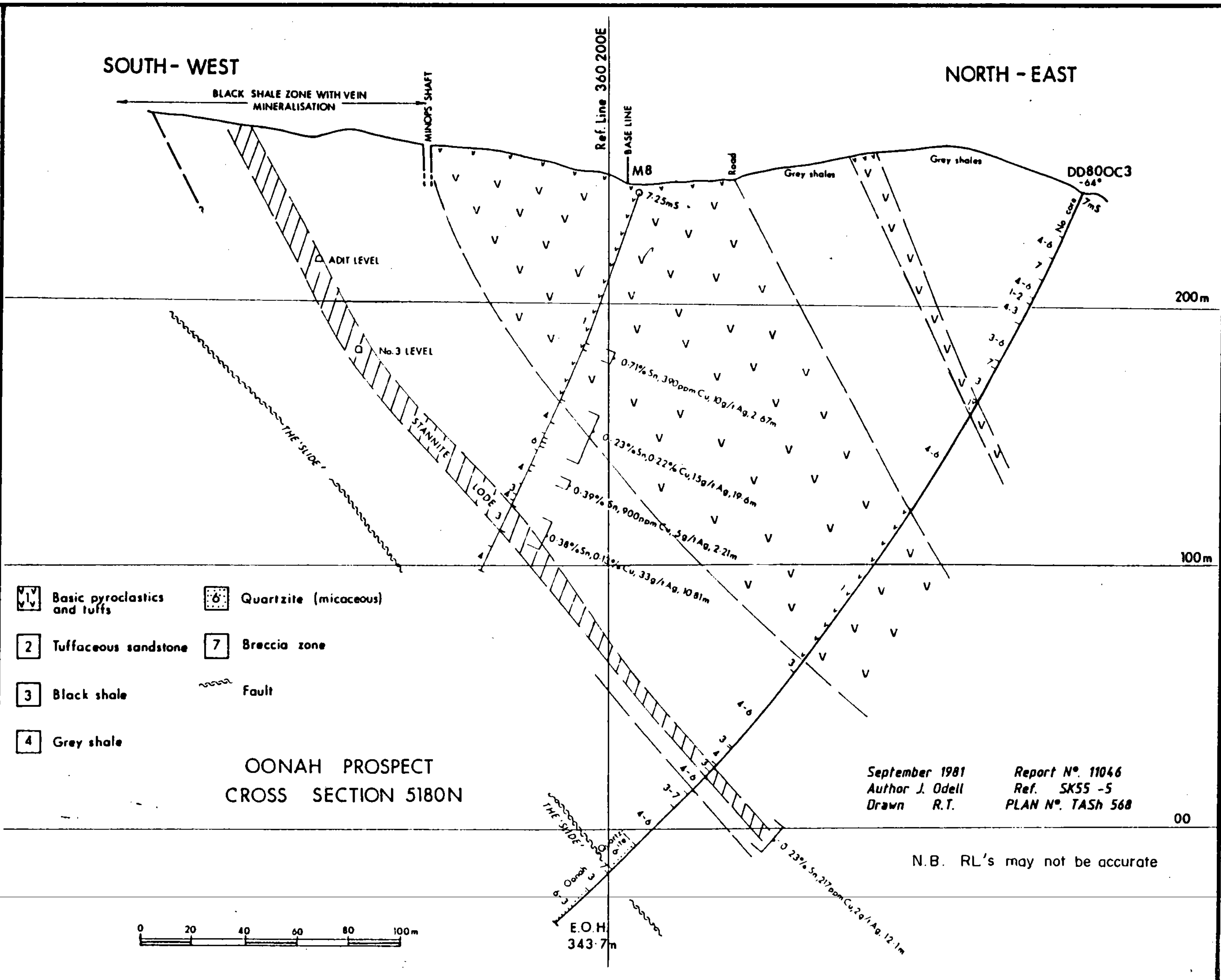
WESTERN TASMANIA
OONAH PROSPECT
CROSS SECTION 5060 N

REVISIONS			
Init.	Date	Init.	Date

Location Code :
Scale : As shown
Date : March, 1989
Compiled : JGP
Drawn : after CRA, 1982
Traced : RJE
Checked :
Plate No. : FIG. 9-4



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WESTERN TASMANIA
OONAH PROSPECT
CROSS SECTION 5180N

REVISIONS

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Location Code :

Scale : As shown

Date : March, 1989

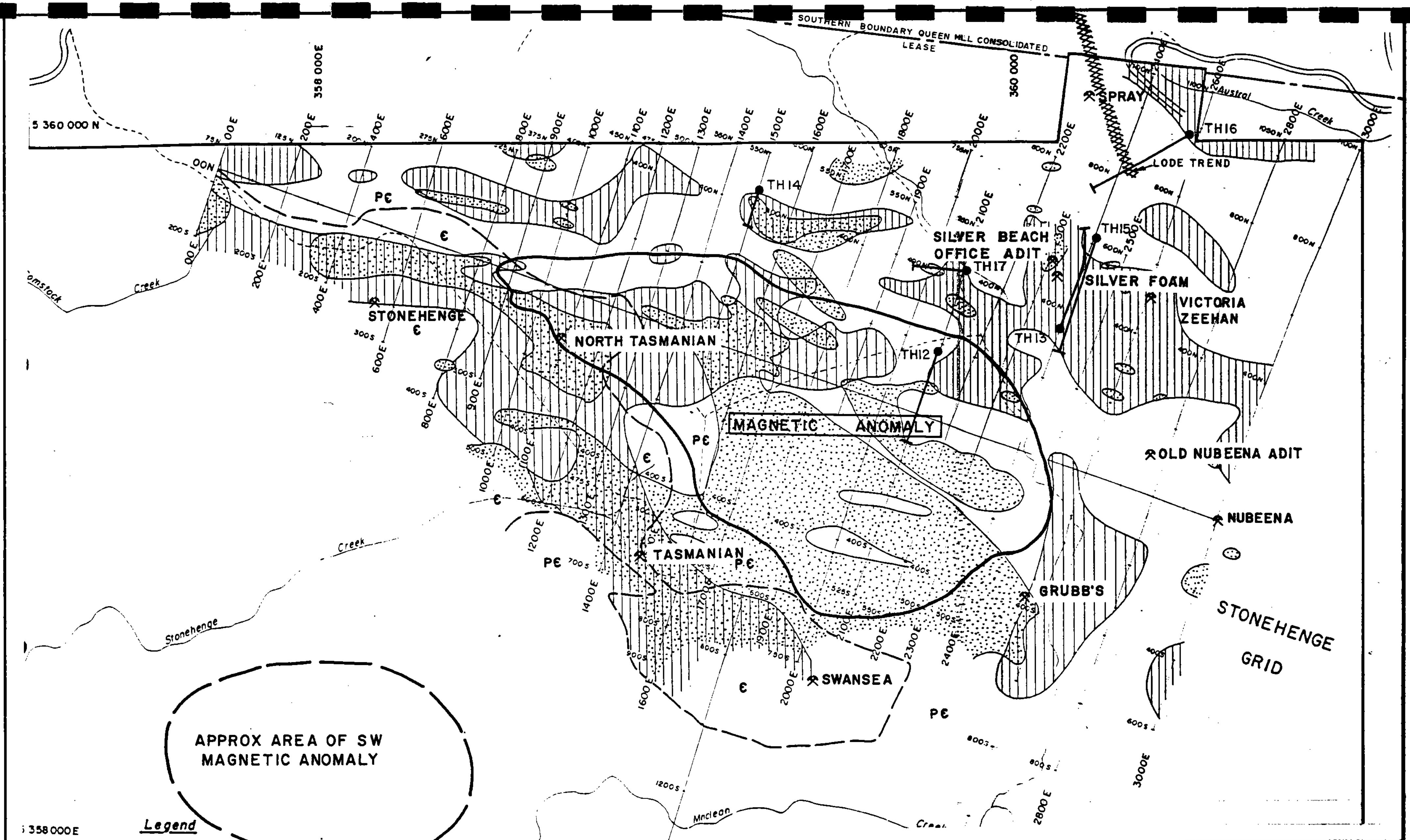
Compiled : JGP

Drawn : after CRA, 1982

Traced : RJE

Checked :

Plate No. : FIG 9-5



Legend

- Precambrian / Cambrian Boundary Oonah Formation / Dundas Group Sediments
- 62925 Magnetic Contour
- Areas Anomalous in Pb & Zn > 100 p.p.m.
- Areas Anomalous in Cu > 50 p.p.m.
- Gold Fields Drillholes (1983-85)
- Old Pb/Ag Workings

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NORTH WEST TASMANIA

STONEHENGE

BASE METAL ZONATION & ANOMALY LOCATION

REVISIONS			
Init.	Date	Init.	Date

Location Code :

