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TIN RESOURCES OF TASMANIA

December, 1963.

No. 121.

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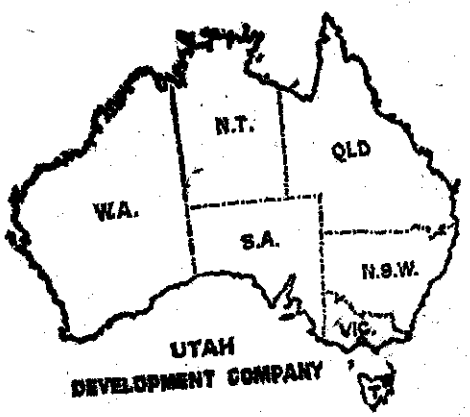
by

D. KING,
Project Geologist.



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INTRODUCTION

An appraisal of the tin resources of Tasmania was required by management as part of the Company's programme of mineral research and development in Australia.

The investigations commenced with a visit to Tasmania during the period September 18 to October 4, 1963. This was followed by a detailed study of all available literature and the compilation of a summarised description of the tin mining areas as presented in the text of this report.

Most of the mines referred to have been inspected in the field by the writer. Many of those in West Tasmania were examined while residing in Tasmania from 1956 to 1961, in the employ of another mining company.

Acknowledgement is due to management (Messrs. R.D. Ellett and T.A. Rodgers) and Dr. P.F. Howard, Staff Geologist with the Company, for suggestions adopted in compiling this report. The staff of the Mines Department in Tasmania also freely gave valuable suggestions and assistance.

For information on physiography, rainfall, transport facilities and land utilisation, the reader should refer to the Regional Planning Atlas, Economic Resources of Tasmania (3rd edition, 1954), issued by the Directorate of Industrial Development, Office of the Premier, Hobart, Tasmania.

CONCLUSIONS AND RECOMMENDATIONS

The island of Tasmania, which has an area of only 26,000 square miles and a present population of 357,000, has produced more tin than any of the larger Australian states.

The tin-bearing deposits are almost entirely confined to granite regions in the north western and north eastern parts of the island.

Past mining activities in the Western Province were mainly associated with primary deposits, particularly massive sulphide orebodies, while most of the tin produced from the North East Province was derived from alluvium and to a lesser extent from vein deposits within or bordering granite.

Although the greater part of Tasmania consists of rugged, densely forested and uninhabited terrain, it should be understood that even the most remote areas have been thoroughly prospected. As tin is particularly easy to detect by simple prospecting methods, the chances of finding virgin occurrences of surface tin are too remote to warrant other than localised surveys in carefully selected areas.

The tin resources of Tasmania are, however, far from expended, but the future of the industry will largely depend on re-assessments followed by the possible revival of activities in some of the old mining areas. Of special interest in this respect are the large sulphide orebodies of the Western Province and the extensive buried alluvials of the North East Province. Only the most accessible and richest portions of these deposits have been worked. Thus there is scope for the application of modern large scale mining methods and improved recovery techniques in the economic development of deposits that were not payable in the past, particularly as the price of tin is much more attractive nowadays.

The average grade of the primary sulphide orebodies of north west Tasmania is in the range of 0.5% to 1.0% tin. The actual yields proved to be considerably less in the early days because of difficulties in recovering the fine grained cassiterite. Accordingly, most of the sulphide ore was disregarded in the past and mining was confined to the richer and more readily treated oxidised cappings.

The largest and richest mine in the history of Tasmania (and Australia) was the deeply oxidised sulphide orebody of Mt. Bischoff, from which more than half of the State's total tin production was derived. Recent drilling by Costigan Tin Mines has shown that only limited quantities of low grade sulphide ore are left in this area.

Sizable reserves of sulphide ore have been established at the Renison Bell mine, where a large operation is planned and seems assured of success. Sufficient reserves to warrant development on a modest scale are reported to have been proved by drilling at Mt. Cleveland. Other massive sulphide deposits of possible future importance are being explored at the Mt. Lyndsay, Razorback and Oonah mines. Another prospect of the same type which warrants drilling, but is not likely to prove large enough to support an independent operation, occurs at the St. Dizier workings held by a private prospector.

Except for the St. Dizier property, all of the other deposits are under the control of well capitalised mining companies. The question of whether Utah should consider a takeover or acquire an interest in any of these deposits deserves serious consideration, but was beyond the scope of the present enquiry.

The partly exploited deep alluvial deposits of north east Tasmania appear to offer equally promising opportunities for future large scale development. Aspects which warrant more detailed investigation and feasibility studies include:

1. the possibility of reopening formerly rich and important producing mines such as the Arba, Briseis and Pioneer, where extensions of the deep leads beneath increasing depths of overburden became uneconomic with the limited hydraulic equipment in use.

2. take over and re-equip existing working such as the Endurance and Wood's Mussel Roe properties.

3. The possible discovery of other virgin deep leads along the lower reaches of the Ringarooma and Mussel Roe River system by a combination of geomorphological studies, geophysical work and drilling.

4. The possibility of locating tin-bearing estuarine deposits in sufficient quantities and in a suitable setting for dredging, e.g., at Fosters Marshes near the estuary of the Ringarooma River, and at the estuary of the George and Scamander Rivers near St. Helens.

A recommendation to acquire a Prospecting Authority covering the main part of the Ringarooma and Mussel Roe basins was submitted in an earlier preliminary report to the Company and has since been adopted. The investigations which are to follow should include a geological inspection of alluvial tin areas on neighbouring islands of the Furneaux Group, where it is possible that important deep leads may have been overlooked.

PART I

GENERAL REVIEW

Except for the occurrence of stannite (sulphide of iron, copper and tin) in fissure lodes at Zeehan, and as minor amounts along with cassiterite in the sulphide orebodies of the Mt. Bischoff-Renison Bell districts (Carey, 1945b), the tin ores from all other Tasmanian deposits described herein consist of the tin oxide cassiterite.

TIN PROVINCES IN RELATION TO REGIONAL GEOLOGY:

The tin deposits of Tasmania are largely confined to two main provinces, namely the Western Province embracing the Moina, Mt. Bischoff, Renison Bell, Mt. Balfour and Mt. Heemskirk districts, and the North Eastern Province which includes the Derby and Gladstone districts of the Ringarooma River valley, the Goshen-St. Helens districts of the George River valley, the Avoca and Blue Tier districts of the north east hinterland, and the islands of the Furneaux Group.

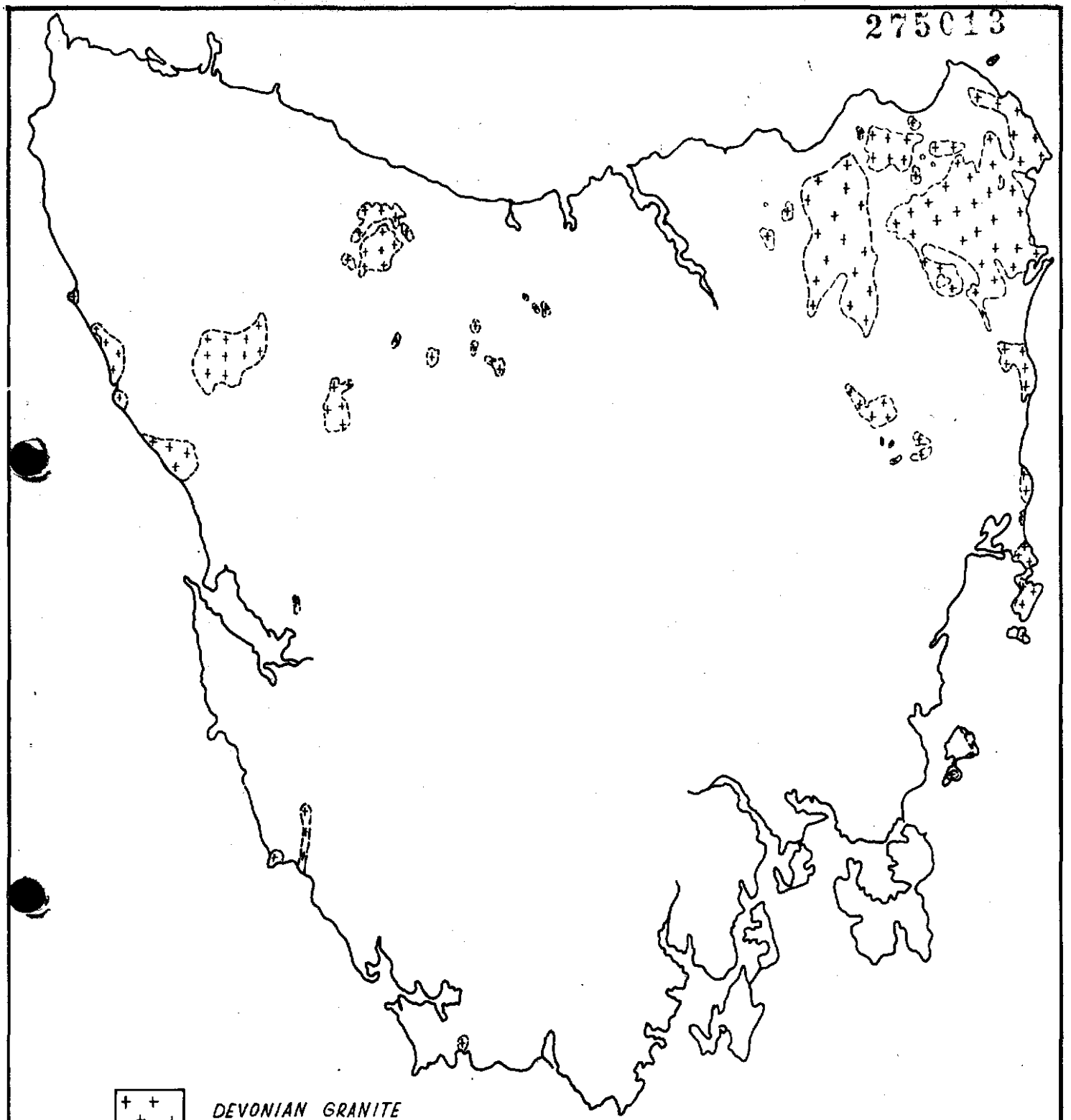
These Provinces correspond closely with the two main regions of Devonian granites in Tasmania (Fig.II).

Outlying occurrences of tin in the Cox Bight district of south-west Tasmania, and on King Island in Bass Strait, are associated with small bosses of granite intruding schists of pre-Cambrian age.

The two Provinces are closely related geologically. They are remnants of Palaeozoic geosynclinal troughs bordering a rigid block of pre-Cambrian rocks (Tyennan Block), the central nucleus of Tasmania (Carey, 1953). A major orogeny in Devonian times (Tabberabberan Orogeny) accompanied by two phases of granite intrusion, was centred about the structurally weak trough zones. In the early stages, the intrusions were granodioritic in composition, coarsely grained to porphyritic, and parent of most of the gold mineralisation in Tasmania. The later phases were more acidic and finer grained and include so-called "tin granites" of the Blue Tier (Thomas, 1943b), Avoca and Mt. Heemskirk districts.

There are, however, notable differences in the types of tin deposits which characterise each of the two Provinces.

Western Province: The tin mines of the Western Province are mainly confined to primary deposits.



DEVONIAN GRANITE

FIG II

DISTRIBUTION OF DEVONIAN GRANITES IN TASMANIA

Of particular importance here are massive sulphide orebodies composed largely of pyrrhotite and pyrite, and subordinate fine grained cassiterite, which occur as replacements of early Palaeozoic bedded rocks (especially dolomites) in proximity to apophyses of granite. The largest mine of this type was at Mt. Bischoff, and among others which are the site of current mining or development operations are Renison Bell, Razorback, Mt. Lyndsay and Mt. Cleveland.

In each of these mines the grade of the unoxidised primary ore was found to be in the range of half to one percent tin, but because of difficulties in recovering the cassiterite prior to the advent of modern metallurgical techniques, this type of deposit could not be profitably worked in the early days. The main workings in the past were therefore confined to the richer oxidised portions of the orebodies from which the free tin could be more readily extracted.

A complex ore containing stannite occurs locally as fissure lodes in the vicinity of the Oonah mine at Zeehan.

Primary deposits worked within or bordering the granites of the Western Province were mostly of minor importance. Wolfram-cassiterite veins in the contact aureole at the Shepherd and Murphy mine, Moina, and stanniferous greisens and vein deposits at the Federation and Maynes mines in the Mt. Heemskirk district, were the site of intermittent operations on a small company scale.

No extensive deposits of alluvial tin have been located in the Western Province, although appreciable amounts of superficial alluvial and detrital tin were won from the immediate vicinity of Mt. Bischoff, Renison Bell and Mt. Lyndsay (Stanley Reward). Shallow ground was also worked for modest returns around the flanks of the Mt. Heemskirk granite belt.

North East Province: In the North East Province, production has been derived mainly from alluvial deposits including both deep leads and shallow deposits, while primary deposits of vein tin and stanniferous greisen have also been exploited at numerous localities.

The largest and most productive workings, such as the Briseis, Arba, Pioneer and Endurance mines, are located on deep leads of Tertiary age along former water courses of the Ringarooma and Mussel Roe river systems, in the Derby and Gladstone districts. These were exploited by hydraulic mining. Other deposits of this type were also worked extensively on Thureau's Deep Lead which defines the former course of the George River between Goshen and St. Helens, on the east coast. The main centres of mining activity along the deep leads were in higher ground towards the head-

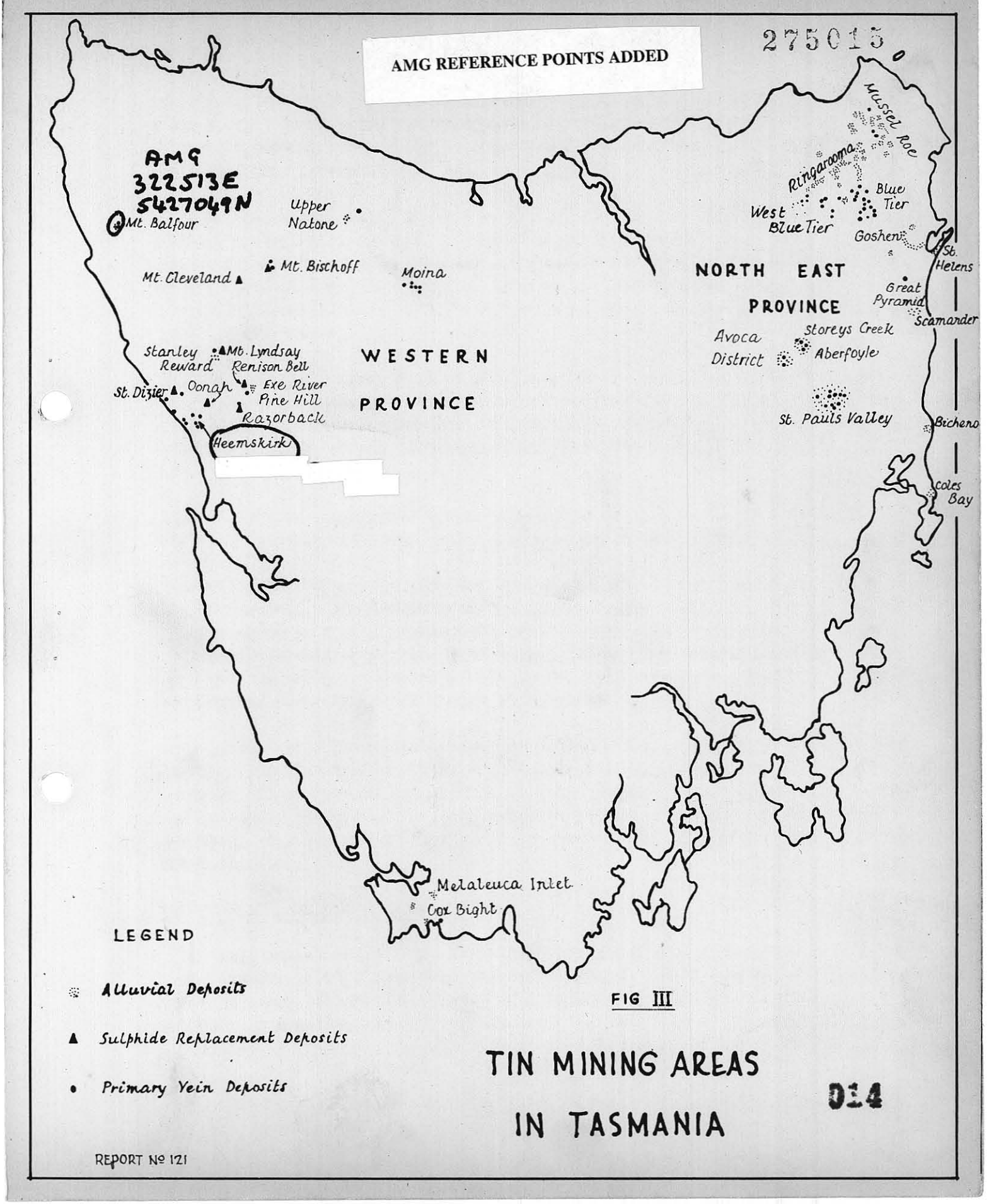


FIG III

TIN MINING AREAS IN TASMANIA

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waters of the old watercourses, where the amount of overburden was at a minimum. Several of the larger mines, including the Arba, Briseis and Pioneer, closed down owing to increasing overburden as the lead was followed down its course.

Nearer the coast, the Tertiary alluvial deposits are succeeded by extensive estuarine deposits, in places containing minor quantities of tin. These have been worked successfully by dredging at Dorset Flats, and unsuccessfully by dredging at George Bay near St. Helens. Preparations are in hand for the dredging of similar deposits and recent alluvium along the Ringarooma River west of Gladstone.

Shallow alluvial deposits of Quaternary age were worked in many localities on or bordering the granite terrains throughout the district, particularly around Gladstone, Branxholm, Weldborough and St. Helens. These deposits were invariably small, but collectively contributed significant quantities of tin.

Little is known of alluvial tin deposits that have been worked intermittently on the Furneaux Group of islands off the north east coast.

The most important primary tin deposits of the North East Province are the Aberfoyle and Storeys Creek mines in the Avoca district. These are still operating on wolfram-cassiterite quartz veins which occur in Palaeozoic (Mathinna Group) quartzites and slates, near their contact with granite. Another tin prospect known as the Great Pyramid mine occurs in a similar geological environment at Upper Scamander.

Low grade tin mineralisation is also characteristic of the granites in many parts of the North-East Province, especially in association with greisenous segregations. Small but profitable returns were obtained in many places by hydraulic mining of the weathered outcrops, and by large scale but selective mining of the fresh granitic rock at the Anchor mine in the Blue Tier district.

TIN PRODUCTION RECORDS:

The total output of tin from Tasmania since figures were first kept in 1873 until the end of 1962, amounts to more than 210,000 tons of tin concentrates, representing 146,995 long tons* of metallic tin (Report of Director of Mines, 1962). A detailed analysis of records embodied in the present investigations (Table A) indicates a slightly higher overall figure of 148,663 tons metallic tin.

* Throughout this report tonnage figures refer to long tons (2,240 pounds).

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TABLE A

PRODUCTION RECORDS
TASMANIAN TIN DEPOSITS
(Year Ending December, 1962)

LOCALITY		TONS METALLIC TIN		
District	Mine	Lode	Alluvial	Total
Western	Mt Bischoff	82,968.9	105.0	83,073.9
	Mt Cleveland	240.6	-	240.6
	Renison Bell	3,600.0	144.0	3,744.0
	Exe River	21.0	-	21.0
	Zeehan Dundas	73.4	-	73.4
	Mt Balfour	-	132.0	132.0
	Mt Heemskirk	477.7	292.0	769.7
	Mt Lyndsay	59.8	79.6	139.4
North East	Avoca	-	286.6	13,429.6
	Aberfoyle	10,250.5	-	-
	Storeys Creek	1,594.7	-	-
	Others	1,297.8	-	-
	Blue Tier	-	156.3	2,808.2
	Anchor	2,365.0	-	-
	Others	286.9	-	-
	Derby-Moorina	237	-	26,855.5
	Briseis	-	20,787.0	-
	Arba	-	2,180.0	-
	Others	-	3,651.5	-
	Gladstone-Pioneer	-	-	14,834.2
	Pioneer	-	9,180.0	-
	Endurance	-	2,630.5	-
	Dorset Dredge	-	1,691.0	-
	Others	-	1,332.7	-
	St Helens-Goshen	2.9	1,786.4	1,789.3
Northern	Moina	-	-	574.8
	Shepherd & Murphy	552.6	-	-
	Others	22.2	-	-
South West	Cox Bight	-	177.7	177.7
	TOTALS	104.051.0	44,612.3	148,663.3

The bulk of this production was achieved prior to 1920 when tin prices were at a minimum (Fig. IV).

A comparison with figures for other Australian states is given below -

State	Tin Production (70% Sn Conc.) (Tons)
Tasmania (to 1962)	210,000
New South Wales (to 1961)	196,000
Queensland (to 1962)	188,500
Victoria (to 1961)	11,000

Thus Tasmania, the smallest Australian state, ranks as the leading past producer of tin.

In recent years (e.g. 1962), the annual output of tin concentrates from Tasmania (1,730 tons) has been of the same order as Queensland (1,504 tons). Several major tin mining developments that are taking place in Tasmania at the present time should result in an appreciable increase in tin production within a few years.

Primary Deposits: About two thirds (70%) of the Tasmanian tin was derived from primary deposits.

Of singular importance among these were the deeply weathered sulphides and associated residual deposits of Mt. Bischoff, which yielded 82,969 tons of metallic tin*, or more than half (56%) of the State's total production. Similar lode deposits have been partly exploited at Renison Bell (3,600 tons) and Mt. Cleveland (240 tons).

Quartz veins carrying cassiterite and wolfram have produced significant tonnages of tin at Aberfoyle (10,250 tons) and Storeys Creek (1595 tons) in the North East Province, and at the Shepherd and Murphy mine (552 tons) in the Western Province.

The main workings on tin-bearing granites were the Anchor mine (2,365 tons) of the North East Province, and the Federation (194 tons) and Maynes (140 tons) mines of the Western Province.

* Production figures throughout this report refer to tons of metallic tin unless otherwise specified.

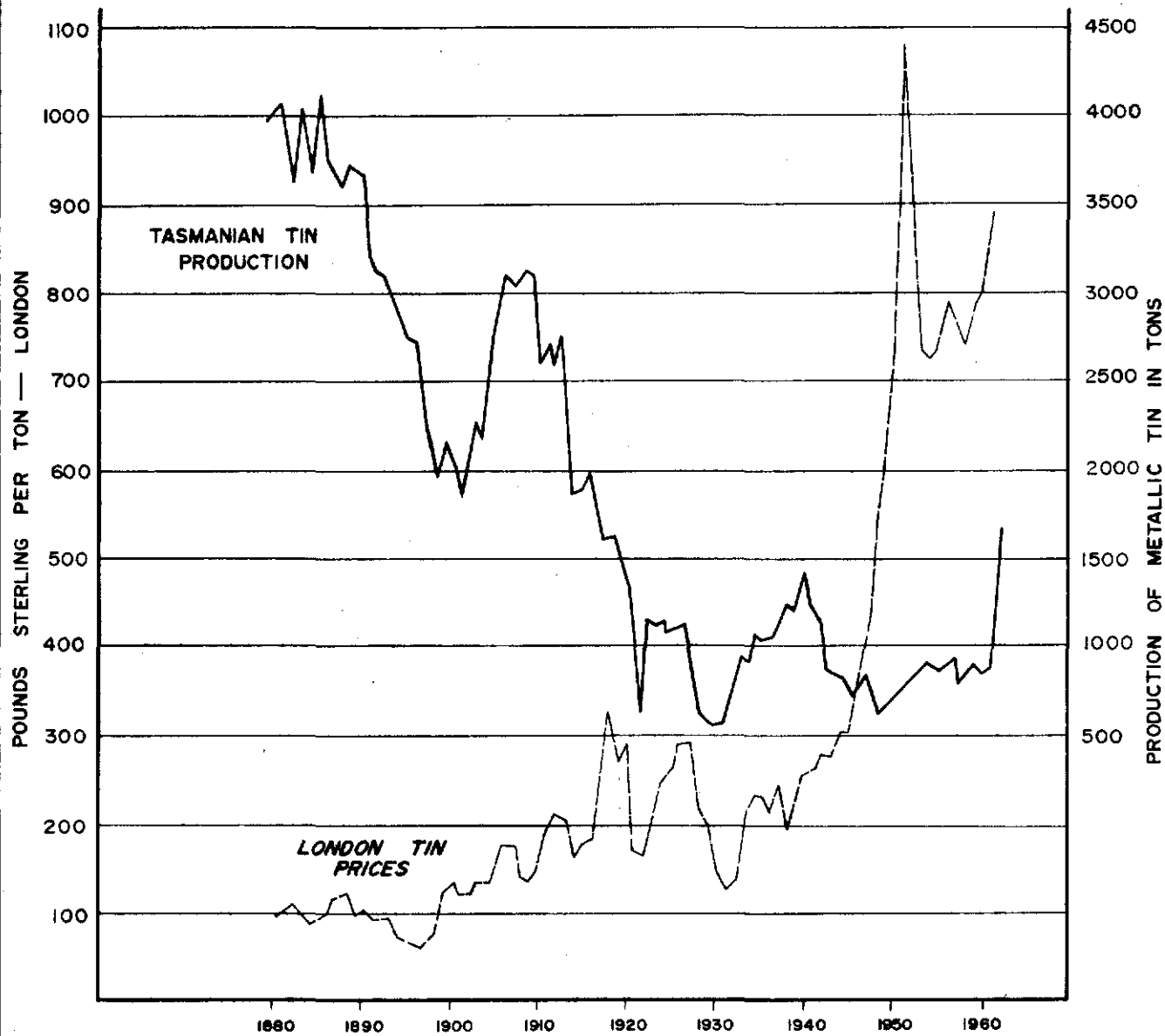

Fig: IV

TRENDS OF ANNUAL TIN PRODUCTION IN TASMANIA

COMPARED TO RULING TIN PRICES: 1880–1962

Alluvial Deposits: The deep leads of the Ringarooma River system in the North East Province have accounted for more than 78% of the 44,612 tons of tin won from alluvial deposits in Tasmania. The major producers were the Briseis (20,787), Pioneer (9,180), and Arba (2,180) mines. The Endurance mine (2,630 tons), a later discovery, is still in operation. In addition, the numerous workings on Thureau's Deep Lead contributed largely to the 1,786 tons of alluvial tin recorded from the Goshen-St. Helens district. Dredging of Tertiary estuarine deposits at Dorset Flats yielded a further 1,691 tons of tin. Deposits of shallow alluvial ground in the North East Province were most productive in the Derby-Moorina area (3,651 tons, including some Tertiary drifts), the Gladstone-Pioneer district (1,332 tons), and the Avoca (287 tons) and Blue Tier (156 tons) districts.

In the Western Province, Mt. Heemskirk (292 tons), Renison Bell (144 tons), Mt. Balfour (132 tons), Mt. Bischoff (105 tons) and Mt. Lindsay-Stanley Reward (80 tons), were the main sources of alluvial tin.

PART IIA - PRIMARY DEPOSITS OF THE WESTERN PROVINCE.

As indicated in Part I, the principal tin ore deposits of West Tasmania consist of cassiterite-bearing massive sulphides which occur in sedimentary rocks of Cambrian age. These are confined to an area of sparsely inhabited rain forest lying between the townships of Waratah (Mt. Bischoff), Renison Bell and Zeehan.

SULPHIDE OREBODIES OF THE MT. BISCHOFF-RENISON BELL DISTRICTS:

Carey (1945b), states that "These orebodies are mainly simple replacements of folded sediments: hence many of them are flat-lying or occupy the troughs of sharp synclines and do not persist indefinitely in depth. The tin ore is of a sulphide type with pyrrhotite as the dominant mineral and with chalcopyrite as a common accessory. The tin is of very fine grain size and is partly in the form of stannite. The bodies are of relatively low grade, but of large size, and represent considerable tonnages of tin. Valuable secondary enrichment gossans occur in the oxidised zone. A striking fact is that all these orebodies are closely associated with ultra-basic rocks. This may be merely a coincidence, but since pyrrhotite, and particularly cupriferous pyrrhotite are common magmatic segregation products from ultra-basic rocks, the possibility suggests itself that these tin-bearing cupriferous pyrrhotite bodies may be genetically related to the basic rocks."
On the other hand, dykes of quartz porphyry occur at Renison Bell and Mt. Bischoff, and quartz porphyry has also been recorded by Reid (1923) at the Mt. Cleveland Mine.

Mt. Bischoff Mine: The main part of the old mine area is held as leases in the name of M. Solomon (Lecturer in Geology, University of Tasmania) on behalf of Mt. Costigan Mines Ltd. (of Canada).
References: Kayser, 1892; Twelvetrees, 1900; Dunn,1922; Reid, 1923; Keid, 1943(b); Stillwell, 1945; Knight, 1953; Carey, 1953; Noldart, 1962.

The Mt. Bischoff mine yielded 83,000 tons of metallic tin, which is almost half of the total Tasmanian output. The deposits were discovered by Smith in 1871, and the Mt. Bischoff Tin Mining Co. was formed in 1873. Between 1877 and 1898, an annual production of more than 2,000 tons of tin oxide was maintained. The company continued operations on a declining scale until 1929, when the mine was let to tributors.

Dividends of £2,550,000 were paid on a paid up capital of £29,600.

The mine was worked by the Commonwealth Government during 1943-1947, and subsequently small scale operations have been carried on by a few prospectors.

Topography: Mt. Bischoff is a monadnock of basement rocks rising to 2,596 ft. above sea level and about 500 ft. above the general level of an extensive dissected peneplain, most of which is covered by Tertiary sediments and basalt flows.
Geology: The best regional geological map of the district accompanies the published report of Reid (1923). However, his dating of the Bischoff Series and Dundas Series in the legend is known to be incorrect, and should be Lower Cambrian and Middle Upper Cambrian respectively (Campana and King, 1963).

The Mount is composed chiefly of slates, quartzites and dolomites (Mt. Bischoff or Carbine Group) of Lower Cambrian age which occupy the axis of a regional anticlinal structure (Bischoff Anticlinorium of Carey, 1953). In the mine area, these sediments are folded into broad anticlinal domes and synclinal basins (Figs. V and VI), complicated by faulting, and are intruded by a series of quartz porphyry dykes and sills which are intensely topazised in the immediate vicinity of the orebodies.

The stratigraphic sequence in the vicinity of the mine, as given by Knight (1953), is -

1.	Upper dolomite beds	150+ feet
2.	Altered dolomitic shale	5-30 feet
3.	Lower dolomite beds	100 feet
4.	Footwall shale	30 feet
5.	Shales, quartzites and slates	800+ feet

All beds above the upper dolomite have been eroded, and units 1-4 above are preserved only in a complex synclinal basin corresponding with the mine area.

The mine workings consist of a series of open cut benches and glory holes among which the Brown Face was by far the most productive. Almost the whole of the Brown Face basin from the surface to the footwall shale consists of ore (Fig. VIII). The Greisen Face, White Face (Fig. VII) and Pig Flat Face (Fig. IX) were other important workings.

In its original state, the Mt. Bischoff deposit was represented at the surface by extensive patches of highly ferruginous gossan (e.g. Brown Face) and in other places by a loose, sandy disintegrated material (e.g. White Face) of residual or detrital origin (Twelvetrees, 1900a). The large quantity of tin produced prior to 1900 was recovered by sluicing of these superficial deposits which were found to be underlain by large bodies of massive sulphide ores.

