TR11-38-48

9. PRELIMINARY REPORT ON THE GRANITIC ROCKS OF THE BLUE TIER TINFIELD

by D. I. Groves

INTRODUCTION

A detailed study of the granitic rocks forming the Blue Tier was carried out at intervals between June and November, 1965. The investigation was designed to determine internal structures of the granites and the relationship of such structures to the relative time and nature of emplacement of the granites, with particular reference to the tin-bearing granite.

The Blue Tier tinfield is accessible by road from the main East Coast Highway about 12 miles NW of St Helens. The road connects Goulds Country with the deserted townships of Lottah and Poimena, and rough tracks branch off to the mining areas of the Tier.

TOPOGRAPHY

The Blue Tier is a dissected plateau area at an elevation of some 2500 feet, with several monadnocks a few hundred feet high rising above the level. The topography is probably a reflection of the pre-Permian surface as shown by a small remnant of Permian strata on Mt Littlechild. The area is drained by a series of streams which flow in broad flat valleys on the plateau and plunge in gorge-like valleys over the edge of the Tier in every direction. The streams are tributaries of the Ringarooma River to the N and E, the Anson and Mussel Roe Rivers to the E and the George River to the S.

HISTORY

An extensive history of mining and exploration is given by Reid and Henderson (1928). The tin deposits were first discovered in 1874 but it was not until 1895, with the removal of the alluvial cassiterite, that lode mining was commenced. An estimated 2,000,000 tons of ore averaging about 0.2 per cent tin have been taken from the lode deposits, about 80 per cent of the total being from the Anchor Mine. The greater part of production was between 1890 and 1914, although 289 tons of metallic tin were produced from the Anchor Mine between 1934 and 1950.

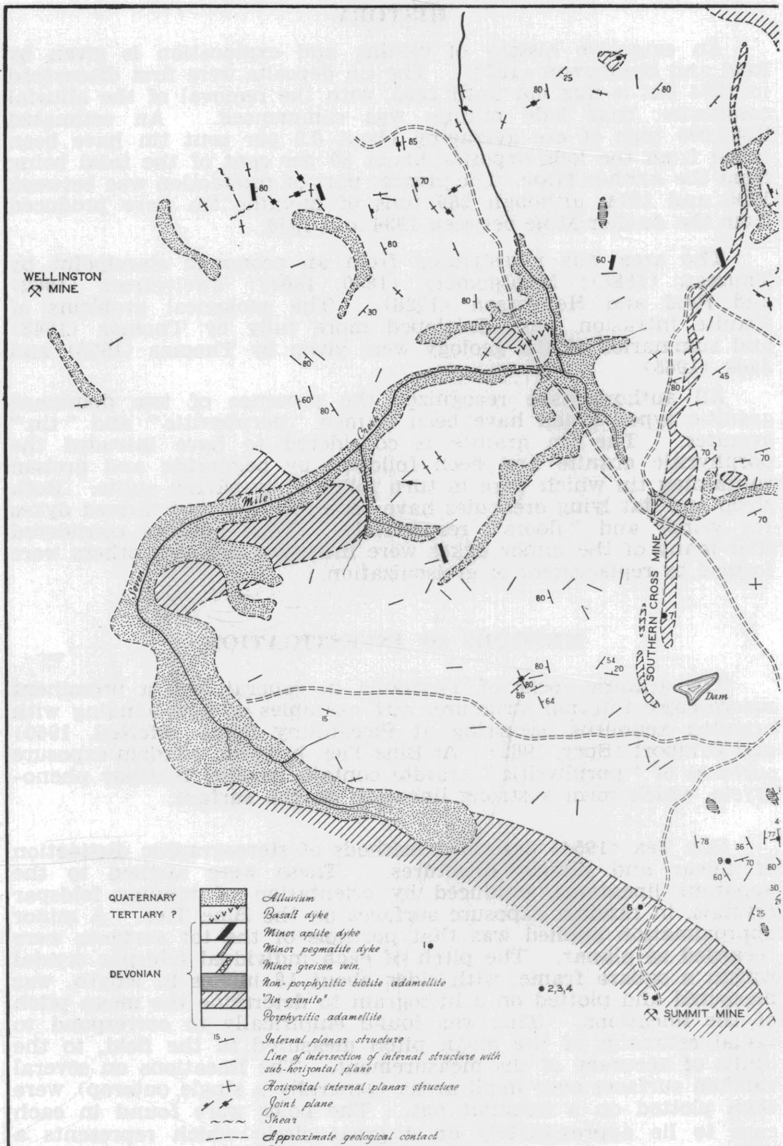
The area was investigated from an economic standpoint by Thureau (1886); Montgomery (1890, 1893); Twelvetrees (1902) and Reid and Henderson (1928). The geological problems of granite intrusion were developed more fully by Thomas (1943) and summaries of the geology were given by Thomas (1953) and Jack (1965).

