816001

OPEN FILE

# KIBUKA MINES PTY. LIMITED

# TIN AREAS N.E. TASMANIA

MICROFILMED
FICHE No. 013494-96

By

C.R. Gibson

K. Piggott

95-3707

15 March 1977

AMG REFERENCE POINTS ADDED

816002

CONTENTS

816003

CONTENTS (cont.)



APPENDICES



PLANS

AUTHORS

Resume of C.R. Gibson

Age: 57

Academic Qualifications: B.A. B.S.'s Major in Geology
University of Western Australia, Perth W.A.

Professional Membership: Membership Australasian Institute of Mining and Metallurgy Inc.,

Employment History / Experience:

1940 - 1941 Tutor in Geology, University of Rangoon, Burma

1942 - 1943 Post graduate schollar. Geological Survey of India
Regional Surveys Baluchistan
Report on the Regional Geology of the Sannisulphur area Baluchistan.

1943 - 1946 Indian Army. Survey Section
Campaign Burma

1946 - 1948 P.O.L. Field Officer, Burma Oil Co., Burma

1948 - 1949 C.R.T.S. Course at University of W.A. Perth, W.A.
(Commonwealth Reconstruction Training Scheme)

1950 - 1956 Geologist Western Mining Corporation, Kalgoorlie W.A.,

(1) Assisted with the Reappraisal and Geology mapping of the Strawell Gold Field, W.A.,
(2) Mine Geologist: Morning Star Mine, Woods Pt, Vic.
(3) Field Geologist: Yalgain Goldfield Area, Southern Cross W.A.
(4) Mine Geologist: General Western N.L.
The Copperhead Gold Mine at Bullfinch W.A.
Production 500,000 tpy

1956 - 1966 Senior Geologist, Clutha Development Ltd. Sydney N.S.W.
Clutha was the exploration arm of Placer Development.

1966 - 1970 Chief Geologist Mineral Deposits Ltd. a subsidiary of National Lead.

1970 - 1972 Director of Operations. Australian and South-East Mining Corporation Ltd., Sydney N.S.W.

1972 Senior Consultant Geologist - I.C.I. Aust
Buka Minerals
Union Corp.
Mining Houses of Australia
Kamilaroi Mines

816005

K. Piggott attended the Camborne School of Mines U.K. from 1961 - 1964 graduating with the A.C.S.M.

He is a member of the Institute of Mining and Metallurgy.

He worked at the Luanshya Copper Mine of R.C.M. in Zambia until 1969 in various production and planning capacities, playing a major role in the changing of this 20,000 tonne per day underground mine to mechanised mining.

In 1970 he transferred to the Chambishi open pit of R.C.M. as Open Pit Manager noteable achievements being in modification of blast design and equipment utilisation. On this 3000 tonnes ore/day mine with a 12:1 stripping ratio.

In 1971 he transferred to the Chibuluma Division of R.C.M. where he worked as Underground Manager and Mine Superintendent of both the Chibuluma Mine and the Kalengwa open pit.

He left R.C.M. in Zambia in 1973 after completion of a study on the total mine and exploration strategy for the Chibuluma Division which has been significantly followed for the past three years.

He attended the London Business School U.K. Executive Development Course for three months in 1972.

In 1973 he joined Amdex Mining Ltd., a wholly owned management company of Buka Minerals N.L. and Triako Mines N.L. where he has worked as Group Mining Engineer in assessment of exploration mining and metallurgical properties and processes together with control for the past year of Kibuka's beach sand mine on King Island Tasmania.

DECLARATION

Neither K. Piggott or C.R. Gibson hold any shares in Buka Minerals N.L. or Triako Mines N.L. or their subsidiary or related companies.

Signed: ____________________

K. Piggott

816007

INTRODUCTION

The N.W. Part of Tasmania is in excess of 500 square kilometres of tertiary tin bearing alluvial gravels.

Past production from the area which mainly ceased between 1930 and 1945 due to uneconomic grades at the then ruling tin price is in excess of 50,000 tonnes of high grade cassiterite.

This production was mainly centred on leads of tin in old river channels being formed from the erosion of the surrounding granitic hills, the largest of which the Briseis produced in excess of 20,000 tonnes of cassiterite.

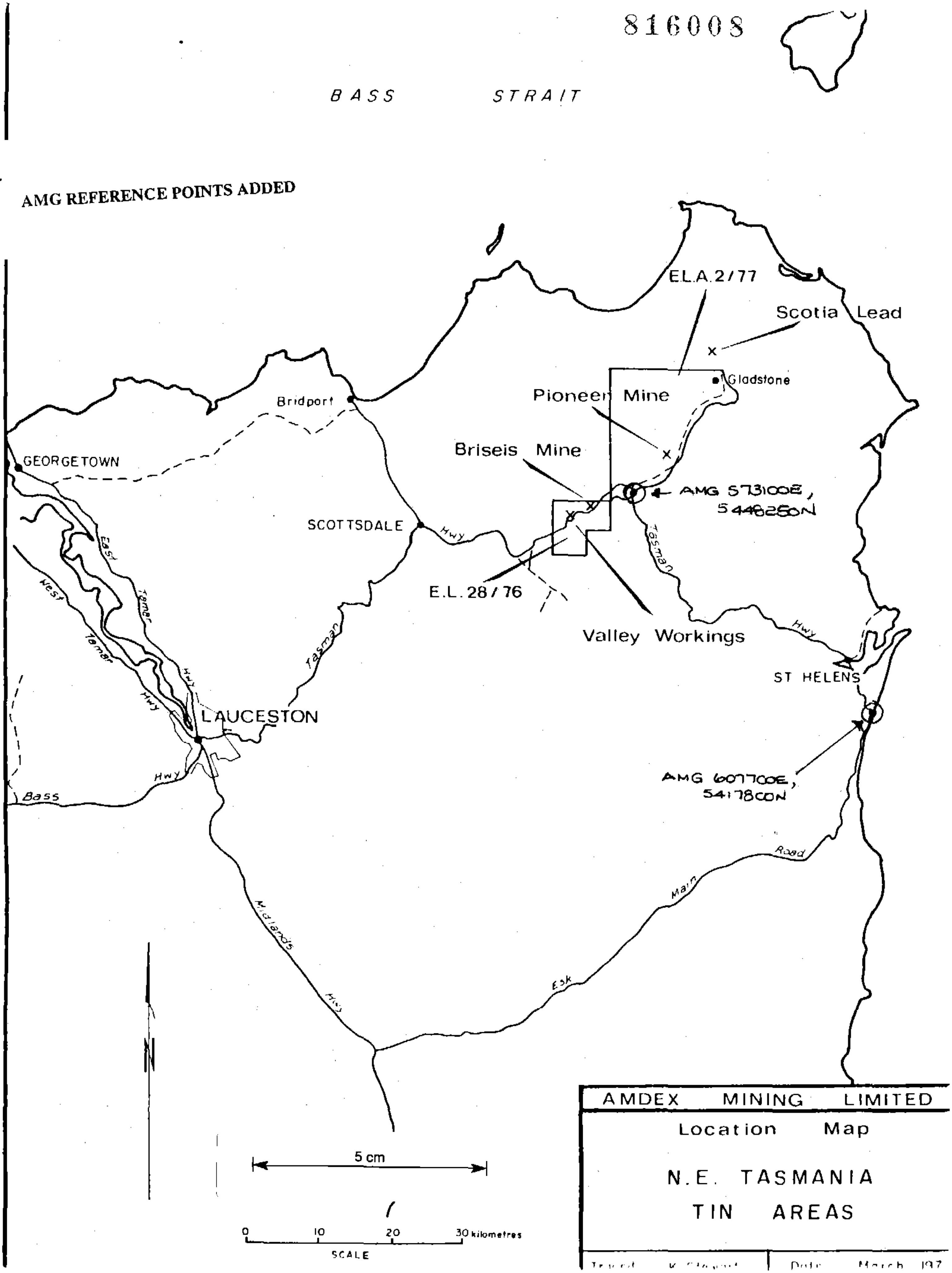
Since the area has a plentiful supply of cheap water and hydroelectric power and with the increasing price of tin, working of these deposits utilising earthmoving or dredging equipment for stripping and monitors and gravel pumps for mining considerably changes the value of ground previously considered uneconomic.

Kibuka Mines has therefore taken options from present leasholders over two known deposits whilst it has a Mines Department licence to explore over a third area. In addition it has one granted Exploration Licence and one Exploration Licence Application covering most of the area of interest.

A drilling programme has recently been completed on the Pioneer property and assaying is currently in hand with a view to commencing production.

816008

AMG REFERENCE POINTS ADDED



UNITS OF MEASUREMENT

816009

Since the old records and terminology of the area is in the Imperial System of measurement, these units are used in this report for familiarity and comparison.

However, references to road distance and land measurements use the official Metric System.

Note: One Tasmania sluice head (s.h.) = 150 gallons per minute.

PROPERTIES

1. Pioneer

Property

The mining property is an alluvial tin mine located at Pioneer in the N.E. Tasmania approximately 119 kilometres east of Launceston and approximately 1 kilometre north of the village of Pioneer. Title to Consolidated Mining Lease 38M-71 (over an area of 218.1 hectares) and water rights is totally held by V. Wood of Pioneer.

| | | | |
|---|---|---|---|
| Water Rights | 2W/65 | 20 sh | (Pioneer) |
| | 15W/64 | 15 sh | ( " ) |
| | 6W/64 | 25 sh | ( " ) |
| | 571/W | 1 | (Badger Creek) |
| | 2998/W | | (Badger Creek) |
| | 2997/W | | ( " " ) |
| | 122/W | 2 sh | (Poimena) |
| | 1789/W | 1 ac | ( " ) |
| | 36/W | 1 sh | (Moorina) |
| | 15W/40 | 1 sh | ( " ) |
| | 1068/W | 191 ac | (Frome River) |
| | 1376/W | 37 sh | ( " " ) |
| | 1001/W | 27 sh | ( " " ) |

816010

| | | |
|---|---|---|
| 639/W | 30 | (Frome River) |
| 2999/W | | ( " " ) |
| 599/93W | | ( " " ) |
| 830/W | 1 sh | (Sawpit Creek) |
| 2249/W | 16 sh | (Wyniford River) |
| 2820/W | 10 sh | ( " " ) |
| 2909/W | 8 sh | ( " " ) |
| 1411/W | 4 sh | ( " " ) |
| 3104/W | 1 sh | ( " " ) |
| 2104/W | | ( " " ) |
| 2248/W | 9 sh | ( " " ) |
| 1065/W | 1 ac | ( " " ) |

---

Kibuka Mines Pty. Ltd. have an option over V. Wood's entire holding of leases and equipment until 31 March, 1977 to purchase the same for a cash sum of $150,000 plus five annual payments of $50,000.

Access

A two lane bitumen road runs from Launceston through Pioneer Village and an all weather 1 kilometre dirt road connects the mine with the village.

## 2. Briseis

Property

The property is an old alluvial tin mine located on the north side of the Ringerooma River at Derby N.E. Tasmania approximately 103 kilometres east of Launceston.

816011

Title to Consolidated Mining Leases 599P/M68, over an area of 67 acres and 7M/47 over an area of 203 acres, together with Easement Licence 11W/70 is totally held by Briseis Tin N.L.

Kibuka Mines Pty. Ltd. have an option over the leases and equipment to purchase for four cash payments of $15,000 each at six monthly intervals commencing on 20th June, 1977 with a final payment of $400,000 after a further six months.

Access

Derby is located on the main N.E. bitumen road from Launceston with a short track leading into the mine workings.

3. Scotia

Property

The property is a Mines Department Mining Reserve located approximately 5 kilometres north of the village of Gladstone in N.E. Tasmania approximately 139 kilometres east of Launceston.

Kibuka Mines Pty.Ltd., hold a licence to explore.

Access

A two lane bitumen road connects Gladstone with Launceston and an all weather dirt road runs from Gladstone to one end of the property.

816012

## 4. Exploration 28/76

### Property

This is a current Exploration Licence of 46 square kilometres over the Briseis area and several other known tin leads.

### Access

Several bitumen roads and tracks cross the area.

## 5. Exploration Licence Application 2/77

### Property

This application covers approximately 200 square kilometres over the Pioneer area and the main alluvial basin.

### Access

A bitumen road and several tracks cross the area.

Copies of the above agreements are attached in a separate report.

## CLIMATE

The climate is temperate with temperatures reaching a near high of 23$^{o}$C in the summer months of December to March and a near high of 12$^{o}$C in the winter months. Rainfall is approximately 975 cms per annum evenly distributed apart from drier months of January to March having approximately half the precipitation of the rest.

## LOCAL RESOURCES

The area has a history of alluvial tin mining mostly from 1900 - 1945. However, some small scale operators are currently working. Parts of the area where covered by basaltic soil support small scale market gardening, beef and sheep. The surrounding granitic hills support some gum timber felling and sawmill operations.

## HISTORY

### 1. Pioneer

The Pioneer mine produces 9093 tonnes of cassiterite from 1902 to 1929, mining 14,221,100 cu yards of drift and wash for a yield of 1.432 lbs/cu yd. Mining was carried out by means of hydraulic monitors, the ground being gravel pumped to sluice boxes and the tails discharged by means of hydraulic elevators or conveyors. The main workings were stopped in 1930 due to insufficient grade at the then ruling price of tin. The cut off grade during the period of working was in the range of 0.4 to 0.5 lbs/cu yd of 70% Sn cassiterite. A table showing the production during this period is shown in Appendix 1.

In addition a plan of the Pioneer company's working showing their drilling ahead of the face is included (Plan 1). This plan also shows the Austral Malay and Storeys Creek drilling discussed below.

In 1935 the Austral Malay Tin Mining Company, who were then assessing mines in the district, drilled 18 scout bore holes ahead of the old main working face.

This drilling (Appendix 2) shows an area of potential ± 0.5 lb/cu yd cassiterite bearing ground to the west of the present pit face. Although no written report is available on this drilling, pencilled comments on a plan in the Tasmanian Mines Department suggests potential for 10 million cu yds at 0.5 lbs/cu yd. Austral Malay did not proceed to mine.

Further drilling was carried out in 1961 by Storeys Creek Tin Mining Co. who drilled a total of 15 holes. This drilling (Appendix 3) shows lower grades than the 1935 drilling. However, verbal evidence suggests samples were not properly cleaned.

In 1967 the present operator of the mine, V. Wood of Pioneer, acquired a mining lease and commenced mining along the south east corner of the old workings, proceeding over the period of 10 years to take a strip of ground 60 feet wide along the south side of the old pit. Initially, Wood mined by nozzle and sluice boxes proceeding to use jigs over the last five years. Over this period of time, he has recovered approximately 242 tonnes of cassiterite generally averaging 73% - 74% Sn (from Tin Buyer and Govt. records).

The average recovered grade of ground mined during this period is approximately 0.5 lbs/cu yd. Wood is currently mining the westerly face of the pit, removing up to 30 ft of surface material either by hydraulic monitors or scrapers and then nozzling the remaining 70 ft to 90 ft of ground to a gravel pump and then to jigs. The production rate is 80 to 90 cu yds/hour and the plant runs 5 days/week, 8 hours/day with extensive breaks at several times in the year when the limited labour force move onto overburden stripping or other non productive jobs.

## 2. Briseis

Cassiterite has been produced from the Cascade River from 1876 to 1960, mainly up to 1945.

Production during this period is in the region of 20,787 long tons of tin metal.

A report on ore reserves in the Cascade Deep Lead by J.B. Braithwaite of the Tasmanian Mines Department in 1964 Appendix 4 shows the working methods employed and discusses the probable ore reserves based on 22 drill holes drilled by Briseis Tin Consolidated N.L. between 1939 and 1941. These are shown as 1,112,000 cu.yds at 3.20 lbs $SnO_2$/cu yd with low grade overburden of 2,213,000 cu yds at 0.08 lbs $SnO_2$/cu yd and barren overburden of 6,414,000 cu yds.

Only minor exploration of no consequence has been carried out since this time.

In addition, from the sections, an additional 300 tonnes of contained $SnO_2$ may be inferred thus giving a total of approximately 2,000 tonnes of contained $SnO_2$.

## 3. Scotia

The Scotia Deep Lead was worked prior to 1924 at its southern end. Since that time no production has taken place.

From 1941 to 1943 the Tasmanian Government drilled approximately 74,000 ft. of percussion drill holes and defined a volume of 4,383,203 cu yds containing 951 tons of cassiterite.

In 1965 Storeys Creek Tin Mining Company bored 16 holes to check selected blocks of the ore reserves.

They concluded that:

a. the accuracy of their own boring is in doubt.
b. the Government results should be used for final evaluation,
c. that sufficient holes should be bored to establish the reliability of the Government results.

From 1971 to 1973 Blue Metal Industries (B.M.I.) carried out an auger and percussion drilling programme.

Auger drilling was used to define the channel whilst percussion boring was used to test for values.

Their programme was designed to:

a. check the reliability of the Mines Department drilling, and
b. to trace the channel north of the intensive drilled areas for information on untested areas.

B.M.I. work confirmed the reliability of the Mines Department drilling but failed to find any new areas.

B.M.I. show reserves of which sections are considered "measured" as 5,257,039 cu yds wash containing 1968 tonnes of tin metal with an overburden of 16,050,918 cu yds at a $30^0$ batter angle, the overall grade being 3.26 oz tin metal per cu yd.

816017

B.M.I. omitted to renew their licence to explore in 1976 and Kibuka obtained the area. C.R. Gibson, consulting for Kibuka was commissioned to:

1. recalculate the ore reserves based on the old drilling,
2. to delineate the distribution of cassiterite,
3. to establish the overburden ratio, and
4. to define the ground conditions of the overburden.

Gibson's report Appendix 5 summarised the results of measured ore, as 1,287,851 cu yds with a grade of 35.34 oz $SnO_2$/cu yd for a total of 1,270 long tons of Cassiterite with an overburden to ore ratio of 6.35:1 at a batter angle of $45^{o}$.

## 4. Exploration Licence 28/76

This covers the Briseis area and also several other known leads, notably the Valley lead which produced 519 tons of Cassiterite to 1909.

Working of this lead was stopped due to the coarse shingle not running to the pumps from the monitors. Approximately 50 ft of shingle was reported to be left at the bottom of the old workings with an inferred volume of 900,000 cu yds at 0.5 lbs $Sno_2$/cu yd but with a suggestion that the grade could be closer to 1.2 lb/cu yd since drilling was difficult in the coarse shingle.

816018

5. Exploration Licence Application 2/77

This covers the Pioneer and Ringerooma basin areas in which several known tin areas are located.

A report on the Sub Basaltin Tin Deposits of the Ringerooma Valley by P.B. Nye the Government Geologist in 1924 gives an outline of most of the major deposits in the area, Appendix 6.

6. Dorset Dredge

Kibuka has made a down payment of $5,000 with an option to purchase the Dorset dredge for $40,000, at present located in a worked out portion of the present Ringerooma River approximately 1.5 kilometres from the Scotia area.

The bucket dredge has a digging depth of 50 ft and can treat approximately 270 cu yds/hour. Although it is possible that, due to relocation costs, it is not economic to move, nevertheless it contains jig treatment capacity, pumps and other useful equipment which could be required at the operations.

816019

## GEOLOGY OF THE PIONEER MINE AREA

It is essential to have a background of the physiography of the area, i.e. the treatment of the areas geology. The Pioneer Mine is only one of many "deep leads" (buried stream courses) along a 100 kms stretch of country traversed by the present Ringarooma River and its buried ancestral course it is thus fitting that the physical aspects and geology of the whole area can be described in order to gain some background to this deposit.

### Physiography

The Pioneer Mine lies in the Ringarooma Valley mid-way between two other townships - Derby 16 kms to the SW and Gladstone a similar distance to the N.E. The Ringarooma River is the main drainage system for the central part of N.E. Tasmania. Its source is on the southern flank of Mt. Maurice which is a peak on the east-west mountain range which forms the southern boundary of the River Valley. The valley runs in a general NNE direction and contains a number of townships along its course, viz. Ringarooma, Ledgerwood, Branxholm, Derby, Herrick, Pioneer and Gladstone - all of which have a history of tin production.

At Gladstone, the town furtherest from its source and near the coast, the River flows close to the southern side of Mt. Cameron (a granite massif) and rounding it changes direction sharply to flow northwards into Ringarooma Bay on the north coast.

The valley which is approximately 65 kms in length is bounded to the north by a low range of hills which is the divide between the Ringarooma

816020

Valley and the north flowing rivers of Boobyalla and Great Forester. The range to the south of the valley is much higher and extends from Mt. Barrow in the west through Mt. Victoria easterly and beyond through the Tier Range to Mt. Pierson on the east coast.

Geology

There are four main rock types in the area :

(1) Cambro-Ordovician Sediments,

(2) Devonian Granites,

(3) Tertiary Sediments containing the alluvial five "deep leads", and

(4) Tertiary Basalts.

(1) The slates and sandstones of Cambro Ordovician age are centred to the upper reaches of the Ringarooma Valley from Derby westward. Eastward from Derby the river traverses granite basement rock. They are steeply folded and metamorphosed at their contact with the granite.

(2) The granite is the predominant rock type of the area. It forms the main range to the south of the valley,also the Mt. Cameron massif in the east where the river passes to the south of Mt. Cameron between it and the granite Tier range to the south. Petrologically the "granite" is a granodiorite.

The alluvial tin (cassiterite) which derived from the granite originated in griesens, altered granite and pegmatites, several occurrences of which have been found and mined in the mountains to the south. Gold mineralisation also occurs in the area more usually associated with the contact areas and the Cambro-Ordovocian sediments, other minerals associated with the cassiterite are topaz, zircon,monazite, tourmaline and sapphire. The latter are rare and few quality stones are found infrequently.

(3) Overlying the Cambro-Ordovician rocks and granite basement of the valley are tertiary sediments. These are made up of basal conglomerates, gravels, grits, sands and clay bands all of which have been derived from the sediments and granite. The tertiary sediments are horizontally laid down over the basements. These sediments were laid down under lake and sub-aerial conditions in the elongated valley depression. They consist of erosion products mainly from the granites to the south and some Cambro-Ordovician sediments especially the hard metamorphosed components. The diastrophism which lowered the valley floor and blocked its entrance in early tertiary times was probably followed by fairly wet conditions giving rise to rapid juvenile erosion and transport of the basal conglomerate wash including cassiterite and associated heavy minerals. Subsequent periods of flooding and deposition also deposited eroded material in the valley including cassiterite but not to the same extent.

The drilling at Pioneer indicates a fairly regular section about 120 ft. in thickness to basement granite. The upper 30 ft. is composed of silty sand with a partially cemented grit section carrying some low tin values between the surface and 25 ft. below. The next 60 ft. below the upper surface comprises sand grits and minor bands of clay carrying very low values of tin. The lowest section, which averages 40 ft. of section and lies on the basement, is generally composed of quartz grits and sand with interbedded clay bands followed by pebble and conglomerate wash (up to 6" stones) in a matrix of yellow stained grit sand and clay. This basal wash carries the interesting tin values, occassionally a little lignitised wood and some fine and nodular pyrite report in the basal section to the exclusion of tin values.

(4) In late tertiary times basaltic lavas flowed over and covered the tertiary sediments burying the tertiary Ringarooma river drainage system in several sections more particularly in the upper reaches above Herrick and Derby. The basalt flows which came in from the north edged the Ringarooma River course southward and raised the bed of the valley well above its old floor. At the present time the Ringarooma River bed is approximately 40 ft. above its ancestral course bed.

The Alluvial Deposits

The alluvial deposits of cassiterite (the Pioneer Mine deposit is one of them) which were laid down by the ancient water courses are now buried below varying thicknesses of newer sediments: hence their label of "deep leads". The best concentrations of cassiterite in the deep leads are associated with the ancient creeks and rivers draining the mineral areas of the granite to the south. The present southern creek courses are unchanged from early tertiary times and it is these valleys which in some cases contain the richest buried deposits - deep leads. Similar deposits also occur in places along the ancient Ringarooma course - located at Pioneer some 2 miles west of the present course. In some instances interesting and rich cassiterite deep leads within the course of the ancient river have been further buried by the basalt flows (Briseis Mine at Derby) of up to 200 ft. in thickness. Exposure of this lead in the deep channel of the present Ringarooma River at Derby fortunately exposed a portion of this concentration which developed into a very rich mine - the Briseis Tin Mine.

The whole length of the valley has been fed erosional products from the granites to the south and the Mt. Cameron granite mass. It is not surprising therefore to find that deep leads received a considerable amount of cassiterite and other heavy minerals along the whole length of the valley from Branxholm in the west to beyond Gladstone to the coast where in Ringarooma Bay deposits of tin have been found at shallow depth under the sea bed. A great number of alluvial tin deposits have been found, mined and dredged over the years.

The Pioneer Deep Lead

The former if not present name of this deep lead is the "Wyniford Lead" because of its parentage and origins in the Wyniford River, a past and present tributary of the Ringarooma River which drains the granite hills of the Weld to the south.

The deposit was discovered before the turn of the century. It was recognised as a deep lead at this time and developed by the Pioneer Tin Mining Co. which mined it for more than 30 years producing a total of some 9,093 tons of cassiterite grading 1.43 lbs/cubic yard. This included the very low grade overburden in the early days.

The deposit runs in a westerly direction beginning at the junction of the Wyniford River and the present Ringarooma River. The floor of the Wyniford lead is some 40 ft. below the level of the bed of the Ringarooma River at this point.

At the present time tailings from the Pioneer Company's workings mark the trace of the lead which has been mined out for a distance of approximately 1.2 kms down lead. The present face of the pit is in tin values contained in 30 - 40 ft of basal wash and drift sitting on the granite floor.

A 30 - 40 ft section of drift sand with minor intercalated clay bands occurs above the mineralised wash section. The overlying ground of some 25 - 30 ft. comprises a foot of soil at the surface with a slightly cemented gritty sand band of 5 - 10 ft. followed by gritty and sandy drift.

Drilling both ahead of the face and ground already mined has provided data on which to draw a basement contour plan. This plan indicates a local constriction of the deep lead valley about 600 yards ahead of the face, i.e. westward and downstream along the deep lead. On limited drilling information available beyond this point it would appear that the valley there opens up into a wider basin with the possibility of a branch lead (Gladstone) entering the main Wyniford Lead from the south. The implication of this constriction and the entrance of another flow of water is that the detrital carrying capacity of the Wnyiford

Lead river would be reduced on the downside end of the constriction resulting in the deposition of its load of erosional products including cassiterite. If this should happen to be the case there could be a slightly increased concentration of mineral at the upper end of the "basin".

Geophysical sounding for the basement followed by drilling could possibly outline the basin, the constriction and the confluence point of the Wyniford and "Gladstone" leads.

Discussion

(1) Additional to the ground already drilled for which a measured reserve figure can be calculated there is a strong possibility that economical concentrations of cassiterite continue to occur along the trace of the Wyniford Lead to the west.

(2) Unfortunately the overlying ground in the downstream direction of the lead rises in elevation with the effect of increasing the overburden.

(3) A further possible and probably a worthwhile target for exploration would be the junction (or just above it) of the Wyniford deep lead and the old Ringarooma deep lead. The conditions for pile-up of and slow-down of the Wyniford lead river waters during floods (and the best detrital transport occurrences) would be most favourable to the deposition of mineral at this position. On projection the target area would be at the intersection of the present surface Gilham Creek and the Wyniford deep lead a distance of approximately 1 mile beyond the present face of the

816026

pit. The depression of Gilham Creek will ameliorate the overburden factor slightly.

(4) It is not possible for available data to pin point the confluence of the Gladstone and Wyniford Leads but this is an area of interest because of the natural conditions of sedimentation and drop out of material at a water pile-up point.

NOTE:

A geological plan of the total area is not yet available. Therefore included is a Geological Sketch Map of the Ringerooma Valley by P.B. Nye 1924 - plan 3.

Basement contour plans of the area of interest are still under construction.

816027

## AREA PROGRAM

Since the Pioneer mine is currently operating with low cost self generated hydroelectricity and large supplies of pressurised water it was decided to take an option over this mine, check its ore reserves by drilling and if justified commence production, using it as a base to further explore the immediate vicinity and then the whole area with a view to expanding into the other deposits.

The immediate target was approximately 500 tonnes of contained cassiterite based on Kibukas drilling with a strong probability of at least this amount again based on the Austral Malay drilling.

## PIONEER DRILLING PROGRAM

The 18 boreholes drilled by Austral Malay in 1935 were surveyed in from the old plans by J.W. Cohen and Associates Registered Surveyors of Launceston. Plan 2. It was decided to check one of these holes with a new borehole, and if this showed a close correlation in depth, and values, then to infil drill on the original grid at closer intervals.

The attached plan 2 shows the positions of the Austral Malay holes numbered 1 to 18.

The Kibuka drilling using 2 percussion cable tool drill rigs with 5" and 6" casing is a check drill hole at Site 1 together with holes at Sites 19 to 29 excluding 27 and 28. Plan 2. A second check hole at Site 22 (high grade) was later bored by the other drill and supervisor to check the accuracy of Kibuka's own drilling.

A comparison of the two drill holes at site 1 is as follows:

| | Depth to Basement | Grade lbs SnO2/cu yd |
|---|---|---|
| Austral Malay (No.1) 1935 | 105' | 0.65 (72% Sn) |
| Kibuka (No.1) 1977 | 111' | 0.87 (70% Sn)<br>(calc'd to 115) |

N.B. Depths logged to basement can vary by a few feet since the basement is a weathered granite and in a wet percussion drill hole some mixing of the granite derived alluvials and basement occurs. Since the Kibuka hole 1 checked with the Austral Malay hole 1, it was assumed that the Austral Malay results of 1935 in their other boreholes were substantially correct. Therefore, Kibuka commenced drilling infil holes on the original Austral Malay grid. Although Kibuka has finished drilling its initial eleven holes full sampling and assays are not yet completed.

The drilling results to-date and an assessment of them are therefore shown in a separate report attached Supplementary Report on Drilling Results to-date, at Pioneer Mine 12.3.77.

## SAMPLING PROCEDURE

Drilling progressed by drilling the casing approximately 2 feet and then sampling by means of a cable held sinker bar with a clap valve to within ½" to 1 foot behind the casing.

To avoid run ins, the hole was kept almost full of water.

A few run ins were experienced in the centre sections of some holes but mainly the ground gave little trouble.

Samples were collected from 5 feet intervals and put in measuring drums to ascertain the volume of material extracted. In much of the drilling, less volume was obtained than the theoretical volume of the casing. In some cases, this was observed to be due to the casing not receiving material when being driven (noted from the depth to bottom before and after drilling). This was caused by the intercalated bands of pug (clay) and gravel drift. At other times it was observed that some of the clay went into suspension shown by decanting the water from the measuring drums and allowing it to settle in seapage ponds and then measuring the residue. Furthermore, some clay was left in suspension in the drilling water on completion of the hole.

It should be noted that some of the clay would occur as naturally filling the interstices between the gravel particles and this would tend to alleviate the problem of clay loss in suspension.

Since the method of assessing the grade of this type of deposit is by a weight of concentrate per volume of material, an accurate volume from which the weight of concentrate is derived is critical.

Therefore the procedure adopted was as follows:

Samples of 5 ft sections of the hole were taken during the drilling. These samples were put into measuring drums, allowed to settle and their volume measured. The sample was then washed in a cradle to remove the + 3/8" coarse material and the clay. This left a fairly clean gravel and sand.

The concentrate from the cradle was then washed over a small five gate sluicing box, from which a heavy mineral concentrate was obtained. This was then panned to produce a higher grade concentrate.

The concentrate was dried and the magnetics extracted. The remainder was weighed and sent to the Mines Department, Launceston for a Tin Assay and at Fox Laboratories Sydney for quicker service.

The grade was first calculated by taking the weight of concentrate, multiplying by the Tin Assay and dividing by 70% to convert to standard $SnO_2$ and dividing by the actual cubic yardage of material pertaining to that sample.

However, since the volume of clay in situ not infilling between the gravel particles is difficult to assess, a conservative view was adopted whereby the volume of ground, when below the theorectical pipe volume, was taken as the theoretical pipe volume. When above the theoretical pipe volume the actual volume was taken. Both results are shown but the corrected grade is used in all reserve calculations.

Check assays were carried out by Fox Laboratories and O.T. Lempriere Sydney.

SECURITY

A company employee logged each hole during drilling and took all samples, The depths of each hole were logged overnight and are shown on the individual hole assay sheets to guard against overnight salting. All sample washing and panning was carried out by C.R. Gibson and a company geologist using a secure padlocked shed for overnight storage. No attempt or inference of salting has been detected.

ADDITIONAL POSSIBLE RESERVES

1. As may be seen from attached plan 2, the ore potential to the North and Northwest is open and it is reasonable to assume that the old river basin follows this direction.

2. Two Austral Malay holes No. 8 and 9 to the South of the present area show depths and values of 146 ft at 0.2 lbs/cu yd and 164 ft at 0.28 lbs/cu yd respectively. This area holds distinct possibilities for several million yards of similar grade. An old lead approximately 1.5 kilometres away appears to lead in this general direction and could be the source of these values.

3. To the North of the old pit area which is due east of the delineated reserves there is a shallower deposit from 55 to 80 ft deep which has several old holes in it going from 0.15 to 0.29 lbs/cu yd. Again this area holds promise of several million yards of similar grade.

4. Old tailings dumps contain practically all the 14,000,000 cu yds treated from 1900 to 1930 by sluice boxes.

   Although the reported recovery was 93% of the original borehole values it is not unreasonable to assume that the recovery was only

85% to 90% of the true insitu grade i.e., the original borehole values were low.

N.B. This is not uncommon in the district, as an example B.M.I. recovered considerably more tin at their limited Monarch operation than their original bore results showed.
*Since the recovered grade averaged 1.435 lbs $SnO_2$/yd during that* time, a residual grade of between 0.16 and 0.25 lbs/cu yd can be inferred.

Obviously all the above possibilities need checking. There is sufficient potential however to suggest much larger volumes than are currently shown.

In summary considerable potential exists for an additional $\pm$ 25,000,000 cu yds at $\pm$ 0.25 lbs $SnO_2$/cu yd.