Primary Deposits: The primary tin ores were confined to an area of one square mile centred about the highest point of the Mount. Most of the ore

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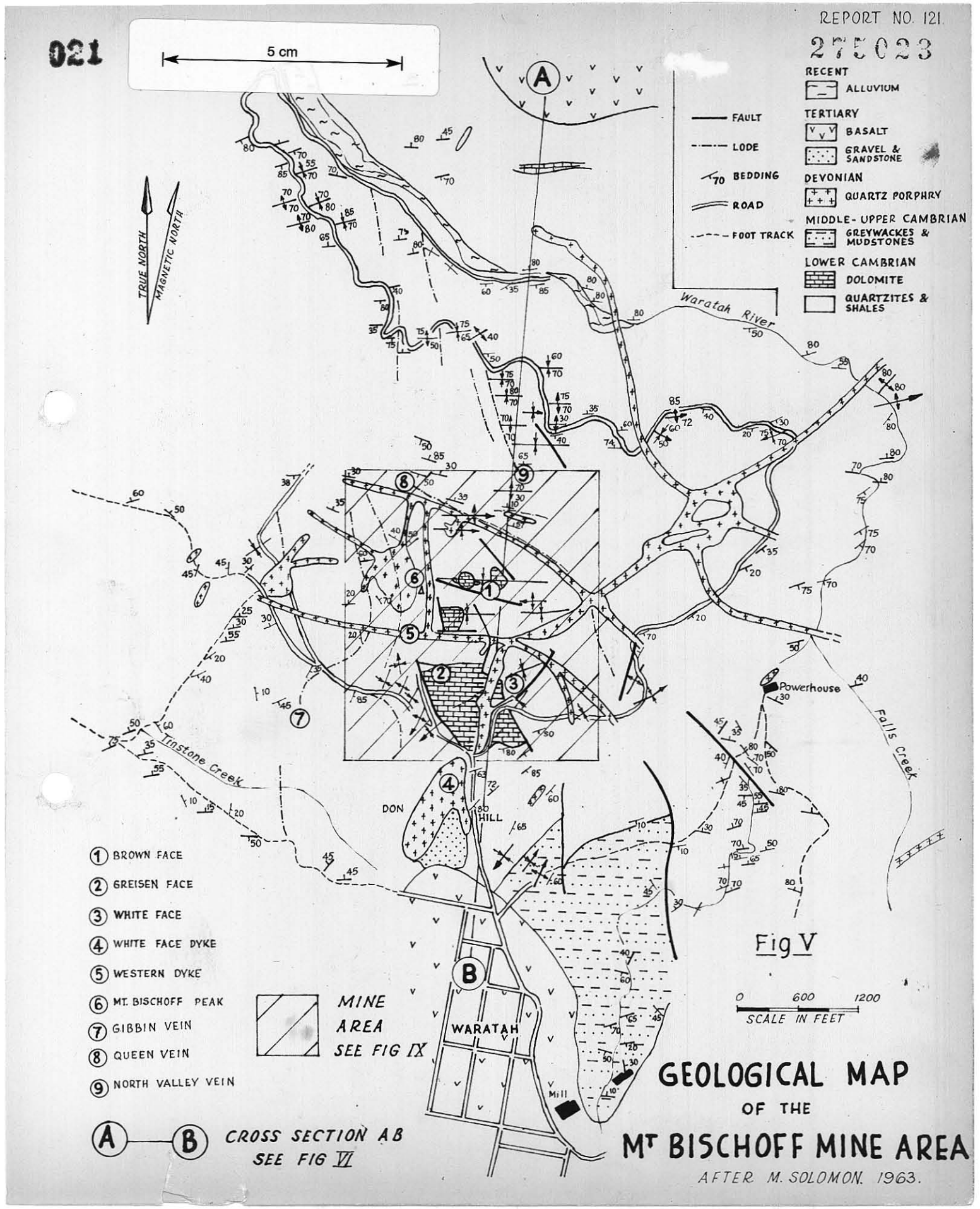

Fig V

GEOLOGICAL MAP OF THE Mt BISCHOFF MINE AREA

AFTER M. SOLOMON. 1963.

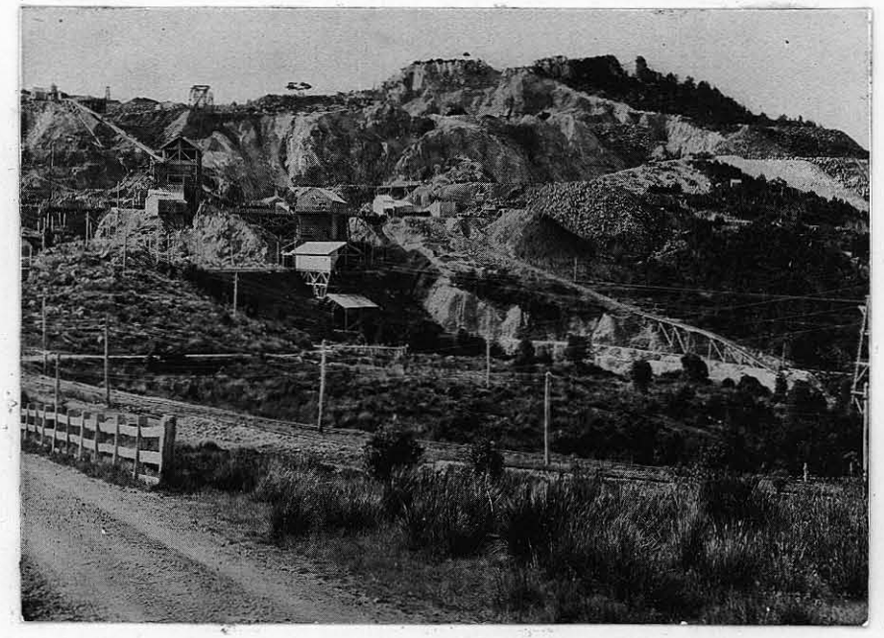

Fig. VII. View looking north from the outskirts of Waratah to the White Face at Mt Bischoff. Here the ore derived from weathering of sulphides was largely, quartz sand with layers of almost pure cassiterite.

Fig. VIII. The Brown Face at Mt Bischoff, from which more than half the total production of the mine was derived. The ore consisted largely of marcasite containing an average of 2% tin.

occurred as large replacement deposits, but some associated vein deposits and local segregations in the porphyry dykes were also worked.

The main orebodies, which consisted of massive pyrrhotite, pyrite and marcasite, with subordinate talc, quartz and carbonates, occurred as almost complete replacements of the folded dolomite beds, particularly the lower dolomite. Ore in the Brown Face was largely marcasite, but, by contrast, the Greisen Face was predominantly unoxidised pyrrhotite. The White Face and Pig Flat orebodies, in the upper dolomite, were essentially pyritic.

Superficial deposits worked prior to 1891 averaged 3% tin. The average yield of the ore from the Brown Face orebody, where much of the cassiterite was coarse grained, was 2% tin. The tin in the Greisen, Pig Flat and White Face ores was normally fine grained and the average values were considerably less than 2%. Primary ores derived mainly from these areas during 1921, for example, averaged only 0.31% tin. According to Knight (1953), ore that remains in the Greisen orebody averages less than 0.4% tin. A similar figure is indicated by recent drilling in the area to be described below.

The three major vein deposits worked were the Queen, Giblin and North Valley, the locations of which are shown on Fig. V. Brief details of each are listed below -

Name	Vein Length (feet)	Vein Width (feet)	Depth Worked (feet)	Grade % Tin
Queen	1,100	1-5	350	?
Giblin	2,000	2 ave.	1,000	?
North Valley	3,000	4 ave.	800	0.8%

Other small vein type prospects which have been worked in recent years are Thompsons Lode, south west of Mt. Bischoff (Noldart, 1962), and Fooks Prospect, south east of the old mine area.

Porphyry dykes were worked locally for tin on the Stanhope, Queen and Western dykes. The Stanhope dyke was open cut for 100 feet long by 60 feet wide and 60 feet deep (Fig. IX) for an average return of 0.2% tin. The Queen dyke (Summit Face) averaged 0.25% tin.

Recent Geophysical Survey: An Induced Polarisation survey of the leases was carried out for Costigan Mines during May-June, 1962, by McPhar Geophysics Pty. Ltd. Two extensive linear anomalies were indicated, the best defined one being to the south east of the old mine along Happy Valley

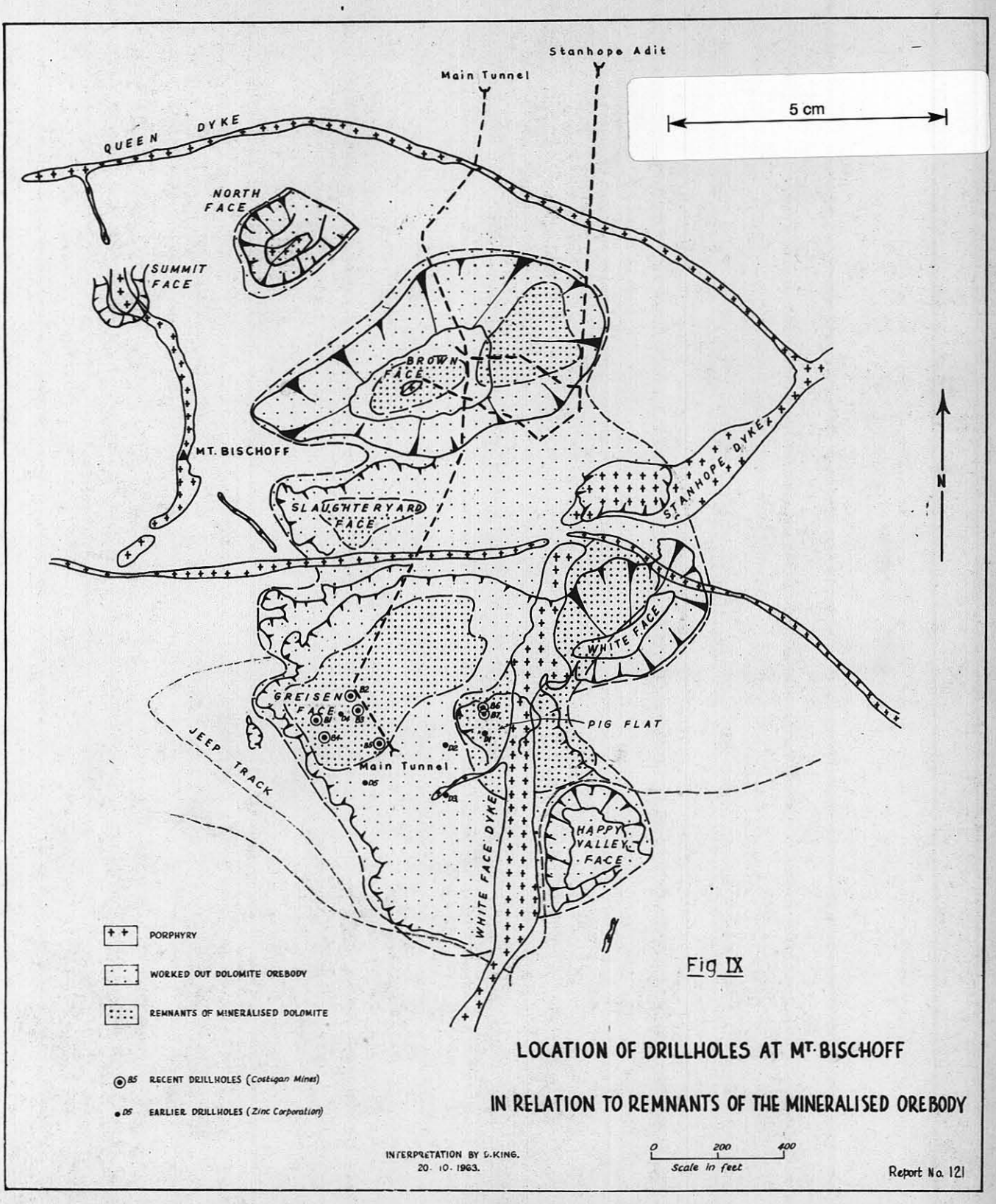

Fig IX

LOCATION OF DRILLHOLES AT MT. BISCHOFF

IN RELATION TO REMNANTS OF THE MINERALISED OREBODY

INTERPRETATION BY S. KING.
20. 10. 1963.

0 200 400
Scale in feet

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Creek. The report and plans of the geophysical survey and results of subsequent drilling were made available to me and a copy has been filed in Melbourne office.

Diamond drillhole No. B8 was sunk to a depth of 550 ft. on the Happy Valley anomaly, but encountered only sedimentary rocks with no mineralised sections worthy of analysis.

Recent Drilling in the Mine Area: During the early part of 1963, seven drillholes were sunk to explore remnants of dolomite-pyrrhotite mineralisation at the Greisen Face and Pig Flat areas in the old mine area. The location of these drillholes and the surface extent of the mineralised bodies which they explored are shown on Fig. IX, while cross-sections along the drillhole lines are given in Fig. X. A summary of all noteworthy intersections extracted from the geological logs and assay sheets are listed in Table B.

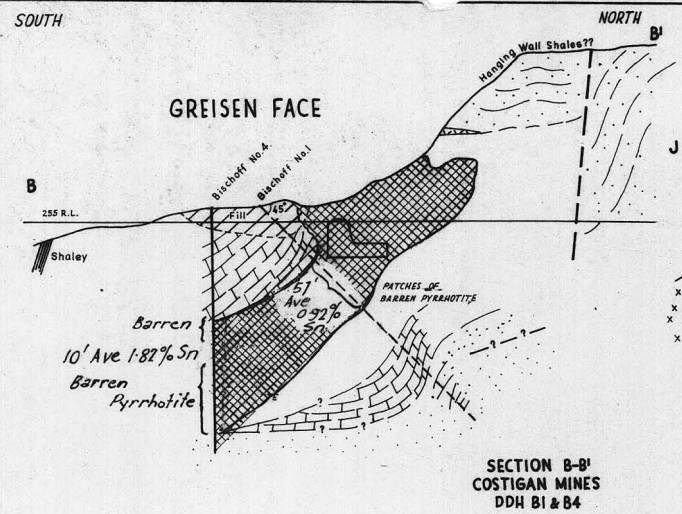
The average width of the mineralised pyrrhotite-dolomite encountered in the drilling is 73½ ft., and the weighted average grade is 0.46% tin. The quantities involved, based on surface measurements (Fig. IX) and the average width, are possibly 300,000 tons at the Greisen Face and 100,000 tons in the Pig Flat area. In my opinion, these remnants of low grade ore are of little or no interest.

Other Possible Exploration Targets: The possibility that other mineralised dolomite beds may occur at depth has been investigated without success by drilling to approximately 500 ft. below the workings. Surface geological mapping has failed to show any dolomites at a lower level in the sequence, so that deeper drilling cannot be justified geologically.

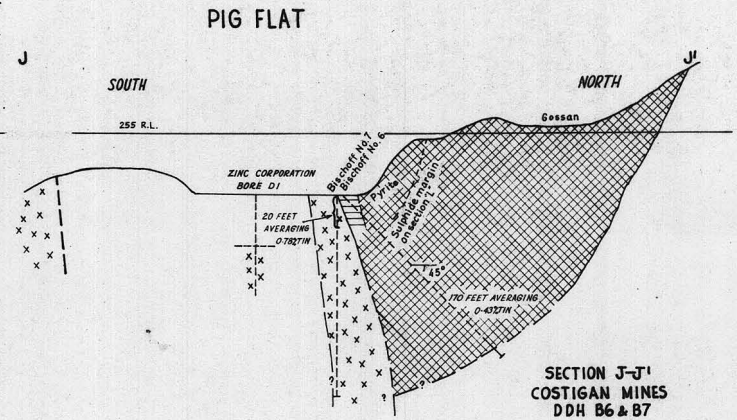
As the rich detrital surface of Mt. Bischoff was the result of continued exposure and weathering at least since early Tertiary times, the writer has always been interested in the possibility of payable alluvials in the Tertiary gravels at the foot of the mountain. The Tertiary sediments are partly exposed and were proved to be stanniferous in depth at Don Hill (Fig. V), and the same gravels would extend below the basalt of the Waratah township plateau. The area surrounding the mine is, however, held at present as an Exploration Licence (No. 1/63) by Aberfoyle Tin Partnership.

Mt. Cleveland Mine: (Held as Special Prospecting Area by Aberfoyle Tin Partnership).
References: Carey, 1945(a); Keunecke & Tait, 1954; Reid, 1923; Williams, 1963.

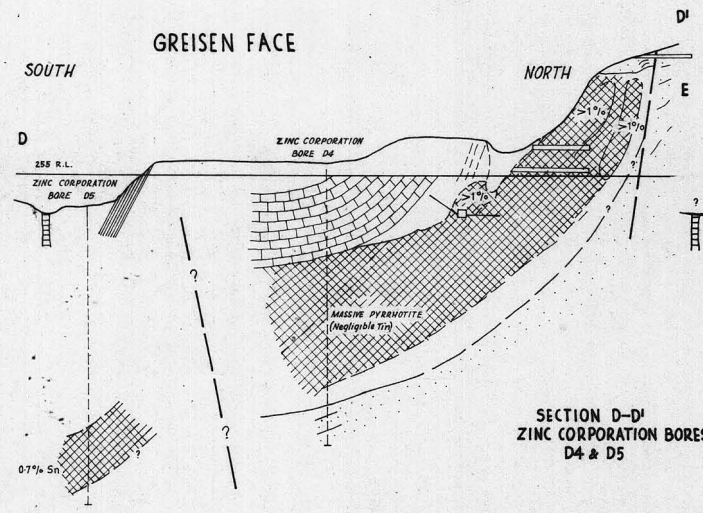
The Mt. Cleveland mine is 10½ miles by road south west of Waratah, and like the primary deposit of Mt. Bischoff, is an isolated occurrence of tin in



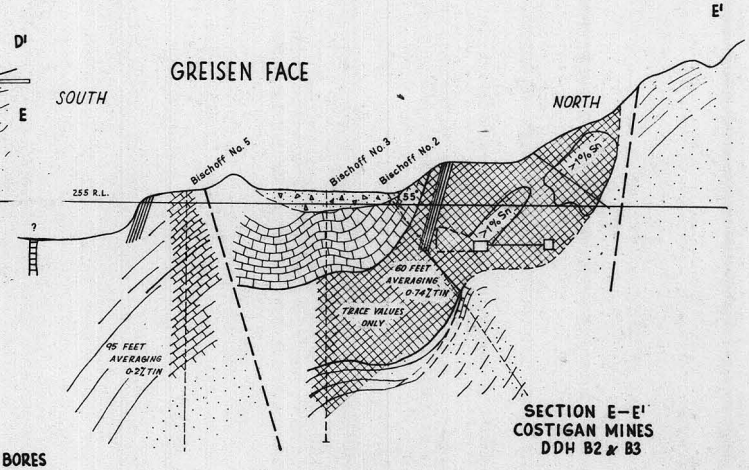
SECTION B-B'
COSTIGAN MINES
DDH B1 & B4



SECTION J-J'
COSTIGAN MINES
DDH B6 & B7



SECTION D-D'
ZINC CORPORATION BORES
D4 & D5



SECTION E-E'
COSTIGAN MINES
DDH B2 & B3

LEGEND

- ROCK FILL
- DOLOMITE
- QUARTZITES & SHALES
- SHALES
- PYRRHOTITE
- PYRITE
- QUARTZ PORPHYRY

FIG X

Mt BISCHOFF TIN MINE

CROSS-SECTIONS SHOWING

RESULTS OF DIAMOND DRILLHOLES

5 cm

0 100
SCALE IN FEET

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TABLE B
Behind Page 12

SUMMARY OF RECENT DRILLHOLE RESULTS
COSTIGAN MINES
MT BISCHOFF MINE AREA

Locality	Bore No.	Total Depth	Mineralised Zone				Best Values			
			From (ft)	To (ft)	Width (ft)	% Tin	From (ft)	To (ft)	Width (ft)	% Tin
Greisen Face	B1	245	60	117	57	0.92	112	117	5	2.10
Greisen Face	B2	196	45	105	60	0.74	75	80	5	1.94
Greisen Face	B3	206	67	140	73	trace	70	75	5	0.20
Greisen Face	B4	198	90	130	40	0.59	115 95	125 100	10 5	1.82 0.59
Greisen Face	B5	224	55	150	95	0.27	145	150	5	1.67
Pig Flat	B6	189	0	170	170	0.43	75	$77\frac{1}{2}$	$2\frac{1}{2}$	2.73
Pig Flat	B7	160	0	20	20	0.78	15	20	5	1.21

massive sulphide orebodies. Exposures of tin bearing gossan led to the discovery of the deposit in 1900. The period of active mining was from 1908 to 1917.

Geology: The tin occurs with some copper as pyritic replacement deposits in a series of slates, tuffs, and cherts of Middle-Cambrian age, which are strongly folded along axes trending north-north-east to north-east with a prevailing dip to the north-west. Much faulting of a minor character is present. Large bodies of basic and ultrabasic rocks outcrop within 25 chains of the lodes and granite is known to outcrop three miles away to the south-east and three and a half miles away to the south-west. Small bodies of porphyry have been noted by Reid (1923) in the vicinity of the mine.

Tuffs were selectively replaced in preference to slates, and the latter have suffered intense local silicification. There is a marked tendency for the replacement to occur in the troughs and adjacent limbs of synclines, as in the case of Henry's Cut, Hall's Cut, No.12 workings, and in all of the Luck's Lodes. It is also possible that the Battery and Smithy Lodes occupy a similar structural position.

The old workings consisted of open cuts, shallow shafts, adits and winzes. These exploited some tin-bearing quartz fissure veins bordering the main orebodies, but much of the massive pyrrhotite ore was disregarded because of its generally lower grade and difficulties in recovering the tin. Reid (1923) states that, "As a rule the fissure fillings contain a greater proportion of tin than the replacement bodies, and this material being more amenable to treatment, is usually attacked first."

Grade: The sulphide ore consists of fine grained pyrrhotite together with chalcopyrite, pyrite, quartz, and cassiterite. A composite of six samples taken at 100-foot intervals across the back of the drive below Hall's Cut yielded 0.95% tin and 0.39% copper. A number of samples recorded by Reid from other workings also indicate that the average grade of the massive sulphide material runs a little under 1% tin. Vanning assays gave a little better than 80% recovery.

Production: The total ore removed from the mine in the past was 36,311 tons for a return of 240.6 tons metallic tin. This indicates an overall average grade of 0.66% tin. As a large part of the ore produced was from oxidised cappings, the grade of the primary ore remaining is likely to be less than the above figure.

Reserves: Carey (1945) concludes that the Mt. Cleveland orebodies, being replacements on fold axes, will not persist to great depths, but he considers that further orebodies are likely to occur. A limited quantity of oxidised ore, said to be of good grade, is still left in Luck's workings. Estimates of probable ore by Carey are given below:

	Tons
Hall's Lode	100,000
Henry's Lode	7,000
Luck's Lode	80,000
Battery and Smithy Lodes	10,000
	197,000

In the report of the Director of Mines for 1962, it is stated that "a significant discovery has resulted from the work by one company (Aberfoyle T.P.) which has proved the existence of tin ore at the old Cleveland Mine near Waratah, which is capable of economic development. Further investigations are in progress and this will be followed by developmental work and finally the establishment of productive mining operations."

Carey's estimate of total reserves is probably of the right order, as it is understood that Aberfoyle are planning to reopen the mine on the basis of 200,000 tons of sulphide ore proved last year by some thirty diamond drill-holes.

Mt. Lyndsay Mine:
References: Waterhouse, 1914; Reid, 1927a; Scott, 1929a.

The mine workings and a surrounding area of 87 square miles is held and is being actively explored by Aberfoyle Tin Partnership.

A feature which may have hampered development of this mine is its remote location and difficulties of overland access, which at present is confined to walking tracks (now partly overgrown) from Zeehan, Renison Bell or Waratah. A detailed geological and geophysical survey of the mine was carried out by Rio Tinto in 1960-62, using helicopter transport, but an option to take over the prospect from the previous leaseholder (M.D. Garretty) was not exercised.

The mine occurs in Cambrian sedimentary rocks near their contact with granite on the northern slopes of Parson's Hood (Fig. III). The bedded rocks include dolomite which is exposed at the nearby Stanley Reward alluvial workings.

The Mt. Lyndsay lode is represented at the surface by magnetite-rich gossan which can be traced at intervals over a distance of 3,600 ft. on a bearing of 80° west of north. It dips to the south at 75° - 80°.

The presence of tin was not recognised until 1909. During 1910-1923, a syndicate from Launceston carried out systematic prospecting of the lode by adits and shafts, and commenced a small scale tin mining operation on the eastern bank of Tulloch Creek. Complete records of production are not available. During the period October 1916 to January 1921, 108 tons of concentrates assaying 68-71% tin were won by the syndicate (Reid, 1927a). The leases were allowed to lapse in 1923, and have remained virtually unworked until the present.

Adits which tested the lode at regular intervals revealed that the primary constituents are mainly magnetite, pyrrhotite, marcasite and pyrite. Records of systematic sampling of the adits and the results of analyses were available to the writer while examining the property several years ago. Except for a small area centred about the old mine workings, tin was found to be absent throughout most of the lode. The width of the lode in the vicinity of the richer tin values varies from 6-20 ft. (Scott, 1929a). Here the type of mineralisation, featuring a preponderance of pyrite and pyrrhotite as replacements along a faulted zone, somewhat resembles that of Renison Bell and Mt. Bischoff.

The mine workings are fully described in the report of Reid (1927a). He adds that "the work performed has proved the extent of certain rich shoots... The position now is that a fairly large tonnage of ore of medium grade (1% tin) has been opened."

Reid sums up the existing evidence well by the following remarks: "Although this is one of the most extensive orebodies known in Tasmania, comparatively small sections only have been proved to contain profitable concentrations of tin ore. It is desirable that much more development work be performed before embarking upon any definite scheme of operations. A small plant may serve a small party a considerable time; but not a company. A large plant is not warranted yet."

It is understood that Aberfoyle T.P. are at present engaged on drilling at the Mt. Lyndsay mine. Some good intersections are reported to have been obtained, but details are not available.

Renison Bell Mine: (Leases and surrounding S.P.L. held by Renison Associated Tin Mines N.L.).
References: Twelvetrees, 1906(a); Mawby and Nye, 1942; Stillwell and Edwards, 1943; Fisher, 1943 & 1953; Loh, 1951; Horvarth and Keunecke, 1953; Williams, 1950; Rattigan, 1957; King, 1957; Gilfillan, 1961; Blissett, 1962; Campana and King, 1963.

Regional Aspects: For regional geology see One Mile Geological Map Series, Zeehan Sheet, 1962, Tasmanian Department of Mines, and explanatory notes by Blissett, 1962. Also refer King, D. (1957).

Several productive lode tin mines and a wide variety of other metalliferous deposits occur in the Renison Bell-Dundas region, between the west coast towns of Rosebery and Zeehan. The Renison Bell mine is the most outstanding of the tin properties. It has consistently been the major producer of tin in the district in past years, and shows great promise for future large scale development. The only other sizable deposit of any interest is the Razorback Mine.

The proven orebodies of the Renison Bell mine are confined to an area of about one square mile immediately south of the township and treatment plant, although other occurrences of tin mineralisation are known over a total leased area of about four square miles.

Early activities (1890-1905) were confined to alluvial deposits, followed during 1906-23 by the mining of gossanous lode cappings and oxidised sulphide ores. The present company was formed with a paid-up capital of £50,000 to take over the property in 1934, and after successful experiments on the treatment of the primary sulphide ore, have since been engaged on a continuous mining operation at a production rate (1962) of about 500 tons of ore per week. In 1958, the Mt. Lyell Mining & Railway Company took over a 50% interest in the company and authorised capital was increased to one million pounds, subsequent to which extensive developmental drilling has been embarked upon.

A gradual expansion of mining activity since 1958 is indicated by the following annual records of ore treated and tin returns:

Year	No. of Men	Quantity of Ore Treated (tons)	Production Metallic Tin (tons)
1958	30	11,622	81
1959	47	9,846	87
1960	55	11,778	84
1961	58	21,604	171
1962	65	26,287	238
1963	-	27,180	240

The orebodies are confined to sediments of early Cambrian age which are exposed along the axis of a regional anticlinal ridge. The sediments

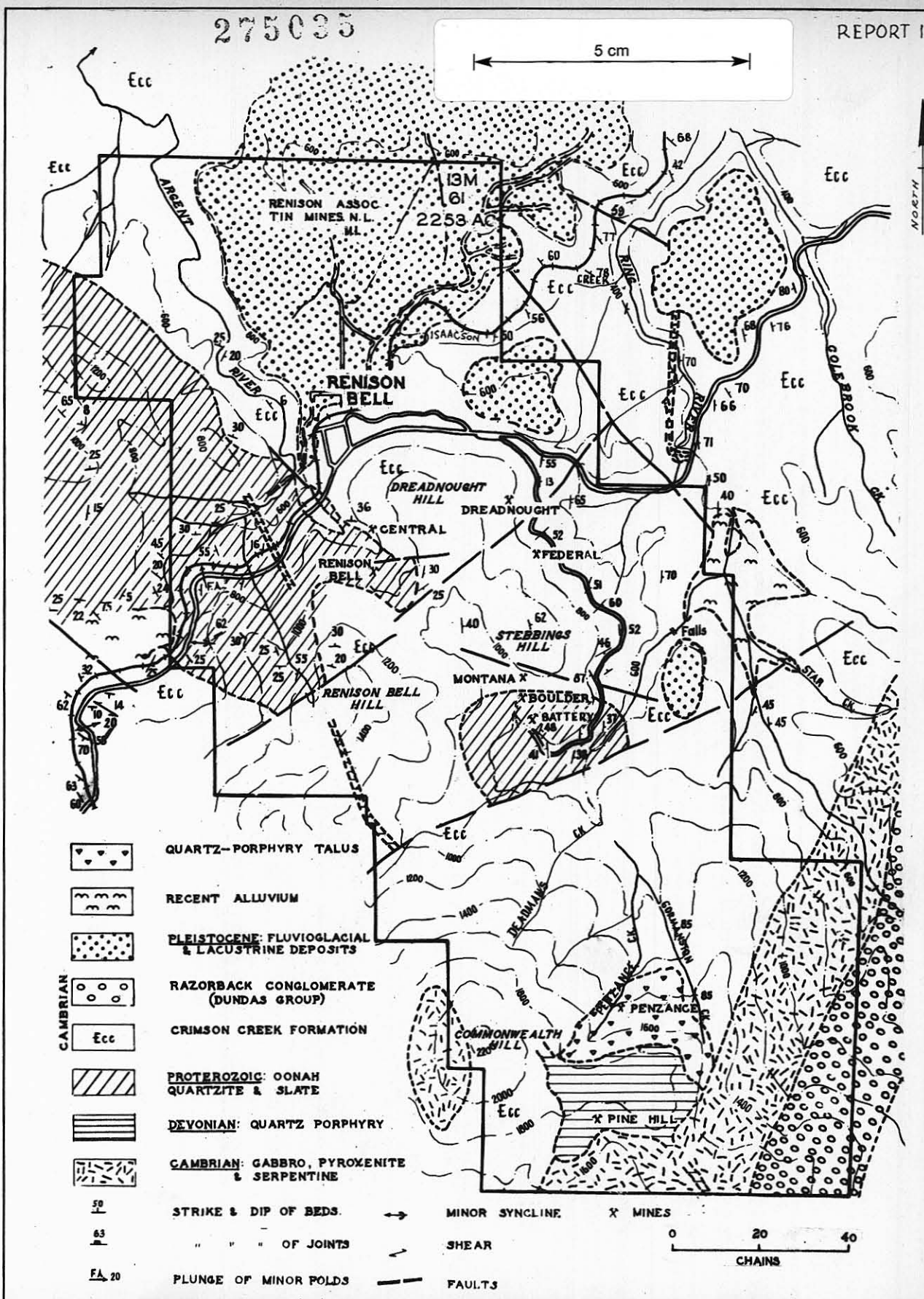
comprise Lower Cambrian quartzite and slate (pre-Cambrian of Blissett, 1962) which are succeeded unconformably (Campana and King, 1963) by inliers of Middle Cambrian argillite, greywacke and conglomerate. The bedded sequences are intruded by numerous bodies of basic igneous rock now largely represented by serpentine, and by dykes of quartz porphyry (Fig. XI).

The orebodies are distributed along two parallel zones trending north west in the general strike direction of the country rock. The north east zone includes the Dreadnaught and Federal Lodes, and the south west zone contains the Renison Bell Lode system, the Montana, Boulder, Battery and other smaller orebodies. The ore consists of massive sulphides, principally pyrrhotite, pyrite and arsenopyrite, with quartz and cassiterite (Stillwell and Edwards, 1943) and is found in the two following environments:

1. Sill-type orebodies or "floors" up to 30 ft. wide such as found in the present Battery workings. Here massive sulphides have partially replaced three different horizons of flat-lying calcareous sediments in the basal Middle Cambrian beds. The middle floor, the site of present mining operations at the Battery workings, is overlain by a useful marker horizon referred to as the "Red Rock" in previous literature (Blissett, 1962). The floors are dismembered by numerous normal faults with movements ranging from 10-30 ft. (Fig. XII) and usually extend outwards from fissure lodes such as those described below.