Scale : 1: 10000

Date : March, 1989

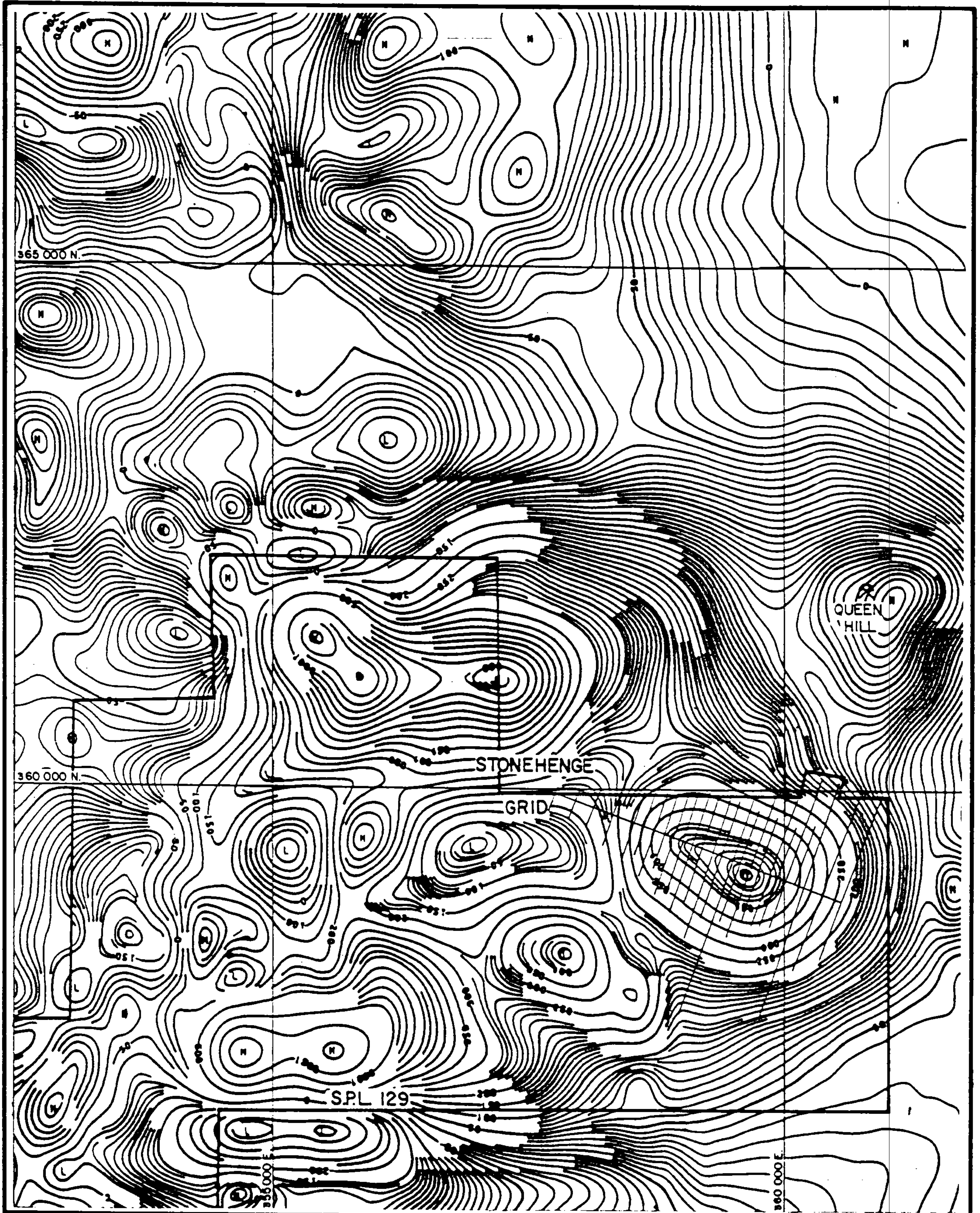
Compiled : JGP

Drawn : from Goldfields 1983

Traced : JLR

Checked :

Plate No. : FIG. 9-6



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EXPLORATION DIVISION

REVISIONS			
Init.	Date	Init.	Date

Location Code :

NORTH WEST TASMANIA

STONEHENGE PROSPECT

AEROMAGNETIC CONTOURS

Scale : As shown

Date : March, 1989

Compiled : JGP

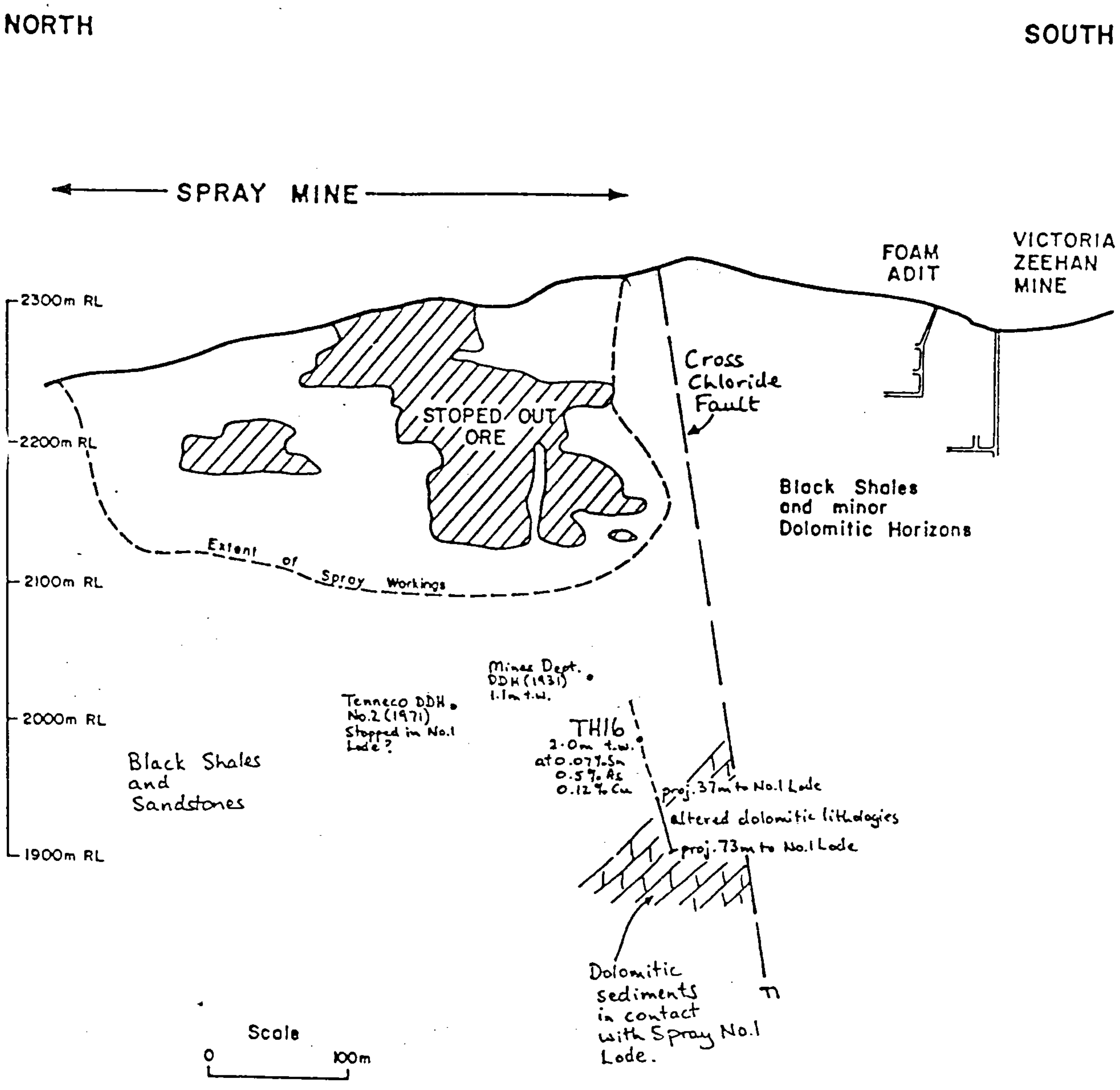
Drawn : After Mitre Geophysics

Traced : JLR

Checked :

Plate No. : FIG. 9-7

1511



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REVISIONS					
Init.	Date	Init.	Date	NORTH WEST TASMANIA **STONEHENGE AREA** **SPRAY MINE WORKINGS** **LONGITUDINAL PROJECTION No.1 LODE**	Compiled : JGP Drawn : After Goldfields 1986 Traced : JLR Checked :
Location Code :				Scale : As shown / Date : March, 1989	Plate No. : FIG.

10. TIN AROUND THE HEEMSKIRK GRANITE

There are several skarn occurrences around the Upper Devonian Heemskirk Granite. The most significant are the St. Dizier deposit on the granite's northern contact, and the Tenth Legion prospect on the eastern contact. These large magnetite-dominated skarns occur in strongly-metasomatised Upper Proterozoic sediments containing extensive carbonate horizons. The alteration occurs intermittently over a 15-20 km distance between Tenth Legion in the SE and the Granville prospects in the NW (see Section 12.8).

Additionally, there is a concentration of small but important tin-mineralised bodies within the Heemskirk Granite close to its southern margin, at South Heemskirk.

The location of all tin prospects is shown in Figure 9-1.

10.1 ST. DIZIER

This large magnetite-dominated contact skarn body lies on the northern contact of the Heemskirk Granite, 17 km WNW of Zeehan. It reputedly contains 5mmt @ 0.5% Sn. The mineralisation is known to be metallurgically complex.

Paringa Mining & Exploration hold the property under a Consolidated Mineral Lease of 33ha. Although Paringa agreed to release the latest data on the property, (that pertaining to the crucial work done by the Paringa-Renison JV in the early 1980's), the data had not yet been made available at the time this report was compiled.

It is hoped the property details can be appended to this report in due course.

10.2 TENTH LEGION

Tenth Legion is a huge magnetite-dominated skarn system on the eastern margin of the Heemskirk Granite. The property lies 7 km west of Zeehan and is held by Savage Resources under a series of contiguous Mineral Leases totalling 146 ha. Savage also hold the surrounding ground under EL 95/87 of 9 sq. km.

Tenth Legion was discovered in 1885 and was tested as a possible iron ore deposit between 1920-36, when 17 adits were put in. IMI (Savage Resource's parent), in 1970 drilled 14 shallow holes (average depth 20m) into the magnetite lenses to test for iron ore, delineating a resource of 2 mmt grading 60% Fe, to 16m depth. IMI pegged ML's over the property in 1975.

From 1980-82 CRA, in JV with IMI, evaluated the tin potential of the skarns. The author was briefly involved in this work, which included detailed aeromagnetics, soil and rock chip geochemistry, ground magnetics, IP, Crone pulse EM and the drilling of 14 diamond drill holes totalling over 2000m. On the basis of two drill intersections, CRA estimated a possible resource of 0.9 mmt grading 0.4-0.5% Sn. The magnetite resource was put at 6 mmt. There has been no work done on the property since CRA quit the JV about 1983.

The results of CRA's work are not publicly available as the ML's are still current. However, Savage Resources have kindly supplied a very brief recent property report by their geologist, H. Shannon, and a copy of information released in their 1987 prospectus. The non-detailed appraisal of the property presented here draws heavily on this rather sketchy data.

The complex geology of the area is dominated by an altered sequence of carbonates (limestones and dolomites), siltstones and shales, apparently correlatable with the Eocambrian Success Creek Group (Shannon 1988). In the northern part of the property the sediments strike WNW and dip northerly, while in the south they generally strike NE. The sequence terminates against a Cambrian gabbro intrusive to the SE, and is cut off to the north by the major ESE-trending Tenth Legion Fault.

The Upper Devonian Heemskirk Granite outcrops 200-300m west of the ML's and is known from Renison drilling to be present at shallow depths on the western property boundary. The indications are that the granite contact dips E and underlies the whole prospect area at no great depth.

The sedimentary sequence has been intensely metasomatised to serpentinite, talc-carbonate, calc-silicate, sericitic chert and hornfels, containing numerous conformable lenses of semi-massive to massive magnetite up to 700m long and 60m wide. The biggest lense occurs adjacent and parallel to the Tenth Legion Fault at the northern end of the property (see Figure 10-1).

