

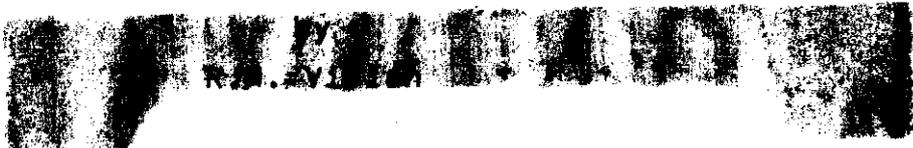
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FINAL REPORT
ON
EXPLORATION ACTIVITIES
WITHIN
E.L. 7/78 ROYAL GEORGE
AMAX/CORNWALL COAL JOINT VENTURE



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i) SUMMARY

In March, 1983 Amax Australia (Operations) Pty. Limited entered into a joint venture agreement with Cornwall Coal Company N.L., title holders of E.L. No. 7/78. Under the agreement, Amax was to test the potential of cassiterite mineralisation located in quartz-cassiterite sheeted veining at Glenair prospect and in the greisenous lodes at the Dyke Lode prospect.

The work programme included costeaning across mineralised lodes at both prospects, gridded soil and bedrock geochemistry, geological mapping and rock chip geochemistry.

In addition to the above a reconnaissance stream sediment survey, augmented by rock chip sampling where appropriate was undertaken with the wider E.L. to prospect the sediments for additional Glenair style mineralisation and/or greisen mineralisation associated with shallowly intruded granites.

Results of the work programme indicate that the originally located quartz-cassiterite sheeted vein system is one of 5 subvertical fracture-vein systems that trend east-west across the Glenair property. Typically they are less than one metre in width and sporadic in outcrop.

Only the quartz-cassiterite sheeted veins contain significant cassiterite mineralisation.

- 2 -

Host rock is a silicified and tourmalinised quartz sandstone that is veined over 0.6m thickness by numerous 3mm wide parallel quartz veinlets spaced, on average, 6mm apart. The veinlets contain cassiterite mineralisation.

The sheeted veins grade 0.28% Sn across a sample width of 2m over an 18m strike length. Best grade is 0.38% Sn across a 1m width. Geochemistry and costeaning indicate that the mineralised sheeted veining does not have any strike continuity beyond 18m and that no other area of similar mineralisation occurs within the Glenair prospect.

Minor opaque oxides and rare zircon, apatite and topaz are present. No sulphide accompanies the cassiterite.

At the Dyke Lode prospect the work programme has indicated that the better grades of tin mineralisation are confined to two siliceous lodes trending 279° - 288° magnetic. These range in grade from 0.34% - 0.52% Sn over a maximum 2m width. The lodes occur in, and are separated by, approximately 60m of a silicified greisenised quartz porphyry. Grades within this greisen are elevated above background although still substantially lower than the lode grades.

Within the wider area of the district, additional east-west fracture-vein systems are located; two of which may be continuous into the Glenair prospect. These are similar in expression to those at Glenair viz. fractures filled by tourmaline and/or quartz-tourmaline veining + breccia textures. In granite these fractures are characterised by green tourmaline, tourmalinised granite selvages and associated greisenisation.

Two occurrences of tourmalinite indicate the concentration of tourmaline and quartz in apical positions of recently exposed granite. Minor cassiterite mineralisation occurs in narrow siliceous and greisenised fractures within the tourmalinite.

Forty-four stream sediment geochemical samples collected from tributaries of the St. Pauls River returned 2 anomalous Sn values. Follow-up work located weakly greisenised granite confined to narrow fracture systems. While up to 0.67% Sn as cassiterite is associated with the greisenisation, its limited occurrence indicated further work was not warranted in the areas.

The district's fracture systems do not contain significant cassiterite mineralisation. Visible sulphide is absent.

ii) CONCLUSIONS

The St. Pauls District possesses a number of weak though persistent fracture-vein systems that are strongly east-west structurally controlled. These fracture-vein systems have served to channel the boron-silica metasomatism and greisenisation within the granite and overlying sediments. Cassiterite mineralisation is associated with these alterations.

At Glenair prospect one of the five recognised fracture-vein systems contains cassiterite in narrow quartz sheeted veins. Best result is 0.38% Sn across one metre in the veining. The narrow width of the system coupled with lack of strike extension indicates the mineralisation to be areally limited and lacking in economic potential.

At the Dyke Lode prospect the two lodes contain sample values up to 0.52% Sn. Greisenised granodiorite between the lodes contains much lower tin values. Thus, the prospect has little potential for a low grade - large tonnage mining operation.

Assessment of the Exploration Licence outside the prospect areas indicates that the current economic potential for tin is low.

On the basis of the above conclusions it is recommended that Amax withdraw from exploration of E.L. 7/78.

1. INTRODUCTION

In March, 1983 Amax Australia (Operations) Pty. Limited entered into a joint venture agreement with Cornwall Coal Company N.L., title holders of E.L. No. 7/78.

The terms of the agreement committed Amax to an expenditure of \$20,000 over an initial three month period, at the end of which time Amax would have the option to withdraw from the agreement. Total expenditure of \$280,000 at the end of a two year period would earn Amax a 51% interest in the licence.

Amax was approached by Cornwall Coal in mid 1982 with a view to joint venturing its interest in E.L. No. 7/78 which covers the main portion of St. Pauls tin field.

Initial visits by Amax personnel, R.J. Yeates and A.I.A. Stewart in August, 1982 indicated that several prospects could hold good potential for cassiterite mineralisation of a sufficient grade and size to be of interest to Amax. These were the quartz-cassiterite sheeted veins at the Glenair prospect and the greisenous lodes at the Dyke Lode prospect.

The major thrust of the proposed work programme was to test the strength and extent of cassiterite mineralisation at both prospects by means of detailed geological mapping, costeaning, rock chip and soil auger geochemistry.

An ancillary concern was to prospect the sedimentary rocks east of Glenair to Royal George for possible leakage

1. (Cont)

mineralisation indicative of shallowly intruded granite cupolas and associated sheeted vein and/or greisen tin mineralisation. A reconnaissance programme incorporating stream sediment and rock chip geochemistry, joint and fracture analysis was proposed for this latter area.

1.1 Location and Access

The Licence area comprising about 121sq.km. is approximately located at longitude 147⁰44' east and 41⁰49' south and is situated 15kms east of the township of Avoca, N.E. Tasmania. Avoca is accessed via the Midland and Esk Highways and lies some 80kms south-east of Launceston.

The area of interest within the Exploration Licence is confined to the St. Pauls River Valley which is serviced by a sealed road from Avoca. Fenceline and forestry tracks provide good access through the Exploration Licence.

1.2 Climate, Vegetation, Physiography

In common with most of eastern Tasmania, the St. Pauls District enjoys a temperate climate which enables field work to be carried out throughout most of the year. The summer months extend from November to March with mean temperature rising to 20⁰C in January from a low of 10⁰C during the winter months.

1.2 (Cont)

Average annual rainfall is approximately 490mm and is fairly evenly distributed throughout the year, though July-August are the wettest months, recording a mean of 95mm for the two months.

Within the district, landform is dominated by rugged topography developed on erosion resistant Jurassic dolerite that caps the mountain ranges of the St. Pauls River Valley. These flat-topped ranges are peaked by Mt. St. Peter and St. Pauls Done (1027m a.s.l.) to the north of the river valley. The river has been entrenched along a line of faulting since Mesozoic time and was further widened by glacial action during the Pleistocene. Today, its alluvial flats and slopes have been largely cleared of the original vegetation and are turned over to cattle and sheep grazing. The vegetation of the flanking ranges is mainly sclerophyll or eucalypt forest, with small areas of dense forest confined to the gullies draining southward and northward into the St. Pauls River.

2. EXPLORATION AND MINING INDUSTRY

The St. Pauls tin field has been the centre of mining and exploration activity since 1828 when Jim Cowrie is reported to have found tin ore in the Brookstead area. If authentic, this report represents the first recorded occurrence of tin in Australasia. Serious attempts to exploit the tin potential of the field did not commence until 1891 when the greisen lodes on Mount Montgomery adjacent to Brookstead Creek were mined. Thirty-eight tonnes of concentrate were obtained from 1300 tonnes of ore material. The alluvial grounds of Brookstead Creek and nearby Baileys Marsh Creek were also sluiced. Records existing for Baileys Marsh Creek indicate over 8 tonnes of ore were produced from this creek. However, subsequent endeavours to prove up substantial tonnages failed and interest lapsed in the property.

The rich tin greisen lodes at the Royal George Mine were discovered at this time and were developed by open-cut and underground methods until the mine's closure in 1922 when economic reserves ran out. Between 1911 to 1922 approximately 170,000 tonnes of ore were produced at an average 0.65% Sn grade

During the period 1958 to 1970, Cornwall Coal, B.H.P. and the Mines Department, variously initiated diamond drilling programmes (totalling 16 holes) to test for tin grades at depth and along strike from the Royal George Mine. In 1979 C.R.A.E. took an interest in the area and, under a joint venture agreement with Cornwall Coal, completed in 1981 an exploration programme which comprised geophysical

traverses and a single drill hole at the Royal George Mine. On the basis of data obtained from the above, activity reserves are estimated at a maximum of 1.7 million tonnes @ 0.34% Sn. C.R.A.E. also considered that the Dyke Lode was one of the few prospects in the E.L. worthy of drilling.

3. REGIONAL GEOLOGY

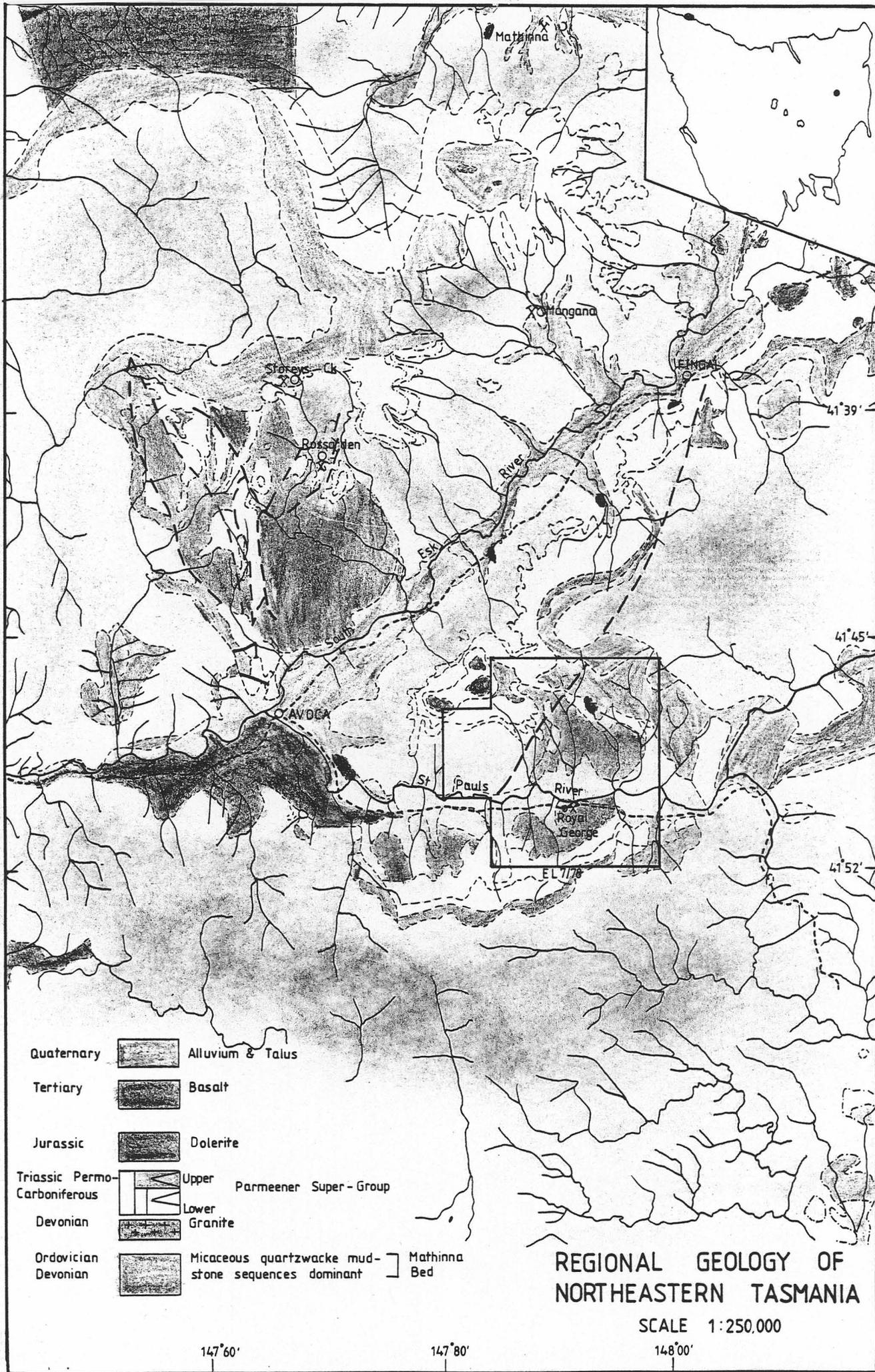
Over much of north-eastern Tasmania the Mathinna Beds, a monotonous succession of deep water quartz-wacke, argillaceous siltstone and minor slate of Siluro-Devonian age, forms the basement rocks in the region. Graded units and small scale slumping suggest a turbidity current origin for the coarser deposits. In the St. Pauls District the Mathinna Beds are exposed in a window in Permian to Jurassic sediments along the flanks of the St. Pauls River and have been intruded by Upper Devonian adamellite-granite which crops out in the Royal George and Storey Creek areas (Figure 1).

Both stocks are southern members of the Ben Lomond Batholith. Regional gravity suggests that the stocks form a single body below some 3km of sediment that infills the South Esk Valley near Avoca. (Leaman & Richardson, 1981).

Unconformably overlying sediments and adamellite-granite is a Permo-Carboniferous sequence comprising arkose, grit, sandstone and fossiliferous mudstone. Jurassic dolerite was intruded as sills and dykes into the Permo-Carboniferous sediments concurrent with an episode of major tensional faulting and now effectively forms the uppermost cover for most of the region. Extensive basalt flows during the Tertiary occurred in response to further tensional faulting. Only remnants now remain in the South Esk and St. Pauls Valleys. Surficial deposits of alluvium and dolerite scree constitute the deposits of the Quaternary.

5 cm

521015



REGIONAL GEOLOGY OF NORTHEASTERN TASMANIA

SCALE 1:250,000

FIGURE 1

4. PROSPECT EVALUATION

4.1 Glenair Prospect

4.1.1 Geology

The Glenair tin prospect is situated in the foothills north of the St. Pauls River, near Glenair Homestead. Though Mines Department records do not indicate any mining activity, a system of fissures is mapped in the prospect area in Geol. Survey Bulletin No. 40 (1929). From conversations with the local residents there appears to have been in the past a prominent outcrop carrying visible cassiterite at the site of the present costeans. This outcrop is no longer visible having been bulldozed during timber clearing for grazing purposes.

Interest in the prospect stemmed from the recognition of quartz-cassiterite sheeted veining in the bulldozed rubble and the location of quartz-tourmaline breccia areas immediately to the north west. Initial sampling of the sheeted veins and breccia rocks recorded up to 3.45% Sn and 0.26% Sn, respectively.

The prospect was mapped over a 600m x 600m area on a 1:500 scale across 50m grid lines. Outcrop is poor and is restricted to costeans

4.1.1 constructed during the present programme and to scattered areas of blocky sub-outcrop rubble and boulders. Rock types present are fine grained quartz-sandstones and interbedded argillaceous sandstone, siltstones and shales of the Mathinna Beds. Bedding within the prospect trends northwest and dips to the south.

Rock chip sampling and soil sampling over grid lines were employed to test the mineralisation within the prospect area. Relevant data is shown on Plates 1 - 4. Geochemical results are tabled in Appendices 1 - 3. Petrography of selected rocks are described in Appendix 5.

Vein-Fracture System

Five vein-fracture systems trend east-west across the property and are of narrow width and sporadic outcrop. Only one system (located at grid co-ordinate 1280N) can be traced more or less continuously through the prospect. Several of the fracture-vein systems though, appear persistent along strike extensions on a district scale. The vein-fracture systems are widely spaced, of the order of 200m apart, and vary in width from 0.3m to 2m.

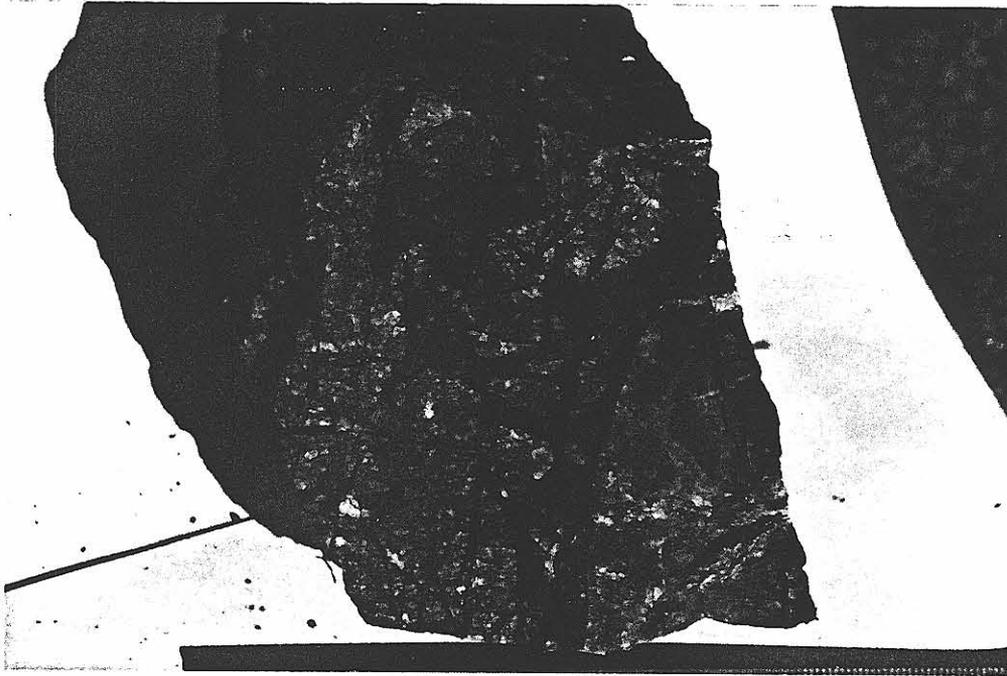
Vein-Fracture System (Cont)

Typically they are characterised variously by tourmalinised fractures, sheeted quartz veining, and by quartz-tourmaline veined and brecciated rock. Also characteristic is an increase in density of fractures 8cm - 14cm apart to 2cm - 4cm apart as the system is approached; reducing to less than 2cm apart within the fracture-vein system.

i) Fractures

The fractures are sub-parallel to anastomosing in form and are finely lined by black tourmaline. A variation on this occurs where tourmaline is absent and the rock is characterised by tight 'dry' fractures. Fractures are on average 2cm apart. Strong local fracturing can produce a weak 'dice' brecciation in which silicified angular blocks show only dilation displacement relative to adjoining fragments (Photograph 1).

This texture is the more common structural expression of the east-west fracture set and is usually a common component in the other types of vein-fracture systems within the prospect.



Photograph 1 - Hydraulic fracturing of earlier brecciated and sealed rock and introduction of tourmaline (rock width is 8cm)

ii) Quartz-Tourmaline Breccia Veins

The quartz-tourmaline breccia rock consists of large, angular, massive black tourmaline fragments cemented in a coarsely crystalline and vughy quartz matrix (Photograph 2). Elongate silicified wallrock fragments in a matrix of quartz and tourmaline can also be seen in some rocks (Photograph 3). The slab-like fragments illustrate brecciation to be structurally controlled by east-west fractures. Further examples of brecciation are shown in Photographs 4 and 5.

The brecciated rock is a light to dark grey sandstone which was initially silicified, fractured and veined by tourmaline. The tourmalinised fractures and veins, formed in the stages prior to the main episode of brecciation, were then fragmented and infilled by quartz. A silica veining phase which was largely devoid of associated tourmaline then followed (Photograph 6).

The operative process is probably one of hydraulic rupture of the sediments by boron-rich fluid in much the same manner as described by Allman-Ward et al (1982). The texture in Photograph 3 may indeed

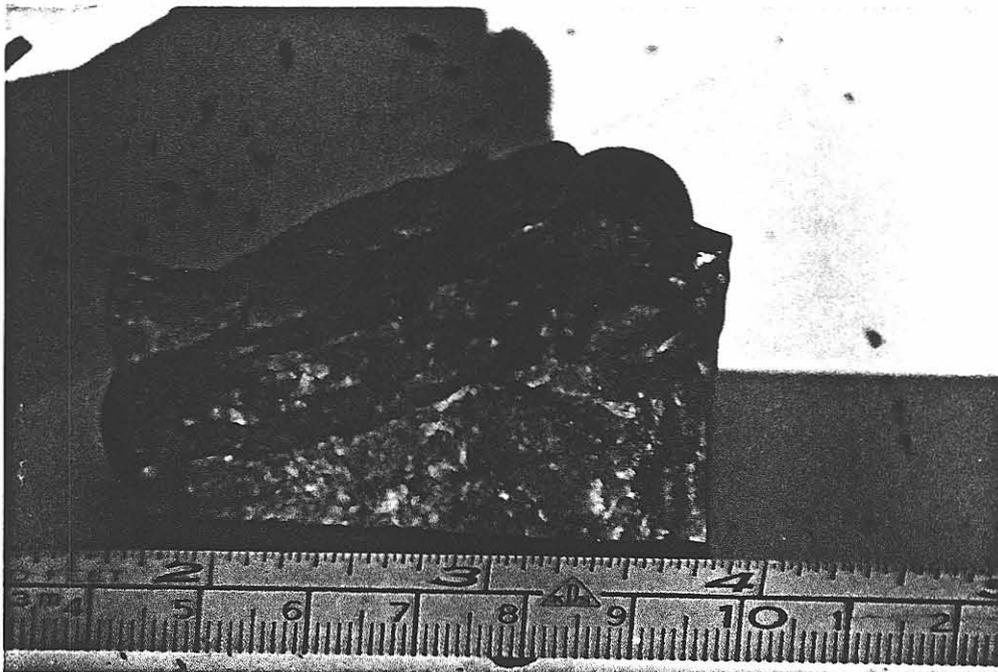
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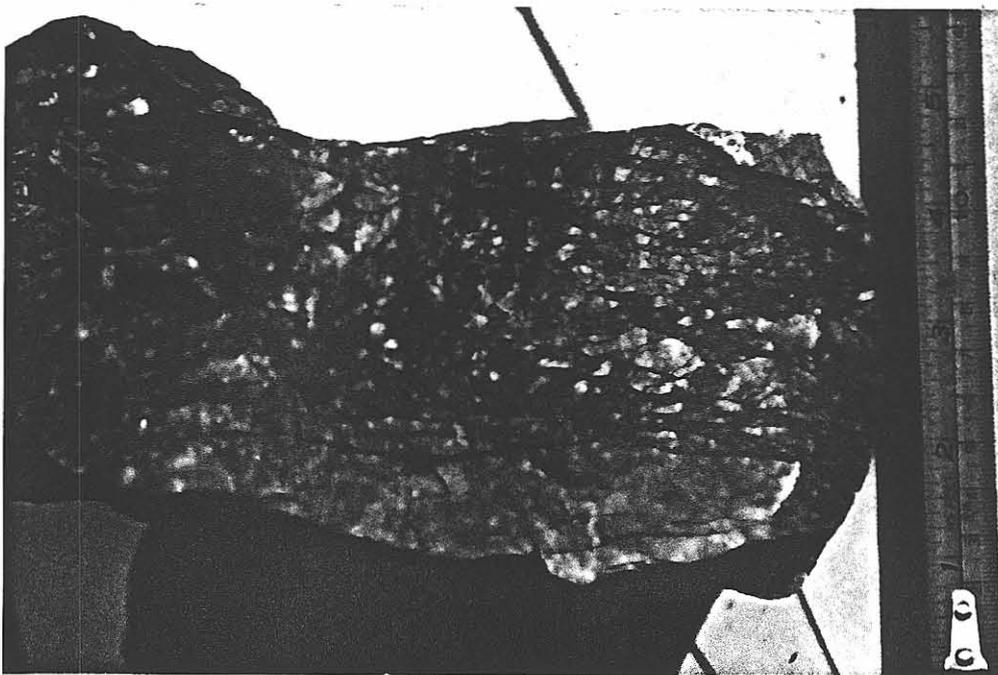
Photograph 2 - Massive black tourmaline fragments cemented by coarse crystalline and vuggy quartz (scale at bottom of photograph is in inches)



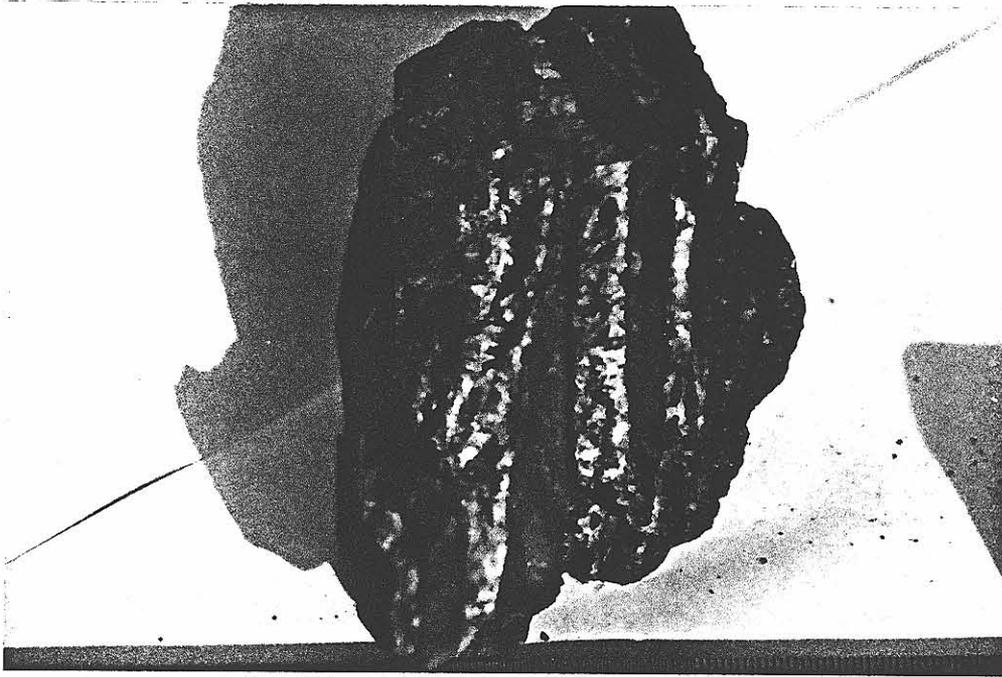
Photograph 3 - Quartz tourmaline vein breccia rock showing slabbing along parallel fractures by a matrix of comminuted quartz and tourmaline aggregate, and brecciation and infilling by vuggy quartz. The host rock is silicified



Photograph 4 - Quartz tourmaline vein breccia with silicified fragments cemented by a matrix of tourmaline and comminuted silicified fragments



Photograph 5 - Intense parallel fracturing and introduction of tourmaline to produce well broken texture and slivers of wall rock in the matrix



Photograph 6 - Open space textures shown by quartz which has infilled fractures devoid of tourmaline but for thin selvages on the margins of the quartz veins (width of central vein is about 1.5cm)

ii) (Cont)

suggest there was a stage of precipitation and growth of quartz and tourmaline which broke away slab-like fragments prior to the introduction of quartz.