2. Steeply dipping Fissure Lodes or "feeders" along N.W.-S.E. fault zones. The feeders are from 5-12 ft. wide, with occasional bulges as great as 45 ft. The longest continual feeder so far traced is the Renison Bell main lode (1,200 ft. long), while the largest individual ore shoot is the Federal lode (worked over 750 ft. in length). The feeders as a rule carry more quartz and arseno-pyrite than the floors, and are richer in cassiterite. The cassiterite tends to be coarser grained in the feeders than in the floors (Fisher, 1953).

Geophysical Work: In 1929-30, the Imperial Geophysical Experimental Survey investigated part of the field and recommended that magnetic and self potential (S.P.) surveys would give best results. Magnetics and S.P. were carried out over part of the mine area during 1950-52 (Loh, 1951; Horvarth and Keunecke, 1953). The known lodes produced strong anomalies. Other anomalies that were indicated have since been drilled by the Company, but the results are not known. During 1957, Rio Tinto carried out airborne magnetic and airborne electromagnetic (E.M.) surveys over the region, and while some anomalies were found, the survey was not followed up by drilling.



GEOLOGY OF THE RENISON BELL AREA

Fig XI

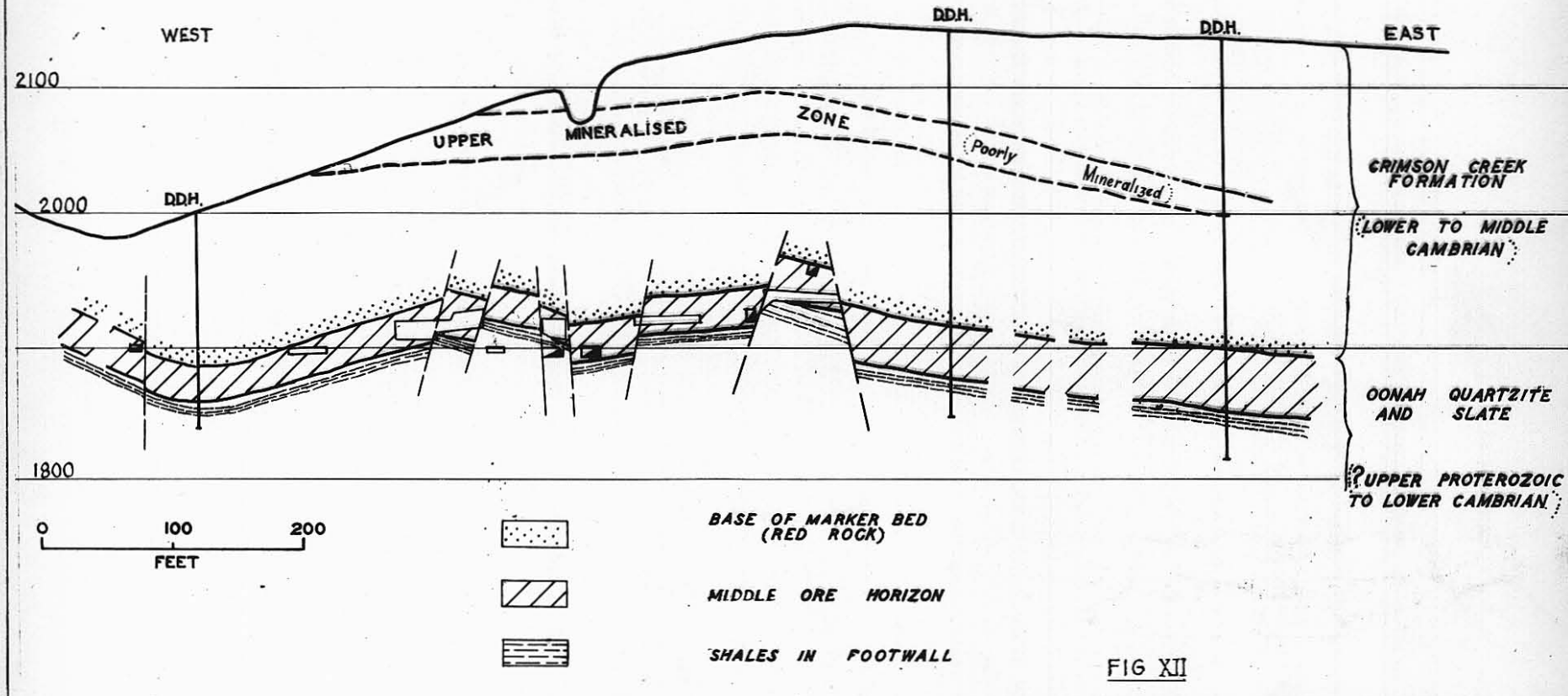


FIG XII

SECTION THROUGH BATTERY MINE
RENISON BELL

REPORT NO. 121.

5 cm

Grade and Recovery: The grade of ore treated in recent years has mainly been in the range of 0.5% - 1.5% metallic tin. Ore treated in 1962 averaged 1.32% tin, and in 1963 was 1.33% tin. This came mainly from the Battery Lode (Fig. XI). The metallurgy involves separation and rejection of the sulphides by flotation, followed by concentration of cassiterite from the sinks on tables and vanners. A recovery of 65% is obtained with the existing plant. The output of the mine is limited at present by the capacity of the plant, which is operated continuously on three shifts.

Ore Reserves: As a result of the first thorough study of the Renison Bell deposits, Fisher (1943) concluded that "The establishment of important ore reserves depends mainly upon the fissure lodes, the most promising of which are the Renison Bell and Federal. Surface exposures suggest that the Renison Bell system may contain 500,000 tons and the Federal 150,000 tons above the lowest level which can conveniently be worked by adits. The Battery lode contains at least 66,000 tons and the Black Face lode, a floor of the Renison Bell system, perhaps 30,000 tons. Average grade of the ore is 0.6% - 1.0%."

Rattigan (1957) suggested that prospective reserves amounted to about three million tons averaging about 1.0% metallic tin. A survey of undeveloped areas surrounding the mine leases (King, 1958) indicated three occurrences of sulphide ore that warranted testing, but failed to disclose any deposits that could be relied upon to provide additional ore reserves.

By August, 1960, the company estimated reserves to be 1,183,000 tons carrying an average of 0.7% tin (Blissett, 1962). In recent years, deep drilling at the Federal lode has resulted in a substantial increase in tonnage and grade of the indicated reserves. A re-calculation to June 30, 1963, showed four million tons with a small but useful overall increase in average grade (R. & S. Bureau, 1963).

Exploitation of these reserves will largely involve underground mining.

Razorback Mine: (Held as Leases and worked by J. Hodge and Syndicate of Zeehan).
References: Thomas and Henderson, 1943; Taylor, 1951; MacLeod and Jack, 1962; Blissett and Gulline, 1960.
Plan: For detailed geological plan, see Blissett and Gulline, 1960.

The Razorback mine workings are located along a major N.N.W.-S.S.E. fault zone which can be traced at the surface for over 2,400 ft. Throughout this length, the hanging wall is serpentine and the footwall consists of Cambrian slates and conglomerates.

The lode has been prospected over and beyond its known length by numerous adits and trenches. These reveal that the southern part of the fault is highly silicified with insignificant tin values, but tin-bearing gossans overlying pyrrhotite-rich sulphide and dolomite have been established over a length of 800 ft. at the northern end of the fault zone.

The width of the lode over the stanniferous interval averages about 60 ft.

Oxidation extends to depths of up to 120 ft. The gossan has been worked intermittently since 1918 and had yielded 49 tons of metallic tin to the end of 1960. The bulk of the ore treated was from richer patches of gossan encountered in rises above the adits and a small open cut. Production figures in recent years indicate a working grade of 1% - 2% metallic tin.

Systematic sampling of the workings has been carried out by Thomas and Henderson (1943), Taylor (1951), and by Rio Tinto geologists (Campana and King) in 1959, and in each case the results have shown that the tin occurs as irregularly distributed "plums" in the deposit, and that the overall average grade for the gossan is less than 0.5% tin. Taylor (1951) estimated reserves of oxidised ore to be about 320,000 tons averaging 0.3% tin (or 960 tons of metallic tin).

While the deposit has some impressive features, the overall grade of the oxidised ore would be sub-marginal now that the richer patches have been worked out. Little is known of the primary ore at depth, but one would expect it to be considerably lower in tin values than the leached outcrop.

Following recommendations by Taylor (1951), three diamond drill holes were put down by the Mines Department in 1958-59 to test the sulphide ore at depth, but because of very poor core recoveries, the results were inconclusive. Analyses of the sections of the core obtained were all below 0.5% tin. However, sludge samples from Bore No.2 over the intervals 136-155 ft. and 195-228 ft. exceeded 2.8% tin (Blissett and Gulline, 1962).

Extensive geophysical surveys (E.M., S.P. and Magnetic) were carried out in the Razorback (and Grand Prize) mine area in 1960 by the Bureau of Mineral Resources and were followed up by seven drillholes in several anomalous areas. No significant mineralisation was encountered in the drillholes (MacLeod and Jack, 1962).

Other Mines of the Central Dundas District: Small quantities of tin have been produced from a number of other mines in the Renison Bell-Dundas district shown on Fig. XIII, and these are briefly described hereunder:

Grand Prize: (Nye, 1931; Blissett, 1962). This is a deeply oxidised vertical fissure lode averaging about 15 feet wide and 800 feet long which intersects Cambrian sediments. The workings include a vertical shaft to a depth of 240 ft. and four adit levels. It has been worked intermittently on a small scale since 1927, yielding in all 18.3 tons of metallic tin.

Tin values are very sporadic. Sampling by Rio Tinto in 1959 indicated large sections were barren and an overall grade well below 0.5%. In 1959, 26 tons of selectively mined ore were treated for the production of 4.05 tons of metallic tin (0.77%).

Penzance: (Ward, 1909). Approximately 37 tons of metallic tin were produced from quartz-tourmaline-cassiterite veins in hornfels at the periphery of a quartz-porphyry dyke (Pine Hill). This occurrence lies within the southern part of the Renison Bell prospecting area.

Exe River Proprietary: (Ward, 1909; Condor, 1918; Blisset, 1962). Sparse and irregular quartz-tourmaline-cassiterite veins with a maximum width of two feet in fractured Cambrian sediments. Although known since 1911, when the deposit was opened up by adits, the total production amounts to only about 4 tons of metallic tin.

Fentons: (Condor, 1918; Blissett, 1962). Cassiterite is associated with quartz and minor amounts of sulphides in narrow veins. Small scale mining took place during 1911-18 and 1928-45, but the total recorded production is only 10 tons metallic tin.

Olympic and Athenic: (Reid, 1927; Blissett, 1962). Seven tons of metallic tin were won from three adits and an open cut on small irregular veins at the Olympic. Similar tin-bearing veins were prospected at the nearby Athenic workings, but there is no record of any production.

Stannite Lodes of the Oonah and Stormsdown Mines: The Oonah mine area is held as S.P.L. 389 by Dr. C. Loftes Hills, and is under option to Clutha Development. Clutha have also pegged an adjoining S.P.L. No. 391. The Stormsdown mine is held as a lease and worked by D. Dunkley and Syndicate of Zeehan.
References: Twelvetrees and Ward, 1910; Blissett, 1960; Blissett, 1962; Gardener, 1963.

The Oonah and Stormsdown mines are located on the western outskirts of the township of Zeehan (Fig. XVIII) among numerous old silver-lead mines which are now virtually worked out and abandoned. While most of the narrow fissure lodes in this district were composed mainly of galena and siderite,

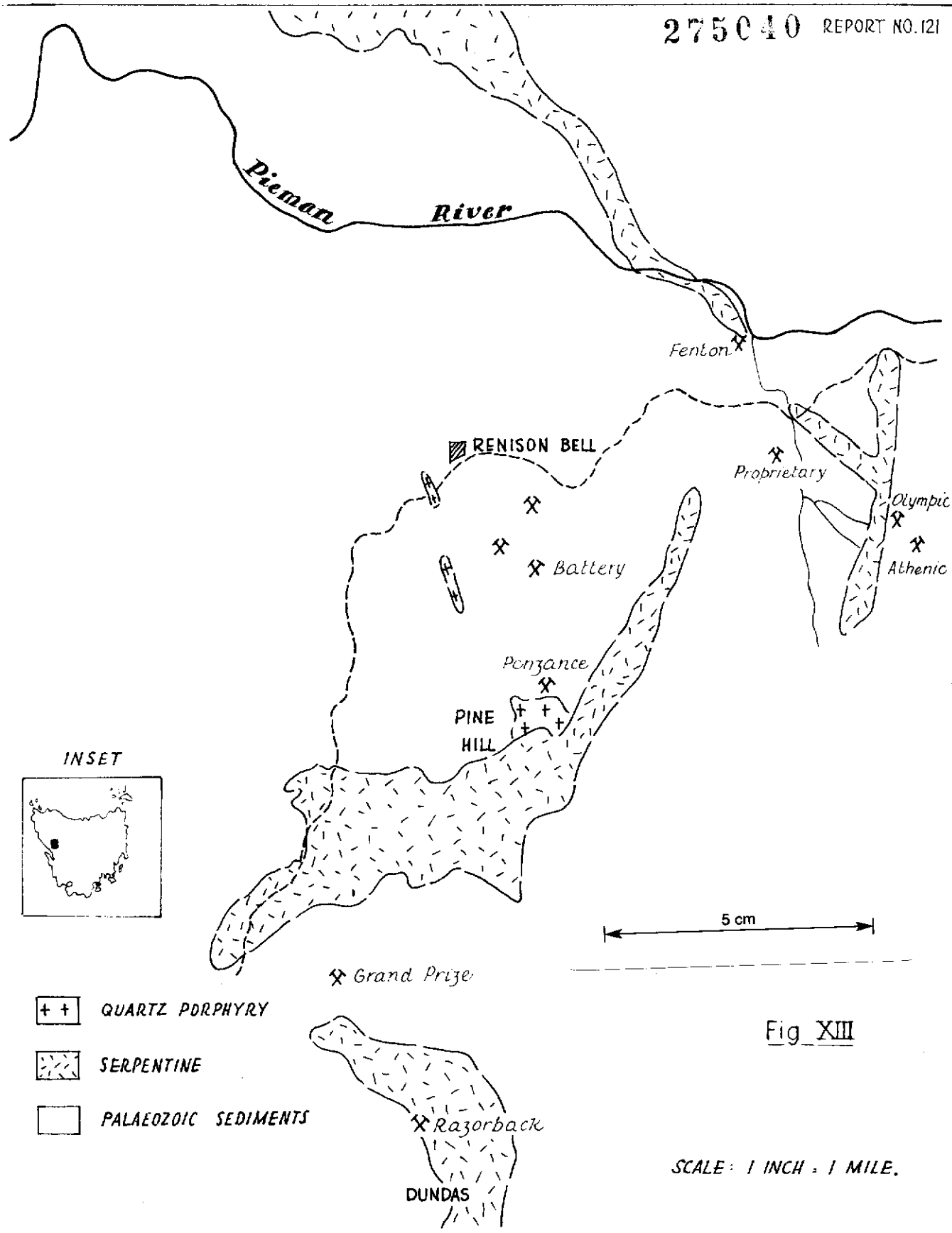


Fig XIII

MINE LOCALITY MAP — CENTRAL DUNDAS TINFIELD

one lode at the Oonah mine (Stannite Lode) features a complex ore containing stannite. Another pyritic lode carrying stannite (formerly known as Clarkes Lode) has been reopened by a syndicate on the adjacent Queen Hill, where the site of operations is now named the Stormsdown mine.

Geophysical surveys were carried out over the area on behalf of Clutha Development earlier this year. The report by Gardener (1963) was briefly sighted. The Stannite Lode was indicated by I.P., S.P. and E.M. anomalies over a length of 400 ft., with a possible extension of another 400 ft. I.P. and S.P. anomalies on which drillholes are recommended were found between the Stannite Lode and Clarkes Lode, while Clarkes Lode itself coincided with an S.P. anomaly.

The Stannite Lode (Oonah Mine) comprises well defined bands of stannite, pyrite and chalcopyrite with some quartz, bismuthinite, wolfram and a little fluorite. The lode has a width in the range of 2-5 ft. and dips steeply to the east. It was largely worked out to No. 6 level from a shaft 450 ft. deep, and driven on for distances of up to 400 ft. (Twelvetrees & Ward, 1910).

The composition of a bulk parcel of the stannite ore is recorded by Blissett (1962) as 10.7% copper, 9.2% tin, 4.4% arsenic, 29.75% sulphur and 23.0% silica.

Clutha Development were engaged on deep drilling on the Stannite Lode during the time of my visit (October, 1963). No details of results were available, but it is known that the country rocks and lodes are badly faulted in this area, and great difficulties in coring and interpretation are likely to be experienced. The chance of the present venture proving successful appears to the writer to be remote.

The Clarkes Lode (Stormsdown Mine) has been worked part-time for tin during the past few years after having been exploited for silver-lead ore in the early days. The tin occurs as fine grained cassiterite (and stannite?) in small irregular masses and veins of pyrite. The area is highly faulted and the relations of several tin-bearing exposures have not been satisfactorily determined (Blissett, 1960). It is clear, however, that the reserves of stanniferous ore are very limited.

Bulk samples representing soft pyritic ore (reserves of which are given by Blissett as only 300 tons), and hard pyritic ore, yielded 4.13% tin and 0.58% tin respectively.

VEIN AND SULPHIDE DEPOSITS OF THE MT. HEEMSKIRK DISTRICT:
References: Waller, 1902; Clark, 1904; Waterhouse, 1915; Keid, 1943(a); Edwards, 1953; Blissett, 1962.

The Mt. Heemskirk tin field comprises prominent granite ranges of the Mt. Heemskirk and Mt. Agnew group, adjacent Cambrian-pre-Cambrian successions of the metamorphic aureole, and alluvial fans occurring around the periphery of the range. Cassiterite is mainly present in quartz-tourmaline veins and greisen within the main mass of the granite, and to a lesser extent as fissure veins and lodes in the neighbouring sediments.

Tin deposits were located in the Mt. Heemskirk area in 1876-79. The field was the site of intensive but short-lived mining operations during the following decade. Since that time, there have been minor revivals of interest with the discovery and working of Maynes Mine (1901-1909), the winning of about 237 tons of alluvial cassiterite from the Tasman River by the Heemskirk Tin Syndicate (1913-1920), and the reopening of the Federation mine (1927-29 and 1935-38).

A lode deposit which was examined at the site of the old St. Dizier alluvials (referred to below as the St. Dizier Lode Deposit), shows some promise.

The total recorded production from the Heemskirk field is 770 tons of metallic tin, of which 334 tons were from the Federation and Maynes mines, 292 tons were from the alluvials at Tasman River, and only 144 tons from the numerous other small workings (Fig. XIV).

Federation Mine: Originally known as the Cumberland group of mines during its early life (1888-1890), the property was reopened in 1926 with little success by Federation Tin Mines Ltd. Total recorded production from the property is 194 tons of metallic tin.

The Federation mine lies within the main mass of the granite. Mineralisation is associated with quartz-tourmaline veins ranging up to 6 ft. wide, and to a lesser extent with greisenous segregations in the granite, e.g. Tributors Workings (Fig. XV). Some rich patches of ore were encountered occasionally but, based on figures given by Blissett (1962), the overall average grade of 14,586 tons of ore on record was 0.31% tin. It is therefore not surprising that several serious attempts to develop the property resulted in failure.

A few tons of tin concentrates have been produced from the area in recent years by prospectors. On one lease held by Coleman, quartz-tourmaline nodules in decomposed granite were locally found to contain up to 17% tin (Keid, 1943).

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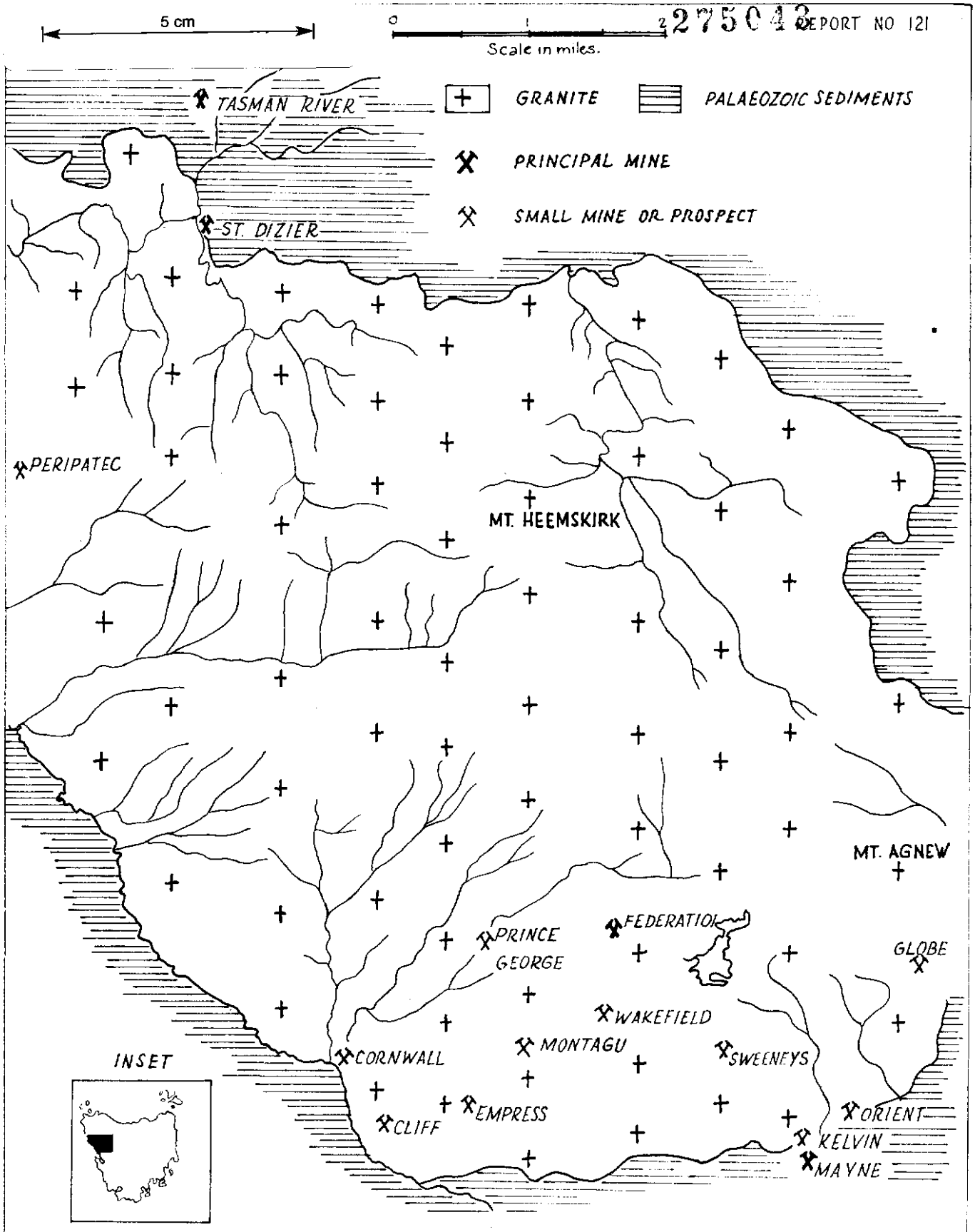

Fig XIV

LOCALITY MAP OF THE HEEMSKIRK TINFIELD

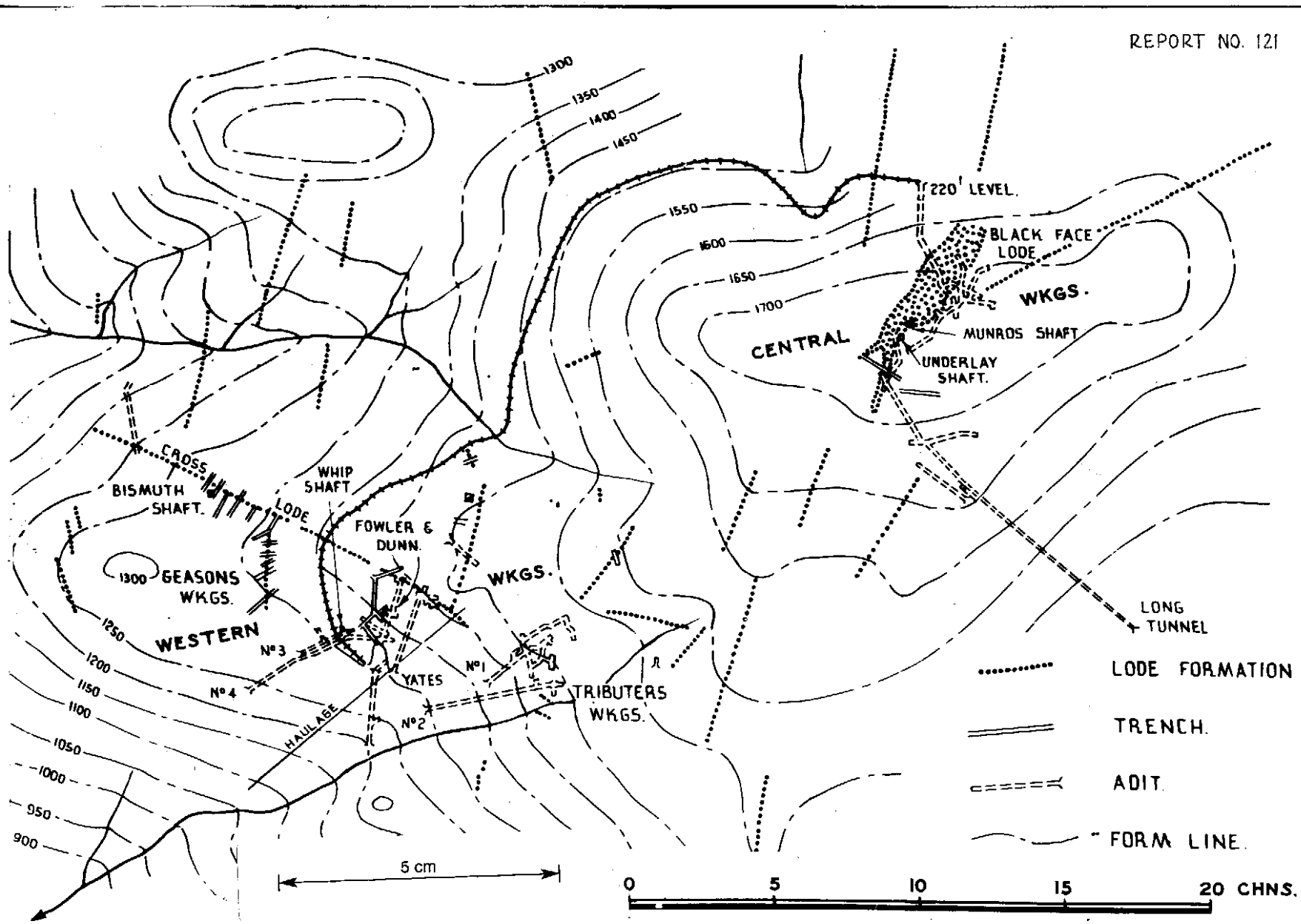

FIG XV

FEDERATION MINE — SOUTH HEEMSKIRK

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Maynes and Kelvin Mines: These two mines are within 500 feet of each other in pre-Cambrian sediments bordering the southern edge of the Heemskirk granite massif (Fig. XIV). In each case, cassiterite occurs in short and irregular quartz-tourmaline veins in intensely fissured country rock. Production from Maynes mine during its life from 1902-1906 is stated to be 140 tons of metallic tin (Waterhouse, 1916). Output of the Kelvin mine is not recorded but was evidently small.

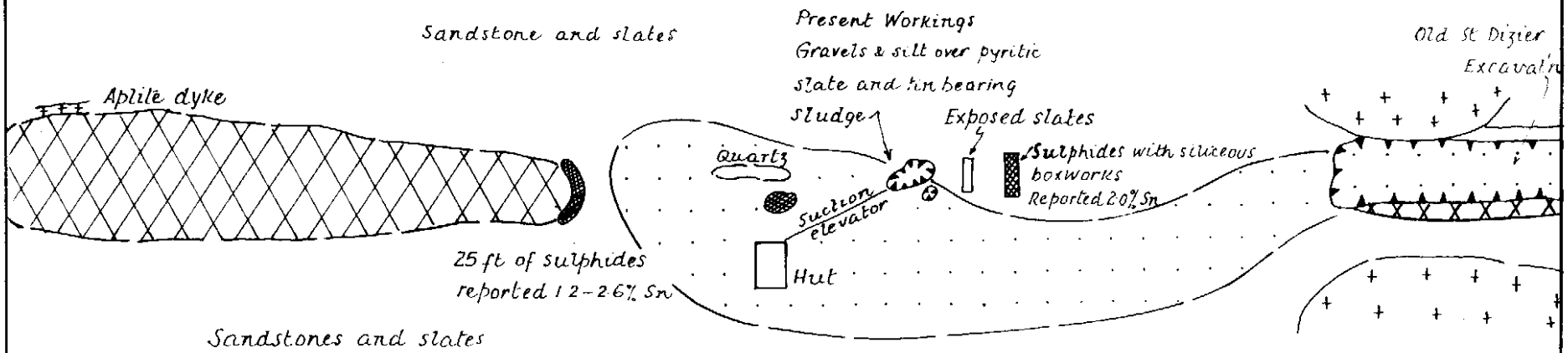
St. Dizier Sulphide Deposit: (60 acres held as leases by R.F. Laffer).
References: Waller, 1902; Waterhouse, 1915.
Location: 16 miles north west of Zeehan. The first 8 miles of access track from Zeehan is by gravel road, but the remainder is by swampy track negotiable only by four wheel drive vehicles. The prospect was visited by the writer during October, 1963.

While working over the old St. Dizier alluvial deposits with a suction elevator during the past two years, the lessee has discovered that the surface tin is mainly residual and derived from an adjacent underlying sulphide body. The country rock consists mainly of contorted slates, but outcrops of granite occur in the near vicinity.

An exposure of tin-bearing lode formation to the west of St. Dizier Creek was reported on in the early days, but was not tested below surface. Waller (1902) refers to it as "a very curious tin-bearing formation which has lately been discovered on the property. It consists of a large lode of magnetite, and some arsenical pyrites with steatite and a green partly decomposed mineral somewhat resembling chlorite.... A sample of the stone, assayed by Mr. A.D. Wilson at the Zeehan School of Mines, yielded 3% tin..... The formation is a large one, and should be opened up". In later years, Waterhouse (1915) states that "A sample of the ore was broken across the outcrop as far as exposed, but in the nature of the occurrence, this could only be regarded as approximate. Reasonable care was taken to take primary material, the oxidised crust of limonite being broken off as far as possible. The sample was assayed by Mr. W.D. Reid, Government Assayer, with the following results: Iron, 47.4%; Tin, 0.97%."

The outcrop of limonitic ironstone referred to above is 730 ft. long (east-west) by an average of 100 ft. wide (Fig. XVI). In a shallow cut at the eastern end of the outcrop, Laffer has shown that the primary minerals are dominantly sulphides, pyrite and pyrrhotite. Samples taken over a width of 25 ft. are stated to have assayed from 1.2% to 2.6% of metallic tin.

At 200-250 ft. east of here is a small outcrop of similar sulphides together with prominent outcrops of vein quartz.



Alluvial Workings (Old St. Dizier Coy)

Limonitic Ironstone

Massive Sulphides (exposed in cuts)

Contorted Slate & Quartzite (dominantly)

Granite & aplite

5 cm

Fig. XVI

PRELIMINARY SKETCH

LAFFERS ST. DIZIER LEASES

NORTH HEEMSKIRK, WEST TASMANIA

NOVEMBER 1963

SCALE: 1 INCH = 200 FT.

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At 150 ft. farther east, an excavation being currently worked by the lessee has exposed a fine sludge rich in tin and sulphide which evidently represents weathered lode material below about 8 ft. of alluvial ground. Slate bedrock with no sign of mineralisation is exposed in a bulldozed costean about 70 ft. east of the excavation, but a width of at least 20 ft. of sulphides (largely pyrrhotite) with siliceous boxworks was cut in another costean 130 ft. east of the excavation (Fig. XVI). A sample taken from this costean gave a reported value of 2.0% tin.