The magnetite is generally hosted within serpentinite and talc-carbonate, and is associated with widespread and significant concentrations of pyrrhotite, pyrite and ubiquitous minor sphalerite. CRA's hole TLC3 intersected zones up to 14m width of 30% banded and disseminated pyrrhotite, and 10% magnetite. Elsewhere on the property, there are lenses of semi-massive pyrite-pyrrhotite up to 6m thick which are not directly associated with magnetite lenses.

The tin mineralisation encountered to date has been in association with the magnetite skarns, but it must be noted that these have also been the only targets drilled. Tin values in most of the skarn lenses and sulphide occurrences are at geochemical levels only (<1000 ppm).

Significant tin values are only known in a structure dipping 60^{o}N associated with the northern-most magnetite lense, and the tin is apparently present either as a sulphide or silicate phase (Robertson Research 1986). (Note, the exact nature of the mineralised ´structure´ is not known to the author). The best drill intersects here were from two holes 60m apart : 1m @ 1.27% Sn (hole TLC1), and 27m @ 0.22% Sn (hole TLC9). CRA´s ´possible resource´ estimate of 0.9 mmt @ 0.4-0.5% Sn is based on these two intersections. See Figure 10-1.

Potential: Tenth Legion is a huge metasomatic skarn system, characterised by intense alteration, magnetite-dominated skarns and widespread sulphides. There appear to be a significant proportion of carbonate units in the local stratigraphy. However, only weak tin mineralisation of complex mineralogy has been intersected to date. The CRA ´resource estimate´ can be disregarded - there is not enough information at this stage on which to base an estimate.

The skarn system is too large and complex to have been fully tested by the work done by CRA. They had little or no understanding of the complex zonation in such skarns nor did they attempt to gain this information in order to direct the drilling to better effect. Their concentration on the magnetite lenses may have been misplaced, as it is the more-sulphidic facies that could host cassiterite mineralisation.

It must be conceded however, that sulphidic sections of the skarn system have to date proved to contain very little tin. Shannon (1988) contends CRA missed testing at least two strong coincident IP/EM anomalies with moderate magnetic signatures, suggestive of concentrations of sulphides.

While it is the size of the skarn system and the intensity of the alteration which are the property´s main attributes, the tin potential and effectiveness of the testing to date, cannot be accurately judged without seeing the detailed data.

10.3 SOUTH HEEMSKIRK

This area is centred 10 km WSW of Zeehan and takes in a series of endogranitic tin bodies hosted by the Heemskirk Granite. The occurrences lie close to the granite´s southern margin and extend in a 5 km long arc from the Globe mine near the Tenth Legion skarns in the east, to the workings on the Federation Plateau in the west. The principal bodies lie in a 3 km long ENE-trending linear zone extending from Sweeneys Mine to the Globe (see Figure 9-1 and 10-2).

The area is rugged and lies immediately north of the Trial Harbour Road. It is currently held by Kingstream Resources within their EL 59/87. Much of the general information given below is taken from Roberts (1984).

Tin was discovered in the area in 1879. A number of small workings were opened up, producing approximately 300t Sn. The area was looked at briefly by several Companies, before Renison were attracted in 1976 by perceived similarities of the South Heemskirk mineralisation to the tourmaline-dominated "porphyry tin" systems of South America. However, their exploration work subsequently showed that the tourmaline-rich deposits, situated mainly on the Federation Plateau, are small and low grade.

Consequently, Renison shifted the focus of their search to the stanniferous polymetallic sulphide bodies near the SE margin of the granite, of which Sweeneys and the Globe were known examples. These were considered viable targets if they could collectively total at least 3mmt @ 0.5-0.6% Sn, with appreciable Ag and Zn credits, and provided their metallurgy allowed the production of both basemetal - silver and tin concentrates.

Before they quit the area in 1985, Renison drilled 30 diamond drill holes at several targets, and undertook extensive gridding, soil and bedrock geochemistry, and IP. Much of the work was helicopter-supported.

The tin mineralisation at South Heemskirk is hosted by the Upper Devonian Heemskirk Granite, a horizontally-layered intrusion that consists of two major phases : an older Red Granite phase that generally occupies the higher levels of the granitic mass, underlain and intruded by a younger White Granite phase. The tin mineralisation occurs in the Red Granite.

To the south and east the granite is in contact with Upper Proterozoic to Paleozoic sediments. Despite considerable exploration, the only mineralisation known in these rocks (in this area), is the tourmaline-cassiterite veins at the Kelvin and Maynes prospect. This was drilled by Renison (3 holes) with discouraging results, and later further tested by Aberfoyle.

Two main styles of mineralisation are present within the granite:

1. Tourmaline-quartz-topaz assemblages containing small patchy concentrations of cassiterite with minor pyrite and arsenopyrite. These occur in irregular, tabloid, flat-dipping 'lodes'; and steeply-dipping pipes and thin veins. They are generally enclosed by an extensive halo of sericitic or argillic alteration which also contains tin (and zinc) values.

   The workings in the Federation area are of this type, and most were drilled by Renison. This work showed that economic-grade material (i.e. +0.5% Sn), is very restricted and the overall grade is around 0.2% Sn. Even at this grade only modest tonnages are present, e.g. Colemans workings are estimated to have a maximum potential for 0.5 mmt @ 0.2% Sn (Roberts 1980).

2. Irregular mushroom-shaped pipes of sericitic alteration containing pyrite, specularite and a complex sulphide-rich stanniferous polymetallic assemblage. The latter includes cassiterite, stannite, sphalerite, chalcopyrite, antimony and bismuth sulphosalts, tetrahedrite and fluorite.

Traces of gold are also present (to 0.4 g/t Au). The pipes are surrounded by an argillic alteration zone containing numerous small mineralised veins, and are hosted by magnetically "noisy" Red Granite. See Figures 10-3, 10-4, 10-5.

These mushroom-shaped mineralised bodies occur within a ENE-trending, 3 km long linear zone close to the SE margin of the granite. There are indications that there is a second parallel zone 1 km to the south, but this zone has never been drilled so very little is known about it. See Figure 10-2.

The flatter top portions of the bodies are controlled by flat-lying fine-grained aplite dykes 1-5m thick, altered (fluorine-enriched), but not mineralised. These have apparently acted as localising structures and fluid channelways, and are thought to be late-stage magmatic products (Cartwright 1983). Within the pipes two phases of mineralisation are evident :

a) An initial Sn-rich sulphide-poor high-temperature phase, comprising very fine-grained cassiterite (20 um), with relatively minor pyrite-arsenopyrite-boulangerite-sphalerite. This phase forms the inner core of the flat-lying upper part of the bodies and the bulk of the mineralisation in the deeper steeply-dipping part of the pipes.

b) A later lower-temperature Sn-Ag-base metal sulphide-rich phase, comprising coarse-grained disseminated, semi-massive and massive pyrite-arsenopyrite-sphalerite-stannite-tetrahedrite-chalcopyrite-galena. This phase forms as an outer zone to the mineralisation, especially in the upper flat part of the bodies, but is not always developed.

Renison initially worked on the body at the old Sweeneys Mine, but in 1980-81 several coincident IP/soil geochemical anomalies were located, mainly between Sweeneys and the Globe Mine. The best of these anomalies (1 and 4, 800m and 1500m ENE of Sweeneys respectively) were drilled, intersecting Sweeneys-style mineralisation in both cases. However, average grades were lower than Sweeneys and exploration stopped in 1983, leaving 10 other IP/geochemical anomalies completely untested. The most significant known bodies (the only ones drilled by Renison) are : Sweeneys (18 holes), Globe (5 holes), Anomaly 1 (6 holes) and Anomaly 4 (1 hole).

Because of their irregular shape and complex mineralisation, Renison found it impossible to make reliable calculations of tonnage or grade for the bodies. They did not fully define any of them, although this work was planned for Sweeneys and Anomaly 1 in 1983-84 but not carried out. The only figures available are ´rough estimates´ by Renison as shown below. In the author´s opinion the tonnage estimates are probably conservative because they understate the amount of material in the upper flat-lying parts of the pipes, as these were not fully defined during exploration.

South Heemskirk - Resource Estimates

Sweeneys: 500,000t @ 0.6% Sn (0.15% acid sol), 1.9% Zn, 37 g/t Ag.

Anomaly 1: 400,000t @ "lower bulk grade than Sweeneys".

Globe: 100,000t @ "quite low" grades.

Anomaly 4: Only 1 hole, no estimates possible. "Unlikely to be larger than the others".

(All Cartwright 1983 or Roberts 1984).

An indication of grade at Anomaly 1 can be gauged from the best drill hole intersections:

Fed 20: 8m @ 0.72% Sn (0.47% acid sol), 3.1% Zn, 0.7% Cu, 123 g/t Ag.

Fed 21: 16m @ 0.54% Sn (0.01% acid sol), 0.02% Zn, 0.01% Cu, 1 g/t Ag.

Fed 24: 7m @ 0.64% Sn, 2 g/t Ag, 0.16 g/t Au.

At the Globe, an indication of grade can again be gauged from drill hole and adit sampling:

Hole TH8: 4m @ 0.32% Sn (<0.01% acid sol), 26 g/t Ag, 0.93% Pb, 0.63% Zn.
Adit 1: 6m @ 0.39% Sn (<0.01% acid sol), 3 g/t Ag.
Adit 3: 10m @ 0.4% Sn, 12 g/t Ag, 0.23% Pb.

At Anomaly 4 the one drill hole intersection was as follows :

Fed 26: 2m @ 0.49% Sn (0.14% acid sol), 4.6% Zn, 1.4% Pb, 0.8% Cu, 334 g/t Ag.
3m @ 0.92% Sn (0.01% acid sol), 0.5% Zn, 0.1% Pb, 6 g/t Ag.

Potential: South Heemskirk has potential to produce at least 1-1.5 mmt of tin ore grading around 0.5-0.6% Sn, with significant credits of Zn, Ag and Cu, and perhaps some gold. The resources are metallurgically complex and occur in several discrete bodies amenable to open-cut mining. There are strong indications that several as-yet-undrilled bodies exist on the property, which could increase the potential resource.

While such resources will be uneconomic in their own right for the foreseeable future, they could be an important factor in any mining operation based on the Queen Hill deposits at Zeehan. The South Heemskirk area should be kept under active scrutiny by Aberfoyle and definitely acquired if mining operations are planned at Queen Hill.

Renison's programme at South Heemskirk was generally excellent. However, once again, the falling tin price led to the work being prematurely abandoned before the identified mineralised bodies could be fully defined and evaluated. Renison also left most of their geophysical/geochemical anomalies untested. Although they considered these were the weaker responses, and therefore indicative of weaker mineralisation, there were dangers in this reasoning which they themselves identified.