Two areas of quartz-tourmaline breccia rock at grid locations 740E/1130N and 685E/1345N (Plate 1) occur in the prospect area, both west of Glenair Creek. Both comprise float or sub-outcrop which directly derive from underlying rock. Within the limits of outcrop exposure maximum widths of the breccia veins are estimated between 0.3m - 0.6m. The breccia veins are not persistent along strike and usually narrow into systems of anastomosing tourmaline filled fractures.

However, outcrop at 1180E/1240N lying eastward along strike from locality 740E/1130N may be part of the same fracture system. Here small scale breccia textures are dominant. Heavily tourmaline-spotted, well cleaved argillaceous sandstone and hornfelsic blocky rock fragments are commonly well fractured and lined by tourmaline. Fractures are 8cm - 12cm apart.

ii) (Cont)

Adjacent to this location are small areas of abundant white quartz scree perhaps belonging to the same fracture system. The quartz is opaque, irregularly fractured and usually coarsely crystalline. A few fragments show terminated quartz crystals between 5mm to 4cm long occupying vughs. Quartz veins are 1cm - 2cm wide. It is most likely that the size of the areas of quartz float are disproportionate to the possible in situ extent of quartz veining, a result of the well fractured nature of the rock.

Rock chip sampling of the above rock types did not indicate significant cassiterite mineralisation.

iii) Quartz Vein System

A vein-fracture system at grid location 1049E/1280N comprises 7 tourmaline-lined quartz veins over a width of 60cm. The 2cm wide white opaque quartz occurs in a pinkish-white saccharoidal silicified sandstone. Margins with the sandstone are sharp but irregular and some of the veins are cross-cutting in form.

iii) (Cont)

Orientation of the veins is 070° strike and dip 70° N. Tourmaline joint planes are noticeably absent in the more silicified parts of the sandstone.

The fracture system can be traced sporadically westward along a strike line of 70° - 90° magnetic and is characterised variously by coarse vughy quartz vein float with associated minor brecciation textures along much of its exposure. At location 820E/1260N it occurs as irregular quartz veining hosted by a weakly silicified granular quartzite in which tourmaline is notably absent. Average vein width is 2cm and vein density is 20% (6 veins/60cm).

iv) Quartz-Cassiterite Sheeted Veins

Quartz-cassiterite sheeted veins are exposed in the costeans and represent one of the five vein-fracture systems recognised on the property. Rock chip sampling over one metre intervals indicates the sheeted veins to average 0.28% Sn over a 2m sample width and extend for 18m across two costeans, but

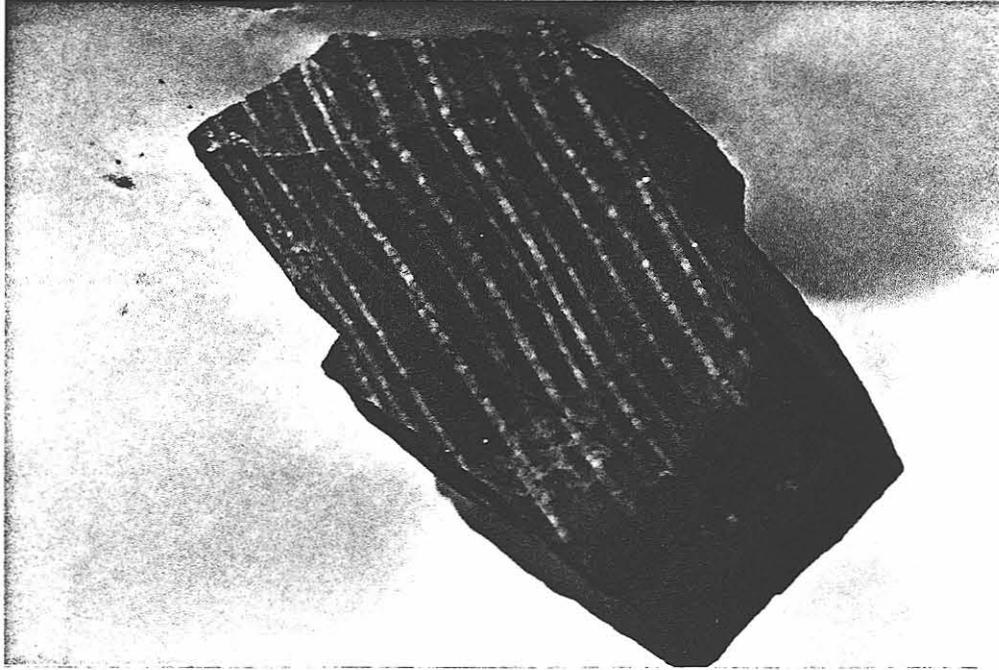
iv) (Cont)

they are not exposed in the western-most third costean. Details of the geology are shown in Costean Plan No. 1. Geochemical results are tabulated in Appendix 3.

The sheeted veins occur over a 0.5m width in silicified quartz sandstone. Strike is 087° magnetic and dip is vertical. The sandstone is veined with numerous quartz veinlets ranging to 3mm wide and regularly spaced at 3mm to 10mm spacings with an average around 6mm (Photograph 7).

Cassiterite grains constitute up to 50% of individual sheeted veins and have an upper grainsize limit of 1.5mm diameter. In Costean No. 1 the veining gives at best a grade of 0.38% Sn over 1m and in Costean No. 2, 0.28% Sn over 2m (Photograph 8).

Host rock is a light buff-grey, massive quartz sandstone which weathers to a buff-brown rock in which foliation is prominent. Silicification of the sandstone is noticeable to approximately 5m from the sheeted veins and produces a hard, massive quartzite. Scarce quartz veinlets ($\leq 1\text{mm}$) traverse this



Photograph 7 - Sheeted cassiterite-bearing quartz veins cut by later stage non-mineralised veins. The dark grey colour is imparted by tourmaline diffused through the matrix of the quartz sandstone. (Vein width is average 3mm)



Photograph 8 - Cut specimen showing coarse cassiterite grains occupying the full width of tear fractures in silicified quartz sandstone. The proportion of cassiterite to vein quartz is high. Dark colouration and spotting is tourmaline. Fracture cavity in lower middle rock is infilled by post-mineralisation quartz. Width of specimen is approximately 15cm

- 25 -

iv) (Cont)

rock; and nearer the sheeted veins a change in colour from mid-grey to dark grey follows the increase in tourmaline present in the matrix of the rock.

Along the eastern border of the sheeted veining, and extending over its 18m exposure, an irregular vein of finely felted green black tourmaline and a mass of vitreous, translucent grey white quartz occurs. Both tourmaline and quartz are cut obliquely by numerous unmineralised quartz veinlets 1mm wide striking $N38^{\circ}E$ and dipping vertically. Approximately 41 veinlets were measured over a 22cm interval width. They persist westward as minute hair fractures containing fine tourmaline flakes. These oblique orientated veins and fractures may be contemporaneous with the main sheeted veining though this relationship is uncertain.

No brecciation textures are associated with the quartz-cassiterite sheeted veins.

A similar occurrence of sheeted veining suboutcrops at 1040E/850N over a 5m

iv) (Cont)

diameter rubble area. It consists of dark grey-black tourmalinised and silicified sandstone cut either by irregular quartz veining or, more dominantly, by subparallel white quartz veinlets (≤ 3 mm wide) to produce a 'ribbon' textured rock. Cassiterite is present within the quartz veins as 1mm grains. Rock chip sampling of the ribbon rock returned 1.95% and 1.45% Sn and anomalous tungsten (55 and 35ppm W). Width of the veining zone is less than one metre.

Tourmaline lined joints or fractures cut perpendicularly across the veins and are on average 5mm apart. Breccia and slabbing textures are present though not common. Adjacent to the veining there are spotted tourmalinised argillaceous sediments characterised by jointing 5cm - 8cm apart. The sheeted veining could not be traced along its projected strike extension out of the known occurrence.

4.1.2 Alteration

Tourmaline is ubiquitous in the Glenair prospect as fracture and joint plane linings

4.1.2 (Cont)

and as 1mm - 2mm wide spottings within the sediments. In closely tourmalinised fractured rock (ie. ≤ 2 cm spacings), tourmaline commonly pervades the inter-fracture area as large 'leopard' spottings to 5mm in diameter (Photograph 9).

While petrographical work was unable to identify the precise nature of the spotting, and though it was suggested that tourmaline growth appears to be contemporaneous with thermal metamorphism, rock textures do suggest that at least some of the spotting is post-thermal and related to metasomatism.

Tourmaline is associated with fractured and brecciated sediments and as well has a close spatial relationship to quartz-cassiterite sheeted veining as previously described. In the more argillaceous sediments tourmaline can be seen to have selectively replaced argillaceous laminae thereby accentuating primary bedding planes to display black wavy lineations and microfold features (Photograph 10).

Some rock specimens also show tourmaline to have splayed of, and propagated into, the laminae from fractures. All the above textures would suggest that a post-thermal metasomatic event was operative and



Photograph 9 - Intensely tourmalinised rock with tourmaline spots (3mm - 5mm wide) distributed throughout the rock fabric to give the characteristic "leopard" spotting



Photograph 10 - Selective replacement of argillaceous laminae by tourmaline has delineated bedding plane structures. Lighter laminae are silica-rich

4.1.2 (Cont)

introduced material from an external source. The lack of alteration assemblages further suggests that tourmaline was perhaps passively introduced and mechanical, not chemical processes, were dominant.

An attempt was made to map the distribution of alteration parameters such as, tourmaline spotting size, tourmaline related colouration and silicification. Lack of exposure did not permit anything but the general observation that there is a greater tourmaline and silica content adjacent to the vein-fracture system and it is more abundantly associated with the breccia veins than with the fractures.

Adjacent to quartz-tourmaline breccia veins, silicification produces a hard, dense, vitreous rock that extends perhaps 5m - 10m around the system. Colouration of this rock by disseminated tourmaline produces a typically dark grey-black rock. Tourmalinised fractures and multiple quartz-tourmaline veins on the other hand may be bordered by a silica selvedge up to 10mm wide.

4.1.3 Structure

The Mathinna Beds in the district are folded along a northwest axis which is orientated in a 325° - 337° direction and dips between 42° - 65° to the southwest. Post thermal metamorphism quartz veins, barren in tourmaline, parallel the primary bedding.

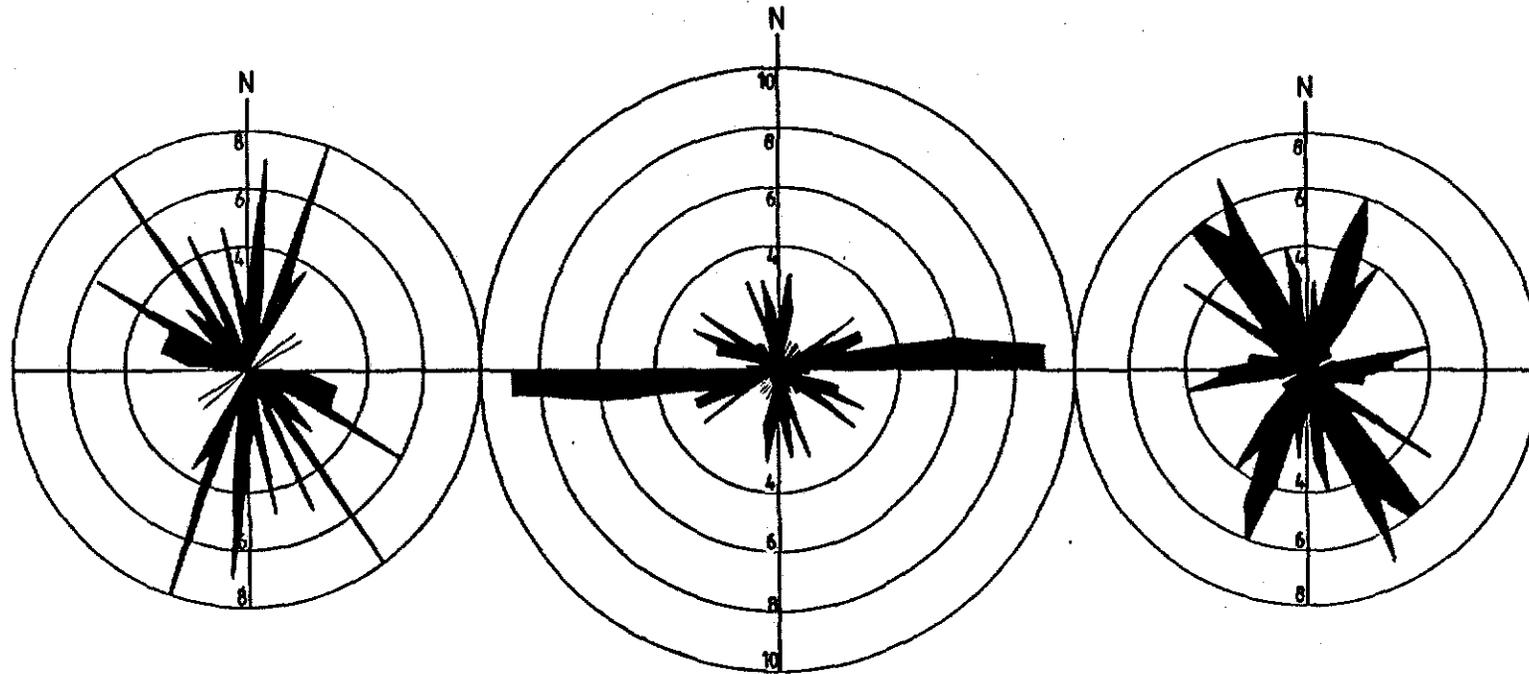
Foliation was produced during a regional metamorphic event and is orientated normal to the primary layering. Its characteristics accord with axial plane structures and are best expressed in the more argillaceous sediments as a weakly developed cleavage.

Measurements taken of structure sets in Glenair prospect and district are presented in rose diagrams shown in Figure 2.

The strong EW structural component is clearly associated with the tourmalinised fracture-vein systems present within the sediments (Figure 2(b) and (c)).

Foliation and primary layering features are represented by the NNW structure set (Figure 2(c)).

Granite is characterised by a number of joint sets, the stronger of which are



a) GRANITE JOINTS

85 Measurements
5° Azimuth Intervals
4, 6, 8, Frequency Intervals

b) GLENAIR SEDIMENTS - STRUCTURES

85 Measurements
5° Azimuth Intervals
4, 6, 8, 10, Frequency Intervals

c) DISTRICT SEDIMENTS - STRUCTURES

100 Measurements
5° Azimuth Intervals
4, 6, 8, Frequency Intervals

STRUCTURAL DIAGRAMS
GLENAIR AND DISTRICT

FIGURE 2

4.1.3 (Cont)

orientated NE, SW and SSE (Figure 2(a)). These sets are represented in Glenair and district sediments and support the view that granite underlies the sediments.

4.1.4 Mineralisation

Cassiterite mineralisation is associated with the sheeted veining recognised at Glenair. It is characterised by cassiterite distributed through sheeted quartz veinlets which range up to 3mm in width and are regularly spaced at 3mm to 10mm spacings.

The cassiterite is amber-brown and occurs as euhedral to subhedral aggregates or as individual grains up to 1.5mm. Distribution of cassiterite is variable within the quartz veinlets. Some veinlets have in excess of 50% cassiterite. While the bulk of the cassiterite is within the vein some fine-grained cassiterite occurs disseminated in host rock adjacent to the vein.

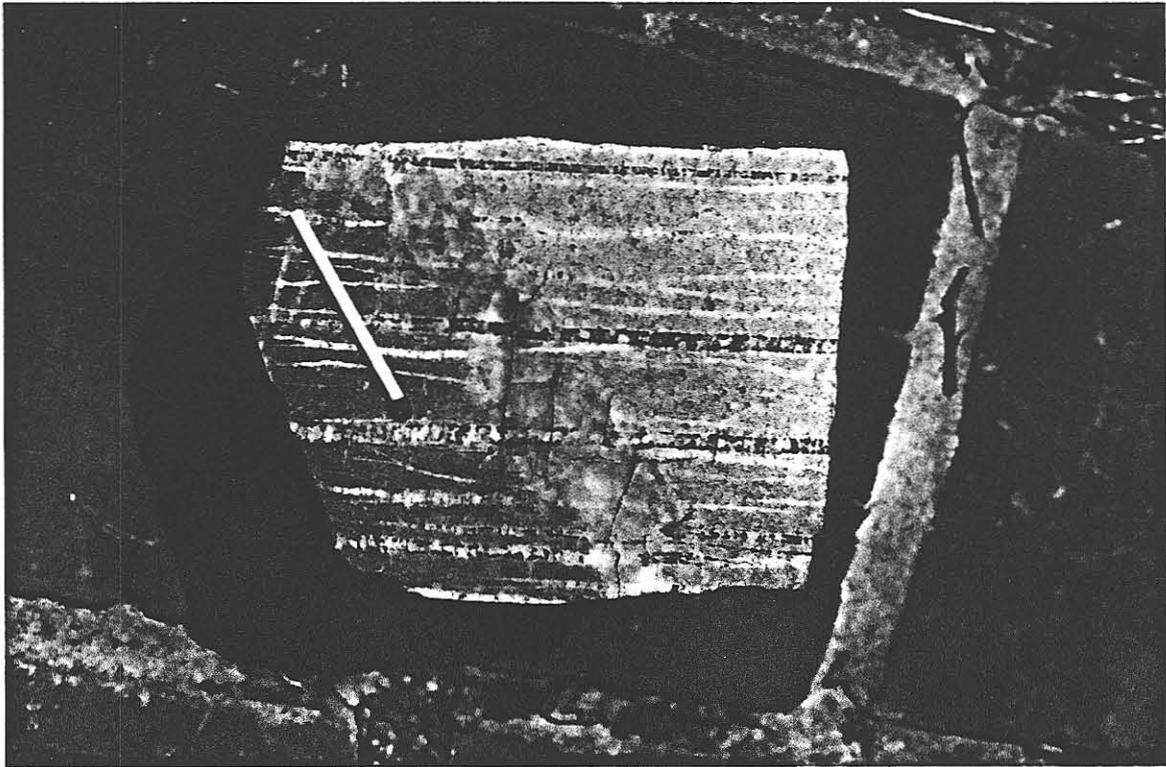
In addition there appears to be a correlation of grain size to vein width with the coarser cassiterite occurring in the widest veins, and being typically of uniform grain size within each vein size.

4.1.4 (Cont)

Two generations of quartz veins are evident:

- i) First generation - Pre-mineralisation veining of barren quartz generally about 1cm wide, which occurs at a low angle to the rock foliation and,
- ii) Second generation - Quartz veining which constitutes a sheeted vein system that cuts at a high angle and displaces the first generation veining. Two episodes of sheeted veining occur - mineralised veins and non-mineralised veins; both are parallel to each other and the latter usually occurs as vughy quartz infillings and overgrowths on terminated quartz-crystals of the mineralised veins (Photographs 8 and 11). Some muscovite is associated with the later episode as fine flakes lining the quartz veining.

Tourmaline is common and whilst concentrated in and close to sheet veins, it also occurs through the adjacent rock matrix. This distribution would suggest that tourmaline and cassiterite formation are closely related but that boron has had a greater diffusive mobility, penetrating further into the rock matrix.



Photograph 11 - Sheeted veining cutting and breaking first generation 1cm barren quartz veins. The cassiterite grains are intimately grown with elongate sutured vein quartz to form mineralised veins

4.1.4 (Cont)

Minor opaque oxide is dusted throughout the matrix along with occasional grains of zircon and apatite. Occasional topaz grains are present. No macroscopic sulphide accompanies the cassiterite.

4.1.5 Soil Geochemistry

One hundred and nine soil geochemical samples were taken at the Glenair prospect predominantly at 25m centres on 50m spaced grid lines. The exception to this was along two lines which bound the costeamed sheeted veins, where sampling was closed down to 12.5m centres. Samples were assayed for Sn, F, Cu, Zn and plotted on element contour maps (Plates 2, 3, 4).

Sn Distribution

The costeamed sheeted veins are distinctly defined by Sn geochemistry. Contoured Sn values form a strike-elongate area that lies over the sheeted veins and broadens out downslope. This latter feature is a secondary dispersion pattern controlled by a slight gully running west into Glenair Creek. All quartz-cassiterite sheeted veining exposed in the costeams lies within the

Sn Distribution (Cont)

» 150ppm Sn contour; suggesting that the mineralised veining does not extend along strike outside the costeans.

Two other areas of elevated Sn values delineated by the soil geochemistry (at 975E/1000N and 950-1000E/950N) were followed-up by rock chip sampling.

The first area returned low Sn values (average 33ppm Sn) from a tourmalinised silicified argillaceous sandstone undistinguished by any veining or visible mineralisation. On the basis of this evidence it was not resampled.

The second area is characterised by silicified, tourmalinised and well jointed grey sandstone intruded by impersistent, irregular and weak quartz veining. Width of veining is less than 1m and strikes east-west. Composite rock chip samples assayed 840ppm Sn, 1500ppm F, 30ppm Cu, 5ppm Pb, 85ppm Zn, 15ppm W, 170ppm As. Sn, Zn, W and As values are anomalous. These values identify a single weakly mineralised quartz-filled fracture extending over only a 50cm outcrop strike length.

Apart from individual spot highs no other elevated Sn areas are apparent in the Glenair property.

F Distribution

Fluorine values are elevated in two areas. One area is located approximately 100m to the south of the costeanned are and is defined by the ≥ 500 ppm F contour line centred on a weakly Sn anomalous area (≥ 130 ppm Sn contour line) and overlaps to some extent the sheeted veins to the north. Outcrop exposure in this area is poor but in general consists of tourmaline-mottled dark grey argillaceous sandstones.

The second area, situated about 350m NW of the costeans shows F values ≥ 500 ppm over 75m of grid-line. This anomalous area is coincident with sub-outcrop consisting of intensely tourmalinised argillaceous sandstones. No anomalous Sn values occur here.

The reason for fluorine concentration in these areas is not clear, but probably reflects the presence of topaz and/or apatite in the sediment.

Cu, Zn Distribution

All significant Cu, Zn values are located adjacent and to the southeast of the costeanned area and lie within a broad zone defined by the ≥ 50 ppm Zn contour.

Cu, Zn Distribution (Cont)

Copper values (≥ 20 ppm) show good coincidence with the Zn values.

Both Cu and Zn values show no correlation with the tin mineralised veins exposed in the costeans. There is, however, some coincidence of elevated Zn values and elevated Sn values approximately 75m to the south of the costeans. As petrological work has indicated that sulphides are absent from sandstones, it is suspected that the Cu zonation, and perhaps that of Zn, reflects the geochemistry of scattered dolerite float found in this part of the prospect area.

4.2 Dyke Lode Prospect

4.2.1 Geology and Mineralisation

The Dyke Lode tin prospect covers an area of outcrop on the low hills west of Lea Creek. Access is through Royslea Homestead. It is cursorily described in Geol. Survey Bulletin No. 40 (1929) as containing "tin ore and more tourmaline". Evidence of former mining activity comprise a collapsed shaft, an ore trench, a shallow costean excavated by B.H.P. in 1958, and a few pits.

4.2.1 (Cont)

The work programme for the prospect comprised gridding, mapping, rock chip sampling, costeaning to expose the northern lode, and a single bedrock auger geochemical traverse orientated across the strike line of the known lodes.

The purpose of the above programme was to confirm C.R.A.E.'s sampling of one of the exposed lodes, which was indicated to contain between 0.33% Sn and 0.5% Sn; to expose and sample the northern lode, and to test the extensive greisenised area between and surrounding the lodes for possible economic tin mineralisation.

A superficial cover of coarse granular white quartz sand overlies much of the area and is derived from in situ weathering of greisenised porphyritic granodiorite. Outcrop is poor and mapping and rock chip sampling was confined to mine dump material, a few scattered outcrops and a low outcropping ridge line.