All authors have recognized the presence of two dominant granitic types which have been termed "porphyritic" and "tin" granites. The tin granite is considered to have intruded the porphyritic granite and been followed by pegmatite and greisen containing tin which were in turn followed by barren aplite. Both steep and flat lying orebodies have been recorded and termed dykes (or veins) and "floors" respectively. Most authors considered that many of the minor dykes were intrusive although others were formed by replacement or greisenization.

METHODS OF INVESTIGATION

The granitic rocks of Tasmania in general lack a prominent macroscopic internal structure, rare examples of flow-banding with oriented xenoliths occurring at Piccaninny Point (McNeil, 1960) and Bridport (Spry, 1962). At Blue Tier, however, random exposure surfaces of "porphyritic" granite contain parallel feldspar phenocrysts, which form a strong lineation on the surface.

Den Tex (1954) described methods of stereographic distinction of linear and planar structures. These were applied to the apparent lineations, produced by orientation of tabular feldspar crystals, in random exposure surfaces on the Blue Tier. A minor approximation applied was that portions of the tor surfaces were regarded as planar. The pitch of each individual feldspar crystal within a square frame, with sides about 18 inches in length, was measured and plotted on a histogram to determine the mean pitch of the lineations. This was found empirically to correspond to visual estimates of the mean pitch measured in the field, to the limits of accuracy of the measurement. The lineations on several random surfaces over small areas (generally a single outcrop) were then plotted on a Schmidt net. The poles were found in each case to lie approximately on a great circle which represents a foliation plan within which there is random orientation. Hence the internal structure of the granites, as represented by the feldspar phenocrysts, is planar and represents the platy flow structure of den Tex (1954).


WELLINGTON MINE
SOUTHERN CROSS MINE
SUMMIT MINE
Dam
Mile
Creek
Seven
QUATERNARY
TERTIARY ?
DEVONIAN
Alluvium
Basalt dyke
Minor aplite dyke
Minor pegmatite dyke
Minor greisen vein.
Non-porphyritic biotite adamellite
"Tin granite"
Porphyritic adamellite
Internal planar structure
Line of intersection of internal structure with sub-horizontal plane
Horizontal internal planar structure
Joint plane
Shear
Approximate geological contact
Road
Jeep track
Sample point for chemical analysis (see appendix)