For example, the IP responses that led directly to the discovery of the Anomaly 1 and 4 bodies, were found in down-hole geophysical tests to be almost entirely due to the highly-sulphidic mineralisation of the low-temperature mineralising phase. There was essentially no response from the principal tin-mineralising phase which is less sulphidic. "This has implications for exploration in that electrical geophysical methods will have great difficulty locating the sulphide-poor inner tin zones" (Cartwright 1983).

But the outer sulphide-rich phase can be poorly developed - at Anomaly 1 it is present only in the SW corner of the body. Therefore, it is possible there are tin-rich bodies at South Heemskirk which lack the sulphide phase altogether and which were either not detected by the IP or formed such weak responses that they were ignored.

The drilled bodies all either outcropped or were in subcrop beneath shallow soil and scree cover. There is no geological reason why the mineralised bodies should not occur completely 'blind', at any depth within the Red Granite as there are no constraints on the distribution of the localising aplite dykes. In this respect it should be noted that Renison used Gradient Array IP, which had a probable effective depth limit around 60m.

A modern EM system, such as Sirotem, may prove effective at South Heemskirk, both in discovering new mineralisation and in further discriminating between the responses left undrilled by Renison.

In 1984, Renison assayed 10 of the mineralised drill hole intersections from Anomalies 1 and 4 for gold by fire assay at the Mt. Lyell laboratory. Results ranged from 0.1 - 0.4 g/t Au, and significantly, there was no direct correlation of the Au with either Sn or Ag.

These results, if valid, are of some importance and it is strange Renison never followed them up with more gold assaying. However, the author is aware that the Mt. Lyell laboratory was prone to contamination problems in its sample preparation facility from the auriferous Lyell ore, and therefore has some doubts about the validity of the results.

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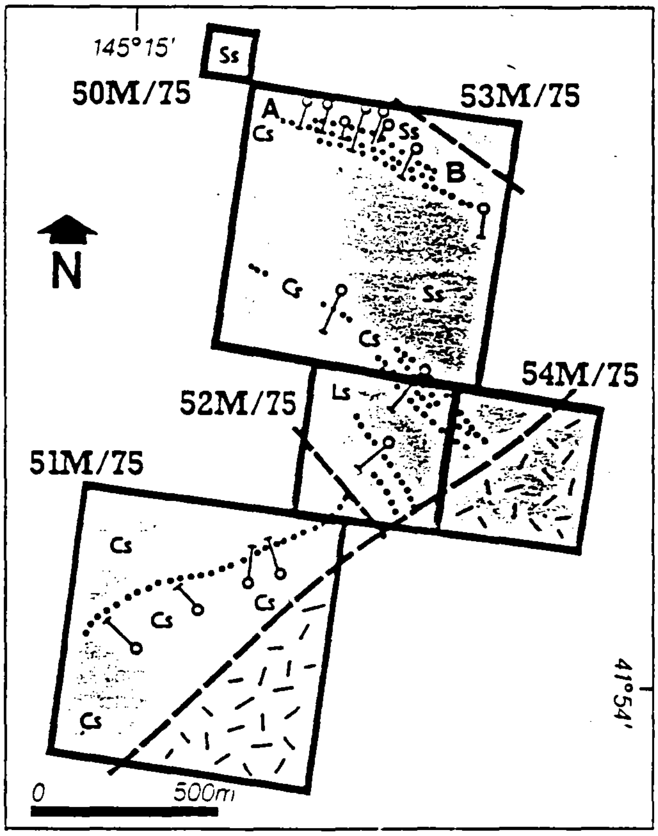
Tenth Legion
Tin, magnetite

Location map

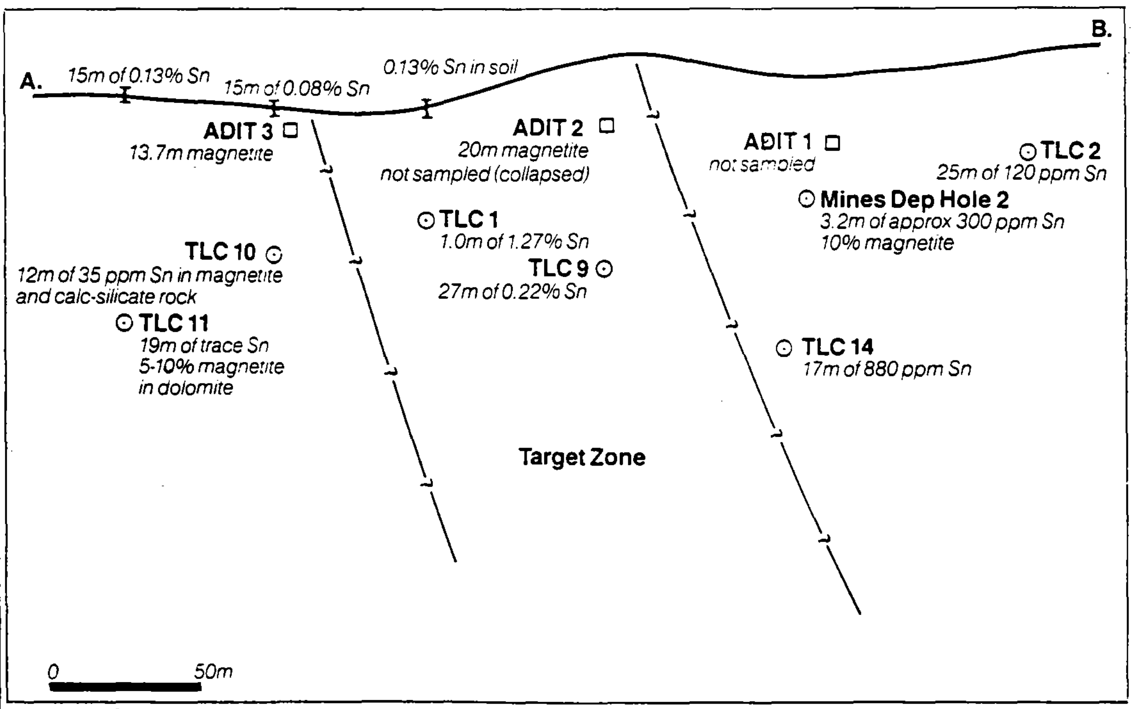


This illustration was prepared by Robertson Research (Australia) Pty Limited

Reference

- Drill hole
- Magnetite
- Ls Limestone
- Cs Calc-silicate rocks
- Ss Siltstone
- Gabbro
- Fault

Longitudinal section
Looking north



Based on CRA Exploration Pty Limited Report

Reference

- ⊙ Midpoint of drill intercept
- I Surface sample
- -?- Interpreted limit of tin shoot

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NORTH WEST TASMANIA

TENTH LEGION

TIN, MAGNETITE DEPOSIT

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Drawn : after Savage Res, 87
Traced : RJE
Checked :

Location Code :
Scale : As shown
Date : March, 1989
Plate No. : FIG. 10-1

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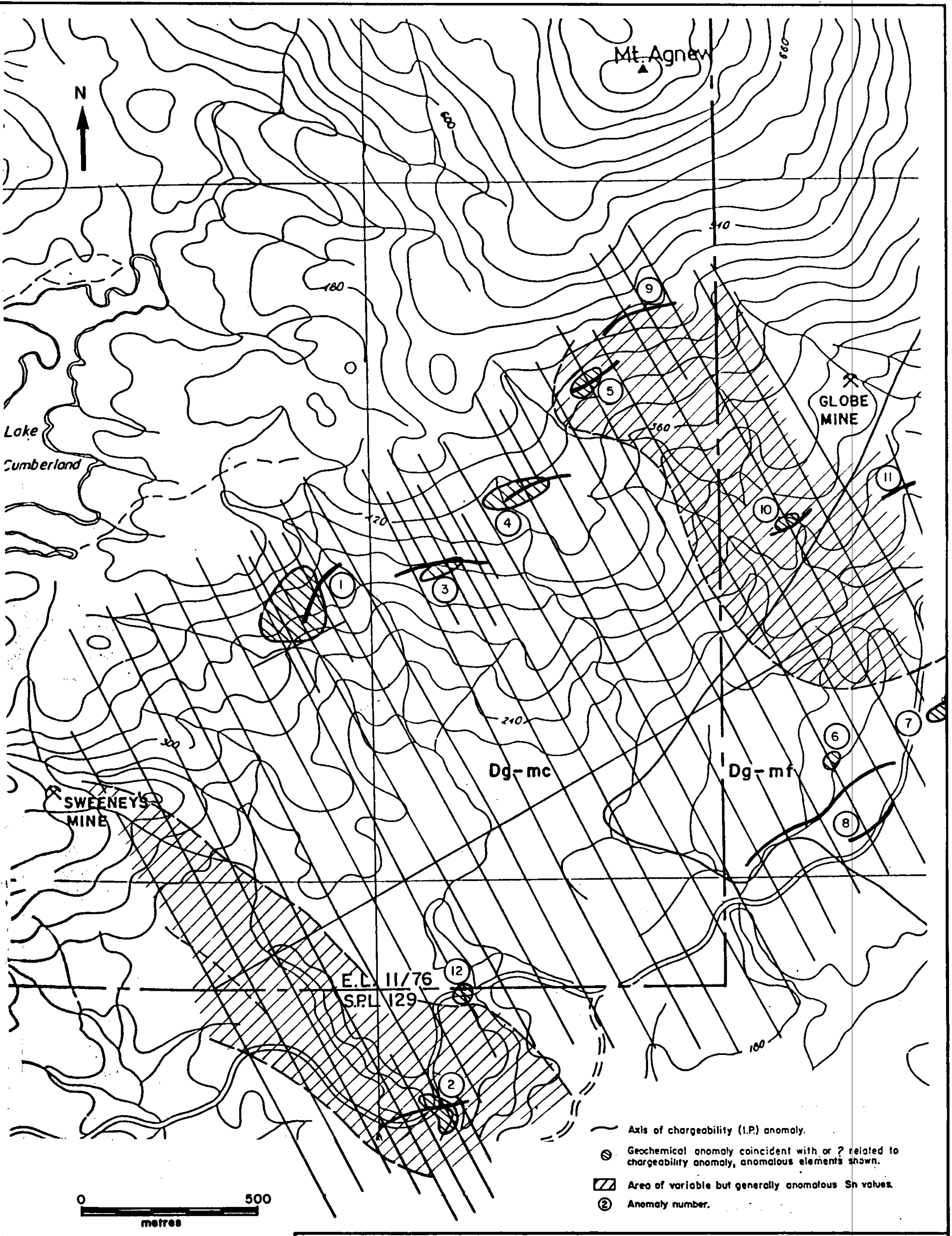