Two siliceous lodes trend 279° and 288° magnetic and are 65m apart. Dip is steep to the south. Maximum width of the lodes is approximately one metre. The lodes consist of quartz veins in a silicified greisenised quartz porphyry containing

- 40 -

4.2.1 (Cont)

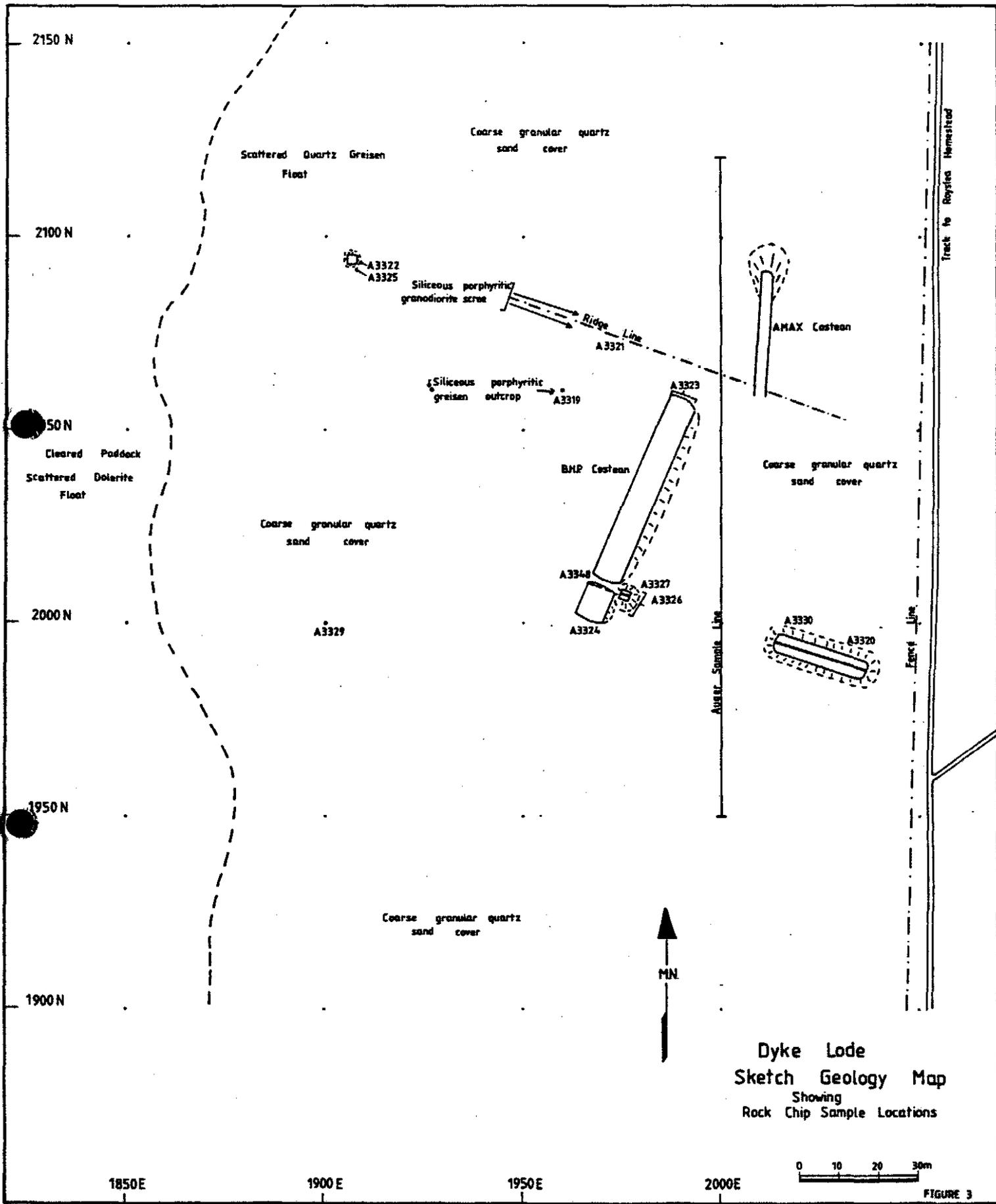
rossettes of green and black tourmaline (Figure 3).

The quartz greisen is cut by minor dog-tooth quartz veining in which single amber to dark brown cassiterite grains occur towards the centre of one of the veins.

Quartz greisen lies between the lodes and is extensive throughout the mine area. Rock float indicates that a mica greisen variety is also present. B.H.P. evidently costeamed between the lodes to test the tin content of the greisen. Results are unknown.

The southern lode or Dyke Lode proper has been opened up by a trench and a shaft over a length of 68m. The northern lode is apparently unmineralised as evidenced by the lack of workings put down on it and follows a low ridge line some 105m in length. Weak unmineralised quartz veining is prominent adjacent to the ridge line in more than one locality.

On the northern lode a single 27m long costean was excavated to expose it and the greisenised area adjacent to it (Plan 2). The costean was mapped on a 1:100 scale and rock chip sampled at 2m intervals.



Dyke Lode
 Sketch Geology Map
 Showing
 Rock Chip Sample Locations

FIGURE 3

4.2.1 (Cont)

The geology consists of a granodiorite with coarse feldspar and embayed quartz phenocrysts. The granodiorite is extensively silicified and greisenised. The greisen is irregularly distributed throughout the rock and consists of a quartz-mica-tourmaline assemblage; nowhere is quartz-mica greisen strongly developed. Tourmaline clots: nodules composed of tourmaline kernels and quartz veins (< 2mm wide), are weakly developed in the porphyritic greisen. Topaz as white dull broken grains accompanies the quartz veining and is difficult to distinguish from the surrounding quartz which has similar physical properties. However, the geochemical results indicate that it is fairly abundant throughout the siliceous greisen (Plan 2).

Silicification is most intense approximately 16m from the lode where veining is strongest, at a density of 5 veins/10cm (an average of 3cm apart). The silicified rock appears as a glassy, waxy rock to which disseminated tourmaline imparts a dark-grey hue. Occasional open space textures and vugs lined with chalcedonic quartz are present. The lode itself is a highly silicified porphyritic rock with a hornfelsic texture. It averages 1.40m wide and contains no visible cassiterite mineralisation.

4.2.2 Geochemistry

Northern Lode

The costean rock chip results show an increase in Sn values towards the lode (from 140ppm to 970ppm Sn). The highest value, and only significant value, is 5250ppm taken across 2m of the quartz lode exposure.

All other sample values are less than 970ppm Sn. High fluorine values (1% - 2%) are recorded for 8 samples, and the highest value (2.00%) is associated with the lode. Cu, As, Pb and Zn values appear to decrease towards the lode. The bismuth trend is unclear, but is noticeably reduced in value as the fluorine values increase.

A definite geochemical relationship between tin and fluorine is apparent and is associated with the development of silicification in the area of elevated Sn and F values.

4.2.2 (Cont)

Southern Lode

Results indicated the tenor of the southern lode to be of the order of 0.34% to 0.38% Sn. Tin values show a sharp decrease into the wall rock as exemplified by Sample No. A3324 (Appendix 4).

Inter-Lode Area

A grid line extending perpendicular to the strike line of the two lodes over 170m was auger sampled on 10m centres.

This line was designed to test the extent of fine mineralisation adjacent to the known lodes and the presence of any significant values in the widespread area of greisenisation between the lodes.

Samples were recovered from the 'C' horizon which is decomposed granodiorite, and assayed for Sn, F, Cu, Pb, Zn, Bi and As.

Tin and fluorine geochemistry show a good correlation to the mapped extensions of the northern and southern lodes. They are clearly defined by elevated values. The geochemical expression of the southern lode (1850ppm Sn) is stronger than the northern lode (730ppm).

4.2.2 (Cont)

Inter-Lode Area (Cont)

Between the lodes Sn values are an order of magnitude lower than the southern lode values and indicate that no significant tin mineralisation lies outside the two lodes.

Cu, Pb, Zn, Bi and As values do not appear to have any certain relation to tin mineralisation. Pb values, though, appear to be uniformly high in samples taken south of the southern lode.

4.2.3 Conclusion

The work programme has indicated that the better grades of tin mineralisation are confined to the two lodes at the Dyke Lode. These range in grade from 0.34% - 0.52% Sn over a maximum 2m width (in the Northern Lode).

Within the prospect area probable mineralised strike length is considered at these grades to be 75m for the Southern Lode and perhaps 110m for the Northern Lode. And while the ground between the lodes contains elevated values rock chip sampling of available suboutcrop supported by bedrock auger geochemistry indicates these values to be lower than the lode grades.

4.2.3 (Cont)

Therefore, the Dyke Lode prospect holds little economic potential for bulk mining operations.

5. DISTRICT EVALUATION

5.1 Introduction

A gravity survey conducted by Leaman and Richardson (1981) shows a lobe from a negative Bouguer anomaly extending west from Royal George over sediments bounded to the south and north-east by granite outcrop (Figure 4). This may suggest that much of the Siluro-Devonian sediments in the St. Pauls District may be shallowly underlain by granite.

Greisen associated cassiterite mineralisation at Royal George Mine is strongly structure controlled and occurs in granite which, at its present level of exposure, has had its sediment cover removed. However, it is interesting to speculate that expression of this mineralisation style in its original sediment cover may have taken the form of the structurally controlled quartz-cassiterite sheeted veining, such as at Glenair prospect.

The secondary emphasis of the exploration programme was thus to prospect the district sediments for possible leakage mineralisation and associated sheeted vein and/or greisen tin mineralisation derived from a shallowly intruded granite. This area was investigated by means of stream-sediment and rock chip sampling. Results of these investigations are the subject of following sections.



**GRAVITY SURVEY
of the
ST PAULS DISTRICT**



Residual Bouguer Anomaly

Contour interval 10 um/s^2
Terrain correction applied $r=19\text{ km}$
Density = 2.67 t/m^3

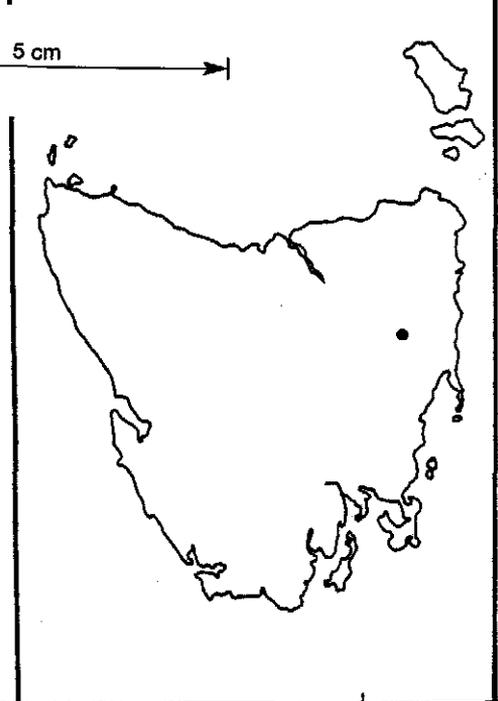
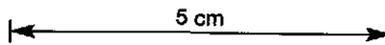
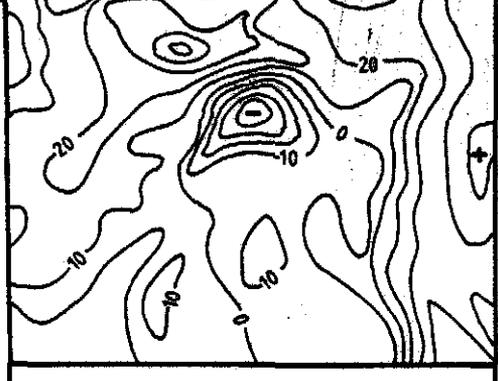
- + Absolute sign
- Relative sign

Sketch Geology

- Recent marsh deposits
- Recent miscellany gravel, alluvium, sand
- Pleistocene talus
- Tertiary sands, clays
- Tertiary basalt
- Jurassic dolerite
- Triassic undifferentiated (incl coal measures)
- Permian undifferentiated
- Devonian granite, adamellite, porphyry granodiorite (grd).
- Ordovician-Devonian undifferentiated

SOURCE

D.E. Leaman & R.G. Richardson, 1981
Gravity Survey of the East Coast Coalfields. G.S Bull 60



5.2 Geology and Mineralisation

Within this area additional quartz tourmaline fracture-vein systems trending east-west are located. Their lateral continuity is confused by poor outcrop, though two vein systems may be continuous into the Glenair prospect. (Refer to district geological map - Plate 5.) These systems display similar geological characteristics to Glenair viz. fractures filled by tourmaline and/or quartz veining + breccia textures in a silicified to tourmalinised fine grained sandstone. However, quartz sheeted veining is absent from the mapped area.

Composite rock chip samples taken from outcrop localities are shown in Plate 6 and results are presented in Appendix 7.

In general the fracture-vein systems are characterised by low Sn values (~ 30ppm - 90ppm Sn) with the best results of 1100ppm and 1050ppm Sn deriving from two localities. Follow-up geology indicated these systems to be narrow and apparently very limited in strike. No visible cassiterite or sulphide mineralisation accompanies these systems.

The old Blue Lode workings are located adjacent to Long Marsh Creek. They comprise a collapsed shaft and several 2m wide trenches orientated east-west at 200m intervals cutting across an elongate body of coarse grained to porphyritic granite. This body is 650m long by 30m - 100m wide. The lode is

5.2 (Cont)

central in a fissure and appears to be less than 0.5m wide.

The fissure is surrounded by lens-shaped bodies of hard, prominent blue-hued rock composed of quartz and tourmaline. It can be termed a tourmalinite. A range of textural variety occurs between a dark blue black rock composed mainly of tightly intergrown fine columnar tourmaline crystals to a light blue quartz rock flecked with prismatic tourmaline crystals. All geochemical results from sampled tourmalinite are uniformly low.

A similar tourmalinite occurs at the Blue Lode workings, on top of Montgomery Hill. Moreover, greisen is associated with the east-west striking lodes, and consists of mica, quartz and black and green tourmaline. Nearby to the north on a knoll there is a prominent outcrop of abundant massive white quartz. Tourmaline occurs as occasional blebs. Composite channel samples taken across the strike of the lodes gave only low Sn values.

Scattered granular greisen rock float is found over a small area to the immediate west of the Blue Lode. Alteration of the surrounding sediments is limited to tourmaline-spotting of the argillaceous sandstones and tourmaline lining of fractures in the more pure sandstone.

- 51 -

5.2 (Cont)

Approximately 500m north-west of the Blue Lode lies an extensive hill area of strongly hornfelsed sandstone. These are characterised by a fawn to orange-brown (weathered), medium-grained sandstone cut by numerous discontinuous, indistinctly margined and irregular white saccharoidal quartz veinlets up to 5mm width (eg. petrological specimen No. A3353). The veinlets also show weak orthogonal and cross-cutting relationships.

Similar rock is found north-east of the Blue Lode in the Salmon Creek area and occupies a prominent conical hill top and ridge line that runs south adjacent to the margin of the main granite body outcropping to the east. Strength of hornfelsing is variable, while some of the rocks retain their foliation, others are hornfelsed with or without apparent quartz veining. Red brown limonite stains fractures and joints and extends into the rock matrix. Permo-Carboniferous sediments directly overlie the Siluro-Devonian rocks here and it is not clear whether the staining represents a weathering effect developed on a palaeosurface, or is related to a hydrothermal event.

Both greisen and hornfels were rock chipped sampled. Assay results in all samples showed Sn values less than 260ppm Sn.

The contact between sediments and granite is marked by a narrow aplite zone perhaps 5m wide which grades

5.2 (Cont)

through a coarse grained granite characterised by a hypidiomorphic granular texture in which quartz crystals are equant and feldspar laths 2cm in size. Minor tourmaline commonly occurs in the matrix as clots or fine stubby crystal aggregates.

Outward from the granite, grey to dark grey (tourmalinised) siliceous fine grained sandstone is encountered, much fractured and lined by matted and fine crystals of black tourmaline. Tourmaline fractures are up to 2mm wide and spaced approximately 10cm apart on average. Dark grey selvages up to 1.5cm wide border the fractures. Quartz veining is not common. Hornfelsed sediments may overlie this rock in topographically high areas.

Fracture systems within the granite follow the same east-west orientation characteristic of the sediments. Strongly expressed fracture systems comprise tourmaline veins bordered by tourmalinised granite. Widths of the closer spaced fracture systems are less than a metre. Reddish brown muscovite flakes and associated vugs may overprint the tourmaline adjacent to the veins and fractures. No cassiterite is visible in the greisen though geochemistry indicates up to 1400ppm Sn and elevated F values are present (A3354 & A3355).

As is the case in Glenair prospect, intensity of mineralisation, fracturing and veining is variable along strike. This is graphically illustrated by

5.2 (Cont)

the Brookstead Mine Lodes which comprised a siliceous greisen (quartz - sericite - tourmaline - fluorite - cassiterite + sulphide) approximately 0.6m - 0.75m wide which passes rapidly into wispy tourmaline fractures along strike.

A number of differences between the expression of the fracture-vein systems in the granites with those in sediments are apparent. Tourmaline, in addition to being black, may be green in colour. Brecciation textures are not as prevalent in the granites, no doubt due to its physical nature and composition. Wispy tourmaline stringers are the more common expression and are weakly persistent through the granite often terminating at unaltered feldspar and quartz crystal margins, to recommence on the other side.

5.3 Reconnaissance Stream Sediment Geochemistry

5.3.1 The Survey

Forty-four stream sediment samples were collected from tributaries draining into the St. Pauls River. Sediment was not taken from creeks known to have been worked for its contained alluvial cassiterite. However, tributaries adjacent to Royal George and Dyke Lode mines were sampled so as to gain an appreciation of levels of

5.3.1 (Cont)

contamination to be expected in creeks draining known worked areas.

The following methodology was undertaken. Active sediment was collected in at least 12 increments along about 30m of drainage for each sample location in order to derive a representative sample. Each sample was then dried, sieved to -80 mesh and variably assayed for Sn, W, As, Cu, Pb, Zn, F. Results are plotted in Plates 8 and 9, and are tabulated in Appendix 6. Sample locations are shown in Plate 7.

5.3.2 Results

Statistical treatment of the data indicated a background of 60ppm Sn.

Samples taken from creeks known to be contaminated by mining activities range in value between 215ppm and 422ppm Sn. Base metal, arsenic values are variable; and all tungsten values are below the detection limit.

Four anomalous Sn stream sediment results were located in Salmon and Panel Marsh Creeks. These were samples Nos. A3357 - 220ppm, A3359 - 250ppm, A3362 - 170ppm Sn and

5.3.2 (Cont)

A3311 - 230ppm. No previous mining activities were known from these creeks and so the results were followed-up by check sampling and additional fill-in sampling at about 200m intervals upstream of the anomalous values.

Two of the initial anomalous results were not confirmed by subsequent resampling. Sampling method error may have been the cause in the case of sample A3357, and the elevated value for A3359 appears to have resulted from sampling of silt in pools at the foot of a waterfall, thereby concentrating tin particles.

The source for anomalous sample A3362 (170ppm Sn) was traced to the eastern hill side of E. Panel Marsh Creek. Here coarse grained granite suboutcrops and is capped along the ridge line by erosional remnants of Permo-Carboniferous sandstones.

Three shallow pits and a trench have been put down over 50m of strike on a fracture system orientated 081° magnetic.

The system comprises subvertical tourmaline fractures over a one metre outcrop exposure at a density of 4 fractures per 20cm width. Between the fractures the rock has been

5.3.2 (Cont)

altered to a coarse aggregate of white quartz and tourmaline in the proportion 40:60 by volume. The tourmaline is variably replaced by reddish brown fine muscovite which in the extreme has totally replaced the tourmaline to produce a quartz-mica greisen.

Geochemical results indicate that up to 0.67% Sn as cassiterite is associated with the greisenisation. (Samples A3438 - A3349, A3440 - A3442). The width of mineralisation is one metre or less. The fractures could not be traced further along strike.

The surrounding area was also carefully examined. Tourmaline fractures with silicified selvages form prominent ribs in granite outcrop. Spacing between the fractures is wide eg. 20cm spacing over a 15m exposure, and granite between fractures is unaltered.

Approximately 100m to the north near the crest of the ridge, another shallow trench has been excavated on a weak fissure system. Additionally, float characterised by vitreous quartz vein material and a (quartz - tourmaline - muscovite) greisen, indicate a further fracture system.

5.3.2 (Cont)

Results indicate cassiterite to be present but not in significant quantities (A3443 and A3444).

Sample No. A3311 result -230ppm Sn was confirmed by check sampling A3311A - 320ppm). These values were found to initiate from greisenised granite material located on the eastern side of East Salmon Creek.

Only scarce greisen float material was located on the hillside adjacent to the creek. In available outcrop, a number of tourmaline-bearing fracture systems separated by fresh granite are in evidence; and between individual fractures there is weak alteration to a quartz-tourmaline aggregate. No greisenisation was observed in outcrop though a few float fragments from one small area do show quartz-muscovite greisenisation. Rock chip sample results indicate that the greisen is weakly mineralised with cassiterite.

It is evident that the elevated stream sediment sample values resulted from the direct sampling of greisenised material shedding from a weak mineralised fracture system of no economic potential.

5.4 Discussion

The St. Pauls District possesses a number of weak semi-continuous tourmaline fracture systems that are strongly east-west structurally controlled.

Lack of outcrop exposure combined with the narrow average width (0.6m) makes an exact determination of the number of these systems within the district difficult.

It is clear from geological and mineralogical considerations that tourmaline occurs in a post-consolidation setting within the granite ie. tourmaline fractures post date the granite emplacement.

Clearly the tourmalinite at the Blue Lode and Black Lode areas represents a situation where a pre-existing phaneritic granite has suffered total replacement to a quartz-tourmaline assemblage. Both represent a situation of high concentration of tourmaline and silica in topographically high or apical positions within the original granite intrusive. The adjacent extensive area of thermally metamorphosed hornfels supports this hypothesis.

It is postulated that during the cooling history of the pluton, the magma finally cooled to allow the formation of tensile fractures in its roof zone and their propagation into overlying sediments. These subvertical fractures served to localise the

5.4 (Cont)

processes of quartz tourmaline and greisen alteration within the consolidated granite.

The more unreactive sediments responded to the influx of silica and boron-rich volatiles by hydraulic fracturing, tourmaline veining and by brecciation textures. These latter textures convey the impression that rapid crystallisation of the quartz tourmaline matrix froze in situ the dynamic processes.

A genetic model which would explain the above field relationship is derived from Allman-Ward (1982). According to this model and under suitable conditions of temperature and pressure, a rising magma body may develop a solid crystalline carapace that effectively seals the remaining magma and marks a halt in its upward intrusive movement.

Crystallisation and differentiation within the remaining magma beneath the carapace could separate out a volatile aqueous component which would rise and concentrate in the apical part of the cupola. A hydrous phase enriched in boron could coexist with the silicate melt at a temperature of 600°C within the roof zone. Tourmaline would result as a consequence of the silica boron metasomatism of the newly formed granite.

As cooling and crystallisation proceeds, volume increases and a stage would be reached within the

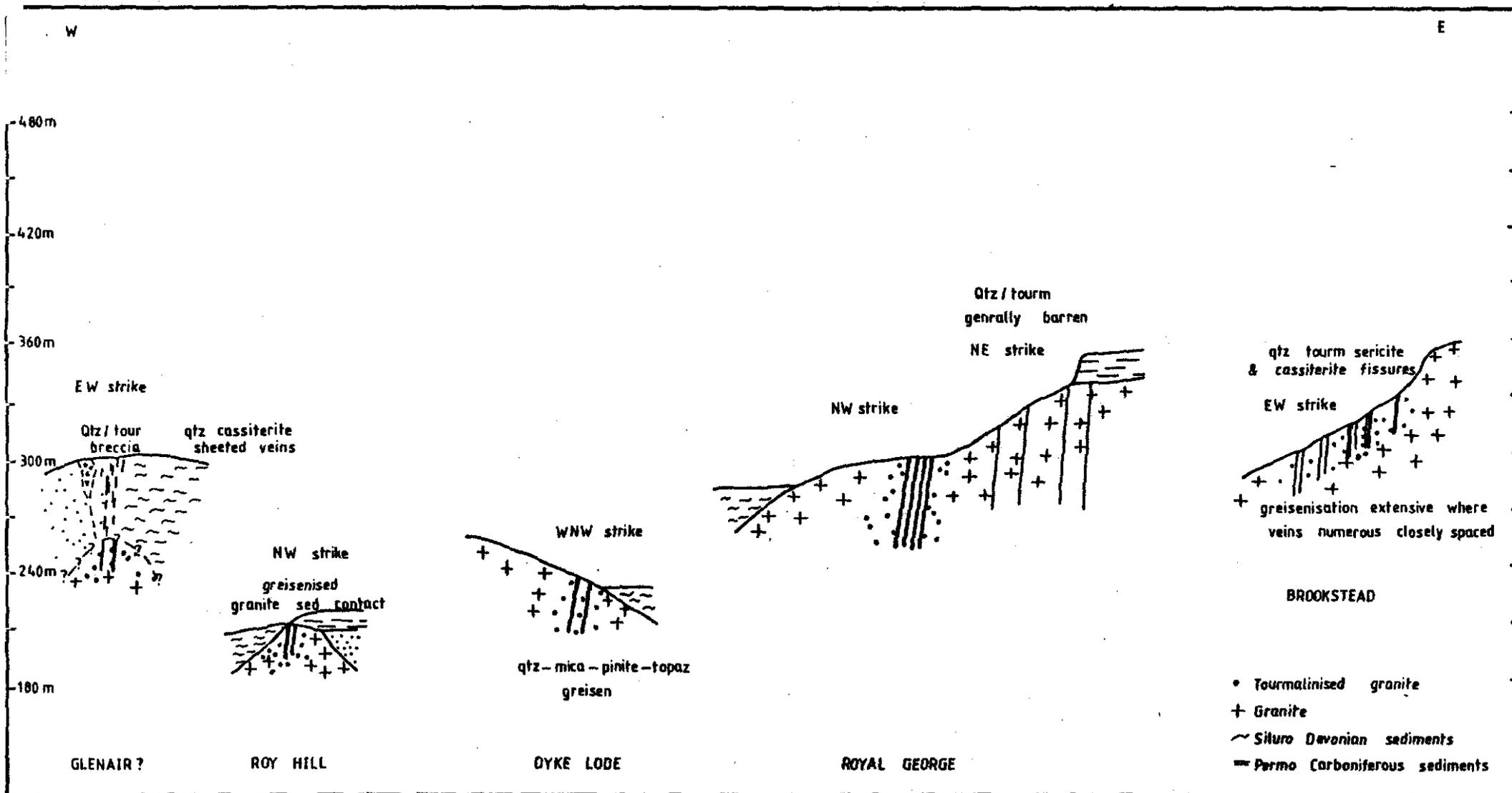
5.4 (Cont)

apical zone when internal hydraulic pressure would build up to a certain critical value where failure in the carapace and wall rock occurs; resulting in the creation of subvertical tensile fractures in the carapace and overlying sediments.