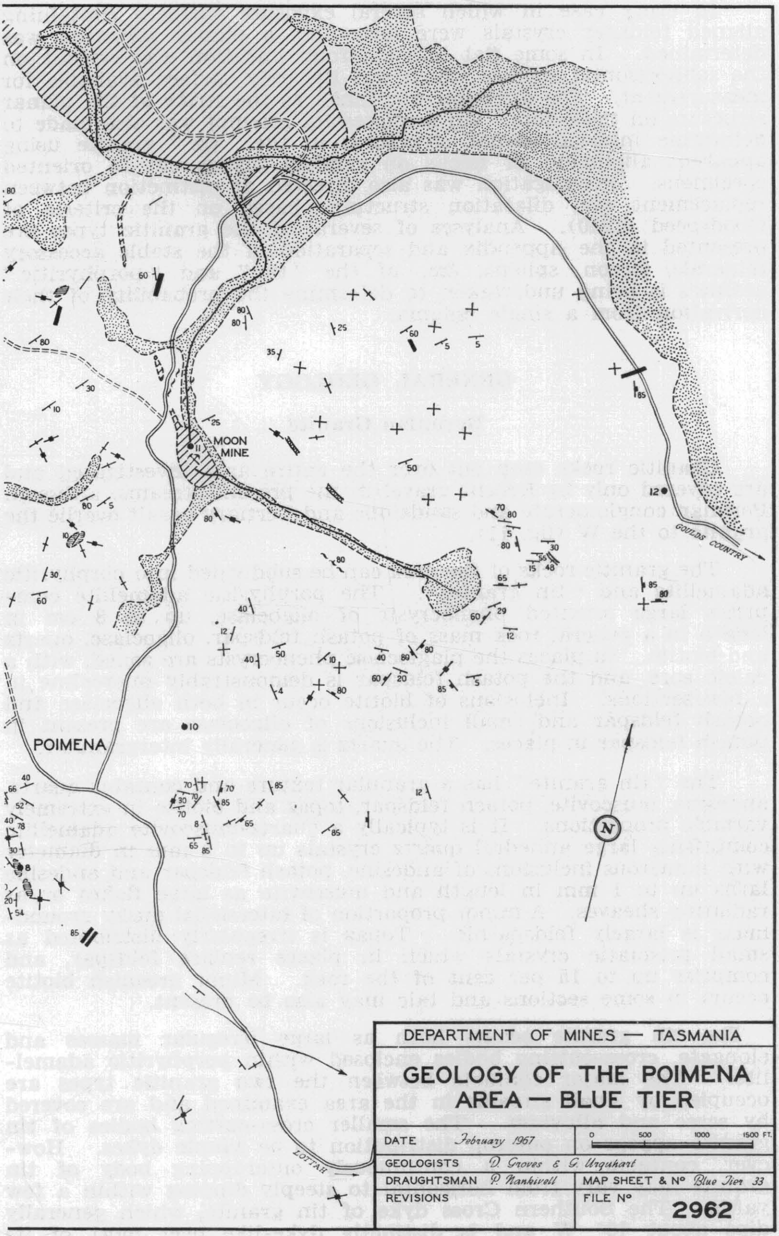


FIGURE 11

5 cm

In every case in which several exposure surfaces containing aligned feldspar crystals were measured, a planar structure was determined. In some flat tors a strong lineation was evident on the subhorizontal surface which was the only surface available for measurement. The direction was taken as the strike of the planar structure on these tors. An unsuccessful attempt was also made to determine internal planar structures in the "tin" granite using apparent alignment of micas on random planes cut in oriented specimens. Investigation was also directed at distinction between replacement and dilatation structures based on the criteria of Goodspeed (1940). Analyses of several of the granitic types are presented in the Appendix and separation of the stable accessory minerals, zircon, sphene, &c., of the "tin" and "porphyritic" granites is being undertaken to determine the probability of their derivation from a single magma.

GENERAL GEOLOGY

Devonian Granite

Granitic rocks crop out over the entire area investigated and are covered only by Recent gravel in the present streams, although Permian conglomerate and sandstone and Tertiary basalt overlie the granite to the W (fig. 11).

The granitic rocks of the area can be subdivided into porphyritic adamellite and "tin granite". The porphyritic adamellite comprises large oriented phenocrysts of oligoclase, up to 8 cm in length in a general rock mass of potash feldspar, oligoclase, quartz and biotite. In places the plagioclase phenocrysts are zoned, with a calcic core, and the potash feldspar is demonstrably microcline in a few sections. Inclusions of biotite occur in both oligoclase and potash feldspar and small inclusions of oligoclase are present in potash feldspar in places. The quartz is generally intergranular.

The "tin granite" has a granular texture and contains quartz, andesine, muscovite, potash feldspar, topaz and biotite in extremely variable proportions. It is typically a quartz-muscovite adamellite comprising large anhedral quartz crystals up to 3 mm in diameter with numerous inclusions of andesine, potash feldspar and andesine laths up to 1 mm in length and muscovite as large flakes or as radiating sheaves. A minor proportion of interstitial dusky groundmass is largely feldspathic. Topaz is irregularly distributed as small prismatic crystals which in places replace feldspar, and comprise up to 15 per cent of the rock. Minor greenish biotite occurs in some sections and talc may also be present.