Dg-mf	Medium-fine grained non porphyritic granite
Dg-mc	Coarse-medium grained porphyritic granite

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NORTH WEST TASMANIA
SOUTH HEEMSKIRK
INTERPRETIVE GEOLOGY & ANOMALY LOCATIONS

REVISIONS			
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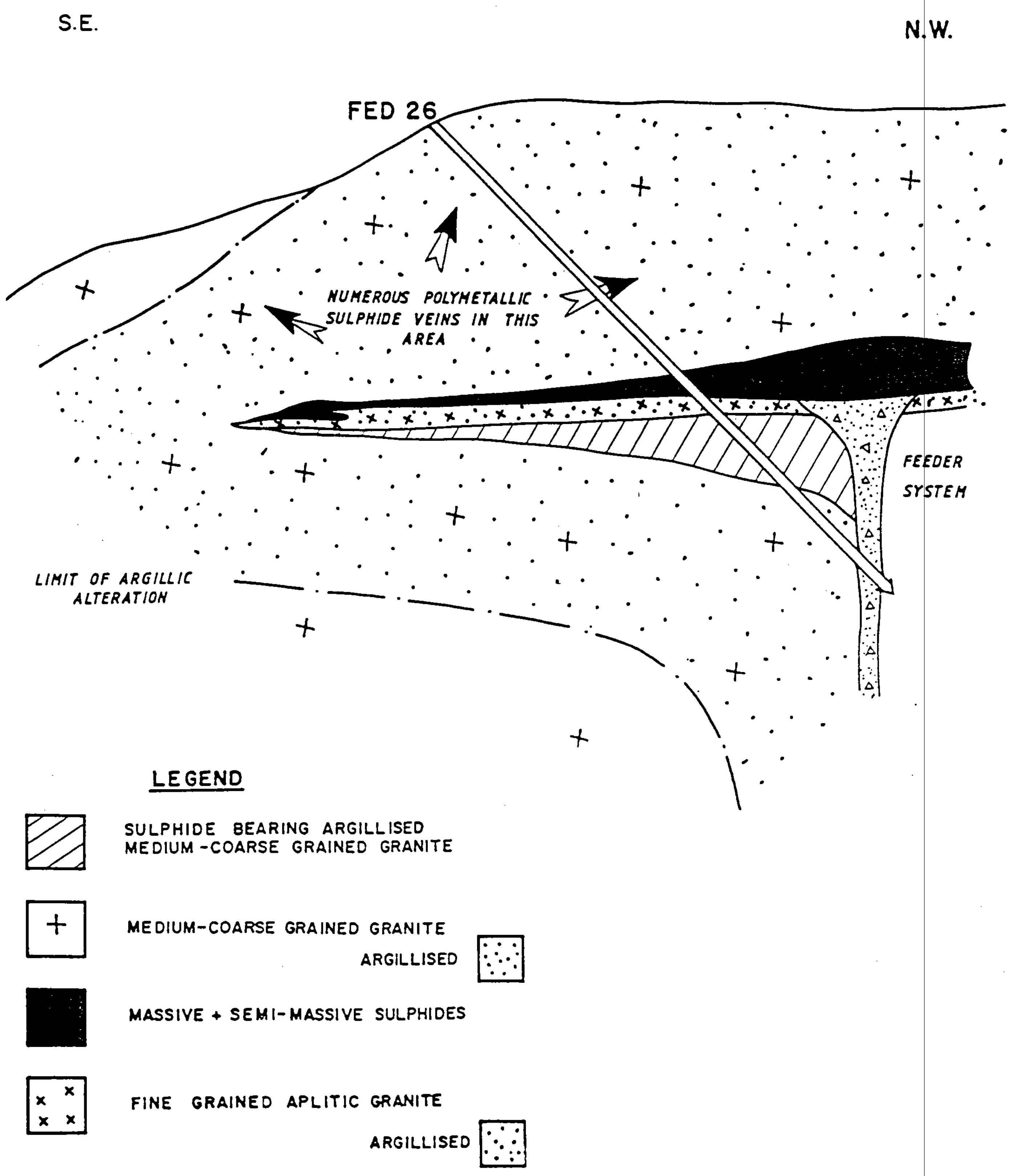
Location Code :

Scale : As shown

Date : March, 1989

Compiled : JGP
Drawn : after Goldfields, 1983
Traced : RJE
Checked :
Plate No. : FIG. 10-2



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NORTH WEST TASMANIA

SOUTH HEEMSKIRK

SCHEMATIC SECTION THROUGH ANOMALY 4

REVISIONS			
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Location Code :

Scale : NTS

Date : March, 1989

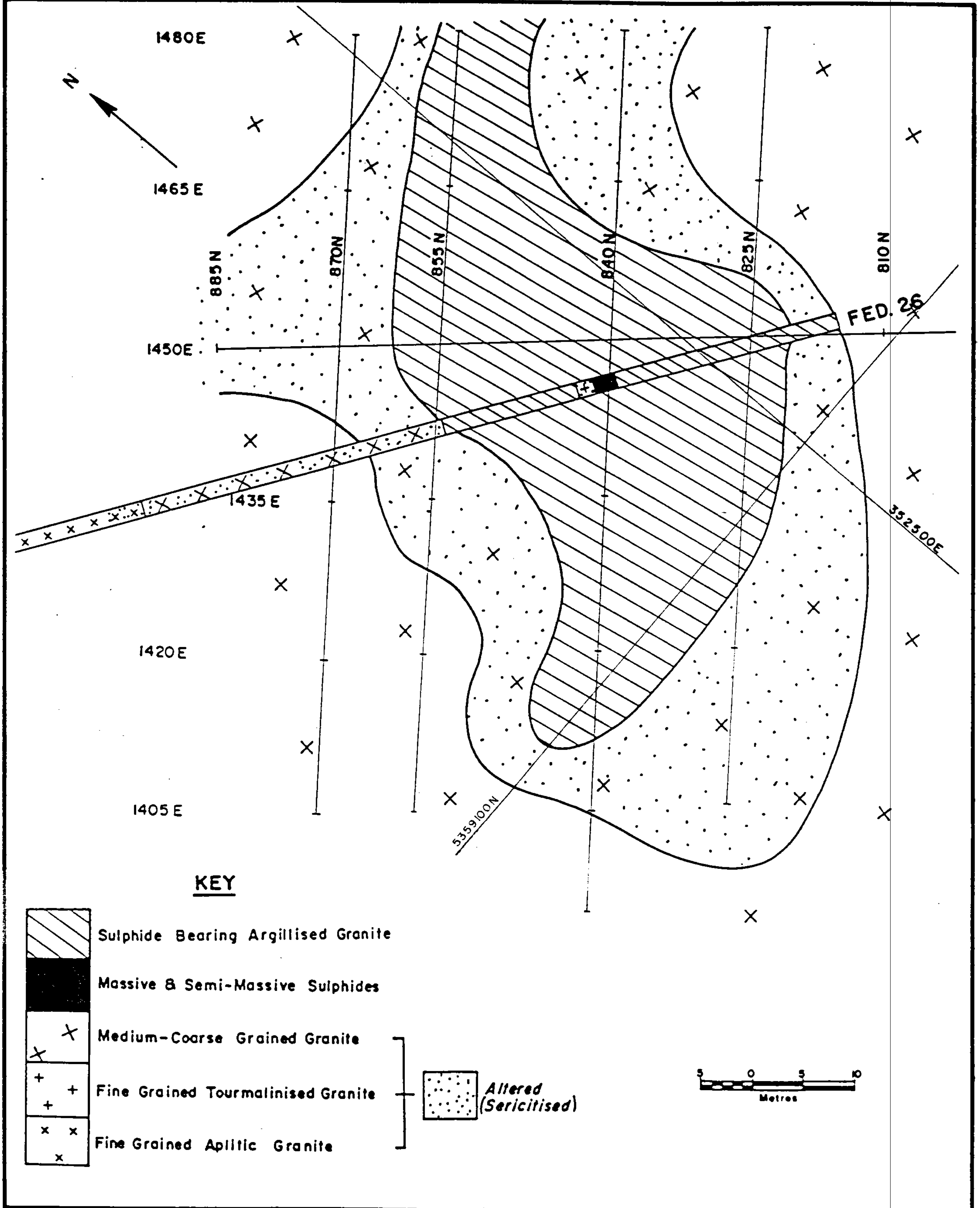
Compiled : JGP

Drawn : after Goldfields, 1983

Traced : RJE

Checked :

Plate No. : FIG. 10-3



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Location Code :