An elongated excavation about 300 ft. long, 50 ft. wide and 15 ft. deep occurs from 500-800 ft. east of the present workings. This excavation is notable for the small amount of pebbles in the so-called drift, a pronounced steeply dipping wall of altered and silicified country rock on the northern face, and exposures of limonitic gossan along the southern face. The tin won from this locality was therefore probably derived from weathering of underlying lode material.

The above features indicate the possibility of a steeply dipping orebody at least 2000 ft. long and averaging possibly 50 ft. in width. It is the best prospect not held by other companies in West Tasmania, and certainly warrants geological mapping and surface sampling as a basis for considering possible geophysical surveys and diamond drilling.

Small Mines and Prospects: Numerous other small mines and prospects are shown on the locality map (Fig. XIV). Most of these, including the Cornwall, Cliff, Empress Victoria, Prince George, Montagu, Wakefield and Orient mines were located on narrow quartz-tourmaline-cassiterite veins of very limited size and are not worthy of detailed description herein. At the Sweeneys and Globe mines, there are localised segregations of sulphides including sphalerite, galena, tetrahedrite and pyrite with some cassiterite, fluorite and tourmaline; but these also appear to be small and not of interest. Longs Iron Blow consists of a prominent outcrop of haematite, quartz and tourmaline, 210 ft. long by 50 ft. wide, on the northern slope of Mt. Heemskirk. A bulk sample across the outcrop is reported to assay 0.29% tin (Waterhouse, 1915; Blissett, 1962).

The Peripatetic Mine is a vein and greisen deposit with possible potential in terms of a small operation. Five adits and three shallow shafts indicated the presence of a tin-bearing vein 4 ft. thick in greisenous granite. The only evidence of grade is a bulk sample taken by Waller (1902) over 7 ft. of decomposed kaolinitic material near the mouth of No. 3 adit, which assayed 2.5% metallic tin. The mine has been idle for many years. The Mines Department are considering drilling the deposit in the near future.

VEIN DEPOSITS OF THE MOINA DISTRICT:

A variety of deposits including tin were formerly worked in proximity to the granites of Dolcoath Hill, near the township of Moina, in central northern Tasmania (Fig. III). The distribution of the wide variety of minerals is such to suggest a thermal zoning pattern with tin, tungsten and bismuth occurring in and around the Dolcoath granite and gold, silver, lead and copper more widely distributed through the country rock. There is also the association of an unstressed granite carrying tin and tungsten and a sheared granitic rock featuring gold, silver, lead and zinc mineralisation (Carey, 1945b).

Shepherd and Murphy Mine: The largest mine in the district was the Shepherd and Murphy mine at Moina, which is credited with a total production of 552.6 tons of metallic tin. The recorded output of the smaller mines amounts to only 22.2 tons.

The Shepherd and Murphy mine was opened up on a series of quartz-wolfram-cassiterite veins (Nos. 1 to 6) which intersect Tubicolar Quartzite and altered Gordon Limestones (skarn rocks) of Ordovician age in the contact aureole of the Dolcoath granite. The mine was actively worked from 1893 until 1924, and again from 1953 to 1958.

The veins chiefly occupy east-west fissure faults and associated tension cracks and joints with some minor branches. The average width of the veins worked in 1958 was $7\frac{1}{2}$ inches. Earlier reports quote larger widths of from 12-18 inches (Twelvetrees, 1913; Elliston, 1953) but a narrowing of the veins occurred in depth (Robinson, 1958). The values present also declined with depth, from 1.66% combined concentrates in the upper levels (1918) to 0.8% combined concentrates at depth (1958).

The run of mine ore grade based on a large number of assay results was 0.21% Sn and 0.37% WO_3.

A mineragraphic study of the ore is described by Williams (1958).

Detailed accounts of the mine given in the reports of Blake (1955a) and Robinson (1958) provide no encouragement for a revival of interest in these deposits.

At the All Nations mine, adjoining the Shepherd and Murphy on the east, similar veins carry a lower proportion of cassiterite.

The Squib mine was located on the northern margin of Dolcoath Hill granite, in greisen carrying wolfram and minor cassiterite.

About 200 tons of tin and wolfram concentrates were produced from alluvial deposits of the Iris mine at Moina.

PART IIB
PRIMARY DEPOSITS OF THE NORTH EAST PROVINCE

The primary tin deposits of the North East Province are all closely associated with Devonian granites. These include all the granite areas of the Ringarooma valley, Mt Cameron, the Blue Tier, Avoca district and the islands of the Furneaux group. Southerly extensions are mostly covered by younger rocks, but the granite reappears at Coles Bay and Bicheno on the Freycinet Peninsula. The granites of this Province are commonly coarsely porphyritic with feldspar phenocrysts up to three inches long; but fine-grained granites and greisens also occur, and it is these that carry the tin (Thomas, 1943b). Quartz reefs in the contact aureole carry cassiterite and wolfram at Storeys Creek and Aberfoyle.

VEIN DEPOSITS OF THE AVOCA DISTRICT :

Tin and wolfram have been won from numerous workings in the Avoca-Rossarden region, principally from quartz fissure veins in tightly folded Silurian sediments (Mathinna group) bordering granite, and to a lesser extent from greisenous segregations and joint fillings in the granite.

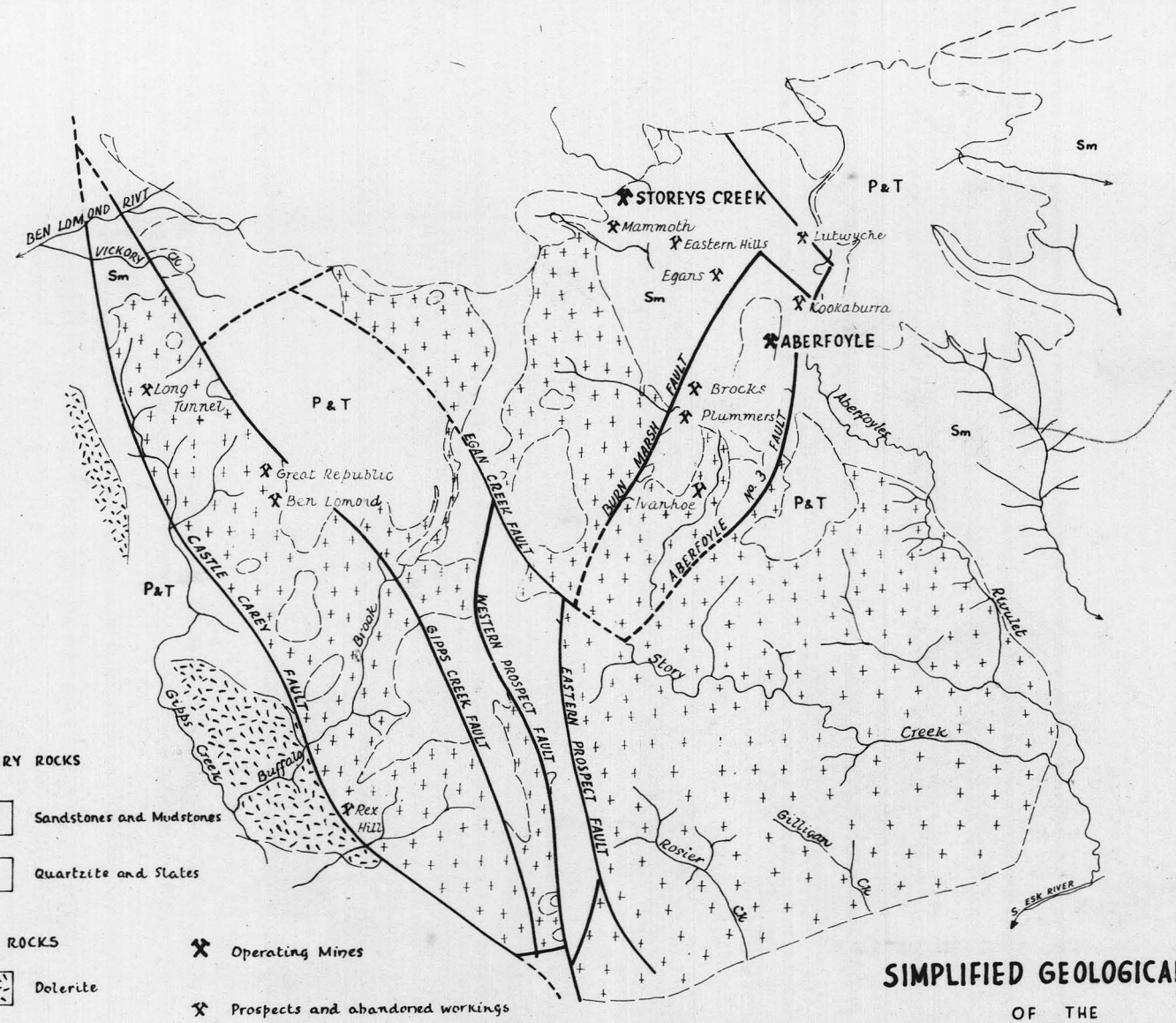
The two largest mines, Storeys Creek and Aberfoyle, are still operating, but in each case ore reserves based on drilling are now seriously depleted. In both mines, tin values declined with depth while tungsten values (wolfram) increased with depth. Cupolas of greisenous rocks were encountered in place of the ore zones in the deeper levels. These and numerous smaller workings are situated on a partly dissected Permian plateau at an elevation of from 2,200 to 2,600 ft above sea level. The nearest railhead is at Avoca, 10 to 12 miles to the south of Rossarden (Fig. XVII).

Aberfoyle Mine

(Consolidated leases totalling 293 acres held by Aberfoyle Tin N.L.)
References: Blissett, 1959; Connolly, 1946 & 1953; Edwards & Lyon, 1957; Henderson, 1946; Lyon, 1957; Nye, 1926; O'Malley, 1938; Reid & Henderson, 1929; Robinson, 1956; Scott, 1928.

In recent years Aberfoyle has been one of the major tin producers in Australia.

The stanniferous veins of the Aberfoyle Mine, concealed at the surface by Permian sediments, were discovered in 1926 during prospecting of some outcropping subsidiary veins. Production commenced in 1931 and the mine has since yielded 10,250 tons of metallic tin. The tin content of the ore fell from 1.35% near the surface (1934) to 1.1% at depth (1958)



SIMPLIFIED GEOLOGICAL MAP

OF THE

ROSSARDEN AND STOREYS CREEK DISTRICT

After Blissett & Gulline 1959

NOVEMBER 1963

5 cm

Fig. XVII

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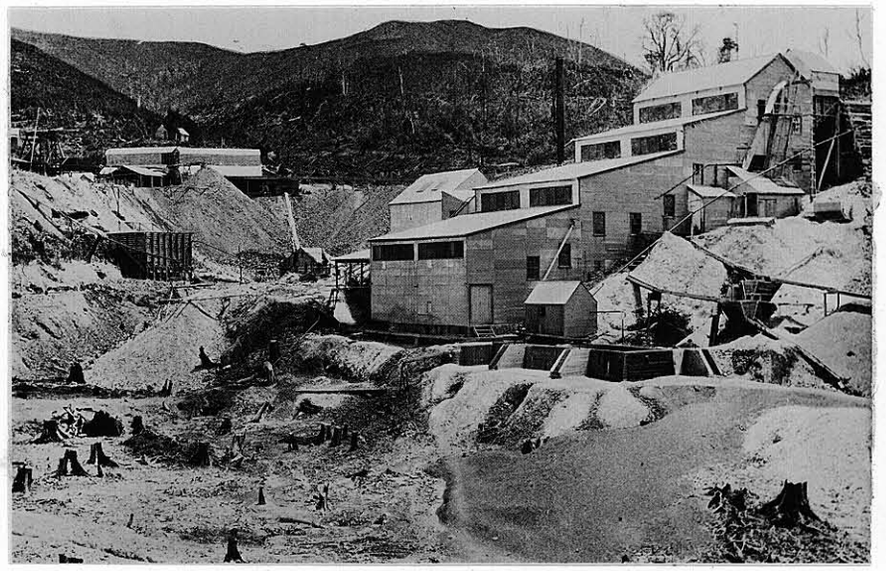


Fig. XVIII. The Oonah mine at Zeehan during active mining operations about 1910. The main lode, which was rich in stannite, is currently being explored at depth by Clutha Development.

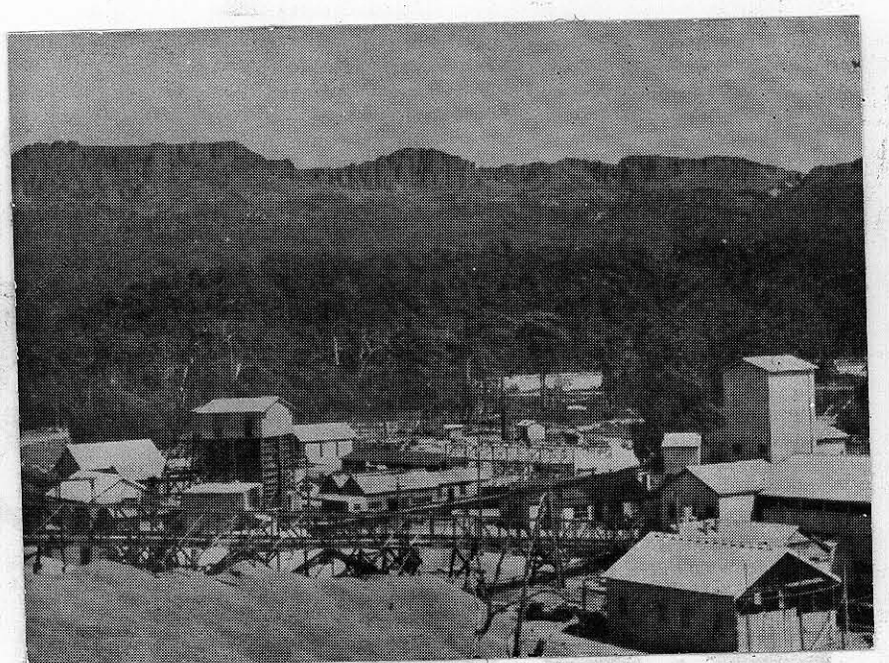


Fig. XIX. The Aberfoyle mine at Rossarden, looking north-west to dolerite-capped hills of Ben Lomond.

but the content of tungstic oxide (or wolfram) in the ore increased from 0.11% to 0.46% over the same interval. Because of the narrow width of the veins, about 55% of the stone milled comprises barren rock.

Mineralisation occurs as fissure veins in a sheeted zone about 200 ft wide and 1,600 ft long in folded slates and quartzites, one mile from the nearest granite outcrop. North of the main shaft the veins dip at 67 degrees west, flattening to 53 degrees west at the No. 5 to 9 levels. South of the shaft the dip is consistent at 57 degrees west (Fig. XX).

The main vein system consists of nine individual quartz veins carrying cassiterite and wolfram. The No. 26 vein is up to 7 ft wide (Lyons, 1957, Fig. V) and averages about 3 ft wide. The thickest sections are confined to quartzite beds along the axes of crumpled folds. The other veins are much narrower and as a rule are richer in tin where the wall rock is quartzite. Faulting of both pre-ore and post-ore age has occurred but little disruption of the veins has occurred.

The main shaft was down to 1,380 ft by 1958. An aplite cupola 400 ft wide was encountered in the main shaft and drives at 1,050 ft. It appears from this and the results of drilling that the lower limit of economic mineralisation is No. 11 level at 1,060 ft below the surface position of the main vein (Blissett, 1959).

It is understood that some interesting drillhole intersections were obtained by the Company last year half a mile away from the present mine.

Storeys Creek Mine

(Leases totalling 463 acres held by Storeys Creek Tin Mining Co N.L. This Company merged with Aberfoyle in 1958.) References: Blissett, 1959; Dunkin, 1946; Hills, 1916; Montgomery, 1892; Reid & Henderson, 1959; Scott, 1934; Waller, 1901; Edwards, 1953.

The Storeys Creek mine has produced 1,595 tons of metallic tin and more than 7,000 tons of wolfram concentrates. In the upper levels (1928), grade determinations based on production figures showed 1.2% cassiterite concentrates and 1.5% wolfram concentrates per ton of ore treated (Reid & Henderson, 1929). In the deeper levels (1957 figures), the grades were 0.2% cassiterite and 1.6% wolfram.

The wolfram and cassiterite, with minor amounts of pyrite, chalcopyrite and martite, are sporadically distributed throughout several ramifying quartz veins averaging about 4 ft in thickness. The veins constitute a mineralised zone which trends north-westerly in the general direction of strike of the enclosing quartzites, slates and siltstones. The dips of the

MAIN SHAFT SECTION

Report No 121

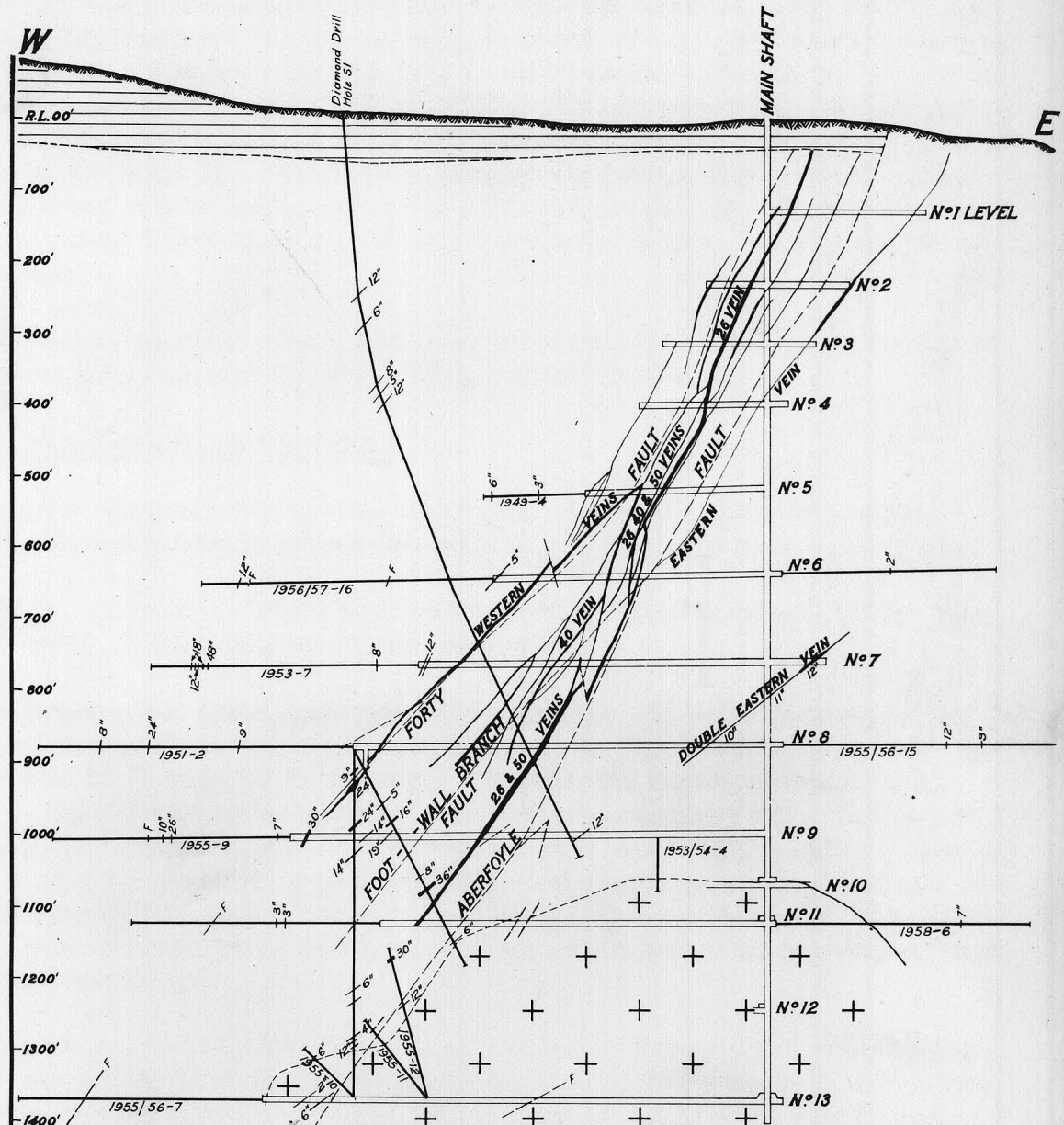
052

ABERFOYLE MINE

275054

5 cm

0 100 200 300 FEET



- LEGEND -

PERMIAN

MATHINNA GROUP (SILURIAN?)

GRANITE

VEINS

FAULTS F

DIAMOND DRILL HOLES

COLLAR OF SHAFT IS AT ELEVATION OF 2200' ABOVE SEA LEVEL.

Fig XX

AFTER F. HAMILTON.
ABERFOYLE TIN N.L.

individual veins range from 20 to 40 degrees to the south-west, which is normally flatter than the bedding plane dips.

The workings were largely confined to the two thickest veins (Edwards, 1953). The eastern (or No. 1 vein) is about 450 ft long and dips west at 20 degrees. The western (or No. 2 vein) has been driven on for 230 ft and dips west at 37 degrees (Fig. XXI). These veins are 130 ft apart at the adit level but intersect at 230 ft below the surface, where the combined width is 18 ft. They diverge again to the north and south of the intersection and in depth, where the No. 1 vein is 3 to 4 ft wide and the No. 2 vein is 2 to 8 ft wide. Small east-west faults displace the veins in places.

Apophyses of granitic rock have been encountered in the lower levels of the mine, and ore reserves are known to be limited.

Other Tin Workings near Avoca

Numerous other abandoned workings and prospects in the Rossarden-Storeys Creek district are shown on Fig. XVII.

Rex Hill: Blissett, 1958; Henderson, 1935; Montgomery, 1892; Nye, 1934; Reid, 1928; Reid & Henderson, 1929.

The main deposit comprised a steeply dipping pipe-like body of mineralised greisen enclosed by granite. In the outcrop section it measured 55 ft wide by 70 ft long. Cassiterite was accompanied by galena, sphalerite, chalcopyrite, pyrite and arsenopyrite. Galena was predominant in the upper 40 ft of the deposit, but became subordinate in importance to cassiterite at depth. The dimensions of the body and the values present declined towards the lowest level worked (290 ft). Other small mineralised veins and bodies were encountered in crosscuts from the main workings.

During 1893-1900, 3,000 tons of ore yielded 170 tons (or 5.6%) tin concentrates but by 1905 the average grade had fallen to about 1.4% tin concentrates (Nye, 1934). A total of 826 tons of cassiterite were produced between 1899 and 1913.

Mining operations ceased in 1935. Twenty samples taken from Nos. 2 and 3 levels by Henderson in that year showed tin contents ranging from 0.01% to 0.7%.

Brocks: Small mineralised fractures in quartzites and slates, drilled with poor results during 1950-54 (Hughes, 1952; Keid, 1954).

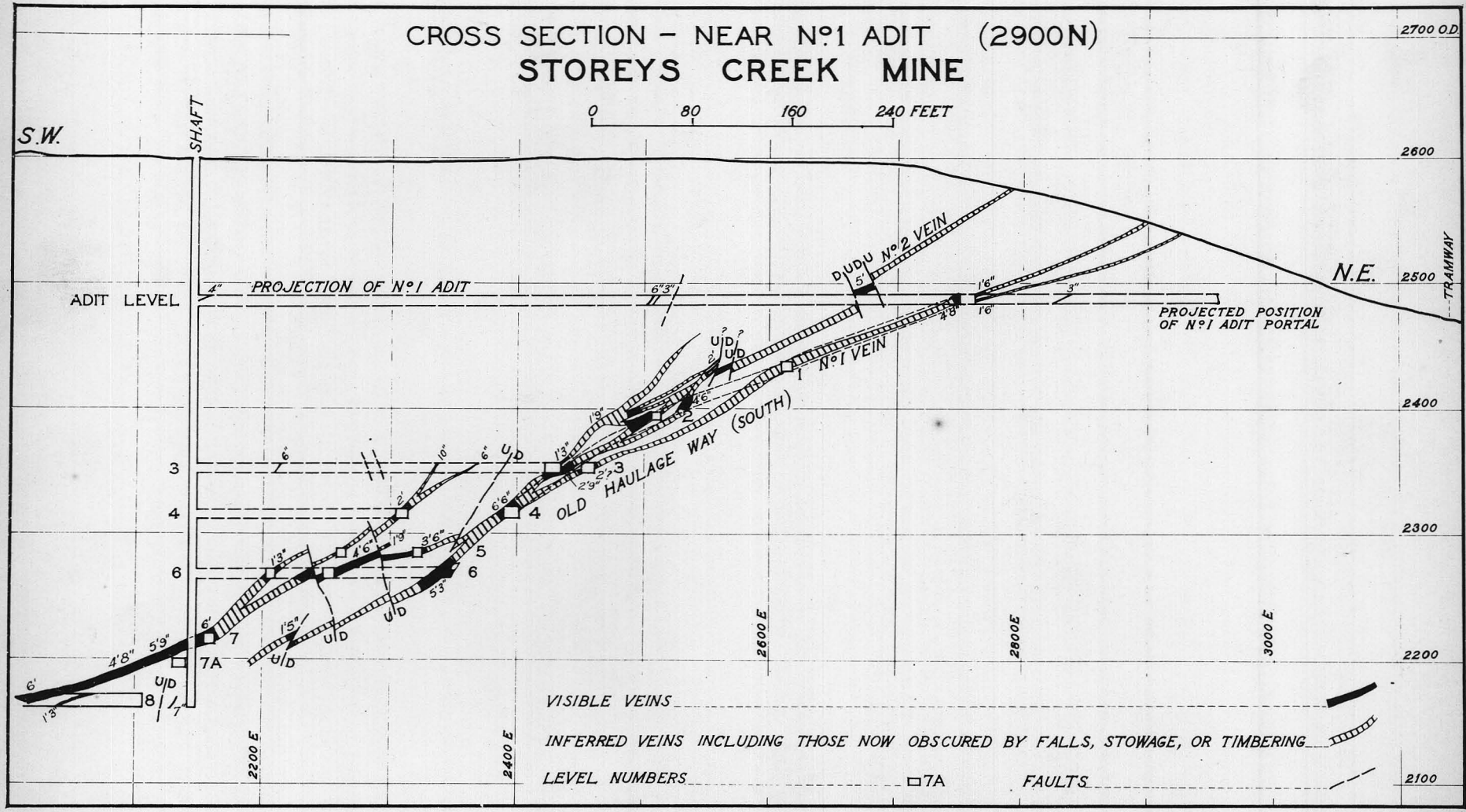


Fig XXI

Ivanhoe: Four tin-bearing veins with low values within greisen (Reid & Henderson, 1929; Henderson, 1937).

Kookaburra: Quartz veins with cassiterite cutting quartzites and slates. Prospected by adits and pits (Reid & Henderson, 1929).

Lutwyche: Veins in quartzites and slates, drilled in recent years with some encouraging results by Aberfoyle Tin N. L. (Henderson, 1946; Reid & Henderson, 1929).

Plummers: Four veins in quartzites and slates, but only sporadically mineralised (Nye, 1941; Reid & Henderson, 1929).

Eastern Hill: Eight parallel veins in quartzites and slates produced 25 tons of tin concentrates (Henderson, 1936; Reid & Henderson, 1929).

Mammoth: Four veins with low tin values near contact of sediments and granite.

Ben Lomond: The Ben Lomond tin mine produced 38 tons of tin concentrates from a quartz vein in greisen (Montgomery, 1892; Thureau, 1881; Waller, 1901).

Great Republic: Produced 132 tons of tin concentrates from quartz fissure veins in pipes of greisen. The yield of metallic tin was almost 6% of the tonnage milled but the values were very patchy (Montgomery, 1892; Reid & Henderson, 1929; Waller, 1901).

Long Tunnel Mine: Twelve-inch vein in greisen (Montgomery, 1892; Waller, 1901; Reid & Henderson, 1929).

St Paul's Valley

A few miles to the south-east of the Avoca field are the greisen and vein tin deposits of St Paul's Valley. Erosion has here exposed similarly mineralised granite basement in the valley, which is enclosed by hills of Permian-Triassic sediments and Jurassic dolerites.

The Royal George mine, ten miles south-east of Avoca, was operated by the Royal George Tin Mining Co from 1911 to 1922. They produced about 900 tons of tin oxide by underground and surface mining of greisenous porphyry in granite. The discovery of some uranium mineralisation (torbernite) at the mine is reported by Hughes (1959).

The St Paul's mine (Baileys Lode of Henderson & Reid, 1929) is one mile south-east of the Royal George. Here, a narrow zone of quartz-

tourmaline rock and greisen was worked for tin to a depth of 60 feet.

During the period 1934-37, Brookstead Tin Mines carried out some short-lived underground mining of vein deposits at Main Creek, and sluicing of alluvial ground at Kent Creek, Bailey's Marsh and Foster's Freehold, several miles to the north of the Royal George mine. Production from creek alluvials in 1936 amounted to 10.7 tons of metallic tin in ground averaging 1.2 lb per yd (Report of Secretary for Mines, 1936).

STANNIFEROUS GRANITES OF THE BLUE TIER DISTRICT

(Held as exploration licence by Aberfoyle Tin Partnership.)
References: Montgomery, 1893; Moore, 1912; Lewis, 1924; Reid & Henderson, 1928; Thomas, 1943; Thomas, 1953; Hughes, 1957; MacLeod, 1961; Lavers, 1962.

The Blue Tier is a prominent plateau consisting almost wholly of Devonian granites elevated about 2,500 ft above sea level at the headwaters of the Ringarooma, Mussel Roe and George Rivers in north-eastern Tasmania. The plateau represents a peneplaned surface of Permian age on which only small remnants of Permian sediments remain (e.g., Mt Littlechild, Fig. XXII).

Tin mining in the district dates back to the discovery of shallow alluvial and residual deposits in 1874. The source of the alluvials was later traced to disseminated deposits in the granite, and numerous mines were opened up on these from 1895 onwards. The open cut workings of the Anchor mine proved to be by far the most important of these primary deposits and yielded at least 2,365 tons of metallic tin.

Thomas (1953) estimates that the total output of tin oxide from the field is 9,250 tons. This may be true but the recorded production from the district since records were kept in 1880 is 2,808 tons of metallic tin, including 156 tons from alluvial workings.

Two distinct types of granitic rocks have been distinguished by previous investigators. The main mass of the batholith consists of virtually barren porphyritic granodiorite which is intruded by smaller bosses of more acid bi-mica granite carrying tin in greisenous segregations and veins. Thomas (1953) considers that the tin ore occurs as three types:-

(a) As flat lying "floors" in the tin granite;
(b) In pegmatite and tin granite dykes; and
(c) In quartz and greisen veins.