The tin granite occurs both as large irregular masses and elongate, cross-cutting bodies enclosed within porphyritic adamellite. The major contacts between the two granitic types are occupied by small streams in the area examined and are covered by scree and alluvium. The smaller cross-cutting bodies of tin granite appear on outcrop distribution to be simple dykes. However, contacts within a continuously outcropping body of tin granite may vary from horizontal to steeply dipping within a few yards. The Southern Cross dyke of tin granite, which generally dips about 40° W and is distinctly dyke-like over most of its length, sits horizontally on porphyritic adamellite towards its southern extension. This may be due to sill-like projections of the tin granite associated with the steeper bodies. The contact of tin granite with porphyritic adamellite is sharp where exposed, the only evident mineralogical variation in the porphyritic adamellite being a pink colouration of the feldspathic constituent.

Patches of greisen occur within the dykes of tin granite and have been worked for cassiterite. A greisen from the southern section of the Southern Cross dyke is a granular rock comprising predominantly quartz and biotite with minor muscovite, topaz and andalusite. Quartz predominates as large anhedral cracked crystals up to 4 mm in diameter with numerous inclusions of biotite, muscovite, andalusite and topaz. The biotite occurs as flakes up to 1 mm in length and in fine radiating rims around the quartz crystals. Grey-brown tourmaline is a common constituent and occurs in elongate crystals up to 2 mm in length.

Numerous small igneous bodies cut the porphyritic adamellite and tin granite throughout the area. Pegmatite is common adjacent to the tin granite-porphyritic adamellite contact, and occurs as both thin bodies parallel to the contact and steeper cross-cutting dykes. The pegmatite contains predominantly quartz, feldspar and mica, and in places includes topaz, fluorite, tourmaline and minor sulphides. The contact of pegmatite with the enclosing granite is fairly sharp and is marked in places with a minor accumulation of biotite. In the Southern Cross workings, pegmatite was observed to intersect and be intersected by quartz veins. Irregular pegmatitic patches which occur within the porphyritic adamellite appear distinct from the dyke-like bodies. Quartz and feldspar with minor mica are the sole constituents, and the pegmatite appears to consist of coarse grained patches of similar mineralogy to the enclosing porphyritic adamellite.

Thin aplite dykes which cut tin granite, porphyritic adamellite and pegmatite are prevalent throughout the area. The aplites are fine grained, granular rocks comprising quartz, potash feldspar, andesine and minor biotite. Topaz is common in some sections and is present in high proportions along the margins of the dykes.

Order of Emplacement

The apparent order of emplacement is similar to that given by Reid and Henderson (1928) based on similar evidence.

(*a*) Emplacement of porphyritic adamellite with some contemporaneous development of simple pegmatite.
(*b*) Emplacement of tin granite with contemporaneous development of pegmatite subparallel to the margins of the tin granite bodies.
(*c*) Development of greisen in portions of the tin granite.
(*d*) Emplacement of pegmatite.
(*e*) Emplacement of aplite.
(*f*) Emplacement of quartz-veins throughout the period of igneous activity.
(*g*) Tin mineralization appears to have been associated chiefly with development of greisen and emplacement of the pegmatite.