NORTH WEST TASMANIA

SOUTH HEEMSKIRK

INTERPRETIVE GEOLOGY PLAN - ANOMALY 4

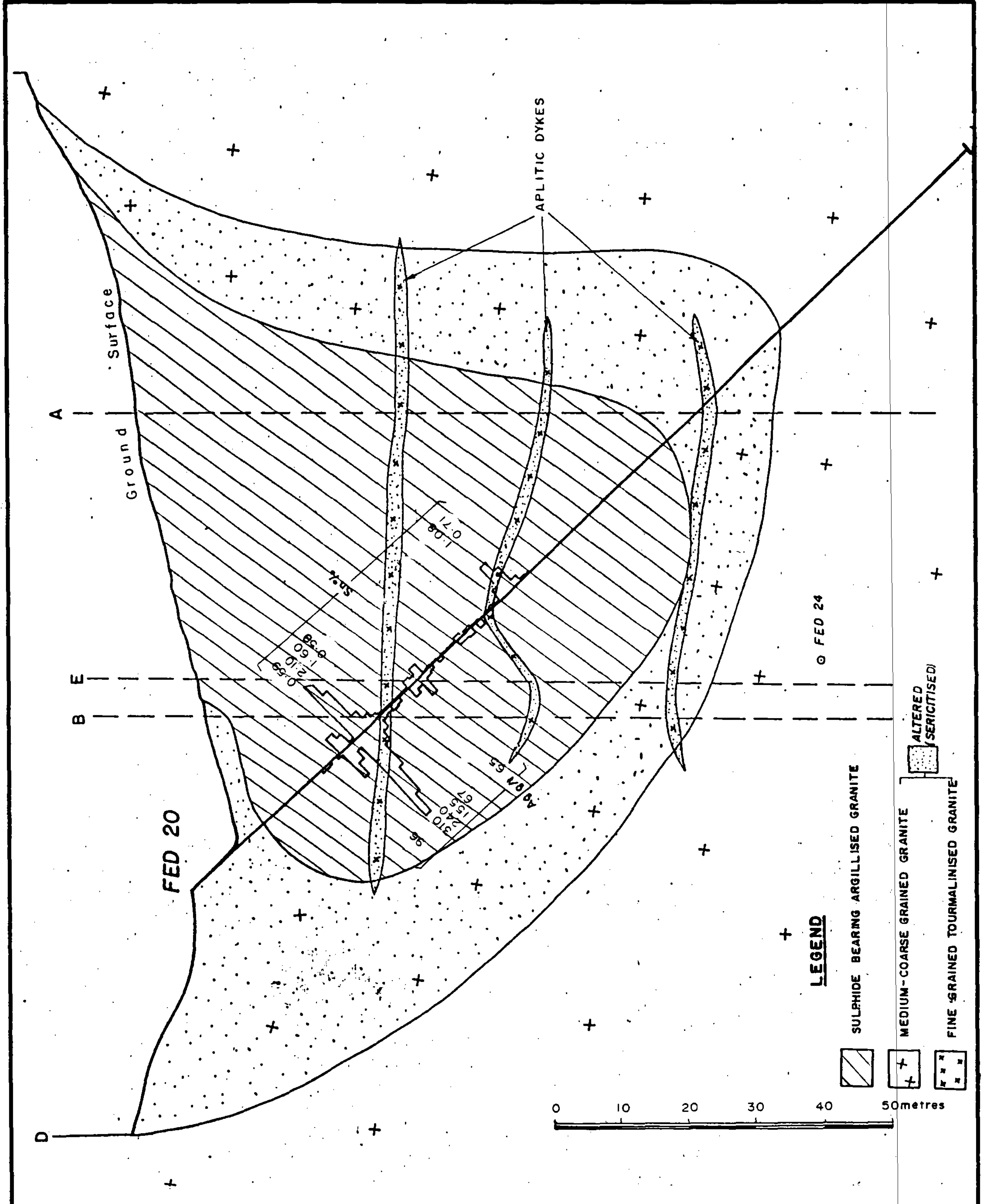
Compiled :	JGP
Drawn :	after Goldfields, 1983
Traced :	RJE
Checked :	

Scale : 1: 500

Date : March, 1989

Plate No. : FIG 10-4

151



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Init.	Date	Init.	Date

NORTH WEST TASMANIA

SOUTH HEEMSKIRK

ANOMALY I. BODY
CROSS SECTION

Compiled : JGP
Drawn : After Goldfields 1982
Traced : JLR
Checked :

Location Code :
Scale : As shown
Date : March, 1989
Plate No. : FIG. 10-5

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11. THE MOINA DEPOSIT

The Moina F-Sn-W-Au skarn deposit occurs in Northern Tasmania, 50km SSE of Burnie and 45 km E of Mt. Bischoff. It is held under Retention Licence 8810 of 2 km^2 by the CRA-Shell JV. The deposit is well known as the largest resource of fluorite in Australia, with an open-cuttable ´indicated resource´ of 26.5 mmt @ 18% CaF_2, 0.15% Sn and 0.1% W (Askins 1979). CRA sampling in 1988 showed this resource alsoc contains spotty gold values, generally in the range 0.2-0.4 g/t Au.

The Moina mineralisation was found in 1893 when the Shepherd & Murphy Mine was developed on four quartz-cassiterite-wolframite veins, up to 0.5m wide x 400m long x 140m deep, trending E-W at right angles to the Bismuth Creek Fault. The veins passed through the fluorite-bearing "wrigglite" skarn but this was not recognised. The mine was worked from 1893-1924 and again from 1953-58. King (1963) lists production as 562t Sn.

Modern exploration of the area began in 1968 when the Mt. Lyell Co. drilled three holes into the Shepherd and Murphy mineralised veins. The highest Sn values were obtained from the wrigglite skarn, with a best intersection of 41m @ 0.29% Sn in hole ML3 (Young 1979).

The fluorite in the wrigglite skarn was first recognised by Comalco geologists in 1974. Between 1974-88 Comalco, Shell and CRA drilled 44 diamond drill holes into the skarn and surrounding area. They also conducted magnetic, IP, MMR and various EM surveys (Turam, Max-Min, VLF). Comalco concentrated on the fluorite potential, Shell on the Sn-W potential, and CRA on the gold potential.

The Moina skarn deposit occurs as an irregular 20-70m thick conformable sheet in the basal part of a flat-lying unit of Ordovician Gordon Limestone. It lies 200m above the intrusive contact of the Devonian Dolcoath Granite (the granite outcrops 3 km further east). Ordovician quartzose pyritic sandstone, (the Moina Sandstone), lies between the limestone and the granite, and in places is thrust over the skarn.

The main skarn occurs within an area 1500m E-W and 600m N-S (see Figure 11-1). It is partly outcropping, with the remainder shallowly buried beneath limestone, Tertiary basalt or Moina Sandstone. Best development of the skarn is adjacent to faults which have allowed the mineralising fluids from the underlying granite to reach the limestone above the sandstone. In the main deposit area, the plumbing system for the access of the mineralised fluids is considered to have been the E-W trending Shepherd and Murphy vein structures. These are associated with the major NW-trending Bismuth Creek Fault which cuts through the centre of the skarn (Askin 1978).

The skarn comprises contorted fine layers of magnetite, fluorite and various calc-silicate minerals (principally vesuvianite), with minor pyrite, pyrrhotite and trace sphalerite. This banded assemblage has been termed "wrigglite" and is considered to have formed by diffusion fronts replacing pure limestone outward from fractures, a mechanism analogous to the formation of liesegang rings (Askins 1978).

Bands of calc-silicate occur within the wrigglitic skarn, and at its upper and lower margins the skarn is garnet-rich (grossularite or andradite). The wrigglite is retrogressively altered in places, particularly alongside faults, to a martite-chlorite-ankerite assemblage and these zones often contain the better Sn, W, Zn and Au values. Sn-W mineralised feldspar and quartz veining is also sometimes present in such zones.

Fringing the main wrigglitic skarn are two areas of sulphidic skarn (see Figure 11-1). The first of these is along the eastern side of the Bismuth Creek Fault, where there is a zone of sphalerite-rich retrograde skarn with elevated gold values. Funnell (1988) estimated this resource at up to 1mmt @ 8% Zn and 0.88 g/t Au, but average Sn and W values were not calculated.

Immediately overlying the sphalerite mineralisation Shell outlined 2.8 mmt @ 0.18% Sn and 0.07% W, (+CaF_2), within retrograde-altered wrigglitic skarn and calc-silicate (Smyth 1981 - see Figure 11-3). Later, CRA sampling found significant gold values in this body, up to 2m @ 2.58 g/t (hole SMD16), and 10.5m @ between 0.27 - 1.34 g/t Au (SMD24). Further details were not given.

The second sulphidic skarn body is pyrrhotite-rich and lies immediately west of the main skarn (see Figure 11-1). It is best developed in hole SMD9 which intersected 27m of 30% pyrrhotite within magnetite-chlorite-fluorite skarn. Although tin values in the hole were low (generally 100-900 ppm Sn, with a maximum of 1700 ppm), it contained elevated gold values (up to 8m @ 1.5 g/t Au).

IP and EM surveys were used by Comalco and Shell to try and locate sulphidic Sn-W skarns peripheral to the main wrigglitic skarn. After these surveys, Shell (Smyth 1981), concluded: "no major sulphide bodies remain to be tested in the limestone area".

The complex mineralogy and fine grained nature of the wrigglite skarn is the principal reason that it has not been mined to date. The fluorite, tin and tungsten apparently cannot be economically recovered using existing technology. The tin occurs as very fine grained free cassiterite (to 20um), in sphene and fluorite as ultra-fine discrete inclusions, and in garnet. The tungsten occurs mainly as fine grained scheelite, with some wolframite. Metallurgical testing in 1979 showed that only about 30% of the tin and tungsten was recoverable using available technology.

Potential: The Moina skarn is a very significant concentration and potential resource of F, Sn, W and Au. Using Comalco's resource estimate of 26.5 mmt @ 0.15% Sn, the deposit contains 40,000t of tin*. The crucial problem is the complex metallurgy.

Young (1979) noted: "the application of new metallurgical techniques to increase Sn and W recoveries to economic levels is seen as the only real possibility for the future economic production of Sn and W at Moina". The author agrees with this conclusion. However, the situation could perhaps now be reviewed in the light of another decade of metallurgical research.

From a purely exploration viewpoint, Moina is not well-drilled. This particularly applies to the pyrrhotite-rich skarn body. The impression is gained of a rather cavalier approach to the testing for Sn, W and Au, by the explorers to date.

Most holes, even in the main deposit area, are in excess of 150m apart. This density is insufficient to have tested all the possibilities for higher-grade Sn-W (+Au, Zn) mineralisation on the property. These well-recognised possibilities include retrograde, veined and/or sulphidic skarn close to faults, and sulphidic lenses near the periphery of the main skarn body. Such mineralisation could occur in numerous small irregular bodies with patchy values, requiring close-spaced drilling.

The pyrrhotite-rich body to the west of the main skarn was tested by three holes - SMD 5, 9 and 35. The geophysical response suggests this skarn body is 350m long and 250m wide (SMD9 showed it was 30m thick). The spacing between these three holes is quite wide at 150-200m, and there is still scope for high grade Sn, W and Au mineralisation here.

(Note, the Comalco 'indicated resource' of 26.5mmt is based on only 8 drill hole intersections - although Shell subsequently put in 2 more holes. However, as they only apply to near-surface skarn west of the Bismuth Creek Fault, the Comalco figures are probably conservative. It should also be noted that Askins (1979) actually quotes the tin grade as 0.1% Sn, but his detailed resource calculations show the grade averages 0.15% Sn. See Table 11A.

As a general comment on the unusually high Au content of the Devonian skarns at Moina, the author is personally of the view that the gold has been leached or similarly derived from the Mt. Read Volcanics which extensively underlie the Moina Sandstone in this general area. If the average grade of the whole skarn deposit is 0.2 g/t Au, which seems feasible, the contained gold resource is around 200,000 oz.

---

* If Shell's 2.8 mmt @ 0.18% Sn east of the Bismuth Creek Fault is added, the total figure is 45,000t of tin.