ORE LOCATION

At present the boreholes show that the deposit is $\pm$ 120 ft deep and that the majority of the cassiterite is concentrated in the bottom 20 to 40 ft with some finer material in the top 10 to 15 ft.

## MINING

If the current drilling is satisfactory, mining will commence at the current pit face i.e., due east of the ore reserve block. The following gives the probable sequence of mining together with anticipated capital and operating costs.

## STRIPPING

Initially overburden will be stripped by means of a dozer or dozers pushing the gravel up to 200 ft to a relocatable grizzly trommel arrangement (buried loader) from where it is slurried and pumped to the waste pile at high pulp density.

This unit which is currently rated at 300 cu yds per hour together with the caterpillar D8 dozers is available ex Kibukas beach sand operation on King Island. It has a known performance and operating costs under very similar conditions and can be upgraded to up to 500 cu yds/hour.

## IN PIT SAMPLING

Short Gemco sample auger holes will be used in the pit as the deposit is cut down by the dozers to ensure that any lenses of cassiterite in the overburden are pushed to the ore monitors.

## ORE MINING

After stripping, the underlying ore grade material will be monitored by high pressure 150 p.s.i. water jets to a gravel pump sump whence it is pumped over a screen to a series of 4 double Juba type jigs and 1 double cleaner jig with a capacity of 120 cu yds per hour.

Any surface ore grade material will be pushed to the nozzle face during stripping.

This equipment is presently installed. However, it is considered that either two or three automatic monitors together with a new vertical suction gravel pump will be required to ensure continuous throughput, minimal downtime and easier manning. Depending on the rate of overburden stripping and monitoring additional jigs may be installed.

## TAILINGS DISPOSAL

Treated gravel is at present allowed to run into the tails area within the confines of the old pit. This system may be continued, however one or possibly two settling ponds will be installed prior to tailings water entering the river.

METALLURGY

The gravel is currently pumped from the pump up 96 ft head to a 1 inch screen to remove oversize and thence to 4 double Juba type primary jigs. The concentrate being cleaned on a double Juba type cleaner jig.

Depending on testwork, on size analysis and distribution it is intended to change the present screening system by installing a rotary trommel with a finer mesh screen to remove much of the +¼" - 1" gravel before entering the jigs. This should benefit the jig operation. In addition it is possible that a hydrosizer might be installed ahead of the jigs to size the feed. This would allow the fine fraction which is assumed to be lost at present to be removed and treated by other means.

Since the material at the top of the deposit is fine grained brown tin, which is not treated by the present operation, modification to the plant to recover this should give immediate advantages.

It is probable that there is insufficient water available to monitor the entire overburden face and this is why the mining method consists of stripping to a waste pile. In addition at the required production rate there would be inadequate jig treatment capacity. However this material does contain cassiterite from 0.02 to 0.10 lbs/cu yd.

Testwork will therefore be carried out to ascertain whether this material can be pumped as a scavenger operation over either additional jigs or trays (already owned by Kibuka - 300 yds/hour capacity). The incremental cut off for a scavanger operation could be as low as 0.03 lbs $SnO_2$/cu yd.

RECOVERY

Historically the Pioneer company recovered 93% of their bore values. However, in the area it is not uncommon to obtain greater than 100% of bore values. Since the Kibuka drilling is corrected to a theoretical pipe volume i.e., conservative whereas the old Pioneer companies drilling was not, the Recovery is taken as 93% of Kibuka's corrected bore values.

ENVIRONMENTAL CONTROL

The mining lease at Pioneer is a granted operating lease.

Kibuka does not expect any problems with the Department of the Environment but will ensure that low solids overflow water enters the local river by installing one or two extra settling ponds between the current tails area and the river.

The other areas are subject to an Environmental Impact Study, however no major problems are envisaged with a mining operation underway and the local people are solidly in favour of mining. Rehabilitation of mined out areas can proceed as part of the mining.

N.B. Kibuka has experience in rehabilitation in its beach sand mine on King Island.

POWER

The Pioneer Mine has its own hydroelectric power station consisting of 3 x 450 KVA (rated capacity) Voith generators driven by Pelton wheels with a 210 p.s.i. head of water. The water is obtained from a 420 million gallon dam.

The power is produced at 6500 V and then transformed up to 22,000 V and fed into the Tasmanian Hydroelectric commission grid and then taken out at the minesite and transformed down to 450 V.

At present the power station is operated on dayshift only with one attendant. On afternoon and nightshift the pit drainage pumps are run on the Tasmanian hydroelectric commission power at an effective rate of 1.16 cents per KWH. This is because the power station has no automatic alarm and Lightning controls.

It is intended to automate the power station so that it satisfies the total mine power requirements. Since the attendants house is nearby this is considered practical.

Adequate supplies of water are available to increase generating output.

## WATER SUPPLY

A 420 million gallon dam feeds the power station. After leaving the power station the water travels via a race and a 270 ft head 40" inverted syphon column to a holding dam where it runs, via 40", 30" and 20" pipes through a vertical head of 300 ft to the mine workings.

It is considered that at least 7500 g.p.m. is continuously available with some additional capacity at times of extra rainfall. It is possible that this quantity could be considerably increased by the diversion of another river above the dam at little cost.

## SMELTER SCHEDULE AND PRICE

### Price

Price assumed is £5000/metric tonne tin metal L.M.E. at

$A1.55 = £1

Australian Price = $A7750.

816040

## SMELTER SCHEDULE

A copy of a smelter schedule from Associated Tin Smelters Pty.Ltd., in Sydney is shown as Appendix 7. It is believed these terms can be improved upon. Using the statement of value and adjusting the tin metal price to $A7750 ex works Sydney and including transport charges from mine site to smelter , the net return at mine site is:-

| | |
|---|---|
| Agreed assay | 73.80% |
| Less penalties | - |
| | 73.80% |
| Less unit deduction | 1.12% |
| | 72.68% of $A7750 |

= $A5632.70 per tonne.

| | |
|---|---|
| Less treatment charge | $A 117.30 |
| Penalty for impurities | $A - |
| Ore bag charges | $A 5.00 |
| Transport minesite to Smelter Including Govt.Freight subsidy | $A 33.00 |
| = | $A 155.30 |
| | $A5477.40 per tonne ex Minesite |
| Adjusted to standard 70% Sn as used in ore calculations. | $A5195.37 |

816041

CAPITAL COST (Provisional)

| | | |
|---|---|---|
| 1. | Purchase price of property | $150,000 at 31.3.77 |
| 2. | Onsite location of Mining machinery | $ 20,000 |
| 3. | Automation of power station | $ 5,000 |
| 4. | New 14/12" gravel pump and motor | $ 53,000 |
| 5. | Installation of screens, hydrosizer and additional jigs if required. | $ 10,000 |
| 6. | 3 automatic face monitors and face pipes | $ 40,000 |
| 7. | Feed arrangement at concentrate treatment plant | $ 3,000 |
| 8. | Floodlights | $ 3,000 |
| 9. | Working capital (6 weeks operation) | $102,000 |
| 10. | Contingencies 10% excluding purchase | $ 22,000 |
| | TOTAL CAPITAL - | $408,000 |

OPERATING COSTS

Operating costs are conservative and are based on similar operations by Kibuka and known costs in the Pioneer area.

All mining and treatment will be on a 3 shift 7 day/week basis manned on 4 shifts of 5 days each.

It is possible that overburden stripping may be conducted on 6 days only. However, the costing allows for continuous operations.

All manning costs include an allowance of 27% to cover workers compensation, payroll tax, sick leave, annual leave, and public holidays.

Buried Loader Operation (overburden stripping)

1. Cost is based on that from operations on King Island during the past year where the material mined was indurated pebbles and sand and the pumping distance and head were 1000 to 1500 ft and 70 to 80 ft respectively.

   These are similar distances and heads to those envisaged at Pioneer. Pioneer has more clay than the Kibuka beach sand deposit but visual inspection during drilling suggests that the section of the deposit's overburden to be dozed is as amenable to dozing as Kibukas indurated sand.

816043

The maximum dozer leads at King Island were up to 300 ft due to the relatively shallow depth of the deposit with an uphill push for the bottom 15 ft., whilst the dozer leads at Pioneer will be 150 to 200 ft. max with no uphill dozing as the buried loader will be recessed in a slot in the ore bearing gravels. All dozing will therefore be downhill or flat.

It is also probable that the main pump on the buried loader can be converted from a diesel to an electric motor to take advantage of the cheap power.

2. Mining face monitors will be automatic. One man will be able to control them from the safety of the gravel pump housing, whilst a second man is required to run the jigs. In addition 2 men are allowed for a dayshift gang - when not required for moving face pipes they will do inpit ore control drilling.

Operating Time

20 hours per day
28 days per month
12 months per year

on an annual basis excluding 11 public holidays this represents a running time of 79%. This is considered easily attainable.

Production Rate

| | | |
|---|---|---|
| Mining | 150 cu yds/hour | 1,008,000 cu yds / year |
| Stripping | 300 cu yds/hour | 2,016,000 " " |
| | | 3,024,000 " " |

3. Power is costed at 1c/kwh although it is reasonable to expect that the automated power station with minimal manpower will generate power for between 0.4 c and 0.6c/kwh.

MONTHLY OPERATING COSTS

Stripping Costs

Labour -

| | | |
|---|---|---|
| 4 dozer drivers | 4833 | |
| 4 operators | 4667 | |
| 1 foreman | 1587 | |
| 1 maintenance | 1481 | |
| TOTAL LABOUR - | | 12,568 |

Operating and Maintenance -

| | | |
|---|---|---|
| Materials dozing | 9311 | |

Operating and Maintenance -

| | | |
|---|---|---|
| Materials pumping | 5428 | |
| Power allow 1c/KWH | 1680 | |
| TOTAL MATERIALS - | | 16,419 |

816045

Mining and Treatment

| | | |
|---|---|---|
| 4 face operators | 4667 | |
| 4 jig operators | 4667 | |
| 2 dayshift pipe movers | 1900 | |
| 1 foreman | 1587 | |
| 1 maintenance | 1481 | |
| TOTAL LABOUR - | | 14,302 |

Operating and Maintenance

| | | |
|---|---|---|
| materials | 6036 | |
| power allow 1c/KWH | 3360 | |
| TOTAL MATERIALS - | | 9,396 |

Tin Dressing

| | | |
|---|---|---|
| 2 operators | 1900 | |
| materials | 700 | |
| | | 2,600 |

1 Operator water race

| | | |
|---|---|---|
| maintenance & rehabilitation | 950 | |
| | | 950 |

Exploration and drilling -

| | | |
|---|---|---|
| 1 geologist/engineer | 1058 | |
| 2 drillers | 1900 | |
| materials | 1400 | |
| | | 4,358 |

816046

Overheads -

| | | |
|---|---|---|
| Manager | 1905 | |
| Secretary/Accounts | 950 | |
| Mining & Water Lease Rentals | 200 | |
| Insurance | 1500 | |
| External Audit | 1000 | |
| Bank Charges | 100 | |
| Communications | 500 | |
| Stationery | 200 | |
| Travelling, etc. | 1000 | |
| | | 7,355 |

| | |
|---|---|
| Depreciation | 12,500 |

TOTAL COST OF OPERATIONS - $80,448

Cost per total cu yd mined = 32¢

## CUT OFF GRADES

At a net price of \$2.36/lb $SnO_2$ (70%Sn), a 93% recovery, and a stripping ratio of 2:1 the total hole cut off grade (Assuming nil value in overburden is 0.146 lbs $SnO_2$/cu yd.)

The incremental (internal) cut off grade (see section on Metallurgy) could be as low as 0.03 lbs $SnO_2$/cu yd.

However, there is a limitation on present plant capacity and probable water availability.

Therefore to keep the overburden stripping operation at high efficiency the incremental cut off grade has at present been taken as 0.10 lbs $SnO_2$/cu yd where the ground is in proximity to the bottom high grade values. This helps to keep the bottom of the overburden stripping at a reasonably constant elevation whilst ensuring that minimal cassiterite is lost in the waste pile.

## REVENUE

Since the drilling results are not yet complete Revenue calculations at 5 different grades are shown:-

For a treatment of 1,008,000 cu yds of wash and stripping of 2,016,000 cu yds of overburden.

| Total Hole Grade lbsSn02/ cu.yd (70%Sn) | Recovered Grade lbsSn02/ cu.yd (70%Sn) | Annual Cassiterite Production Tonnes 70% Sn | Annual Net Revenue $5195.37/ tonne Net Mine Site | Annual Cost $ | Net Royalty $ | Annual Net Profit before Tax. $ |
|---|---|---|---|---|---|---|
| 0.20 | 0.186 | 255 | 1374819 | 965376 | 17972 | 341471 |
| 0.25 | 0.233 | 320 | 1662518 | " | 33250 | 663892 |
| 0.30 | 0.279 | 383 | 1989826 | " | 39796 | 984654 |
| 0.35 | 0.326 | 447 | 2322330 | " | 46446 | 1310508 |
| 0.40 | 0.372 | 549 | 2852258 | " | 57045 | 1829837 |

## NOTES

1. Tasmanian Government Royalty is 5% of net profit or 2% of gross proceeds whichever is the less.

2. The total hole grade assumes nil grade in the overburden area since no attempt is made to recover this tin.

816049

SUPPLEMENTARY REPORT

Drilling Program to Date
at Pioneer Mine, 14-3-77

by

K. Piggott

March, 1977

816050

CONTENTS



APPENDICES

816051

# SUPPLEMENTARY REPORT

## Drilling Program to Date at Pioneer Mine, 14-3-77

by

K. Piggott

March, 1977

816052

SUPPLEMENTARY REPORT

Drilling Program to date at Pioneer Mine 14-3-77

PROGRAM

The 18 boreholes drilled by Austral Malay in 1935 were surveyed in from the old plans by J.W. Cohen and Associates Registered Surveyors of Launceston. It was decided to check one of these holes with a new borehole, and if this showed a close correlation in depth, and values, then to infil drill on the original grid at closer intervals.

The attached plan 2 shows the positions of the Austral Malay holes numbered 1 to 18, together with the surface elevation in metres.

The Kibuka drilling using 2 percussion cable tool drill rigs with 5" and 6" casing is a check drill hole at Site 1, together with holes at Sites 19 to 29, excluding 27 and 28.

A comparison of the two drill holes is as follows:

| | Depth to Basement | Grade lbs $SnO_2$/cu yd |
|---|---|---|
| Austral Malay (No.1) 1935 | 105' | 0.65 (72% Sn) |
| Kibuka (No.1) 1977 | 111' | 0.88 (70% Sn) |

 816053

N.B. Depths logged to basement can vary by a few feet since the basement is a weathered granite and in a wet percussion drill hole some mixing of the granite derived alluvials and basement occurs. Since the Kibuka hole 1 checked with the Austral Malay hole 1, it was assumed that the Austral Malay results of 1935 in their other boreholes were substantially correct. Therefore, Kibuka commenced drilling infil holes on the original Austral Malay grid.

Kibuka also drilled a second check hole at their own site 22. This hole choked up badly between 108' and 110' and although the casing was advanced to 121' no sample could be obtained of the ground below approximately 109'. The check hole calculation sheets show a small volume of ground recovered from 110' - 115' and 115' - 120' but this must apply to the 108 - 110' area since the casing pushed a clay plug down, when being advanced, i.e., material did not enter the casing over this distance. Subsequently, on removing the casing it was found to be plugged by a section of hard clay which the lighter weight 5" check drill had compacted, acting as a plug in the end of the casing.

Midway through Kibuka's drilling program the results of 15 holes drilled by Storeys Creek in 1961 were found in the Mines Department Archives. One of their holes No. 4 was located at the same position as the Austral Malay site 1 and the Kibuka site 1.

Storeys Creek showed 104 ft at 0.26 lbs $SnO_2$/cu yd (no tin percentage shown).

Since this result was much lower than both the Kibuka and Austral Malay results, enquiries were made as to the reliability of Storeys Creek drilling. In discussion with L.W. Morris, a retired mines inspector from Burnie, the writer was informed that the sampling of this drilling was not performed correctly by the drillers at the time, who were on a footage contract doing their own sampling. Since he had observed on inspection, cassiterite still lying in the cuttings around the boreholes at that time. This appeared a logical explanation and Kibukas drill program was continued. However, a second Kibuka hole No.19 has given a grade of 0.27 lbs/cu yd whilst a Storeys Creek hole No.2 drilled at approximately the same location shows 0.33 lbs/cu yd. Due to the slowness in panning and assaying Kibukas result has only recently come to hand. It should be noted that if Kibuka use the same method of calculating the whole hole value as Storeys - Creek i.e., using uncorrected pipe volumes then the Kibuka result would be 0.34 lbs/cu yd (assuming a grade of 0.05 lbs/cu yd for the Centre section of the hole not assayed).

As these two holes substantially check, this causes some doubt as to the value of the other Austral Malay holes Nos 4, 5 and 6 where Storeys Creek holes are drilled in the same location, since additional potential is thought to exist here.

816055

A comparison of that drilling follows:

| Austral Malay | | | Storeys Creek | | |
|---|---|---|---|---|---|
| Hole No. | Depth | Grade lbs $SnO_2$/Cu yd | Hole No. | Depth | Grade lbs $SnO_2$/Cu yd |
| 4 | 132' | 0.50 | 7 | 122' | 0.24 |
| 5 | 137' | 0.54 | 9 | 119' | 0.22 |
| 6 | 127' | 0.21 | 11 | 128' | 0.14 |

As may be seen the two high grade Austral Malay holes are deeper and this indicates that the Storeys Creek drilling didn't bottom.

It is however, a reasonable assumption that the grade of the ground in this area lies in the region from 0.2 to 0.5 lbs/cu yd - a considerable discrepancy but still payable.

816056

KIBUKA DRILL HOLE SUMMARY

| HOLE NO. | ORE DEPTH FT. | PROBABLE ORE VOLUME CU YDS | CORRECTED GRADE LBS $SnO_2$ (70% Sn) PER CU YD. | TONNES CONTAINED $SnO_2$(70%Sn) | OVERBURDEN DEPTH FT. | OVERBURDEN VOLUME CU YDS | STRIPPING RATIO | TOTAL HOLE DEPTH | TOTAL HOL GRADE LBS $SnO_2$ (70%) PER CU YD |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 50 | 201666 | 1.97 | 180 | 65 | 262167 | 1.3:1 | 115 | 0.87 |
| 19 | 50 | 201666 | 0.55 | 50 | 55 | 221833 | 1.1:1 | 105 | 0.26 |
| 20 | 55 | 221833 | 0.60 | 60 | 60 | 242000 | 1.1:1 | 115 | 0.29 |
| 21 | 50 | 201666 | 0.65 | 59 | 80 | 322667 | 1.6:1 | 130 | 0.25 |
| 22/22CHECK | 60 | 242000 | 1.54 | 169 | 70 | 282333 | 1.2:1 | 130 | 0.71 |
| 23 | 55 | 221833 | 1.19 | 120 | 95 | 383167 | 1.7:1 | 150 | 0.44 |
| 24 | 30 | 121000 | 0.45 | 25 | 100 | 403333 | 3.3:1 | 130 | 0.10 |
| 25 | 55 | 221833 | 0.38 | 38 | 75 | 302500 | 1.4:1 | 130 | 0.16 |
| 26 | Results not complete | | | | | | | | |
| 29 | Results not complete | | | | | | | | |
| Total incl. hole 24 | 50.6 | 1633497 | 0.95 | 701 | 75 | 2420000 | 1.48:1 | 125.6 | 0.38 |
| Total excl. hole 24 | 52.1 | 1512497 | 0.99 | 676 | 71.4 | 2016667 | 1.33:1 | 125.0 | 0.43 |

816057

NOTES TO DRILL HOLE SUMMARY

1. Corrected Grade is the WT of 70% Tin concentrate recovered, divided by the Theoretical Pipe Volume of the Bore Casing, when the volume recovered is lower than the theoretical pipe volume. When the volume recovered is above the theoretical pipe volume, the corrected grade is calculated using the actual volume recovered. This method is conservative but allows for the fact that where actual volumes recovered from the drilling are lower than theoretical some clay could be lost in water suspension (i.e., not measured). It has been observed in some cases that clay intermittently plugging the Borehole casing does cause low recoveries.

2. It is practice to drill at least five feet into the basement to ensure bottom is reached. Some cassiterite carries over into this section. The weight of cassiterite in this section is therefore added back to the lower ore section when calculating the average grade for that section.

3. Hole 22 and 22 Check are averaged down to 110' whilst below this hole 22 values are taken.

| INTERVAL | FT. | HOLE 22 | HOLE 22 CHECK | AV. |
|---|---|---|---|---|
| 10' - 15' | 5 | 0.12 | 0.06 | 0.09 |
| 55' - 60' | 5 | Not Assayed | 0.32 | 0.32 |
| 80' - 110' | 30 | 1.22 | 0.89 | 1.06 |
| 110' -130' | 20 | 2.94 | Hole Blocked | 2.94 |
| TOTAL ORE | 60 | | | 1.54 |
| WASTE | 70 | | | - |
| TOTAL HOLE | 130 | | | 0.71 |

816059

## DISCUSSION OF KIBUKA DRILL HOLE RESULTS

The drill holes show a lower tin area to have a consistent thickness of 40 - 50 feet with a further ±10 feet at or near the surface. The waste to ore ratio is generally less than 2:1 although in the hole 24 to 25 area it shows a marked increase.

Kibuka's drilling indicates that the tin bearing ground is regular in thickness over a large area, and also indicates that the grade is higher in the line of holes 1, 22 and 23 with lower grade on the north side in holes 19, 20 and 21.

The average thickness and grade of the lower area is compared below:

| HOLE | THICKNESS LOWER ORE | GRADE lbs/cu.yd $SnO_2$ (70%Sn) | |
|---|---|---|---|
| 1 | 40' | 2.37 | |
| 22/22Check | 50' | 1.81 | Average 48.3' 1.73 |
| 23 | 55' | 1.19 | |
| 19 | 40' | 0.56 | |
| 20 | 45' | 0.67 | Average 41.7' 0.66 |
| 21 | 40' | 0.75 | |
| 24 | 25' | 0.50 | Average 35.0' 0.43 |
| 25 | 45' | 0.39 | |
| Av. incl. 24 | 42.5 | 1.01 | |
| Av. Excl. 24 | 45.0 | 1.11 | |

Results from Holes 26 and 29 are not yet available.

816060

The results also show that the majority of the ore volume and grade is in the lower 40 - 50 ft section. In terms of contained tin ± 90% is in this section.

Within this section there is an enriched layer of up to 20 ft thick, generally at the bottom, although this is not always so.

CONCLUSION

At present using the 330 ft x 330 ft grid, the grades and consistent thickness indicate a volume of ground of 1,633,500 cu yds @ 0.95 lbs $SnO_2$ (70% Sn)/cu yd with an overburden volume of 2,420,000 cu yds, giving an overall stripping ratio of 1.48:1 excluding the batters. This gives contained cassiterite (70% Sn) of 704 metric tonnes, at grades and stripping ratios that are amenable to mining inside the cost parameters as outlined in the main report.

This not only exceeds Kibukas initial requirement of 500 tonnes but indicates considerably further potential for this part of the Pioneer property.

# APPENDIX A

Hole K1

816062

| .(1) | Col.(2) | Col.(3) | Col.(4) | | Col.(5) | | Col.(6) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| MPLE | FROM - TO FT. | DEPTH SAMPLE IN VOL. BUCKET INCHES | VOL. OF SAMPLE COL. (3)x .10225 $FT^3$ | | WT. OF PANNED CONC. GMS. | | TIN ASSAY % SN IN $CONC^T$ | | 70% SN LBS/CU YD NO CORRECTION (5)x(6)x.000851 / (4) | CORRECTED TO PIPE VOL. |
| 2 | 0-6 | 5.55 | 0.567 | | 18.6 | | 45.0 | | 1.26 | 0.81 |
| 3 | 6-10 | 6.05 | 0.619 | | 8.4 | | 21.8 | | 0.25 | 0.18 |
| 4 | 10-15 | 6.15 | 0.629 | | 0.7 | | 22.2 | | 0.02 | 0.01 |
| 5 0/N | 15-20 | 6.60 | 0.675 | | 1.05 | | 24.0 | | 0.03 | 0.02 |
| 6 | 20-25 | 6.85 | 0.700 | | 1.00 | | 23.5 | | 0.03 | 0.02 |
| 7 | 25-30 | 5.75 | 0.588 | | 1.20 | | 26.0 | | 0.05 | 0.03 |
| 8 | 30-35 | 5.75 | 0.588 | | 2.50 | | 37.2 | | 0.13 | 0.09 |
| 9 | 35-40 | 7.20 | 0.736 | | 1.45 | | 38.6 | | 0.06 | 0.05 |
| 10 | 40-45 | 6.80 | 0.695 | | 1.95 | | 21.2 | | 0.05 | 0.04 |
| 11 | 45-50 | 6.20 | 0.634 | | 0.70 | | 15.6 | | 0.01 | 0.01 |
| 12 0/N | 50-55 | 6.50 | 0.665 | | 0.45 | | 19.1 | | 0.01 | 0.01 |
| 13A | 55-60 | 10.3 | 1.053) | | 1.00) | | 17.5) | | 0.01) | |
| 13B | " | 6.7 | 0.685) | 1.74 | 2.80) | 3.80 | 26.2) | 23.91 | 0.09) .04 | 0.04 |
| 15 | 60-65 | 10.3 | 1.053 | | 2.85 | | 34.4 | | 0.08 | 0.08 |
| 16 0/N | 65-70 | 10.2 | 1.043 | | 5.50 | | 25.3 | | 0.11 | 0.11 |
| 17 | 70-75 | 8.6 | 0.879 | | 4.30 | | 6.1 | | 0.03 | 0.03 |
| 18 | 75-80 | 9.4 | 0.961 | | 10.95 | | 26.5 | | 0.26 | 0.26 |
| 19 0/N | 80-90 | 15.2 | 1.554 | | 14.40 | | 30.5 | | 0.24 | 0.24 |
| [illegible]0 0/N | 90-95 | 6.7 | 0.685 | | 28.10 | | 31.1 | | 1.09 | 0.87 |
| 21 | 95-100 | 5.8 | 0.593 | | 15.80 | | 40.7 | | 0.92 | 0.63 |
| 22 | 100-105 | 9.7 | 0.992 | | 29.00 | | 20.1 | | 0.50 | 0.50 |
| 23 | 105-110 | 7.0 | 0.716 | | 183.00 | | 70.8 | | 15.40 | 12.78 |
| 24 | 110-115 | 5.1 | 0.521 | | 55.40 | | 58.1 | | 5.26 | 3.18 |
| 25 | 115-120 | 4.7 | 0.481 | | 12.95 | | 22.8 | | 0.52 | 0.29 |

| INTERVAL | | | |
|---|---|---|---|
| 0-10 | 10' | 0.86 | 0.56 |
| 75-115 | 40' | 3.05 | 2.37 |
| TOTAL ORE | 50' | 2.61 | 1.97 |
| WASTE | 65' | - | - |
| TOTAL HOLE | 115' | 1.13 | 0.87 |

$$Calc^{N} = \frac{GRMS\ CONC^{T}}{453} \times \frac{27}{VOL\ OF\ SAMPLE} \times \frac{ASSAY}{.70} = \frac{GMS\ CONC^{T} \times ASSAY}{VOL\ OF\ SAMPLE} \times .000851$$

# APPENDIX B

| Col.(1) SAMPLE NO. | Col.(2) FROM - TO FT. | Col.(3) DEPTH SAMPLE IN VOL. BUCKET INCHES | Col.(4) VOL. OF SAMPLE COL. (3)x .10225 $FT.^3$ | Col.(5) WT. OF PANNED CONC. GMS. | Col.(6) TIN ASSAY % SN IN CONC[T] | 70% SN LBS/CU YD NO CORRECTION (5)x(6)x.000851 / (4) | CORRECTED TO PIPE VOL. |
|---|---|---|---|---|---|---|---|
| 500 | 0-5 | 6.0 | 0.614 | 4.05 | 0.8 | 0.00 | 0.00 |
| 501 | 5-10 | 2.7 | 0.276 | 5.35 | 1.5 | 0.02 | 0.01 |
| 502 | 10-15 | 8.15 | 0.833 | 89.95 | 6.0 | 0.55 | 0.55 |
| 503 | 15-20 | 6.9 | 0.706 | 64.70 | 6.3 | 0.49 | 0.49 |
| 504 O/N | 20-25 40 | 4.2 | 0.430 | 13.85 | 3.4 | 0.09 | 0.07 |
| 505 | 65-70 | 4.2 | 0.430 | 82.05 | 1.7 | 0.28 | 0.21 |
| 506 | 70-75 | 4.4 | 0.450 | 28.15 | 4.6 | 0.24 | 0.19 |
| 507 | 75-80 | 5.4 | 0.552 | 35.45 | 2.2 | 0.12 | 0.11 |
| 508 O/N | 80-85 | 4.5 | 0.460 | 23.25 | 5.3 | 0.23 | 0.18 |
| 509 | 85-90 | 4.5 | 0.460 | 27.35 | 9.2 | 0.47 | 0.37 |
| 510 | 90-95 | 4.2 | 0.429 | 7.50 | 14.5 | 0.22 | 0.16 |
| 511 | 95-100 | 4.7 | 0.481 | 60.90 | 27.6 | 2.97 | 2.45 |
| 512 | 100-105 | 5.0 | 0.511 | 19.20 | 27.2 | 0.87 | 0.76 |
| 513 | 105-110 | 3.0 | 0.307 | 3.15 | 16.4 | 0.14 | 0.07 |

| INTERVAL | | | |
|---|---|---|---|
| 10-20 | 10' | 0.52 | 0.52 |
| 65-105 | 40' | 0.69 | 0.56 |
| TOTAL ORE | 50' | 0.66 | 0.55 |
| WASTE | 55' | - | - |
| TOTAL HOLE | 105' | 0.31 | 0.26 |

# APPENDIX C

Hole K20

816066

| ol.(1) | Col.(2) | Col.(3) | Col.(4) | Col.(5) | Col.(6) | 70% SN | |
|---|---|---|---|---|---|---|---|
| AMPLE O. | FROM - TO FT. | DEPTH SAMPLE IN VOL. BUCKET INCHES | VOL. OF SAMPLE COL. (3)x .10225 FT³ | WT. OF PANNED CONC. GMS. | TIN ASSAY % SN IN CONC | LBS/CU YD NO CORRECTION (5)x(6)x.000851 / (4) | CORRECTED TO PIPE VOL. |
| 53 | 0-5 | 4.5 | 0.46 | 6.85 | 1.7 | 0.02 | 0.01 |
| 54 | 5-10 | 8.3 | 0.85 | 59.70 | 8.4 | 0.50 | 0.50 |
| 55 | 10-15 | 6.6 | 0.674 | 8.70 | 11.0 | 0.12 | 0.09 |
| 56 | 15-20 | 8.1 | 0.828 | 5.95 | 11.8 | 0.07 | 0.07 |
| 57 | 20-25 | 7.8 | 0.797 | 5.00 | 10.5 | 0.06 | 0.06 |
| 58 O/N | 25-30 | 6.8 | 0.695 | 7.45 | 18.3 | 0.17 | 0.14 |
| 59 | 30-35 | | | | | | |
| 60 | 35-40 | | | | | | |
| 60 | 40-45 | | | | | | |
| 61 | 45-50 | | | | | | |
| - O/N | 50-55 | | | | | | |
| - | 55-70 | | | | | | |
| 62 | 70-75 | 5.0 | 0.511 | 6.10 | 17.0 | 0.17 | 0.10 |
| 63 | 75-80 | 8.2 | 0.838 | 9.10 | 15.1 | 0.14 | 0.14 |
| 64 | 80-85 | 13.5 | 1.380 | 5.20 | 25.8 | 0.08 | 0.08 |
| 65 | 85-90 | 12.6 | 1.288 | 10.50 | 17.4 | 0.12 | 0.12 |
| 66 | 90-95 | 8.5 | 0.869 | 3.50 | 20.4 | 0.07 | 0.07 |
| 67 O/N | 95-100 | 8.0 | 0.818 | 13.40 | 16.5 | 0.23 | 0.22 |
| 68 | 100-105 | 10.8 | 1.104 | 67.20 | 44.0 | 2.28 | 2.28 |
| 69 | 105-110 | 6.8 | 0.695 | 51.00 | 43.5 | 2.72 | 2.19 |
| 70 | 110-115 | 4.9 | 0.501 | 20.00 | 31.5 | 1.07 | 0.62 |
| 71 | 115-120 | 6.7 | 0.685 | 8.60 | 22.0 | 0.24 | 0.19 |

| INTERVAL | | | |
|---|---|---|---|
| 5-15 | 10' | 0.31 | 0.30 |
| 70-115 | 45' | 0.79 | 0.67 |
| TOTAL ORE | 55' | 0.70 | 0.60 |
| WASTE | 60' | - | - |
| TOTAL HOLE | 115' | 0.33 | 0.29 |