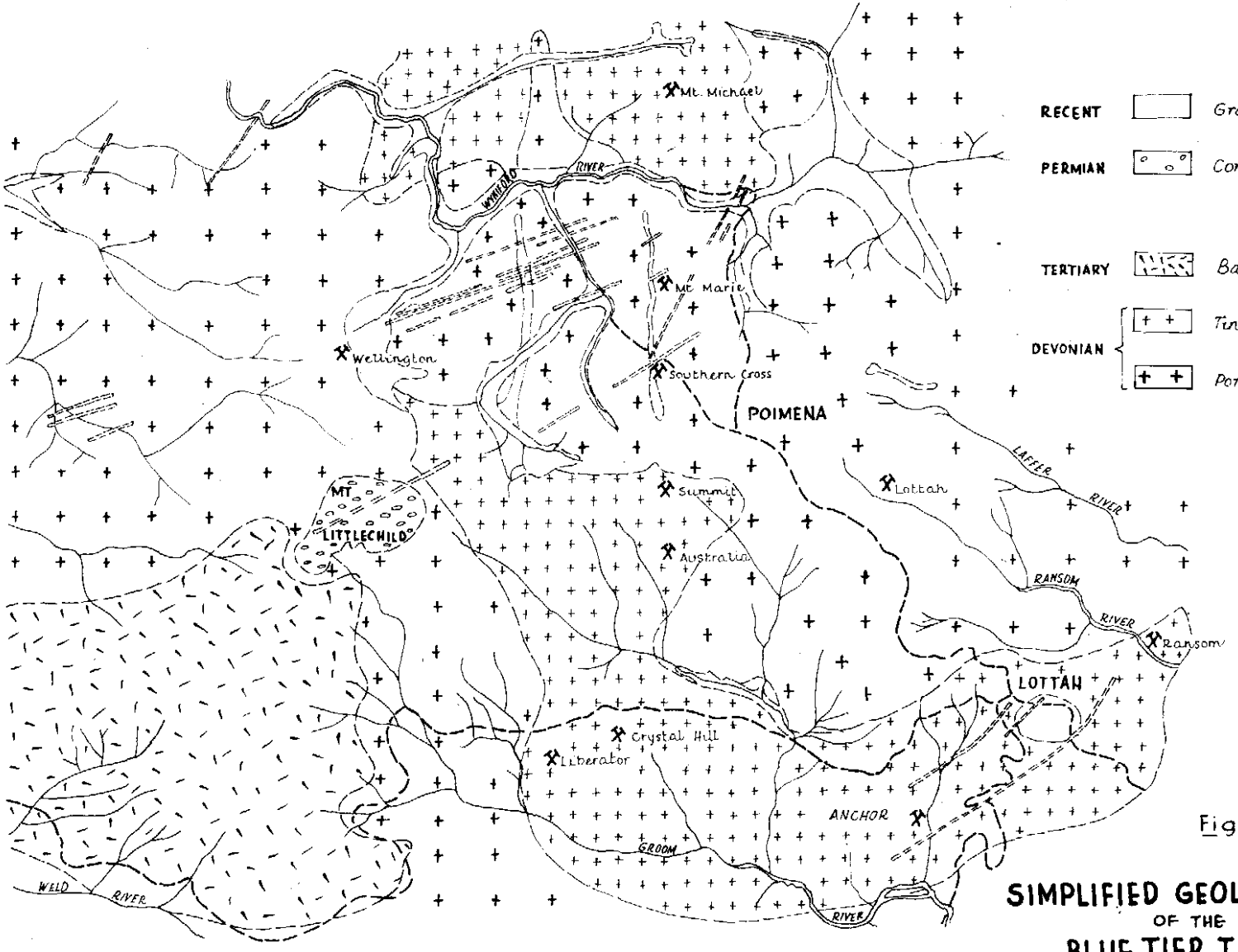


Fig. XXII

SIMPLIFIED GEOLIGICAL MAP OF THE BLUE TIER TINFIELD

REPORT №121

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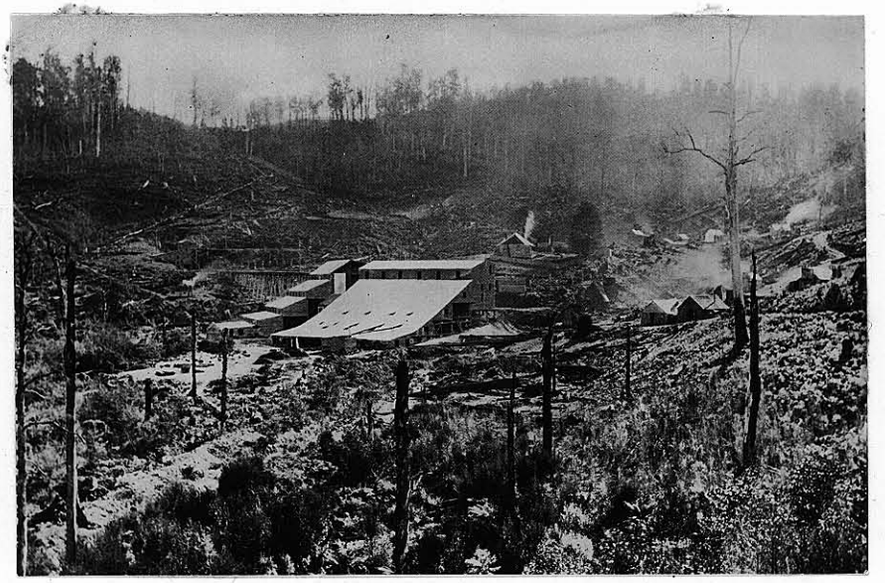


Fig. XXIII. The Anchor mine in the Blue Tier district during active mining operations. Total production was 2,365 tons of metallic tin.

Fig. XXIV. Part of the workings at the Anchor mine. The ore consisted of stanniferous greisen and granite which averaged about 0.2% tin.

The floor deposits proved to be the largest and most important orebodies, although the overall grades worked were sub-marginal even by present day standards. The floors occur within the tin granite over depths of up to 100 ft below its contact with barren porphyritic granodiorite.

The contact of the two granites is sharp and is usually marked by a narrow zone of pegmatite. The largest and best exposed orebody of this type was that of the Anchor mine while others were productive at the Liberator, Crystal, Hill, Don, Australia, Summit, Moon and Michael mines.

Anchor Mine: The primary orebody of the Anchor mine was exposed by the sluicing of overlying alluvium and detritus in the early days. Subsequent development by open cuts (Figs., XXIII & XXIV) revealed that the tin-bearing granite was overlain in most places by up to 70 ft of barren granodiorite and that the best values were associated with NE and SW greisen veins separated by walls of almost barren granite.

The now abandoned workings consist of four opencut benches at successive levels over an area measuring 1,200 ft (E-W) by 700 ft. According to Thomas (1953), the average grade of 2,142,000 tons of primary ore treated to the end of 1941 was 0.2% tin.

Some test boring at the mine was recently recommended to the Mines Department (MacLeod, 1961) but will not be proceeded with while the mineral rights are under the control of a private company (Aberfoyle).

Other Granite Deposits of the Blue Tier District

The Crystal Hill mine was located on a small body of greisen which averaged 0.012% tin, within enrichments of up to 0.65% tin.

The Liberator greisen deposit produced about 6,100 tons of ore averaging 0.2% tin.

From two open cuts, the Australia produced about 4,000 tons of ore which yielded 35 tons of tin oxide, mostly from four parallel greisen veins.

Early production from the Mt Michael mine averaged 0.4% tin but quarrying operations in 1937 showed a decline to 0.2% tin. A shaft on the opencut also gave assays of 0.2% tin. Boring results of the Mines Department in 1935 around the opencut were not encouraging.

060

The Don orebody was worked as an opencut measuring 360 ft by 120 ft and by chambering beyond the quarry faces. Two floors ranging from 0.08% to 0.91% tin are reported to have been worked. Bores put down by the Mt Lyell Company showed that values did not extend far beyond the limits of the cut.

The Moon workings are in a roughly rectangular area of tin granite with a length of 350 ft. The western boundary dips steeply to the west while the eastern boundary with the overlying porphyritic granite dips about 12 degrees east. The outcrop has been tested by bores but the results of these, apart from one small patch worked in recent times, were not encouraging.

A dyke of stanniferous granite ranging from 30 - 120 ft wide is the site of the Southern Cross workings. The dyke rock passes into coarse pegmatite at the walls. Cassiterite occurs in short shoots in greisenised parts of the dyke, and the better grade ore averages about 0.2% tin. Sampling has proved the existence of 124,000 tons of 0.2% tin ore to a depth of 50 ft (Thomas, 1953). Other low-grade deposits of similar type are known from the Mt Marie and Ransom workings.

The Wellington and Lottah mines were opened up on narrow quartz-cassiterite veins. Recent sampling of the Lottah No. 1 vein at regular intervals along the adit workings, over widths of 1 to 4 ft, revealed only traces of tin in nine samples, and values ranging from 0.14% to 0.27% tin in three others (Hughes, 1957).

Previous Exploration

Systematic testing of the Blue Tier deposits was carried out by the Mt Lyell Mining and Railway Co in 1904-07, involving sampling of the faces of old workings, 7,200 ft of diamond drillholes and 49,000 ft of trenches. Analyses of samples obtained during this work are filed in the Mines Department. They reveal that the overall average grade of the tested ground is less than 0.1% tin, with some showings of better grade stone (comprising less than 10% of the whole), averaging from 0.2% to 0.4% tin.

A contour plan of tin values based on the Mt Lyell Co's testing in the Blue Tier field is published on page 1,219 of Thomas (1953), and clearly illustrates the sporadic and restricted distribution of payable tin mineralisation.

In 1927, the Blue Tier Committee was appointed by the Tasmanian Government to report on the economic possibilities of the field. The Committee recommended pattern drilling of an extensive area but this was not carried out.

061 Extensive borehole and surface sampling was carried out by Tasman Tin N. L. in 1937 with generally disappointing results (Thomas, 1943).

The region was held and prospected geologically as an exploration licence by the Electrolytic Zinc Co of Australia during 1959-62 but was relinquished after sampling and spectrographic analyses disclosed average values considerably less than 0.1% tin (Lavers, 1962).

Granitic Deposits of West Blue Tier

The name West Blue Tier is introduced for the purpose of this report to describe an area of tin-bearing granite which adjoins the Blue Tier proper on the west, between the townships of Branxholm and Weldborough. Numerous small showings of stanniferous granite and associated detrital deposits are recorded in this area.

The Mt Paris mine, which is located on the south side of Mt Paris, four miles south of Branxholm, was opened up on a series of quartz-mica greisen "lodes" and surrounding stanniferous aplite. The early mine workings consisted of four adits driven on greisen at progressively higher levels on the hillside, and later a large cut was sluiced out in the surrounding weathered aplite (Nye, 1933b).

Production was at a maximum in 1937 when "the application of hydraulic mining on a scale not previously possible resulted in the treatment of 99,600 cu.yd of material for a recovery of 22.6 tons of metallic tin" (report of Secretary for Mines, 1937). This would indicate a grade of 0.5 lb of tin per yd. The operating company closed down in the following year.

A sketch plan of the Mt Paris cut is published in the report of Jack (1961b). Samples he took of the greisen and aplite yielded less than 0.1% tin.

An adjacent area of possible interest for a recurrence of the Mt Paris type of deposit is described by Hughes (1949).

The Bell Hill mine is situated six miles west of Weldborough on the south side of the back road to Ringarooma. Here, an irregular system of tin-bearing greisen veins varying from a few inches up to 20 feet in width is distributed through massive granite. The workings comprise extensive shallow excavations from which detrital material was sluiced, and a crosscut adit driven into the hill for a distance of 474 feet. A detailed description of greisen veins encountered in the adit is given in a report by Keid (1944). He records the following assays on samples of greisen vein 8 ft thick (which is described as the main lode) :-

Location	No. of Samples	Width of Vein (feet)	Tin Values % Tin
1	3	3 - 5	0.35 - 0.49
2	3	2 - 3	0.09 - 0.49
3	4	3½ - 5	Trace - 0.06

The Royal Gordon mine is near Mt George, 1½ miles south of Branxholm. The workings consist of a large excavation in decomposed granite from which cassiterite was recovered by sluicing. The surrounding area was tested by shafts and boreholes by Siamese Tin in 1933 (Nye, 1933a). No information on the grade of the ground worked is available.

Two nearby areas of similar granite with veins of tin-bearing greisen were recently suggested to the Mines Department as drilling targets (Jack, 1961b). Subsequent drilling (Jack, 1962b) revealed that values were limited to narrow zones and were of no economic importance. Flanking the Royal Gordon on the east is Ruby Flat, the site of formerly extensive alluvial tin workings.

Other productive mines on similar tin-bearing granite referred to in the annual reports of the Mines Department are the Cambria (e.g., 1936-38), Laffer (1932-38), Star of Peace (1934) and Bakers Discovery (1948).

STANNIFEROUS QUARTZITES OF THE ST HELEN'S DISTRICT

An isolated occurrence of cassiterite mineralisation in quartzite exists at Great Pyramid Hill, at Upper Scamander, about eight miles (direct) south-west of St Helens.

Great Pyramid Mine: This prospect is held as leases by R.D.L. Palmer and L. Price. A field inspection of the deposit in company with the lessees was carried out on October 3, 1963.

References: Twelvetrees, 1911; Keid and Gulline, 1957; Jack, 1963.

History: Twelvetrees (1911) recorded that tin was first discovered in the area in the year 1909 and that the Great Pyramid Tin Mine operated until the end of 1910. The work done was exploratory and there is no record of production. Apparently the tin values were too low and work ceased towards the end of 1910. During 1914, an option was taken up by the Troy Tin Syndicate and more exploratory work was done; some of the adits were extended and crosscuts were driven. Extensive sampling of both walls at 10 feet intervals was done in all the new work

as well as in the parts of the old workings where values had been obtained by the previous lessees.

The area was taken up in 1925 by H. Aulich and held until 1936. A small stamp battery was constructed on the Scamander River during 1926-27, and during 1928 the first ore was treated. Recorded production during 1928-36 was 2.931 tons of tin from 331 tons of ore (or 0.9% metallic tin).

Geology: The host rocks of the tin mineralisation are the Mathinna group of sediments of Silurian age. On the leases they are mainly sandstone, mudstone, siltstone and quartzite. The general strike of the rocks is NW-SE and the dip is steeply SW, but many variations of strike and dip occur due to folding and faulting. No granitic rocks can be seen on the leases but there are large areas of granite a few miles to the north-east.

The mineralisation consists mainly of cassiterite with minor pyrite and chalcopyrite. The cassiterite present is generally finely crystalline but some crystals are up to one-sixteenth of an inch across. The cassiterite is generally associated with limonite, sericite and a little introduced silica. It also occurs as a coating on some joints and faults, and it has been reported to occur in the gouge material along fracture planes. As the strongest fracturing is associated with the hard quartzite, the best tin values are obtained in these beds. Tin values also occur in the sandstone beds but these are generally of less importance, while only very low values are present in the mudstone and siltstone.

Sampling: Some check sampling was done in 1957 on selected areas by the Department of Mines (Keid, 1957). This showed lower values than the sampling by the Great Pyramid Co in 1909 and the Troy Tin Syndicate in 1914. While values were found to be low in most places, some small high-grade patches of ore occur irregularly throughout the lower grade material.

Bulk samples taken from the north adit and surface workings were assayed by the Department of Mines in 1963. Each sample weighed approximately half a ton, and a comparison with previous sampling is as follows -

Mines Department 1963 % Tin	Great Pyramid 1909 % Tin	Troy Tin 1914 % Tin	Workings
2.17	6.37	3.55	Surface pit.
0.69	0.80	0.60	North Adit (25 ft)

Mine Workings: Two levels of adits were driven to intersect mineralised zones found in surface trenching. The upper adits are from 90 - 130 ft below the top of the hill and the lower ones 90 - 170 ft below the upper adits. These workings are fully described in a report by Jack (1963).

The best tin mineralisation appears to be confined to the areas around the north adit, adit C and Brock' s adit. The early sampling at Adit C showed a width of 130 feet averaging 0.64% tin, but Government check sampling (Keid & Gulline, 1957) yielded only 0.26% tin over the same interval. Similar values occur over narrower widths in the north adit and Brock' s adit and there appears to be a chance of establishing a moderate tonnage of workable grade ore (say, 0.4% tin) as an opencut proposition. Detailed mapping and additional sampling by trenches would, however, be needed for any assessment of the prospect.

PART IIIA - ALLUVIAL DEPOSITS OF THE NORTH-EAST PROVINCE.

The alluvial tin deposits of N.E. Tasmania were accumulated during Lower Tertiary times when the land evidently subsided relative to sea level, and alluvium derived from the granite ranges of the hinterland (Blue Tier) and monadnocks (Mt. Cameron) were built up along submerged drainage channels. With continued subsidence, the alluvials deposited in the lower reaches of the drainage systems were inundated by extensive lakes and estuaries of an encroaching shoreline.

The purely alluvial deposits of the higher ground carry tin concentrations shed from the granite catchments, especially towards the base of the gutters, while the lacustrine and estuarine sediments also contain some stanniferous layers washed in during periods of rapid deposition or by resorting of alluvial drifts.

Subsidence ceased in the late Tertiary. At about the same time basalt was extruded over the low lands and covered most areas of early Tertiary drift. During or shortly after the volcanism, a re-emergence of the land surface to about its present level occurred.

The retreat of the sea led to the stranding of widespread shingle terraces in the lower areas near the present coastline, and many of these have been worked for alluvial tin.

As the headwaters of the old water courses had remained active although sluggish throughout the Tertiary, the rejuvenated rivers assumed a similar pattern as their pre-Tertiary ancestors. The modern Ringarooma River, follows the same general course as a main pre-Tertiary river between Ringarooma and Herrick. North of Herrick, however, the present river passes around the east side of Mt. Cameron, whereas all evidence suggests that its Tertiary equivalent entered the Boobyalla Basin to the west of Mt. Cameron. The upper reaches of the modern Mussel Roe River similarly occupy an old Tertiary valley, but towards the coast follows an entirely independent course (Fig. XXV).

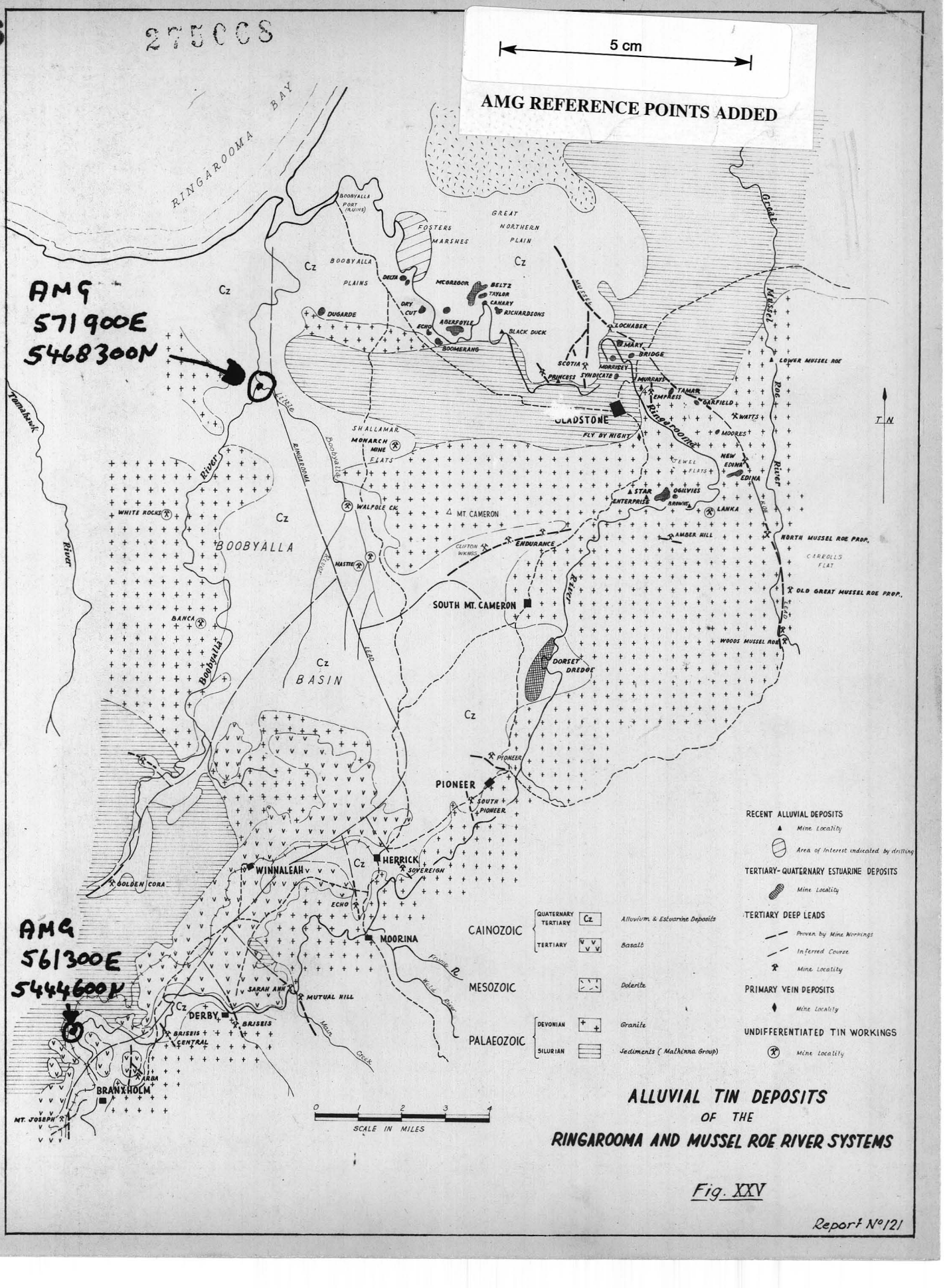
The present cycle of erosion has resulted in partial stripping of the Tertiary basalt and drift deposits, and the formation of some younger alluvial tin deposits in the present streams. Near the coast, as at Fosters Marshes and the Lower Mussel Roe River (Fig. XXV), accumulations of mixed alluvial and marine deposits up to 75 ft. thick are developed adjacent to the existing river courses and probably reflect fluctuations of sea level during the Pleistocene glaciation.

066

275CCS

5 cm

AMG REFERENCE POINTS ADDED



ALLUVIAL TIN DEPOSITS OF THE RINGAROOMA AND MUSSEL ROE RIVER SYSTEMS

Fig. XXV

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THE RINGAROOMA DEEP LEAD SYSTEM:

The bulk of the tin produced from the north east district was won from the Tertiary leads of the upper Ringarooma River area. The principal mines were between the towns of Branxholm and Pioneer, and in order downstream were the Arba (Branxholm Lead), Central Briseis (Valley Lead), Briseis (Cascade Lead), Mutual Hill (Main Creek Lead), Echo (Weld Lead) and Pioneer mine (Wyniford Lead). All of these are located on tributaries of the old Ringarooma Lead.

The major producers were the Briseis mine (20,787 tons metallic tin) and Pioneer mine (9,180 tons metallic tin).

The Endurance mine at south Mt. Cameron, the largest of the mines operating at present, is also considered to be on a tributary of the old Ringarooma system. It produces about 38 tons metallic tin annually, and has a total recorded output of 2,630 tons metallic tin.

It happens that most of the workings are on tributary leads along the flanks of the granite highlands, because most of the discoveries were made on outcropping sections of the leads. As these were followed down towards the main Ringarooma Lead, increasing overburden eventually precluded continuation of economic mining.

The gutter of the main Ringarooma Lead has never been worked, or even located by drilling. Between Branxholm and Pioneer, it presumably underlies an extensive basalt plateau (Fig. XXVII) and has not warranted consideration. North west of Pioneer, the inferred lead courses for 15 miles to the coast through the Boobyalla Basin. Only isolated remnants of basalt are known in this area, but no systematic work has been done to locate the Lead.

Arba Mine (Branxholm Lead): (Not worked or leased at present).
References: Nye, 1925; Rattigan, 1957(d).
Location: The Arba Mine is situated immediately to the north east of Branxholm (Fig. XXV). Part of the workings were described as the Ormuz Mine in recent years (e.g. Director of Mines Report, 1951).
History: Prior to 1883, the ground was being worked by the Arba Tin Mining Coy. They evidently were successful at some periods, as a production of 51 tons of tin ore is recorded for three months in 1886. However, the drifts were deepening as work progressed. Much developmental work was carried out during the period 1899-1902 and was followed by continuous production from 1902 to 1920. Company operations ceased in 1920, when the readily accessible parts of the lead were worked out and the depth of overburden in the working face became unmanageable.

Grade and Production: The average grade of 3,260,850 yards of drift treated during the period 1903 to 1920 was 0.933 lbs tin. The total recorded production is 2,180 tons of metallic tin.

Reserves: Practically all the Tertiary drifts have been removed from the old Arpa leases, with the exception of small lengths of tributary leads. To the north west, however, the lead passes under a hill on Edwards' property which is capped with up to 60 ft. of decomposed basalt. The face of the abandoned workings was 167 ft. high, and the floor of the workings here was 30 ft. above basement.

Drilling ahead of the old working face (Fig. XXVI) has been carried out by three different interests.

Briseis Consolidated drilled 26 holes on behalf of Burma-Malay Tin in the vicinity of the working face on Edwards' property.

Bores Nos. 1 to 13 were sited in the actual working face below the natural surface (see inset Fig. XXVI). The results of these holes are given in Table C, with values corrected for total depths (natural surface to bottom of hole). The lead was encountered in bores Nos. 1, 2, 3, 9, 10 and 12, over a width of about 300 ft., for which the average corrected depth and tin values are 172 ft. at 0.50 lbs cassiterite per yard. The central part of the gutter (Bore 12) averages 0.95 lbs per yard.

Bores nos. 23-26 were collared in basalt above the lead. The average depth from the natural surface to basement in these holes was 234 ft., and the overall grade 0.41 lbs cassiterite per yard.

Average values for the best part of the lead, say 200 ft. wide, would be nearer 0.8% tin.

Records of other bores not listed in Table C are not available.

The Government is known to have carried out boring in the flats north of Edwards' property, towards the junction of the Branxholm and Ringarooma Leads. However, the actual localities and the results obtained are not on record.

Fourteen shallow holes (not to basement) were put down on the flats immediately north of Edwards' property at localities shown on Fig. VIII. The low values obtained (also shown on Fig. XXVI) are inconclusive at such shallow depths. ?XXVI

The dimensions and grade of the lead below the hill on Edwards' property, based on the results of the Briseis Coy. drilling, would probably be of the following order -

RESULTS OF BORING AT ARBA MINE BY BRISEIS CONSOLIDATED

Bore No.	Depth of Bore (feet)	Height of Natural Surface above Collar (feet)	Corrected Total depth (feet)	Average Value over total depth (lbs cassiterite per yard)
BORES LOCATED IN WORKING FACE:				
1	73	38	111	.50
2	126	106	232	.30
3	98	107	205	.29
4	73	99	172	.18
5	69	96	165	.23
6	69	92	161	.12
7	30	90	120	.06
8	29	89	118	.11
9	105	63	168	.51
10	59	27	86	.37
11	65	nil	65	.31
12	118	110	228	.95
BORES LOCATED ON BASALT HILL:				
23	241	nil	241	0.44
24	240	nil	240	0.46
25	245	nil	245	0.46
26	211	nil	211	0.26

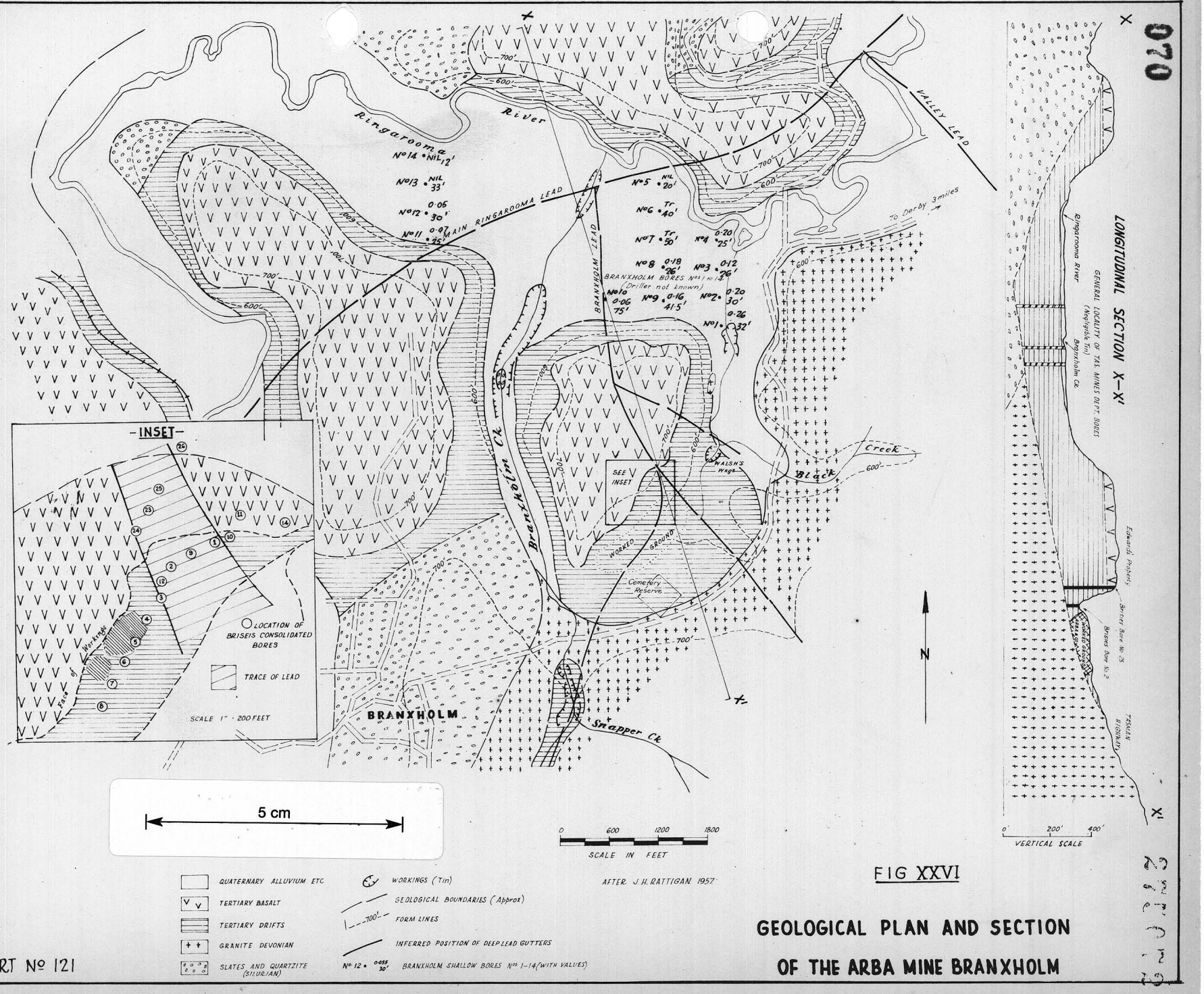

FIG XXVI

GEOLOGICAL PLAN AND SECTION OF THE ARBA MINE BRANXHOLM

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Length of Lead (untested)		say 2,000 ft.
Width of Lead		300 ft.
Average depth		200 ft.
Average overall grade		0.4 lbs. cassiterite per yard.
Total yardage involved	=	$\frac{2,000 \times 300 \times 200}{27}$
	=	4,450,000 cu. yds.
Tons cassiterite returned	=	$\frac{4,450,000 \times 0.4}{2240}$
	=	793 tons or approx. 555 tons metallic tin.

Briseis Central Mine (Valley Lead): (Held as leases by Briseis Tin N.L. Worked in a small way during 1960-62, but at present there is no mining activity).
Reference: Nye, 1925.
Location: The Briseis Central Mine is situated on the south bank of the Ringarooma River, near the junction of Valley Creek between Branxholm and Derby (Fig. XXV).
History: The discovery of tin ore at this locality was made in 1882. The early method of working is stated to have been very inefficient, and only a small amount of ground was treated. In 1904, a more modern plant was used and more material treated, but the lower portions of the drifts were not worked in parts of the mine.

The Tertiary stanniferous deposits of the Valley Lead, a tributary of the old Ringarooma River system, is 300-400 ft. wide and trends to the north west below existing river flats. It is shallow at its south eastern end, but deepens to over 100 ft. to the north west. The depth of the junction of the Valley and Ringarooma Leads should be approximately 200 ft. below the present river level.
Production and Grade: The total recorded production is 519.2 tons of cassiterite.

Nye (1925) estimates that 968,000 cu. yds. averaging 1.2 lbs cassiterite per yard were worked.
Reserves: Several boring campaigns have been undertaken in order to test the drifts, both in the old workings and to the north of them. The earliest of these was in 1900, and gave results up to 2.48 lb per cu. yd., the average being much lower than this. In 1920, a further campaign gave results in the old workings ranging from a little tin to 1½ lb cassiterite per cu. yd., but the values were generally lower than those previously obtained. Another

boring campaign was carried out in 1921, the results of which indicate an average content of 0.5 lb cassiterite per cu. yd. Nye considers that the grade indicated by the bores is conservative and he estimates the quantity of unworked drift as 900,000 cu. yds. up to 150 ft. below surface, with a grade ranging from 0.5 to 1.2 lb cassiterite per yard. This could yield about 225 tons of metallic tin.

However, in the report of the Director of Mines for 1962, it is stated that Briseis Tin N.L. "ceased working the Valley Mine at the beginning of the year in the face of a combination of adverse factors, e.g., heavy shingle, inadequate water supply and a low ratio of recovery to bore value".