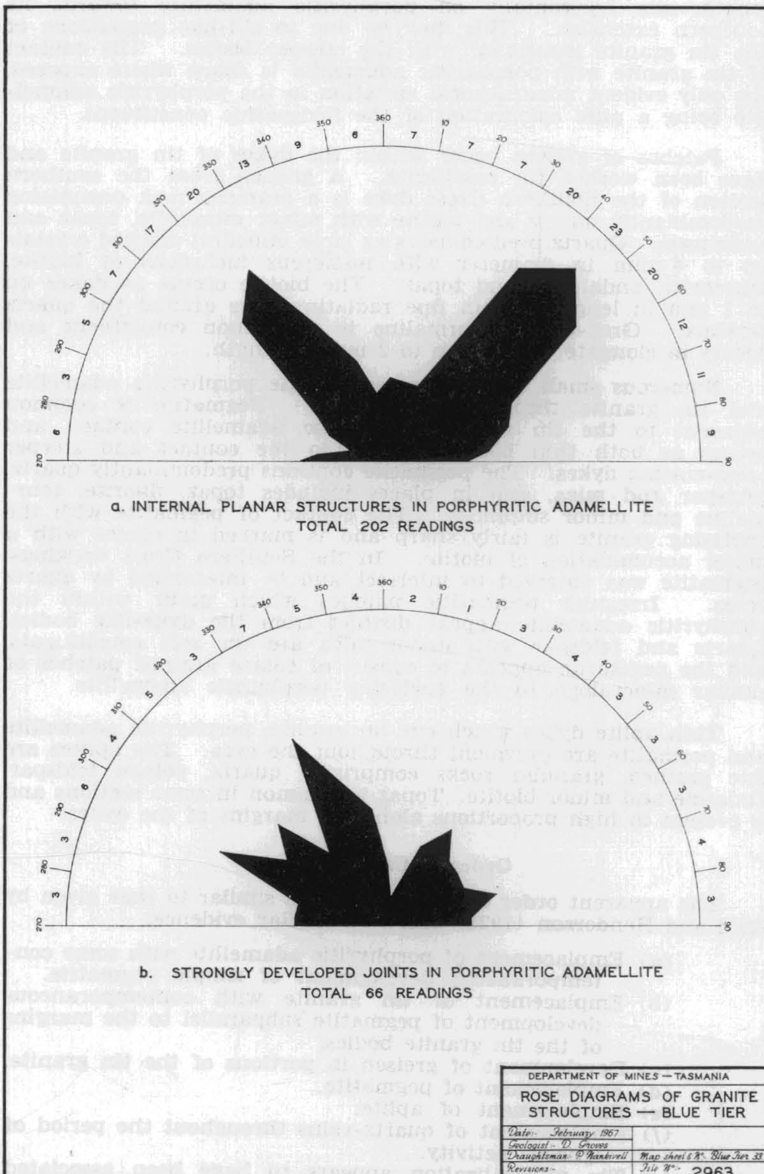

a. INTERNAL PLANAR STRUCTURES IN PORPHYRITIC ADAMELLITE
TOTAL 202 READINGS
b. STRONGLY DEVELOPED JOINTS IN PORPHYRITIC ADAMELLITE
TOTAL 66 READINGS
DEPARTMENT OF MINES — TASMANIA
ROSE DIAGRAMS OF GRANITE STRUCTURES — BLUE TIER
Date:- February 1967
Geologist:- D. Groves
Draughtsman:- P. Hankivell
Map sheet & N°. Blue Tier 33
Revisions:-
File N°.- 2963

FIGURE 12

Structure of the Granites

Intersections of granitic rock masses were studied throughout the area in an attempt to determine an intrusive or replacement origin for the bodies using the criteria of Goodspeed (1940), King (1948), Noble (1952) and Williams and Groves (1967). The results of the investigation were inconclusive due to lack of well exposed intersections and marked dyke-wall irregularities.

The internal structure of the porphyritic adamellite was also investigated as described previously. The planar structures are represented on fig. 11 and the steeply dipping planes are represented on a rose diagram (fig. 12). It is evident that the internal planar structures form a major set, approximately mutually perpendicular, which trends about NW and NE (310°-330°M and 35°-55°M). These directions do not coincide with any of the major structural features of the area. However, where planar structures and jointing are developed in a single exposure, they show rough parallelism. A general comparison between the internal planar structures and jointing is shown in fig. 12. The paucity of well developed jointing, however, restricts positive correlation.

CONCLUSIONS

An attempt has been made to differentiate intrusive and replacement phenomena in a portion of the Blue Tier area. Little success was gained from the project mainly due to lack of good exposure, and lack of distinguishing criteria in the limited exposure available.