# APPENDIX D

HOLE 21 - 6 Casing

816068

| Col.(1) SAMPLE NO. | Col.(2) FROM - TO FT. | Col.(3) DEPTH SAMPLE IN VOL. BUCKET INCHES | Col.(4) VOL. OF SAMPLE COL. (3)x .10225 $FT.^3$ | Col.(5) WT. OF PANNED CONC. GMS. | Col.(6) TIN ASSAY % SN IN CONC[T] | 70% SN LBS/CU YD NO CORRECTION (5)x(6)x.000851 / (4) | CORRECTED TO PIPE VOL. |
|---|---|---|---|---|---|---|---|
| 72 | 0-5 | 7.00 | 0.716 | 19.15 | 1.2 | 0.03 | 0.02 |
| 73 | 5-10 | 7.15 | 0.731 | 93.20 | 3.1 | 0.34 | 0.29 |
| 74 | 10-15 | 7.60 | 0.777 | 33.95 | 6.0 | 0.22 | 0.20 |
| 75 | 15-20 | 6.8 | 0.695 | 7.00 | 2.2 | 0.02 | 0.02 |
| 76 O/N | 20-25 | 6.5 | 0.665 | 4.20 | 4.6 | 0.02 | 0.02 |
| - | 25-60 | NOT SAMPLED | | | | | |
| 76A | 60-65 | 8.25 | 0.844 | | | | |
| 76B | 65-70 | 8.10 | 0.828 | | | | |
| 77 | 70-75 | 5.4 | 0.552 | 7.9 | 3.6 | 0.04 | 0.03 |
| 78 | 75-80 | 8.4 | 0.859 | 9.9 | 13.1 | 0.13 | 0.13 |
| 79 | 80-85 | 6.4 | 0.654 | 1.9 | 13.3 | 0.03 | 0.02 |
| 80 O/N | 85-90 | 10.6 | 1.084 | 9.25 | 6.2 | 0.05 | 0.05 |
| 81 | 90-95 | 7.6 | 0.777 | 15.35 | 10.7 | 0.18 | 0.16 |
| 82 | 95-100 | 8.7 | 0.890 | 20.55 | 18.0 | 0.35 | 0.35 |
| 83 O/N | 100-105 | 10.35 | 1.038 | 12.00 | 11.0 | 0.11 | 0.11 |
| 84 | 105-110 | 10.65 | 1.089 | 44.35 | 36.1 | 1.25 | 1.25 |
| 85 O/N 116 | 110-115 | 11.65 | 1.191 | 24.50 | 30.2 | 0.53 | 0.53 |
| 86 | 115-120 | 6.30 | 0.644 | 39.70 | 18.5 | 0.51 | 0.38 |
| 87 | 120-125 | 13.20 | 1.350 | 66.70 | 40.0 | 1.68 | 1.68 |
| 88 | 125-130 | 12.00 | 1.227 | 56.10 | 34.9 | 1.36 | 1.36 |
| 89 | 130-135 | 16.00 | 1.636 | 10.90 | 24.2 | 0.14 | 0.14 |

| INTERVAL | | | |
|---|---|---|---|
| 5-15 | 10' | 0.28 | 0.25 |
| 90-130 | 40' | 0.76 | 0.75 |
| TOTAL ORE | 50' | 0.66 | 0.65 |
| WASTE | 80' | - | - |
| TOTAL HOLE | 130' | 0.25 | 0.25 |

# APPENDIX E

Hole K22

816070

| Col.(1) SAMPLE NO. | Col.(2) FROM - TO FT. | Col.(3) DEPTH SAMPLE IN VOL. BUCKET INCHES | Col.(4) VOL. OF SAMPLE COL. (3)x .10225 $FT^3$ | Col.(5) WT. OF PANNED CONC. GMS. | Col.(6) TIN ASSAY % SN IN CONC | 70% SN LBS/CU YD NO CORRECTION (5)x(6)x.000851 / (4) | CORRECTED TO PIPE VOL. |
|---|---|---|---|---|---|---|---|
| 26 | 0-5 | 8.4 | 0.859 | 4.0 | 7.4 | 0.03 | 0.03 |
| 27 | 5-10 | 7.2 | 0.736 | 17.2 | 2.7 | 0.05 | 0.04 |
| 28 | 10-15 | 6.7 | 0.685 | 53.7 | 2.2 | 0.15 | 0.12 |
| 29 | 15-20 | 6.9 | 0.706 | 7.4 | 5.0 | 0.04 | 0.03 |
| 30 | 20-25 | 7.9 | 0.808 | 4.6 | 8.4 | 0.04 | 0.04 |
| 31 O/N | 25-30 | 5.7 | 0.583 | 10.5 | 6.2 | 0.10 | 0.07 |
| 32 | 30-35 | 8.4 | 0.859 | 22.4 | 4.4 | 0.10 | 0.10 |
| 33 | 35-40 | 8.0 | 0.818 | | | | |
| 34 | 40-45 | 8.25 | 0.844 | | | | |
| 35 | 45-50 | 7.2 | 0.736 | | | | |
| 36 | 50-55 | 7.4 | 0.757 | | | | |
| 37 | 55-60 | 9.0 | 0.920 | | | | |
| 38 | 60-65 | 12.3 | 1.258 | | | | |
| 39 | 65-70 | 8.5 | 0.869 | | | | |
| 40 | 70-75 | 6.1 | 0.624 | 4.5 | 7.4 | 0.05 | 0.04 |
| 41 | 75-80 | 7.3 | 0.746 | 3.5 | 11.3 | 0.05 | 0.04 |
| 42 | 80-85 | 4.9 | 0.501 | 9.7 | 13.5 | 0.22 | 0.13 |
| 43 | 85-90 | 5.3 | 0.542 | 28.6 | 5.3 | 0.24 | 0.15 |
| 44 | 90-95 | 5.4 | 0.552 | 32.2 | 6.8 | 0.34 | 0.22 |
| 45 O/N | 95-100 | 6.7 | 0.685 | 11.65 | 14.0 | 0.20 | 0.16 |
| 46 | 100-105 | 5.7 | 0.583 | 114.1 | 10.9 | 1.82 | 1.23 |
| 47 | 105-110 | 4.1 | 0.419 | 114.2 | 48.4 | 11.23 | 5.45 |
| 48 | 110-115 | 4.1 | 0.419 | 126.85 | 52.7 | 13.58 | 6.59 |
| 49 | 115-120 | 6.5 | 0.665 | 78 | 46.1 | 4.60 | 3.54 |
| 50 | 120-125 | 5.5 | 0.562 | 15.8 | 49.6 | 1.19 | 0.77 |
| 51 | 125-130 | 7.1 | 0.726 | 14.5 | 46.5 | 0.79 | 0.66 |
| 52 | 130-135 | 5.4 | 0.552 | 6.95 | 27.4 | 0.29 | 0.19 |

| INTERVAL | | | |
|---|---|---|---|
| 10-15 | 5' | 0.15 | 0.12 |
| 80-130 | 50' | 3.45 | 1.91 |
| TOTAL ORE | 55' | 3.15 | 1.75 |
| WASTE | 75' | - | - |
| TOTAL HOLE | 130' | 1.33 | 0.74 |

# APPENDIX F

816072? what hole is this

| Col.(1) SAMPLE NO. | Col.(2) FROM - TO FT. | Col.(3) DEPTH SAMPLE IN VOL. BUCKET INCHES | Col.(4) VOL. OF SAMPLE COL. (3)x .10225 $FT^3$ | Col.(5) WT. OF PANNED CONC. GMS. | Col.(6) TIN ASSAY % SN IN CONC$^T$ | 70% SN LBS/CU YD NO CORRECTION $\frac{(5)x(6)x.000851}{(4)}$ | CORRECTED TO PIPE VOL. |
|---|---|---|---|---|---|---|---|
| 601 | 0-5 | 6.1 | .624 | 5.45 | 4.88 | .04 | .04 |
| 602 | 5-10 | 3.6 | .368 | 21.4 | 3.13 | .15 | .09 |
| 603 | 10-15 | 5.4 | .552 | 14.84 | 2.44 | .06 | .06 |
| 604 | 15-20 | 5.6 | .573 | 4.00 | 6.49 | .04 | .04 |
| 605 | 20-25 | 4.8 | .491 | 25.49 | 1.00 | .04 | .03 |
| 606 | 25-30 | 4.8 | .491 | 18.52 | 2.63 | .08 | .07 |
| 607 | 30-35 | 3.4 | .348 | 13.10 | 5.94 | .19 | .11 |
| 608 | 35-40 | 4.9 | .501 | 16.29 | 3.05 | .08 | .07 |
| 609 | 40-45 | 4.8 | .491 | 9.11 | 4.75 | .07 | .06 |
| 610 | 45-50 | 5.1 | .521 | 9.35 | 5.42 | .08 | .07 |
| 611 | 50-55 | 4.8 | .491 | 20.64 | 2.85 | .10 | .08 |
| 612 O/N | 55-60 | 5.2 | .532 | 25.32 | 8.60 | .35 | .32 |
| 613 Lock Cap | 60-65 | 3.5 | .358 | 4.40 | 6.84 | .07 | .04 |
| 614 | 65-70 | 4.7 | .481 | 3.84 | 8.03 | .05 | .04 |
| 615 | 70-75 | 3.7 | .378 | 6.42 | 2.68 | .04 | .03 |
| 616 | 75-80 | 5.6 | .573 | 14.90 | 2.46 | .05 | .05 |
| 617 | 80-85 | 4.9 | .501 | 13.70 | 25.00 | .58 | .50 |
| 618 | 85-90 | 5.7 | .583 | 28.1 | 14.15 | .58 | .58 |
| 619 | 90-95 | 4.6 | .470 | 38.86 | 3.29 | .23 | .19 |
| 620 | 95-100 | 5.7 | .583 | 81.35 | 7.67 | .91 | .91 |
| 621 | 100-105 | 5.5 | .562 | 96.47 | 7.10 | 1.04 | 1.00 |
| 622 O/N | 105-110 | 6.7 | .685 | 70.00 | 10.66 | 0.93) | 2.133 |
| 623 | 110-115 | 1.2 | .123 | 65.40 | 13.13 | 5.94} 2.133 | } no correction factor -samples not from this section |
| 624 | 115-120 | 1.7 | .174 | 187.41 | 4.57 | 4.19) | |
| 625 | 120-121 | Immeasurable | | 73.06 | 0.79 | | |

N.B. SAMPLES 623 AND 624 ARE COMBINED WITH SAMPLE 622 TO GIVE THE GRADE FROM 105' - 110'

| INTERVAL | | | | |
|---|---|---|---|---|
| 5-10 | 5 | .15 | | |
| 30-35 | 5 | .19 | 5 | .11 |
| 50-60 | 10 | .23 | 5 | .32 |
| 80-110 | 30 | .91 | 30 | .89 |

HOLE PLUGGED BELOW 110

TOTAL HOLE VALUE NOT GIVEN SINCE HOLE DIDN'T BOTTOM.

# APPENDIX G

Hole K23

816074

| Col.(1) | Col.(2) | Col.(3) | Col.(4) | Col.(5) | Col.(6) | 70% SN | |
|---|---|---|---|---|---|---|---|
| SAMPLE NO. | FROM - TO FT. | DEPTH SAMPLE IN VOL. BUCKET INCHES | VOL. OF SAMPLE COL. (3) x .10225 $FT^3$ | WT. OF PANNED CONC. GMS. | TIN ASSAY % SN IN CONC[T] | LBS/CU YD NO CORRECTION (5)x(6)x.000851 / (4) | CORRECTED TO PIPE VOL. |
| 90 | 0-5 | | | 33.1 | 5.28 | | |
| 91 | 5-10 | 6.6 | 0.675 | 11.7 | 4.09 | 0.06 | .06 |
| 92 | 10-15 | 6.3 | 0.644 | 7.8 | 3.11 | 0.03 | .03 |
| 93 | 15-20 | 7.3 | 0.746 | 7.9 | 2.69 | 0.02 | .02 |
| 94 | 20-25 | 7.5 | 0.767 | | | | |
| 95 O/N | 25-30 | 8.4 | 0.859 | | | | |
| 96 O/N | 70-75 | 8.7 | 0.890 | | | | |
| 97 | 75-80 | 6.95 | 0.711 | | | | |
| 98 O/N | 80-85 | 17.7 | 1.810 | | | | |
| 99 | 85-90 | 11.8 | 1.207 | 18.81 | 6.04 | | |
| 100 | 90-95 | 9.0 | 0.920 | 37.5 | 1.96 | 0.07 | |
| 101 | 95-100 | 12.0 | 1.227 | 115.9 | 4.15 | 0.33 | 0.33 |
| 102 | 100-105 | 9.4 | 0.961 | 66.0 | 7.28 | 0.43 | 0.43 |
| 103 O/N | 105-110 | 28.1 | 2.873 | 152.9 | 15.18 | 0.69 | 0.69 |
| 104 | 110-115 | 18.5 | 1.892 | 100.4 | 8.06 | 0.36 | 0.36 |
| 105 | 115-120 | 18.9 | 1.933 | 98.6 | 29.15 | 1.27 | 1.27 |
| 106 | 120-125 | 23.7 | 2.423 | 117.7 | 36.00 | 1.49 | 1.49 |
| 107 | 125-129 | 17.8 | 1.820 | 127.3 | 28.50 | 1.70 | 1.70 |
| 107A | 129-130 | 6.0 | 0.614 | 37.2 | 32.46 | 1.67 | 1.67 |
| 108 | 130-135 | 17.8 | 1.820 | 65.3 | 33.50 | 1.02 | 1.02 |
| 109 | 135-140 | 20.6 | 2.106 | 117.4 | 22.00 | 1.04 | 1.04 |
| 110 | 140-145 | 20.3 | 2.076 | 150.3 | 38.0 | 2.34 | 2.34 |
| 111 | 145-150 | 17.9 | 1.830 | 157.6 | 33.6 | 2.46 | 2.46 |

N.B. VALUES AT BOTTOM SUGGEST
HOLE WAS STOPPED SHORT.

| INTERVAL | | | |
|---|---|---|---|
| 95-150 | 55' | 1.19 | 1.19 |
| TOTAL HOLE | 150' | 0.44 | 0.44 |

APPENDIX H

HOLE 24 (Stackpole) 5" Casing

816076

| Col.(1) SAMPLE NO. | Col.(2) FROM - TO FT. | Col.(3) DEPTH SAMPLE IN VOL. BUCKET INCHES | Col.(4) VOL. OF SAMPLE COL. (3)x .10225 FT3 | Col.(5) WT. OF PANNED CONC. GMS. | Col.(6) TIN ASSAY % SN IN CONC T | 70% SN LBS/CU YD NO CORRECTION (5)x(6)x.000851 / (4) | CORRECTED TO PIPE VOL. |
|---|---|---|---|---|---|---|---|
| 514 | 0-5 | 12.7 | 1.299 | 76.3 | 3.4 | 0.17 | 0.17 |
| 515 | 5-10 | 5.1 | 0.522 | 10.8 | 4.7 | 0.08 | 0.07 |
| 516 | 10-15 | 3.9 | 0.399 | 6.5 | 2.83 | 0.04 | 0.03 |
| 517 | 15-20 | 2.7 | 0.276 | 9.3 | 2.69 | 0.08 | 0.04 |
| 518 | 20-25 | 5.3 | 0.542 | 14.3 | 4.36 | 0.10 | 0.09 |
| 519 | 25-30 | 3.55 | 0.363 | 4.4 | 8.04 | 0.08 | 0.05 |
| O/N | 30-65 60 NOT SAMPLED | | | | | | |
| 520 | 65-70 | 3.90 | 0.399 | 5.6 | 3.05 | 0.04 | 0.03 |
| 521 | 70-75 | 3.60 | 0.368 | 7.2 | 3.41 | 0.06 | 0.04 |
| 522 | 75-80 | 2.30 | 0.235 | 5.75 | 5.9 | 0.12 | 0.05 |
| 523 | 80-85 | 4.10 | 0.419 | 2.05 | 4.9 | 0.02 | 0.01 |
| 524 | 85-90 | 2.4 | 0.245 | 1.45 | 3.1 | 0.02 | 0.01 |
| 525 | 90-95 | 3.3 | 0.337 | 1.70 | 13.1 | 0.06 | 0.03 |
| 526 | 95-100 | 3.8 | 0.389 | 3.10 | 9.0 | 0.06 | 0.04 |
| 527 | 100-105 | 5.0 | 0.511 | 6.00 | 0.8 | 0.01 | 0.01 |
| 528 | 105-110 | 7.1 | 0.726 | 21.25 | 24.6 | 0.61 | 0.61 |
| 529 | 110-115 | 2.9 | 0.297 | 16.95 | 16.4 | 0.80 | 0.41 |
| 530 | 115-120 | 4.1 | 0.419 | 26.95 | 17.3 | 0.95 | 0.68 |
| 531 | 120-125 | 2.4 | 0.245 | 9.80 | 15.9 | 0.54 | 0.23 |
| 532 | 125-130 | 1.3 | 0.133 | 7.40 | 28.2 | 1.34 | 0.31 |
| 533 | 130-135 | 2.5 | 0.256 | 16.60 | 10.41 | 0.57 | 0.25 |

| INTERVAL | | | |
|---|---|---|---|
| 0-5 | 5' | 0.17 | 0.17 |
| 105-130 | 25' | 0.95 | 0.50 |
| TOTAL ORE | 30' | 0.83 | 0.45 |
| WASTE | 100' | - | - |
| TOTAL HOLE | 130' | 0.19 | 0.10 |

# APPENDIX I

HOLE [illegible]

25

816078

| Col.(1) | Col.(2) | Col.(3) | Col.(4) | Col.(5) | Col.(6) | 70% SN | |
|---|---|---|---|---|---|---|---|
| SAMPLE NO. | FROM - TO FT. | DEPTH SAMPLE IN VOL. BUCKET INCHES | VOL. OF SAMPLE COL. (3)x .10225 $FT^3$ | WT. OF PANNED CONC. GMS. | TIN ASSAY % SN IN CONC[T] | LBS/CU YD NO CORRECTION (5)x(6)x.000851 / (4) | CORRECTE TO PIPE VOL. |
| 534 | 0-5 | 5.7 | 0.583 | 5.0 | 6.7 | 0.05 | 0.05 |
| 535 O/N | 5-10 | 4.7 | 0.481 | 3.4 | 5.02 | 0.03 | 0.02 |
| 536 | 10-15 | 3.65 | 0.373 | 25.1 | 11.33 | 0.65 | 0.42 |
| 537 | 15-20 | 2.30 | 0.235 | 5.8 | 5.40 | 0.11 | 0.04 |
| 538 | 20-25 | 4.30 | 0.440 | 11.0 | 2.11 | 0.04 | 0.02 |
| 539 | 25-30 | 2.95 | 0.302 | 9.2 | 2.83 | 0.07 | 0.04 |
| 540 | 30-35 | 5.40 | 0.552 | 11.0 | 3.28 | 0.06 | 0.06 |
| 541 | 35-40 | 3.30 | 0.337 | 21.1 | 7.43 | 0.40 | 0.23 |
| 542 O/N | 70-75 | 3.95 | 0.404 | 5.2 | 2.12 | 0.02 | 0.01 |
| 543 | 75-77 | 2.0 | 0.205 | 4.4 | 1.35 | 0.02 | 0.01 |
| 544 | 77-80 | 2.8 | 0.286 | 3.3 | 1.65 | 0.02 | 0.01 |
| 545 | 80-85 | 2.25 | 0.230 | 8.3 | 2.53 | 0.08 | 0.0 |
| 546 | 85-90 | 4.6 | 0.470 | 5.6 | 16.85 | 0.17 | 0.14 |
| 547 | 90-95 | 3.9 | 0.399 | 8.9 | 13.70 | 0.26 | 0.18 |
| 548 | 95-100 | 4.0 | 0.409 | 2.9 | 5.53 | 0.03 | 0.02 |
| 549 O/N Lock Cap | 100-105 | 5.3 | 0.542 | 112.0 | 0.42 | 0.07 | 0.07 |
| 550 | 105-110 | 6.2 | 0.634 | 12.3 | 8.38 | 0.14 | 0.14 |
| 551 | 110-115 | 5.2 | 0.532 | 40.5 | 15.75 | 1.02 | 0.9 |
| 552 | 115-120 | 3.6 | 0.368 | 16.33 | 23.04 | 0.87 | 0.55 |
| 553 | 120-125 | 4.5 | 0.460 | 60.5 | 8.00 | 0.90 | 0.7 |
| 554 | 125-130 | 5.5 | 0.562 | 153.79 | 3.57 | 0.83 | 0.80 |
| 555 | 130-135 | 2.6 | 0.266 | 6.79 | 1.30 | 0.03 | 0.0 |

| INTERVAL | | | | |
|---|---|---|---|---|
| 10-20 | 10' | .38 | 5 | .4 |
| 35-40 | 5' | .40 | 5 | .2 |
| 85-130 | 45' | .48 | 45 | .3 |
| TOTAL ORE | 60' | 0.46 | 55 | 0.3 |
| WASTE | 70' | - | 75 | - |
| TOTAL HOLE | 130' | 0.21 | 130 | 0.1 |

# APPENDIX J

HOLE 26 - (Stackpole) 5" Casing

816080

| Col.(1) SAMPLE NO. | Col.(2) FROM - TO FT. | Col.(3) DEPTH SAMPLE IN VOL. BUCKET INCHES | Col.(4) VOL. OF SAMPLE COL. (3)x .10225 $FT^3$ | Col.(5) WT. OF PANNED CONC. GMS. | Col.(6) TIN ASSAY % SN IN CONC[T] | 70% SN LBS/CU YD NO CORRECTION (5)x(6)x.000851 / (4) | CORRECTED TO PIPE VOL. |
|---|---|---|---|---|---|---|---|
| | 0-5 | | | | | | |
| | 5-10 | | | | | | |
| | 10-15 | | | | | | |
| | 15-20 | | | | | | |
| | 20-25 | | | | | | |
| | 25-30 | | | | | | |
| | 30-35 | | | | | | |
| | 35-40 | | | | | | |
| | 40-45 | | | | | | |
| | 45-50 | | | | | | |
| | 50-55 | | | | | | |
| | 55-60 | | | | | | |
| | 60-65 | | | | | | |
| | 65-70 | | | | | | |
| | 70-75 | | | | | | |
| | 75-80 | | | | | | |
| | 80-85 | | | | | | |
| | 85-90 | | | | | | |
| | 90-95 | | | | | | |
| | 95-100 | | | | | | |
| | 100-105 | | | | | | |
| 573 | 105-110 | | | RESULTS NOT YET AVAILABLE | | | |
| 574 | 110-115 | | | | | | |
| 575 | 115-120 | 5.0 | 0.511 | | | | |
| 576 | 120-125 | 4.0 | 0.409 | | | | |
| 577 | 125-130 | 5.3 | 0.542 | 10.8 | 2.64 | .04 | .04 |
| 578 | 130-135 | 2.7 | 0.276 | 8.9 | 15.66 | .43 | .20 |
| 579 | 135-140 | 6.0 | 0.614 | 64.8 | 24.39 | 2.19 | 2.19 |
| 580 | 140-145 | 5.7 | 0.583 | 49.49 | 22.98 | 1.66 | 1.66 |
| 581 | 145-150 | 3.0 | 0.307 | 29.49 | 10.15 | 0.83 | 0.44 |
| | | | | | 130-150 | 20 1.28 | 1.12 |

816081

OPEN FILE

APPENDIX 1

MICROFILMED
FICHE No 013494-96

Pioneer Mine Production Record

95-3707.

# PIONEER MINE PRODUCTION RECORD

| | Year | Yards | Tin Long Tons | Recovered Grade lbs/ yd |
|---|---|---|---|---|
| pre | 1902 | 111,400 | 104 | 2.091 |
| July | 1902 | 237,900 | 217 | 2.136 |
| | 1903 | 315,900 | 397 | 2.815 |
| | 1904 | 351,100 | 371 | 2.367 |
| | 1905 | 327,100 | 308 | 2.113 |
| | 1906 | 439,400 | 422 | 2.156 |
| | 1907 | 488,400 | 395 | 1.813 |
| | 1908 | 382,300 | 437 | 2.564 |
| | 1909 | 456,800 | 361 | 1.772 |
| | 1910 | 495,900 | 362 | 1.637 |
| | 1911 | 706,100 | 505 | 1.604 |
| | 1912 | 667,300 | 475 | 1.593 |
| | 1913 | 621,200 | 429 | 1.547 |
| | 1914 | 571,700 | 441 | 1.728 |
| | 1915 | 613,700 | 327 | 1.194 |
| | 1916 | 996,000 | 444 | 0.999 |
| | 1917 | 894,700 | 471 | 1.179 |
| | 1918 | 702,600 | 302 | 0.965 |
| | 1919 | 534,800 | 272 | 1.142 |
| | 1920 | 481,200 | 266 | 1.240 |
| | 1921 | 235,500 | 92 | 0.883 |
| | 1922 | 372,300 | 235 | 1.418 |
| | 1923 | 381,800 | 281 | 1.651 |
| | 1924 | 504,500 | 309 | 1.373 |
| | 1925 | 447,300 | 233 | 1.171 |
| | 1926 | 488,200 | 195 | 0.834 |
| | 1927 | 458,200 | 159 | 0.720 |
| | 1928 | 510,400 | 177 | 0.739 |
| | 1929 | 427,400 | 106 | 0.521 |
| | | 14,221,100 | 9,093 | 1.432 |

# APPENDIX 2

Austral Malay Pioneer Boring Results 1935

# AUSTRAL MALAY PIONEER BORING RESULTS 1935

| Hole No | Feet | Value 72% Sn Cassiterite lbs /cu yd |
|---|---|---|
| 1 | 105 | 0.65 |
| 2 | 130 | 0.44 |
| 3 | 140 | 0.19 |
| 4 | 132 | 0.50 |
| 5 | 137 | 0.54 |
| 6 | 127 | 0.21 |
| 7 | 142 | 0.06 |
| 8 | 146 | 0.20 |
| 9 | 164 | 0.28 |
| 10 | 110 | 0.09 |
| 11 | 65 | 0.03 |
| 12 | 107 | 0.09 |
| 13 | 136 | 0.18 |
| 14 | 126 | 0.03 |
| 15 | 104 | Trace |
| 16 | 135 | Trace |
| 17 | 143 | Trace |
| 18 | Not bored | |

# APPENDIX 3

Storey's Creek Statement of Drilling at Pioneer 1960-1961

M

# STOREYS CREEK TIN MINING CO. N.L.

## DORSET TIN DIMENSION

STATEMENT OF DRILLING AT PIONEER AREA

Plant: Goldfields G33-6$^{0}$
(W.L. Sides & Son Pty. Ltd.)

| Date | Bore No. | Depth: Bottom | Depth: Wash | Value | Bottom |
|---|---|---|---|---|---|
| 24/10 - 26/10. | 4 | 104' | 11' | .26 | Soft |
| 26/10 - 1/11. | 6 | 113' | 15' | .27 | Soft |
| 1/11 - 4/11. | 8 | 119' | 2' | .15 | Soft |
| 7/11 - 9/11. | 10 | 130' | 11' | .07 | Soft |
| 10/11 - 16/11. | 11 | 128' | 9' | .14 | Soft |
| 16/11 - 19/11. | 2 | 105' | 17' | .35 | Soft |
| 21/11 - 23/11. | 7 | 122' | 30' | .18 | Soft |
| 24/11 - 26/11. | 9 | 119' | 8' | .21 | Soft |
| 28/11 - 30/11. | 5 | 109' | 4' | .14 | Soft |
| 1/12 - 2/12. | 20 | 55' | 4' | .20 | Soft |
| 2/12 - 3/12. | 21 | 59' | - | .21 | Soft |
| 5/12 - 6/12. | 25 | 73' | 6' | .29 | Soft |
| 7/12 - 13/12. | 27 | 71' | - | .29 | Soft |
| 14/12 - 11/1. | 30 | 133' | 33' | .10 | Soft |
| 12/1 - 14/1. | 31 | 134' | 32' | .18 | Soft |
| | | 1574' | | | |

981608

# APPENDIX 4

Ore Reserves in the Cascade Deep Lead - J.B. Braithwaite, 1964

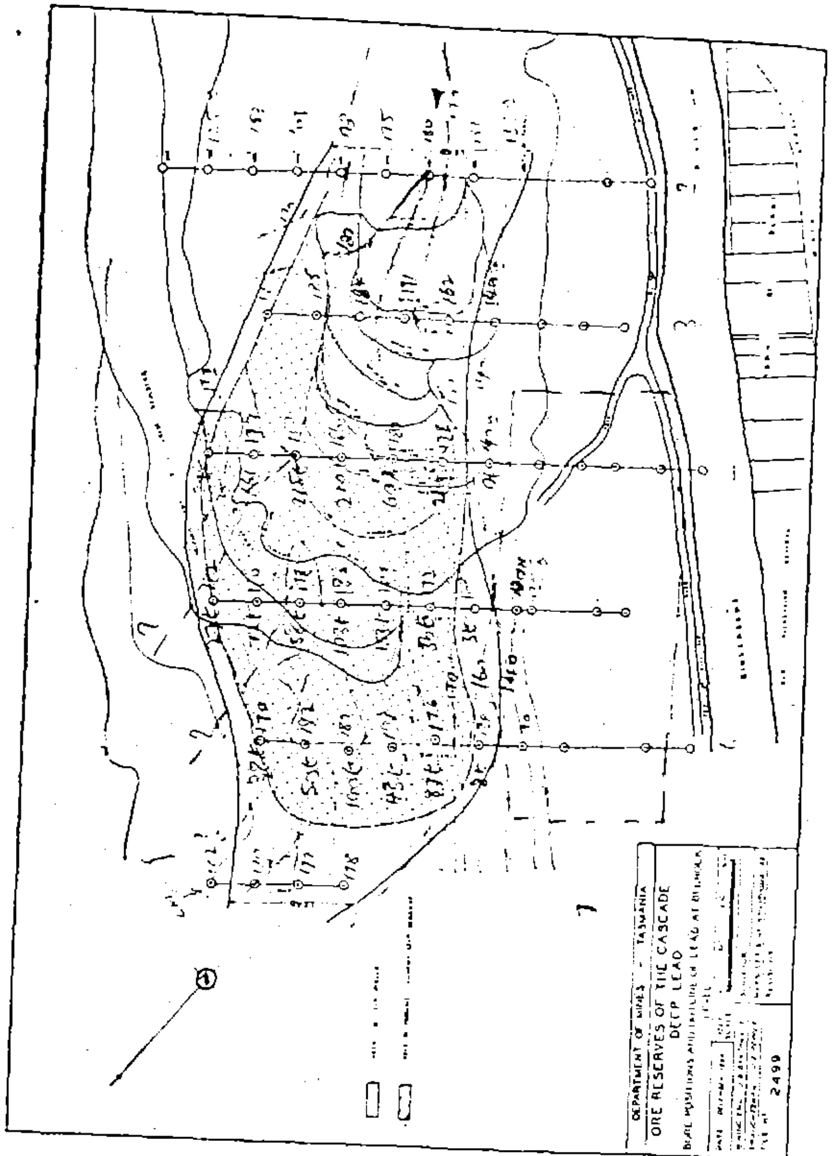



FIGURE 21.

5 cm



# 19 ORE RESERVES IN THE CASCADE DEEP LEAD

by J. B. Braithwaite 1964.


## ABSTRACT

An area near the town of Derby has been assessed for tin ore reserves with the result that a possible maximum of 2000 tons of tin has been estimated.


## INTRODUCTION

Cassiterite was found by the Krushka Brothers in the Cascade River about the end of 1875 and the area seems to have been worked continuously, in varying degrees, from then until 1960. It proved to be by far the greatest alluvial tin deposit in Tasmania, and, although records prior to 1900 are meagre, the total production was in the region of 20,787 tons of tin metal.

Table 1 summarizes the information available as regards production, values and labour employed.

The area is still held under Mining Lease by Briseis Tin No Liability, who have given permission for the publication of information contained in their old records.

The leases are on the edge of the town of Derby on the Tasman Highway, 61 miles NE of Launceston.

## GEOLOGY

The early workings were shallow and rich and thus presented no difficulties but as they moved downstream it was realized that the main body of ore was a deep lead under the basalt. This lead occupied the old valley of the Cascade River, passed under the Ringarooma River (present) and was presumed to join the old course of the Ringarooma well to the NW. The bottom of the lead is some 150 feet below the present Ringarooma River and to the NE is over 400 feet below the present surface. Nye (1924) identified the lead as of Tertiary origin, filling the old Cascade River valley to a depth of some 300 feet and overlain by 150 feet of basalt in several flows of late Tertiary age. The bedrock in the upper portion of the lead is granite but near the lower limit of the workings this gives way to sandstone older than the granite. All the evidence regarding the origin of the tin points to the granite and its associated mineralization.

## PROSPECTING

Prospecting of the lead was by drilling at 100 feet intervals on lines 315 feet and 330 feet apart and the positions of these bores are shown on Figure 21. Along Line 2 a tunnel was driven at about RL 720 feet and hand bores were sunk from this tunnel. 4 inch casing being used for a start but dropping to 3 inches in the lower sections. Bore No. 6 on Line 6 was sunk in the same way but all the others on Lines 3 to 7 were put down with power drills starting with 6 inch casing and reducing to 5 inches and in some cases finally to 4 inches. The cross sections and bore values are

816088

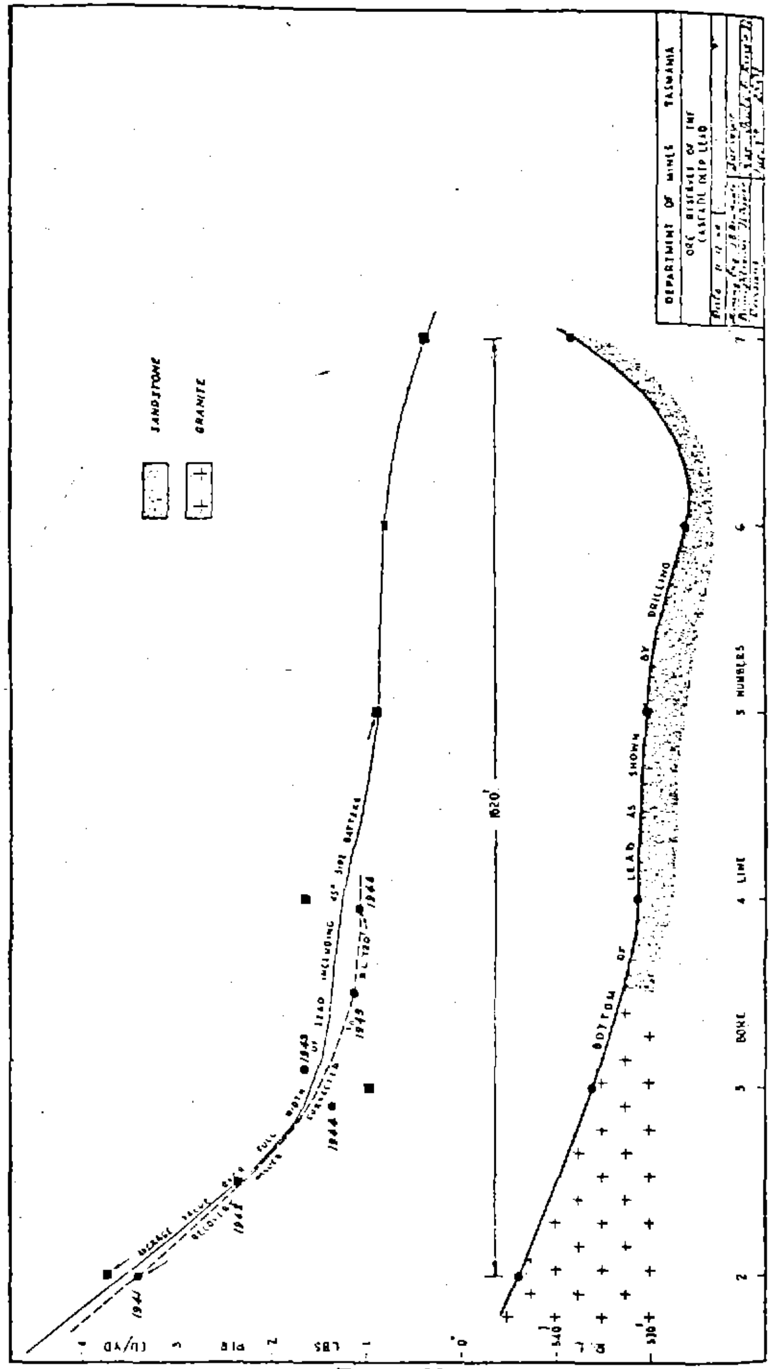


FIGURE 22.



shown on Figure 32 and Table 2 shows various statistics based on the results. Figure 22 shows a profile along the deepest section of the lead, as indicated by the bores, and the corresponding average bore values over an assumed economic width (assuming a side batter of 45°).