Briseis Mine (Cascade Lead): (Consolidated Mining Leases of 203 acres and leased private property totalling 242 acres held by Briseis Tin N.L. Water rights are held on the Ringarooma and Cascade Rivers. No work is being done at present.).
References: Nye, 1925; McKeown, 1938; Braithwaite, 1963.
Location: The Briseis Mine is situated 62 miles north east of Launceston, adjacent to the town of Derby. It is connected with Launceston by the main north eastern railway and also by a good road.
History: Tin was first discovered in the Cascade River, a tributary of the Ringarooma, in 1876. The early workings (e.g., Brothers Home) were shallow and rich, and consequently offered no difficulties in working. It was not until after 1890 that the deposit was recognised to be a sub-basaltic deep lead.

In 1885, the Briseis Tin Mining Coy. N.L. was formed in London to work the land adjacent to the Brothers Home and, in 1901, became the Briseis Tin Mining Co. Ltd., with a capital of £600,000. By 1907, all adjacent properties had passed into the control of this company.

The record of the Briseis Tin Mining Co. Ltd. to December 31, 1922, is summarised by the figures below -

Overburden removed	5,330,400 cu. yds.
Drift treated	8,447,200 cu. yds.
Tin oxide produced	12,074 tons of 75% tin.
Equivalent metallic tin	9,055 tons
Average value of all ground treated	1.5 lbs metallic tin per yard.

Up to 1929, the company had produced 13,939 tons of tin oxide, making the total production from the Cascade Lead from the time of its discovery, 23,539 tons of concentrates. Dividends paid by the Briseis Co. amounted to £517,000.

Notable engineering works carried out in this period were three diversions of the Ringarooma River, designed to permit the removal of the underlying drift to depths from 100-150 ft. below its new and parallel channel (Fig. XXVIII) In 1929, an exceptional flood in the Cascade River carried away the dam and completely destroyed the mine workings, plant and offices, and shortly afterwards the company proceeded to liquidation.

During 1934, after an examination of the property by Burma-Malay Tin Ltd., Briseis Consolidated N.L. was formed to purchase the leases. A diversion of the river from the workings to its original channel was completed in April, 1935, and a new dam on the Cascade River was built under contract and finished in April, 1936. The construction of a tunnel 800 ft. long, part of the overburden removal scheme, was also carried out during 1935. By 1938, 50,000 cu. yds. of drift were being mined each month for a recovery of 40 tons of tin oxide.

Briseis Consolidated N.L. ceased operations in 1948, but the mine was taken over and kept in production by the present Company, Briseis Tin N.L., which is controlled by local interests. Mining operations ceased in 1959, when overburden problems got beyond the scope of the Company, but geophysical work and drilling is to be carried out next year with the object of proving up adequate reserves to justify re-equipping and re-opening of the mine.

Total production from the mine was 20,787 tons metallic tin (Table D).

Geology: In the Briseis workings, the bottom and rim rock is granite. The tin-bearing drifts occur in overlying Tertiary sediments which have a total thickness ranging up to 310 ft. They consist mainly of coarse angular and sub-angular quartz sand. At the base is a bed about 10 ft. thick of coarse alluvium containing boulders of granite, quartzite and sandstone up to 2 ft. in size, and finer quartz sand with cassiterite. An overlying bed of soft sandstone is up to 10 ft. in thickness, and above it is a uniform deposit of drift, interstratified at irregular intervals with coarser pebbly beds up to 2 ft. thick. Lignitised wood and portions of tree trunks occur in the lower drift.

A detailed stratigraphic section of the Tertiary sequence at the Briseis mine is given in Table E.

The stanniferous drifts are known as the Cascade Lead. The present Cascade River follows a parallel course along the north eastern side of the Lead. The Lead trends north westerly through the lease and passes below the Ringarooma River immediately to the east of the town ship of Derby. It should continue on the same general course to join the Ringarooma Lead near the Derby Railway Station (Fig. XXV).

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TABLE D.

PRODUCTION RECORDS - BRISEIS MINE.

Behind Page 43.

(After Braithwaite, 1963)

Period	Tons of Tin	Value/c.yd.		Men Employed	Remarks
		Drift only	Overall		
1876/00	7100	3.41	2.09		
1900/22	8935	3.41	2.09		Briseis Tin & Gen. Mining Co. Ltd.
1923	254			91	
4	179			126	
5	140			120	
6	118			99	
7	184			104	
8	217			102	
9	89			61	Flood damage.
1930	45			25	
1931	43			34	Taken over by
2	47			30	Briseis Tin Mines
3	49			40	N.L.
4	35				Briseis Tin Cons.
5	18				N.L. formed.
6	55			103	Workings flooded.
7	158	1.57	1.30	128	
8	394	1.75	1.34	142	
9	364	1.57	1.15	149	
1940	482	2.05	1.62	163	
1	425	1.86	1.45	152	
2	329	1.49	1.08	146	
3	253	1.08	0.85	150	
4	191	0.86	0.66	140	
5	168	0.68	0.51	124	
6	95	0.63	0.52	80	Work on main lead
7	75		0.84	42	ceased.
8	36		0.45	36	Briseis Tin N.L.
9	14		0.25	37	took over and op-
1950	40		0.74	N.A.	erations moved to
1	39		0.26	N.A.	Cascade River.
2	38		0.26	42	
3	26		0.21	40	
4	40		0.22	39	
5	33		0.27	39	Retreatment started
6	16		0.21	37	Cascade River work-
7	25		0.26	28	ings finished.
8	18		0.32	27	
9	13		0.38	20	
1960	6		0.95	20	
	20,787				

DETAILED STRATIGRAPHIC SECTION OF THE TERTIARY SEQUENCE BRISEIS MINE, DERBY.

(After Nye, 1925)

Thickness (feet)	Description
118	Hard, dense, fine-grained olivine basalt with large masses of olivine. Slightly vesicular at upper surface. Columnar and ball-and-socket jointing.
2	Quartz grits and sands.
40	Basalt completely decomposed, with exception of a few kernels in areas of spheroidal jointing and weathering. Highly vesicular at upper surface.
30	Basalt completely decomposed, with exception of a few kernels in areas of spheroidal jointing and weathering. Highly vesicular at top.
25	Quartz grits and gravels.
25	Clay (pug) with quartz grit, and interbedded quartz grits and gravels.
10	Gravels.
10	Quartz grits, gravels, and clayey beds.
10	Sands and quartz grits.
5	Clay (pug) with quartz grit.
10	Quartz gravels with pebbles up to $\frac{1}{2}$-inch diameter.
15	Clay with quartz grit.
55	Strata not exposed. Probably quartz grits, gravels and clays as above.
-	Present River-level.
20	Quartz grits.
40	Quartz grits, sands and gravels.
10	Thinly-bedded sands with pieces of lignitised wood. Interbedded layer of quartz grits and coarse gravels.
20	Sands with occasional pieces of lignitised wood.
10	Sands and grits.
10	Grits and coarse gravels with pebbles up to 6-inch diameter. Rocks cemented with iron pyrite.
10	Sands and grits cemented with iron pyrite, and containing numerous pieces of lignitised wood.
20	White clay (pug).
5	Basal beds of large boulders, white clay (pug). Decomposed granite.
Total 500 ft.	

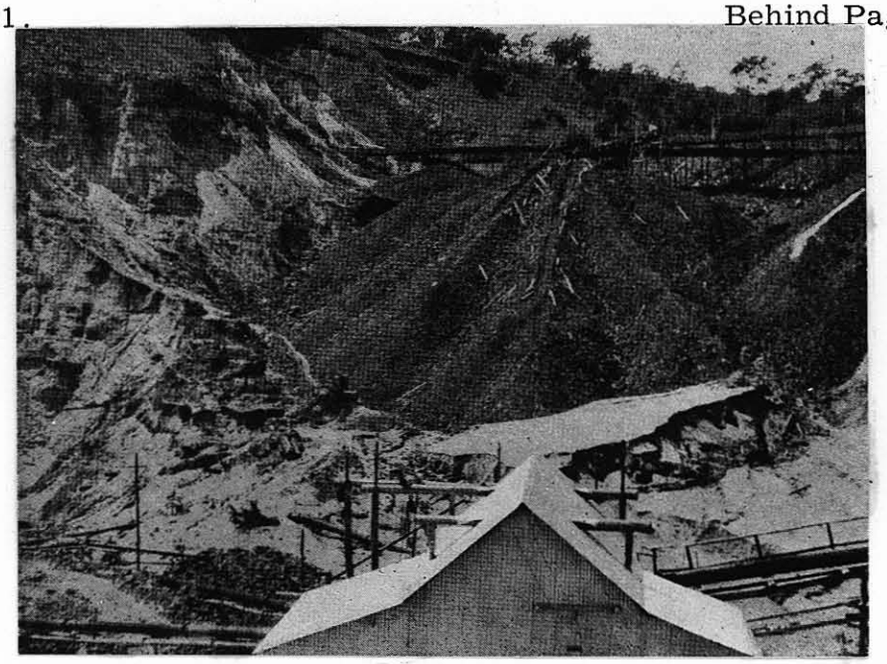

FIG. XXVII: Part of the Briseis Mine during operations in 1938. The drift face just below the basalt contact can be seen on the left and the overburden sluice and basalt dumps are on the right.

FIG. XXVIII: View of the Briseis Mine and part of the town of Derby from the top of the basalt hill above the lead. The workings on the right are below the level of the diverted Ringarooma River.

At the south eastern end, the bottom of the drifts was about at stream level, but it falls rapidly to the north west, and the drifts become correspondingly thicker. At the Ringarooma River, the gutter was 100 ft. below river level, and in later workings it was more than 150 ft. below river level.

The drift is capped by three distinct basalt flows, up to 190 ft. in total thickness. The lowest is vesicular and semi-decomposed; above it lies a layer also semi-decomposed, but containing solid unaltered rock. The uppermost flow is columnar and hard and forms the crest of the basalt hill.

The width of the drift, as shown by No.2 line of bores was 1,500 ft. The width of the gutter in which the best values occurred was approximately 400 ft. (Fig. XXIX).

The best tin values occurred towards the base of the drift. For example, the bore at 200 ft. on line 2 proved values of 16.96 lb per cu. yd. throughout the bottom section of 60 ft, and 1.13 lb in the upper 100 ft., the highest concentration of cassiterite being 78.55 lb per cu. yd. in the basal 5 ft.

Overburden Removal: The first method of overburden removal practised by the original company, was open cut mining and transport by trucks to the dump. This method was used only until an augmented water supply permitted hydraulic mining and removal of waste through fluming around the contour of the face to the stone dump (Fig. XXVII). In the later years (1935), an overburden tunnel was driven in the upper drift. Removal of the upper 40 ft. of low grade drift as overburden was essential to the undermining of the basalt. The basalt fell in large masses and the lowest decomposed material broke up readily. The overlying solid unaltered basalt had to be broken by "blistering". The broken basalt in pieces up to 20 inches was sluiced to a shaft which led into the tunnel.

Prospecting: Briseis Consolidated carried out boring across the western portion of the lead at strike intervals of 300-315 ft. Bores were sunk at 100 ft. spacings along each line (Fig. XXIX). The cross-sections and bore values resulting from this work are shown on Fig. XXX, while Table F shows various calculations by Braithwaite (1963) based on the results.

Ore Reserves: Figures submitted to a Government investigating committee in 1946 claimed total reserves of 3,600,000 cu. yds. assaying 0.9 lbs cassiterite per cu. yd. (a total of 1450 tons). The committee considered the figure of 0.9 lbs too high, as it was assumed that recoveries would be higher than bore values. The Director of Mines claimed that a check indicated lower recoveries than bore values. No calculation of overburden yardage was made in the estimate, and it was assumed that the ratio would be the same as in the past, i.e. about 32% of the drift yardage. Payable drift was taken as extending up to R.L.820 ft. Fig.XX shows that there is no appreciable quantity of tin above R.L.720 ft., and as this is also the approximate level of

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TABLE F.

BRISEIS MINE, DERBY

SUMMARY OF BORE RESULTS.

(after Braithwaite, 1963)

Line No.	2	3	4	5	6	7
Total depth of bores in Lead	605 ft.	855 ft.	1065 ft.	1255 ft.	1040 ft.	545 ft.
Percentage of all bores containing values (below R.L.720 ft.)	100	57	61	48	45	45
Width of Lead	400 ft.	500 ft.	600 ft.	700 ft.	600 ft.	300 ft.
Average val/c.yd. in all bores in Lead (SnO_2)	5.36	1.27	1.92	0.96	0.93	0.52
Tons of SnO_2 per yd. along Lead	15.7	5.4	10.2	6.0	4.8	1.4
Thickness above bedrock containing 50% of tin	30 ft.	5 ft.	20 ft.	15 ft.	10 ft.	10 ft.
R.L. of lowest point of Lead	554.0 ft.	536.0 ft.	531.5 ft.	530.4 ft.	526.1 ft.	538.6 ft.

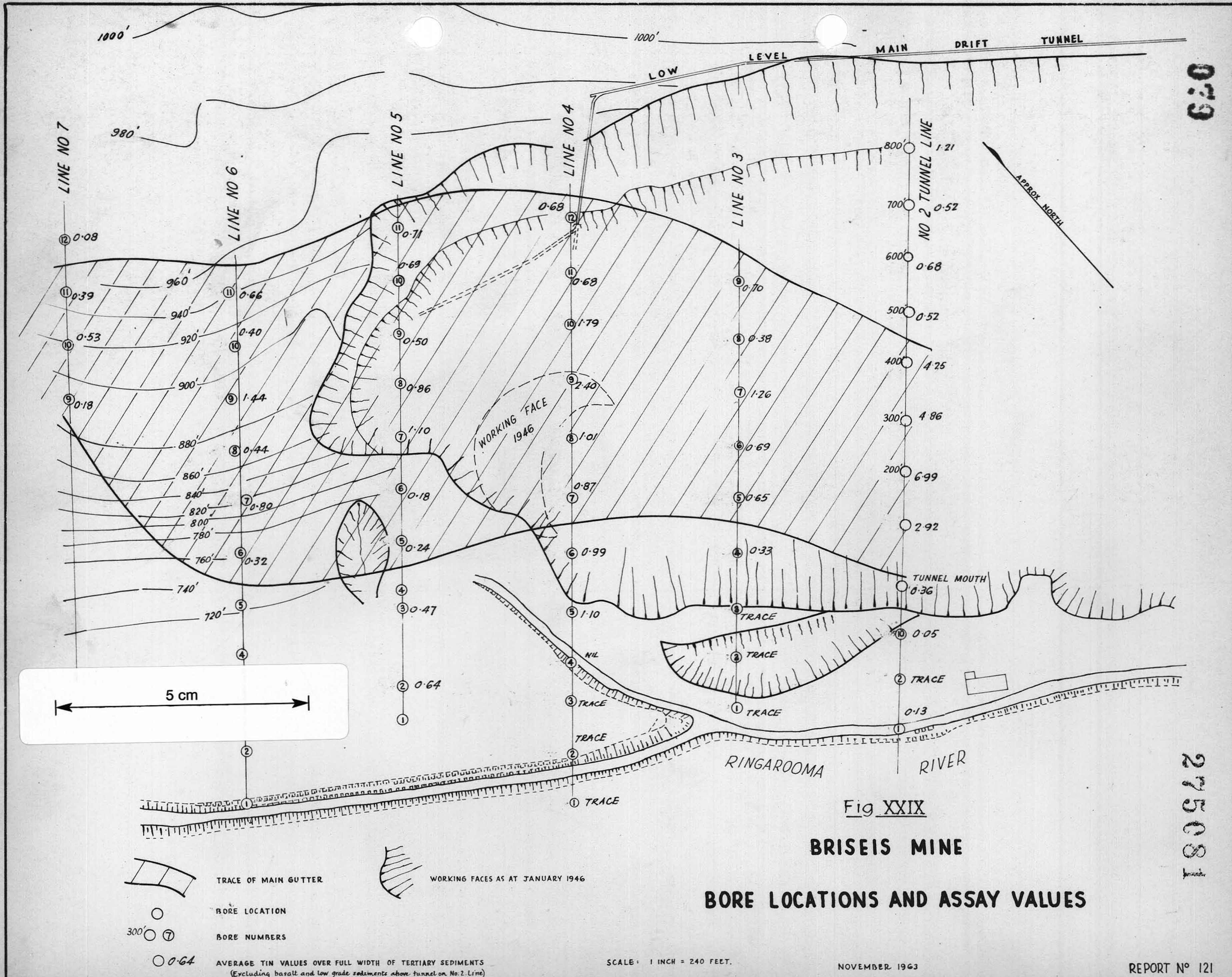

Fig XXIX

BRISEIS MINE

BORE LOCATIONS AND ASSAY VALUES

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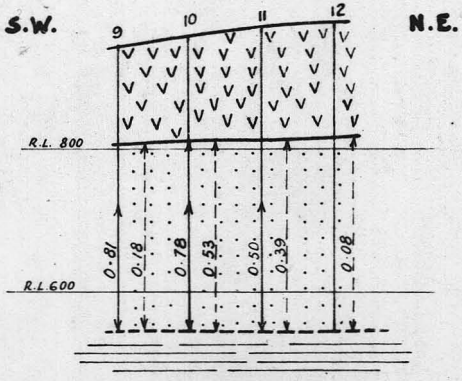
LEGEND

- Basalt
- Tertiary Sediments
- Granite & Sandstone bedrock

LINE NO. 7.



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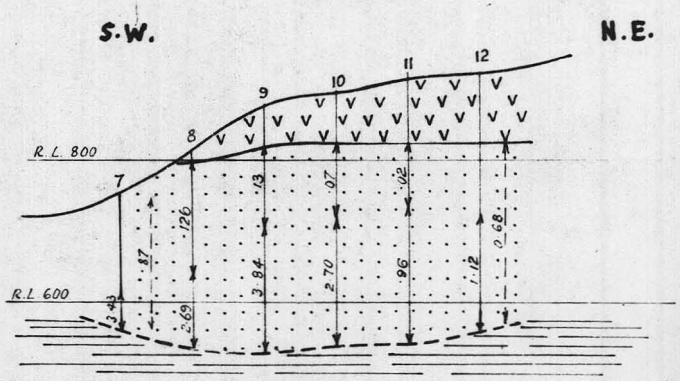
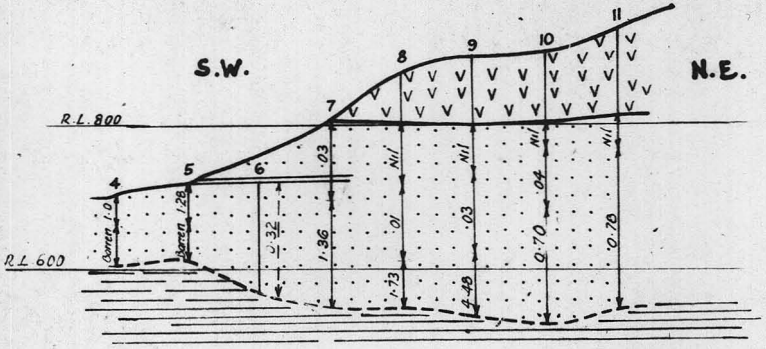


LINE NO. 6



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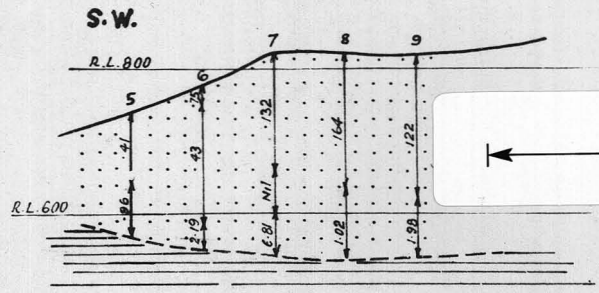

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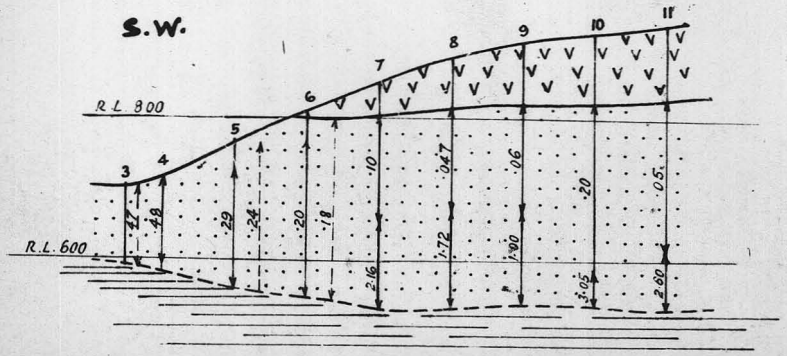
LINE NO. 5



LINE NO. 2

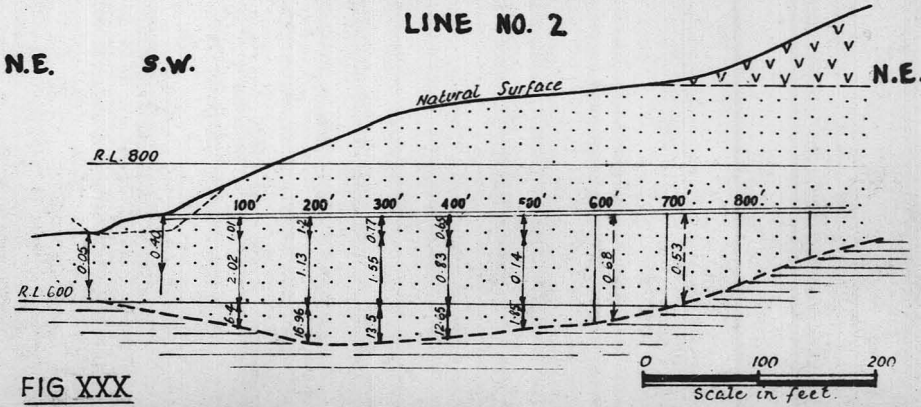


FIG XXX

CROSS SECTIONS AND TIN VALUES ALONG DRILLHOLE TRAVERSES — BRISEIS MINE

the river protection bund, more recent calculations by Braithwaite assume R.L.720 ft. as the division between drift and overburden.

The total quantity of cassiterite ore proved by the bores and remaining unmined in 1946 was 2340 tons, but an area of high level alluvium on the west end was mined out by Briseis Tin N.L. Proven reserves now remaining would be approximately 2200 tons of cassiterite. The proportion of this ore that can be recovered will depend on the mining method, and Braithwaite assumes that it will be open cast. Allowing a batter of 45° in both drift and overburden, he demonstrates that 9,095,000 cu. yds. of overburden and drift with an overall average value of 0.43 lbs. per yard remain to be treated (Table G).

As the number of bores is small compared to the yardage involved, (one bore can represent as much as 400,000 cu. yds. and 200 tons of tin ore), no attempt was made by Braithwaite to calculate the yardages accurately, nor to speculate on whether a 45% batter is flat enough. He considers that the value of 0.43 lbs/cu. yd. and reserves of about 1800 tons of tin based on the limited boring would probably not justify the large capital expenditure required to -

(a) dewater the excavation and remove the rock and slurry which now probably covers the whole area to a considerable depth.

(b) advance strip a large area of overburden.

and (c) install a sluicing and treatment plant and repaid the Cascade water system.

An alternate method of mining would be by underground methods, but the ore is not sufficiently concentrated on the bottom to make this practicable. 530,000 cu. yds. of drift could yield 1600 tons of cassiterite, but the average depth to be mined would be 28 ft.

Possible Extensions: The cross section on line 3 (Fig. XXX) shows anomalously low values and that the eastern edge of the lead was never definitely reached, either by the bores or the workings. The management at the time thought that the main lead had swung away to the right about this point, but they were prevented from following it by the position of the overburden tunnel and falls along the eastern wall. The fact that values made a partial recovery at line 4 tends to confirm that the lead curved to the right and then swung back, which could mean additional reserves of about 500 tons of cassiterite.

If the main lead is still within the area covered by the bores up to line 6, there are two possible explanations for the high bottom on line 7 -

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TABLE G.

BRISEIS MINE, DERBY

ORE RESERVES.

(after Braithwaite, 1963)

Area	Drift 1000 c.yd.	Overburden 1000 c.yds.	Total 1000 c.yds.	Tin Ore Tons	Lbs per c.yd.	
					Drift	Overall
A	3,137	3,880	7,017	1,388	0.99	0.44
B	508	672	1,180	227	1.00	0.43
C	348	550	898	140	0.90	0.35
Total:	3,993	5,102	9,095	1,755	0.98	0.43

(1) that the deepest part of the lead is either to the right or left of the section bored. There is no indication that the bottom is rising on either side, but values are certainly higher on the west and an extension on this side would be more valuable owing to the much shallower overburden;

(2) that the bar extends right across the lead and was the cause of the wide lake-like deposit. If the second alternative is correct, the lead could still exist below the bar, but would be unlikely to be rich enough to warrant open cast mining. Its economic value would depend on whether it was sufficiently concentrated to justify underground mining.

Proposals: Boring to test for extensions of the lead will be unusually expensive owing to the great depths involved. The company have therefore arranged for the Bureau of Mineral Resources to carry out geophysical (gravity) surveys before embarking upon a drilling programme.

Mutual Hill and Sarah Ann Mines (Main Creek Lead): These abandoned old workings were located on outlying terraces of Tertiary drift along the banks of Main Creek about two miles east of Derby.

The head of this lead occurs on the Sarah Ann workings, where about 50 ft. of Tertiary conglomerates, sands and clays were exposed on a granite-slate pavement about 100 ft. above the level of the present stream. The main work was done by the Briseis Coy. in 1913-18, but the size of the deposit was found to be very limited.

Between the Sarah Ann and Mutual Hill mines, which are about quarter of a mile apart, the Tertiary drifts have been largely removed by erosion.

The Mutual Hill mine, also worked by the Briseis Coy. during 1912-18 for a return of at least 80 tons of cassiterite concentrates, exploited another small remnant of the Main Creek Lead where it is preserved on the western side of a basalt-capped hill.

On the north western banks of the Ringarooma River, the drifts of the Main Creek Lead are again exposed in some old working faces along the margin of an extensive basalt plateau. Nye (1925) considered that the worked ground was above the bottom of the lead. He suggested that testing might disclose a limited reserve of payable ground and that the values obtained by such testing would determine whether the lead was worth following to the north west below the basalt.

Echo Mine (Weld Lead):
Reference: Nye, 1925.

Shallow alluvial deposits of recent origin were worked in the Weld and Frome Rivers near Moorina in the early days, but it was not until 1901 that the Weld Lead of Tertiary age was discovered on the opposite (northern) side of the Ringarooma River, half a mile north of Moorina township and $1\frac{1}{2}$ miles south of the railhead at Herrick.

The full width of the Tertiary deposit is about one-quarter mile (Nye, 1925) but the workings were confined to the eastern side of the drift along the margin of outcropping granite (Fig. XXXI). To the south of the mine, the lead was denuded by the present Ringarooma River, but the lead continues to the north to join the main Ringarooma Lead about $2\frac{1}{2}$ miles north west of Herrick.

Total production for the mine during its main period of operation (1901-1922) is stated to be not less than 265 tons of cassiterite concentrates (Nye, 1925), but no information is available on the tin values of the worked ground. Increasing depths of overburden ahead of the workings, caused by the northerly dip of the gutter, evidently resulted in the closure of the mine.

The results of more recent boring in both shallow and deep ground are shown on Mines Department plans and indicate consistently low tin values.

Plans Nos. 557 and 557C-32 show 13 Government bores sunk in 1930 ranging from 134 to 280 ft. in depth with values from 0.05 to 0.2 lbs tin oxide per yard. Plan No. 1311-25 (Keid, 1953) records twenty shallow bores between Hardwick Creek and Echo Creek with values ranging up to 0.4 lbs tin oxide per yard to a maximum depth of 19 ft.

Pioneer Mine (Wyniford Lead): (Formerly worked by the Pioneer Tin Mining Coy. Ltd. The ground is now held by Mr. Lipscombe and Syndicate).
References: Nye, 1925; Keid, 1952.
History: The Pioneer Mine, now closed down, is probably the oldest mine in the district. Nye (1925) recorded that tin was first discovered in 1877, and that the Pioneer Tin Coy. was formed in 1882. As the rich ground of the deep lead became exposed, the company was reorganised in 1900 and commenced sluicing in the same year. Operations were carried out very successfully, and by 1926 an amount of £512,129 had been distributed as dividends (Keid, 1952).

The Wyniford Lead of the Pioneer Mine comprised Tertiary deposits along a tributary of the ancient Ringarooma River. The lead entered the property from the east, near the junction of Bradshaw's Creek with the present Ringarooma River. It followed a sinuous course across the leases in a general west-north-westerly direction, and passes out in a general westerly

Fig. XXXI: Shallow alluvial workings on granite basement along the eastern margin of the Weld Lead at the Echo (or Moorina) Mine.

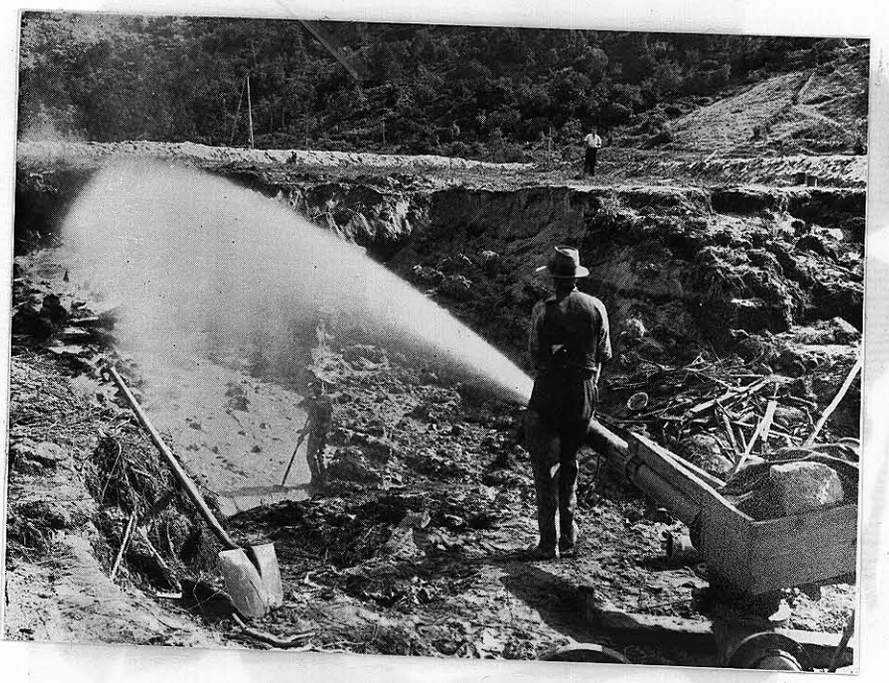

FIG. XXXII: Hydraulic tin mining (sluicing) near St. Helens, Tasmania. This scene shows the usual type of deposits, and method of working adopted, in north-east Tasmania.

direction to join the main Ringarooma Lead about 2 miles to the west (Fig. XXV).
Grade and Production: The average grade of material treated up to 1907 was 2.16 lbs per yard (Nye, 1925). Records from 1912 to 1922 show that 6,618,800 yards were treated for a recovery of 3,647 tons of tin, at an average grade of 1.23 lbs per cu. yd. As the lead was followed to the west, the bottom was falling while the natural surface was rising.

A total of 9,180 tons of metallic tin is the recorded output of the mine.
Possible Extensions: The closure of the mine was evidently due to the dilution of grade to uneconomic limits by increasing overburden as the lead was followed westerly down course. The adjacent areas were drilled by the Endurance Co. and Dorset Tin, but no information on this is to hand.

Endurance Mine: (Endurance Lead). Leases covering 750 acres at South Mt. Cameron held by Endurance Tin Mining Coy. N.L.
References: Keid, 1952; Rattigan, 1958(b).

The Endurance mine is one of the larger operating tin mines in the north east district, with an annual output in recent years of about 50 tons of metallic tin per year.

The Endurance deep lead has been traced over a length of 4 miles along the southern flanks of Mt. Cameron, where it follows an east-west course heading off towards the Boobyalla Basin.