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APPENDIX

by M. J. Longman

CHEMICAL ANALYSES OF GRANITIC ROCKS, BLUE TIER DISTRICT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
SiO_2	73.80	77.14	72.62	73.10	76.22	70.56	72.20	71.04	69.46	74.94	77.34	77.58	73.94	71.06
Al_2O_3	14.31	8.79	17.58	12.60	13.63	16.76	12.83	16.13	14.63	12.73	10.66	10.04	15.14	13.28
Fe_2O_3	0.46	0.52	0.31	0.30	0.59	1.73	1.10	1.18	1.23	0.83	1.69	0.56	0.53	0.33
FeO	0.77	0.58	0.26	0.51	0.51	3.66	0.58	0.64	4.37	2.00	1.35	2.50	0.71	1.93
MnO	0.01	0.003	0.01	0.01	0.01	0.07	..	..	0.01	0.01	..	0.02	0.01	..
TiO_2	0.02	..	..	0.02	..	..	..	..	0.06	0.13	..	0.09	..	0.12
P_2O_5	0.04	0.05	..	0.20	0.16	0.03	0.13	0.04	0.14	0.21	0.05	0.18	0.09	0.17
CaO	..	1.84	0.60	1.20	0.50	0.50	1.08	1.80	0.70	1.20	0.64	0.86	0.36	1.80
MgO	0.15	1.61	0.29	1.45	0.14	0.38	0.90	0.60	0.72	0.11	0.20	0.36	0.22	1.16
Na_2O	4.30	4.10	4.00	4.00	3.80	..	4.20	3.00	2.20	2.80	4.50	2.60	3.60	3.00
K_2O	3.40	2.70	3.60	3.60	3.10	2.40	2.90	3.50	3.40	3.40	0.90	3.40	3.30	3.60
H_2O-	0.08	0.21	0.18	0.22	0.11	0.15	0.23	0.10	0.05	0.05	0.15	0.05	0.18	0.08
H_2O+	1.73	1.51	1.86	1.66	1.71	2.35	2.06	1.07	2.11	1.15	2.10	1.50	1.45	2.18
CO_2	..	0.03	0.01	0.13	..	..	0.02	0.04	0.01	0.01	0.01	0.02	..	..
F	0.20	0.06	0.06	0.04	0.06	0.48	0.09	0.09	0.04	0.04	0.04	0.12	0.16	0.09
SO_3	0.05	0.18	0.04	0.06	0.03	0.07	0.01	0.04	0.01	0.09	0.01	0.06	0.03	0.06
TOTAL	99.32	99.323	101.42	99.10	100.57	99.14	99.33	99.27	99.14	99.70	99.64	99.94	99.72	98.86

Analyst: Department of Mines Laboratory

NORMS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Quartz	39.38	43.38	37.24	34.21	45.21	62.12	37.70	39.97	43.52	46.37	49.57	49.81	43.92	37.61
Orthoclase	19.29	14.91	20.11	20.08	17.32	18.36	16.49	19.79	19.55	19.02	5.26	18.73	18.60	20.31
Albite	36.97	29.31	34.39	34.35	32.02	..	36.17	25.67	19.01	23.78	38.40	21.85	30.83	25.65
Anorthite	..	..	2.65	5.55	1.31	0.55	4.79	8.29	2.72	4.76	2.89	2.60	0.27	7.48
Diopside	..	8.23	..	4.76	..	..	..	..	..	..	..	..	..	..
Hypersthene ..	1.61	2.06	1.19	0.53	0.92	6.71	3.06	2.14	9.64	3.30	1.97	5.07	1.73	6.95
Acmite	..	0.77	..	..	..	..	..	..	..	..	..	..	..	..
Sodium Metasilicate	..	0.90	..	..	..	..	..	..	..	..	..	..	..	..
Magnetite	0.40	..	0.26	0.26	0.52	1.51	0.93	1.07	1.09	0.66	1.18	0.52	0.40	0.27
Ilmenite	..	..	..	..	..	..	..	..	..	0.13	..	0.13	..	0.13
Apatite	..	..	..	0.26	0.26	..	..	..	0.27	0.26	..	0.26	0.27	0.27
Fluorite	..	0.19	0.20	..	0.20	1.37	0.33	0.27	..	..	..	0.39	0.40	0.27
Pyrite	..	0.26	..	..	..	..	..	..	..	..	..	..	..	..
Corundum	2.34	..	3.97	..	2.23	9.38	0.53	2.81	4.21	1.72	0.72	0.65	3.59	1.07