A portion of the hydrous fluid is released and internal pressure is relieved. It is during this latter period that metasomatism, greisenisation and mineralisation events occur localising cassiterite in structures both within granite and within the sediments. These points are synthesised in a hypothetical section for Glenair in Figure 5.

As a final comment, it appears that the Royal George Mine occurrence itself is perhaps unique in the area, not only as perceived from its previous grade and tonnage figures, but also because the NW structural control on mineralisation is not repeated elsewhere within the district.

This structure appears to act as a fundamental control on mineralisation. It is interesting to note that Blue Lode and the nearby extensive area of hornfelsisation lie along the projection of this structure and perhaps define a granitic ridge axis with which mineralisation is closely associated. It would also be interesting to speculate on the importance of this structure which on a regional scale passes into the Rossarden - Storeys Creek district.



MINERALISATION STYLES & LEVELS OF
EMPLACEMENT OF LODES ST PAULS DISTRICT

521065

5.4 (Cont)

The following conclusions are made.

Geological and structural considerations suggest that much of the district's sediments are shallowly intruded by granite. At Glenair prospect granite may be a little as 18m - 30m below the surface. The Blue Lode and Black Lode occurrences indicate that the large granite outcrop area in the east of the district has recently been unroofed.

Extensive boron and silica metasomatism has affected the apical parts of the granites. Cassiterite mineralisation is confined, with the exception of the Royal George Mine Lodes, to east-west fracture-vein systems and post-dates the metasomatism.

These systems are characterised by fractures filled by tourmaline and/or quartz-tourmaline veining + breccia textures in a silicified to tourmalinised sandstone. Within granite, breccia textures are not apparent and the fractures are characterised by green tourmaline, tourmalinised granite selvages and associated greisenisation.

Nowhere in the district is there any indication of extensive mineralisation either within the granite or sediments, nor areas of similar mineralisation such as at Glenair and Dyke Lode prospects.

6. EXPENDITURE STATEMENT

A total of \$28,013 was expended on the Exploration Licence covered by this report. A breakdown of the nature of this expenditure is given below:

PRELIMINARY SUMMARY OF EXPENDITURE
from 1.1.83 to 15.8.83

Legal Fees and Expenses	\$ 847
Publications, Maps, Reports	142
Contractors	1,069
Drafting Services & Supplies	82
Assaying and Analysis	4,704
Stationery & Office Supplies	13
Office Rent and Maintenance	511
Utilities	45
Telephone, Telex & Telegraph	720
Postage, Shipping & Freight	32
Field Materials	326
Travel incl. Lodgings & Meals	435
Camp Accommodation	57
Vehicles - Maintenance	812
Salaries incl. Fringe Costs	15,802
Office Overhead	<u>2,416</u>
TOTAL	<u>\$28,013</u>

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APPENDICES

APPENDIX 1

GLENAIR ROCK CHIP GEOCHEMISTRY

SAMPLE RECORD

1:250,000 Sheet Area OATLANDS

AMAX IRON ORE CORPORATION
(MINERALS EXPLORATION DIVISION)

White: Office
Yellow: Project Geologist
Green: Sampler

Property or Prospect ROYAL GEORGE GLENAIR

Date: 14 April 1983

Collected by: R. VIVIAN + D. ELLIS

Sample Batch No.

Analyses by: ANALABS

GLENAIR ROCK CHIP GEOCHEMISTRY

Analyses (ppm unless otherwise stated)

Sample No.	GLR	Description	Location	Analyses (ppm unless otherwise stated)					Comments
				Sn	F	W	As	Zn	
60E 1300N		moderately - strongly; finely tourmalinised & silicified sediment (outcrop); d. grey-black weak sugary qtz veins to 3mm some tourm. spotting & lamination in more argill. parts.	W. Glenair prospect	170	5100	10	42	100	
670E 1345N		D. grey silic. hornfels; well fractured with vughy qtz & tourm. veinlets; some strong tourm. glassy fragments o/c	W. Glenair	180	6200	25	18	60	
670E 1375N		D. grey to black strongly tourm. & mod. silic. sediment o/c; (tourm. on laminae as spottings)	W. Glenair	85	3600	x	18	65	
675E 1325N		D. grey tourmalinized finely laminated argill. sst. & tourm. spots to 2mm (tourm. weathered to mica flakes); rare X-cutting qtz.	W. Glenair	100	6500	x	21	90	
690E 1350N		Quartz/tourm. breccia with coarse crystalline qtz/ lining vughs which form the matrix in which massive tourm. clasts are set; also some intensely tourm. & silic. rock fragments	W. Glenair	1150	3800	x	6	25	
700E 1350N		D. grey siliceous hornfelsic sub-o/c, associated with Q/T brecciation dissem. tourm. through matrix & faint X-cutting qtz/tourm. veinlets ($\leq 2mm$)	W. Glenair	200	3000	45	8	30	
710E 1325N		Float; coarsely xrstline qtz as vugh linings in qtz/tourm. breccia rock, tourm. clasts black and felted	W. Glenair	250	3600	20	10	20	

521071

SAMPLE RECORD

1:250,000 Sheet Area OATLANDS

AMAX IRON ORE CORPORATION
(MINERALS EXPLORATION DIVISION)

ROYAL GEORGE GLENAIR

White: Office
Yellow: Project Geologist
Green: Sampler

Property or Prospect

Date: 14 April 1983

Collected by: D. ELLIS + R. VIVIAN

Sample Batch No.

Analyses by: ANALABS

GLENAIR ROCK CHIP GEOCHEMISTRY

Analyses (ppm unless otherwise stated)

Sample No.	Description	Location	Analyses (ppm unless otherwise stated)						Pb	Comments
			Sn	F	W	As	Zn	Cu		
770E 1400N	well fract. grey- white opaque qtz fragment; tourm. lines fractures; in highly altered (weathered?) tourmalinised seds.	W. Glenair	85	1700	15	300	85			
315E 1260N	numerous white fract. qtz veins & faint irregular sweat qtz veins in pinkish silic. & sugary sst. stringers of chlorite? occur in the some qtz veins		35	500	X	7	25			
370E 1045N	well cleared d. grey black rx highly tourmalinised o/c	W. Glenair	35	1000	X	18	105			
975E 1000N	gr silic. tourmalinised sst. with moderate qtz veining composite	Glenair	60	1900	X	30	65	15	X	
975E 975N	ditto	Glenair	840	1500	15	170	85	30	5	
034E 1139N	D. grey to black strongly tourm.; cleared sed. tourm. as disseminations. Float.	Glenair	70	4400	X	39	115			
040E 855N A	black silic. tourmalinised rock with irregular white qtz tear veinlets	S. Glenair	1.95%	4600	55	18	80			
040E 855N	high tourm; silic. black rock cut by sub-parallel white qtz veinlets (3mm wide) "ribbon rock" cassiterite grains (1mm) o/c	S. Glenair	1.45%	2900	35	6	45			
040E 1280N	Fine grained hornfels sed. o/c; d. grey; well jointed & tourm. on surfaces; & dissem. colourless to grey opaque qtz veinlets (3mm) & tourm. selvages with terminated qtz xystals; silic. of seds adjacent to veining	N. Glenair prospect	85	4200	20	18	50			

E21072

SAMPLE RECORD

OATLANDS

1:250,000 Sheet Area

AMAX IRON ORE CORPORATION
(MINERALS EXPLORATION DIVISION)

White: Office
Yellow: Project Geologist
Green: Sampler

Property or Prospect

ROYAL GEORGE - GLENAIR

Date: 10 December 1982

Collected by: R. YEATES, A. STEWART,
J.M. HAMMOND

Sample Batch No.

Analyses by: ANALABS

GLENAIR ROCK CHIP GEOCHEMISTRY

Analyses (ppm unless otherwise stated)

Sample No.	Description	Analyses (ppm unless otherwise stated)											Comments
		F Zn	Cu	Pb	Zn	Sn	W	Ag	Au	Hg	As		
GL.10	grab sample of spotted (contact metamorphosed) siltstone pinky-grey in colour	600	5	15	35	10	x	x	x	.070	3		
GL.11	grab sample of dark grey siltstone which weathers to a dark red-brown containing minor disseminations and fracture coatings of a quartz-sericite assemblage	1200	20	15	130	40	x	x	x	.025	14		
GL.12	grab sample of silicified and tourmalinised grey sandstone including numerous vughs and lenses of drusy quartz and limonitic material	1500	5	5	25	1600	x	x	x	.020	13		
GL.13	grab sample of black highly tourmalinised siltstone containing numerous veins and vughs of drusy quartz. Pervasive fine tourmaline-sericite alteration of the host	4100	10	10	35	260	x	x	x	.020	4		
GL.14	grab sample of grey (black+white) quartz-tourmaline rock containing 2 vughy veins with drusy quartz coated in goethitic boxworking with possible fine cassiterite	460	5	5	15	85	10	x	x	.025	9		
GL.15	grab sample of relatively massive quartz which is either of 1 ^o origin or a highly silicified s/s which has undergone thermal deformation. It contains some goethitic vughs and fractures.	100	5	5	30	10	x	x	x	.025	9		

521074

APPENDIX 2

GLENAIR SOIL GEOCHEMISTRY

SAMPLE RECORD

1:250,000 Sheet Area OATLANDS

AMAX IRON ORE CORPORATION
(MINERALS EXPLORATION DIVISION)

ROYAL GEORGE GLENAIR

White: Office
Yellow: Project Geologist
Green: Sampler

Property or Prospect

Date: 20 March 1983

Collected by: D. ELLIS

Sample Batch No. GLS

Analyses by: ANALABS

APPENDIX - GLENAIR SOIL GEOCHEMISTRY

Analyses (ppm unless otherwise stated)

Sample No.	Description	Location	Analyses (ppm unless otherwise stated)					Comments
			Sn	F	Cu	Zn		
550E 1325N			35	1200	10	40		
700E 1200N			40	300	5	35		
1225N			25	600	5	20		
1250N			30	900	5	50		
1275N			40	500	5	30		
1300N			35	600	10	40		
1325N			35	300	5	30		
1350N			25	300	5	35		
1375N			35	300	5	25		
1400N			15	200	5	50		
1425N			25	200	5	35		
1450N			25	200	5	35		
OE 1200N			30	300	5	15		
1225N			35	300	5	25		
1250N			40	300	5	25		
1275N			25	300	5	25		

521078

SAMPLE RECORD

1:250,000 Sheet Area OATLANDS

AMAX IRON ORE CORPORATION
(MINERALS EXPLORATION DIVISION)

White: Office
Yellow: Project Geologist
Green: Sampler

Property or Prospect

ROYAL GEORGE GLENAIR

Date: 20 March 1983

Collected by: D. ELLIS

Sample Batch No.

Analyses by: ANALABS

GLENAIR SOIL GEOCHEMISTRY

Analyses (ppm unless otherwise stated)

Sample No.	GLS	Description	Location	Sn	F	Cu	Zn		Comments
OE 1300N				25	400	5	25		
1325N				30	200	5	35		
1350N				20	200	5	15		
1375N				35	400	5	25		
1400N				190	1200	10	30		
1425N				35	300	5	30		
1450N				25	200	5	25		
OE 1200N				30	400	10	30		
1225N				30	400	10	30		
1250N				25	400	5	25		
1275N				30	300	5	20		
1300N				25	400	5	30		
1325N				20	300	5	20		
1350N				25	300	10	20		
1375N				30	300	10	30		
1400N				75	500	10	35		
1425N				45	400	10	40		

521079

SAMPLE RECORD

AMAX IRON ORE CORPORATION
(MINERALS EXPLORATION DIVISION)

White: Office
Yellow: Project Geologist
Green: Sampler

1:250,000 Sheet Area OATLANDS

Property or Prospect ROYAL GEORGE GLENAIR

Date: 20 March 1983

Collected by: D. ELLIS

Sample Batch No. GLS

Analyses by: ANALABS

GLENAIR SOIL GEOCHEMISTRY

Analyses (ppm unless otherwise stated)

Sample No.	GLS	Description	Location	Analyses (ppm unless otherwise stated)				Comments
				Sn	F	Cu	Zn	
E 1450N				45	200	5	25	
E 1325N				30	200	5	10	
E 900N				55	200	5	25	
925N				65	400	5	25	
950N				90	500	5	20	
975N				80	600	10	35	
1000N				95	500	5	30	
1025N				55	600	10	45	
1050N				130	600	5	25	
1075N				140	400	5	25	
1100N				95	300	5	15	
1325N				25	600	10	60	
DE 900N				85	300	5	20	
925N				70	500	5	15	
950N				110	800	10	50	

SAMPLE RECORD

AMAX IRON ORE CORPORATION
(MINERALS EXPLORATION DIVISION)

White: Office
Yellow: Project Geologist
Green: Sampler

1:250,000 Sheet Area OATLANDS

Property or Prospect ROYAL GEORGE GLENAIR

Date: 20 March 1983

Collected by: D. ELLIS

Sample Batch No. GLS

Analyses by: ANALABS

GLENAIR SOIL GEOCHEMISTRY

Analyses (ppm unless otherwise stated)

Sample No.	GLS	Description	Location	Analyses (ppm unless otherwise stated)				Comments
				Sn	F	Cu	Zn	
50E 975N				85	600	15	35	
1000N				90	800	10	30	
1012.5N				90	500	10	40	
1025N				100	500	10	35	
1037.5N				120	400	10	40	
1050N				110	500	5	30	
1075N				150	400	5	25	
1100N				75	500	5	20	
1125N				55	900	10	35	
1150N				50	800	10	35	
1175N				140	1000	5	25	
1200N				35	400	5	20	
1225N				45	600	5	25	
1250N				90	1000	5	15	
1275N				35	700	5	15	
1300N				45	900	10	30	
1325N				80	1000	5	20	

521081

SAMPLE RECORD

AMAX IRON ORE CORPORATION
(MINERALS EXPLORATION DIVISION)

White: Office
Yellow: Project Geologist
Green: Sampler

1:250,000 Sheet Area OATLANDS

Property or Prospect ROYAL GEORGE GLENAIR

Date: 20 March 1983

Collected by: D. ELLIS

Sample Batch No. GLS

Analyses by: ANALABS

GLENAIR SOIL GEOCHEMISTRY

Analyses (ppm unless otherwise stated)

Sample No.	GLS	Description	Location	Analyses (ppm unless otherwise stated)						Comments
				Sn	F	Cu	Zn			
5E 1000N				150	500	10	45			
1012.5N				75	500	10	30			
1025N				210	600	15	40			
1037.5N				150	500	10	25			
1050N				150	500	10	25			
00E 900N				70	400	5	20			
925N				95	600	5	30			
950N				110	700	10	35			
975N				85	500	10	85			
1000N				60	600	10	35			
1012.5N				80	400	10	45			
1025N				140	300	15	40			
1037.5N				150	400	10	40			
1050N				150	400	10	25			
1075N				90	300	5	20			
1100N				80	400	5	15			

521082

SAMPLE RECORD

AMAX IRON ORE CORPORATION
(MINERALS EXPLORATION DIVISION)

White: Office
Yellow: Project Geologist
Green: Sampler

1:250,000 Sheet Area OATLANDS

Property or Prospect ROYAL GEORGE GLENAIR

Date: 20 March 1983

Collected by: D. ELLIS

Sample Batch No. GLS

Analyses by: ANALABS

GLENAIR SOIL GEOCHEMISTRY

Analyses (ppm unless otherwise stated)

Sample No.	GLS	Description	Location	Analyses (ppm unless otherwise stated)				Comments
				Sn	F	Cu	Zn	
50E 900N				65	200	5	65	
925N				65	300	10	45	
950N				60	200	25	55	
975N				55	100	30	55	
1000N				60	100	15	35	
1025N				70	200	25	60	
1050N				110	400	10	50	
1075N				90	400	10	35	
1100N				75	400	5	35	
00E 900N				45	100	30	55	
925N				40	20	40	90	
950N				35	200	30	80	
975N				80	200	15	40	
1000N				85	200	20	50	
1025N				80	200	X	30	
1050N				65	400	X	30	
1075N				70	400	X	20	

521083

APPENDIX 3

GLENAIR COSTEAN ROCK GEOCHEMISTRY

SAMPLE RECORD

1:250,000 Sheet Area OATLANDS

AMAX IRON ORE CORPORATION
(MINERALS EXPLORATION DIVISION)

White: Office
Yellow: Project Geologist
Green: Sampler

Property or Prospect ROYAL GEORGE GLENAIR

Date: 25 February 1983

Collected by: D. ELLIS

Sample Batch No. GLC

Analyses by: ANALABS

GLENAIR COSTEAN

Analyses (ppm unless otherwise stated)

Sample No.	GLC 1	Description	Location	Analyses (ppm unless otherwise stated)						Comments
				Sn	F	Cu	Pb	Zn	As	
LC 1	<u>GLENAIR COSTEAN</u>	See Plan 1								
0-2 m				85	900	30	5	70	33	
2-3 m				55	1100	20	5	40	15	
3-5 m				40	700	30	x	50	26	
5-7 m				60	800	45	10	60	31	
7-9 m				70	700	65	5	50	60	
9-11 m				310	600	90	x	60	65	
11-12 m				1950	1600	55	x	50	29	
12-13 m				3800	2700	20	5	70	13	
13-15 m				130	1000	40	x	55	15	
15-17 m				80	900	20	10	80	25	
17-19 m				70	1200	35	x	100	32	
19-21 m				70	1100	15	10	85	20	
21-23 m				35	900	20	x	65	20	

1221086

APPENDIX 4

- DYKE LODE - Bedrock Auger Geochemistry
- Rock Chip Geochemistry
- Costean Geochemistry

SAMPLE RECORD

1:250,000 Sheet Area OATLANDS

AMAX IRON ORE CORPORATION
(MINERALS EXPLORATION DIVISION)

521089
White: Office Geologist
Yellow: Project Geologist
Green: Sampler

Property or Prospect ROYAL GEORGE DYKE LODE

Date: 2 March 1983

Collected by: D. ELLIS, R. VIVIAN,

Sample Batch No.

Analyses by: ANALABS

S. HARRISON
DYKE LODE BEDROCK AUGER GEOCHEMISTRY

Analyses (ppm unless otherwise stated)

Sample No.	Description	Location	DEPTH	Analyses (ppm unless otherwise stated)						As	Comments
				Sn	F	Cu	Pb	Zn	Bi		
2000E 1950N	'C' Horizon - Yellow brown decomposed		1.40m	60	2200	5	170	50	x	37	
1960N	ditto		1.40m	60	3600	10	260	135	10	21	
1970N	ditto		0.9 m	40	1900	10	315	55	10	98	
1980N	ditto			80	1200	5	225	45	20	5	strike extensio of southern
1990N	ditto		taken from depth of one auger flight (0.76m) in 'C' horizon	110	2400	10	255	65	X	27	lode is at 200BN
2000N	ditto		ditto	1850	7600	10	130	45	10	21	
2010N	ditto		ditto	310	2500	10	165	80	10	20	
2020N	ditto		ditto	290	2100	10	80	45	X	13	
2030N	Moderate Fe Ox		ditto	120	2700	10	115	85	X	18	
2040N	ditto		ditto	170	2300	10	75	85	X	19	
2050N	Moderate Fe Ox		ditto	260	2200	10	125	115	10	42	
2060N	ditto		ditto	150	2800	15	85	80	10	27	strike exten- sion of
2070N	ditto		taken at 2072.5 from base of 'B' horizon due to boulders	730	6000	15	130	30	10	170	northern lode is at 2065N
2080N	ditto		ditto	180	600	15	135	95	X	3	
2090N	ditto		ditto	140	2400	15	150	115	X	87	
2100N	ditto		ditto	240	3800	15	95	55	X	35	
2110N	ditto		ditto	140	1800	15	210	85	10	66	
2120N	ditto		ditto	380	2700	10	195	145	X	84	

SAMPLE RECORD

AMAX IRON ORE CORPORATION
(MINERALS EXPLORATION DIVISION)

521090

White: Office
Yellow: Project Geologist
Green: Sampler

1:250,000 Sheet Area OATLANDS

Property or Prospect ROYAL GEORGE DYKE LODE

Date: 14 April 1983

Collected by: D. ELLIS + R. VIVIAN

Sample Batch No.

Analyses by: ANALABS

DYKE LODE ROCK CHIP GEOCHEMISTRY

Analyses (ppm unless otherwise stated)

Sample No.	Description	Location	Analyses (ppm unless otherwise stated)					Comments
			Sn	F	W	As	Zn	
A 3319	L. grey siliceous qtz porphyry greisen with dog-tooth qtz vein & granular top az. (composite o/c)	2060N / 1968E	1300	33.5%	10			
A 3320	L. grey siliceous qtz porphyry with an equigranular med. gr. matrix of qtz, topaz & greisenised feldspar matrix is more silicified near weak qtz vein	costean no. 1 (trench)	640	11.8%	10			
A 3321	ditto + tourm. clots silicified gr. granodiorite porphyritic in qtz & to a lesser degree in feldspar; minor qtz veins to 1cm width; minor tourm. stringers (composite)	northern ridge line	1100	26.3%	10			
A 3322	tourmaline generally absent; 1 piece qtz vein shows coarse qtz xstls intergrain with slabby tourm. xstls; minor greisenization of the porphyry	mullock heap shaft 2 (western end)	4650	44.4%	10			High F value in these rocks due to granular topaz indistinguishable from quartz
A 3323	weathered l. brown weakly greisenised to fresh weakly porphyritic granodiorite (composite)	northern end BHP costean dump material	3050	18.5%	X			
A 3324	o/c exposed in bottom of costean; moderate f-m gr. qtz/mica greisen with fresh tourm. xstls centre filling qtz vughs or adjacent to coarse qtz aggregates; qtz veining; qtz phenocrysts rare	composite southern part of BHP costean	500	8900	X			wall rock to lode in shaft 1

SAMPLE RECORD

1:250,000 Sheet Area OATLANDS

AMAX IRON ORE CORPORATION
(MINERALS EXPLORATION DIVISION)

521093

White: Office
Yellow: Project Geologist
Green: Sampler

Property or Prospect ROYAL GEORGE DYKE LODE

Date: 2 March 1983

Collected by: D. ELLIS + R. VIVIAN

Sample Batch No. DLC

Analyses by: ANALABS

Sample No.	Description	Location	Analyses (ppm unless otherwise stated)						As	Comments
			Sn	F	Cu	Pb	Zn	Bi		
DLC 2	DYKE LODE COSTEAN See Plan 2									
0-2 m			300	2800	30	165	160	20	140	
2-4 m			180	3800	60	260	225	10	73	
4-6 m			65	2800	60	200	175	10	58	
6-8 m			110	4900	40	180	140	20	56	
8-10m			140	6100	30	230	220	30	75	
10-12 m			180	6400	45	150	165	30	100	
12-14 m			370	1.19%	45	345	135	X	66	
14-16 m			400	1.45%	40	515	90	X	4	
16-18 m			380	1.35%	35	350	105	X	340	
18-20 m			850	1.75%	45	695	90	20	510	
20-22 m			780	1.30%	25	355	55	10	310	
22-24 m			970	1.95%	30	245	80	X	99	
24-26 m			5250	2.00%	25	185	70	X	21	
26-27 m			670	1.35%	15	105	80	10	17	

APPENDIX 5

PETROGRAPHY

521095

PETROGRAPHIC REPORT ON SAMPLES A3349-A3353,
AVOCA AREA, TASMANIA.

by

Hugh K. Herbert

Prepared for: Amax Australia Ltd.,
- Exploration Division.

24th April, 1983.

PETROGRAPHIC REPORT ON SAMPLES A3349-A3353,
AVOCA AREA, TASMANIA.

MATERIAL AND AIMS

Five rock specimens, designated A3349 to A3353, from the Avoca area, Tasmania, were submitted for petrographic examination as per instructions (R.M.V./jv - 18th April, 1983).

The main aims were :-

- (1) To identify any evidence of hornfelsing and/or hydrothermal alteration affecting the rocks;
- (2) To comment on the nature and mineralogy of variably abundant "spotting" in some samples; and
- (3) To comment on any other significant features.

In this connection, a 3" x 1½" thin section of each sample was prepared and examined.

PETROGRAPHY

Sample A3349

Hand Specimen:- (R.M.V.) Buff, fine-to medium-grained sandstone, regularly spotted by ? chlorite/tourmaline to 1mm width. Hair fractures present.

Thin Section:- In thin section, the rock is composed of quartz (~55%), K-feldspar (~15%), limonite/goethite (~8%), biotite (~8%), muscovite (~8%) and tourmaline (~5%).

The rock has a crudely preserved foliation, reflected mainly in the sub-parallel alignment of elliptical and attenuated quartz grains. Overprinting this is a thermal event which has resulted in modification of mica habit to decussate intergranular aggregates and flakes. Quartz and feldspar grains have only partly recrystallised due to abundance of micaceous matrix. However, large strained quartz grains have developed polygonal sub-aggregates. Typical fabric is shown in Plates 1(a) and (b)

and Plate 2. It is quite clear that none of the existing mineral grains act as nucleii for tourmaline crystallisation in this specimen. Rather, tourmaline occurs as ragged intergranular plates and granules and, in its habit, appears to have been contemporaneous with thermal recrystallisation of the rock.

There is no evidence of post-thermal metamorphism hydrothermal alteration of this sample in the presence of subsequent veining, sericitisation, argillitisation or silicification. Despite this, the rock contains abundant limonite/goethite granules and staining which impart the overall buff-orange colour to the hand specimen. Many of these granules appear to represent oxidised and hydrated primary mineral components, perhaps sulfides (?) and so may suggest a hydrothermal pulse through the rock. Alternatively, they may simply be a weathering product and, without details of the sampling, this cannot be resolved.