TABLE 11A

WEIGHTED AVERAGE ANALYSES

DIAMOND DRILL HOLES, MOINA, WITHIN "INDICATED" WRIGGLITE

(from Askin 1979)

Hole No.	From metres	To metres	Interval metres	CaF_2 %	Sn ppm	W ppm
ML 2	43.3	50.4	7.1	17.8	ca 800	ca 400
	50.4	61.0	10.6	11.6	ca 1400	ca 150
	61.0	82.9	21.9	19.2	ca 1500	ca 800
	43.3	82.9	39.6		1350	540
SMD 6	22.75	83.05	60.30	17.6	1400	910
	22.75	67.70	44.95	19.5	1540	930
SMD 7	1.00	55.00	54.00	20.9	1450	1030
SMD 10	38.75	88.50	49.75	17.6	1320	535
	38.75	76.00	37.25	19.2	1300	500
SMD 11	31.00	74.00	43.00	16.9	1525	1020
	31.00	60.70	29.70	19.4	1540	1010
SMD 15	33.00	105.00	72.0	18.0	1470	1250
SMD 28	29.00	90.60	61.60	20.3	1740	940
	90.60	101.00	10.40	10.1	1110	560
	29.00	101.00	72.00	18.8	1650	890
SMD 29	0.00	23.25	23.25	20.8	2180	2260

Note: All intervals except for SMD 29 are approximate true thicknesses.

Overall indicated tonnage and weighted average grade:

26.5 million tonnes @ 18% CaF_2, 0.15% Sn, 0.1% W.

Holes added by Shell (1981):

MD 40	10.00	85.20	75.20		1360	950
MD 41	0.00	28.50	28.50		1560	820

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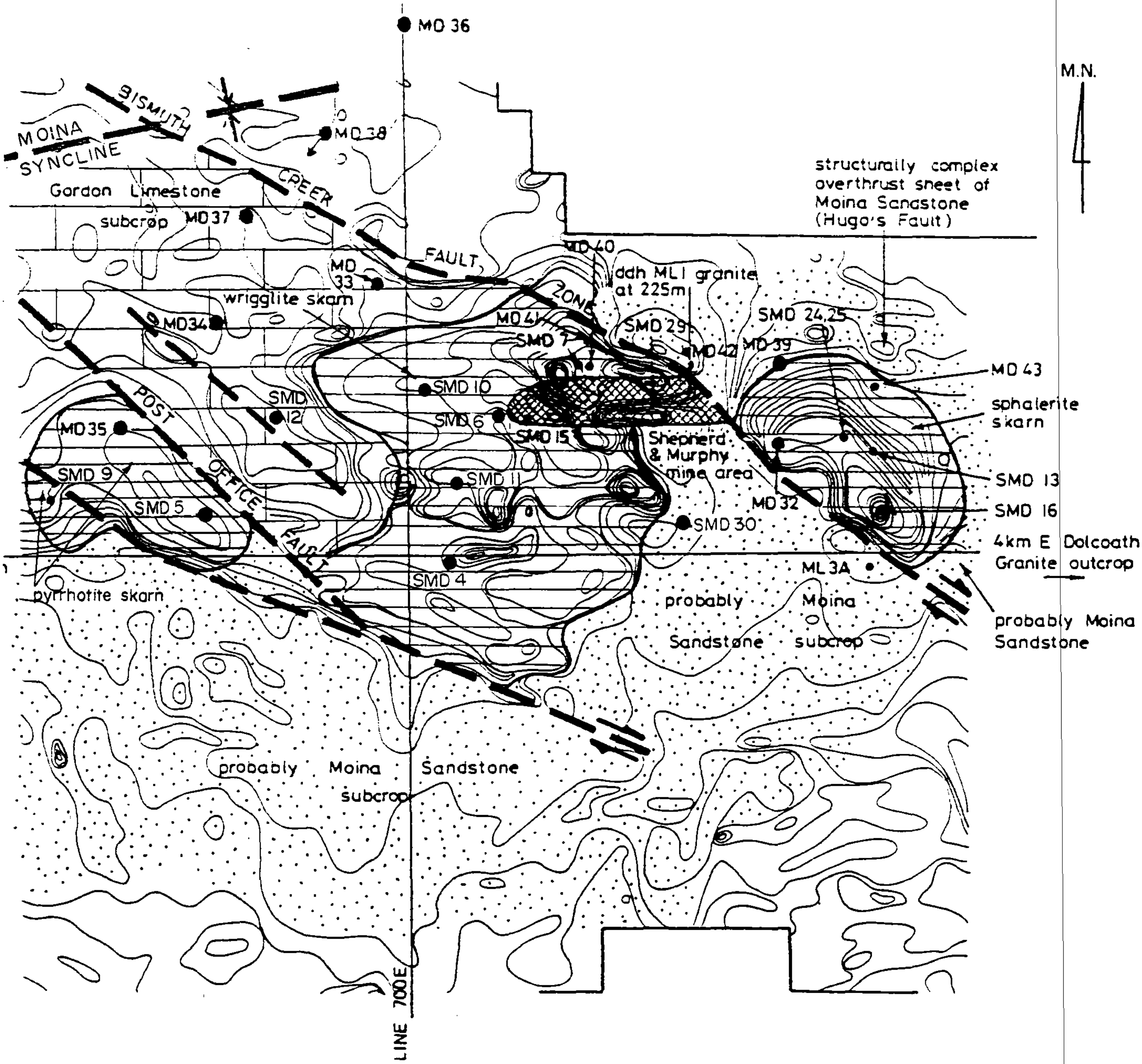

Stockwork scheelite target

Gordon Limestone

Skarn (at base of limestone)

Moina Sandstone

○ Proposed Shell drill hole

● Completed Shell drill hole

0 — 500 metres

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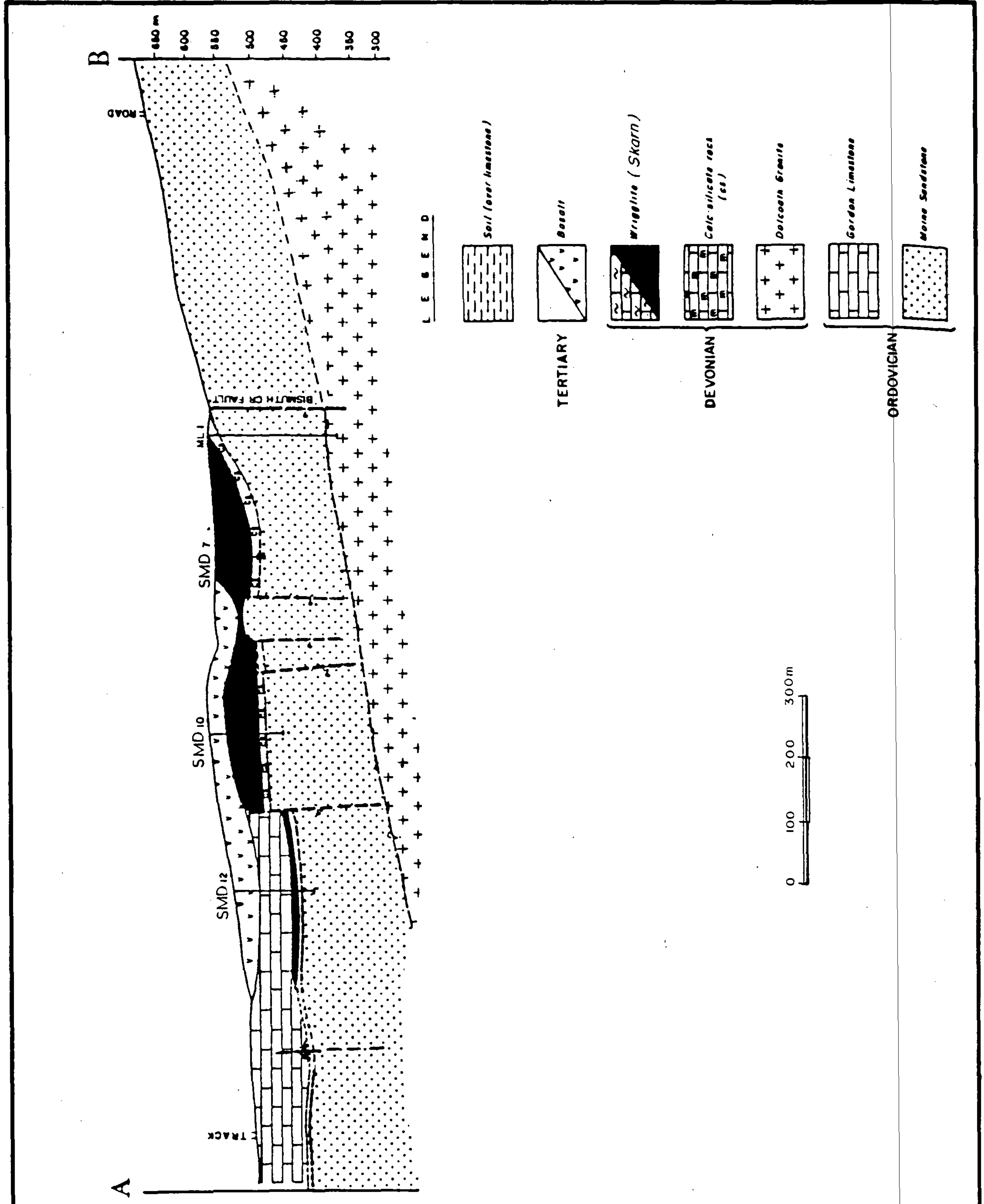
Init.	Date	Init.	Date	**MOINA**	Drawn : after Shell, 1980
				GEOLOGY, GROUND MAGNETICS & DRILLING	Traced : RJE
					Checked :
Location Code :				Scale : As shown — Date : March, 1989	Plate No. : FIG. 11-1



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EXPLORATION DIVISION

NORTH WEST TASMANIA

MOINA

EAST-WEST SECTION

SHEPHERD & MURPHY MINE AREA

REVISIONS			
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Location Code :