The bore values shown on Figure 32 must be used with a certain amount of caution as they have been calculated on box measurements of the material recovered. The diameters of the casing used in each section of each bore is known but not the shoe diameters and hence it is not possible to calculate accurate core ratios. It appears that in tin-bearing ground the core ratios are usually better than 100% so that the calculated values of most 5 feet sections are more conservative than if a pipe factor had been used. In barren ground the core ratio is often very low and as total weight of tin and total box measurement had been used to arrive at average values these are often too high. The values of 5 feet sections on Figure 32 have not been corrected for assay but all average values have been corrected to 72% Sn. In the present calculations, values of 5 feet sections have been used to arrive at average values of bores, sections of bores and ore reserve blocks and corrections have then been made for assay. Table 3 shows a comparison of the two methods of calculating average values between RL 720 feet and bedrock. It will be seen that the present method gives lower values on the whole.

The economic portion of Line 2 was bored between 1907 and 1911 and Lines 3 to 7 between 1939 and 1941. The later series was done by one contractor and the bore logs are still available.

## WORKING METHODS

The method of working adopted by Briseis Tin Consolidated No Liability was to break down the drift immediately below the basalt with hydraulic monitors, thus causing the basalt to collapse, pop any large boulders and remove the whole of the overburden hydraulically in a flume located in a tunnel. From the end of the flume fines went direct to the river while the oversize was stacked by a conveyor belt. In a similar manner the remainder of the drift was broken down by monitors and elevated to sluices by gravel pumps. Ample water at high pressure was provided by a 30 mile race from the Ringarooma River and a 2½ mile race from a dam on the Cascade River. Neither race is now in working order but the Cascade Dam remains and that system is capable of repair at reasonable cost. During the course of operations the Ringarooma River was diverted three times and although there were two disastrous floods which completely wrecked the plant and workings the present river diversion bund would appear to be well above any possible flood level.

The overburden face along the eastern side of the lead was very high and as the original overburden tunnel was not far in from this face the lateral extent of the workings on this side was restricted. With the construction of the new tunnel the workings were extended to the east but not to the full extent of the lead as the overburden had not been stripped far enough back. The use of water for the movement of both overburden and drift would tend to make the face unstable and it appears that even a batter flatter than 45° was insufficient.

The profit made by the Company in 1945 was small and it was realized that with decreasing values below Line 4 future operations were likely to be at a loss and an approach was made to Government for a free grant of £12,000 towards stripping, in order to regain control of the overburden and keep the mine in operation until 1948. An alternative proposal was to cease stripping overburden and merely mine as much drift as possible before closing down. While these discussions were proceeding some 1500 feet of overburden along the eastern wall collapsed and the workings were buried under 25-30 feet of slurry and rock. Some major items of plant were recovered but a great deal was lost and a committee investigating the possibility of re-opening the mine under Government control condemned the scheme as unsound.

Figure 21 shows the extent of the workings when mining of the deep lead ceased in the middle of 1946. It should be particularly noted that both Figures 21 and 22 picture the mine as it was just prior to the cessation of operations and that subsequently there was a large fall of overburden along the eastern face and extensive work was done on the shallow tin-bearing alluvium, particularly along the old river bed. The quantity of tin in the deep lead is, however, unchanged and also the total quantity of overburden to be moved although some of the latter may not be in the position shown in Figures 21 and 22.

## ORE RESERVES

Figures submitted to the Investigating Committee in 1946 claimed reserves of 3,600,000 cu. yd. of drift going 0.9 lb./cu. yd. (cassiterite), a total of 1450 tons, but the committee considered 0.9 too high as it was based on the assumption that previous recoveries had been higher than bore values. The then Director of Mines claimed that a check indicated lower recoveries than bore values. In the 1946 estimate no calculation of overburden yardage was made and it was assumed that the ratio would be the same as in the past, i.e., about 32% and this would make the estimated overall value 0.68 lb./cu. yd.

Figure 21 shows the extent of the lead as indicated by previous boring, the area worked out, and the area remaining which could be worked, all at bedrock level. The total quantity of cassiterite proved by boring and remaining unmined when operations ceased in 1946 was 2200 tons but some of the higher level deposits have since been mined and the total now remaining is probably not more than 2000 tons, not all of which could be mined.

From Figure 22 it will be seen that, while in the vicinity of Bore Line No. 2 tin values are distributed over the full depth from RL 720 feet to bedrock, lower down the lead values are almost entirely below RL 600 feet. The present calculations are therefore based on the quantity of ore below RL 600 feet and that between 720 feet and 600 feet and the results are shown in Table 4. In this Table the overburden involved in stripping to a 45° batter is shown against the nearest bore in each case. The Table indicates that the best method of working under modern conditions with heavy earth-moving equipment would be to strip to RL 600 feet and treat the balance in a high efficiency jig, cyclone and table plant. This would involve stripping 8,600,000 yards of overburden and treating 1,128,000 cu. yards of wash containing 3.20 lb. of cassiterite per cu. yd. The overall value of the ground to be moved in this scheme would be 0.37 lb./cu. yd.



It will be noted from Table 4 that bore values are erratic and that 6 bores account for 1000 tons of ore out of a total of 1600. Owing to the very large yardage represented by each bore it is extremely difficult to check past recoveries against bore values but an attempt to do this is shown on Figure 32. Recoveries for the years 1941 to 1946 have been adjusted to allow for the increased overburden ratio involved in stripping to RL 720 feet and plotted on the approximate positions along the lead. It will be noted that although the average value of Line 3 is very much below that of Line 4 this is not fully matched by a corresponding fall in recoveries and in fact recoveries fall off steadily and follow very closely the interpolated curve of bore values. It must also be remembered that the old plant consisted of sluice boxes only, and as the yardage handled was very large owing to the inclusion of so much barren overburden, the tin losses must have been high compared to what can be expected in a modern plant treating the wash only.

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

## POSSIBLE EXTENSIONS OF LEAD

When the values fell off so rapidly below Line 2 the management at that time are believed to have considered the possibility that the lead had swung away to the right. A more reasonable explanation is that the deposit was formed in a lake and this would account for the rapid drop in values away from the inlet, the great width of the lead and the great change in the distribution of tin in depth from Line 2 to Line 7, i.e. in Line 2, there are values all the way down from RL 720 feet and 50% of the tin is more than 30 feet from the bottom while on Line 6 there is practically no tin above RL 600 feet and 50% of the tin is within 10 feet of bedrock.

Although it is unlikely that the lead was lost below Line 2 it is still possible that there are extensions to the right. There is no great rise in bedrock, as shown by the bores in Lines 3 to 7, which would indicate a definite boundary such as exists on the left, and further bores, particularly on Line 5, could show results. The bores on Line 7 show very little variation in depth and further boring in both directions is necessary to show whether this high bedrock does extend right across the lead. There is always the possibility that there is a narrow channel through this bar and that the lead will open out again below it as was the case with other leads in the district. Even if the deposit was formed in a lake there must have been an outlet and there could be an extension of the lead along this. Such a lead would be on a very much smaller scale but could be so concentrated, both in width and depth, that it would be an economic underground mining proposition.

Drilling to depths in excess of 400 feet, particularly where there is 150 feet of basalt capping, can be very expensive and an attempt should be made to project the bedrock profiles beyond the present bores and to try to find the lead beyond Line 7 by seismic or gravity surveys before trying out a new boring programme.

## REFERENCE

NYE, P. B., 1924.—The sub-basaltic tin deposits of the Ringarooma Valley. *Bull. Geol. Surv. Tas.*, 35.

### TABLE 1

PRODUCTION RECORDS

| Period. | Tons of Tin. | Value (lb/cu.yd.) Drift only. | Value (lb/cu.yd.) Overall. | Men Employed. | Remarks. |
|---|---|---|---|---|---|
| 1876 to 1900-07 | 7100 | 3.41 | 2.09 | | Production outside Briseis Tin & General Mining Co. Ltd. |
| 1900 to 1922 | 8935 | 3.41 | 2.09 | .... | Breseis Tin & General Mining Co. Ltd. |
| 1923 | 254 | .... | .... | 91 | |
| 1924 | 179 | .... | .... | 126 | |
| 1925 | 140 | .... | .... | 120 | |
| 1926 | 118 | .... | .... | 99 | |
| 1927 | 184 | .... | .... | 104 | |
| 1928 | 217 | .... | .... | 102 | |
| 1929 | 89 | .... | .... | 61 | Flood destroyed workings and plant |
| 1930 | 45 | .... | .... | 25 | |
| 1931 | 43 | .... | .... | 34 | Taken over by Briseis Tin Mines N.L. |
| 1932 | 47 | .... | .... | 30 | |
| 1933 | 49 | .... | .... | 40 | |
| 1934 | 35 | .... | .... | .... | Briseis Tin Consolidated N.L. formed. |
| 1935 | 18 | .... | .... | .... | |
| 1936 | 55 | .... | .... | 103 | Workings flooded. |
| 1937 | 158 | 1.57 | 1.30 | 128 | |
| 1938 | 394 | 1.75 | 1.34 | 142 | |
| 1939 | 364 | 1.57 | 1.15 | 149 | |
| 1940 | 482 | 2.05 | 1.62 | 163 | |
| 1941 | 425 | 1.86 | 1.45 | 152 | |
| 1942 | 329 | 1.49 | 1.08 | 146 | |
| 1943 | 253 | 1.08 | 0.85 | 150 | |
| 1944 | 191 | 0.86 | 0.66 | 140 | |
| 1945 | 168 | 0.68 | 0.51 | 124 | |
| 1946 | 95 | 0.63 | 0.52 | 80 | Work on main lead ceased. |
| 1947 | 75 | .... | 0.84 | 42 | |
| 1948 | 36 | .... | 0.45 | 36 | Briseis Tin N.L. took over. |
| 1949 | 14 | .... | 0.25 | 37 | Main workings cleaned up and operations moved to Cascade River. |
| 1950 | 40 | .... | 0.74 | N.A. | |
| 1951 | 39 | .... | 0.26 | N.A. | |
| 1952 | 39 | .... | 0.26 | 42 | |
| 1953 | 26 | .... | 0.21 | 40 | |
| 1954 | 40 | .... | 0.22 | 39 | |
| 1955 | 33 | .... | 0.27 | 39 | Retreatment started. |
| 1956 | 16 | .... | 0.21 | 37 | Cascade River workings finished. |
| 1957 | 25 | .... | 0.26 | 28 | |
| 1958 | 18 | .... | 0.32 | 27 | |
| 1959 | 13 | .... | 0.38 | 20 | |
| 1960 | 6 | .... | 0.95 | 20 | |
| | 20787 | | | | |



160918

TABLE 2.

SUMMARY OF BORE RESULTS IN TUNNEL LINES 2 TO 7

| Tunnel Line No. | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| Total depth of bores in lead (from RL 720 to bedrock) | 605′ | 855′ | 1065′ | 1255′ | 1040′ | 545′ |
| Width of lead | 400′ | 500′ | 600′ | 600′ | 600′ | 300′ |
| Average value of lead in lb/cu.yd of $SnO_2$ over all bores including a batter of 45° | 3.74 | 1.06 | 1.77 | 0.92 | 0.87 | 0.42 |
| As above but corrected to 72% Sn | N.A. | 0.98 | 1.62 | 0.88 | 0.80 | 0.38 |
| Depth of wash containing 50% of the ore | 30′ | 5′ | 20′ | 15′ | 10′ | 10′ |
| R.L. of lowest point of lead | 544.0′ | 536.0′ | 531.5′ | 530.4′ | 526.1′ | 538.6′ |



TABLE 3

CORRECTED BORE VALUES—R.L. 720′ to bedrock.

| 1<br>Line No. | 2<br>Bore No. | 3<br>Dates of Boring. | 4<br>Assay Value of Concentrates. | 5<br>Corrected Values shown on Fig. 22. | 6<br>Uncor'd Value re-cal'd. | 7<br>Col. 6 corrected for Assay. | 8<br>Depth below RL 720′ |
|---|---|---|---|---|---|---|---|
| 2 | 100′ | not available | | 2.92 | 3.11 | .... | 157 |
| | 200′ | | | 6.99 | 6.83 | .... | 180 |
| | 300′ | | | 4.86 | 4.86 | .... | 175 |
| | 400′ | | | 4.25 | 4.19 | .... | 173 |
| | 500′ | | | 0.51 | 0.52 | .... | 163 |
| | 600′ | | | 0.68 | 0.41 | .... | 153 |
| 3 | 5 | 25.8.41-9.9.41 | 69.7 | 0.72 | 0.66 | 0.64 | 162 |
| | 6 | 4.8.41-25.8.41 | 66.6 | 0.93 | 0.85 | 0.79 | 171 |
| | 7 | 3.4.41-2.5.41 | 66.9 | 2.45 | 2.33 | 2.16 | 184 |
| | 8 | 15.3.41-2.4.41 | 71.7 | 0.82 | 0.82 | 0.82 | 185 |
| | 9 | 18.2.41-14.3.41 | 70.0 | 1.05 | 1.17 | 1.14 | 186 |
| 4 | 7 | 26.5.41-17.6.41 | 68.0 | 0.87 | 0.99 | 0.93 | 178 |
| | 8 | 22.4.41-26.5.41 | 66.8 | 1.48 | 1.61 | 1.50 | 180 |
| | 9 | 19.10.39-23.11.39 | 64.0 | 3.80 | 4.11 | 3.66 | 186.5 |
| | 10 | 29.8.39 11.10.39 | 71.6 | 2.70 | 2.49 | 2.47 | 180 |
| | 11 | 27.6.39-18.8.39 | 70.9 | 1.59 | 1.00 | 0.98 | 179 |
| | 12 | | 64.2 | 1.12 | 1.13 | 1.01 | 164 |
| 5 | 5 | 20.10.41-29.10.41 | 73.5 | 0.29 | 0.22 | 0.22 | 168 |
| | 6 | 1.10.41-20.10.41 | 71.6 | 0.40 | 0.44 | 0.44 | 172 |
| | 7 | 6.9.41-3.10.41 | 70.1 | 1.48 | 1.90 | 1.85 | 189 |
| | 8 | 16.6.41-7.8.41 | 65.5 | 1.31 | 1.23 | 1.14 | 183 |
| | 9 | 12.6.41-17.7.41 | 67.8 | 0.77 | 0.68 | 0.64 | 178 |
| | 10 | 14.8.41-22.9.41 | 55.6 | 1.03 | 1.09 | 0.78 | 186 |
| | 11 | 1.10.41-6.12.41 | 68.7 | .... | 1.03 | 0.98 | 182 |
| 6 | 6 | 6-7.39 | 66.2 | 0.32 | 0.24 | 0.22 | 158 |
| | 7 | 15.1.41-14.2.41 | 65.3 | 1.11 | 1.26 | 1.14 | 176 |
| | 8 | 21.8.40 12.9.40 | 61.5 | 0.57 | 0.58 | 0.50 | 169 |
| | 9 | 6.6.40-16.8.40 | 65.0 | 2.17 | 2.14 | 1.93 | 182 |

816092

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 10 | 30.9. | 63.8 | 0.56 | 0.55 | 0.43 | 192 |
| | 11 | 14.12.39-13.5.40 | 64.7 | 0.94 | 0.83 | 0.74 | 170 |
| 7 | 9 | 5.8.40 5.9.40 | 67.3 | 0.31 | 0.44 | 0.41 | 178 |
| | 10 | 4.9.40-8.10.40 | 67.1 | 0.78 | 0.86 | 0.80 | 177 |
| | 11 | 17.10.40-21.1.41 | 62.2 | 0.50 | 0.38 | 0.33 | 180 |

TABLE 4

ORE RESERVES

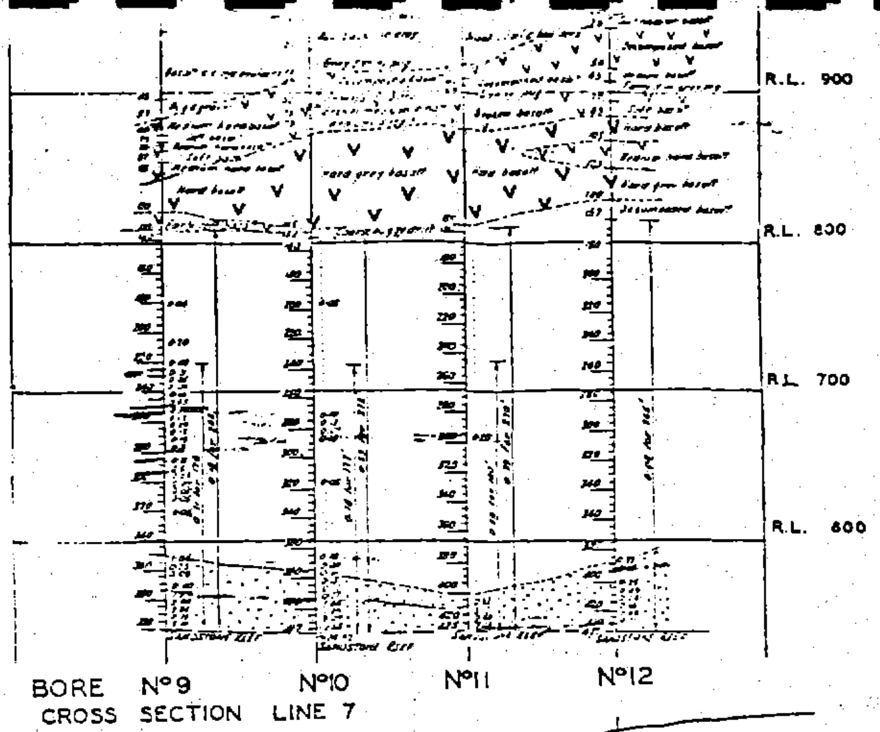
| | | Below RL 600′ | | | From RL 720′ to 600′ | | | Above RL 720′ |
|---|---|---|---|---|---|---|---|---|
| Line No. | Bore No. | Corrected Value (lb. cu. yd.) | 1000 Cu. Yd. | Tons $SnO_2$ | Corrected Value lb. cu. yd. | 1000 Cu. Yd. | Tons $SnO_2$ | Ovrbrdn. 1000 Cu. Yd. |
| 3 | 8 } 9 } | 2.68 | 84 | 100 | 0.13 | 60 | 3 | 330 |
| 4 | 6 | 0.00 | 2 | 0 | 0.00 | 6 | 0 | .... |
| | 7 | 3.91 | 12 | 21 | .... | 9 | 0 | .... |
| | 8 | 4.24 | 32 | 60 | 0 | 10 | 0 | .... |
| | 9 | 10.24 | 46 | 210 | 0.04 | 25 | 0 | .... |
| | 10 | 7.36 | 65 | 215 | 0.04 | 80 | 2 | 15 |
| | 11 | 2.03 | 73 | 66 | 0.24 | 120 | 13 | 60 |
| | 12 | 3.73 | 22 | 37 | 0.20 | 120 | 11 | 900 |
| 5 | 5 | 0.48 | 13 | 3 | 0.08 | 133 | 5 | 60 |
| | 6 | 1.36 | 60 | 36 | 0.04 | 140 | 3 | 120 |
| | 7 | 4.92 | 83 | 183 | 0.08 | 140 | 5 | 120 |
| | 8 | 3.30 | 70 | 103 | 0.04 | 140 | 2 | 120 |
| | 9 | 1.84 | 70 | 58 | 0.05 | 140 | 3 | 125 |
| | 10 | 2.19 | 74 | 72 | 0.11 | 140 | 7 | 180 |
| | 11 | 1.21 | 50 | 27 | 0.08 | 140 | 5 | 1060 |
| 6 | 6 | 0.62 | 28 | 8 | 0.06 | 140 | 4 | 83 |
| | 7 | 3.00 | 65 | 87 | 0.07 | 140 | 4 | 240 |
| | 8 | 1.55 | 65 | 45 | 0 | 140 | 0 | 400 |
| | 9 | 5.80 | 73 | 190 | 0.02 | 140 | 1 | 446 |
| | 10 | 1.33 | 85 | 50 | 0.06 | 140 | 4 | 530 |
| | 11 | 2.10 | 40 | 38 | 0.08 | 110 | 4 | 1625 |
| | | 3.20 | 1,112 | 1,609 | 0.08 | 2,213 | 76 | 6,414 |

81693

# ORE RESERVES

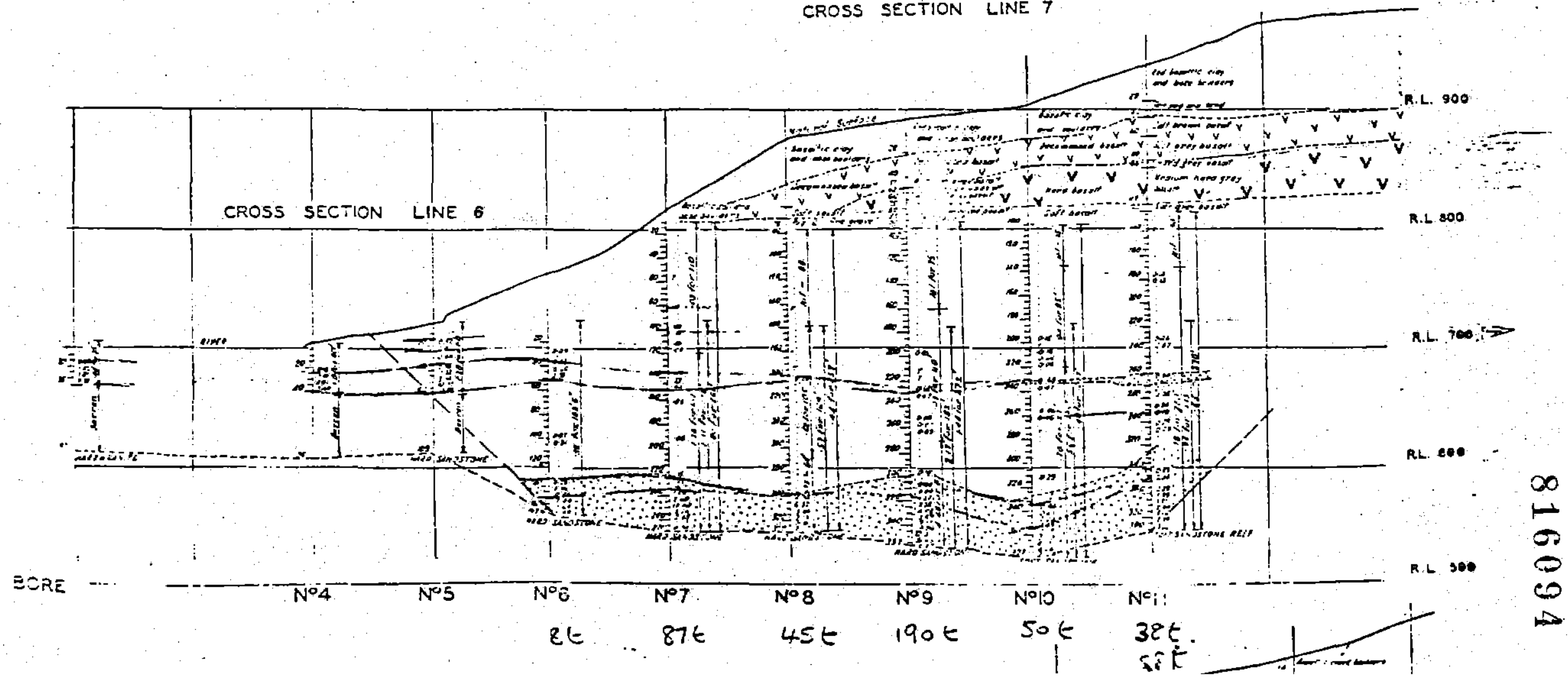
## IN THE

# CASCADE DEEP LEAD

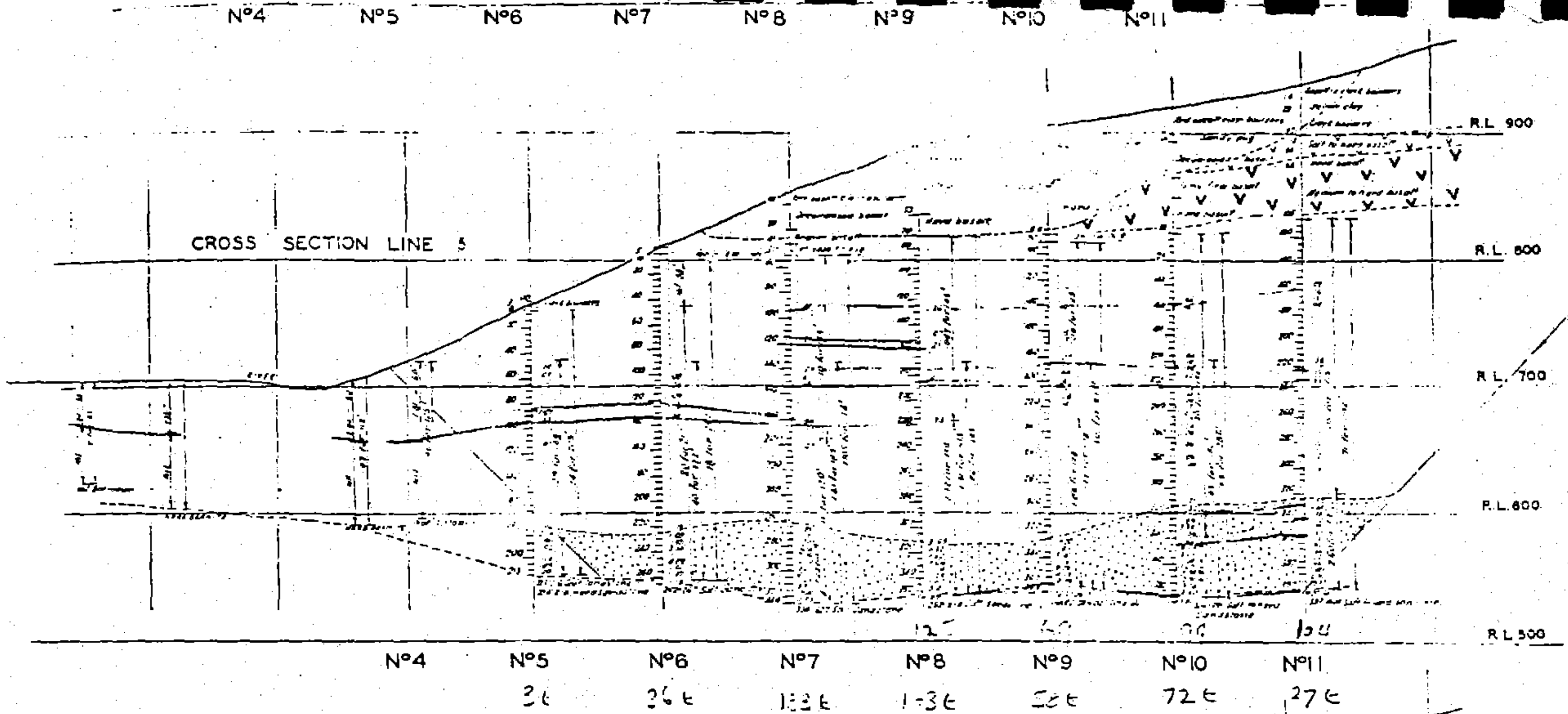


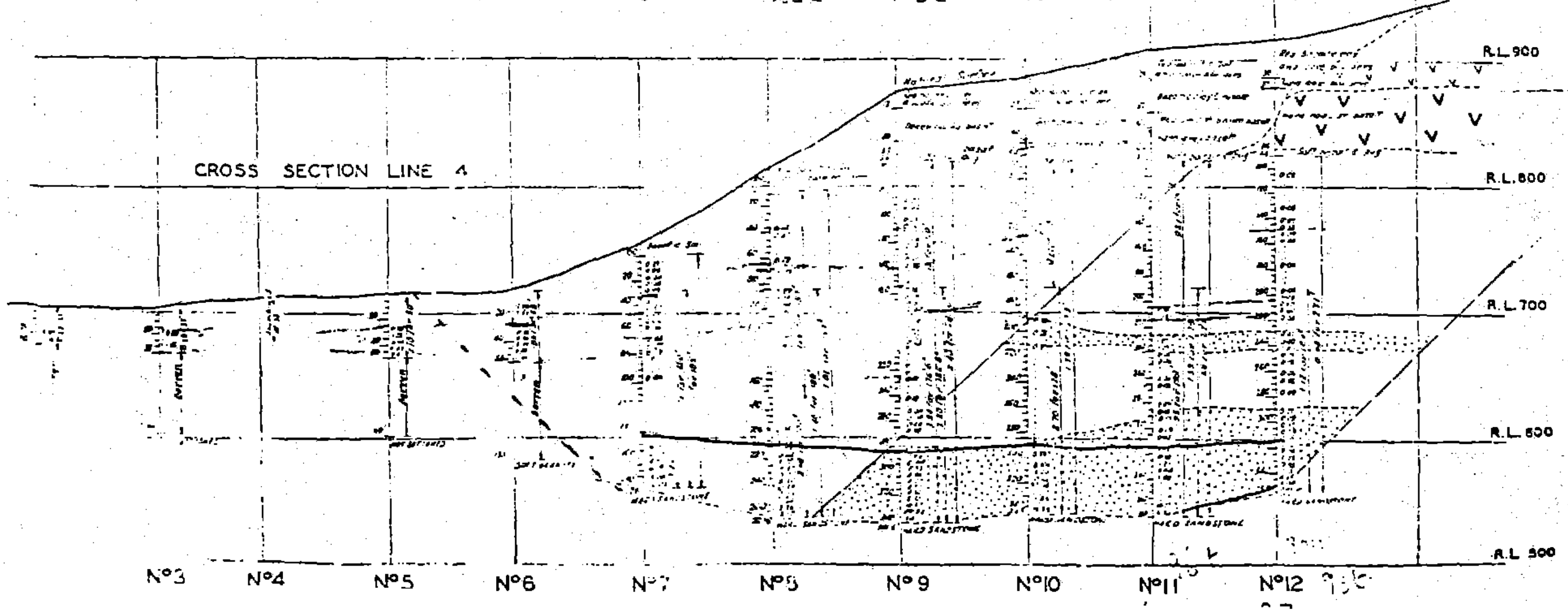

LEGEND

- MEDIUM BASALT
- HARD BASALT
- TIN BEARING WASH

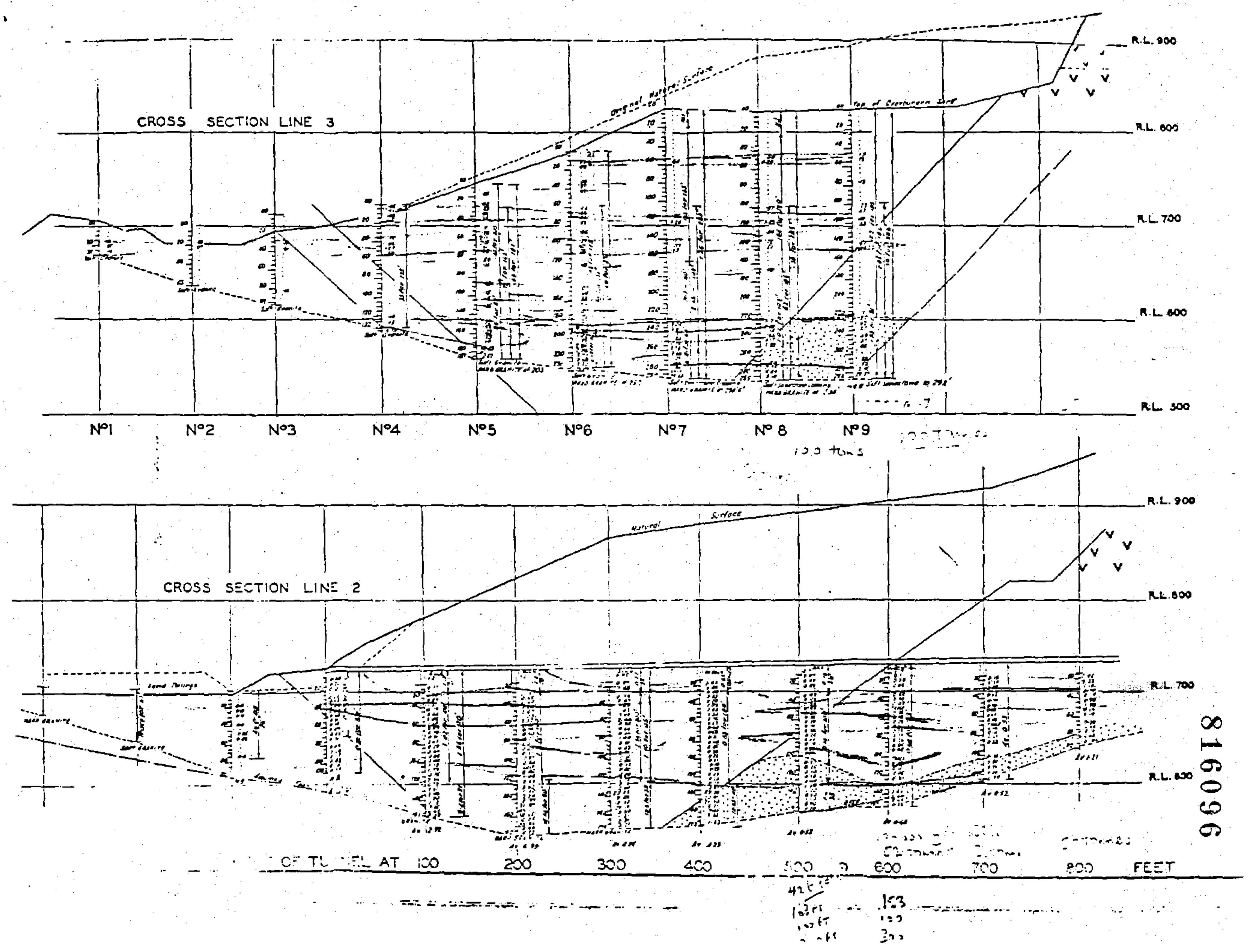



81609 4


N°4 N°5 N°6 N°7 N°8 N°9 N°10 N°11
CROSS SECTION LINE 5
R.L. 900
R.L. 800
R.L. 700
R.L. 600
R.L. 500
N°4 N°5 N°6 N°7 N°8 N°9 N°10 N°11


CROSS SECTION LINE 4
R.L. 900
R.L. 800
R.L. 700
R.L. 600
R.L. 500
N°3 N°4 N°5 N°6 N°7 N°8 N°9 N°10 N°11 N°12

816095


CROSS SECTION LINE 3
Original Natural Surface
Top of Overburden Surf
R.L. 900
R.L. 800
R.L. 700
R.L. 600
R.L. 500
Soft Granite
Hard Granite
Nº1
Nº2
Nº3
Nº4
Nº5
Nº6
Nº7
Nº8
Nº9
CROSS SECTION LINE 2
Natural Surface
Sand Tailings
Hard Granite
Soft Granite
R.L. 900
R.L. 800
R.L. 700
R.L. 600
100
200
300
400
500
600
700
800
FEET
816096

# APPENDIX 5

Report on an Assessment of Geology and Reserves of the Scotia Deep Lead - C.R. Gibson Dec. 1976

816098

# REPORT ON AN ASSESSMENT OF GEOLOGY AND RESERVES OF THE SCOTIA DEEP LEAD

by C.R. Gibson
December, 1976

816099

# TABLE OF CONTENTS



## APPENDICES

## INTRODUCTION

The object of the study was to analyse the possibility of economically mining the tin from the Scotia deep lead. In order to do so it was necessary to :

1. re-calculate the total number of tons cassiterite contained in the deep lead,

2. to delineate the distribution of the cassiterite, and

3. to establish the ratio of overburden to ore.