NIGGLI VALUES

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
si	462.4	479.9	400.7	410.1	498.0	417.0	423.6	376.5	359.6	466.0	534.9	529.9	458.7	386.6
al	52.6	32.1	57.3	41.8	52.2	58.5	43.4	50.2	44.4	46.7	43.6	40.2	55.0	33.6
fm	7.9	20.1	5.0	16.5	7.5	29.1	15.3	12.7	29.5	15.3	17.4	21.3	8.2	19.2
c	..	12.3	3.7	7.1	3.5	3.2	6.9	10.2	4.0	7.8	4.6	6.6	2.2	10.4
alk	39.5	35.4	34.1	34.7	36.9	9.2	34.4	27.0	-22.0	30.2	34.4	32.0	34.6	28.0

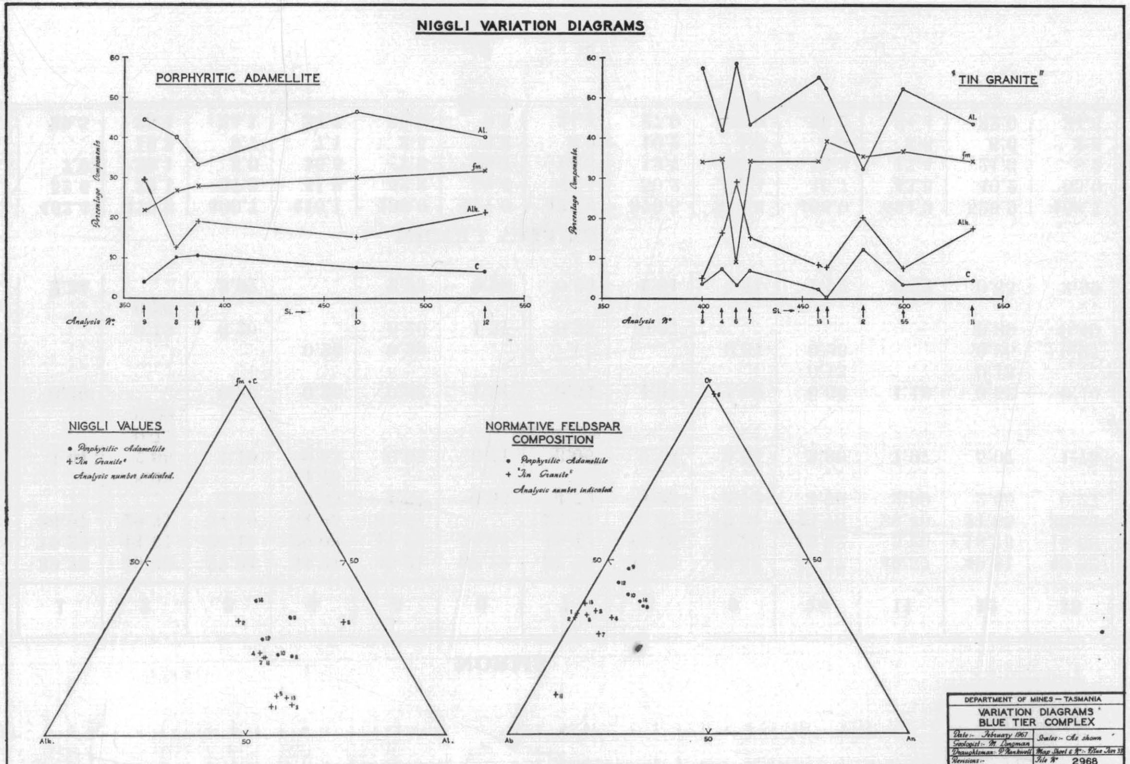

FIGURE 13

5 cm