The company was formed in 1922 to take over the holdings of the Endurance Tin Syndicate and commenced operations on leases about one mile north of the township of South Mt. Cameron between Bradshaw's Creek and Gladstone. The ground varied in depth to 100 ft. Steam power was used to drive gravel and water pumps mounted on a wooden barge. In 1928, the power units were augmented by the installation of a diesel engine, but the mine closed down soon afterwards, and for some years the only operations were those of tributors.

In 1933, when the Pioneer Tin Coy. ceased operations, its assets and equipment, including electrically driven gravel and water pumps, were acquired by the Endurance Coy. Power was generated at the old Pioneer Coy's hydro-electric station situated on the Frome River near Moorina, a distance of about 8 miles from the mine. Water for sluicing operations was obtained from the Ringarooma River.

The operations of the company at the higher or eastern end of the lead were unprofitable, and a boring campaign was carried out to locate higher grade ground. The boring showed that the lead extended westerly beyond the early

site of operations. A section in the middle part of the drilled area proved to be too narrow and low grade to be payable, but the lead improved to the west. The western section (Clifton Creek) was opened up in 1945, and sluicing operations have continued there to the present time.

Official figures show that for the period 1935-46, the quantity treated was 3,926,000 cu. yds. for a recovery of 1,311 tons of concentrate (an average grade of 0.75 lbs per cu. yd.). This grade was maintained until 1950. During 1950-60, 3,944,400 cu. yds. were treated for a return of 693.5 tons of metallic tin, i.e. about 0.4 lbs tin per yard, but in recent years (1962), the recoveries have decreased again to about 0.34 lbs per yard. Despite a high overburden:paywash ratio (which exceeds 10:1), hydraulic mining in an open cut 110 ft. deep is, however, proving payable.
Production: Total output is recorded as 2,630 tons of metallic tin.
Reserves: Rattigan (1958b) states that the Endurance lead has at least 5,000,000 yards indicated, with values of the order of 0.5 lbs at depths less than 135 ft., and is fortunate in that the natural surface is falling as the bottom of the lead slopes away to the west. At the present rate of treatment ($\frac{1}{2}$ million cu. yds. annually) a life of at least ten years is assured.

Additional reserves were located as a result of geophysical surveys carried out by the B.M.R. (Keunecke, 1957), followed up by some drilling for the Company by the Mines Department. Reserves are now stated to be adequate for another 20 years of operation.

A recent bore line 2,500 ft. west of the western working face of the Endurance Mine (1958) suggests that here the Endurance Lead enters an old valley as a tributary to another lead (Fig. XXV). The wash deposits of the Endurance Lead occur about 40 ft. above the deepest ground in this valley, and it appears likely that the bottom of the Endurance gutter will merge with those of the main valley to the west of the bore line.

THE MUSSEL ROE DEEP LEAD SYSTEM:
References: Twelvetrees, 1901 & 1916; Keid, 1946; Blake, 1955(b).

Dismembered remnants of tin-bearing drift representing a second major water course of Tertiary age occur near the Mussel Roe River south-east and north of Gladstone. Alluvial tin was mined on a small scale at a number of places along this gutter, named the Mussel Roe Lead by Twelvetrees (1901, 1916). The total output was very small in comparison to that won from the Ringarooma Lead. However, most of the old workings were shallow and above basement, and it seems from the records that the Mussel Roe deposits were not thoroughly prospected. Recent successful operations by V. Wood, and other good results by the Star Hill Syndicate near the old Garfield workings, suggest that the deposits have a greater potential than was previously realised.

The presence of ilmenite is a distinctive feature of the concentrates from the Mussel Roe Lead.

In its upper reaches, the old Mussel Roe gutter corresponded closely with the position of the modern river. It was worked adjacent to the river in the early days at the Great Mussel Roe Proprietary (Ogilvies) and $1\frac{1}{4}$ miles downstream at the North Mussel Roe Proprietary (Fig. XXV). The area being worked by Wood is approximately one mile upstream from the Great Mussel Roe Proprietary, and is evidently a later discovery.

Wood's Mussel Roe Mine: (Leases and water rights held by V. Wood and at present under option to U.D.C.).

This ground was being worked in 1946 by M. H. Groves and F. D. Richardson. Keid (1946) records that "Mining operations have shown a depth of up to 25 ft. of alluvial material overlying a granite bottom. Recovery of tin ore is reported to be one pound of tin oxide per cu. yd. This lease comprises portion only of a fairly extensive flat extending along the course of the river."

During 1948-51, the property was leased by the Lanka Tin Mine Syndicate of Gladstone, and sluicing was carried out at two faces using water pumped from the Mussel Roe River, supplemented by some from the Mt. Cameron water race. Production figures taken from the annual reports of the Director of Mines for this period (but excluding that produced on a royalty basis using the Government water race) are listed hereunder -

Year	Yardage Treated (cu.yds.)	Tin Concentrates (tons)	Metallic Tin (tons)	Grade (lbs met.tin per yd)
1948	-	1.73	1.24	-
1949	15,400	7.19	5.16	0.7
1950	17,900	5.51	3.94	0.5

Boring was carried out on the leases in 1951 (report of Director of Mines) which it is understood was part of an option agreement with Endurance Coy. Mr. Wood has made available this data to U.D.C.

The Mussel Roe workings were re-opened four years ago by Mr. Vernon Wood of Pioneer, and since that time he has produced 115 tons of tin concentrates valued at £95,000. During the first two years of operation, two men were engaged on sluicing at the old southern workings, and subsequently another party of two men were employed to work the northern paddock,

situated 660 yards above the original workings. Details of production from April, 1960, to June, 1963, are given in Table H.

The two working faces are in a mature river flat bordering the diverted course of the Mussel Roe River. They expose some 20 - 30 ft. of overburden consisting of 6 - 10 ft. of soil and silt, 8 - 12 ft. of unconsolidated granite grit and sand with vegetable debris, and about 6 ft. of puggy grey clay. The tin is present as cassiterite in a basal gravel bed up to 2 ft. thick. Remnants of a Tertiary surface carrying tin occur at a higher level on the flanks of the flat, and the adjacent hilly country is composed mainly of granite.

The width of the lead has not been established in either of the workings, but it exceeds 100 yards in both places and appears to correspond with the full extent of the river flat, which averages more than 200 yards wide. As the deposit here is possibly of Recent age, derived from the resorting of Tertiary gravel, the values may extend over most of the existing river flat.

The tin values in the ground that has been worked were reported by Wood to range from 1 - 1½ lbs of concentrates per yard, and these figures are verified by the production details published in the Annual Reports of the Director of Mines (Table H). These show a weighted average recovery of 0.9 lbs metallic tin per yard for 113,400 yards treated. The lessee has carried out some scout drilling on his leases. He maintains that tin values extend for at least 880 yards downstream from the lower workings, and 1,100 yards upstream from the upper workings, or over a total distance of at least 2,600 yards. The depth of overburden is about 24 ft. at No.1 paddock, 30 ft. at No.2 paddock, and increases to 60 ft. or more upstream of No.2 paddock.

A preliminary estimate of possible tin reserves in the Mussel Roe leases, using an average grade of 1 lb tin concentrate per yard, and other dimension figures discussed above, is given hereunder -

Depth (yds.)		Width (yds.)		Possible Length (yds.)
$\frac{10}{1}$	x	$\frac{200}{1}$	x	$\frac{2600}{1}$

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TABLE H.

PRODUCTION RECORDS
1960-1963

WOODS MUSSEL ROE MINE

Year and Quarter	Yardage Treated (cubic yards)	Tin Concentrates (tons)	Metallic Tin (tons)	Grade (lbs. metallic tin per yard)
1960 June	8,200	7.134	5.236	1.4
Sept.	6,000	3.477	2.514	0.9
Dec.	-	-	-	-
1961 March	14,500	5.780	4.254	0.7
June	4,000	2.286	1.637	0.9
Sept.	18,000	6.966	5.066	0.6
Dec.	16,000	8.011	5.830	0.8
1962 March	14,000	5.083	3.745	0.6
June	11,000	7.330	5.301	1.1
Sept.	11,000	6.301	4.726	1.0
Dec.	16,000	11.034	8.140	1.1
1963 March	9,500	5.509	4.047	0.9
June	14,000	5.750	4.089	0.6
Totals:	142,200	74.66	54.585	Weighted Average 0.9

Note:- The figures for September, 1961, and June, 1963, are taken from the original quarterly returns of the mine owner. These are incorrectly entered in the tin production register of the Mines Department.

Not Rec. [illegible]

Figure for Sept 61 is 18000 C.Y. and June 63 is 14000 C.Y.

= 5,000,000 yards at 1 lb tin concentrate per yard.

= 2,300 tons of tin concentrate,

or about £2,000,000 (Aust.).

The present workings are serviced by the Mt. Cameron water race at a cost of about £120 per month. An alternative supply would be available from the Mussel Roe River itself, which normally flows for 10 months of the year.

Great Mussel Roe Proprietary Workings:

About one mile north of Wood's mine, the deep lead of the old Great Mussel Roe Proprietary section is parallel, but to the east of the present river, from which it is separated by a low ridge of granite. The drift is a coarse granitic sand, composed of even sized grains of rounded to sub-angular quartz, with feldspathic material in the interstices, and small flakes of mica (Twelvetrees, 1901). The seams of tin wash are a little coarser than the rest of the drift, and have evidently been derived from stanniferous granites in the immediate neighbourhood.

The base of the drift consists of dark silt containing lignitic wood fragments and pyrites. The known seams are from 10 - 12 ft. from the surface, and show tin up to 1 lb to the dish for about a foot thick, but no bottom has been reached beyond the margin of the workings.

Ahead of the face is a flat 500 yards wide bordered by a granite hill. Twelvetrees (1901) states that this is one of the best defined channels to be seen in the district, and "no attempt seems to have been made to get down to bedrock". The Proprietary Company abandoned work in 1901.

In 1946, D. R. Mallinson held a 10 acre lease in this locality, but "had just ceased operations because of unprofitable returns" (Keid, 1946).

The lead continues to the north of the Great Mussel Roe Proprietary through Carroll's Flat. A line of bores was put down across the flat by the Government in 1902. Twelvetrees (1916) records that the

first bore intersected 3 inches of gravel, with good tin at 7½ ft. from surface, and 3 inches of pug and drift with a little tin. The second bore revealed a gutter at 49½ ft. from surface with 3 inches of quartz wash, carrying a little tin ore "but not payable". The third bore at 9½ ft. went through 18 inches of wash with "fair prospects of tin and a good deal of iron", and at 32 ft. a bed of drift 8½ ft. thick and carrying a little tin was found lying on the bedrock.

North Mussel Roe Proprietary:

North of Carroll's Flat the Mussel Roe Lead crosses to the west side of the present river where two small faces were worked in the early days by the North Mussel Roe Proprietary. Early records show that the southern face, on granite bedrock about 20 ft. from grass, was the principal producer. Along the shallow eastern edge, the tin values were payable, but the deeper ground was found to be poor (Twelvetrees, 1901). He describes the wash as a granitic sand composed of sub-angular quartz, feldspar, yellow clay, cassiterite and mica. The area to the west of the North Mussel Roe Proprietary is stated to be granite covered with partly consolidated Tertiary terraces containing minor amounts of tin.

Lower Course of the Mussel Roe Lead:

Below the North Mussel Roe Proprietary, the trace of the Tertiary lead diverges to the west of the existing river valley (Fig. XXV). A hard capping of cemented Tertiary drift related to the Mussel Roe lead is exposed on Edina Sugarloaf to the north west of the Mussel Roe mine. The lead itself was worked at the nearby New Edina mine, where 14 ft. of soil and pipe clay and 10 - 15 ft. of granite drift overlie granite bedrock. Most of the tin occurs in a layer of gravel 6 - 9 inches thick at the base of the drift. The average value of the ground is claimed to be about 3/4 lb per cu. yd. (Twelvetrees, 1916). A line of Government bores between the New Edina and the river intersected up to 54 ft. of alluvium carrying no tin (Twelvetrees, 1916).

North of Edina Flat, Watts (or Cybele) Workings exposed 20 ft. of sand with layers of quartz pebbles overlying at least 10 ft. of brown pug with vegetal debris and pyrites, considered to be part of the Mussel

Roe Lead. A long line of Government bores in this locality proved the deepest gutter to be 84 ft. deep, but tin values were mainly poor. The best result was in Bore No.10, which revealed 2 ft. of basal drift at 20 ft. yielding 29 lb cassiterite per yard. The main gutter of the lead is, however, believed to be near Moore's Workings, about 600 yards south west of Watts (Twelvetrees, 1916).

North west of Watts, the Tertiary deposits of the old Mussel Roe Lead are poorly represented. Dismembered sections of the Lead were, however, observed by Twelvetrees (1901 and 1916) below estuarine terrace deposits at the Garfield and Tamar claims. The correlation of these with the Mussel Roe Lead infers that the present river follows a more direct and more easterly course than its Tertiary predecessor, which would have discharged through the Great Northern Plain into Ringarooma Bay (Fig. XXV).

An area embracing the formerly abandoned Watts and Garfield claims is being worked now by the Star Hill Syndicate, without reaching bedrock in some places. An average annual production of 25 tons of cassiterite has been maintained by this group in recent years. Production during 1962 was 20 tons of concentrate containing 15 tons of metallic tin from the treatment of 97,500 yards of wash (Grade 0.35 lbs per yard).

Lochaber-Scotia Leads: The Lochaber Lead and its tributary, the Scotia Lead, which occur in an area of higher ground on the eastern side of the Great Northern Plain, were regarded by Twelvetrees (1916) as near-shore remnants of the old Mussel Roe Lead (Fig. XXV). The original Lochaber workings exposed 40 ft. of quartz drift with lignitised wood over a slate basement. The Scotia workings exposed a gutter which evidently had its source at Mt. Cameron. It is reported that 1,000 tons of concentrates were won from 35 acres of worked ground at the Scotia (Rattigan, 1958a).

During the years 1935 to 1944, an extensive prospecting campaign was carried out by the Mines Department along extensions of the Lochaber and Scotia Leads, and the results are summarised in a report by Blake (1955b). Using two power boring plants, 855 holes were sunk to an average depth of 91 ft., involving 78,153 ft. of boring over a distance of 3 miles.

As a result of the boring, an extension of the Lochaber Lead was indicated over a length of 4,900 ft. from the original working face to the junction with the Scotia Lead. The Main Lead extending north of this junction (Scoloch Lead of Blake) was closely bored over a length of 7,000 ft. and scout bored for a further 6,300 ft. Another 11,800 ft. of inferred extension to the north

has not been tested. The Scotia Lead was traced to the north of the workings by close boring over a length of 4,550 ft., with an additional unexplored central zone 2,500 ft. long.

Blake (1955b) states that "the tin content of possible economic value is confined to narrow gutters ranging in width from 100 ft. to 250 ft. The richer concentrations are contained in basal beds, from 10 to 30 ft. in thickness, overlying the slate and sandstone bedrock. Only a little tin occurs in the upper 50-80 ft. of the deposit.

The basal beds consist of gravels and coarse grits, while the superincumbent material, extending to surface, is largely composed of siliceous sands and grits, intermixed with lesser quantities of clay. The average depth of sediments along the gutters is 110 ft. and, with the exception of a thin cemented zone occurring near the surface in a few places, the deposit as a whole is unconsolidated.

Over the total area tested, a length of four miles of lead has been indicated by the boring. Where close boring has been undertaken, it has been possible to tabulate data in relation to six blocks of ground covering portions of the narrow gutters, along an aggregate length of 7,250 ft. In calculating the volume and value of the ground, these blocks were considered as having vertical sides and no allowance was made for any batter which would be required in mining the deposit."

Blake estimates that the total reserves in the six blocks considered (which comprises about one third of the total known length) are 4,383,000 cu. yds. of alluvium averaging 0.50 lbs tin oxide per yard (or about 1,000 tons of tin oxide). Details used in this estimate are given in the accompanying Table I.

The following unpublished plans were prepared by Blake, and are available from the Mines Department -

1. Overall Plan of the area bored at 5 chains to 1 inch, showing surface contours, bore locations, average value for each bore and position of lead gutters.

2. Detail Sheets (10) at 1 chain to 1 inch, showing outline of six selected areas from which reserve estimates given above were computed.

3. Cross Section Sheets (6) giving tin values for entire bores.

The detail on these plans is beyond the scope of the present report, but a copy of 1 above has been submitted to head office under separate cover.

Behind Page 54.

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TABLE I.

STATISTICS OF THE LOCHABER-SCOTIA LEADS INDICATED BY GOVERNMENT BORING.

(after Blake, 1955)

Block No.	No. of Holes	Total Depths (feet)	Area (sq.yd.)	Average Depth (feet)	Volume (sq.yds.)	Tin Oxide (oz.per cu.yds.)	Width Min. Ft.	Width Max. Ft.
1	25	2,199	10,745	88.00	315,000	7.04	100	260
2	46	4,723	16,940	102.67	579,687	7.30	100	230
3	25	3,017	34,364	120.68	1,384,525	9.00	100	200
4	10	1,052	7,260	105.20	258,964	10.48	115	130
5	57	6,744	31,944	118.31	1,259,871	6.68	100	200
6	22	2,574	15,004	117.01	585,156	6.95	100	130
Totals:	185	20,309	116,257	109.78	4,383,203	7.78 oz.		

The area containing the Lochaber-Scotia Leads is reserved by the Government but would be available to a company subject to negotiation.

A few check holes drilled by Rio Tinto (Rattigan, 1958c) gave considerably lower tin values than recorded from adjacent Government bores. Aberfoyle T.P. are at present undertaking another programme of check drilling.

Amber Hill Lead: (not leased at present and within UDC's Exploration Licence).

The Amber Hill workings expose narrow deep leads heading south-easterly across granite terrain along the divide between the old and present Mussel Roe and Ringarooma water sheds.

Twelvetrees (1916) records that the west face (Fig. XXXIII) exploited a bed of tin wash from 2-5 ft. thick below granitic drift. The grade averaged 1 lb tin oxide per yard. The drift also carries a little tin and in places rich patches were found at the grass roots. The east face, half a mile to the east of the above, was worked to about 70 ft. deep on a similar or the same lead. Sluicing was hampered by an inadequate water supply. The central face was evidently opened up over the period 1916-35.

In 1937, 53 bores totalling 3,155 ft. were sunk by the Mines Department on the property (Keid, 1952). The records of this boring (Fig. XXXIII) outlined a narrow lead extending south-easterly from the central to the east face. The positions of earlier boring by the Pioneer Co. and Siamese Tin are also shown on Fig. XXXIII.

The mine was idle until 1949 when it was re-equipped to work part of the lead proven by drilling. It closed again in 1952 because "the overburden to be removed to ensure safety became too great for economic mining" (Keid, 1952). Incomplete production figures during this period of activity show that the grade varied from 0.43 to 0.71 lbs tin oxide per yard, which is slightly less than indicated by the Government boring.

The Empress Syndicate worked a similar small gutter occupying a north-south channel across a prominent granite saddle near Gladstone.

EVIDENCE OF LEADS IN THE BOOBYALLA BASIN:

Small workings at the Monarch (Shallamar Flats), White Rocks, Hasties, Banca and Walpole Creek mines suggest the presence of buried leads in the virtually untested areas of the Boobyalla Basin, in proximity to the inferred course of the main Ringarooma Lead.

DETAILS OF BORES WHICH SHOWED SIGNIFICANT TIN VALUES

(GREATER THAN 4 OZS/YD)

GOVT. BORES	NO	DEPTH	GRADE (OZS TIN OXIDE/YD)
	1	73'	16·79
	17	52'6"	7·21
	20	72'7"	6·78
	22	54'4"	19·25
	30	38'4"	32·32
	31	33'7"	7·33
	33	19'3"	10·62
	34	33'0"	5·08
	35	48'7"	8·53
	36	62'2"	54·6
	37	73'10"	19·35
SIAMESE TIN	1	73'0"	16·0

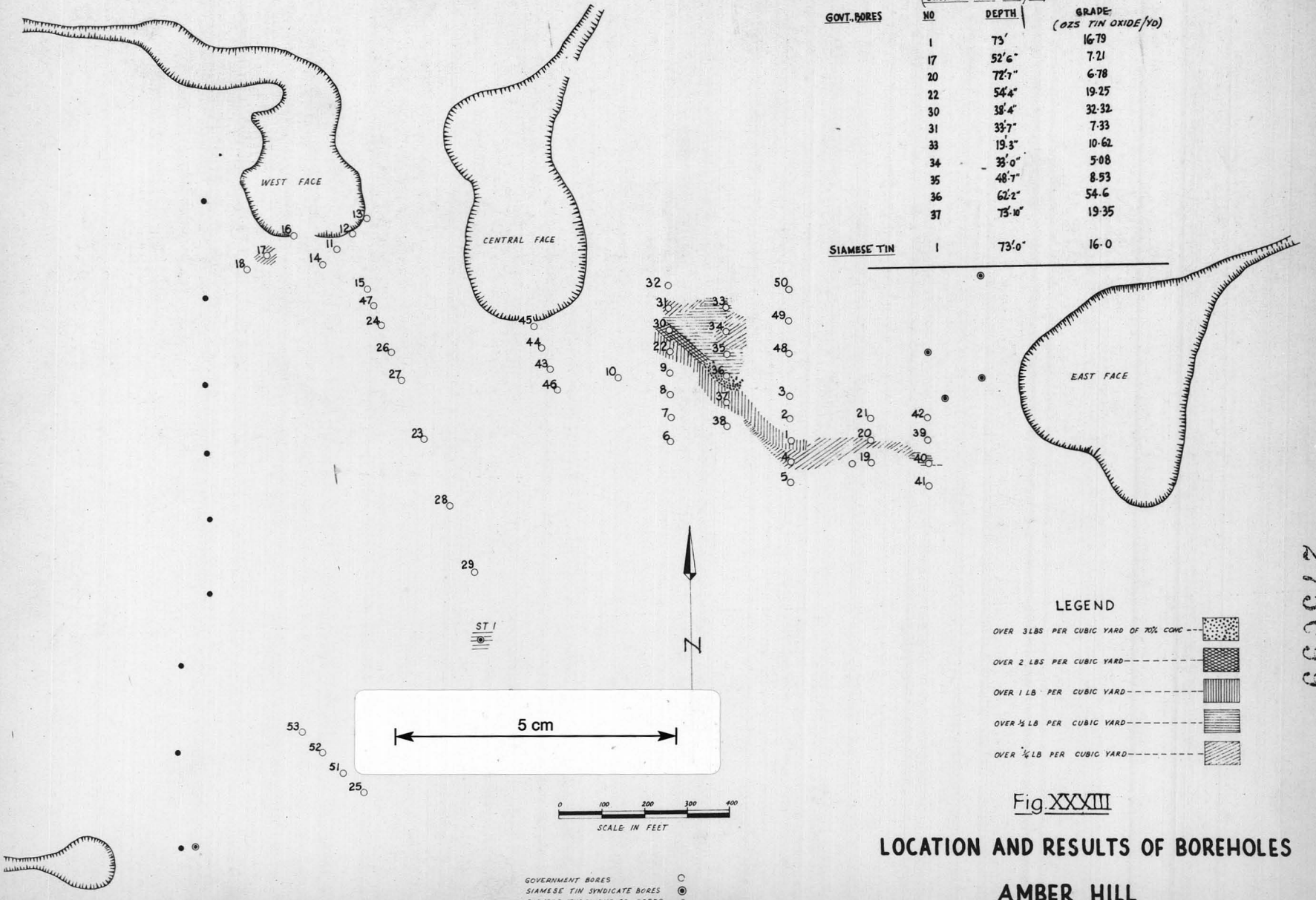

Fig. XXXIII

LOCATION AND RESULTS OF BOREHOLES

AMBER HILL

AFTER MINES DEPT. TASMANIA 1937

REPORT No. 121.

Other workings along a tributary course named the Boobyalla Lead (Rattigan, 1958a) are Martins and the Golden Cora mines. This Lead has a well defined course following the lower reaches of the present Boobyalla River but, east of the Banca mine, its identity is lost under widespread lucastrine and estuarine deposits.

West of the Boobyalla Basin, a small and isolated occurrence of alluvial tin in association with monazite occurs at Mt. Stronach, about 20 miles west of Branxholm. Boring in this area described by Keid (1951) revealed that "monazite of an economic grade does not exist and there are only very limited possibilities for the recovery of tin ore". About 10 miles north of Branxholm, prospecting in the headwaters of Tomahawk Creek (Jack, 1962a) has indicated alluvial ground with tin values up to 0.26 lb concentrate per yard.

Monarch Mine: (held as lease by V. Wood).

This claim is located at Shallamar Flats, an embayment at the western end of Mt. Cameron.

Twelvetrees (1916) records that the ground was worked with good results in the early days, but was later bored by various interests and proved to be patchy. He observed that the wash consists mainly of quartz and sandstone, and regarded it as a marine terrace deposit. Some of the tin occurred as unusually coarse nuggets.

Five hand bores were put down in the flats ahead of the workings by Rio Tinto in 1958 with negative results. Deeper ground (Bore No.14) was not bottomed and Rattigan (1958c) records that "the work done has by no means exhausted the possibility of a lead arising in the area". He also observed from the boring that "the deepest bottom occurs beneath high timbered rises, and this fact may be significant, as there has always been a tendency for past boring to be carried out over the flats".

Banca Mine: (Leases covering 39 acres held and worked by R.L. Rainbow).

The Banca mine is situated on Simpson's Creek, a tributary of the Boobyalla River, about 9 miles north from the township of Winnaleah. The original lease in the Banca area was taken up in 1934. Records show that to the year 1941 a total yardage of 44,350 was treated for the recovery of 19.873 tons of concentrate containing 14.230 tons of metallic tin (i.e. 0.7 lbs tin per yard).

In the year 1940, some boring was done under the supervision of the Department of Mines in the vicinity of Banca workings, on the flat through which Simpson's Creek and the Boobyalla River flow. To the east of the river the

boring proved deep ground which was becoming deeper towards the east. Some of the bores proved high grade drift and some failed to reach bottom.

R.L. Rainbow purchased the property in 1947, and has worked there since for a return of about 3 tons of metallic tin annually.

An examination of the working face (Keid, 1952) shows that the drift contains a high proportion of clayey material, but responds readily to treatment with the nozzle. Seams of coarse wash are visible in the drift which appears to carry some tin throughout.

TIN-BEARING ESTUARINE DEPOSITS:

Shoreline terraces of shingle and wash were stranded during the emergence of the land in late Tertiary-Quaternary times. Numerous tin-bearing deposits of this type were worked on a small scale around the flanks of Mt. Cameron at the Great Northern Plain, Boobyalla Plains, and near Gladstone. The tin values usually proved to be limited and very patchy in these deposits. An extensive terrace deposit with an overall grade of about 2 oz. tin per yard was worked by the Dorset Dredge at Dorset Flats.

Great Northern Plain: Included among the terraced workings were the Canary, McGregor's, Aberfoyle, Taylor, Beltz, Roy, Richardson's, Vulcan and Boomerang claims (Fig. XXV). The Dorset Dredge which was previously owned by the Storeys Creek Tin Mining Co. N.L., but is now under the control of Aberfoyle T.P., is at present being dismantled and transfered to the banks of the Ringarooma River at Great Northern Plain where it will work these shingle terraces and recent river deposits.

A description of the area to be dredged is given in a brief report by Jack (1961a). "The area of river flats available for dredging is 485 acres, and if an average dredgable depth of 35 ft. is assumed, there would be approximately 23 million cu. yds. of material available". The results of preliminary drilling by Storeys Creek showed that the alluvium is up to 50 ft. thick but the distribution of tin is erratic and not all the ground would be worth working.

Boobyalla Plains: Four small mines occur in this area, mainly the Delta, Davis, Dugarde Creek and Dry Cut. All are less than 30 ft. deep. Tin occurs in coarse conglomerates and grits which are considered to be largely composed of marine and estuarine wash. At the Delta mine, about 40 tons of tin were obtained from about 2 acres of ground to depths of 25 ft., which indicates a grade of about 2 lb per yard. Some good values were also shown by boring ahead of the Delta mine.

Gladstone-South Mt. Cameron: Shingle terraces were worked on a small scale at Morrissey's Syndicate, Bridge, Mary and Ogilvie's claims, and above deep leads at the Tamar and Garfield (later the Star Hill properties).

Dorset Flats: (worked until recently by Storey's Creek Tin Mining Co. N.L., leases will presumably be abandoned).
Reference: Keid, 1952.
Location: Adjacent to the Ringarooma River near its junction with Corduroy Creek, three miles north of Pioneer township.

The ground was worked during 1906-12 by several different companies using a bucket dredge, yielding during this period 270 tons of tin oxide and 390 oz. of gold. The deposit was then idle until 1943, when it was taken up by the Commonwealth Government (Department of Supply and Shipping) and construction of the Dorset Dredge commenced. The dredge, with a reputed capacity of 150,000 cu. yds. per month, began operating in 1944.

In June, 1960, the Commonwealth Government sold the Dorset Dredge and property to Storey's Creek Tin Mining Co. N.L., but the deposit was worked out by early 1963.

Total production of the Dorset Dredge was 1,615 tons metallic tin. The average grade of the material treated during 1944-57 was 0.13 lb metallic tin per yard. The ground worked by the Storey's Creek Co. during 1959-62 also averaged 0.13 lb tin.

QUATERNARY ALLUVIAL DEPOSITS OF THE RINGAROOMA RIVER:

Minor quantities of tin have been obtained from modern river gravels. These were most important in the upper reaches of the Ringarooma River, where erosion and resorting of deep leads occurred in places. Numerous other deposits related to the present cycle of erosion are known in the granite areas, including alluvium at Brown's and the Black Duck and residual deposits at the Star and Enterprise workings, near Gladstone.

Extensive Quaternary deposits carrying some tin are known at Foster's Marshes, as described below -

Foster's Marshes: About 2,000 acres of low swampy country underlain by thick Quaternary alluvials and marine sands and muds, occur near the mouth of the Ringarooma River. Rattigan, 1958a, states that "the natural dredging advantages have led to partial testing of the Marshes by at least three organisations". Delta Tin Mines put down about 33 bores east of the Delta Mine in the southern section of the Marshes, with results as summarised below -

No. of bores	33
Depth range of bores	32-74 feet
Average depth	53 feet
Area covered	250 acres (approx.)
Maximum values	1.96 lb per yard
Average values	0.7 lb per yard
Maximum thickness of pay wash	21 feet
Minimum thickness of pay wash	3 inches

In contrast to these Delta records are the figures from recent testing by Dorset, which showed much lower values, viz:-

No. of bores in Foster's Marshes	22
No. of bores adjacent to Marshes	15
Depth range of bores	33-77½ feet
Average depth	54 feet
Maximum depth of bottom pay wash	22 feet
Minimum depth of bottom pay wash	0 feet
Average depth of bottom pay wash	13 feet
Maximum values	0.47 lb per yard
Minimum values	0.00 lb per yard
Average values	0.133 lb per yard

Dorset consistently encountered a bottom shingle in which average values of 0.60 lbs per yard were present, but the average overburden ratio of about 3 : 1 indicated that the ground would be unpayable. The Dorset boring was to the north of the Delta bores, and Rattigan considers that they may have missed a channel of generally thicker pay wash with better values.

GOVERNMENT RESERVATIONS IN NORTH-EAST TASMANIA:

Apart from the Reservation over the drilled extension of the Lochaber-Scotia Lead referred to above, three other prospective alluvial areas are being tested by the Mines Department and are exempted from the terms of the Mining Act. These areas were first suggested as worthy of testing by Keid (1953a).

Boobyalla Area: (North of Winnaleah). (Area 1 on Fig. I). The area covers low country extending for about 6 miles between the Boobyalla and Little Boobyalla Rivers embracing part of the inferred old course of the Main Ringarooma Lead. Boring has been carried out by the Government on the western margin of the area near the Banca workings and revealed deep ground carrying some tin values.

A small amount of drilling done by Rio Tinto in the north east part of the area failed to disclose any tin (Rattigan, 1958c).

Geophysical surveys were carried out by the BMR in 1962. The Mines Department are awaiting a report on this work before embarking on some scout drilling.

Mussel Roe Area: (Area 3 on Fig. I). This area, with a length of approximately 3 miles and a width up to 1½ miles, extends along the Mussel Roe River south from the Gladstone-Anson's Bay road crossing (Jack, 1960a). It consists mainly of flat country with a few low ridges and includes the Lower Mussel Roe (or Elizabeth) workings shown on Fig. VII and described above.