A further important consideration was the Geology of the overburden and particularly its clay content. The results and reports on several drilling programmes conducted on the Scotia Lead were made available by the Mines Department. The most comprehensive drilling programmes have been conducted in the area by the Mines Department. Although some of the Mines Department results have been at variance with private company testing the comparisons have been consistent in suggesting that the Mines Department drilling is reliable.

## ORE CALCULATIONS

The approach was to redraw dredge paths and sections across them and to calculate the tin in the basal wash.

A series of 72 sections covering the various runs of ore were drawn and the dredge paths outlined in the plan showing the drill hole locations.

A report on the drilling conducted by Storey Creeks Tin Mining Company (S.C.T.M.C.) during the first half of 1965 was made available to us and their results, particularly those pertaining to "Ore Block 3", were reappraised, as their conclusions appeared to be negative. In summary they reported lower values than those obtained by the Government programme. Their "lower" results are treated in more detail in the text of this report.

ORE RESERVES (see plan of drill hole locations, orebody and dredge path outlines)

The ore reserves are based on the Mines Department drilling results. Blocks 1, 2, 3, 4 etc. in parenthesis refer to the ore areas used in the Mines Department reports.

## SUMMARY OF RESERVES

Measured Ore Runs (drilling density fairly high)

| Ore Run | | Overburden (cu yds) | Ore Wash (cu yds) | Grade ozs/cu yd | Tons $SnO_2$ | Ore to Overburden Ratio |
|---|---|---|---|---|---|---|
| I. | Southern Run Sections A-V (Block I) | 2,079,725.0 | 298,840 | 47.84 | 398.9 | 1:6.96 |
| II. | Link Area (Block 3 plus some overlap Block 4) Sections LA1-LA14 | 2,462,998.0 | 275,347 | 52.47 | 403.10 | 1:8.95 |
| III. | Northern Run (Block 4) Sections N1-N25 and I-XIII | 3,630,122.0 | 713,664 | 23.49 | 467.83 | 1:5.09 |
| | | 8,172,845.0 | 1,287,851 | 35.34 | 1,269.87 | 1:6.35 |

816102

Possible Ore (very limited drilling in these areas)

| Ore Run | | Overburden (cu yds) | Ore (Wash) (cu yds) | Grade ozs/cu yd | Tons $SnO_2$ | Ore to Overburden Ratio |
|---|---|---|---|---|---|---|
| IV. | Run connecting I & II above (Block 2) | 1,701,678.0 | 135,850 | 31.74 | 120.31 | 1:12.53 |
| V. | Run to North of III above (Blocks 5 & 6) 80 chains long | 3,400,000.0 | 270,000 | 20.0 | 150.00 | 1:12.59 |
| VI. | Eastern Tributary to old Lochaber workings | 410,742.0 | 45,041 | 26.54 | 33.35 | 1:9.12 |
| VII. | Dredge path connecting Main Run & Eastern Tributary | 365,212.0 | 22,360 | 74.53 | 46.50 | 1:16.33 |
| | | 5,877,632.0 | 473,251 | 26.52 | 350.16 | 1:12.42 |
| (VI and VII combined | | 775,954.0 | 67,401 | 42.45 | 79.85 | 1:11.51 |
| Total | | 14,050,447.0 | 1,761,102 | 32.96 | 1,620.03 | 1: 7.98 |

COMPARISON OF ORE RESERVES GIVEN IN THE MINES DEPARTMENT REPORTS WITH RESERVES CALCULATED BY B.M.I., STOREYS CREEK AND KIBUKA MINES

Overall Reserves

| | This Report (Kibuka) | B.M.I. Report | Storeys Creek Report | Tas. Mines Department Report |
|---|---|---|---|---|
| Overburden (cu yds) | 14,050,477 | 23,542,126 | 9,231,700) | 4,383,203 |
| Ore (cu yds) | 1,761,102 | 1,448,424 | 1,571,738) | |
| Grade ozs/ cu yd | 32.96 | Valuation not attempted | 32.8 | 7.78 |
| $SnO_2$ (tons) | 1,620.03 | | 1,439.0 | 951.63 |
| Ore to overburden ratio | 1:7.98 | 1:16.25 | 1:5.87 | NA |
| Batter slope used | $45^0$ | $30^0$ | $60^0$ | $90^0$ |

816103

COMPARISON OF RESERVES BY ORE BLOCK AREAS (as first used and designated by the Tasmanian Government in their calculation of reserves)

The comparison is not exact as slightly different areas along the deep lead were used.

| | This Report (Kibuka) Combined Ore & Overburden Sn oz | B.M.I. Report Combined Ore & Overburden | Storeys Creek Report Combined Ore & Overburden $SnO_2$ | Tas. Mines Department Report |
|---|---|---|---|---|
| Block 1 | 2,378,565 (399 tons) | 3,223,429 | 497,417 (58) | 315,000 (62) |
| " 2 | 1,837,528 (120.31 ") | 4,329,429 | 1,761,078 (265) | 580,000 (118) |
| " 3 | 2,738,345 (403 ") | 4,348,446 | 2,415,187 (582) | 1,380,000 (346.3) |
| " 4 | 4,343,786 (468 ") | 5,150,079 | 619,630 (32) | 260,000 (76) |
| " 5) | 3,670,000 (150 ") | 7,839,167 | 2,142,460 (298) | 1,260,000 (235) |
| " 6) | | | 1,920,540 (204) | 585,000 (113) |
| Total | 14,968,224 (1540 ") | 24,990,554 | 9,353,312 (1439) | 4,400,000* (952)<br>*9,400,000 (952) batters vol added |

There is near agreement between Storeys Creek and Kibuka calculations which indicate a similar tonnage of cassiterite in the main lead (1440 vs 1540). The difference in overall yardage (overburden and wash) is probably a function of batterslope - $60^o$ vs $45^o$ - and of interpretation. B.M.I. overall yardage is 30% greater than Kibukas and is probably due to use of an even flatter - $30^o$ - batter. In the reports made available for study by the writer, B.M.I. have not attempted a valuation of contained cassiterite.

GENERAL COMMENT ON RESERVES

1. The cassiterite values lie in approximately 15' of wash on the basement (slate or sandstone) in which the original channel (gutter) of the former river flowed NNW to the sea.

2. Subsequently the wash-filled gutter was covered by layers of mixed sand, clay and in some sections further gravel wash containing some cassiterite. This overburden averages 80' in depth. In places a hard-pan cement layer is encountered just below the present soil covered surface.

3. In some sections the deep lead or buried river course has widened and spread out. These flatter sections appear to be somewhat richer which is explained by the fall-out of tin in the more quiescent sections of the river.

4. The Southern Run of ore (I in Summary of Ore) is separated from the Link Area (II) to the north by a gap of 40 chains in which there are only a few drill holes. Several of these holes have plumbed the channel which is narrow for the most part, deeply buried, and contains fairly good (2lb) cassiterite values. For "continuity" of mining it would be necessary to dredge along this path to get to the larger and richer Northern Runs (II and III).

5. Dredging of the Lochaber Tributary (VI) and the main channel northward beyond the Northern Run would depend on information from additional test drilling. The few holes drilled in these sections are very widely spaced.

6. Ground on both sides E and W of the old Scotia workings also needs further testing before the start of operations. Government geologist, Nye comments "In addition to the deep ground of the Scotia Lead, some of the shallow ground at the southern and western sides of the worked-out ground may contain sufficient values to enable it to be worked. Thus on the fall to Newhaven Creek, on the western side of the workings, a Mr. H. Roach put down 24 bore holes. The ground ranged in depth from 4 to 9.5 feet, and the values from a little tin to 1lb per c. yard".

Of the 24 bore holes :

| | | | | | | |
|---|---|---|---|---|---|---|
| 2 | holes | had | a | value | of | 1lb/yard |
| 6 | " | " | " | " | " | between 0.5 - 1lb yard |
| 7 | " | " | " | " | " | 0.25 to .5 lb/yard |
| 5 | " | " | " | " | " | 0.1 and 0.25lb/yard |

RELIABILITY OF DRILLING RESULTS

1. The B.M.I. test work (1970 - 1973) aimed at :

   a. checking the reliability of the Mines Department drilling, and
   b. to trace the channel north of the area of intensive drilling and provide information on untested areas.

B.M.I. work confirmed the reliability of the Mines Department drilling. Auger drilling was used to delineate the channel while Percussion boring was used to test for values.

The delineation of the main channel to the west of the old Scotia workings was achieved as a result of this work. It also found "no new results" in the northern part of the area where the lithology of the bore holes demonstrated an "intermingling of fluvial and marine sediments".

2. Storeys Creek Tin Mining Company's test work (1964 - 1966) also aimed at checking the results of the Government boring. They set out in particular to check selected blocks of the ore reserves, namely: Block 3, Block 4, Block 5 and 6.

Eight bore holes, S16 to S23 inclusive, were bored in Blocks 5 - 6 alongside Government bore holes. "In general the values were lower", however, "the relative distribution of values was similar".

Eight bore holes S1 - S3, S8 - S12 were bored between lines of Government bores in Block 3. They compared the weighted mean value of these bores to the average grade for the Block from the Government results. They admit that the comparison was "improper" but state that their work indicates more erratic values than suggested by the Government results. They conclude that :

a. the accuracy of their boring is in doubt,
b. the Government results should be used for final evaluation, and
c. that sufficient holes should be bored to establish the reliability of the Government results.

In our study the Storeys Creek Mining Company's results for holes bored in Block 3 were compared with results of adjoining Government bore holes. S.C.M.C. bored a total of 11 holes in Block 3 whereas the Government bored 52 holes in this area.

Whereas S.C.M.C.'s holes S1 - S3 and S8 - S12 were positioned to plumb the centre of the channel (lead) their additional holes S13, S14 and S15 were designed to test alongside a Government bore and on either side of it. As the channel is narrow (in this section) the two holes to the side at distances of 2 chains from the centre were not particularly useful.

Our comparison which disregards the overburden, shows that of the 11 holes bored by S.C.M.C.:

a. 6 reported lower values than the adjoining Government holes but of these four (S1, S2, S8, and S13) intersected mineable values. In the case of S.C.M.C. hole S2 the comparison was as follows :

| | | | |
|---|---|---|---|
| S2 | 17'00" @ | 9.27 ozs/cu yd | (95' -112') |
| Govts 59B | 21' 6" @ | 68.1 ozs/cu yd | (95'4"-116'10") |
| " 60B | 24'10" @ | 5.54 ozs/cu yd | (82'8"-107'6") |

It is very likely that whereas Government hole 59B was in the centre of the gutter hole 60B was located on the edge of it.

(b) 5 S.C.M.C. bore holes reported higher values than the adjoining Government bore holes. Of the 5 holes S3 and S11 intersected mineable values :

S3 20'0" @ 36.6 ozs/cu yd (95'-115')

S11 17'0" @ 14.50ozs/cu yd (108'-125')

It is felt that S.C.M.C.'s assessment of their results was superficial and their conclusion "(3) values did not confirm the 9 ozs/cu yd as expected from Government boring" was not warranted. The best explanation of their low value holes is of course that the lead is narrow and their holes were on the edge of the gutter.

Metallic tin content of concentrate from the wash was estimated at a conservative 50% in most cases. Concentrates from three of the holes were assayed by the Government and these were :

| | | | | | | |
|---|---|---|---|---|---|---|
| S2 | Govt. assay | 33.0% | Sn | Samplers | estimate | 10% |
| S3 | " " | 70.7% | " | " | " | 60% |
| S8 | " " | 60.7% | " | " | " | 50% |

Additional check drilling will be necessary in this area. The number of traverses may be reduced but hole spacing along a traverse should be closed up to 10 metres.

Appendix I "Assessment of S.C.M.C. Testing of Block 3" details the comparison of S.C.M.C.'s results and the Mines Department results.

816109

GEOLOGY

A serious concern was felt initially because of the large thicknesses of material in the overburden which had been described as pug. The lithology of only a selected few bore holes (as reported in the boring logs) has been plotted on geological cross-sections of the lead. However all the bore logs were sighted covering the whole length of the lead from north to south.

This information suggests :

(i) there are some thick beds of pug in some sections in the Southern Run,

(ii) the pug beds decrease in thickness and occurrence to the north, and

(iii) it will be necessary to check the material which has been called "pug" because if it is indeed a dense clay it could be a problem.

A hard-pan layer of brown cement occurs frequently two to three feet below the surface. This layer of cement is up to 5' in thickness in some places. There is usually no problem in ripping this material which in any case occurs intermittently.

Other lithological descriptions of sections include puggy drift, sandstone and clay. The latter is a minor occurrence whereas puggy drift forms the major rock type in the area. It is further described as a "puggy clayey coarse to medium sand". It is most likely that this is essentially unconsolidated material which would be susceptible to being broken up and disintegrated by the action of a suction-cutter.

The Government Geologist, Mr. P.B. Nye (Report on the Scotia Mine dated 4.7.72) describes the lead material of the old workings in the south in detail: "The lead consists of alternating layers of clayey sand and granitic quartz sand.

816110

Gravels are absent except in surface layers where rounded quartz pebbles are present on the western side. These gravels, however, have probably been formed subsequent to the lead. On the sides of the gutter the bottom "wash" consists of angular quartz pebbles, associated with brownish sandy clay. As far as can be seen from unworked portions of the lead, lignitic clayey sand fills the gutter while in places large boulders (up to 5 feet) of quartz with rounded edges rest directly on the bottom (slates and quartzites)."

No large boulders have been reported from drill holes to the north in the unworked ground. Their presence in the old workings indicate the juvenile nature of this part of the old river course (the lead). It is presumed that the wash will contain fewer large size boulders away from this source area.

## CONCLUSION

The assessment confirms the estimates of the Mines Department Reports. The deep lead contains economic grades of tin to support a profitable mining operation but only if the overburden can be removed at low cost. Kibuka's engineers are investigating low cost overburden removal methods.

Further investigations should include check evaluation of the previous boring programmes not by further boring, although this will be necessary in the low density tested areas (possible ore), but by trenching across the deep lead at two or three selected traverses. Trenching could be done by bulldozer or drag line to give a lot of vital information on clay content, rippability of cement layers, tin concentrate values, water inflow rates, size of wash boulders, dredge pond wall stability etc. Obviously each trench would involve fairly large yardages as the trench floor would have a minimum width of at least 20 metres.

Appendix I

# ASSESSMENT OF S.C.M.C. TESTING OF BLOCK 3

## TEST HOLE LOCATIONS

| S.C.M.C. Hole | | Contiguous Govt. Holes | | | Section Line |
|---|---|---|---|---|---|
| S2 | | (60B) | (59B) | | LA 1 |
| S1 | | (80B) | (92B) | (91B) | LA 3 |
| S3 | (77B) | (75B) | (50B) | (79B) | LA 4 |
| S8 | (90B) | (20B) | (21B) | (88B) | LA 9 |
| S9 | | (17B) | (20B) | | LA 10 |
| S10 | | (17B) | 17B | | LA 11 |
| S11 | | 10B | 109B | | LA 12 |
| S12 | | 97B | 13B | | |
| S13 | | 88B | | | LA 8 & 9 |
| S14 (East) | | (1W) | (48B) | | LA Bet 8-9 |
| S15 (West) | | (90B) | (24B) | | |

## TEST HOLE VALUE COMPARISONS (disregarding overburden)

| | Remarks |
|---|---|
| **Sect. LA1** | |
| 59B 21' 6 " @ 68.1 ozs (95'4 " - 116'10") | Low cp Govt hole in centre of gutter |
| 60B 24' 10" @ 5.5 ozs (82'8 " - 107' 6") | |
| S2 17' 00" @ 9.27 ozs/cuyd (95' - 112') | (Govt assay higher than Govt hole on 33% Sn) edge of gutter |
| **Sect. LA3** | |
| S1 34' 9" @ 41.0 ozs/cu yd (90' - 124'9") | |
| 91B 23' 1" @ 104.46 ozs/cu yd (93' - 116'1") | Half of Govt's good values |
| 92B 29' 0" @ 123.83 ozs/cu yd (93' - 122') | |
| **Sect. LA4** | |
| S3 20' 0" @ 36.6 ozs/cu yd (95' - 115') | Govt Assay 70.7% Sn |
| 77B Too low to be recorded TRACE | Much better than Govt holes around it are probably on side of gutter |
| 50B " " " " " " | |
| 75B 31' 8" @ 1.86 ozs (72'4" - 194' 0") | |
| 79B 5' 0" @ 29.4 ozs/ cu yd (93'0" - 98'0") | |

**Sec. LA9**

| | | Remarks |
|---|---|---|
| S8 | 14' 3" @ 23.10 ozs/cu yds (100' - 114'3") | Govt Assay 60.7% Sn |
| 90B | Trace to 101.0' | |
| 20B | 18' 8" @ 44.44 ozs (103'6" - 122'2") | Govt holes average for all ground is 9.0 ozs $SnO_2$/cu yd |
| 21B | 34' 6" @ 3.0 ozs (approx) | S8 has fairly good value at bottom i.e. half Govt value |
| 88B | 23' 2" @ 55.96 ozs/cu yd (95'4" - 118'6") | |

**Sec. Line Between LA8 and LA9**

| | | Remarks |
|---|---|---|
| or | 40' @ 8.35 ozs ( 79' - 119') | |
| S13 | 17' @ 14.32 ozs/cu yd (50/70) (102' - 119') | Lower than Govts 88B |
| S14 | 12' @ 6.45 ozs/cu yd (60/70) (103' - 115') | cp (48B) to 86' only last 12' approx 8 ozs/cu yd |
| S15 | 51' @ 3.7 ozs/cu yd (60' - 111') | Higher than Govts and over 51' Govts are trace |
| 24B | Trace to 36' only (side of gutter) | |

**Sec. Line LA 10**

| | | Remarks |
|---|---|---|
| S9 | 11'10" @ 0.9 ozs/cu yd (110' - 121'10") | No assay - estd. 10% Lower than Govt's bore value |
| 17B | 27' 6" @ 101.53 ozs/$yd^3$ (103'6" - 130') | |
| 20B | 18' 8" @ 44.44 ozs/$yd^3$ (103'6" - 122'2") | |

**Sec. Line LA 11**

| | | Remarks |
|---|---|---|
| 17B | 27' 6" @ 101.53/$yd^3$ (103'6" - 130') | |
| S10 | 14' 0" @ 4.94 ozs/cu yd (115' - 129') | Weak cp. Govt bores on either side |
| 12B | 34' 6" @ 125.6 ozs/ cu yd (99'6" - 133'10") | |

**Sec. Line between LA 11 and LA 12**

| | | Remarks |
|---|---|---|
| S11 | 17' 0" @ 14.506 ozs/cu yd (108' - 125') | Twice as high as Govt bore result |
| 10B | Stopped at 91'6" ? Low values | |
| 109B | 15' 7" @ 8.64 ozs/cu yd (102'8" - 118'3") | |

**Sec. Line between LA 11 and LA 12**

| | | Remarks |
|---|---|---|
| S12 | 25' 0" @ 2.20 ozs/cu yd (95' - 120') | ) |
| 97B | Trace values | )Comparatively low |
| 13B | 32' 6" @ 1.63 ozs/ cu yd (85'10" - 118'4") | ) |

816114

SUMMARY

6 S.C.M.C. drill holes weaker (of 6 S1, S2, S8 & S13 have mineable or interesting values)

5 S.C.M.C. drill holes better (of 5 S3, S11 have mineable values)

Low values due to :

(1) Narrow lead is probably best explanation. Values appear to be consistently low except in middle of gutter. Metallic tin content estimated in most cases. Only 3 Govt. assays for metal content.

(2) Although the lead is continuous values could be irregular, intermittent- in pockets - as would be expected.

(3) Government results higher because of run-ins caused by poor boring methods/ technique.

(4) Holes S13, S14, S15, test over 4 ch width. Whereas the actual "gutter" could be a mere one chain wide.

COMPARISON OF ORE RESERVES FOR BLOCK 3

| | Kibuka Estimates | Mines Department (Govt) Estimates |
|---|---|---|
| Volume Cubic Yards | 2,738,345 | 1,380,000 |
| Grade | 5.2 ozs/cu yd | 9.0 ozs/ cu yd |
| Tons $SnO_2$ | 403 | 346 |

N.B. Kibuka calculations use a 45% batter for the dredge pit while the Mines Department calculation is based on vertical sides. Tin concentrate tonnage is fairly close for both estimates.

816115

# APPENDIX 6

The Sub Basaltic Tin Deposits of the Rigarooma Valley - P.B. Nye, 1925

[Registered by the Postmaster-General for transmission through the post as a book]

Tasmania

DEPARTMENT OF MINES

GEOLOGICAL SURVEY BULLETIN

No. 35

# The Sub-Basaltic Tin Deposits of the Ringarooma Valley

BY

P. B. NYE, M.Sc., B.M.E., Government Geologist

Issued under the authority of

The Honourable A. G. OGILVIE, M.H.A.

Minister for Mines for Tasmania

Tasmania:

Wholly set up and printed in Australia by

JOHN VAIL, GOVERNMENT PRINTER, HOBART

1925

Price 2/6

23529

## TABLE OF CONTENTS.

## II.—LITERATURE.

The following publications contain descriptions of parts or the whole of the district:—

- Gould, Chas.: Geological Surveyor's Report on Part of County of Dorset ... ... ... ... ... 1864
- Thureau, G.: Report on Some of the More Prominent Stanniferous Deposits in the Vicinity of the River Ringarooma, County of Dorset, Tasmania ... ... ... ... ... ... ... ... 1884
- Thureau, G.: Report on Water Scheme for Supplying the North-Eastern Tin-mining Districts ... ... ... ... ... ... ... ... ... ... 1884
- Montgomery, A.: Mineral Resources of Tasmania ... ... ... ... ... ... ... ... ... ... ... 1891
- Montgomery, A.: Mineral Resources of Tasmania ... ... ... ... ... ... ... ... ... ... ... 1894
- Smith, J. Harcourt: Report on the Alluvial Tin Mines at Derby ... ... ... ... ... ... ... ... 1899
- Twelvetrees, W. H.: Report on the Arba Extended Tin Sections at Branxholm ... ... 1899
- Twelvetrees, W. H.: Preliminary Report on the Deep-Lead or Infrabasaltic Stanniferous Gravels of the Ringarooma Valley, near Derby ... ... ... ... ... ... ... ... ... ... ... 1900
- Lewis, J. B.: The New Brothers' Home No. 1 Tin Mining Company, Derby ... ... ... ... 1902-3

## III.—HISTORY.

The early history of the Ringarooma was one of settlement for agricultural and pastoral purposes. The settlement of the north-eastern part of Tasmania commenced along the northern coast, and the port of Bridport and the township of Ringarooma (now Boobyalla) were established. At the same time it was also radiating outwards from Launceston, from which centre tracks and roads were extended. This settlement was carried out on areas on which the most fertile soils were found, and thus the districts of Piper's River, Lilydale, Ferny Hills, Scottsdale, &c., were founded. The occupation of land around what is now the Scottsdale district began about 1860, and that around Maurice, in the Ringarooma Valley, about the same time. In the two latter districts the rich basaltic soil of the locality formed the attraction for the settlers who occupied them. The development of the Ringarooma Valley proceeded very slowly, however, due to lack of transportation facilities.

The history of the district as a mining one began at a much later date. Gold was the first mineral discovered in the north-eastern part of Tasmania, but it had little or no influence on the development of the Ringarooma Valley. It is the later discovery of tin ore and the establishment of the tin-mining industry that has played such an important part in the present prosperity of the district.

Specimens of tin ore were apparently found in the north-eastern part of Tasmania before 1870, but such discoveries were not followed up. During 1872 several applications were made for licences to search for tin and other ores in the district to the east of Scottsdale. In December, 1872, Benjamin Brooks and party discovered specimens of tin ore near Mt. Maurice, or Patersonia, but were not successful in obtaining financial assistance to further prospect their discovery.

In February, 1874, G. R. Bell found alluvial tin ore at several places between Scamander River and George's Bay, and tin ore at Bell Hill, but did not develop these deposits. He followed this up in March, 1874, by prospecting for, and finding, alluvial tin ore in the Boobyalla River, near Little Mt. Horror. As a result eight mineral leases of 80 acres each were applied for by separate individuals, including Bell himself, for the Boobyalla Tin Mining Company. Operations continued for several months, and 4½ cwt. of ore was forwarded to Launceston.

816117

816118

# The Sub-Basaltic Tin Deposits of the Ringarooma Valley.

## I.—INTRODUCTION.

### (1)—Preliminary Statement.

The Ringarooma Valley, in which the following investigation was carried out, is well known, not only for its rich deposits of alluvial tin ore, but also for its large extent of first-class basaltic soil.

The latter is particularly suitable for potato-growing, dairy-farming, cattle-raising, as well as other branches of the agricultural and pastoral industries, which have made the district a very prosperous one.

The deposits of tin ore have been equally responsible in the production of the prosperity of the district. They occur mainly in the form of deep leads—*i.e.*, deposits formed along the courses of former streams, and which have been covered by later sedimentary and igneous rocks. These deep leads represent the deposit along the streams of an ancient river system which drained the Ringarooma Valley of that period. This former Ringarooma Valley was filled with Tertiary sediments up to several hundred feet in thickness, and finally by Tertiary basaltic lava flows, with a thickness in places of 150 feet. The greater part of this cover of Tertiary sediments and basalt still remains intact, and the problem associated with the investigation was to determine as accurately as possible the courses of the streams forming the ancient drainage system.

Numerous mines have in the past been operating at various parts of the deep leads with varying degrees of success. The majority of these are now idle, or have been absorbed in other mines.

The only two mines operating on a large scale at the present time are the Briseis Mine at Derby, and the Pioneer Mine at Pioneer. Several parties of tributers are working at the Arba Mine at Branxholm, but the remainder of the mines are idle.



A considerable extent of sluicing has also been carried out on alluvial and detrital deposits to the south and south-east of Branxholm, notably at Ruby Flat, Anson's Creek, &c. Operations are still being carried out at the New Ruby Flat, Loyal Gordon, and Mt. Ruby Mines, and also by small parties at numerous other localities in this area.

Greisen lodes have also been found outcropping in this area, while others have been exposed during sluicing operations. These have received attention during past years, but no work is at present being performed.

### (2)—General Statement.

The field work in the Ringarooma Valley was carried out during the period between the 19th May and 17th June, with the exception of the five days' interval between 1st June and 5th June. The area to the south-east of Branxholm was examined during the period from 25th August to 7th September.

The geological mapping was carried out with the aid of the mineral charts of Warrentinna, Kay No. 3, Kay No. 1, Kay No. 2, Kay No. 4, Moorina, South Boobyalla, and South Mt. Cameron, and land charts of Dorset, 4, 5a, and 5b. The topographical features were altered where necessary, and also added to in numerous cases. Contours at intervals of 100 feet are shown on the geological map (Plate I.), and further illustrate the topography. The contours are based on aneroid readings, the datum points used being the stations on the Launceston to Herrick railway.

### (3)—Acknowledgments.

The writer desires to express his appreciation of the assistance and information given to him by Messrs. Lindesay Clark (manager, Briseis Mine), C. G. Ryan (manager, Pioneer Mine), A. J. Ritchie (manager, Mt. Ruby Mine), A. Power (manager, New Ruby Flat and Loyal Gordon Mines), and T. McDonald (representing the Granville syndicate), and also to the numerous other residents of the districts who helped in a similar manner.

The company appears to have ceased operations in September, and the sections do not appear to have been surveyed.

Subsequently, in 1874, G. R. Bell made further discoveries of alluvial tin ore in the Upper Cascade River and at Thomas Plains (now Weldborough).

The latter part of 1874 and the succeeding years (1875 and 1876) were the times of numerous other discoveries. Prospecting revealed the alluvial deposits at Mt. Cameron, and ore was sent away in 1875. At the same time mines were being worked at the Winiford River, Blue Tier, Weldborough, Upper Cascade River, Moorina, Derby, Branxholm, &c. All the important discoveries, excepting the Pioneer and Arba mines, were made between 1874 and 1876.

The history of the mines is that familiar on many other mining fields. The fluctuating price of tin caused alternate periods of activity and idleness. The shallow and rich alluvial deposits along the streams gradually became worked out and exhausted.

In some cases the following of shallow deposits led to the discovery of the Tertiary sub-basaltic alluvial deposits, but these had also been independently found at Branxholm, Derby, Main Creek, &c. The mining of these deposits was a much larger problem, and one only to be undertaken by companies, which has been carried out at Pioneer, Moorina, Main Creek, Derby, and Branxholm. Of the companies operating such deposits, only the Pioneer at Pioneer and the Briseis at Derby have persisted, although it is only comparatively recently that the Arba at Branxholm ceased operations.

With the advent of the mining industry the necessity for better transport facilities was emphasised. The roads from Scottsdale, George's Bay, and Boobyalla were gradually improved in order to overcome these difficulties. In 1893 a railway was constructed as far as Scottsdale, and was later extended to Branxholm, and subsequently to Herrick. Not only did these facilities help the mining industry, they also assisted the agricultural and related industries of the district. At the present time dairy-farming, potato-growing, cattle-raising, and agriculture are carried out on the fertile basaltic soil. Also the timber industry came into existence, and sawmills have been, and are at present, operating throughout the district.

These industries (mining, timber, agriculture, &c.) have jointly contributed to the prosperity which the district is at present experiencing.

816120

## IV.—GEOGRAPHY AND PHYSIOGRAPHY.

### (1)—Location and Extent.

The district described in this report is situated in the eastern portion of the County of Dorset, in the north-eastern part of Tasmania. It consists of a long tract of country along the course of the Ringarooma River, from Maurice to Pioneer, and extending from the latter township as far north as the western end of the Mt. Cameron Range.

It lies wholly within the Municipality of Ringarooma, and includes the townships of Ringarooma, Legerwood, Branxholm, Derby, Winnaleah, Moorina, Herrick, and Pioneer.

The total area of the district examined is between 90 and 100 square miles.

### (2)—Access.

Access to the district is readily available, either by road or railway, from Launceston, the chief centre of Northern Tasmania.

The Tasmanian Government Railway from Launceston to Herrick enters the district near Legerwood (66¼ miles), and passes through it as far as Herrick, which is the terminus, and is 84¾ miles from Launceston.

The main road from Launceston to the North-East and East Coast districts also passes through the district. It enters near Legerwood, and passes out of the district at Moorina. The continuation of this road through Weldborough, Lottah, St. Helens, and Scamander is connected with St. Marys, the terminus of the Conara to St. Marys railway.

Herrick is connected with the small port of Boobyalla by two roads. One of these runs directly between these two places, but has a bad surface for a large proportion of its length. The other passes through Pioneer and Gladstone, and while it is of greater length, it is a much better road.

Numerous good by-roads traverse the district and connect outlying parts with the main road and the railway.