Scale : As shown

Date : March, 1989

Compiled : JGP

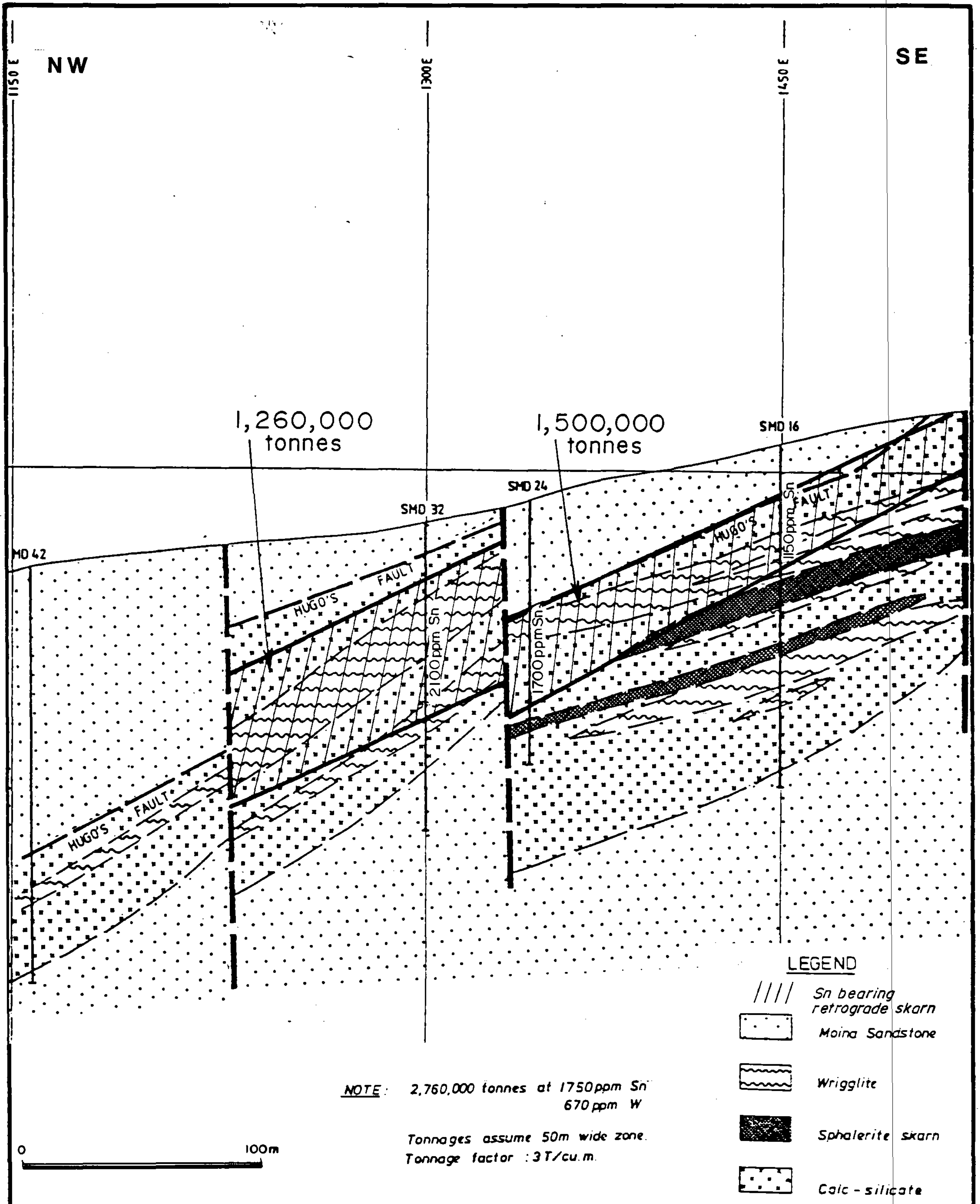
Drawn : after Askin, 1978

Traced : JLR

Checked :

Plate No. : FIG 11-2

1511



Aberfoyle Resources Limited

EXPLORATION DIVISION

REVISIONS			
Init.	Date	Init.	Date

Location Code :

NORTH WEST TASMANIA

MOINA

SECTION PARALLEL BISMUTH CREEK FAULT

Showing Sphalerite Skarn & Sn-Bearing Retrograde Skarn

Scale : As shown

Date : March, 1989

Compiled : GJP

Drawn : from Shell, 1981

Traced : JLR

Checked :

Plate No. : FIG. 11-3

1511

12. LESSER TIN OCCURRENCES
(All Shown on Figure 1).

12.1 TIN SPUR

This tin prospect lies 5 km ESE of the Moina deposit. Fine disseminated cassiterite and gold occur in leached, calc-silicate altered and topazised limey zones within quartzose Ordovician Moina Sandstone. The Dolcoath Granite is postulated to occur at depth. Comalco drilled 3 holes in 1980 with best intersections of 2m @ 0.15% Sn and 1m @ 5 g/t Au. Shell trenching in 1981 across the 800m x 25m outcropping mineralised zone had best results of 16m @ 0.2% Sn and 7m @ 2.1 g/t Au. Shell estimated "potential reserves" as approximately 2mmt @ 0.2% Sn, 1 g/t Au. Because of the irregular nature of the mineralisation actual tonnages may be much less. References: EL 7/74, Comalco - Askins 1980. Shell - Smyth 1981.

12.2 IFIELD CREEK

On the northern contact of the Devonian Meredith Granite, Ifield Creek was found by Aberfoyle in 1979 by drainage sampling in the Upper Castray River. Costeaning obtained values up to 10m @ 0.37% Sn, from skarnified carbonated serpentinite within an embayment in the granite margin. At least some of the tin is in silicates. The mineralised zone is 25m wide and at least 150m long. No drilling has been done. Potential appears limited. References: EL 16/78, Aberfoyle - Joyce 1982, Sise 1983.

12.3 TADPOLE HILL

This endogranitic tin prospect lies within the Meredith Granite near its southern margin (see Figure 7-4). Cassiterite occurs in an area of quartz-tourmaline veined, tourmalinised and greisenised granite. A 1973 trench sample by Comstaff assayed 0.25% Sn over 49m, across a mineralised zone 300m x 50m, estimated to have potential for 40,000t/vert m. This is the only systematic sample ever taken from this zone. Goldfields did IP and some geochem 1979-84, but the mineralised zone remains undrilled and essentially untested. References: EL 1/68, Comstaff - Pigott 1973 (73-953)*. EL 17/77, Renison - Ross 1980 (80-1506); GFEL - Roberts et al 1982 (82-1857), Cartwright et al 1984 (84-2281).

12.4 GRANITE TOR

This large Devonian granite complex lies 13 km east of Tullah. It was half-heartedly explored for tin by Alcoa and Shell 1978-83. Geophysics was restricted to DIGHEM, airmag and ground mag surveys. No drilling was done. Two minor old tin workings are known within and around the granite, which is greisenised in places. Restricted calc-silicate and skarn development, with low tin values, occurs in

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* Note, these are the Tasmanian Department of Mines library report file numbers.

rare carbonate horizons in the Proterozoic sediments surrounding the granite. Compared to other Devonian granites in W Tasmania, the tin indications at Granite Tor are very weak, but the area is not well explored. References: EL 2/78, Alcoa - Speijers 1978 (78-1308), 1979 (79-1349 & 1400), 1980 (80-1490); Shell - Smyth (1983).

12.5 **Merton Hill**

Merton Hill comprises fault and vein-style Pb-Zn-Ag-Sn mineralisation within weakly-metasomatised Cambrian and Silurian sediments, including carbonates, on the W limb of the Huskisson Syncline (see Figure 7-4). The area is complexly faulted. The prospect was explored by the Renison-Aberfoyle JV 1979-82, and 7 DDH's were put down with best results being: 3m @ 0.2% Sn, 1.3% Pb, 3.7% Zn, 53 g/t Ag; and 13m @ <0.01% Sn, 1.8% Pb, 3.6% Zn, 67 g/t Ag. The holes tested the mineralisation to depths of 300m. Tin values are weak and best near surface. Renison estimated maximum potential as 0.9mmt @ 0.2% Sn, 1% Pb, 2% Zn, 50 g/t Ag. References: EL 17/77, Renison - Ross 1980 (80-1440), Martin 1981 (81-1568), Martin et al 1982 (82-1751).

12.6 **STERLING VALLEY**

This unusual mineralisation lies along the Henty Fault, 5 km S of Tullah. Remobilised, structurally-controlled but conformable, po-aspy-py occurs in Cambrian Mt. Read Volcanics W of the fault and Farrell Slate sediments E of the fault. The sulphides contain gold and cassiterite, as well as Pb, Zn, Ag. The author has been heavily involved in exploration of the area and considers the mineralisation a "hybrid" Cambrian and Devonian system. Gravity data indicates a Devonian granite beneath the area. Over 25 DDH's have been put down for best tin results of: 1m @ 0.5% Sn, 0.7m @ 0.4% Sn, 2.2m @ 0.3% Sn. 3m @ 0.65% Sn was obtained in surface trenching. Work by the Aberfoyle-Asarco and Aberfoyle-EZ-Getty JV's 1976-84 showed that the tin values are of little consequence, although the gold is significant. References: EL 4/73, Asarco 1973-76; Aberfoyle 1976-79, EZ 1979-84.

12.7 **COLEBROOK HILL**

This sizeable metasomatic alteration system is dominated by significant Cu-W mineralisation with lesser Sn. It lies 5 km E of Renison, and is hosted by steeply-dipping carbonate-bearing sediments of the Cambrian Crimson Creek Formation and Huskisson Group. The rocks have been extensively altered to po-py-aspy-cp-scheelite-bearing axinite-chlorite and actinolite-chlorite skarn, by underlying Devonian granite. EZ explored for Cu before testing for Sn 1980-85. 17 DDH's were put down to depths up to 1064m, with best Sn intercepts: 6m @ 0.16% Sn, 2m @ 0.25% Sn, 0.7m @ 1% Sn. Highest tin values were obtained from chip sampling at the old Olympic-Athenic workings: 6m @ 1% Sn, but several DDH's here got a best intercept of only 1m @ 0.3% Sn. (The location of the old workings is shown on Figure 8-7). A 1985 Sirotem survey located several off-hole anomalies which were not drilled. Although the metasomatic system is large and not yet fully tested, the tin potential appears modest. References: EL 1/62, EZ - Mill et al 1980, McDonald 1981, 1983, 1984, 1985.

12.8 GRANVILLE EAST & WEST

These prospects cover substantial metasomatised zones in sediments of the Upper Proterozoic Oonah Formation, on the N side of the Heemskirk Granite. (The E Granville area is NW along strike from the St. Dizier deposit - see Figure 9-1). Major magnetite and sulphide-bearing skarns and calc-silicate horizons, are developed within 3-4 km long zones of altered quartzite, black shale and dolomite. The area was explored by CRA and Peko 1977-85. Although basemetals (mainly Cu) are locally significant, Sn values in extensive bedrock sampling were low with few +1000 ppm Sn. 6 DDH's were put down for best intercepts: 1m @ 0.36% Sn (Granville E), 1m @ 0.3% Sn (Granville W). The Sn in drainage which led CRA into the area was traced to Tertiary gravels. The Granville prospects are part of the extensive zones of metasomatism on the N margin of the Heemskirk Granite, but appear to contain less tin than most of these zones. More drilling is probably justified. References: EL 1/77, Peko - Heithersay et al 1982 (83-1961), Perring 1983 (84-2097), Kendall 1984 (85-2339); CRA - Weir 1985 (85-2335 & 2336), Caithness 1985 (86-2538).