Sample A3350

Hand Specimen:- (R.M.V.) Dark grey, siliceous sandstone. Spotting is abundant. Massive, black tourmaline-lined fractures board the rock; and one is bordered by a dark grey silica/tourmaline selvage.

Thin Section:- In thin section, the rock is composed of quartz, feldspar, muscovite, tourmaline and limonite/goethite.

Within the rock, distinct mica-rich and mica-poor bands occur. These presumably represent primary sedimentary compositional differences. A fairly well preserved foliation occurs normal to this "sedimentary" banding and is reflected by alignment of elliptical and attenuated quartz grains in mica-rich bands, in which muscovite constitutes about 25%.

Superimposed upon this is a period of thermal recrystallisation. In the mica-poor, quartz-rich bands, this has resulted in the development of an obvious granoblastic fabric, whereas, in the mica-rich bands this is not as well-defined. Here, however, mica has recrystallised to an intergranular decussate matrix.

Tourmaline in the rock occurs as dispersed fine-grained

- 3 -

(av. 0.1 - 0.2mm long) subhedral to euhedral grains. Both the concentration and orientation of the tourmaline grains is clearly controlled by compositional variations in the host. Tourmaline is much more abundant in quartz-rich, mica-poor bands (~10%) than in mica-rich bands (~1%). This is clearly illustrated in Plates 3 and 4. Also illustrated in Plate 4 is the random orientation of tourmaline grains in keeping with the granoblastic fabric of the host. This may be contrasted with Plate 5, in which crude alignment of tourmaline crystals occurs. Clearly, this is controlled by the relict foliation present in the mica-rich bands.

Another feature present in this sample is the confinement of fairly abundant limonite/goethite granules and aggregates to mica-rich bands - limonite/goethite does not appear to be present in quartz-rich bands. This may reflect a primary compositional feature, but may equally well be secondary.

Whilst K-feldspar is not uncommon in this sample, it is nevertheless much less abundant than in A3349 and appears overall to represent less than 3% of the rock.

Superimposed upon the rock are a number of fine post-thermal metamorphism quartz veinlets completely barren of tourmaline (Plate 5). In this case, the veinlet occurs at the interface of mica-rich and mica-poor bands and are hence parallel to primary layering and normal to foliation.

Sample A3351

Hand Specimen:- (R.M.V.) Dark grey-black, intensely spotted argillaceous sandstone; the spots tend to coalesce. Three "leopard spotted" bands follow (?) bedding.

Thin Section:- The section is composed mainly of very fine (0.02 mm) decussate biotite and muscovite in the ratio of about 1:5, minor quartz and feldspar (<5%), fairly abundant ragged tourmaline granules (0.05-0.1 mm) (often coalesced into spongy clots up to 2 mm in diameter) and less than 1% isolated scattered opaques.

There is a strong tendency for spotty tourmaline clots to occur in distinct bands where it constitutes up to 40% of the band and 70% of the clots (Plate 6(a) and (b)). As far as can be determined, there does not appear to be any significant difference between bands containing abundant tourmaline clots and those that do not. The matrix of both is essentially a fine decussate biotite/muscovite matrix in the ratio about 1:5 (Plate 7). However, there does appear to be a slight increase in muscovite relative to biotite in the tourmaline-rich bands and, if this impression is correct, may suggest that tourmaline is preferentially formed in bands having primary compositional, that is, sedimentary differences. Furthermore, many of the tourmaline clots contain very fine, opaque filaments and wisps which may be composed of graphite. If so, it may be that nucleation of tourmaline clots was controlled by organic material occurring in specific bands.

Apart from the occasional post thermal metamorphism quartz veinlet, no evidence of later hydrothermal preparation appears to have occurred.

Sample A3352

Hand Specimen:- (R.M.V.) Dark grey siliceous (hornfelsic) fine-grained sandstone.

Thin Section:- In thin section this rock is composed of quartz (~45%), K-feldspar (~15%), chlorite (~18%), biotite (~8%), muscovite (~12%), tourmaline (<1%), and opaques (~2%). An occasional grain of zircon is present.

The sample is medium-grained with quartz and feldspar averaging between 0.2-0.4 mm. Some of the clastic quartz grains contain fairly abundant rutile filaments. Tourmaline is not a significant component and where present occurs as ragged equant granules.

The rock is noticeably foliated and is not hornfelsed to the same degree as other samples in this suite. Nevertheless, micaceous matrix phases, chlorite, biotite and muscovite, tend to have a decussate fabric. The presence of fairly abundant chlorite in this sample, coupled with better preserved foliation, accords with the suggested

lesser thermal overprinting. Furthermore, extensively strained quartz grains in the rock do not show any appreciable recrystallisation which would normally occur with thermal energy input.

The sample contains a number of thin, non-recrystallised quartz veins, parallel to foliation, and often with fairly "coarse" fringing muscovite (Plate 8).

Sample A3353

Hand Specimen:- (R.M.V.) Fawn to brown (weathered), medium-grained sandstone cut by discontinuous, indistinctly margined white sachtoidal quartz veinlets. Some cross-cutting features.

Thin Section:- In thin section the rock is composed of quartz (~50%), K-feldspar (~10%), biotite (~15%), muscovite (~15%), Fe oxide/hydroxides (~10%) and tourmaline (~1%).

Quartz and feldspar are in the grainsize range 0.1-0.5 mm; whilst minor tourmaline occurs as ragged anhedral grains rarely larger than 0.1 x 0.1 mm.

This rock does not show any evidence of foliation. Whilst quartz grains show some strain effects, they are nevertheless much more extensively recrystallised to polygonal subaggregates. Muscovite and biotite flakes are much coarser (up to 0.3 x 0.2 mm) than other samples of the suite and occur as decussate masses and flakes. Biotite is a lime-green to brown-lime green in colour and is frequently overprinted by brown, orange-brown or red-brown limonite staining.

The orange to red-brown colour of the rock in hand specimen results from extensive iron staining and abundant fine dusty granular limonite around grains and throughout the micaceous matrix; abundant diffuse and fine capillary limonite networks are also present.

Traversing the rock, are a number of totally polygonised quartz veinlets (Plate 9) up to 2 mm wide. Clearly these are pre-thermal ^{? syn-} metamorphism which has caused extensive hornfelsing with obliteration of foliation, if originally present in the rock. It is interesting

to note that the very extensive iron staining of the matrix does not extend into the polygonised quartz veins, presumably reflecting the very tight grain boundaries of the polygonised quartz veins relative to the matrix.

Assuming that the extensive iron staining, etc., is a function of weathering, then the rock does not appear to have sustained a recognisable period of hydrothermal fluid passage. This rock is clearly the most strongly hornfelsed.

DISCUSSION

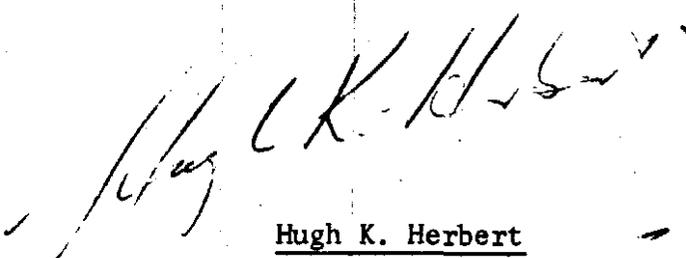
Samples of this suite range from matrix supported, argillaceous sandstones through to argillite. Most have sustained a period of deformation resulting in the development of a pronounced foliation. Without any field criteria, it is impossible to meaningfully comment on the foliation, except to say that the characteristics accord with axial plane structures. In any event, where primary sedimentary layering can be defined by present compositional variation, the foliation is normal to the layering. Some samples, e.g., A 3352 possess fairly strong foliation, whereas others, e.g., A 3353 do not exhibit any evidence of foliation; A 3349 and A 3350 are intermediate between the above two. This may simply reflect intensity of thermal overprinting or may be inherited and represent proximity to axial plane features.

The whole suite has been variably thermally metamorphosed. It is suggested, on the basis of strong relict foliation and presence of chlorite, that sample A 3352 is the least thermally metamorphosed and sample A 3353, without any evidence of foliation (note comment above) but quite strongly recrystallised, is the most strongly thermally metamorphosed. Samples A 3349 and A 3350 are intermediate. The position of sample A 3351 (meta-argillite) is unknown.

In samples A 3349 and A 3350, leopard spotting is not related to intensity of tourmalisation or tourmaline aggregation. In fact, it is difficult to identify, in thin section, the precise nature of the spotting. Reference to Plates 3, 4 and 5 clearly illustrate this. Certainly, there is no evidence to suggest that primary mineral grains have acted as nuclei for secondary mineral growth in these samples.

However, in sample A 3351, tourmaline aggregation leads to spotting up to 2 mm in diameter. It was suggested earlier, under the description of this sample, that tourmaline nucleation may have been controlled by filamentous organic matter. There does not appear to be any other petrographic evidence of primary mineral nucleation of tourmaline in this sample.

In all samples, tourmaline growth appears to be contemporaneous with thermal metamorphism. Some quartz veining is pre- or syn-thermal metamorphism, whilst other quartz veining is post-thermal metamorphism. Apart from the latter, and with due attention to the extensive limonite/goethite alteration, there does not appear to have been a significant post-thermal metamorphism hydrothermal fluid pulse pass through rocks of the suite.


Hugh K. Herbert

24th April, 1983.

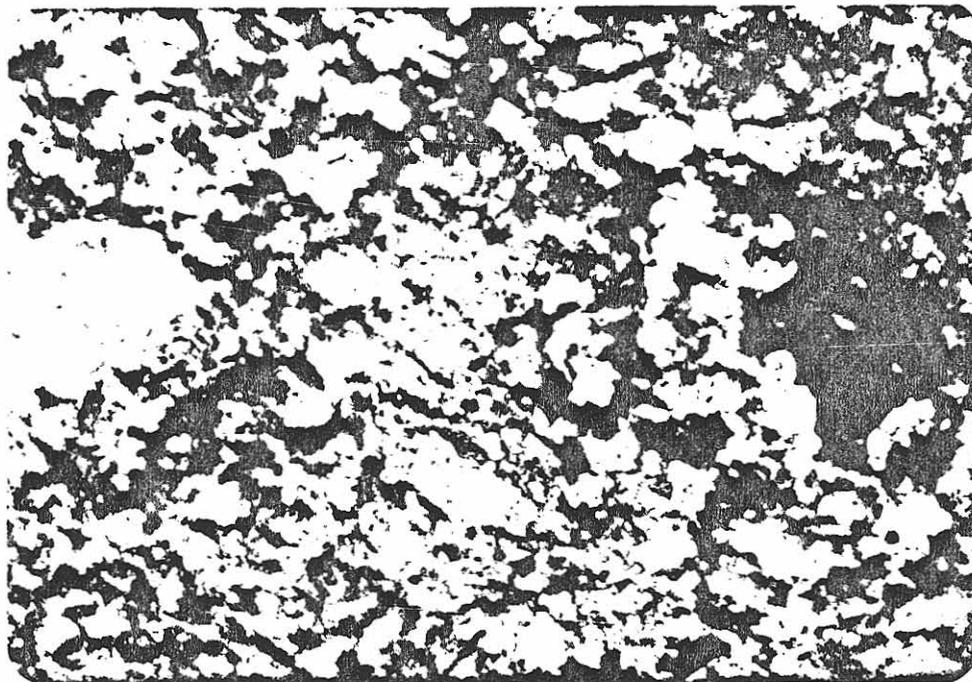
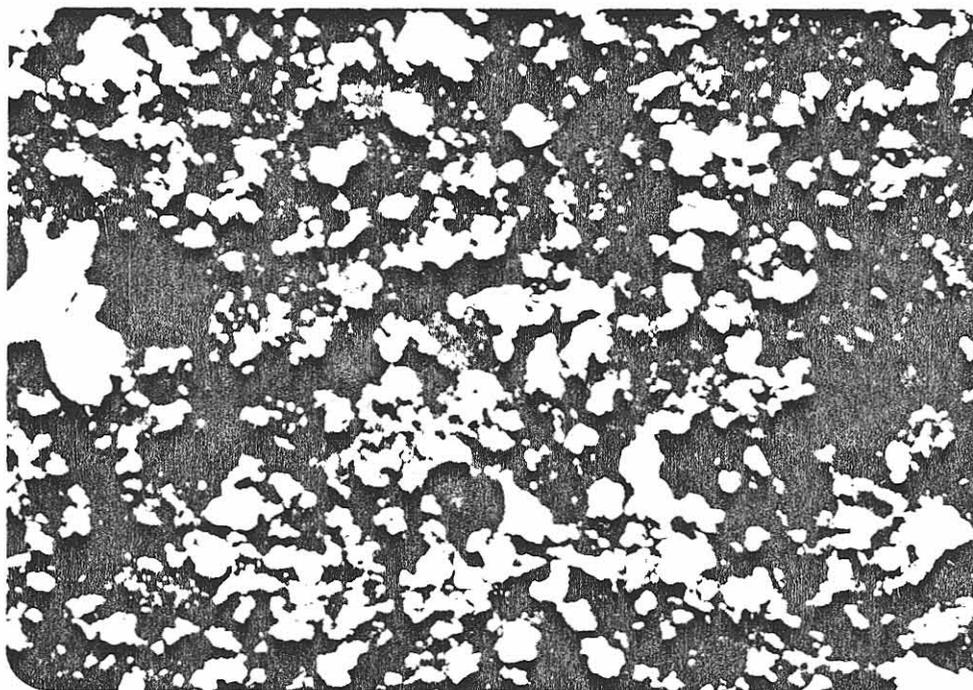


Plate 1 (a):- (Sample A3349) Photomicrograph showing typical area of the sample; quartz (colourless, anhedral), biotite (orange to greenish brown), muscovite (colourless, high relief), tourmaline (dark brown to dark green-brown, high relief) and limonite (dark brown to black, granular). Note the crudely developed foliation depicted by parallel alignment of elliptical quartz grains. Note also the absence of any obvious spotting in the matrix or around primary mineral grains.
Plane polarised transmitted light; micrograph 2 x 1.4mm.



(b):- (Sample A3349) Crossed polarised light micrograph of same area as (a). Note the granoblastic and decussate fabric of the rock and the polygonisation of coarse quartz grains.

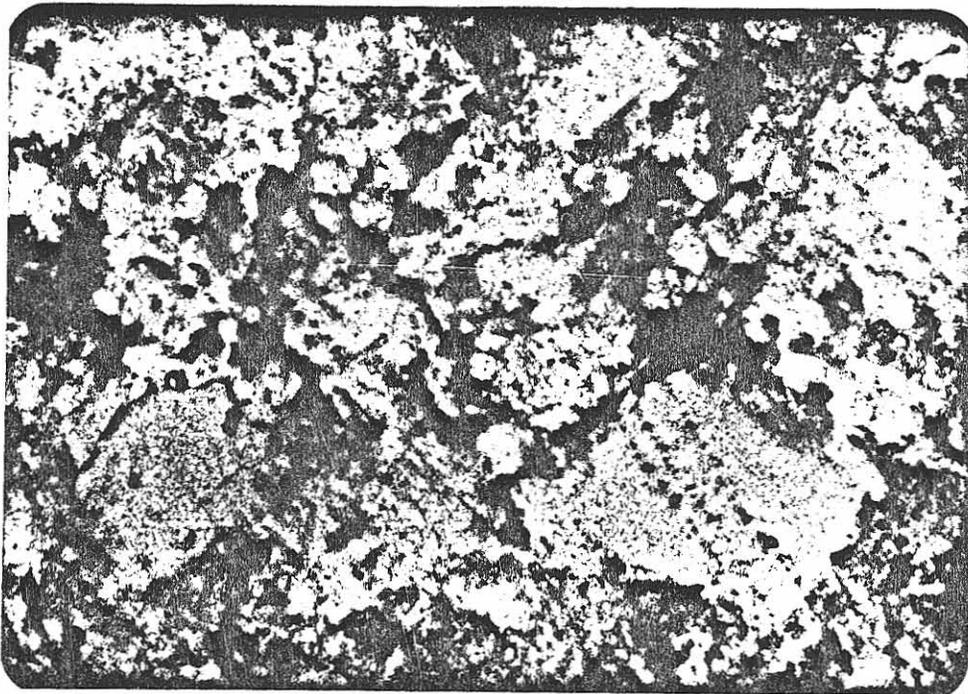


Plate 2:- (Sample A3349) Photomicrograph showing detail of a typical area of the sample; quartz (colourless, clear, anhedral), muscovite (colourless, high relief), biotite (pale to mid orange-brown), and limonite granules (dark brown to black). Note the intergrown decussate muscovite and biotite, forming an intergranular meshwork to quartz (and K-feldspar) grains, in which granular limonite/goethite occurs. Some limonite/goethite clots may be after sulfide.

Plane polarised transmitted light; micrograph 1 x 0.7mm.

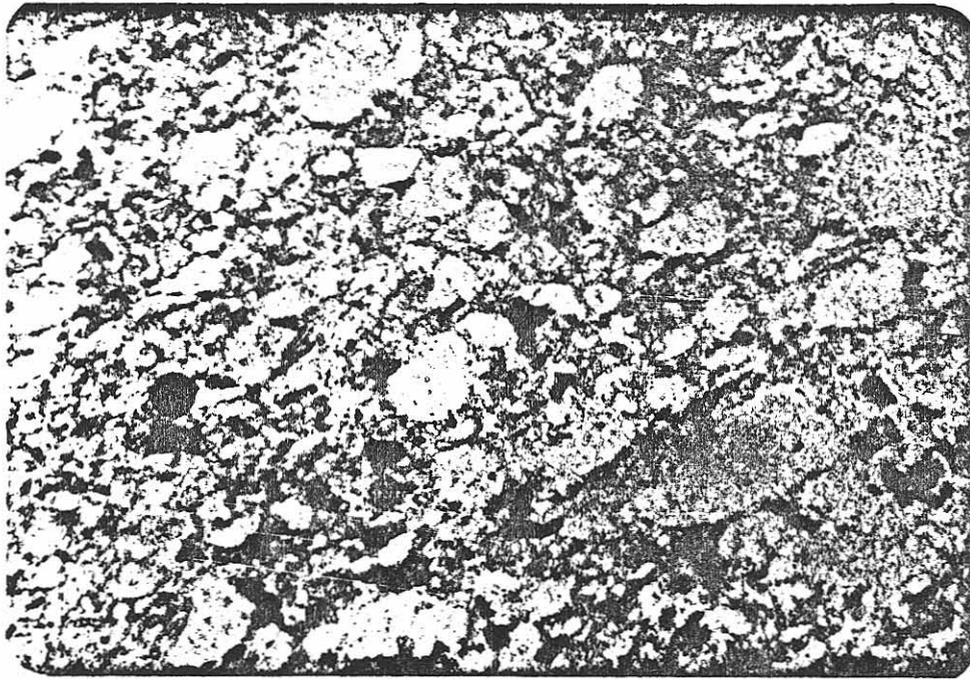
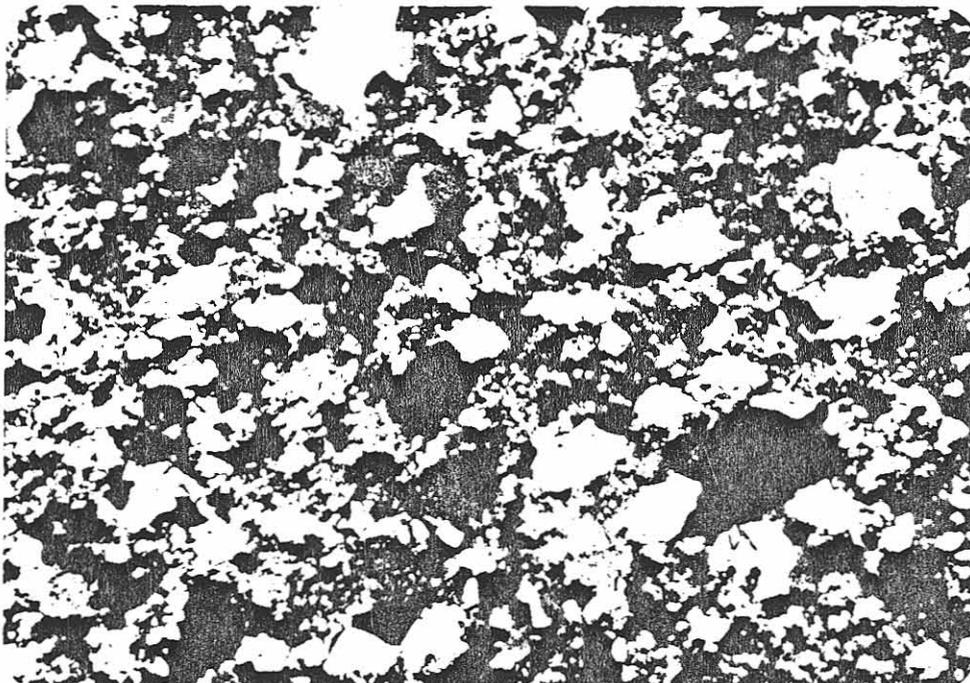


Plate 3 (a):- (Sample A3350) Photomicrograph showing typical area of mica-rich band in the sample; quartz (colourless, clear, elliptical and attenuated grains), muscovite (colourless, dusty, high relief), and tourmaline (dark brown). Note the strong relict foliation defined by parallel alignment of elliptical quartz grains and the low concentration of dispersed tourmaline granules. Note also that there is no tendency for aggregation of any of the components into "spots".
Plane polarised transmitted light; micrograph 2 x 1.4mm.



(b):- (Sample A3350) Crossed polarised light micrograph of same area as (a). Note the abundant decussate muscovite (birefringent) forming an intergranular mesh to granoblastic quartz (cream to black).

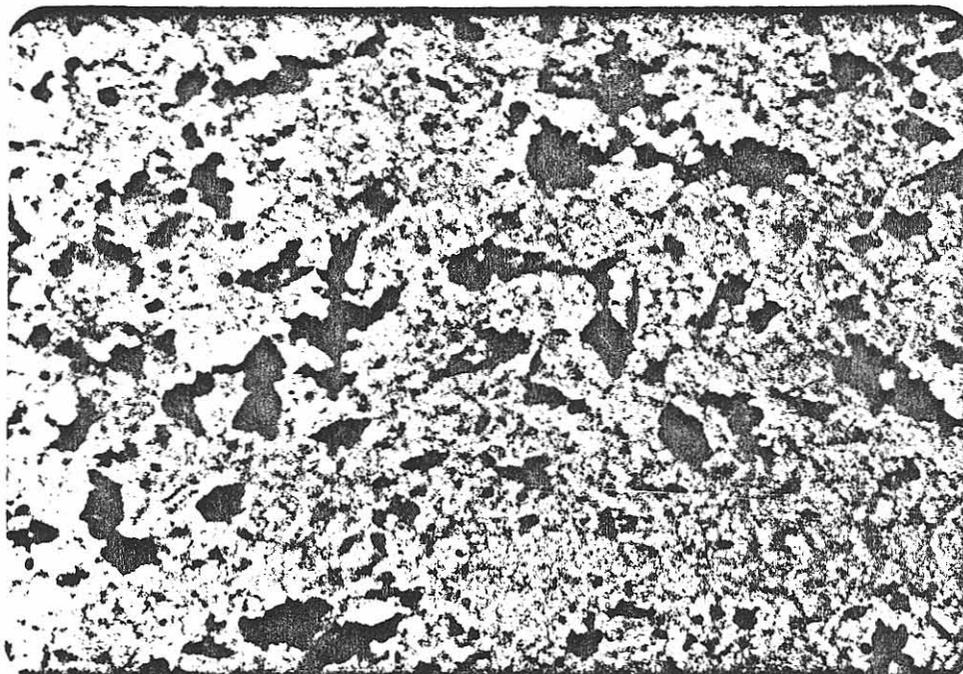
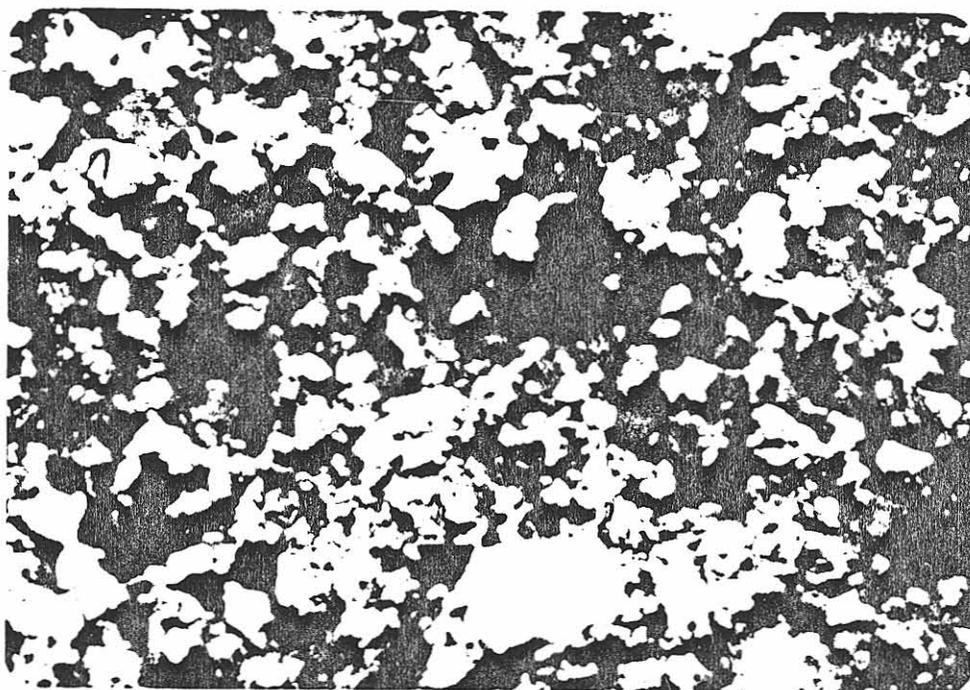


Plate 4 (a):- (Sample A3350) Photomicrograph showing typical area of mica-poor band in the sample; quartz (colourless), tourmaline (dark green-brown). Note the absence of foliation in this mica-poor section and the very much more abundant and slightly coarser, dispersed tourmaline grains relative to Plate 3 (a) and (b). Once again, there is no petrographic criteria to identify the cause of spotting observed in hand specimen. Plane polarised transmitted light; micrograph 2 x 1.4mm.