### (3)—Topography.

#### (a) General Description.

The topography of the Ringarooma Valley is essentially that of a long narrow plain, which has been largely dissected by the present Ringarooma River. The plain was formed by the flooding of, and deposition of sediments in, an ancient river valley, the sediments being later covered by flows of basaltic lava. The sides of the old valley form those of the present one, but have been modified by denudation.

The north-western side of the valley consists of a low range, which branches off the Billycock Tier in a north-easterly direction, and forms the divide between the head-waters of the Great Forester River and the Boobyalla River on the north-west and the Ringarooma River on the south-east. The south-eastern side of the valley is formed by the comparatively elevated country between Mt. Victoria and Weldborough, which is the divide between the Ringarooma River and the George River to the south.

To the north and east of Herrick and Pioneer the Ringarooma River has departed from its former course, and passes to the east of Mt. Cameron. The ancient river valley was also much wider at this locality, and a comparatively low-lying tract of country composed of Tertiary sediments extends northwards to the coast.

### (*b*) *Mountains.*

No prominent hills or mountains occur within the district examined, the only elevated country being the sides of the ancient and present Ringarooma River valley. In close proximity, however, such mountains as Mt. Horror (2000 feet) and Mt. Cameron (1800 feet) occur to the north, and Mt. Victoria (3964 feet) and the elevated country of Weldborough and the Blue Tier to the south.

Small prominences on the latter elevated country are Murray Look-out, Bell Hill (2600 feet), Gray Hill or Bullman's Bluff (1860 feet), and Mt. Paris (1810 feet).

In the valley of the Ringarooma River the corrosion of the river through the basalt and underlying Tertiary sediments has formed steep cliff-faces. These are highest in the northern part, and in some cases rise to heights of 300 feet above the surrounding country.

### (*c*) *Plains.*

The filling of the Ringarooma Valley with Tertiary sediments and basaltic lava flows caused the formation of a long narrow plain. The subsequent denudation of the Ringarooma River system has largely dissected this plain and divided it into a number of smaller ones.



### (*d*) *Streams.*

The greater portion of the district examined is drained wholly by the Ringarooma River and its tributaries. This river rises by means of numerous branches in the elevated country between Mt. Victoria, Mt. Maurice, and Mt. Scott, the more important of these being the main stream itself and the Maurice River. It has a general northerly course as far as Branxholm, where it turns to the north-east and follows that course to the east of Mt. Cameron, where it changes its direction to north-west and enters Ringarooma Bay at Boobyalla.

The most important tributaries enter the river from the south and south-east side, and south to north are the Dorset River, Branxholm Creek, Black Creek, Cascade River, Main Creek, Weld River, Frome River, and Winiford River. The largest tributaries on the north-western side are Legerwood Rivulet, David Creek, and Bradshaw's Creek.

The northern part of the area is drained by the head-waters of the Boobyalla River and the Little Boobyalla River.

## (4)—Climate and Meteorology.

The climate of the Ringarooma Valley is a moderately cold and wet one. It varies with the altitude, and the elevated country to the south is, of course, much colder and wetter. Snow falls only occasionally on the more elevated country. Severe frosts are experienced in the valley during the winter.

816121

The following table (No. 1) gives the average monthly and yearly rainfall for all stations at which it is recorded in the district:—

TABLE No. 1.

*Rainfall Data of the Ringarooma District.*

| Station. | Number of Years of Average. | Jan. | Feb. | Mar. | April | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Year. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Weldborough .. | 4 | 297 | 191 | 195 | 260 | 502 | 795 | 686 | 558 | 537 | 653 | 342 | 219 | 5233 |
| Ringarooma ... | 26 | 267 | 176 | 311 | 351 | 475 | 698 | 577 | 517 | 498 | 460 | 384 | 292 | 4909 |
| Branxholm ... | 15 | 229 | 174 | 361 | 289 | 471 | 753 | 551 | 561 | 476 | 441 | 274 | 268 | 4701 |
| Moorina... ... | 15 | 197 | 145 | 363 | 294 | 461 | 694 | 482 | 454 | 433 | 391 | 263 | 310 | 4487 |
| Pioneer ... ... | 21 | 188 | 214 | 271 | 265 | 391 | 539 | 432 | 362 | 337 | 338 | 200 | 252 | 3789 |

816122



The annual rainfall varies from 3789 to 5233 points, which represents a fairly high rainfall. It will be observed that the rainfall increases as the Ringarooma Valley is ascended from Pioneer to Ringarooma. This is due partly to the *greater* altitudes at the head of the valley, and partly to the proximity to the more elevated regions. The rain is not evenly distributed throughout the year, but it is essentially a winter rainfall, the months of May, June, July, August, September, and October being those of largest rainfall. June is the wettest month, and February the driest.

### (5)—VEGETATION AND TIMBER.

The greater part of the district was formerly covered with forests and undergrowth of many kinds, but much of it has now been cleared *for agricultural*, mining, and sawmilling purposes.

Eucalypt forests are the common type, with myrtle trees occurring only at the higher altitudes, or in isolated localities along streams. The most plentiful species are stringy-bark, stringy-gum, white-gum, and peppermint. Blue-gum does not occur. The stringy-bark and stringy-gum trees are the most important ones from the sawmilling point of view.

Blackwood and lightwood trees are fairly numerous, and the former plays a large part in the timber industry, owing to its value for furniture-making, &c.

The above forests occur to the west, south-west, and south of Herrick. The district to the *north-east* and east of Herrick is almost treeless.

Practically all the basaltic land and adjacent regions have been cleared and grassed, and now sustain thriving dairying and cattle-raising industries. Potato-growing and agriculture are also practised.

The timber and sawmilling industry is being carried on to a large extent, though the valley itself is now almost depleted of timber, and operations are being continued further afield in the hills.

### (6)—RELATION OF MINING TO TOPOGRAPHY.

#### (a) *Mining Operations.*

Owing to the fact that the alluvial tin deposits are buried under a large thickness of Tertiary sediments and basalt in the Ringarooma Valley, the topography is rather unfavourable for mining purposes.

81623

In the Ruby Flat area, to the south-east of Branxholm, the topography is favourable for the exploitation of the primary and secondary tin deposits of that area.

### *(b) Water-Supply and Power.*

The rainfall of the parts of the district from which water-supplies are drawn is probably at least 50 inches, which is moderately high, and one which should ensure a good water-supply. It is, however, a winter rainfall, and the rainfall during summer is comparatively low. This, combined with the fairly rapid run-off, makes the storage of water necessary to ensure a continuous supply throughout the year.

The youthful nature of the topography is favourable to the development of hydro-electric power, as the steep grade of the streams permits of suitable pressure heads being obtained.

# V.—GEOLOGY.

## (1)—Introduction.

### *(a) Summary.*

The oldest rocks occurring within the district are the slates and sandstones (Mathinna series) referred to the Cambro-Ordovician period. They are intruded on a large scale by granite of Devonian age, which is a portion of the batholith of North-Eastern Tasmania. Diabase of Upper Mesozoic age occurs intrusive into the above rocks.

Gravels, grits, sands, and clays of Tertiary age overlie the above along the valley of the Ringarooma River. These are, in turn, overlain by flows of Tertiary basalt.

River alluvium of Pleistocene to Recent age has been formed along the courses of the streams.

### *(b) Geological Map.*

A geological sketch-map of the district is shown on Plate I. On it are marked the geographical and topographical features, and, in addition, contours at 100-feet intervals.

The geological formations which outcrop at the surface, and the boundaries thereof, are indicated.

## (2)—The Sedimentary Rocks.

### *(a) The Cambro-Ordovician System.*

The rocks of this system consist of slates, sandstones, and quartzites. The slates, where exposed on the surface, are light buff-coloured varieties, but those from mine workings are much darker. They are thinly laminated, but cleavage-planes, unless coincident with the bedding, are not prominent.

Light-coloured sandstones outcrop at the surface, but at depth they appear to be represented by darker-coloured quartzites and sandstones. The light colour of the slates and sandstones, and the alteration of quartzites to sandstones are due to superficial weathering.

These rocks occupy a relatively small part of the surface, but they form the bedrock of the whole of the Ringarooma Valley between Maurice and Derby, and portion as far as

Winnaleah. They form an irregular tract of country, with a general north-westerly trend, which is bounded to the west, north-east, and east by granite. This tract attains its greatest width in the north, where it is about 9 miles wide across the strike of the rocks. Near Ringarooma it is narrower, and only 4 to 5 miles wide.

The areas in which these rocks occur are covered with soil, and so strikes and dips can only be recorded in artificial exposures, such as road and railway cuttings, &c.

The general strike is from north-north-west to south-south-east, but in one area it is east of north. The strata are folded into a series of anticlines and synclines, and dip at all angles up to 75 degrees. Between the cutting at the western end of Mara and the Telita station two anticlines, with intervening synclines, occur. There is also a faulted area in this section in which the strike of the beds is east of north, and the dip to the west. Other folds undoubtedly occur in other parts of the district, but cannot be detected.

These strata have therefore been intensely folded and faulted. No detailed section of the whole thickness of them could be obtained, but the total thickness must be considerable.

No fossils have been found in this series of rocks anywhere in the north-eastern part of Tasmania, so that their age cannot be definitely determined, and they are referred to the Cambro-Ordovician system. The same belt extends southwards to the Alberton and Mathinna goldfields, and is found in other localities in the north-east of Tasmania, and is referred to as the Mathinna slates and sandstones. The similar strata of the Balfour and the Bischoff slates and sandstones in North-Western Tasmania are correlated with this series. Lithologically and structurally it is very similar to the Ordovician system in Victoria, but no graptolites have yet been found in it.

### (*b*) *The Tertiary System.*

The rocks of this system consist of conglomerates, gravels, grits, sands, and clays. The conglomerates and coarse gravels form the basal members, and are composed of boulders of granite, quartz, and metamorphosed sandstones in a finer matrix. The finer gravels consist of water-worn pebbles of white opaque reef quartz, and also of glassy quartz, such as that derived from granite. The

81624



grits form the greater portion of this system, and are composed of angular and partly-rounded pieces of glassy quartz, between ⅛-inch and ¼-inch in diameter. These pieces of quartz have been derived from the disintegration of granite, and were deposited without undergoing any considerable amount of rounding by water action. Strangely enough, the other products of weathered granite, viz., mica and decomposed felspar, have been almost totally separated from the quartz. Beds of very stiff clay occur erratically within the system. The clays and sands are sometimes stained black, due to the presence of carbonaceous matter derived from wood and vegetation.

These rocks are horizontally bedded, except where local current-bedding is evident. Their thickness varies according to the position they occupy in the Ringarooma Valley. They are thickest at the north-eastern extremity of the district, and gradually decrease in thickness, until between Ringarooma and Maurice they peter out. This variation is due to the gradual filling-up of the ancient Ringarooma Valley, with its bottom sloping to the north-east, by horizontally-bedded sediments. The thickness also varies across the valley, being naturally greater in the portion where the ancient river flowed.

The lowest point in which the base of the Tertiary beds is exposed is in the Pioneer Mine workings, where the bedrock is about 200 feet above sea-level. To the north and west of Herrick the upper beds are overlain by basalt at altitudes of 650 feet above the sea. The total thickness is therefore at least 450 feet, and allowing for the slope of the Winifred lead into the Ringarooma lead, it must total at least 500 feet. At the Briseis Mine, on the Cascade lead, a thickness of 310 feet of Tertiary sediments is exposed, and at the junction of this lead with the Ringarooma lead the thickness must be between 350 and 400 feet. Further to the south-west the thickness cannot be measured or estimated, but it gradually decreases in that direction.

The system consists of the rock-types described above. The basal members consist of coarse conglomerates and gravels, which pass upwards into finer gravels or grits. The grits form the greater part of the system, and contain interbedded gravels and clays. The clays and the carbonaceous material are confined to the bottom part of the system, and are exposed only in mine workings such as the Briseis, Echo, Moorina, and Pioneer. A complete and detailed section is unobtainable, except at the Briseis Mine, from which the following general section was taken:—

| Depth. | Thickness. | Strata. |
|---|---|---|
| ft. in. | ft. in. | |
| 118 | 118 | Hard, dense, fine-grained olivine basalt with large masses of olivine. Slightly vesicular at upper surface. Columnar and ball-and-socket jointing. |
| 120 | 2 | Quartz grits and sands. |
| 160 | 40 | Basalt completely decomposed, with exception or a few kernals in areas of spheroidal jointing and weathering. Highly vesicular at upper surface. |
| 190 | 30 | Basalt completely decomposed, with exception of a few kernals in areas of spheroidal jointing and weathering. Highly vesicular at top. |
| 215 | 25 | Quartz grits and gravels. |
| 240 | 25 | Clay (pug) with quartz grit, and interbedded quartz grits and gravels. |
| 250 | 10 | Gravels. |
| 260 | 10 | Quartz grits, gravels, and clayey beds. |
| 270 | 10 | Sands and quartz grits. |
| 275 | 5 | Clay (pug) with quartz grit. |
| 285 | 10 | Quartz gravels with pebbles up to ½-inch diameter. |
| 300 | 15 | Clay with quartz grit. |
| 355 | 55 | Strata not exposed. Probably quartz grits, gravels and clays as above. |
| 355 | ... | Present river-level. |
| 375 | 20 | Quartz grits. |
| 415 | 40 | Quartz grits, sands, and gravels. |
| 415 | ... | Black colouration, due to carbonaceous material, appears. |
| 425 | 10 | Thinly-bedded sands with pieces of lignitised wood. Interbedded layer of quartz grits and *course gravels.* |
| 445 | 20 | Sands with occasional pieces of lignitised wood. |
| 455 | 10 | Sands and grits. |
| 465 | 10 | Grits and coarse gravels with pebbles up to 6-inch diameter. Rocks cemented with iron pyrite. Lead water issuing from gravels. } To north-east of section a 20-foot bed of clay occurs at this depth. |
| 475 | 10 | Sands and grits cemented with iron pyrite, and containing numerous pieces of lignitised wood. |
| 495 | 20 | White tenacious clay (pug). |
| 500 | 5 | Basal beds of large boulders, white clay (pug), &c. |
| | | Decomposed granite. |

816125



These Tertiary beds are found throughout the Ringarooma Valley, from Ringarooma in the south-west to Pioneer and the west end of Mt. Cameron in the north-east, and further north than the latter. They are thinnest near Ringarooma, but cover a fairly wide area. At Branxholm the width is less than ¾-mile, and near the Briseis Central Mine it is only ½-mile. To the north-east of Derby it increases to 1½ mile, and even greater, but it decreases again at the west end of Mt. Cameron. Further north they probably connect with other Tertiary beds, which extend more or less continuously along the northern coast. To the north of Herrick, near the western end of Mt. Cameron, the sediments are different in nature, and consist of fine sands and grits, which are abundantly stained and cemented by oxides of iron.

The only organic remains found in these sediments consist of pieces of wood and fossil fruits. The wood is very abundant at some localities, and occurs as pieces up to several feet in length. Several specimens of fruit have been obtained, but no leaves have yet been reported. These fossils have not been examined and described, so that no precise age-determination is possible, but generally they indicate a Tertiary age.

The field relations do not yield evidence for a precise age determination. The strata overlie Cambro-Ordovician slates and sandstones and Devonian granite, and are themselves overlain by basalt regarded as being of Tertiary age. In correlation with other districts in Tasmania, *e.g.*, Launceston Tertiary Basin, Sassafras, Waratah, Macquarie Harbour, and Derwent Valley, where similar unconsolidated fresh-water sediments are overlain by basalt, the sediments are regarded as of Lower Tertiary age, and the basalt as closing this period.

### (c) *Pleistocene to Recent.*

Since the flows of Tertiary basaltic lava were poured out, the streams of the Ringarooma Valley have been busily engaged in cutting down their course to a depth somewhere near their original level. This process is not complete, but is now proceeding at a much slower rate than formerly, and since Pleistocene or Recent times deposits of alluvium, &c., have been accumulated at various points along the courses of the streams. These deposits consist mainly of river alluvium. Mine workings have revealed, however, that several feet of the upper layers consist of "shingle." This material is composed of flat pebbles up to 6 inches in diameter. The pebbles consist of Cambro-Ordovician rock types (sandstone, quartzite, and metamorphic types), and are water-worn and rounded at the edges. Similar alluvium, river gravels, and shingle have also been formed along the tributary streams of the Ringarooma River.

### (3)—The Igneous Rocks.

#### (a) *Devonian.*

Granite outcrops over a large part of North-Eastern Tasmania, and is remarkably uniform in appearance and mineralogical composition. The typical granite is a coarse-grained holocrystalline rock, with numerous large porphyritic crystals of felspar, and consists essentially of *quartz, felspar, and mica*. The quartz is of the usual clear, glassy variety common in granitic rocks. It is very uniform in size (up to half an inch diameter), and only occasionally larger, and porphyritic in appearance. The felspar is a white variety showing multiple twinning, and represents one or more members of the plagioclase series. It occurs as large phenocrysts up to 3 inches in length, and also as smaller crystals in the remainder of the rock. Biotite is the usual mica present, and muscovite occurs only to a very small extent. The biotite was the first mineral to crystallise, and numerous small flakes are contained in the porphyritic felspars.

The rock is generally termed granite, but it is probably a granodiorite (excess plagioclase over orthoclase). Petrologically it is very similar to the Devonian granodiorites of Victoria.

In the Ringarooma Valley this rock occurs at the surface as two isolated bodies, one in the west of the district, and the other in the eastern part. The western body extends both to the north and south, and forms such prominent features as Ben Nevis, Mt. Maurice, Billycock Tier, Mt. Stronach, &c. The eastern body forms the elevated country around Weldborough and the Blue Tier, and extends further easterly to the coast. To the north it forms the Mt. Cameron Range and a large portion of the surrounding country, although it is covered by Tertiary and later deposits.

Though separated at the surface, these two bodies undoubtedly unite at depth, and with adjacent outcrops of granite form the batholith of North-Eastern Tasmania.

81612



The age of the granite cannot be precisely fixed within the district. It is intrusive into, and therefore younger than, the Cambro-Ordovician rocks. It is overlain by Lower Tertiary sediments, and is therefore older than these. In other parts of Tasmania granite intrudes Silurian rocks, and is overlain by Permo-Carboniferous rocks, and it is therefore regarded as being of Devonian age. In accordance with this evidence the granite of the north-east is also regarded as Devonian.

In the vicinity of greisen and other forms of tin lodes, the normal granite is generally absent, and an even-grained muscovite or muscovite-biotite granite occurs. Tourmaline is also present in the granite, but while some of it may have been formed at the time of consolidation of the granite magma, most, if not all, appears to have been introduced during the period of mineralisation which accompanied the final phase of the consolidation.

In the district to the south-east of Branxholm the granite is overlain at many places by small areas of the Cambro-Ordovician rocks. The junction of these rocks represents the upper surface of the granite batholith, which is therefore intact at these places, and has suffered little denudation in adjacent areas.

#### (b) *Upper Mesozoic.*

Diabase of this age occurs in the south-western portion of the district. It is a medium to coarse-grained rock similar in every respect to that found in many parts of Tasmania, and consisting of plagioclase felspar and augite. It has been described so often that repetition here is unnecessary.

The rock occurs as an elongated dyke-like body about half a mile wide, and with a trend from north-west to south-east. To the north-west its extension is covered by Tertiary basalt, and it was not followed any great distance to the south-east. On its western extremity the rock is intrusive into Devonian granite, and on its eastern side it intrudes Cambro-Ordovician rocks. The diabase intrusion therefore took place along the junction of the granite and the Cambro-Ordovician slates.

The field evidence in this area proves the diabase to be post-Cambro-Ordovician and pre-Tertiary. At Mt. Victoria, to the south-east, it is intrusive into Permo-Carboniferous rocks. In other parts of Tasmania it also intrudes the Trias-Jura rocks. Its age is therefore post-Trias-Jura and pre-Tertiary, and it is generally referred to as Upper Mesozoic.

Numerous boulders of diabase occur along the south-western slopes of Bullman Bluff, but the rock cannot be found *in situ*. These boulders are found in the country occupied by the Cambro-Ordovician rocks, and a short distance below the basalt capping of the hill. They are undoubtedly shed from a dyke which intrudes the Cambro-Ordovician rocks.

### (c) *Tertiary.*

Basaltic lava flows filled the valley of the Ringarooma River, and completely covered the Tertiary sediments therein. Later denudation has removed portion of the basalt, but the rock at present occurs continuously from Maurice to the north of Herrick.

The rock is generally of the one type, but slight differences are discernible throughout the district. These are due mainly to the fact that several flows occurred, but variation is also present in the same flow.

The usual type is a dense, fine-grained, slightly vesicular basalt in which individual crystals cannot be detected in hand-specimens. Large patches of greenish-coloured olivine occur, but they weather so rapidly that their former presence can only be detected by the holes and depressions in the rock from which they have weathered out. Smaller areas of olivine are also present, and the rock is undoubtedly a basic olivine basalt, consisting probably of the essential minerals, felspar, augite, and olivine. The rock is amygdaloidal at some localities, but the amygdules are generally very small and cannot be satisfactory determined.

A sample of the material from one of the larger amygdules was analysed in the Mines Department laboratory, with the following results:—

| Constituent. | Per Cent. |
|---|---|
| Silica ($SiO_2$) | 40·4 |
| Ferric Oxide ($Fe_2O_3$) | 1·43 |
| Alumina ($Al_2O_3$) | 31·87 |
| Lime ($CaO$) | 5·75 |
| Magnesia ($MgO$) | 1·08 |
| Ignition Loss at 250° C | 17·00 |
| TOTAL | 97·53 |

816127



The mineral therefore appears to be a hydrated calcium aluminium silicate analogous to a zeolite. On comparing the analyses and the formula calculated therefrom with known species it is found that the mineral contains an excess of alumina, as shown by the calculated formula—

$$(Ca\ Mg\ Na_2)O \quad 2Al_2O_3 \quad 4SiO_2 \quad 5H_2O.$$

The basalt weathers very rapidly, and some flows are almost completely decomposed, while others remain quite fresh and hard.

Numerous flows are undoubtedly represented in the district, but it is difficult to detect different flows unless suitable exposures occur. Between Branxholm and Ringarooma only one flow appears to be present, but it is possible that at least two are represented between Legerwood and Ringarooma. South of Ringarooma the basalt rises to much greater altitudes, and is several hundred feet thick, which thickness may be made up of several flows.

To the north-east of Branxholm the different flows are more readily detected. At the Briseis Mine three flows are exposed in the workings. The bottom flow is 30 feet thick and slightly vesicular at the top, and is almost completely decomposed. The few unaltered portions consist of a fine-grained olivine basalt, similar to the usual type occurring within the district. The middle flow is 40 feet thick, and rests directly on the bottom one, and is almost completely decomposed in a similar manner. The unaltered kernals remaining are fine-grained, but somewhat coarser than the lower flow. Olivine occurs sparingly, and the rock appears less basic and more felspathic than the average type. The middle flow is slightly vesicular at the top, and a layer of grits, from a few inches to several feet thick, separates it from the upper flow. The upper flow is a dense, fine-grained, basic type, with abundant olivine, and slightly amygdaloidal in places. It is extremely resistant to the weather at certain localities, and forms a very rocky surface. This flow flooded the valley beyond the limits of the Tertiary sediments, and at its margin rests on the "rim-rock" of granite or slates and sandstones. It is at least 120 feet thick at its thickest part, and extends from Derby to the north-east as far as the basalt extends in that direction. The underlying flows are exposed along the railway between Herrick and Winnaleah, and are separated from the upper flow by several feet of grits.

A rather uncommon type of basalt forms the bottom flow over the Main Creek lead. It is an extremely coarse-grained type, individual crystals varying in length up to ¾-inch. The rock is largely composed of felspar, and olivine is absent. This coarse-grained type is present only in the Main Creek lead. If it has any connection with any of the other flows, it is probably with the middle flow of the Briseis Mine.

The source or sources of the flows have not been located, and they are probably still covered by the existing basalt. From the elevation of the basalt to the south of Ringarooma, and around Maurice, it is evident that part, at least, of the basaltic lava originated in this locality and flowed down the valley of the old Ringarooma River. The extreme southern edge of the basalt was not examined, and it is possible that the source may be readily located. In addition to this source it is also probable that others existed in the vicinity of Derby, and gave rise to the upper and possibly middle flows, and also to the coarse basalt of the Main Creek lead. Bullman's Bluff, or Gray's Hill, has been described as an extinct crater, but represents merely a surface flow at a much higher level (1800 feet above the sea) than those in the Ringarooma Valley.

Narrow dykes of completely decomposed igneous material occur in the granite country to the south-east of Branxholm. Many of these appear to represent decomposed basic rock-types, similar to basalt. Pieces of relatively unaltered basalt occur near some of these dykes, though none were found *in situ*. It is probable, therefore, that some of the dykes were of basalt.

The basalt and underlying Tertiary rocks containing wood and plant remains are to be correlated with similar occurrences throughout Tasmania. The leaf-beds are referred to as Lower Tertiary, and the basalt is regarded as closing this period. The basalt of the Ringarooma Valley is therefore regarded as closing the period of Lower Tertiary sedimentation.

### (4)—The Metamorphic Rocks.

Contact-metamorphic rocks are the only ones which occur within the district, and of these those which have been formed by the granitic intrusions are the only ones of any extent. The Cambro-Ordovician slates and sandstones have been altered for some distance from their contact with the granite. The alteration is, of course, greatest at the contact, but the actual contact is seldom

81612



exposed. In the deep railway cutting at the summit of the railway, between Legerwood and Tulendeena, a good section is exposed, although the rocks are largely weathered and decomposed. Adjacent to the granite the sedimentary rocks (sandstones) have recrystallised and formed a fine-grained rock containing contact metamorphic minerals, which have, however, been decomposed by weathering. Outside this zone of recrystallisation the effect is less, and the rocks have been altered to hornfels, quartzites, hardened sandstones, &c., until finally the normal types occur. The quartzites and indurated sandstones are the common types, and occur at Legerwood, Branxholm, and Derby.

The diabase has had little or no effect on the intruded rocks, and the action of the basalt on the underlying Tertiary sediments is negligible.

### (5)—Structural Geology.

#### (*a*) *General.*

The structure of the district is comparatively simple. The Cambro-Ordovician rocks have been folded into a series of anticlines and synclines, and also largely faulted. These were intruded by a portion of a large granitic batholith. Diabase intrusions penetrated the above on a small scale. The above rocks were subjected to a long period of denudation, during which the river system of the ancient Ringarooma River was evolved. The valley of the main stream, and portion of its tributaries, were filled with Tertiary sediments to a thickness of 300 feet, which were in turn covered by flows of basalt up to 200 feet thick.

#### (*b*) *Folding.*

The Cambro-Ordovician sediments have been the only ones subjected to earth-movements, causing folding of the strata. These rocks have been folded into a number of steeply-dipping anticlines and synclines. The general strike is from north-north-west to south-south-east.

#### (*c*) *Faulting.*

Only a small amount of faulting could be detected in the district, and this occurred within the Cambro-Ordovician strata. It is probable that these rocks are largely affected by faults, the majority of which cannot be detected through lack of exposures. This faulting would be caused by the Devonian and any previous periods of diastrophism.

Faulting may also have occurred during the diabase intrusions, and at or near the close of the Tertiary sedimentation, but could not be detected.

### (d) *Igneous Intrusions.*

The granite occurs as two separate intrusions into the Cambro-Ordovician rocks. These form parts of the batholith of the north-eastern districts of Tasmania, and at depth are undoubtedly connected with the main body of the latter, which underlies the district.

Only a small area of diabase is present, and this occurs as a large dyke-like body.

The Tertiary basalt occurs in the form of comparatively thin surface flows.

## (6)—Geological History.

The geological history of the district is of great importance in connection with the alluvial tin deposits, and will therefore be considered in detail.

(1) *Cambro-Ordovician Sedimentation.*—The history of the district, as represented by the rocks at the surface, begins with the period of Cambro-Ordovician sedimentation. The rocks upon which these were laid down are nowhere exposed. Layers of clay and sand were formed during this period, probably under conditions of moderate depths.

(2) *Period or Periods of Diastrophism.*—At one or more periods after the deposition of the above sediments, intense earth-movements affected the rocks. The strata were folded into a series of anticlines and synclines, and also faulted. It is probable that the most important of these periods was that at the close of the Silurian sedimentation, and connected with the intrusions of Devonian granite.

(3) *Devonian Igneous Intrusions.*—Accompanying the diastrophism at the close of the Silurian period there occurred large intrusions of igneous magma throughout Tasmania. In the north-eastern district these intrusions were of granite magma, and the consolidation thereof resulted in the formation of the granite.

(4) *Period of Ore-Deposition.*—The closing stages of the consolidation of the granite magma, and the passage therefrom of vapours and solutions, resulted in the formation of the tin, gold, and other lodes of the north-eastern districts. The tin lodes were formed more particularly in the granite, and the gold ones in the intruded slates and sandstones.

816129



(5) *Period of Denudation.*—From the close of the Silurian period until the commencement of the Permo-Carboniferous the district remained a land surface. Continued denudation throughout this period resulted in the formation of an extensive peneplain, probably throughout Tasmania.

(6) *Permo-Carboniferous Sedimentation.*—Although no Permo-Carboniferous strata are present in the district, they are known to occur to the north and south thereof, and undoubtedly covered part at least of the district. This Permo-Carboniferous sedimentation occurred on the peneplaned surface of the Cambro-Ordovician rocks and the granite.

(7) *Trias-Jura Sedimentation.*—Although no Trias-Jura rocks are present, it is possible that sedimentation occurred during this period, and that the sediments were laid down over part at least of the Permo-Carboniferous rocks.

(8) *Period of Denudation.*—After the close of the Permo-Carboniferous and Trias-Jura sedimentation, if either or both occurred, the district became a land surface, and a long period of denudation began. The Trias-Jura (if present) and the Permo-Carboniferous rocks were entirely removed, and the streams of a river system practically identical with that at the present time began to corrode their courses in the underlying granite, slates, and sandstones.

This denudation and stream-development continued until Lower Tertiary time, when the then Ringarooma River had a somewhat similar course to that of the present one as far as Branxholm and Derby, but then flowed more to the north, and continued its course to the west of the west end of the Mt. Cameron Range.

(9) *A Period of Relative Depression of the Land and Lower Tertiary Sedimentation.*—A relative depression of the land then commenced, either due to slow subsidence of the land or rise of the level of the ocean's surface. This appears to have been a slow process, and resulted in the damming up of the waters of the Ringarooma River. Sediments were deposited in the resulting lake, or fresh-water estuary, the material (sand, grit, &c.) being supplied by the main stream and its adjacent tributaries.

These processes continued until the sediments accumulated as far upstream as a point between Ringarooma and Maurice, and a thickness of at least 550 feet accumulated to the north of Herrick.

(10) *Extrusions of Basaltic Lava.*—The Lower Tertiary sedimentation was closed by flows of basaltic lava originating from several sources within the Ringarooma Valley. In some instances there were small intervals of time between successive flows, and small thicknesses of Tertiary sediments were deposited.

(11) *Relative Elevation of the Land.*—Contemporaneously with, or immediately succeeding, the basaltic lava flows, the land was elevated relatively to the sea by an amount not quite equal to that by which it was depressed during the Lower Tertiary sedimentation.

(12) *Period of Denudation and Development of the Present River System.*—The basalt flows had not completely filled the old Ringarooma Valley, and so the drainage system was able to re-establish itself in its former valley. The Ringarooma River developed a meandering course across the basalt between Ringarooma and Derby, but from Main Creek to the north-east it kept to the south-eastern edge of the basalt, and corroded a course in the granite. This course forced the Ringarooma River past the eastern end of the Mt. Cameron Range, and into a new channel, instead of its former one past the western end of Mt. Cameron.

The development of the Ringarooma River in its new course, of the lower portions of former tributaries, and of new tributaries, has proceeded in connection with the present cycle of denudation. The present Ringarooma River has nowhere cut down its course to the level of the older one.

During this period river gravels and alluvium have been deposited at certain localities along the course of the streams.

816130

## VI.—ECONOMIC GEOLOGY.

### (1)—Introduction.

The most important deposits of metallic minerals in the north-eastern part of Tasmania are those of tin and gold, particularly the former. The tin ore is found in association with the large areas of granite, and occurs both as primary and alluvial deposits. It is particularly abundant within the district, and to the south-east, south, and east thereof in the vicinity of Ruby Flat, Weldborough, Blue Tier, and Mt. Cameron.

The gold lodes are associated with the Cambro-Ordovician slates and sandstones. The most important field is that of Mt. Victoria to the south, but others, such as Warrentinna and Forester, are situated to the north of the district.

Gemstones, such as topaz and sapphires, are found occasionally in the alluvial tin deposits.

Recently attention has been directed to deposits of arsenopyrite on the southern flanks of Mt. Horror, but they have not yet been proved of economic importance.

The deposits that will be described in this bulletin are the alluvial tin ores within the district examined.

### (2)—Secondary Tin Deposits.

Secondary tin deposits of various ages from Tertiary to Recent have been formed within the district. The Recent ones occurred along the courses of the present streams, but were narrow and shallow and of no great length, and have been more or less exhausted. Others, *e.g.*, South Mt. Cameron, are more ancient than Recent.

Within the district examined those of Lower Tertiary age formed the special object of part of this investigation.

#### (a) *Lower Tertiary Alluvial Deposits.*

(i) *Nature of the Deposits.*—The Lower Tertiary alluvial deposits consist of conglomerates, gravels, grits, and sands containing cassiterite. The boulders in the conglomerates are chiefly of granite and white opaque quartz. The gravels, grits, and sands consist almost entirely of glassy quartz from decomposed granite, and a subordinate amount of white opaque quartz. The cassiterite is distributed throughout the " drifts " in the form of small pieces of the black variety. The distribution is not uniform, and concentration occurs at particular layers, one of the principal being the basal ones.