Some boring was done on the southern part of the eastern bank under the direction of Keid (1953c) and proved a narrow lead with a grade of 0.40 lbs per yard to a depth of 23 ft. Subsequent boring on the western bank in 1953 proved another lead was present near Garfield Creek. The deepest ground bored was 58½ ft., but the tin-bearing lead was at 14 ft. in the stream bed which cut into underlying Tertiary clays.

A limited geophysical programme (gravity and seismic) was carried out along the northern part of the eastern bank in 1962 by the BMR, and revealed some depressions in the bedrock which will be tested by drilling in the near future. (Sedmik, 1963).

Great Fraser River Area: (Area 4 on Fig. I). This reservation covers an area 3 miles long and 1½ miles wide along the eastern bank of the Great Fraser River, near its headwaters on the eastern side of the Blue Tier. Keid (1953a) reported panning some tin in this locality, but there has been no previous mining activity.

Seismic and gravity traverses by the BMR (Sedmik, 1963) indicated a definite channel about 7,000 ft. long and 150 ft. deep to unweathered bedrock which is to be drilled by the Government.

St. Helen's Area: See following section of report and Fig. XXXIV.

THE GEORGE RIVER DEEP LEAD SYSTEM (GOSHEN-ST. HELENS DISTRICT)

Alluvial tin deposits are widespread along the George River system which rises on the eastern fall of the Blue Tier area, and courses easterly through Goshen to the coast at St. Helens. The bedrock throughout most of this region is granite (Fig. XXXIV). Vein tin was worked to a small extent at the Priory Mine, four miles north west of St. Helens, but most of the alluvial tin is believed to have derived from the stanniferous granites of the Blue Tier.

Dredging of tin from beach sand deposits at George Bay was attempted by the Rose Bay Tin Co. in 1900, but proved to be unpayable (Waller, 1901b).

AMG REFERENCE POINTS ADDED

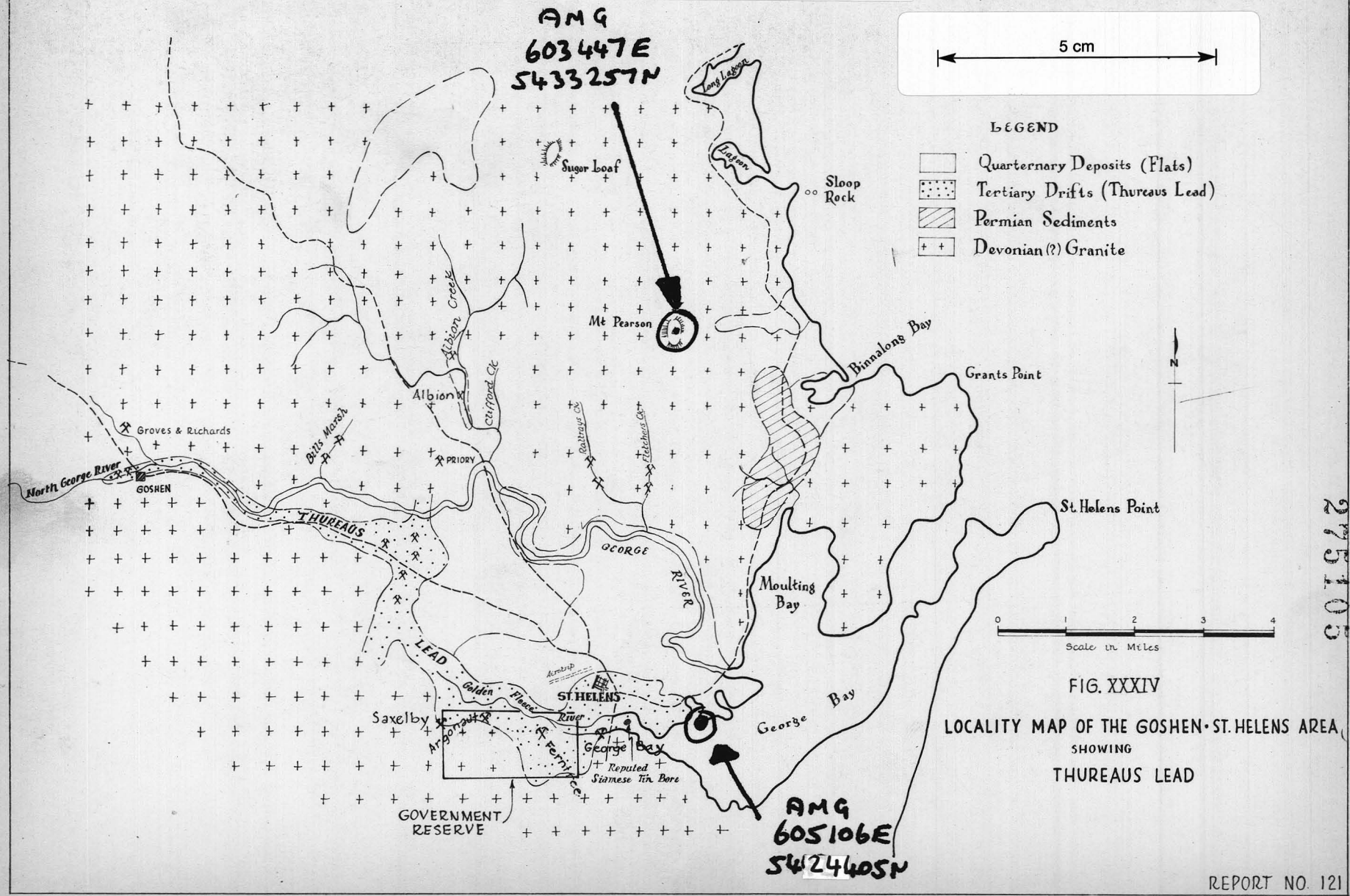

FIG. XXXIV

LOCALITY MAP OF THE GOSHEN-ST. HELENS AREA
SHOWING
THUREAUS LEAD

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Thureau's Deep Lead: The bulk of the tin produced has been won from Tertiary deposits known as Thureau's Deep Lead (Montgomery, 1893b; Nye, 1933c) along a former course of the George River (Fig. XXXIV). In the lower reaches of the George River, near St. Helen's, the Tertiary sediments are of estuarine origin and are poorer in tin content (Waller, 1901b).

The most productive workings on Thureau's Lead were 4 to 5 miles north west of St. Helen's. The depth of the working faces in 1901 varied from 10 to 20 ft. and averaged "2 lbs of tin ore to the yard of dirt" (Waller, 1901b). It is evident from later production figures given below that remaining ground averaged about ½ lb cassiterite to the yard.

In the headwaters of the George River system, shallow fluviatile deposits have been extensively worked along the valley of the Groom River above the town of Goshen. The values are mainly confined to basal gravels along the former course of the river which was narrow in comparison to the extent of the present flood plain. Fine granitic drift with minor tin overlie the stanniferous gravels and are in turn covered by a considerable thickness of tailings from the old mines in the area (e.g., the Anchor).

Reid (1928) records the results of 37 boreholes sunk on behalf of the Groom River tin syndicate. These show values ranging from 0.1 to 2.1 lbs tin oxide per yard over depths of 8 to 20 ft. The average grade is 0.4 lbs tin oxide per yard.

Farther down stream, on the north bank of the Groom River, about 3/4 mile from its junction with the George river, operations by Groves and Richards about 1946 revealed 5 ft. of coarse wash yielding 2 lbs tin oxide per yard under 5 ft. of soil (Keid, 1946).

The Argonaut and George Bay mines, near St. Helen's, were sluiced successfully on a small scale during 1925-1930. In later years, the George Bay syndicate carried out sluicing in the Ferntree and Saxelby areas and are credited in the annual reports of the Mines Department with the following production figures -

Year	No. of Men	Locality	Quantity Treated (cu. yds.)	Metallic Tin (Tons)
1932	-	-	38,330	8.5
1934	-	Ferntree	45,820	7.0
1936	-	Saxelby	70,124	9.7
1937	8	Saxelby	38,500	4.7
1938	9	-	130,650	14.1

The average grade based on the above figures was 0.3 lbs metallic tin per yard.

Considerable interest centred around the St. Helen's district in 1929 when Siamese Tin Syndicate commenced intensive boring and shaft sinking of alluvial tin areas.

In 1932, the Siamese Tin Syndicate took up numerous leases along the George River and commenced construction of water races with the object of carrying out large scale hydraulic mining. The syndicate employed from 60 to 111 men during the period 1932-1938 at various localities in the St. Helen's district, including the Argonaut, George River, Groom River and Priory areas.

Records of production extracted from the annual reports for the Secretary of Mines (Tasmania) are listed hereunder -

Year	No. of Men	Locality	Quantity Treated (cu. yds.)	Metallic Tin (tons)
1932	111	Constructing water races.		
1934	62	Argonaut and George River	359,800	59.8
1936	-	George and Groom Rivers	423,900	60.8
1937	-	Priory and Argonaut	369,200	67.7
1938	62	Various	400,600	60.4

The average grade of the 1,553,500 yards treated was 0.35 lbs metallic tin to the yard.

North of Priory, shallow alluvial deposits were worked along Albion Creek and Clifford Creek (Albion Mine). The Albion workings were bored by Siamese Tin. In 1944, 12 check bores were sunk by the Mines Department and showed 1½ lbs cassiterite per yard over an average depth of 9 ft. (Keid, 1946). This ground has since been worked out.

Another syndicate named Goshen Tin Mines was formed in 1937 to reopen old workings in the Goshen-St. Helen's region. This syndicate continued to operate until 1962 at various sites along the Groom River, Launceston Creek, Ferntree Creek, Golden Fleece rivulet and George Bay, employing about six men. Details of the yardage worked and tin produced by the syndicate

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TABLE J.
Behind Page 62.

PRODUCTION RECORDS - GOSHEN TIN MINES

Year	No. of men	Location	Production (Metallic tin) (tons)	Quantity Treated (cu. yds.)
1937	8	Groom River	4.7	38,500
1941	11-35	St. Helens	41.45	-)
"	8	Groom River	.89	6,300)
1942	12-36	St. Helens	27.79	-
"	-	Groom River	3.94	-
1943	34	George Bay	32.565	-
1944	27	St. Helens	28.19	147,500
1945	24	Bog No. 2 George Bay Argonaut	35.5549	-
1946	18	Bog No. 2 Argonaut George Bay	16.54	219,300
1947	15	Bog No. 2 Argonaut George Bay	23.7989	216,920
1948	-	Bog No. 2 Argonaut George Bay	12.1153	102,700
1949	9	Argonaut George Bay Face	7.3765	22,300
1950	9	St. Helens	6.0988	30,600
1951	11	Argonaut George Bay	8.488	64,200
1952	11	George Bay Argonaut	3.158	36,700
1953	10	Argonaut	3.573	67,800
1954	7	Argonaut George Bay	4.796	52,000
1955	8	Golden Fleece Rivulet	10.76	74,050
1956	9	Golden Fleece	5.798	47,100
1957	10	(Fern Tree Creek (Groom River	-	45,900
1958	9	Launceston Creek Groom River	-	60,300
1959	8	Groom River	-	52,600
1960	7	Groom River	-	78,000
1961	5	Groom River	7.541	-
1962	4	Groom River	2.450	-
		Totals:	287.5734	1,362,770

during the life of the operations, as recorded in annual reports of the Secretary and Director of Mines, are given in Table J. These figures indicate an average grade of 0.47 lbs metallic tin per yard.

Interest in tin mining in the district has declined greatly in recent years. One area of possible interest on Thureau's Lead to the west of St. Helens (Fig. XXXIV) was reserved and tested by the Government. Numerous lines of boreholes and some supporting geophysical work were carried out in the last few years, but only traces of tin were encountered.

Scamander River: Alluvial tin deposits have been worked in a small way along tributaries of the Scamander River. An area of possible interest in terms of a company operation comprises extensive flats near the estuary of the Scamander River which have been tested in places by Siamese Tin. These include terraces of alluvium near the junction of Kelly's Creek and the River, and from the coast at Falmouth to beyond the northern end of Henderson's Lagoon. Between these older deposits are modern alluvial swamps about half a mile wide and three miles long. According to Waller (1901b) some prospect holes put down across the Scamander Flats in the early days showed an average grade of "less than 0.6 lbs per yard".

While it is evident that fine tin is present in these alluvial deposits, and that the ground is adequate (150 million yards) and suitable for dredging (Rattigan 1957), no details of values encountered in test holes are on record. A more detailed examination of this area would therefore appear to be warranted.

ALLUVIAL DEPOSITS AT BICHENO AND COLES BAY:

Alluvial deposits of limited extent have been worked along water courses in granite country near Bicheno and Coles Bay, on the east coast of Tasmania.

One such occurrence is at Lilla Lilla, two miles south west of Bicheno. Nye (1927a) observes that "these alluvial deposits are shallow (up to 10 ft. in depth) and narrow, being confined to the stream valleys". The wash from the bottom of two shafts sampled by Nye yielded "0.95 and 4.25 lbs per cu. yd." but scout boreholes in the same area showed a maximum grade of 0.2 lbs per cu. yd. Keid (1954c) refers to the high grade of the wash in the vicinity of old workings at Lilla Lilla, but confirms that the extent of the deposits is very limited.

Near Coles Bay, a small amount of work has been done on alluvial tin deposits at Middleton Creek, Saltwater Creek, and Moulting Lagoon, where some patches of rich ground are reported to occur. Boring carried out in 1944 on Saltwater Creek under the supervision of the Mines Department proved 98,000 cu. yds. with an average depth of 9 ft. and an average grade (70% tin) of 0.54 lbs per cu. yd. (Keid, 1954c).

PART IIIB
ALLUVIAL DEPOSITS OF SOUTH-WEST TASMANIA

References: Twelvetrees, 1906b; Nye, 1927b; Reid, 1928a; Stefanski, 1957.

Alluvial tin deposits of very limited size have been worked in the vicinity of Cox Bight, on the almost uninhabited south-west coast of Tasmania. Total recorded production from the locality is 178 tons metallic tin.

Throughout most of this south-west region, the country rocks consist of poorly mineralised schistose sediments of the pre-Cambrian Davey group, which are locally intruded by granite near the coast at Cox Bight. Tin occurs near the granite at Cox Bight and also has been produced in minor quantities from alluvial workings on pre-Cambrian basement at Melaleuca Inlet and the upper Ray River, a few miles to the north and north-west of Cox Bight.

An examination of aerial photographs of the Cox Bight-Melaleuca region was undertaken as part of the present investigation. This study revealed that bedrock outcrops throughout most of the region, and there is little or no scope for sizable alluvial tin deposits.

Cox Bight

Following the discovery of alluvial tin at Cox Bight in 1890, and the production of about 120 tons of tin concentrate by prospectors prior to 1906, several unsuccessful efforts were made by small companies to prove and develop additional deposits.

The tin showings are confined to the margins of a small granite hill which protrudes from a narrow strip of coastal plain measuring five miles long by one mile wide (Fig. XXXV). In the hinterland are the high ranges of Mt Counsel (2, 629 ft).

Production in the early days was largely derived from shallow terraces of alluvial ground bordering the granite outcrop where the values were about 2 lb metallic tin per yard (Twelvetrees, 1906). These deposits were essentially worked out by prospectors and Cox Bight Tin Mines prior to 1910.

Two adjoining areas of alluvial ground attracted interest in later years. They are the Plateau Area comprising approximately 160 acres of alluvial terrace up to 15 feet deep bordering the old workings to the east of the granite outcrop, and about 400 acres of swampy flats with

AMG REFERENCE POINTS ADDED

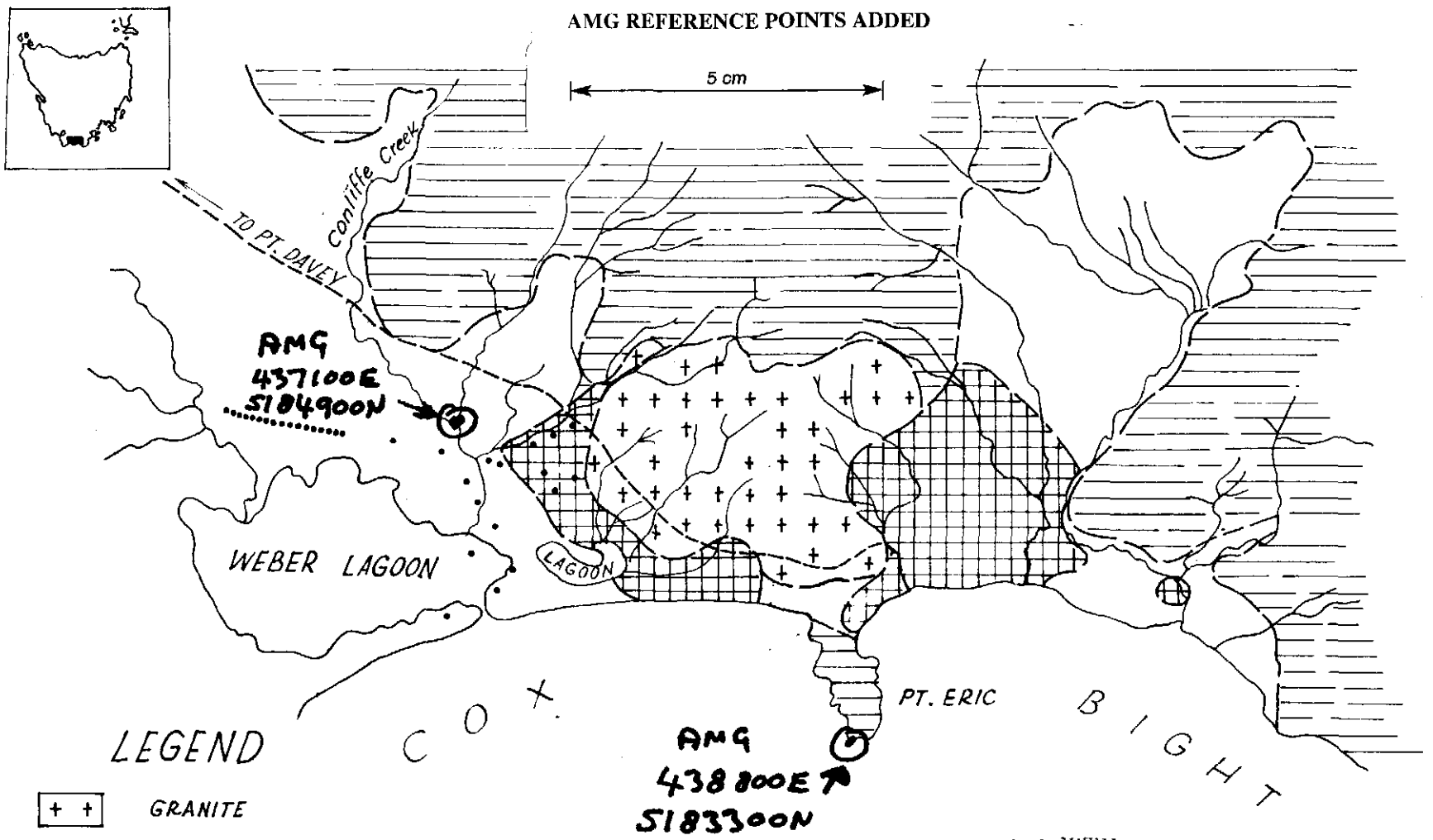

FIG. XXXV

SIMPLIFIED GEOLOGICAL MAP OF THE COX BIGHT TIN AREA

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alluvial deposits up to 30 feet thick known as the Lagoon Area to the west of the granite outcrop. These were prospected by boreholes and shafts by the Tasmanian Tin Co in 1913 and by a syndicate from Adelaide in 1927.

Results of the testing are recorded in part by Reid (1928). While no average grade figures are quoted, he concludes that the Plateau Area gravels are "valuable in parts, but as a whole are poor and not worthy of the serious attention of a company". In the Lagoon Area, alluvium up to 40 feet in thickness along the western fringe of the granite showed values of from 0.5 to 1.5 lb tin per yard (No. 6 shaft and No. 3 bore, respectively), but scout holes in other parts of the flat yielded trace or negative tin values.

Melaleuca Inlet

(Leases covering 240 acres held by C.G. King and R. Young.)

Leases were taken up at Melaleuca Inlet, eight miles north-west of Cox Bight in 1934, and since that time small-scale operations by one or two men have produced 63 tons of metallic tin. The production last year (1962) was 1.1 tons of tin concentrates.

The workings have been confined to alluvial and residual deposits less than ten feet thick, and the area of potentially workable ground is only half a square mile in extent. The exposed bedrock consists of altered pre-Cambrian sediments in which tin-bearing quartz veins have been observed. Stefanski (1958) estimates that the unexploited parts of the deposit could yield a further 60 tons of metallic tin.

Ray River Workings

An occurrence of alluvial tin at Ray River, a few miles to the north of Cox Bight, was first recorded by the former Government geologist, P.B. Nye in 1927. A minor amount of tin concentrates was produced from this area during 1926-36 after which the workings were abandoned (Stefanski, 1958).

PART IIIC
ALLUVIAL DEPOSITS OF THE WESTERN PROVINCE

The main sources of alluvial tin in west Tasmania have been Mt Heemskirk, Renison Bell, Mt Balfour, Mt Bischoff and Mt Lyndsay. The deposits at Renison Bell and Mt Bischoff were found close to sulphide orebodies described above (Part IIA) and do not warrant further description.

Mt Heemskirk District

The most important workings were in Tertiary and Quaternary gravels ranging up to 50 feet in thickness in proximity to the Tasman River, originally known as the Granville mine. Sluicing operations carried out here by the Heemskirk Tin Syndicate yielded 237 tons of cassiterite concentrates from 1913 until the ground was worked out in 1920.

St Dizier Creek: Shallow tin-bearing wash which extends for about half a mile up St Dizier Creek from its confluence with the Tasman River was largely worked out by 1915 (Waterhouse, 1915). As shown in Part IIA, above, however, these workings overly a tin-bearing sulphide lode (Laffer's St Dizier leases) and are more in the nature of residual deposits.

Eureka Workings: A small quantity of alluvial tin has been won from this area, evidently derived from a mineralised fault zone in the nearby slates which assayed 1.78% tin over a width of 37 inches (Berger, 1950).

South Heemskirk: Most of the creeks draining to the south of the Heemskirk Range were worked for tin, but stretches of alluvium are generally small and yielded no more than a few tons of tin.

Mt Balfour District

(Area of 25 square miles held as an SPL by the Balfour Mining Syndicate. BHP are at present examining the area under option.) References: Ward, 1911a; Henderson, 1935a; MacLeod, 1961a.

Records indicate that a total of 132 tons of metallic tin was produced from alluvial deposits of the Mt Balfour district. The tin has evidently been shed from narrow (three inch) quartz veins which intersect quartzites and slates of pre-Cambrian age.

A comprehensive description of the area during the peak period of both copper and tin mining was given by Ward (1911a). Activities on the field declined rapidly after 1918, and there has been no noteworthy production of tin for the past thirty years.

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Henderson (1935a) records that "The alluvial deposits are practically confined to the valley of Tin Creek and some of its tributaries. The maximum depth of wash is 9 to 10 feet, and it is reported that only the bottom 2½ feet are tin-bearing."

As a result of a recent survey, MacLeod (1961a) concludes that "the prospects of restoration of any large scale mining appear to be remote".

Upper Natone and Interview River: Minor amounts of alluvial tin have been recorded from Upper Natone, 16 miles SSW of Burnie (Blake, 1957) and Interview River, 20 miles south of Mt Balfour (Henderson, 1935a).

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PART III D
ALLUVIAL DEPOSITS OF THE BASS STRAIT ISLANDS

Alluvial tin has been worked in an area of pre-Cambrian schists on King Island, Bass Strait, and in granite terrain on Flinders Island and Cape Barren Island of the Furneaux group, north-east Tasmania (Fig. XXXVI). Full descriptions of these occurrences are not available due evidently to the isolation of the tin workings.

King Island

Primary and alluvial tin deposits are known five miles west of Sea Elephant Bay and 16 miles by road from Currie, the principal settlement on King Island.

The country rocks in this area are pre-Cambrian schists. Alluvial tin is reported to occur in fluvioglacial debris (Scott, 1926) which may be of Permian age.

Vein Deposits: Cassiterite-bearing quartz veins up to three feet wide have been found to intersect the schists in several places near Sea Elephant Bay. A shaft with crosscuts was sunk on one of the veins in 1936 by King Island Tin Lodes N.L. (annual report of Secretary for Mines) without any noteworthy developments.

Alluvial Deposits: Alluvial tin was discovered near Sea Elephant Bay in 1920. Shortly afterwards, the Currie Tin Mining Co was formed and carried out about six months of productive but unpayable sluicing work. The deposit was taken up about 1924 by the Sea Elephant Prospecting Association, and an extensive testing programme involving more than 600 boreholes and 100 prospecting shafts was undertaken (see detailed plan No. 952-6 submitted under separate cover).

According to W.A. Beamish, Consultant to the Association, the boring proved four main areas of interest in which the depth of ground varies from 5 - 20 feet, viz :

Area	Volume (yd)	Average Values lb tin oxide ?
A	250,000	1.02
B	26,000	0.87
C	80,000	1.10
D	210,000	0.70

This would represent a total yield of 220 tons of tin oxide.

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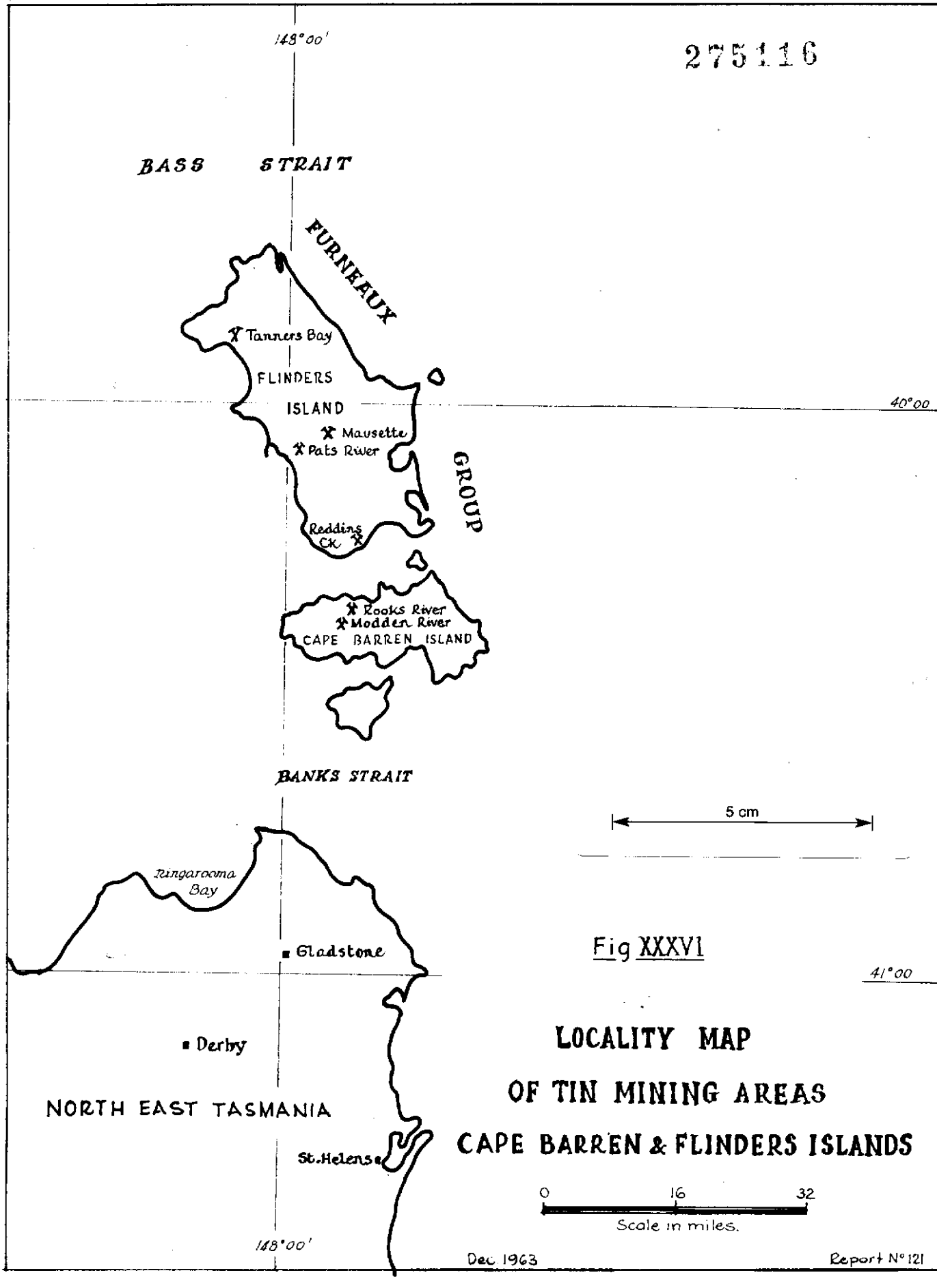

Fig XXXVI

LOCALITY MAP
OF TIN MINING AREAS
CAPE BARREN & FLINDERS ISLANDS

0 16 32
Scale in miles.

Dec 1963

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Scott (1926) refers to two main areas and concludes that by "combining the two areas, the average depth of ground is 7.6 feet containing 870,552 cu.yd of an average value of 1.03 lb per cu.yd. Total tin content 400.4 tons".

The Sea Elephant Prospecting Association commenced mining of the deposit in 1929, when it is recorded that "some 14,920 yd of ground was sluiced for an output of 3.20 tons of metallic tin". (Report of Director of Mines, 1929). These figures indicate a grade of 0.48 lb metallic tin per yd. No reference could be found to any further work.

Another potential area for alluvial tin west of the Sea Elephant area is referred to in a report by Hughes (1960).

Mr. Curtain of Currie, King Island, was referred to me as a contact in the event of a ground inspection being necessary.

ISLANDS OF THE FURNEAUX GROUP

Mining of alluvial tin deposits on a one or two man basis has been carried out intermittently since 1896. On both islands, water storage facilities proved inadequate and were at least partly responsible for the discontinuity of operations.

Records assembled by Keid (1949) show that Cape Barren Island was the largest producer. Combined production for the period 1911-49 was 104 tons metallic tin.

No detailed reports on these deposits are available. It is evident from the limited data, however, that extensive areas of deep alluvium are present which warrant a field geology examination.

Cape Barren Island

Rooks River: Alluvial deposits at Rooks River have been worked on a small scale since 1882. Sluicing operations have revealed depths of more than 30 feet of compact sand and gravel over a granite floor, but values are reported to have been very irregular (Keid, 1949).

Minor quantities of alluvial tin have also been obtained from the head-waters of the Modder River, several miles to the south-west of Rooks River.

In recent years, very small parcels of tin have been sent away; e.g., 0.01 tons in 1962 (L. Maynard).

Flinders Island

Pats River: The old Pats River workings, on the mid-west coast of Flinders Island, extend along the course of the river for approximately two miles, where faces up to 14 feet deep were worked. In recent years, R. Aitken has operated upstream from the old workings in ten feet of drift resting on a hard granite bottom. Prospects taken during mining operations showed up to 20 lb per cu.yd in places but the high values were confined to narrow gutters. Prospects up to 5 lb per cu.yd were obtained 40 yards ahead of the existing face (Keid, 1949) and deeper ground (unbottomed) was proved to the north-west of the present workings. The only recorded producer in recent years was R. Aitken who was credited with 0.1 tons of tin in 1961 and nil in 1962.

A lode tin prospect and some associated alluvials are also recorded from about six miles inland from Pats River at Mausette (Fig. XXXVI).

Tanners Bay: Alluvium along a small creek which enters Tanners Bay from the north, in the north-eastern part of Flinders Island, has been worked for tin over a distance of half a mile. The more important workings were at the northern end where several channels were exploited over a total width of about 160 yards and a length of 400 yards. The working faces varied in depth up to 15 feet (Keid, 1949).

Reddins Creek: On the southern end of Flinders Island some previous mining of low-grade stanniferous and auriferous wash is recorded from the headwaters of Reddins Creek.

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O. WARIN UTAH. drilling results NT

BHP on Monach Area (WOODS Area) ✓

" Great Pyramid (to come)

AUSTRAMEY further drilling (Monach or WOODS) ✓

" Great Pyramid.

SPORE DATINGS Dept Mines S.A. (HARRIS)