(b):- (sample A3350) Crossed polarised light micrograph of same area as (a). Note the typical granoblastic fabric indicative of hornfelsing.

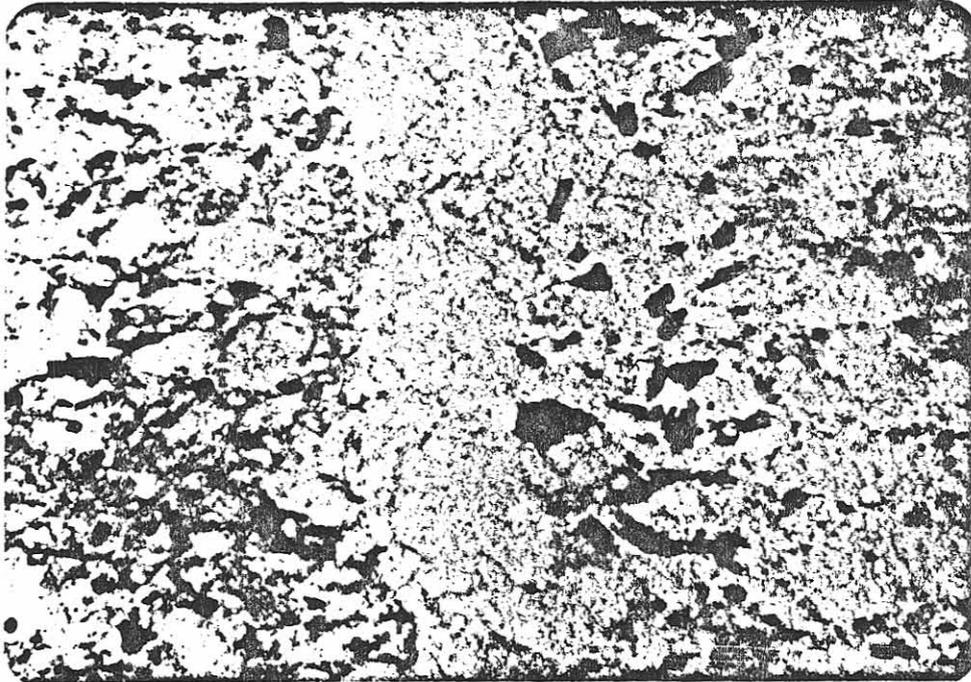
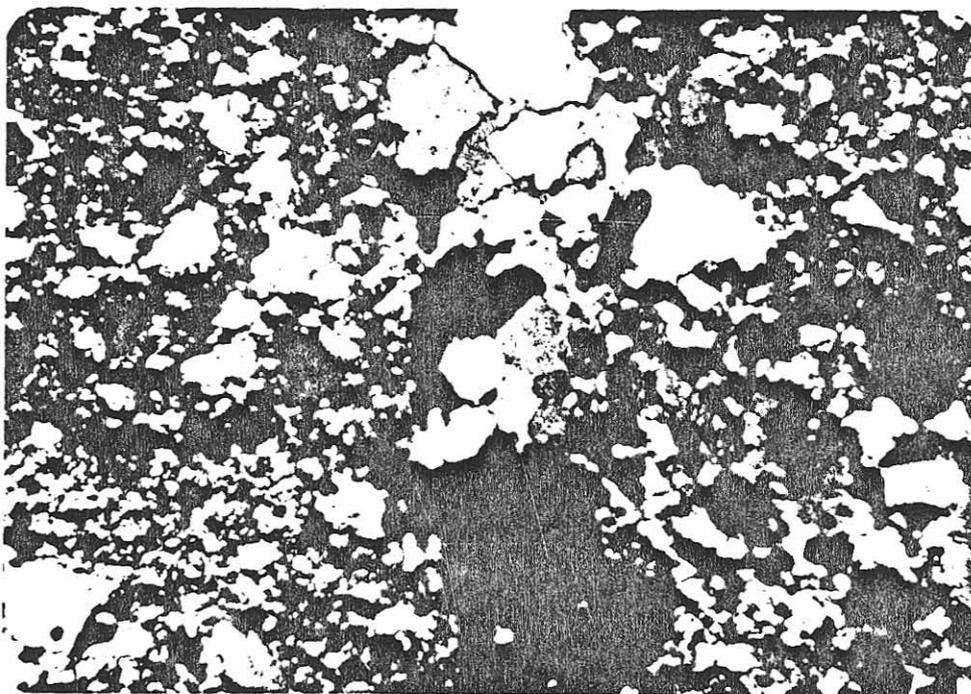


Plate 5 (a):- (Sample A3350) Photomicrograph showing junction between mica-rich (left side) and mica-poor (right side) bands in the sample and separated by narrow post-thermal metamorphism quartz vein (colourless band). Note (i) the strong foliation in the mica-rich band relative to the mica-poor band; (ii) the increased abundance and grainsize of tourmaline (dark brown, high relief) in the mica-poor band; and (iii) the total absence of tourmaline from the quartz vein.

Plane polarised transmitted light; micrograph 2 x 1.4mm.



(b) (Sample A3350) Crossed polarised light micrograph of same area as (a). Note the abundance of muscovite (birefringent) in the mica-rich band (left side) and absence from the mica-poor band (right side). Note also the granoblastic fabric and non-polygonised nature of the quartz vein.

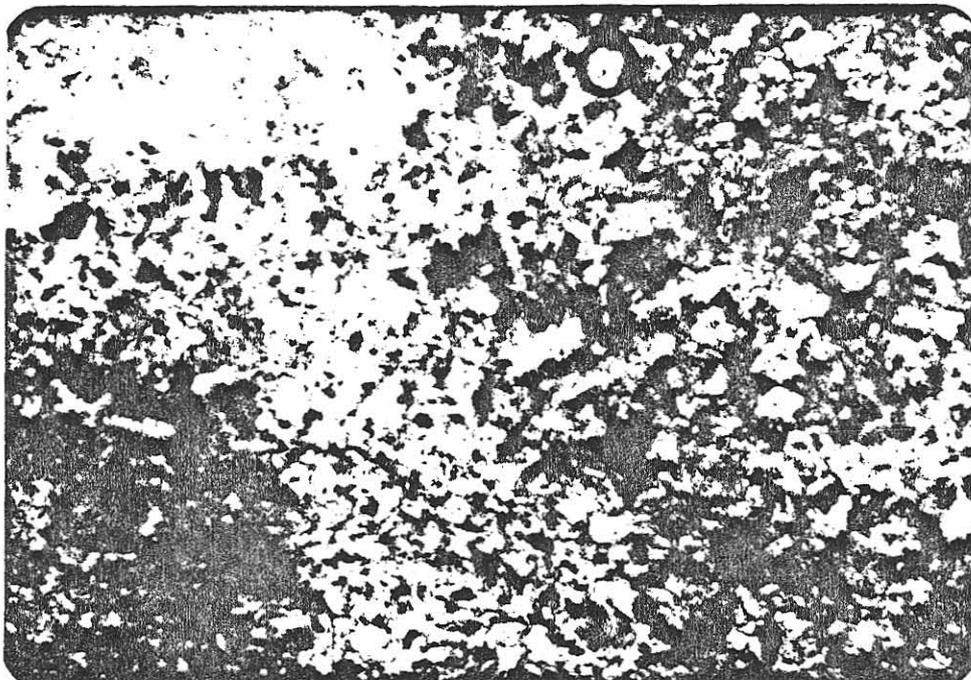
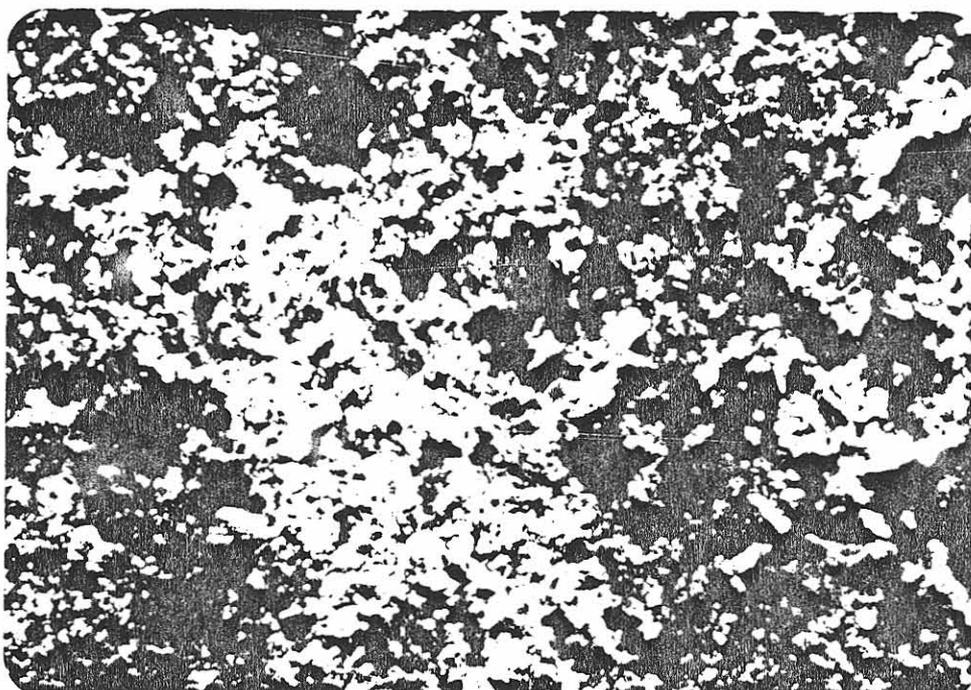


Plate 6 (a):- (Sample A3351) Photomicrograph showing typical aggregation of anhedral tourmaline grains (pale to dark emerald green, orange to brown) into clots up to 2mm in diameter within specific bands and intergrown with muscovite (colourless) and biotite (pale Brown) in a matrix of muscovite and biotite, with isolated black opaque granules.
Plane polarised transmitted light; micrograph 1 x 0.7mm.



(b):- (Sample A3351) Crossed polarised light micrograph of same area as (a).

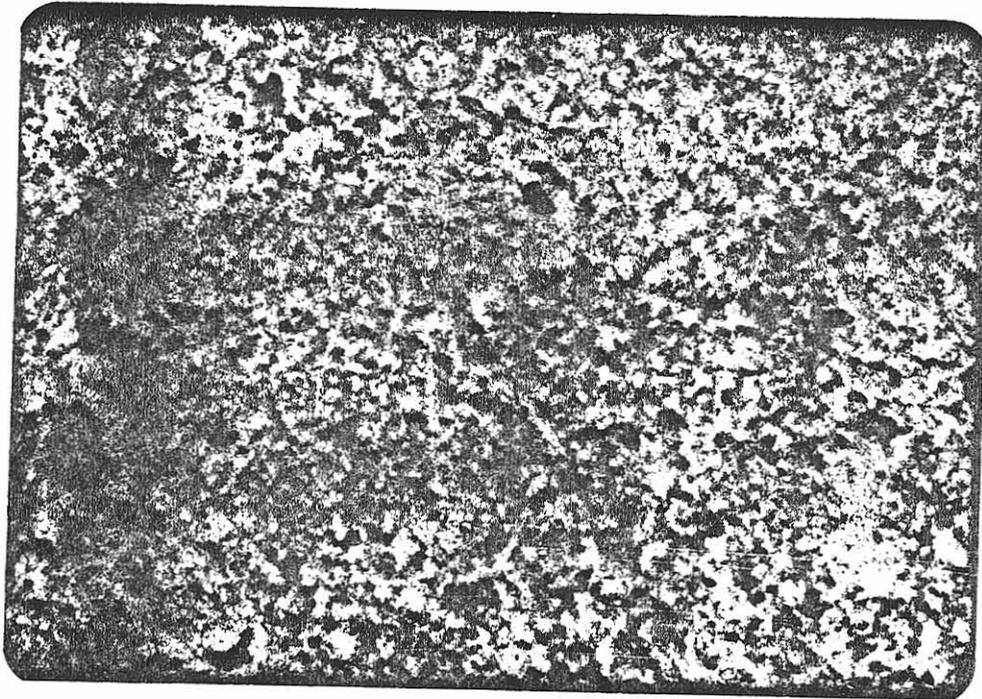


Plate 7:- (Sample A3351) Photomicrograph showing typical fine-grained decussate aggregate of muscovite (colourless) and biotite (pale brown) with isolated opaque granules (black) in bands free of tourmaline granules and clots.
Plane polarised transmitted light; micrograph 1 x 0.7mm.

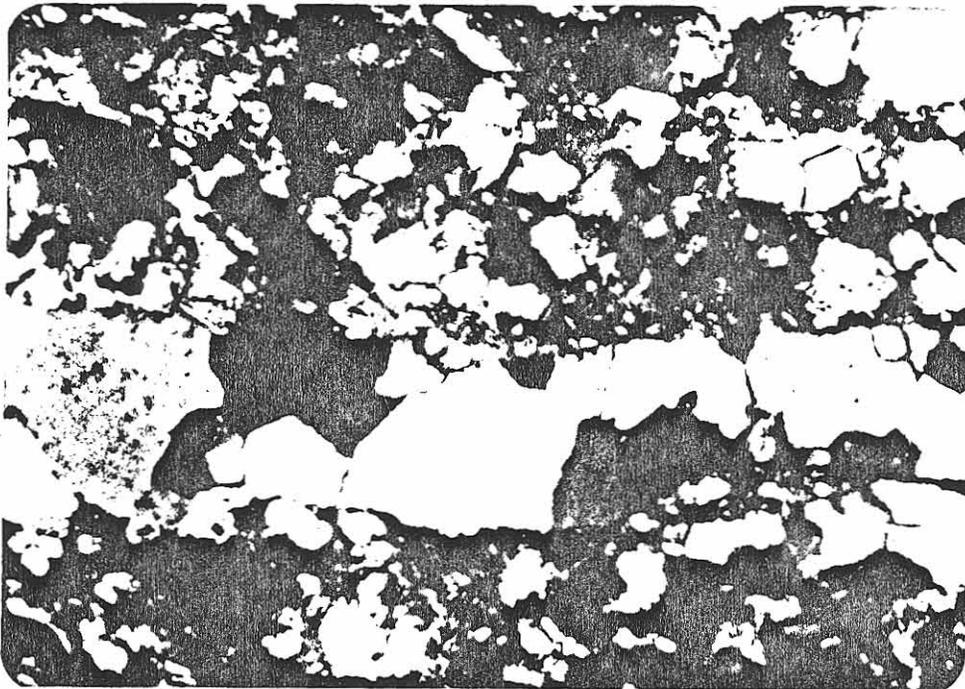


Plate 8:- (Sample A3352) Photomicrograph of typical area of the sample showing post-thermal metamorphism quartz vein traversing granoblastic aggregate of quartz (clear, white to black), K-feldspar (grey to black, dusty), muscovite (birefringent, platy) and isolated tourmaline. Note the fairly coarse fringing muscovite to the quartz vein.
Crossed polarised transmitted light; micrograph 1 x 0.7mm.

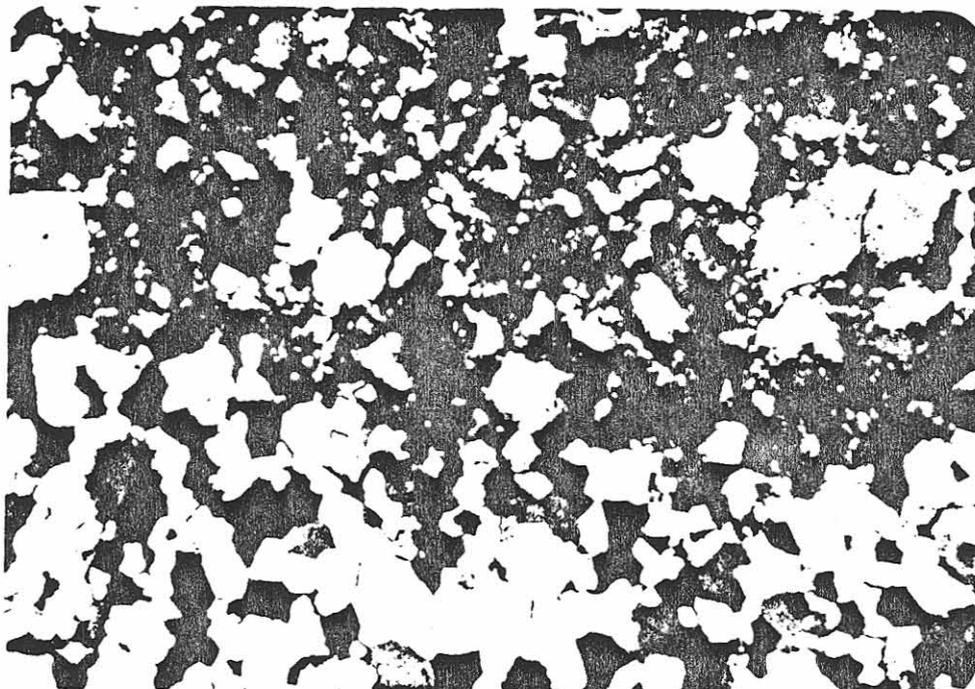


Plate 9:- (Sample A3353) Photomicrograph of typical area of the sample showing polygonised pre-thermal metamorphism quartz vein traversing granoblastic aggregate of quartz with intergranular decussate muscovite/biotite (birefringent) and limonite/goethite granules (black).
Crossed polarised transmitted light; micrograph 1 x 0.7mm.

SAMPLE NO.LOCATION

GLP 1	Costean no. 1 area, Glenair
A 3349	1050 E / 1450 N (Glenair)
A 3350	1000 E / 1000 N (Glenair)
A 3351	1058 E / 1050 N (Glenair)
A 3352	720 703 St. Pauls Dome 1 : 25000 Topo
A 3353	703 716 " " " "

recrystallisation as follows :-

- (1) regional metamorphism producing a micaceous and chloritic quartz schist with attendant attenuation of clastic quartz grains.
- (2) thermal metamorphism producing a granuloblastic mosaic in the quartz lenticles and overprinting of decussate texture in the micaceous matrix.
- (3) Further deformation resulting in strain effects with little or no recrystallisation.

Minor opaque oxide (less than 0.05 mm) is dusted throughout the matrix, e.g., Figure 1, along with occasional grains of zircon and apatite; minor K-feldspar is present.

Tourmaline is common, and whilst concentrated in and close to sheet veins, nevertheless occurs throughout the rock matrix. In the sheet veins tourmaline is closely associated with cassiterite (Figure 2). This distribution would suggest that tourmaline and cassiterite formation are closely related but that boron has had a greater diffusive mobility, penetrating further into the rock matrix.

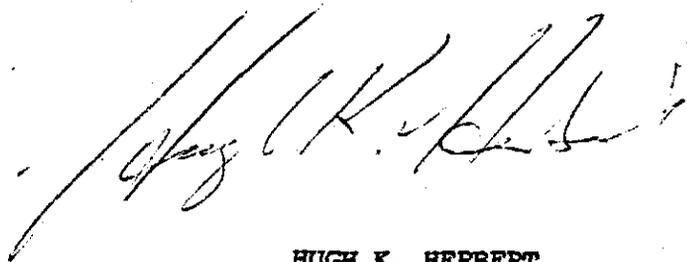
The rock is veined by two generations of quartz veins - a pre-mineralisation veining of pure barren quartz which shows considerable strain effects and so was probably pre-stage (3) above. The vein, about 1 cm wide, occurs at a low angle to the foliation.

The second generation quartz veins constitute a sheet veining system that occurs normal to foliation in the rock sample studied; veins range from 0.01 to 3 mm wide. This sheet veining appears to have mineralised and non-mineralised components in the ratio about 1:1 and strongly suggests two episodes of sheet veining, the non-mineralised veins being later than the mineralised veins. Evidence for this thesis is provided by the very common quartz infillings and overgrowths of terminal quartz-crystals of mineralised veins (Figure 3), coupled with occasional topaz grains in the mineralised veins.

Amongst the mineralised veins cassiterite generally is very abundant and may constitute up to 50% of individual veins, particularly the widest and coarsest veins. The upper grainsize limit of cassiterite is 1.5 mm - this coarse cassiterite is of very uniform grainsize in the widest veins. Thinner veins have finer grained cassiterite. Thus, cassiterite grainsize is correlatable with vein width.

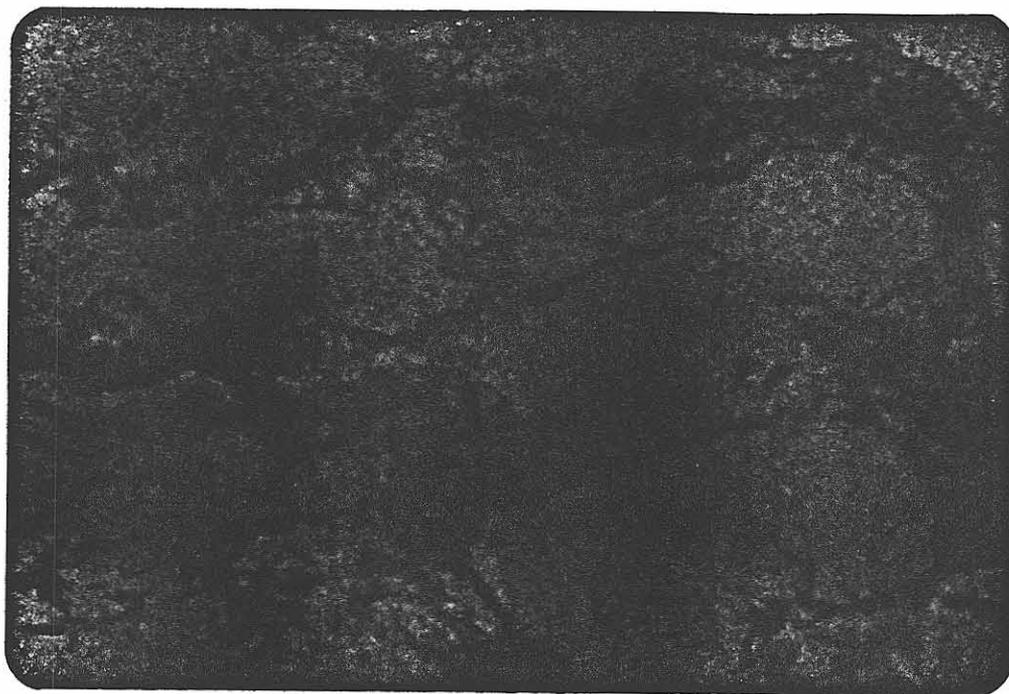
The lower limits of cassiterite grainsize is shown in Figure 4. Here, it is clear that the bulk of the cassiterite is within the vein but that fine-grained cassiterite also occurs disseminated in host rock adjacent to the vein. The vein quartz is composed mainly of elongate sutured grains which have grown normal to the vein walls. This vein quartz shows only minor strain effects whilst the associated strongly colour-zoned, euhedral to subhedral cassiterite is undeformed. Some coarser decussate patches of muscovite are associated with the quartz veins.

In terms of original composition, the host was a fine-grained quartz sandstone with a clayey matrix.

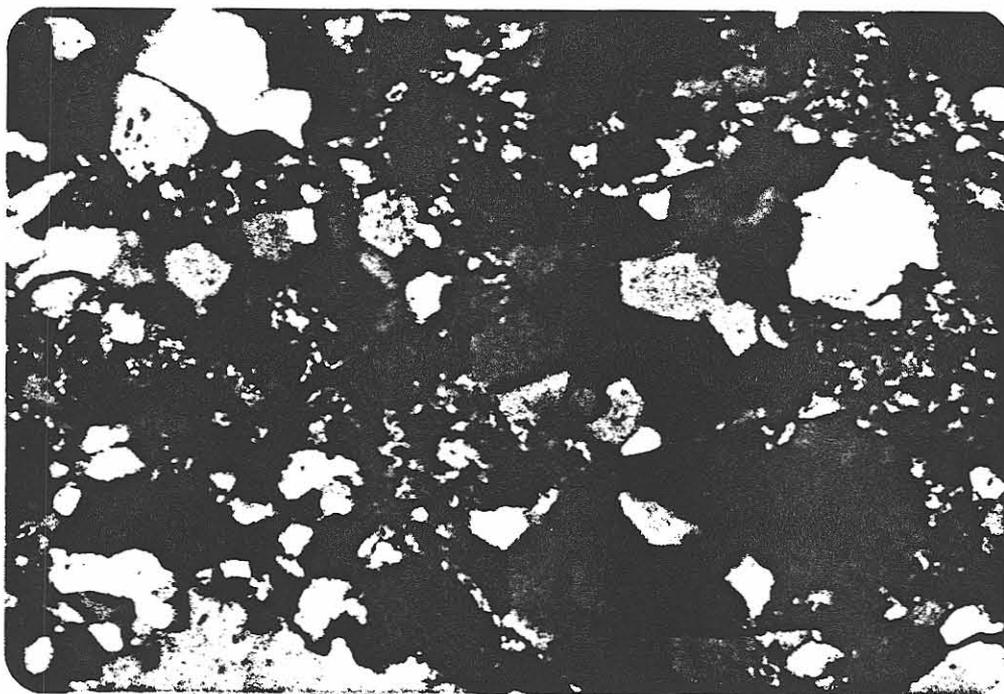


HUGH K. HERBERT

7th December, 1982.