(ii) *Distribution.*—The Lower Tertiary sediments occupy a considerable area of the Ringarooma Valley, although they are generally covered by basalt, and outcrop at only a few points. The same general conditions prevailed with regard to the deposition of the sediments throughout the district, but this does not also apply to the cassiterite contained in the sediments. All the mines which have been operating on these deposits are situated on the south and south-east sides of the Ringarooma Valley. Further, as can be seen from the geological plan (Plate I.), the mines are situated on tributary "leads" entering the Ringarooma "lead" from the south or south-east. The Arba has worked the Branxholm Creek, or Arba, lead; the Briseis Extended (now the Briseis Central, and originally the Ringarooma Valley), the Valley Creek lead; the Briseis, Krushka Brothers' Home; New Brothers' Home, North Brothers' Home and Triangle mines on the Cascade lead; the Mutual and Sarah Ann and others, on the Main Creek lead; the Echo on the Weld River lead; the Moorina on the O.K. Creek lead; the South Pioneer probably on the Gladstone Creek lead; and the Pioneer on the Winiford River lead.

The workings of these mines have followed the leads downstream towards the Ringarooma lead, but none has yet reached the junction with the latter.

(iii) *Origin of the Deposits.*—The origin of the deposits has already been pictured in the descriptions above. At the commencement of the Lower Tertiary era a river system was developed consisting of a Ringarooma River and tributaries not much different from the present ones. Conglomerates and gravels were formed at some localities along these streams. When the Lower Tertiary subsidence occurred, the process of formation of the series of deposits now existing began. The greater portion of the material which went to form these deposits was contributed by the main stream and its tributaries from the south and south-east. At the same time as this material was brought along, the cassiterite was also washed into it. This process continued until the close of the sedimentation, but the amount of cassiterite enclosed was less in the upper beds of the series.

81613



(iv) *The Cassiterite and Associated Minerals.*—The cassiterite is generally of the dark-black variety, and is present in small pieces not exceeding, as a rule, one-sixteenth of an inch in diameter. The small size is due to the distance the tin ore has had to travel, and this travelling has also undoubtedly influenced by physical means the production of the black colour.

Other minerals obtained along with the cassiterite, when concentrated from the drifts and dressed, are tourmaline, pyrite, pleonaste, monazite, topaz, corundum (including corundum, emery, and sapphire), and zircon. The pleonaste ("black jack") is the dark-black variety of spinel, and occurs in much larger pieces than the cassiterite. It is always very much water-worn and rounded, but partly rounded crystals of characteristic shape are common. The pyrite and tourmaline are found in the usual form of these minerals. The monazite is not very plentiful, but is fairly common in the Pioneer Mine. Topaz occurs only sparingly within the district, but is common in adjacent portions, such as Mt. Cameron and Weldborough. Zircon is well distributed, and varieties ranging in colour from nearly colourless, through yellow and brown (jargoon), to red (hyacinth) are present. It occurs in small rounded pieces generally not exceeding [illegible] inch in diameter.

Common corundum is well distributed in small quantities throughout the district, but the sapphire is less common, and stones of value are rare.

These associated minerals are such that their origin is either the granite, or pegmatite, or greisen veins in the granite. Some of the zircon and pleonaste in the post-Tertiary deposits may have been derived from the basalt.

(v) *Source of the Cassiterite.*—A large amount of evidence exists upon this question, and there is little doubt that the granite is the source from which the cassiterite was derived. The tin-bearing drifts upon which the mines have operated occur along tributary leads, entering the Ringarooma lead from the south and south-east. The present and the older streams which formed these leads flowed over granite for nearly the whole of their lengths, so that the tin ore must have been obtained from this rock. In addition, the minerals in association with the cassiterite are generally found to be of granitic origin. Further, the material, particularly the quartz grit and sand forming the drifts, has been derived principally from the decomposed granite.

## (2)—The Branxholm Creek Lead.

### (a) The Arba Tin Mining Company No Liability.

*Location and Access.*—The Arba Mine is situated immediately to the north-east of Branxholm. The leases held by the company are the consolidated lease, 8772-M, of 150 acres, and 8659-M, of 40 acres. The latest workings have progressed beyond the former lease, and are situated on private land (charted in the name of J. R. Scott, 320 acres) to the north.

The main-road to the north-eastern districts passes through the property, and connects it with Branxholm railway-station, distant about 1¼ mile therefrom.

*Previous Reports.*—

Thureau, G.: Stanniferous Deposits at Ringarooma, 1884.

Montgomery, A.: The Mineral Resources of Tasmania, 1894.

Twelvetrees, W. H.: Preliminary Report on the Deep Lead or Intra-basaltic Stanniferous Gravels of the Ringarooma Valley, near Derby, 1900.

*History.*—Tin ore was first discovered on the land now held by the Arba Company in 1876, the site of the discovery being along the Branxholm Creek, south of the main-road. This discovery was made at the head of the Branxholm Creek lead, and may have included Recent as well as Tertiary deposits. The deeper Tertiary ground to the north was not found until a year or so later. Little is known about the early workings, but some time prior to 1883 the ground was being worked by a proprietary company known as the Arba Tin Mining Company. Operations must have been carried out on a large scale, as it is recorded that 40 miners were employed in 1883. They must also have been successful at some periods, as a production of 51 tons of tin ore is recorded for three months in 1886. The drifts were getting deeper as work progressed, and more costly equipment would be necessary to treat it. This was apparently the reason for the formation of the Arba Tin Mining Company No Liability in 1888. In the same year the Ormuz Tin Mining Company No Liability was formed to work ground situated on private property to the west. Operations were carried on intermittently until 1898 or 1899, when the Ormuz and Arba companies were incorporated. An extensive scheme was planned, including provision of machinery, repairing of races, &c. This programme, together with much

816132



developmental work, was carried out during the period between 1899 and 1902, and a certain amount of ore obtained in the process. Operations began in earnest during 1902, and continued until 1920. In addition to the Tertiary drifts in the Arba, Ormuz, and private land to the north, the Recent sands and gravels along the Branxholm Creek were acquired in 1913 under mineral lease. Work was carried out on this easement lease from 1913 to 1920. From 1920 onwards the mine has been let on tribute, and at present one party is continuing the work on the easement lease, and another is treating portion of the tailings dump; while a third party is working virgin ground on the adjoining private property.

*Geology.*—The bedrock in the greater part of the workings is the Devonian granite. It is intrusive into Cambro-Ordovician rocks, the junction being a short distance to the west of the Branxholm Creek, at the township, and crossing the creek near the lower end of the easement lease. Tertiary grits, gravels, and sand occur to the east of Branxholm Creek, and rest upon the granite. Basalt overlies the drifts on the private property to the north of the Arba consolidated lease. Recent gravels occur along the Branxholm Creek through the easement lease.

*The Ore-Deposit.*—The deposit which has been worked on the Arba consolidated lease and the private property to the north-west consists of the Tertiary stanniferous drifts of the Branxholm Creek lead. This lead departs from the course of the present creek near the southern end of the consolidated lease, and runs in a general north-north-easterly direction through this lease. It continues under the basalt forming the hill on the private property to the north-west, and then through the eastern portion of Lease 9247-M to junction with the Ringarooma lead near the present river.

At the north-eastern end of the workings a small tributary lead, formed by the ancestor of the small unnamed creek between Branxholm and Black creeks, should have entered the Branxholm Creek lead. The shape of the workings indicates that the lower part of this tributary lead was worked. Further north the Black Creek lead should have crossed the northern portion (now surrendered) of consolidated lease No. 8772. The drifts have, however, been denuded, except at the western end of this lead. Of these Tertiary deposits on the Arba mineral leases actually remaining intact, the only portion is that of the unnamed tributary lead.

The deposit in the easement lease is of Pleistocene to Recent age. The part of it to the north of the present lease (8659-M) has been partly worked out. In this northern portion it rested on Lower Tertiary drifts of the Ringarooma lead. In the present workings at the northern end of the lease the bedrock is metamorphosed Cambro-Ordovician rocks, and in a short distance the junction with the granite will be reached, and the latter will then become the bedrock. The deposit remaining does not exceed 5 chains in width, and (with overlying tailings) does not exceed 15 feet in depth. It will extend along the greater length of the lease, but does not represent a large amount of ground.

*Production.*—Complete records of the amount of tin ore produced from the Arba properties prior to 1903 do not exist. Incomplete records to June, 1903, show a total of 193·15 tons, and it is probable that the total amount to that date exceeds 500 tons. From June, 1903, until the end of 1920, 3,260,851 cubic yards of drifts were treated, for 1361·7 tons of tin ore. These figures refer to the Tertiary drifts, and do not include any records of the Ormuz workings between 1888 and 1898.

From the Recent deposits on the easement lease along the Branxholm Creek 562,859 cubic yards were treated, for 274·3 tons of tin ore between June, 1913, and the end of 1919. Since 1919 the mine has been let on a tribute, and up till the end of 1923 the production has been 96·75 tons of metallic tin, or 138·2 tons of oxide.

The recorded production is therefore 1967·35 tons of tin ore.

*Methods of Working.*—In the early days ground sluicing was probably the method used to treat the shallow ground, and was augmented later by hydraulic sluicing with nozzles, &c. From the commencement of the extensive operations in 1902 machinery and more powerful plants were used. The drifts and overburden were broken down by hydraulic sluicing with nozzles, &c. The broken material was raised from the bottom of the workings by hydraulic elevators and gravel-pumps, and deposited in bins. It was then elevated in large skips up an inclined tramway by the usual method of winding-ropes, pulleys on poppet-legs, and winding-engine. Wood was the fuel used for generating steam in the power plant. Tailings were dumped behind and to the east of the workings, and also down the valley of Black Creek.

816133



The material in the easement lease was at first worked by a pumping plant on a dredge. The plant contained a gravel and nozzle pump operated by electric motors supplied with power from the main Arba plant. Later hydraulic sluicing was resorted to, and the material elevated by hydraulic elevator in overhead sluice-boxes.

*Quantity and Value of the Ground.*—Practically all the Tertiary drifts have been removed from the Arba leases, with the exception of small lengths of the unnamed tributary lead and the Black Creek lead. A short length of the former—perhaps 5 to 10 chains—may exist to the east of the main workings. The quantity of drift would be small, and the quality either similar or less than that on the main workings (about 1 lb. per cubic yard). A similar length of the Black Creek lead should exist on the forfeited portion of Consolidated Lease 8772-M, and also on the tailings lease, 172-91w. The quantity of drift in it would be comparatively small, and the value, though it has not been tested, should be similar to that in the Branxholm Creek lead.

*Water-Supply.*—The Arba Company holds water-rights along the Dorset River and Black Creek amounting in all to 52 sluiceheads.

*Future Prospects.*—Practically all the drifts on the mineral leases held by the company have been worked out, and during the later years of operation the workings were for the most part on the private property to the north-west. The future of the company must therefore depend upon the continuation of the work from this point. A discussion of the prospects will be given below in describing this private property.

*(b) Private Property (P. W. Edwards).*

The Branxholm Creek lead passes from the Arba lease under the basalt-covered hill to the north-west, charted as part of the 320 acres in the name of J. R. Scott, and now owned by P. W. Edwards. The Ormuz Company worked portion of this ground, and later, by arrangement, the Arba Company continued its workings into this property.

This hill consists of a capping of basalt overlying Tertiary drifts of the Branxholm Creek lead, and the southern edge of the drifts of the Ringarooma lead. Granite forms the bedrock, except a small area in the north-west

The Branxholm Creek lead passes under this hill in a general north-north-easterly direction for about 30 chains, until it reaches Lease 9247-M. About midway along the eastern side of the hill it should receive the tributary lead of the Black Creek from the east.

The southern part of the Branxholm Creek lead was worked by the Arba Company on its own leases, and then followed into the above property. The following figures show the results of the later years of the Arba workings, and also the totals and averages over a period of 17½ years. The average content of the drifts over this period was 0·933 lb. per cubic yard. From 1909 onwards it was generally over 1 lb. per yard, except in 1917, 1918, and 1919, when large quantities of overburden were removed. Further, the lower 30 feet of drifts were not treated, owing, apparently, to the insufficient capacity of the plant. As the highest values of the drifts are generally in this portion, the average value of the drifts was considerably lowered by not treating these layers.

In 1920, however, the content of material treated rose to 1·34 lb. per cubic yard. Considering the figures as a whole, it would appear that the drifts in the face should average, approximately, 1 lb. per cubic yard, especially if the basalt and any upper layers of barren drift were treated as overburden and removed separately.

| Year. | Quantity Treated. | Working Costs. | Tin Ore Won. | Contents per Cubic Yard. |
|---|---|---|---|---|
| | cub. yds. | d. | tons. | |
| 1909 | 197,516 | 6·05 | 175·3 | — |
| 1910 | 221,311 | 7·59 | 95·5 | 0·966 |
| 1911 | 242,935 | 6·32 | 116·6 | 1·07 |
| 1912 | — | — | 101·7 | — |
| 1913 | 265,554 | — | 60·55 | — |
| 1914 | 182,425 | 6·72 | 85·51 | 1·05 |
| 1915 | 137,259 | — | 81·95 | 1·33 |
| 1916 | 223,627 | 7·38 | 102·6 | 1·02 |
| 1917 | 190,686 | 9·88 | 45·14 | 0·536 |
| 1918 | 136,690 | 12·66 | 40·4 | 0·63 |
| 1919 | 154,159 | 14·01 | 53·0 | 0·77 |
| 1920 | 91,190 | 18·84 | 54·75 | 1·34 |
| From 30/6/03 to 31/12/20 | 3,260,851 | 6·91 | 1361·7 | 0·933 |

816134



It is stated that the face of the workings was 167 feet high, and that the bottom of the workings was 30 feet above the bottom of the drifts, which would make the thickness of drifts and basalt 197 feet. There is a thickness of about 50 feet of basalt on the hill, so that the total depth of drifts is 147 feet. This should increase as the lead dips to the north, and a larger thickness would exist at the northern end of the property. The basalt represents non-stanniferous overburden, which has to be removed; but it is very much decomposed, and can be almost entirely removed by hydraulic sluicing.

Any future working of the deposits on this property would really represent the continuation of the Arba workings, and its success or otherwise would depend upon the tin content of the drifts and the method and cost of working them. By 1920 the cost of the Arba working had mounted to 18·84 pence per cubic yard. The drifts would have to average 1 lb. per yard, with tin at £250 per ton, in order to pay (without profits) for this cost of working. The future profitable working, therefore, depends upon reduction of working costs by methods other than those used by the Arba Company. The greatest economies would probably result from the obtaining, if possible, of sufficient supplies of water, with suitable pressure-heads for sluicing the deposits, elevating the material partly or wholly by hydraulic elevators, and generating electric power for use where required.

### (c) *Leases* 9247-M *and* 9282-M.

These two leases—9247-M, of 79 acres, and 9282-M, of 38 acres—have been recently acquired by P. W. Edwards. They are situated on the flats of the Ringarooma River and Black Creek, to the north and north-east of the private property discussed above.

The Branxholm Creek, after receiving the Black Creek lead, should pass out of the northern boundary of the private property, and traverse the eastern portion of Lease No. 9247-M in a general northerly direction, to join the Ringarooma lead approximately below the present river. The length of lead thus occurring is about 30 chains.

It is impossible to give even an approximation of the value of the drifts, as they are too far downstream to compare them with the Arba workings, and they have not been bored or worked. The first essential step before attempting to work these drifts should be a boring campaign to ascertain their value. If the value should be sufficient to justify their treatment, the drifts are very favourably situated for this purpose. The overburden consists only of a shallow depth of tailings and Recent alluvium, with perhaps a few feet of "shingle," the basalt having been removed by denudation. This absence of basaltic overburden, as well as some of the upper layers of only slightly stanniferous drifts, would result in low working costs.

This property could be worked either separately or in conjunction with that of the private land to the south. In the latter case the total length of the Branxholm Creek lead available would be about 60 chains, together with a small portion of the Black Creek lead.

### (3)—The Valley Creek Lead.

#### *The Briseis Central Tin Mining Company No Liability.*

*Location and Access.*—The Briseis Central Mine is situated on the south bank of the Ringarooma River, near the junction of Valley Creek, between Branxholm and Derby. The leases held by the company at this locality are: 8413-M, of 20 acres; 7891-M, of 25 acres; and 7760-M, of 10 acres. Two other leases—8237-M, of 5 acres, and 8226-M, of 5 acres—are also held at the head of the Cascade River, in the vicinity of the dam-site.

The main-road from Launceston to the North-East and East Coast districts passes through the property midway between Branxholm and Derby. The Launceston to Herrick railway passes immediately to the north of the mine, which is connected by road to Branxholm station (3 miles), Telita (3 miles), and Derby (3½ miles).

*Previous Reports.*—No official reports contain descriptions of the mine, although it is mentioned in the following:—


Montgomery, A.: The Mineral Resources of Tasmania, 1894.

Twelvetrees, W. H.: Preliminary Report on the Deep Lead or Infra-basaltic Stanniferous Gravels of the Ringarooma Valley, near Derby, 1900.


816135



*History.*—The discovery of tin ore at this locality was not made until several years after the majority of those on the North-East Coast, as the first lease was not applied for until 1882. The property was held by several lessees until taken over and worked by the Ringarooma Valley Tin Mining Company No Liability. This company was formed in 1885, and continued operations at intervals until 1892, and the mine became known as the Ringarooma Valley Mine. The method of working is stated to have been very inefficient, and only a small amount of ground was treated. In 1904 the Briseis Extended Tin Mines Company No Liability was formed to work the deposit, and continued operations until 1910. A more modern plant was used and more material treated, but the lower portions of the drifts were not treated in the deeper parts of the workings. The Briseis Central Tin Mining Company No Liability was formed in 1918, and holds the property at the present time. No actual mining operations have been performed by this company, but sufficient water-rights to economically treat the deposits have been obtained, a long length of the main race constructed, and preliminary steps taken to construct a large dam. In addition, a large amount of boring has been carried out to test the property.

*Geology.*—The main-road from Branxholm to Derby runs practically along the boundary of the granite to the south and the flats of the Ringarooma River to the north. The granite forms the hills which rise steeply to the south, and which are part of the elevated granitic country around Weldborough. The flats of the Ringarooma River consist of a shallow depth of Recent alluvium containing several feet of shingle. To the north of the river Tertiary basalt overlies Lower Tertiary tin-bearing drifts. These latter deposits extend below the alluvial flats of the Ringarooma River and rest on a bedrock of granite.

*Ore Deposit.*—The tin-bearing deposit which has been worked on this property consists of Lower Tertiary stanniferous drifts. The south-eastern boundary is the main-road at the locality where the Valley Creek crosses the road. The deposit is 300 to 400 feet wide at the top, and trends to the north-west below the river flats. It is shallow at its south-eastern end, but deepens to over 100 feet to the north-west. These drifts have been referred to as being portion of the main lead (the Ringarooma) and also as a tributary (the Valley Creek lead) thereof. The geological structure, as seen on the surface and *revealed by the* mining and boring operations, proves the latter view to be the correct one. This lead should join the Ringarooma lead at a distance of approximately *half a mile from its* south-eastern extremity. The leases include a length of about 1750 feet of this lead, the remaining portion (about [illegible] feet) being situated under the *river or on private* property north of the river. The depth of the junction of the two leads should be approximately 200 feet below the present river-level.

*Production.*—It is generally stated that the Ringarooma Valley Company produced about 400 tons of tin ore, but, according to Montgomery in 1891 (about two years after work ceased), the production was 90·5 tons of tin ore.

The official statistics show the production of the Briseis Extended Company to be 428·7 tons, obtained during the years 1905 to 1909.

The total production has therefore been 519·2 tons of tin ore.

*Value of the Drifts.*—Approximate estimates of the content of cassiterite in the drifts *can be arrived at by* two methods. Firstly, there are the results obtained by past working; and, secondly, the results from the boring operations carried out. The *first is necessarily* very approximate, as the amount of ground treated is not definitely known. The old workings cover an area of 15 acres, and have a maximum depth of 50 *feet, and the assumption of* an average depth of 40 feet is rather high than otherwise. These figures give a total volume of 968,000 cubic yards. The total production from this *amount has been* 520 tons, so that the content of tin ore was 1·2 lb. per cubic yard.

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 cubic yard, the average being much lower than this. The *upper portion* of the ground in which these bores were put down was treated by the Briseis Extended Company at a later date. In 1920 a further campaign gave *results in the old* workings ranging from a little tin to 1½ lb. per cubic yard, but the results were generally lower than those previously obtained. Another campaign was *carried out* by a *different* operator in 1921, the results of which are given below. Judging by the records, this campaign was very thorough and efficient as far as it went and the results *obtained* are probably as reliable

816136



as boring results can be. The tin content is calculated on the total depth of ground, which includes virgin drifts and any overlying tailings in the old workings. The content for virgin drifts will therefore be appreciably higher than the figure given. The *figures* show a tin content from a little tin up to 1·5 lb. per cubic yard, the average of the total number being 0·7 lb. by volume panned off, and 0·6 lb. by tube displacement. Bores 19 to 23 were sited along the gutter; bores 14 to 18 were sited across the gutter, and represent a section of the lead, while bores 7 to 13 are in the centre of the gutter, and Nos. 1 to 6 in shallow ground, possibly tailings, at the head of the workings. The average value of the ground, as shown by the section in Nos. 14 to 18, is 0·65 lb. per cubic yard by volume panned off, and 0·5 lb. by tube displacement, which results are slightly lower than those quoted above.

These figures are lower than those deduced from the results of past workings. The past workings were carried out in the upper part of the drifts, and it is generally found that the tin ore is *more* concentrated in the lower than the upper part of a lead, so that it would be reasonable to expect the lower drifts to contain more than 1·2 lb. per cubic yard. That this *fact* is not reflected in the boring results does not necessarily mean that it is not the case. At the bottom of the drifts, boulders of granite, quartz, &c., occur, among which *concentrations* of tin ore are likely to exist, and boring under such conditions is not necessarily accurate.

From the above review it is seen that approximate calculations of the results of past workings show a tin-ore content of 1·2 lb. per cubic yard, while boring of remaining portions of the drift indicate a content of 0·5 lb. per cubic yard, though the latter might reasonably be anticipated to contain a higher content.

| Bore. | Total Depth. | Depth of Water | Depth of Ground Treated. | Volume Panned Off. | By Tube Displacement. | Tin Ore Obtained. | From Volumes. | From Tube Displacement. |
|---|---|---|---|---|---|---|---|---|
| | ft. | ft. | ft. | cub. ft. | cub. ft. | gr. | lbs. cu. yd. | lbs. cu. yd. |
| 1 | 15 | 12 | 3 | 0·10 | 0·20 | Trace | Trace | Trace |
| 2 | 28 | 22 | 6½ | 0·40 | 0·40 | 2·0 | A little tin | A little tin |
| 3 | 20 | 14 | 6 | 0·30 | 0·40 | 2·5 | A little tin | A little tin |
| 4 | 33 | 26 | 7 | 0·40 | 0·50 | 3·0 | A little tin | A little tin |
| 5 | 28 | 22 | 2 | 0·10 | 0·10 | 3·0 | A little tin | A little tin |
| 6 | 35 | 22 | 13 | 0·30 | 0·90 | 17·5 | ·2 | ·1 |
| 7 | 65 | 32 | 33 | 1·10 | 2·20 | 20·5 | A little tin | A little tin |
| 8 | 71 | 42 | 29 | 1·31 | 1·67 | 212·5 | ·7 | ·6 |
| 9 | 77 | 39 | 38½ | 1·93 | 2·23 | 618·0 | 1·2 | 1·1 |
| 10 | 96 | 41 | 43½ | 2·38 | 2·51 | 1002·0 | 1·5 | 1·5 |
| 11 | 93 | 38 | 47½ | 2·26 | 2·76 | 945·0 | 1·5 | 1·5 |
| 12 | 91 | 39 | 41 | 2·16 | 2·36 | 387·5 | ·7 | ·6 |
| 13 | 76 | 39 | 37 | 2·30 | 2·14 | 403·5 | ·7 | ·7 |
| 14 | 60 | 20 | 15 | 0·70 | 0·86 | 24·0 | ·1 | ·1 |
| 15 | 85 | 47 | 38 | 1·85 | 2·18 | 425·0 | ·9 | ·8 |
| 16 | 103 | 50 | 53 | 3·00 | 3·09 | 736·0 | ·9 | ·9 |
| 17 | 91 | 48 | 43 | 1·72 | 2·52 | 69·0 | ·2 | ·1 |
| 18 | 51 | 33 | 18 | 0·17 | 1·06 | 4·0 | Nil | Nil |
| 19 | 101 | 35 | 63 | 3·70 | 3·64 | 630·0 | ·7 | ·7 |
| 20 | 104 | 30 | 74 | 3·30 | 4·26 | 544·0 | ·6 | ·5 |
| 21 | 107 | 15 | 92 | 4·82 | 5·33 | 1087·0 | ·9 | ·8 |
| 22 | 97 | 14 | 83 | 4·14 | 4·80 | 356·0 | ·3 | ·3 |
| 23 | 105 | 23 | 83 | 4·11 | 4·79 | 375·0 | ·4 | ·3 |
| | 1632 | 706 | 869 | 42·55 | 50·88 | 7903·0 | ·7 | ·6 |

*Quantity of Ground.*—As already recorded above, the property contains about 1750 feet of the Valley Creek lead. At the upper and shallower end 1450 feet have been removed to a depth of 40 feet and a width of between 300 and 400 feet. Below these workings there exist virgin drifts 60 to 70 feet deep in the gutter, and which should increase rapidly in depth to the north-west. To the north-east of these old workings there is about 300 feet of the lead, and the gutter should be about 150 feet below the surface.

81613



The quantity of drifts below the old workings should be approximately 600,000 cubic yards, and in the north-western part of the lead 300,000 cubic yards. The total quantity is therefore approximately 900,000 cubic yards. It depends upon the course of the Valley Creek lead as to whether a further length of it is situated upon the property or not.

*Water Supply and Power.*—The company holds the following water-rights:—

1883-w. for 34 sluiceheads.
2053-w. including 4 and 6 sluiceheads respectively and 3 dam-sites of 1, 2, and 3 acres respectively.
1873-w. of 89 acres, for dam-site.

In all, there is a total of 44 sluiceheads and 95 acres of dam-sites.

It is stated that the main dam-site is 1300 feet above the mine, near the head of the Cascade River.

The intake of the race is much lower down the river, and delivers the water at the mine with a pressure-head of 500 feet.

*Facilities for Working.*—The overburden on the drifts is the alluvium and shingle of the Ringarooma Flats, which do not exceed 10 feet in depth. Below this overburden the drifts occur, and are tin-bearing throughout, so that the actual overburden is not more than 10 feet in thickness.

There is plenty of space available for dumping purposes on the flats of the Ringarooma River adjacent to the mine.

If the water schemes as proposed by the company were carried into effect, there should be available sufficient water under suitable pressure to efficiently work the mine.

*Conclusions.*—The Valley Creek lead, a tributary of the Ringarooma lead, crosses the property of the Briseis Central Company. The drifts in it are stanniferous, and two attempts have been made in the past to work it, although apparently not financially successful. In the first attempt the material was moved by hand labour and trucked, each haulage-line, pump, &c., being operated by a separate engine, which operations could not be regarded as efficient. In the second attempt a more modern and efficient method of dredging and sluicing was used, but the plant was only capable of treating the drifts to a depth of 40 feet. In the first case 90·5 tons, and in the second 428·7 tons, of tin ore were obtained, indicating an approximate content of the drifts of 1·2 lb. per cubic yard. The boring campaigns of the lower *drifts*, *and other parts of the* lead, have not given an average result as high as this (the best campaign gave an average of 0·5 to 0·7 lb. per cubic yard), although it is generally found that the lower portions of leads have a higher value than the upper. Greater reliance must, however, be placed upon the results of actual working, and it is probable that the content may be as high as 1·2 lb. per cubic yard, and it should certainly be between 0·5 and 1·2 lb. per cubic yard; but the actual contents can, of course, only be proved by working.

There appears to be sufficient tin ore present, and sufficient drifts available, to justify working the deposit, provided the mine can be equipped at low capital cost. The conditions as regards overburden and disposal of tailings are very favourable, and should the water schemes be completed, there should be enough water at a suitable pressure to economically work the deposit. The success or otherwise of the mine will, of course, depend on the content of tin ore found in the Valley Creek lead and the cost of working.

Beyond the Valley Creek lead, after it passes below the Ringarooma River, the future is dependent upon the course of this lead and the content of tin ore in the Ringarooma lead after the junction of the former. No definite expression of opinion can be given upon this matter, and it can only be decided by boring or by working, should the latter prove successful, along the Valley Creek lead.

### (4) – The Cascade River Lead.

#### (*a*) *The Briseis Tin and General Mining Company Limited.*

*Location and Access.*—The workings of this company are situated upon Consolidated Lease No. 6955-M, of 566 acres, adjacent to the township of Derby. The lease extends both to the north and south of the Ringarooma River, and in the latter direction includes a considerable length of the Cascade River. The company also holds by agreement the mining rights over the property (private) to the north.

The main-road from Launceston to the North-East and East Coast districts passes through the above lease. The Launceston to Herrick railway traverses the district to the north, and the mine is connected therewith by good roads to Derby station (1½ mile) and Branxholm station (5 miles).

8148



*Previous Reports.*—


Thureau, G.: Stanniferous Deposits at Ringarooma, 1884.

Montgomery, A.: The Mineral Resources of Tasmania, 1894.

Smith, J. Harcourt: Report on the Alluvial Tin Mines at Derby, 1899.

Twelvetrees, W. H.: Preliminary Report on the Deep Lead or Infra-Basaltic Stanniferous Gravels of the Ringarooma Valley, near Derby, 1900.

Lewis, J. B.: The New Brothers' Home (No. 1) Tin Mining Company, Derby, 1903.


*History.*—The land now leased by the Briseis Company includes much that was formerly leased and worked by other companies which have long since ceased operations.

Tin ore was first discovered by the Krushka Bros., either late in 1875 or early in 1876. The first lease (No. 205) was applied for in January, 1876, by C. Krushka, but was cancelled; another (No. 316) being applied for by F. Krushka in October of the same year. Other sections were quickly taken up along the course of the lead, and the work of treating the deposits and the formation of mining companies soon began.

The section taken up by F. Krushka was worked by the Krushka Bros., and became known as the Brothers' Home Mine. The drifts were treated down to stream-level, and gave splendid returns, the mine remaining the premier mine of the district for many years. Operations were continued until 1901, and then ceased, the lease being acquired by the Briseis Company.

The Brothers' Home (No. 1) Tin Mining Company was formed in 1880 to work the land to the south (No. 535, 80 acres) and east (No. 1586, 80 acres) of the Brothers' Home Mine. Operations were carried on intermittently until 1899, when the company was voluntarily wound-up, and the New Brothers' Home Tin Mining Company No Liability was formed. Work was carried on at intervals until 1906, when arrangements were made with the Briseis Company to work the ground adjoining that of the latter company. In 1915 the land held by this company was included in the present consolidated lease of the Briseis Company.

The Briseis Tin Mining Company No Liability was formed in 1885 to work the ground to the east of the Brothers' Home and the Brothers' Home (No. 1) Mines, on sections first charted in the name of J. A. Thompson.

### (c) *Future Prospects of the Main Creek Lead.*

Any future work on this lead should be devoted to that part on the western bank of the Ringarooma River. The gutter occurs about 30 to 40 feet above the river, and is situated approximately to the north-west of the sharp bend from north to south-east, adjacent to W. Krushka, 320 acres. Prospecting by means of trenches and shallow shafts, or shallow bore-holes, would quickly determine the position of the gutter. The gutter and central part of the lead should then be tested to determine the value of the drifts preparatory to any further work. Above the gutter, on the hill to the north, there will exist about 140 feet of drifts and 220 feet of basalt. The drifts would become thicker, and the basalt maintain the same thickness, as the lead was followed to the north-west.

The question of successfully mining the lead is purely an economic one, dependent upon the tin content of the drifts, the market value of the ore produced, and the working expenses in obtaining same. It can only be settled by the prospecting work outlined above, followed, if favourable, by actual mining operations. The working facilities would be favourable at first, as there would not be much overburden, and the tailings would have to be elevated only a short distance, if at all. As working progressed, however, the full thickness of the basalt overburden would be gradually encountered. Further, the dip of the bottom of the lead would be such that after a time the treated drifts would have to be elevated. The favourable conditions outlined above would, however, continue for a sufficient distance to enable the stanniferous content of the drifts to be ascertained by working even on a small scale.

## (6)—The Weld River Lead.

### (a) *The Echo Tin Mine.*

*Location and Access.*—The Echo Mine is situated on a group of mineral leases immediately to the north of Moorina, which are charted in the name of J. A. Thompson, and amount to 193·5 acres. The main part of the workings on the deep lead is situated upon Leases 3572-93M and 3640-M. The main-road through the north-eastern district passes within a few chains of the workings. Moorina is half a mile to the south along this road, and

81619



Herrick, the terminus of the railway, is 1½ mile to the north along a good branch-road off the main-road.

*History.*—Alluvial tin deposits have been worked in the vicinity of Moorina since the late seventies of the last century. They were situated chiefly along the Weld and Frome Rivers to the south of the Ringarooma River. Operations were also carried out to the north and west of the river, and progressed up the small unnamed creek which enters the river to the north of Moorina. The deposits worked were shallow ones of recent origin, but near the Moorina-road it was found that the shallow deposits dipping to the south-east gave place to others dipping to the north. This lead to the discovery of the Weld River lead in 1901. The lead was found on the leases of the Moorina Tin Mines Limited, which company was formed in 1900, and continued to work the lead until 1907. In 1911 the leases and water-rights of this company were purchased by J. A. Thompson, proprietor of the Weld River Tin Mining Company, and both the Weld and the Echo (or Moorina) Mines were worked up till 1922. The Echo Mine is not being worked at present.

*Geology.*—From the Herrick turn-off to the southern extremity of the Echo workings the main-road to Moorina runs along the boundary of the granite to the east and Tertiary sediments to the west. The granite also appears to the south of the workings. To the north-west the Tertiary sediments are overlain by Tertiary basalt. Small areas of Recent alluvial and detrital deposits occurred along the course of the unnamed creek and the Ringarooma River.