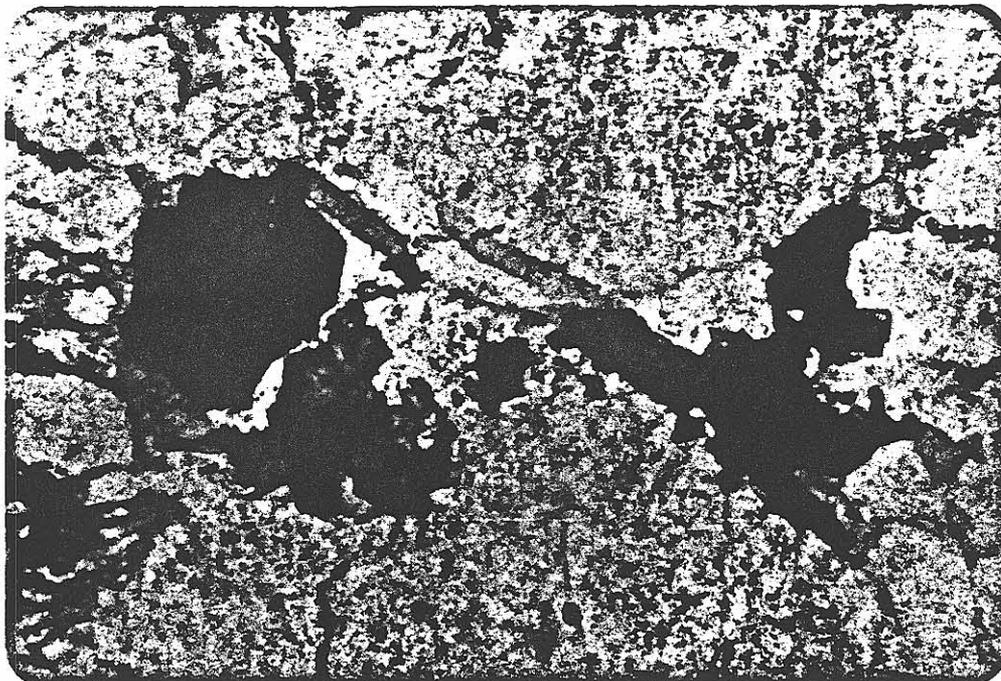
(a)



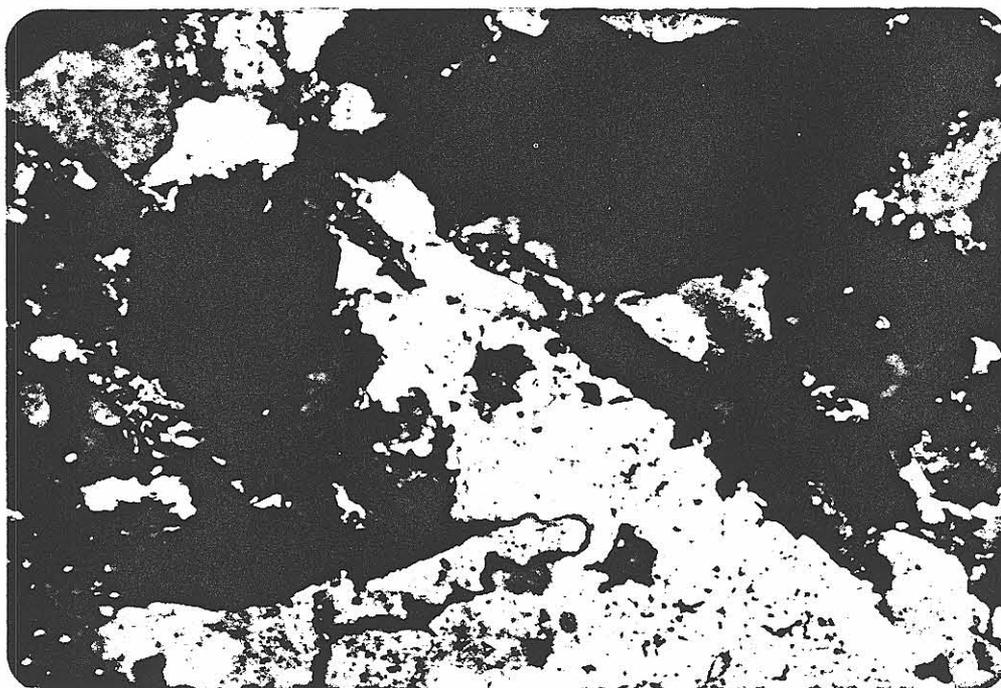
(b)

Figure 1 (a): Photomicrograph showing attenuated quartz lenticles defining a foliation are set in a matrix of sericite/muscovite and chlorite. Opaque oxide granules are dusted throughout the matrix. Plane polarised light; X60.

(b): Crossed polarised light micrograph of area (a) showing granuloblastic aggregates within quartz lenticles. X60.



(a)



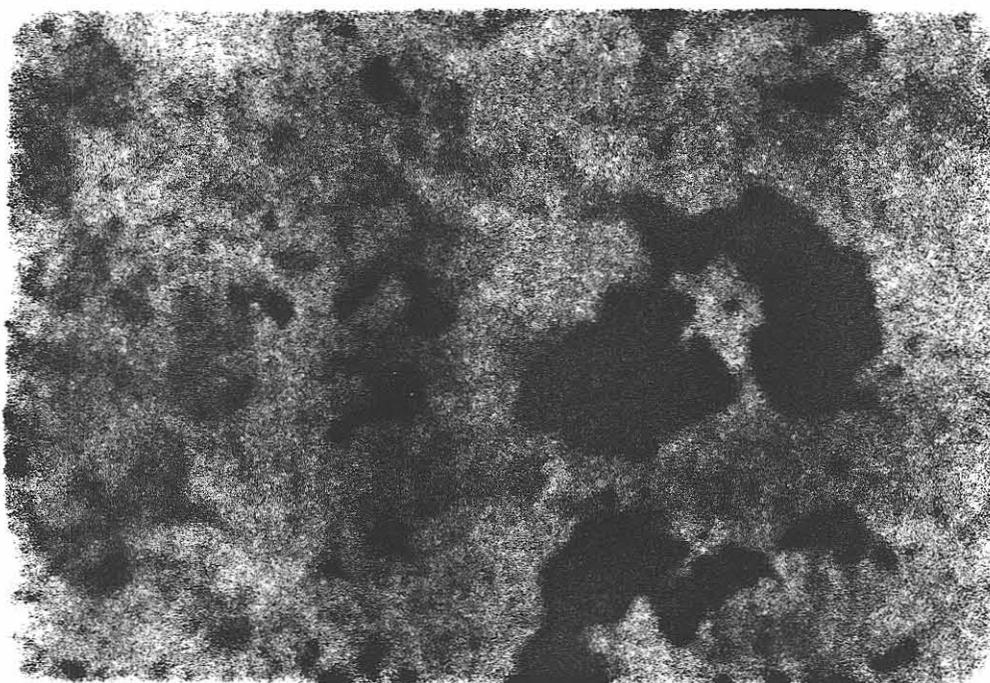
(b)

Figure 2 (a): Photomicrograph showing intimate association of tourmaline (pale green-brown, high relief) and cassiterite (dark brown, high relief) in quartz vein (pale cream). Pale cream areas of low relief in the quartz vein are muscovite. Fine black speckling is fluid inclusions. Plane polarised light; X60.

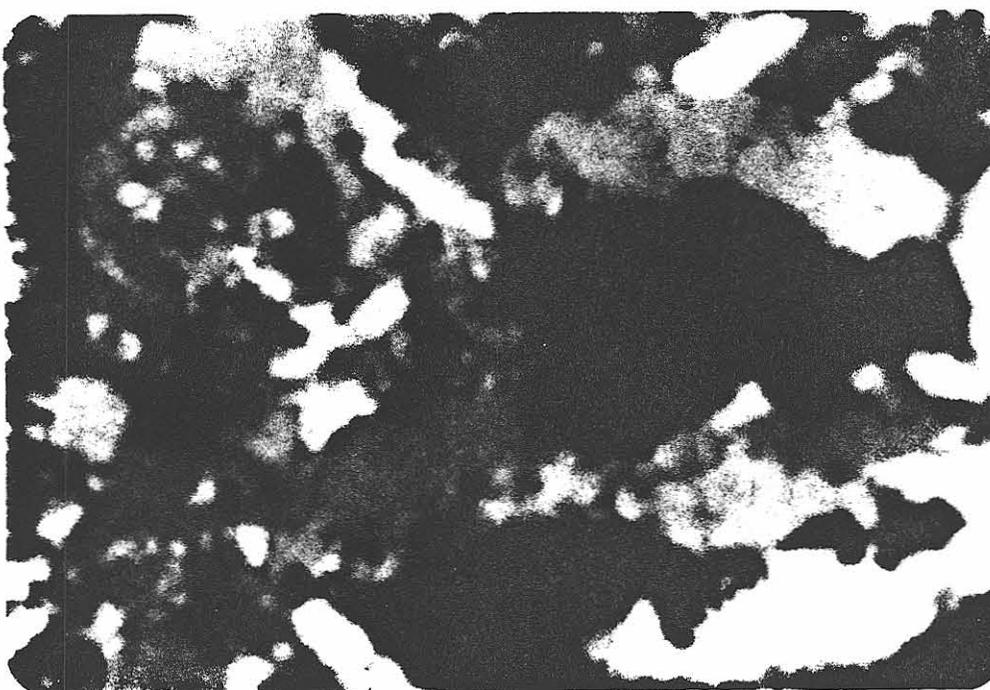
(b): Crossed polarised light micrograph of area (a). X60.



Figure 3: Photomicrograph showing cassiterite grains (dark brown, high relief) in quartz vein (pale cream) with areas of muscovite (pale cream, low relief). Also present are small grains of tourmaline (pale brown, top center), whilst black speckling is fluid inclusions. Note the euhedral quartz crystals overgrown by later-stage quartz with the boundary defined by a dense train of fluid inclusions. Plane polarised light; X60.



(a)



(b)

Figure 4 (a): Photomicrograph showing cassiterite (dark brown) in quartz vein together with disseminated cassiterite in muscovite-rich (cream, low relief) host rock adjacent to vein. Note the range in grainsize of the fine-grained cassiterite. Plane polarised light; X60.

(b): Crossed polarised light micrograph of area (a) showing details of vein quartz and adjacent host rock. X60.

APPENDIX 6

STREAM SEDIMENT GEOCHEMISTRY

SAMPLE RECORD

521120

AMAX IRON ORE CORPORATION
(MINERALS EXPLORATION DIVISION)

White: Office
Yellow: Project Geologist
Green: Sampler

1:250,000 Sheet Area OATLANDS

Property or Prospect ROYAL GEORGE

Date: 14 April 1983

Collected by: D. ELLIS

Sample Batch No.

Analyses by: ANALABS

STREAM SEDIMENT GEOCHEMISTRY

Analyses (ppm unless otherwise stated)

St. Pauls Dome
1 : 25000 Topo
Grid Ref.
Comments

Sample No.	Description	DATA BASE NO	Location	Sn	W	As	Cu	Pb	Zn	St. Pauls Dome 1 : 25000 Topo Grid Ref. Comments
A 3301	Stream sediment	4951	South Glenair Ck	50	x	14	30	300		688706
3302		4952	South Kellys Ck	60	x	6	55	90		694708
3303		4953	West Arm Long Marsh Ck	15	X	8	20	300		703712
3304		4954	East Arm Long Marsh Ck	50	X	18	40	1100		708712
3305		4955	South Williams Ck	60	X	4	10	300		716706
3306		4956	South Salmon Ck	50	X	4	25	1800		723705
3307		4957	South Panel Marsh Ck	50	X	4	25	700		728705
3308		4958	Lower Forbes Ck	32	X	54	25	15	75	679708
3309		4959	North Long Marsh Ck	15	X	7	10	5	50	710719
3310		4960	Lower Panel Marsh Ck	30	X	13	5	10	70	726708
3311		4961	North East Salmon Ck	230	X	2	5	X	45	722718
3312		4962	North West Kellys Ck	60	X	5	15	5	80	694718
3313		4963	North East Kellys Ck	15	X	8	5	5	30	695718
3314		4964	W. Arm North Long Marsh Ck	10	X	5	5	X	15	701716
3315		4965	W. Arm North Long Marsh Ck	20	X	7	10	5	40	702716
A 3356		4966	N. Williams Ck	65	X	5	5	X	35	716713
3357		4967	West Arm Salmon Ck	220	X	4	X	5	20	720718
3358		4968	North West Arm Salmon Ck	55	X	3	X	X	30	717721

SAMPLE RECORD

521121

AMAX IRON ORE CORPORATION
(MINERALS EXPLORATION DIVISION)

ROYAL GEORGE

White: Office
Yellow: Project Geologist
Green: Sampler

1:250,000 Sheet Area OATLANDS

Property or Prospect

Date: 14 April 1983

Collected by: D. ELLIS

Sample Batch No.

Analyses by: ANALABS

STREAM SEDIMENT GEOCHEMISTRY

St. Pauls Dome
1 : 25000 Topo
Grid Ref.
Comments

Analyses (ppm unless otherwise stated)

Sample No.	Description	DATA BASE NO	Location	Analyses (ppm unless otherwise stated)						St. Pauls Dome 1 : 25000 Topo Grid Ref. Comments
				Sn	W	As	Cu	Pb	Zn	
A 3359	Stream Sediment	4969	North Salmon Ck	250	X	5	5	x	55	720725
3360		4970	North East Arm Salmon Ck	80	X	2	X	30	45	721715
3361		4971	North Panel Marsh Ck	80	X	21	5	20	100	726721
3362		4972	East Arm Panel Marsh Ck	170	X	5	X	5	15	726712
3363		4973	North Snow Ck	4	X	9	45	20	80	702677
3364		4974	South Snow Ck	3	X	5	20	15	40	703666
3365		4975	Creek East of Dyke Lode	422	17	4	5	25	25	713679
3366		4976	Royslea Ck	22	15	9	5	35	40	723677
3367		4977	North Stable Ck	3	X	2	35	20	70	727679
3368		4978	South Stable Ck	36	X	3	25	10	70	733672
3369		4979	East Arm School Ck	266	17	2	5	30	35	737678
3370		4980	West Arm School Ck	215	26	11	10	100	150	735676
				Sn	W	As	Zn	F		
N 7550		4981	Nth. Glenair Ck	35	X	14	25	400		689712
7551		4982	Central Glenair Ck	35	X	17	25	400		688710
7552		4983	Forbes Ck	20	X	6	35	200		681712

521122

SAMPLE RECORD

AMAX IRON ORE CORPORATION
(MINERALS EXPLORATION DIVISION)

White: Office
Yellow: Project Geologist
Green: Sampler

1:250,000 Sheet Area St. PAULS DOME 1 : 25 000

Property or Prospect ROYAL GEORGE

Date: 10 June 1983

Collected by: R. VIVIAN

Sample Batch No.

Analyses by: ANALABS

St. Pauls Dome
1 : 25 000 Topo
Comments

Sample No.	Description	Location	Analyses (ppm unless otherwise stated)					St. Pauls Dome 1 : 25 000 Topo Comments
			Sn	W	As			
A 3311A	Replicate of A 3311 stream sed	L4984 Nth East Salmon Creek	320	X	7			722 718
3357A	" " A 3357 " "	L4985 West Arm Salmon Creek	100	X	9			720 718
3359A	" " A 3359 " "	L4986 Nth Salmop Creek	95	X	7			720 725
A 3398	Stream sediment	L4987 West Trib Salmon Creek	60	X	9			719 719
A 3398A	" "	L4988 " " " "	60	X	9			718 720
3399	" " Replicate of A 3358	L4989 Nth West Arm Salmon Creek	80	X	13			717 721
A 3435	" "	L4990 Nth Salmon Creek	90	X	6			720 728
A 3447	Stream Sediment	L4991 E. Salmon Creek						722 719
3448	" "	L4992 " "						722 721
3449	" "	L4993 " "						721 722
3450	" "	L4994 " "						721 723

APPENDIX 7

RECONNAISSANCE ROCK CHIP GEOCHEMISTRY

SAMPLE RECORD

AMAX IRON ORE CORPORATION
(MINERALS EXPLORATION DIVISION)

White: Office
Yellow: Project Geologist
Green: Sampler

1:250,000 Sheet Area OATLANDS

Property or Prospect ROYAL GEORGE DYKE LODGE & GLENAIR

Date: 14 April 1983

Collected by: D. ELLIS + R. VIVIAN

Sample Batch No.

Analyses by: ANALABS

APPENDIX 7 - RECONNAISSANCE ROCK CHIP GEOCHEMISTRY

Analyses (ppm unless otherwise stated)

Sample No.	Description	Location	Analyses (ppm unless otherwise stated)					Comments
			Sn	F	Cu	Pb	Zn	
A 3331	brown soft looking rock sacchroidal texture; some frags silic & fractured: carries much vague white qtz veins	Refer to Plate 7	85	8400	5	30	65	
A 3332	Pinkish cream sugary sst cut by T stringers & numerous intersecting dull white qtz veinlets (2-3mm)	ditto	X	700	5	10	25	
A 3333	Coarse granular qtz & mica, greisen, carrying minor qtz veinlets & tourm clots	ditto	260	2600	25	X	10	E. Long Marsh Ck
A 3334 & A 3335	L grey silic hornfelsic sandstone. Well fractured & green tourm lined joints; qtz/ tourm veinlets; multiple veining & brittle fracture textures v. minor tourm argillac sed	ditto	130	4400	X	X	20	
A 3336	massive tourm (green & felted) infilling fractured silic. sst; vughy qtz veining	location uncertain	380	2700	X	X	35	
A 3338	D grey tourmalinised & silicified rock qtz veined (anastomising); T stringers	See records	75	3700	X	5	30	
A 3339	Ditto	ditto	85	4000	X	25	30	
A 3340	Qtz tourmaline rock blueish tourm/qtz groundmass with small clots of black tourm xrystls coarse aggregates equivolume of bluish finely xrystline to massive tourm and sacchroidal qtz. Fine gr bluish black dominantly massive to fine xrystline tourm plus qtz. Small blue green tourm clots in a largely sacchroidal qtz rock. D blue black, completely fine acicular tourm crystals	Blue Lode (Sthn Trench)	30	4400	X	X	40	

521124

SAMPLE RECORD

AMAX IRON ORE CORPORATION
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1:250,000 Sheet Area OATLANDS

Property or Prospect

ROYAL GEORGE GLENAIR RECCE

Date: 14 April 1983

Collected by: D. ELLIS + R. VIVIAN

Sample Batch No.

Analyses by: ANALABS

sample No.	Description	Location	Analyses (ppm unless otherwise stated)					Comments
			Sn	F	Cu	Pb	Zn	
A 3341	Ditto	Blue Lode Northern area	45	4000	X	X	25	
A 3342	Ditto	Long Marsh Ck, East side	55	4100	X	X	25	
A 3343	Ditto	Blue Lode Dump	60	8700	15	X	25	
A 3344	composite rock chip (sub o/c) well fractured/ tourm. lined siliceous d grey hornfelsic sst much qtz veining sericite on margin of some T fractures, some rock frags black tourmaline	E Long Marsh Ck	1100	7500	5	X	40	Sub o/c E. Long Marsh Ck
A 3345	composite across 3 metres of tourmalinised grey sst carrying qtz veining of varying orientations	Homeward Ck	25	300	25	X	50	
A 3346 & A 3347	d grey black silic tourmalinised + grey sst containing numerous tourm veinlets & white crystalline qtz/tourm veins to 3mm wide; locally intense tourmalinised fractures to produce brecciated rock	Homeward Ck area, W. Freeman property area of prominent well jointed sub o/c (inside gate)	530 590	4000 4000	10 15	30 55	50 70	
A 3348	open or minute dogtooth qtz lined siliceous greisenised qtz porphyry (minor qtz phenos); tourm clots	Dyke Lode S.W. costean near	2050	1.38%	X	30	65	
A 3354	heavily silicified & tourmalinised sst & qtz/ tourm veined (open space textured) composite	West Hill Side Salmon Ck 721 707	860	5800	X	X	40	
A 3355	greisenised in part ditto	ditto	1400	7250	X	35	40	

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PLANS

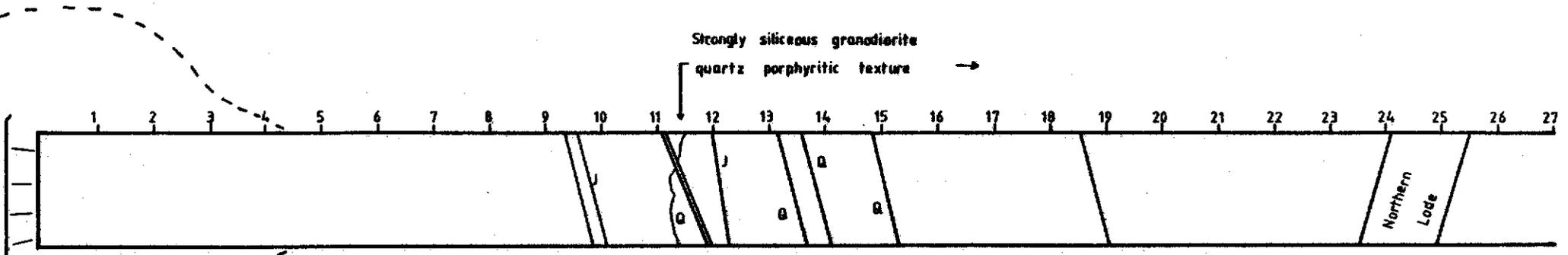
521130

MN ←

Host rock across entire costean exposure

Siliceous grey granodiorite porphyritic in large feldspar and indistinct Qtz phenocrysts + tourmaline rosettes.

Strongly siliceous granodiorite
quartz porphyritic texture →



I <

weak silicification

weak jointing

> K

minor mica lined joints.
moderate silicification ± clay

qtz / mica <1
minor

qtz

120

qtz/mica-tourm

5 / cm 7 / 10 cm

qtz

<1

chalcedonic qtz vughs

weak jointing

qtz / Tourm <1
minor

> K Strong Silico <

: alteration

: Veinlets Joints filling & width mm

: Veinlet joints per cm

Sn ppm	300	180	65	110	140	180	370	400	380	850	780	970	5250	670
F	2800	3800	2800	4900	6100	6400	1.19%	1.45%	1.35%	1.75%	1.30%	1.95%	2.00%	1.35%

Q - quartz veins

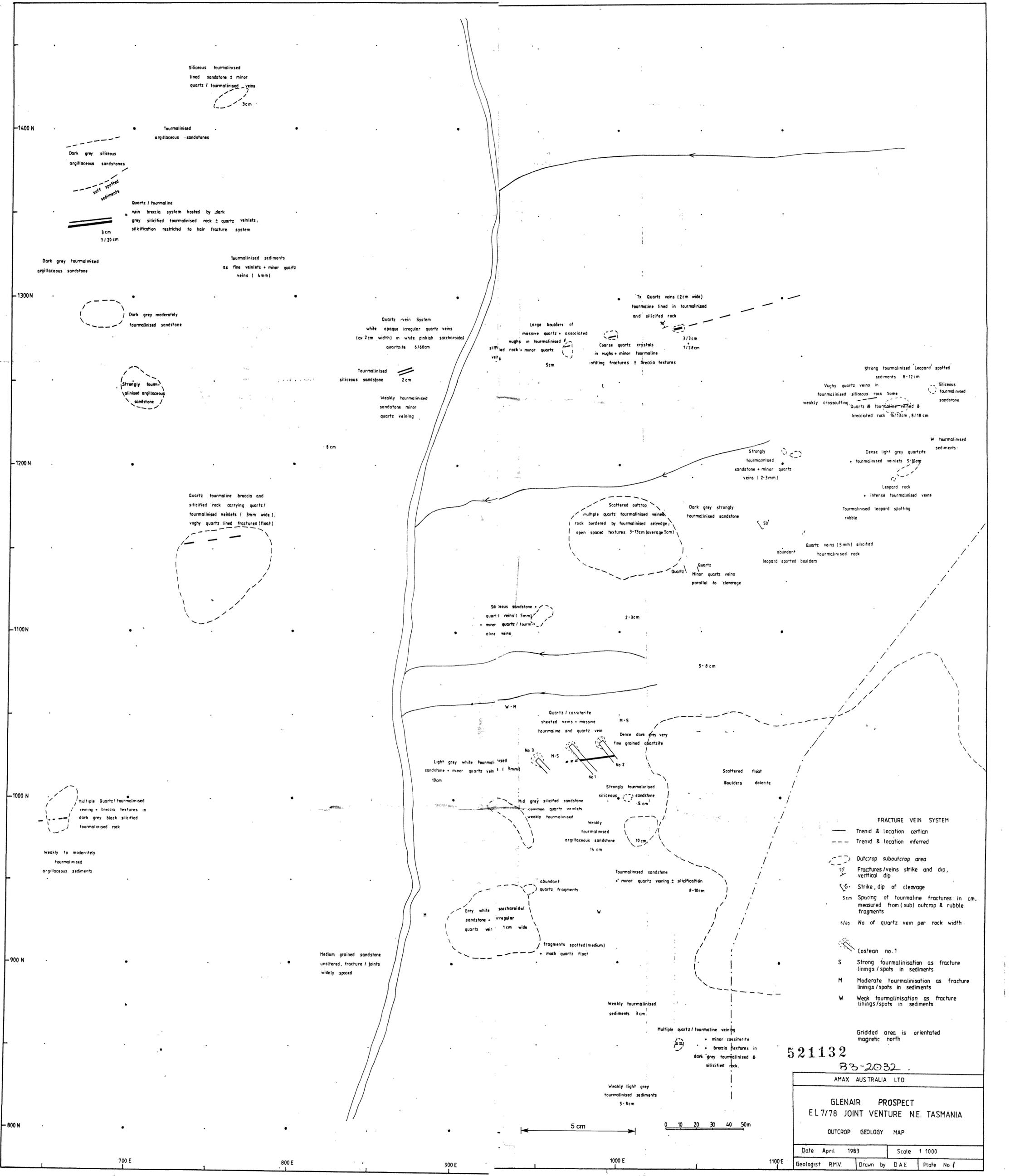
J - Joints

Scale 1:100

16.3.83 R.M.W.

DYKE LODGE COSTEAN GEOLOGY AND GEOCHEMISTRY

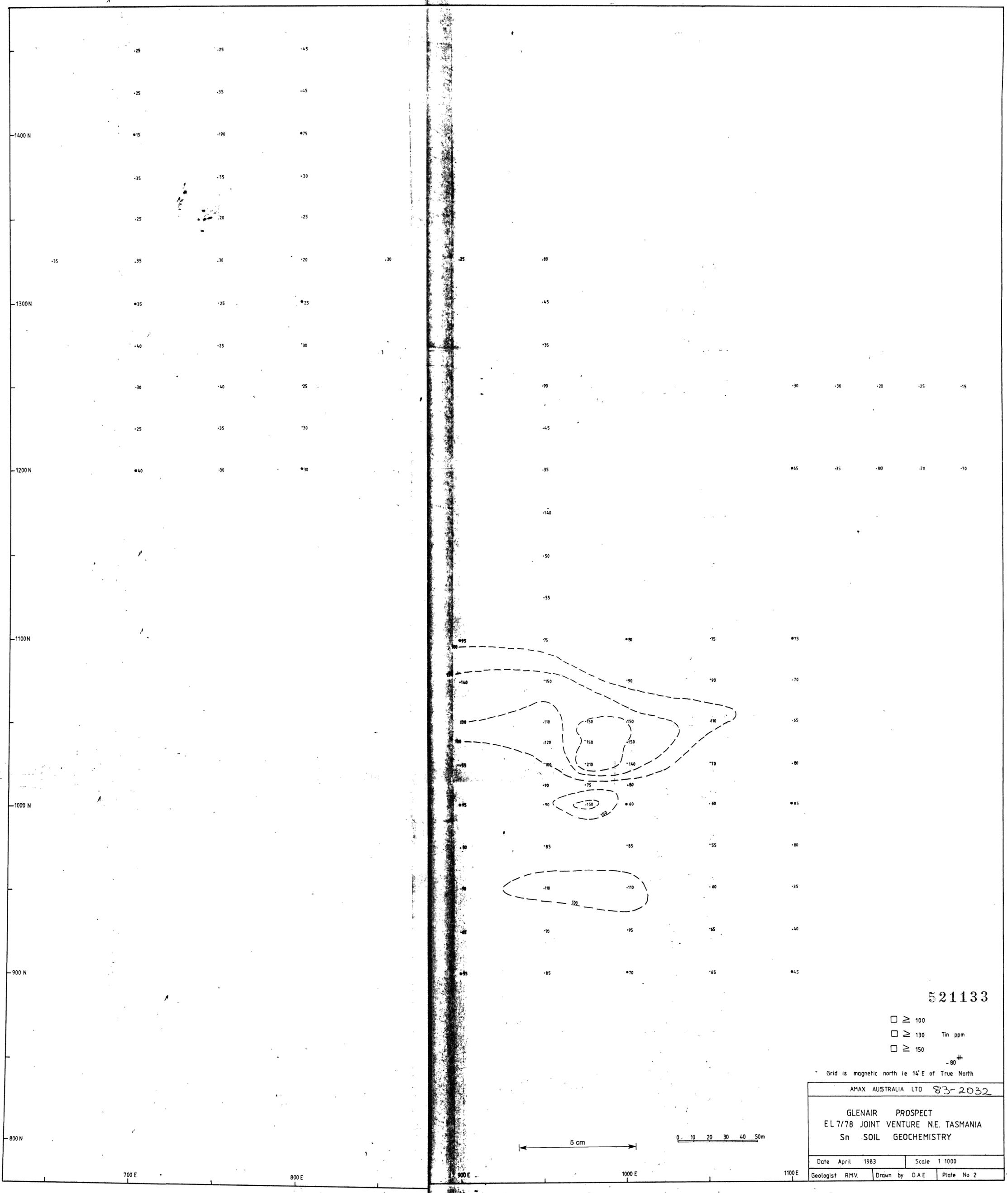
PLATES



521132

83-2032

AMAX AUSTRALIA LTD	
GLENAIR PROSPECT EL 7/78 JOINT VENTURE N.E. TASMANIA	
OUTCROP GEOLOGY MAP	
Date April 1983	Scale 1:1000
Geologist RMV	Drawn by DAE
Plate No /	



521133

- ≧ 100
- ≧ 130 Tin ppm
- ≧ 150

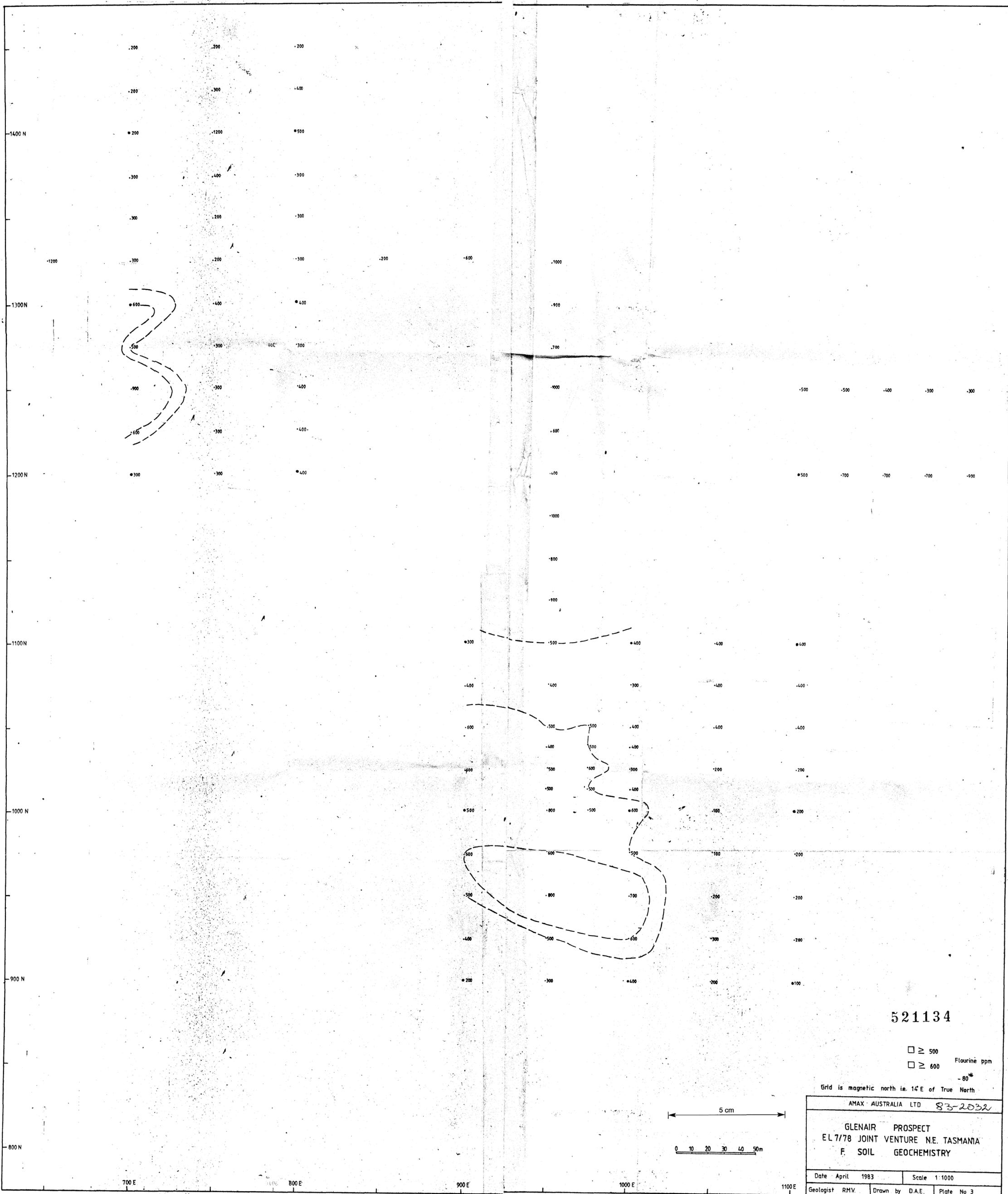
Grid is magnetic north ie 14° E of True North

AMAX AUSTRALIA LTD 83-2032	
GLENAIR PROSPECT EL 7/78 JOINT VENTURE N.E. TASMANIA Sn SOIL GEOCHEMISTRY	
Date April 1983	Scale 1 1000
Geologist RMV.	Drawn by D.A.E. Plate No 2



800 N 900 N 1000 N 1100 N 1200 N 1300 N 1400 N

700 E 800 E 900 E 1000 E 1100 E



521134

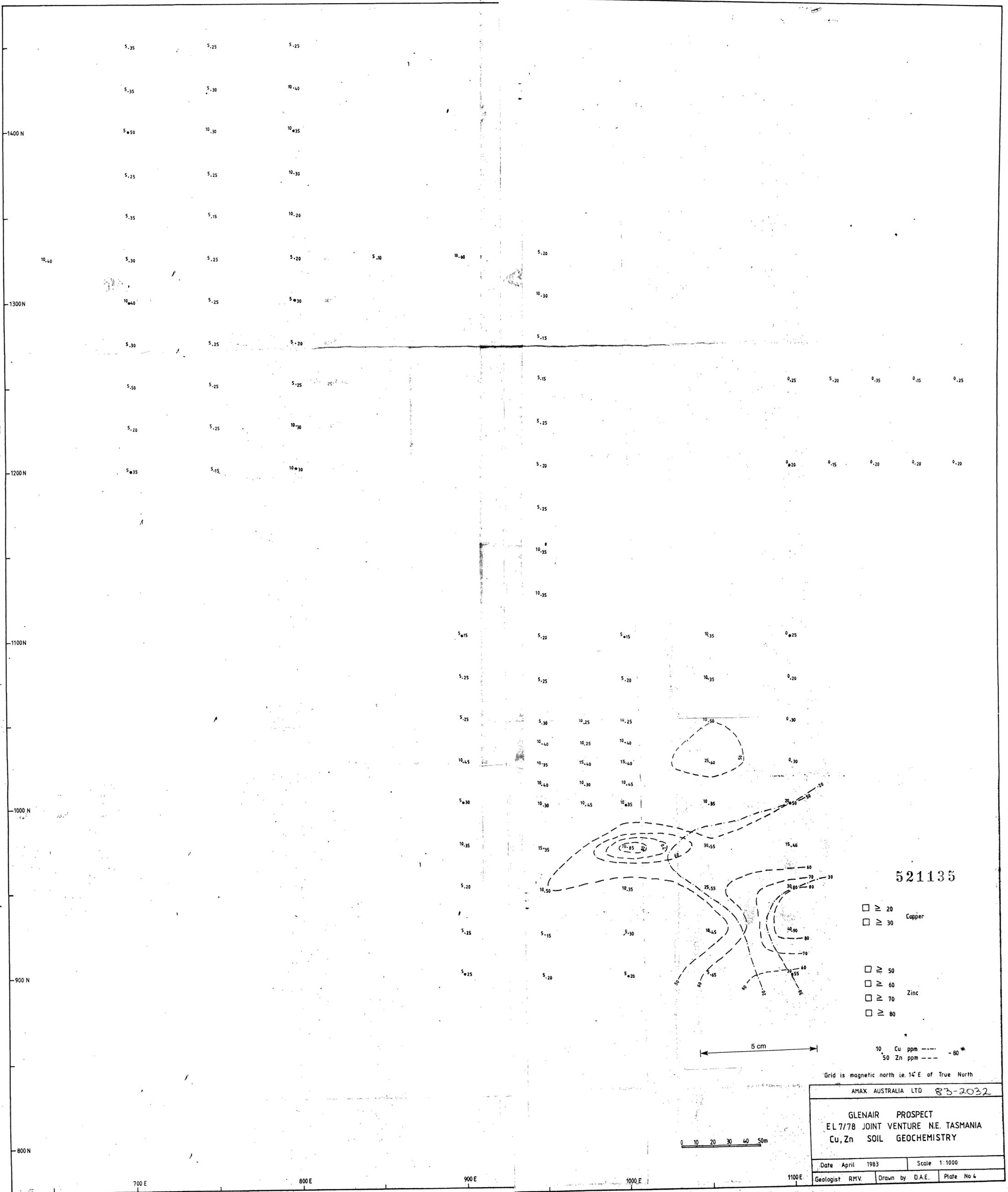
□ ≥ 500
 □ ≥ 600
 - 80*

Grid is magnetic north i.e. 14° E of True North

5 cm

0 10 20 30 40 50m

AMAX AUSTRALIA LTD 83-2032		
GLENAIR PROSPECT EL 7/78 JOINT VENTURE NE. TASMANIA F. SOIL GEOCHEMISTRY		
Date April 1983	Scale 1:1000	
Geologist RMV	Drawn by D.A.E.	Plate No 3



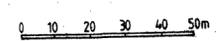
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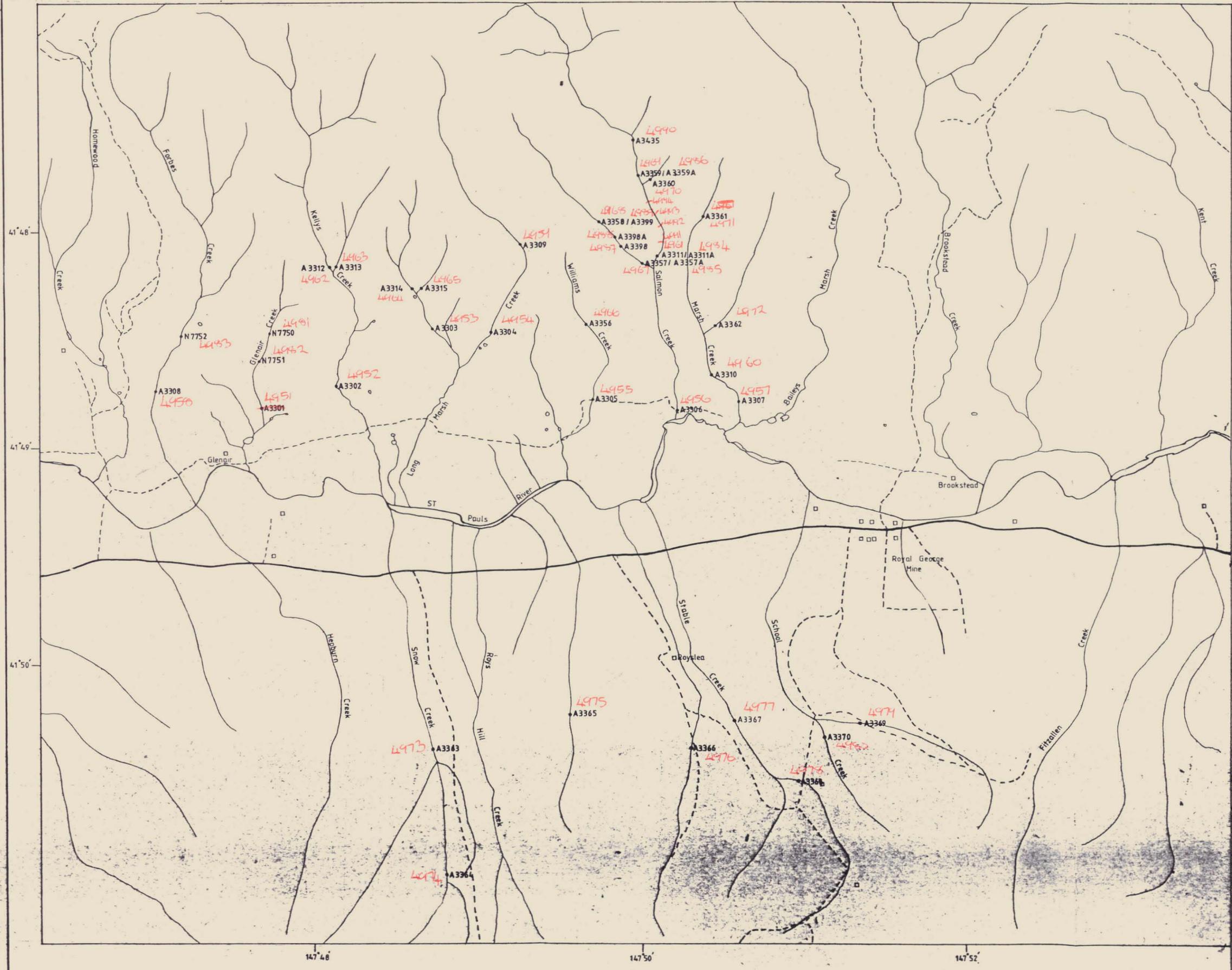
- ≥ 20 Copper
- ≥ 30
- ≥ 50 Zinc
- ≥ 60
- ≥ 70
- ≥ 80

10 Cu ppm - - - - - 80 *
50 Zn ppm - - - - -

Grid is magnetic north ie. 14° E of True North

AMAX AUSTRALIA LTD 83-2032	
GLENAIR PROSPECT EL 778 JOINT VENTURE NE, TASMANIA Cu, Zn SOIL GEOCHEMISTRY	
Date April 1983	Scale 1:1000
Geologist RMV	Drawn by D.A.E. Plate No 4



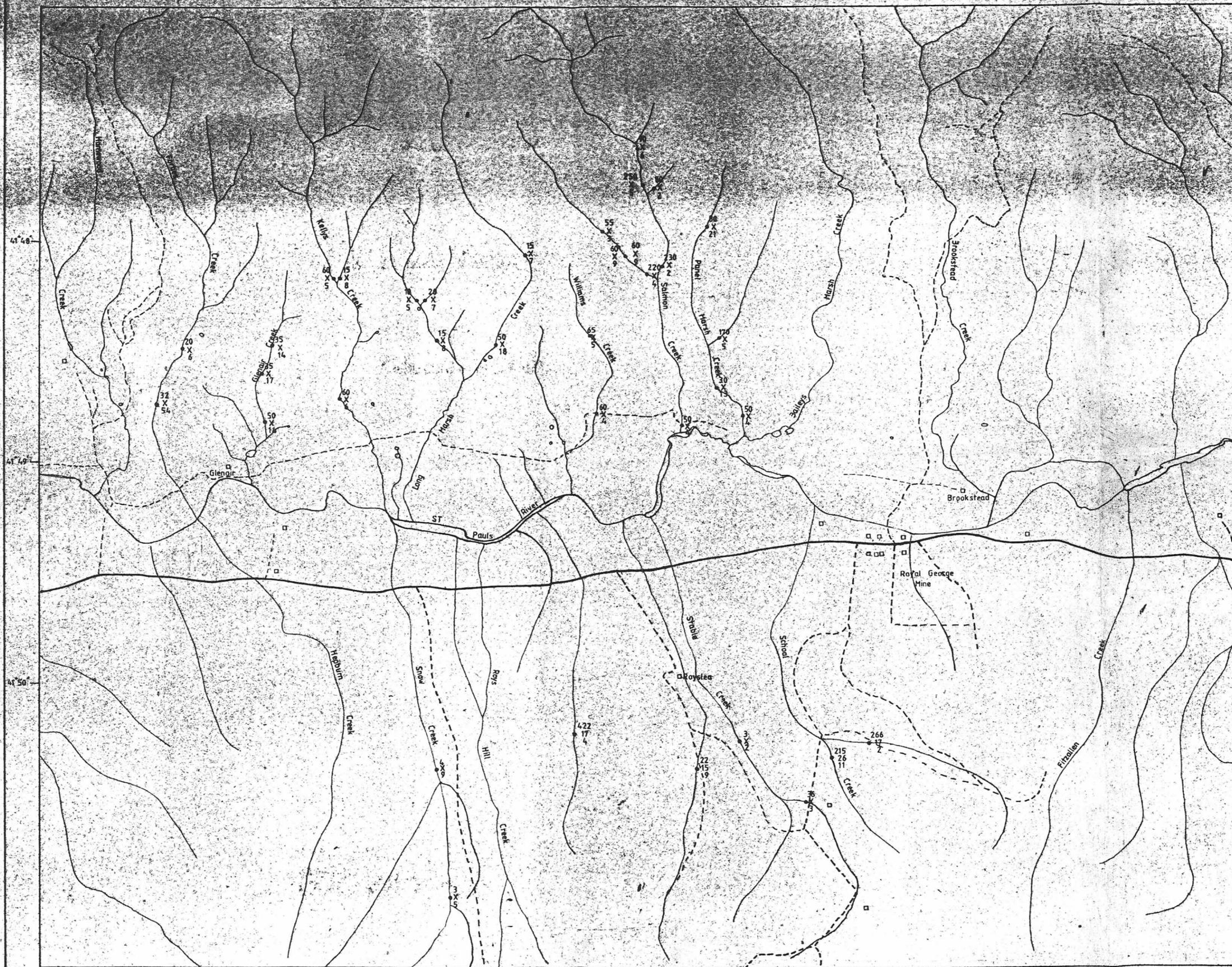


DATA BASE NO 5 IN RED

521138

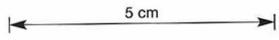


AMAX AUSTRALIA LTD		
ROYAL GEORGE PROJECT EL 7/78 JOINT VENTURE NE TASMANIA RECONNAISSANCE STREAM SEDIMENT SAMPLE LOCATIONS		
Date May 1983	Scale 1: 25,000	
Geologist RMV.	Drawn by D.A.E.	Plate No 7



30 ppm Sn
 X ppm W
 13 ppm As
 all samples minus 80 mesh
 — Roads
 --- Tracks

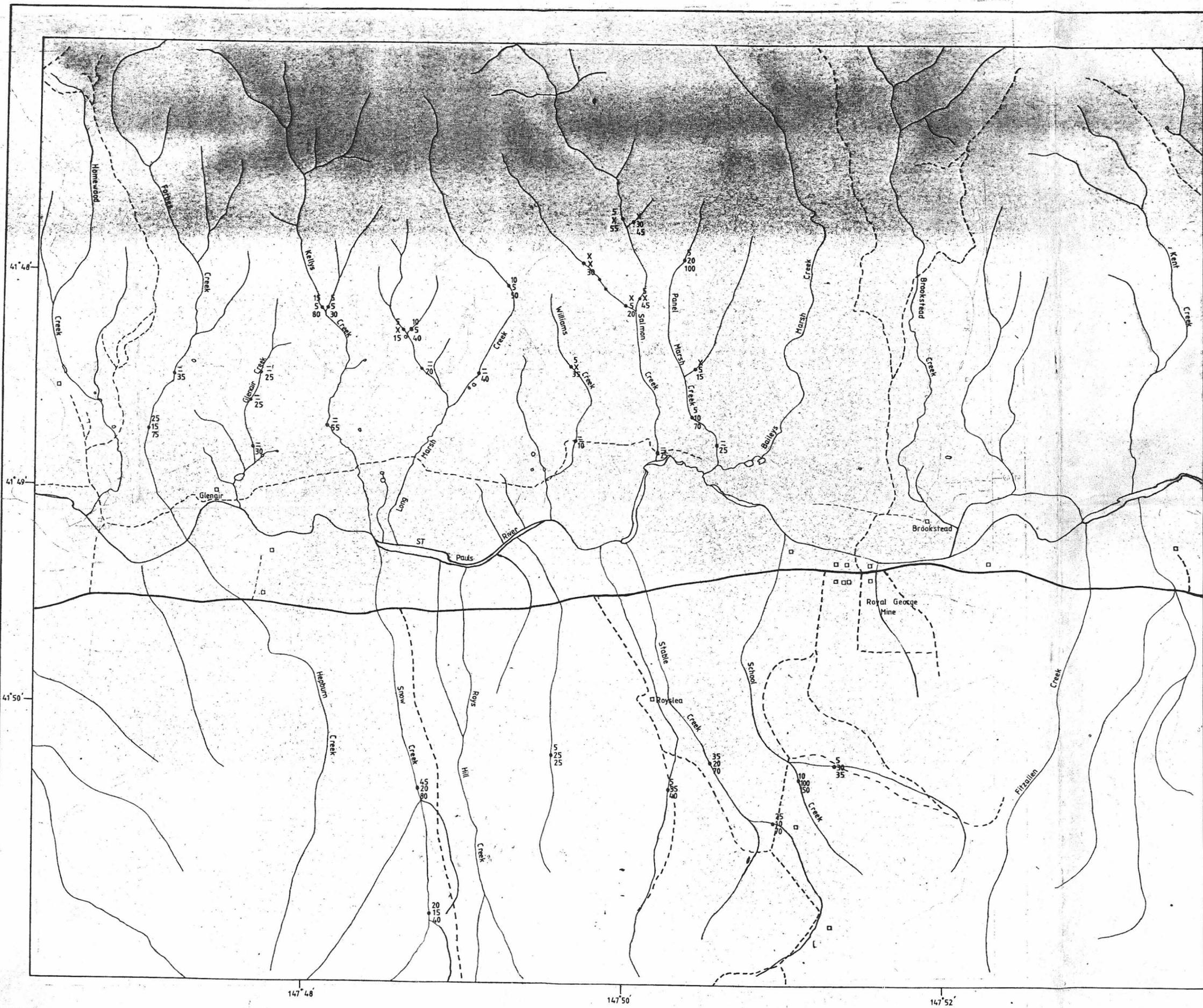
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AMAX AUSTRALIA LTD 83-2032

ROYAL GEORGE PROJECT
 EL 7/78 JOINT VENTURE N.E. TASMANIA
 STREAM SEDIMENT GEOCHEMISTRY
 Sn, W, As

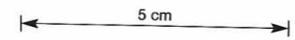
Date May 1983	Scale 1:25000
Geologist: RMV	Drawn by: D.A.S.



521140

5 ppm Cu
 20 ppm Pb
 100 ppm Zn
 all samples minus 80 mesh

— Roads
 --- Tracks



AMAX AUSTRALIA LTD 83-2032

ROYAL GEORGE PROJECT
 EL 7/ 78 JOINT VENTURE N.E. TASMANIA
 STREAM SEDIMENT GEOCHEMISTRY
 Cu, Pb, Zn

Date	May 1983	Scale	1:25,000
Geologist	RMV	Drawn by	D.A.E. Plate No. 9