*The Ore-Deposit.*—The deposit worked in this mine was one composed of stanniferous drifts of Lower Tertiary age. These drifts filled the valley of the Weld River, and represent the lead of this stream. The part of the lead to the south of the workings was removed by denudation by the present Ringarooma River. To the north the lead continues in a general northerly direction to join the main lead of the ancient Ringarooma River at a point about 2¼ miles north-west of Herrick.

The workings are situated at the eastern side of the drifts where they junction with the granite. The bottom of the drifts or the bedrock of granite is not clearly exposed, and as the drifts extend 15 chains westward it is possible that the actual gutter of the lead was not worked, unless it is situated very close to the eastern side of the lead.

pany is following the lead in this direction, with profitable results. No other point of attack need be considered, apart from the continuation of the Briseis workings, owing to the enormous difficulties and expense which would be incurred in attempting to open up a working place by removal of the 200 feet of basalt overburden and the 350 feet or more of underlying drifts.

As already stated above, the question of the successful exploitation of the continuation of the lead will arise when the lead passes below the basalt-capped cliffs to the north-west, and it will be entirely an economic one, depending upon the amount of tin ore obtained and the market value thereof, and the cost of obtaining same."

### (5)—The Main Creek Lead.

#### (a) *Sarah Ann Tin Mine.*

A portion of the workings of the old Sarah Ann Tin Mining Company Registered (formed in 1882) are situated on the south-west bank of the Main Creek, about 25 chains from its junction with the Ringarooma River. In the bottom of the workings both granite and Cambro-Ordovician slates and sandstones occur, and the junction of the two is visible and easily determined as an intrusive one. Overlying the granite there are heavy conglomerates containing boulders of Cambro-Ordovician rocks, quartz, granite, &c., between which are small water-worn pebbles, sand, &c. In one of the faces about 50 feet of roughly stratified beds of sands and clays, with boulders, succeed the conglomerates. These conglomerates, sands, and clays represent Lower Tertiary sediments formed near the head of the Main Creek lead. The base of these beds is nearly 100 feet above the Main Creek, and their immediate extension to the north has been denuded by the present stream.

It was the drifts of this lead and the detrital material from them occurring on the hillside below that were worked at this locality. They appear to have been worked by the Sarah Ann Company in the early eighties, and by the Briseis Company during part of the period 1913-1918. The drifts represent the head of the Main Creek lead, and only a very short length of the lead can occur to the south of the faces which have been worked, so that the deposits are of little economic importance. The fact that the operations on them have been abandoned also suggests that the tin content is low.

816140



#### (b) *Mutual Hill Tin Mine.*

The Mutual Hill is situated on the east bank of the Main Creek, immediately to the south of its junction with the Ringarooma River. The old workings are situated on the western slope of the hill adjacent to Main Creek.

Tin ore was discovered at this locality in 1884 on land leased by R. Bennall. The mine became known as the Mutual Hill, and appears to have been worked during the eighties. It was later held by numerous individuals and companies, including the Native Paint and Oxide Proprietary No Liability and the Tasmanian Tin Dredging Company Limited, but no record of any work exists. The Mutual Hill Tin Mines No Liability was formed in 1910 to work the deposit, but this does not appear to have been done, and in 1912 arrangements were made with the Briseis Company to equip and work the mine. The latter company carried out sluicing operations until 1918, since when the mine has been idle.

The Mutual Hill is a basalt-capped one, the basalt overlying Lower Tertiary sediments on the western side and granite on the eastern side. The Lower Tertiary sediments rest upon a bedrock of granite.

The deposit worked upon this hill consists of part of the stanniferous drifts of the Main Creek lead. The head of this lead occurs on the Sarah Ann workings described above, but the part of the lead between these and the Mutual Hill workings has been removed by the denudation of the present Main Creek. Similarly, the part of the lead to the north of the Mutual Hill has been removed by the Ringarooma River. There thus exists only a portion of the lead, with a length of 15 to 20 chains. Further, the whole of the width of the lead has not been preserved on the Mutual Hill, but only the eastern portion thereof.

The Briseis Company worked the deposits on Mutual Hill and adjacent flats from 1912 to 1918. The base of the drifts is about 50 feet above the present streams, so that they are easily treated. Tail-races were taken easterly into the drifts at two points along its length on the fall to Main Creek, and another from the fall to the Ringarooma River at the northern end of the deposit. The drifts and overburden were attacked from these points by hydraulic sluicing, the faces being extended to the north and south until they met, and also easterly into the hill. A fair proportion of the basaltic overburden consisted of boulders, which were dumped to the west of the workings. About 60 to 70 feet of drifts were exposed below the lowest basalt tudes of 20 feet or so above river-level. Bores have been put down below these adits at regular intervals in order to determine the actual course of the lead.

The Cascade lead should pass from the Briseis lease into the private property to the north. Its junction with the Ringarooma lead should be in the vicinity of Derby station, but is dependent upon the course of the latter lead, which cannot be accurately determined on geological evidence alone.

*Method of Working.*—The methods of working have, of course, changed during the history of the mines. Hydraulic sluicing was introduced at an early date, but shortage of water-supplies greatly hampered operations. Some of the mines, such as Brothers' Home (No. 1), Triangle, and North Brothers' Home, worked the drifts by underground methods, successive layers of payable drifts being mined. The method of removal of overburden depended upon the hardness thereof. Hydraulic sluicing was resorted to where possible, but dry-stripping by hand labour or mechanical devices was used in other cases.

The present Briseis workings are 150 feet below the surface of the banks of the Ringarooma River. The overburden of soft and hard basalt is removed by sluicing. The fine material is conveyed through a race, elevated, and dumped, while the boulders are handled independently and trucked away. The drifts are removed by hydraulic sluicing. From the bottom of the workings the broken drifts and water are elevated by hydraulic elevator to the tail-race and sluice-boxes. The tailings are elevated by hydraulic elevator to the dump slightly above river-level. The water from the lower workings is pumped 100 feet into the river by means of two altered gravel pumps (centrifugal) in series. The pumps are rope-driven from two Francis turbines in series (300 h.p. at 700 revolutions per minute). Another pumping set consists of an Australian turbine (260 h.p.) and pump, while there is a small turbine and pump for a stand-by. The turbines are operated by water with 420-foot head, but lift their own water to river-level, so that the effective head is 320 feet. An emergency hydraulic elevator set is also available for pumping the water.

The gutter of the lead is followed in the workings, which are extended across the lead to such points that removal of further drifts from the side would not be payable. The basalt and a small thickness of the underlying drifts are regarded as overburden and removed accordingly.

816141



*Water-Supply.*—The Briseis Company holds numerous water-rights amounting in all to a considerable quantity of water. On the Cascade River water-rights amount to 110 s.h. A dam is now being constructed on Lease 2083-w, of 187 acres, in this river, in connection with this supply. The water is conducted by a race 2½ miles in length to a point above the mine, and is delivered by a 20-inch pipe-line with a pressure-head of 320 feet.

On the Maurice and Ringarooma Rivers water-rights amounting to 132 s.h. are held. The water is conveyed by a race, including several syphon pipe-lines, 20 miles in length. From the end of the race the water is delivered to the mine through a line of 30-inch pipes at a pressure-head of 420 feet.

In addition to the above, rights amounting to 30 s.h. are held on the Main Creek.

*Future Prospects.*—The mine workings are now on the north side of the Ringarooma River, and close to the basalt-capped cliffs to the north. The Cascade lead is trending to the north-west from the present workings, and is pursuing a parallel course to the Ringarooma River and the cliffs. For some distance, therefore, the working conditions will be the same as at present, namely, with basaltic overburden on the north-eastern side only. The mining operations are at present being profitably conducted, and this state of affairs should continue, the actual amount of profit, of course, being dependent on the content of the drifts, the market price of tin, and working expenses.

To the north-west of the workings the river has an easterly course, and the cliffs follow the river. The lead in following its north-western course will thus pass below the cliffs, and there will be basalt above and on both sides of it. A larger quantity of overburden will have to be removed, which will increase the working expenses. The question of profitably mining the lead under such conditions is purely an economic one, and will depend upon the content of the drifts, the market value of the tin ore produced, and the working expenses.

### (b) *Prospects of the Extension of the Lead.*

As already noted, the Cascade lead extends through the Briseis leases, and continues in a general north-westerly direction to join the Ringarooma lead at a point approximately below the Derby railway-station. The Briseis Com-

*On the north side of the* Ringarooma River the Triangle Tin Mining Company Registered was formed in 1882, and the North Brothers' Home Tin Mining Company Limited in 1883. The Triangle Mine was worked until the early nineties, but was idle afterwards. The Brothers' Home Extended Company was formed in 1895 to work the North Brothers' Home Mine, but was wound up in 1900. In the *same year the Triangle and Brothers' Home* Extended Mines were purchased by the Ringarooma Tin Mines Limited, who worked them until 1906.

The Briseis Company continued operations from its formation onwards, although hampered by shortage of water, lack of working facilities, low price of tin, &c. In 1900 the Briseis Tin Mining Company Limited was formed in London *to further work the deposits.* Provision was made for bringing in large and adequate supplies of water from the Cascade and Ringarooma Rivers, and the latter scheme was completed in 1902. The Brothers' Home Mine was acquired in 1902, and those of the Ringarooma Tin Mining Company in 1906. In 1907 arrangements were made for the adjoining parts of the Briseis and New Brothers' Home (No. 1) *Mines to be worked by the former company.* By 1909 practically the whole of the upper portion of the lead was worked out on these two properties, and operations were directed to following the lead to the north below the Brothers' Home workings, and ultimately below those of the Triangle and Brothers' Home Extended.

The main-road was diverted to the south of the river in 1912, and the Ringarooma River diversion completed in 1914. A second river diversion had to be made to the north in 1919. A third diversion was necessary in 1921, and was completed in 1923. A third diversion was to the south, and the workings are now situated to the north of the river, and can proceed uninterruptedly.

*Geology.*—The country to the south of the Ringarooma River *is occupied almost entirely by granite, and the line of* junction with the Cambro-Ordovician to the north is approximately along the course of the Ringarooma River. The old mine workings along the Cascade lead proved the presence of Tertiary basalt overlying Lower Tertiary sediments. The same association is found to the north of the river, where basalt with a maximum thickness of 200 feet *overlies up to 310 feet of Tertiary sediments.*

*The Ore-Deposit.*—The stanniferous drifts which have been worked are those of the Cascade lead. The present Cascade River departed from its former course near the

816142



south-east corner of the Briseis lease, and followed a *parallel course on the north-eastern side.* The Cascade lead is therefore found to the south-west of the present stream. The lead *follows a general north-westerly course* through the lease, and passes below the Ringarooma River immediately to the east of the township of Derby. *It will* continue on the same general course to join the Ringarooma lead near the Derby railway-station.

At the *south-eastern* end the bottom of the drifts was about at stream-level, but falls rapidly to the north-west, and the drifts become *correspondingly thicker.* At the Ringarooma River the gutter was 100 feet below river-level, and in the present workings it is 150 feet below.

*Production.*—Only very incomplete records of the amount of tin ore produced by the various companies exist. It is estimated by Mr. C. Lindesay Clark, general manager, that prior to the formation of the Briseis Company other companies had extracted from the Cascade lead 9600 tons of tin ore (cassiterite).

Up till the 31st December, 1922, the summary of results is—

| | |
|---|---|
| Overburden removed | 5,333,400 cubic yards |
| Drift treated ... ... | 8,147,200 cubic yards |
| Black tin won ... ... | 12,074 tons (74 per cent. to 75 per cent. tin) |
| Value ... ... ... ... | £1,512,000 (excluding 2 units smelting loss) |
| Dividends ... ... ... | £502,500 |

The *results for* 1923 make the total production of ore 12,427 tons, with a value of £1,564,000.

The total amount of *ore obtained from* the mines on the Cascade lead is therefore 22,027 tons.

*Value of the Drifts.*—From the above figures the value of the drifts *treated* up till 1922 was 3·2 lb. of tin ore per cubic yard.

It is stated that *the average content of* the drifts being treated at present is approximately 2 lb. per cubic yard. The upper portion of the drifts contains about 0·25 lb. per cubic yard.

*Extension of the Lead.*—The Cascade lead extends in a general north-westerly direction *from* the *present* workings towards the northern boundary of the lease. From the cliff faces on the north bank of the Ringarooma River three adits have been driven in a north-easterly direction at alti-

To the north-west the basalt covers the drifts in the vicinity of the main-road to Derby.

*Production.*—From the year 1902 till [illegible]07, 77·95 tons of tin ore were produced from the Echo Mine. From 19[illegible] onwards, until 1922, the production was not separated from that of the Weld Mine, worked by the same company, although the Echo worked during the greater part of the period. The recorded production of the two mines from 1908 until 1918 was 3[illegible]·17 tons of tin ore, and from 1918 till 1922 it was 27·73 tons of metallic tin produced in the form of ore. It is probable that half of these figures represent the production of the Echo Mine, and the total production would therefore be not less than 265 tons of tin ore.

*Working Facilities.*—The lead extends to the north through the north portion of the leases, and still further for a distance of at least 2 miles until it joins the main Ringarooma lead. The lead will become wider and a larger thickness of drifts be present as it is followed in this direction. For a distance of 1½-mile from the workings no basalt overburden should be met with, except possibly a small area on the western side of the lead where it passes beneath the main-road. To the north of the railway-line basalt overburden would be encountered.

The facilities are thus favourable for working along 1½ miles of the lead.

*Water-Supply.*—Numerous water-rights are held by J. A. Thompson for working the Weld and the Echo Mines, the water being obtained from the Weld and the Frome Rivers. The total amount used for the Echo Mine was 22 sluiceheads.

*Future Prospects.*—The future working of the mine depends, of course, upon the stanniferous content of the drifts and the cost of extracting the tin ore. The tin content appears to have been sufficient to enable operations to be carried out over a period of 20 years with apparently some degree of success. The production fell somewhat towards the latter end of the working period, but this is to be attributed partly or wholly to the deeper nature of the ground and the need of a more powerful plant to elevate and treat the drifts. The value of the ground ahead of the workings will be similar to that worked, but it can only be satisfactorily determined by boring or further workings.

81613



If the value of the ground is satisfactory, the absence of basalt overburden makes the conditions for working compare favourably with other leads of the district. For efficient working on a larger scale it is probable that a larger supply of water for sluicing and elevating purposes would be necessary.

*(b) Prospects of the Northern Part of the Lead.*

The same remarks apply generally to the continuation of the lead beyond the leases of the Echo Mine, as to that part within the leases which has been discussed above. If the tin content be proved by boring to be satisfactory, there is a length of 1½ mile of lead which can be easily worked, as there is little or no basalt overburden present. A boring campaign on this part of the lead is to be recommended.

### (7)—The O.K. Creek Lead.

A small amount of work has been performed at a point about three-quarters of a mile to the south-south-east of Herrick. The land in this vicinity was first leased by the Moorina Tin Mining Company Registered, which was formed in 1881, but it is doubtful if the presence of a lead was known. The land was last held under lease as 7770-M, of 40 acres, in the name of R. H. White and C. H. Newman.

The workings occur near the south-eastern corner of this lease, and are several chains in length and one-half to 1 chain in width.

The material exposed in the workings consists of grits and clayey beds, very similar to those of the Weld River lead in the Echo Mine. These beds represent the drifts of a small lead formed by the ancestor of the present O.K. Creek.

Granite occurs immediately to the south-west, south, and east of the lead, and also forms the bedrock. The southern part of the lead has been denuded by the unnamed creek entering the Ringarooma River, and also by the river itself. The lead extends to the north-west, and passes about 20 chains to the east of Herrick, to ultimately join the Ringarooma lead nearly 2 miles to the north-north-west of Herrick.

For a distance of three-quarters of a mile from the workings the lead has no basaltic overburden, but from this

To the north-west the basalt covers the drifts in the vicinity of the main-road at Derby.

*Production.*—From the year 1902 until 1907, 77·95 tons of tin ore were produced from the Echo Mine. From 19·· onwards, until 1922, the production was not separate from that of the Weld Mine, worked by the same company, although the Echo worked during the greater part of the period. The recorded production of the two mines from 1908 until 1918 was 3·· 17 tons of tin ore, and from 1918 till 1922 it was 27·75 tons of metallic tin produced in the form of ore. It is probable that half of these figures represent the production of the Echo Mine, and the total production would therefore be not less than 265 tons of tin ore.

*Working Facilities.*—The lead extends to the north through the north portion of the leases, and still further for a distance of at least 2 miles until it joins the main Ringarooma lead. The lead will become wider and a larger thickness of drifts be present as it is followed in this direction. For a distance of 1½-mile from the workings no basalt overburden should be met with, except possibly a small area on the western side of the lead where it passes beneath the main-road. To the north of the railway-line basalt overburden would be encountered.

The facilities are thus favourable for working along 1½ miles of the lead.

*Water-Supply.*—Numerous water-rights are held by J. A. Thompson for working the Weld and the Echo Mines, the water being obtained from the Weld and the Frome Rivers. The total amount used for the Echo Mine was 22 sluiceheads.

*Future Prospects.*—The future working of the mine depends, of course, upon the stanniferous content of the drifts and the cost of extracting the tin ore. The tin content appears to have been sufficient to enable operations to be carried out over a period of 20 years with apparently some degree of success. The production fell somewhat towards the latter end of the working period, but this is to be attributed partly or wholly to the deeper nature of the ground and the need of a more powerful plant to elevate and treat the drifts. The value of the ground ahead of the workings will be similar to that worked, but it can only be satisfactorily determined by boring or further workings.

816144



If the value of the ground is satisfactory, the absence of basalt overburden makes the conditions for working compare favourably with other leads of the district. For efficient working on a larger scale it is probable that a larger supply of water for sluicing and elevating purposes would be necessary.

*(b) Prospects of the Northern Part of the Lead.*

The same remarks apply generally to the continuation of the lead beyond the leases of the Echo Mine, as to that part within the leases which has been discussed above. If the tin content be proved by boring to be satisfactory, there is a length of 1½ mile of lead which can be easily worked, as there is little or no basalt overburden present. A boring campaign on this part of the lead is to be recommended.

### (7)—The O.K. Creek Lead.

A small amount of work has been performed at a point about three-quarters of a mile to the south-south-east of Herrick. The land in this vicinity was first leased by the Moorina Tin Mining Company Registered, which was formed in 1881, but it is doubtful if the presence of a lead was known. The land was last held under lease as 7776-M, of 40 acres, in the name of R. H. White and C. H. Newman.

The workings occur near the south-eastern corner of this lease, and are several chains in length and one-half to 1 chain in width.

The material exposed in the workings consists of grits and clayey beds, very similar to those of the Weld River lead in the Echo Mine. These beds represent the drifts of a small lead formed by the ancestor of the present O.K. Creek.

Granite occurs immediately to the south-west, south, and east of the lead, and also forms the bedrock. The southern part of the lead has been denuded by the unnamed creek entering the Ringarooma River, and also by the river itself. The lead extends to the north-west, and passes about 20 chains to the east of Herrick, to ultimately join the Ringarooma lead nearly 2 miles to the north-north-west of Herrick.

For a distance of three-quarters of a mile from the workings the lead has no basaltic overburden, but from this point (immediately to the north of the Herrick-Boobyalla-road) the lead has for the most part a thick overburden of basalt.

The lead is only a small one relatively to those of the Branxholm Creek, Cascade River, Main Creek, &c., but it should increase somewhat in size to the north-west. The tin content is the determining factor as to whether the lead is of economic importance, and could be determined by boring or other methods. If the content be satisfactory the lead could be readily worked as far as the Boobyalla-road. Reliable information would then be known as to possibilities of success if the lead was followed further to the north-west, below the basalt overburden.

### (8)—South Pioneer Lead.

The Pioneer Tin Mining Company Limited has worked a small and narrow run of deep ground on Leases 7969-M and 3297-M, to the south-west of their main workings. This deposit represents a small deep lead, formed probably by the ancestor of the Gladstone Creek, or else by a small creek which has been completely buried by the Lower Tertiary sediments. The lead traverses the leases referred to above, and passes to the west of the low hill of granite south-east of the recreation reserve, and then through the latter, to junction with the *Wyniford River* lead a short distance ahead of the Pioneer workings.

Where it has been worked the lead is only 1 chain wide, being confined between granite sides. The drifts gave a yield of 0·75 lb. per cubic yard, and the ground was proved to be up to 70 feet deep.

There is no basalt overburden, and the lead could be easily worked down to its junction with the Wyniford River lead.

### (9)—The Wyniford River or Pioneer Lead.

#### (a) *The Pioneer Tin Mining Company Limited.*

*Location and Access.*—The Pioneer Tin Mine is situated upon Consolidated Lease No. 5353-M, of 456 acres, immediately to the north of the township of Bradshaw's Creek. The road from Herrick, the terminus of the railway, to South Mt. Cameron, Gladstone, and Boobyalla passes through Bradshaw's Creek, which is distant 3½ miles from Herrick.

81645



*Previous Reports.*—Reference is made to the Pioneer Mine in the following reports:—

Thureau, G.: Stanniferous Deposits at Ringarooma. 1884.*

Twelvetrees, W. H.: Preliminary Report on the Deep Lead or Infra-Basaltic Stanniferous Gravels of the Ringarooma Valley, near Derby: Secretary for Mines' Report, 1899-1900.

*History.*—The discovery of tin ore at the site of the Pioneer Mine was made by Wm. Bradshaw, who applied for a lease in 1877. This discovery was made near the junction of the creek which now bears his name and the *Ringarooma River*. The tin ore was probably found in the Recent gravels of Bradshaw's Creek, and was derived mainly by the denudation and re-sorting of the drifts of the deep lead which was later exposed.

The Pioneer Tin Mining Company Limited was formed in 1882 to work the deposit, but operations were not entirely successful. The working was then let on tribute, chiefly to Chinese, who carried on operations successfully until the late nineties. As the rich ground of the deep lead became exposed, the company took steps to equip and work the mine, construct water-races, dams, &c., and tested the property by boring. The company was reconstructed in 1900 in order to efficiently equip the mine and undertake operations on an extensive scale. Sluicing commenced in the same year, and operations have been carried out very successfully and continuously up till the present time.

*Geology.*—The greater portion of the surface near the Pioneer Mine is occupied by Lower Tertiary sediments and surface soil and waste derived therefrom. Granite outcrops over the remaining portion as low hills above the general level of the district.

*The Ore-Deposit.*—The deposit worked in the Pioneer Mine consists of Lower Tertiary stanniferous sediments representing a deep lead. This lead was formed by the ancestor of the Wyniford River, which was a tributary of the ancient Ringarooma River. The lead enters the property from the east, near the junction of Bradshaw's Creek with the present Ringarooma River. It follows a sinuous course across the leases in a *general west-north-westerly* direction, and then passes out in a general westerly direction to join the main Ringarooma lead about 2 miles to the west.

816146

*Production.*—Only very incomplete records of production prior to 1900 are in existence. These show a total amount of 145 tons, but it is probable that at least 500 tons of tin ore were obtained. From the commencement of sluicing in 1900 the total amount of tin ore produced has been approximately 7867·88 tons. This ore has been obtained from approximately 11,500,000 cubic yards of drifts, but portion of this total has been estimated in the absence of records. From 1912 to 1922, however, 3646·38 tons have been obtained from 6,618,800 cubic yards of drifts.

*Value of the Drifts.*—The tin content of the drifts has naturally varied as work has progressed down the lead, and also according to the position of the working face in the cross-section of the lead. Up to the year 1907 the average content of material treated was 2·161 lb. per cubic yard. During 1906 it was 1·637, and during 1907 1·604 lb. per cubic yard. From 1912 until 1922 the average content was 1·23 lb. per cubic yard. These figures suggest a decrease in the tin content of the drifts as work has progressed down the lead. This is due to the greater depth and width of drifts which occur as the lead approaches the main Ringarooma lead. The upper layers contain less tin ore than the lower ones, and becoming progressively greater in quantity, reduce the average content of the whole thickness of the drifts. This effect has been more pronounced in the case of the Pioneer workings, because the natural slope of the surface along Bradshaw's Creek is in a direction opposite to that of the dip of the bottom of the lead. At the eastern end of the workings the upper layers had been removed by denudation, and the lower ones only remained to be worked. As work progressed to the west, the surface rose and the bottom of the lead dipped, and a relatively large proportion of the upper drifts had to be treated.

*Extension of the Lead.*—The lead has been proved by boring operations to extend as far as the western boundary of the lease, beyond which it passes in a general westerly direction. Its exact course cannot then be traced, owing to the surface being wholly occupied by Tertiary drifts, but it should follow a general westerly course for 2 miles to join the main Ringarooma lead.

*Method of Working.*—The drifts are broken down by hydraulic sluicing, the stiff clayey layers being broken by means of explosives and hand labour. The face is worked



in two benches, the upper drifts being removed from the upper one, which is kept well ahead of the lower. The face may also be attacked at two or more points across the lead. The sluiced material drains to a small sump, and is elevated by an hydraulic elevator. It is delivered to another sump, from which it is taken by an electrically-driven centrifugal gravel-pump and elevated another 100 feet. It then passes through the sluice-boxes, and the drained tailings are elevated and dumped by a mechanical elevator of the endless-belt type.

*Water Supply and Power.*—The Pioneer Company hold water-rights on the Weld River, Frome River and tributaries, and the Wyniford River and tributaries, amounting to 163 sluiceheads. The supplies from the latter two sources are taken by race to the large dam which has been constructed on the 191 acres dam-site (1068-w) on the Frome River. The water (145 sluiceheads) from this dam is used for the generation of electric power, which is transmitted to the mine. This water, as well as that (18 sluiceheads) from the Weld River and other streams, is then conducted by two separate races to the vicinity of the mine, where the supplies are united and taken across the Ringarooma River in a pipe-line for sluicing purposes.

*Working Facilities.*—The working facilities are extremely favourable. There is a total absence of the basaltic overburden so common in the Ringarooma Valley, and little or no overburden of barren drifts. The greatest depth of the drifts is 70 to 80 feet. The drifts are payable across a width of 1000 to 1200 feet, so that a very wide face is available for working, and the total quantity of payable drifts is large. The moderate depth of drifts and the general configuration of the land surface are such that no great elevation of tailings is necessary. Ample dumping ground exists in the old workings and the adjacent portions of the surface.

*Future Prospects.*—The future of the mine depends, of course, on the tin contents of the drifts, the cost of obtaining same, and the value of the product. There is no reason to expect any great difference in the tin content of the drifts from that obtained at present. The working facilities are excellent, and, with the supplies of water and electric power, should be conducive to low working costs. With a favourable price of tin the future of the mine should be a successful and prosperous one.

*(b) Prospects of the Western Extension of the Lead.*

As already indicated, the Wyniford River lead extends beyond the western boundary of the Pioneer lease in a general westerly direction, and should ultimately join the Ringarooma lead about 2 miles to the west. For one and a half miles of this continuation no basalt overlies the drifts, and the favourable conditions of the Pioneer Mine are present along this length. The conditions are not quite so favourable as at the Pioneer Mine, however, as the surface of the land rises to the west, and the total thickness of drifts will be gradually increasing. Thus a relatively greater proportion of the upper and poorer drifts will be present, and would have to be treated in any attempted working.

Whether this would reduce the average content of the drifts to such an extent that they could not be profitably treated cannot be definitely decided without actual tests. Before any work was contemplated a boring campaign would undoubtedly be a wise and necessary preliminary step. With the advance of the Pioneer workings in this direction the position is different, as evidence as to the value of the drifts is being obtained continuously as a result of the working.

## (10)—The Ringarooma River Lead.

*(a) Reasons for Lack of Operations on the Lead.*

The above descriptions of the mines which have been, and are being, worked on the deep leads of the Ringarooma Valley show that they are all situated on tributary leads, and not a single one has been opened up on the main Ringarooma lead. In addition, it will be noticed that all these tributary leads enter the main one from the south, south-east, and eastern sides. Not only has no attempt been made to work the main lead, but only one attempt has been made to penetrate it by boring, and even in this case the bore was some distance off the centre of the lead, though on what was thought to be its course at that period. (This boring was carried out in David Creek, and was referred to by Thureau in 1884.)

The reasons for this neglect of the main lead are, of course, numerous. In the first place, the modern streams have not succeeded in exposing the bottom layers of drift at any locality to the north or north-east of Ringarooma township, as in the case of the tributary leads. The

816147



possible tin-bearing drifts have therefore not been exposed for testing, and possibly treatment by prospector and miner. Secondly, although its presence, but not its actual course, was known or suspected, the thick overburden of basalt, and to a less extent barren drifts, would be regarded as such insurmountable difficulties, that further thought would not be given to the testing of the underlying lead.

A further reason was the fact that the course of the lead was not known with any considerable degree of accuracy. The course could only be determined as the result of a detailed geological survey of the greater portion of the Ringarooma Valley. Such a survey had not been carried out, although considerable areas of the valley were briefly examined at different periods. While these enabled the course of the lead to be determined more or less accurately within these areas, yet the lack of opportunity to examine the adjacent areas naturally introduced an element of error into the deductions as to the course. Further, the deducted course happened to be within the area in which the lead is almost continuously overlain by basalt, the disadvantages of which have already been referred to.

The present investigation was more extended, and resulted in the tracing of the lead with a fair amount of accuracy. This course has been shown on the geological map (Plate I.).

*(b) Value of the Drifts.*

The tracing of the course of the lead, important as it is, is, however, only a preliminary step towards the determination of the most important factor, the value or stanniferous content of the lead. This content can only be determined by boring or actual treatment of the drifts, but a discussion of the factors influencing the content will serve a useful purpose in indicating the results likely to be obtained.

It will be seen that the Ringarooma and Maurice Rivers of Lower Tertiary time had their source in the granitic country around and to the south and south-east of Mt. Maurice. Tin ore occurs in this district, and so the heads of these streams may have contributed cassiterite to the gravels, &c., along their courses. The ancestor of the Dorset River probably flowed wholly over Cambro-Ordovician rocks, and derived little, if any, cassiterite therefrom. The Legerwood Rivulet and tributaries headed in granite country, and may have contributed a small amount of tin ore to the main valley. From the junction of the Dorset River northwards the tin-bearing granite occurs. All the small creeks, as far as the Branxholm Creek, would contribute their share of ore to the main lead. From the Branxholm Creek, Black Creek, Valley Creek, Cascade River, Main Creek, Weld and Frome Rivers, and Wyniford River, vast quantities of tin ore were washed along their courses, as is evident from the mines working on these leads. It is certain, also, that some of this proceeded further along their courses than the present working faces of the mines, and that considerable amounts must have entered the main lead. Thus it can reasonably be anticipated that the main lead contains tin ore, possibly along the whole of its course, but certainly getting more plentiful as Branxholm is approached from the south, and being particularly so from Branxholm down the lead. The Ringarooma River itself would have gathered little, if any, from its bedrock between Talawa and Winnaleah, but from Winnaleah to the north it is following wholly over granite, and may have derived considerable quantities from this source.

While the drifts of the main lead will undoubtedly contain cassiterite, it is the actual content that is of economic importance. The gravels in the gutter of the lead may even be as rich as those in the tributary leads. In the case of the overlying drifts, however, the determining factor is the relatively greater volume of drifts being deposited in the larger valley of the main stream than in the smaller valleys of the tributaries. This would necessarily mean that, even if as much cassiterite was being brought into the main valley, it would be distributed through a much greater volume of drifts, which would therefore have a much lower content in comparison with those of the tributary leads. Just how far this process operated is a problem which can only be solved by actual test of the main lead. It may be that the lead at the junction of tributary ones may be as rich, if not more so, than these tributaries. This may even apply to the whole of the lead from Branxholm down the lead, or to portions thereof. Or it may be that the lead is poorer than the tributary ones.

### (c) *Testing the Lead.*

The best, and the least expensive, localities to test the lead are those in which the basalt overburden has been removed. This has actually been accomplished by the

816148



denudating action of the present Ringarooma River at several points along its course. These are: on the alluvial flats around and to the north-west of Branxholm railway-station; on the alluvial flats to the north-west of the Arba Hill; on the alluvial flats to the north-west of the Briseis Central; and north of the northern extremity of the basalt, three miles north of Herrick. At the first two localities the depth from the surface to the gutter of the lead would be 100 feet and 100 to 150 feet respectively, while in the last one it would be approximately 150 to 200 feet.

The course of the gutter of the lead is shown as accurately as it is possible to determine it. A line of test bores sited from this information would quickly locate it, and a further systematic scheme could then be undertaken to test the lead at any of these points. Such a campaign of boring is recommended as a necessary preliminary procedure to any proposed mining of the lead.

If the lead be so tested to the north of Herrick, and found payable, it could be readily traced beyond the northern limit of the district examined, by the same method of geological survey, followed by boring.

## VIII.—CONCLUSIONS.

The geological examination of the portion of the Ringarooma Valley described above was carried out with the object of determining the courses of the numerous deep leads containing alluvial tin ore which have been proved to exist. This has been done as accurately as possible from the mapping of the geological features at the surface. When it is remembered that the valley of the ancient Ringarooma River was filled with sediments to a maximum depth of 500 feet, and basalt to a maximum depth of 200 feet, and these filled the valley in places to a width of one and a half miles, it will be readily understood that the location of the leads is not absolutely accurate. Nevertheless the locations are such that any preliminary boring scheme based on them would quickly locate the gutter of the lead, whence the remainder of the scheme could be more accurately planned.

The deep lead system consists of the main lead of the former Ringarooma River and numerous tributary leads entering it from the east. The upper parts of the tributary leads connect with streams which are tributaries of the present Ringarooma River, and so the tributary leads represent deposits along a system of tributary streams which were the ancestors of the present ones.

The Ringarooma River has nowhere corroded its course deeply enough to expose the gutter of the Ringarooma lead, but has in places exposed the gutters in the upper parts of some of the tributary leads.

It is at these exposed parts of the tributary leads that all the mines have been opened up. The most important leads are those of Branxholm Creek (and Black Creek), Valley Creek, Cascade River, Main Creek, Weld River, and Wyniford River. The Arba Mine was the principal one on the Branxholm Creek lead, but is idle at the present time. The same remarks apply to the Briseis Central Mine on the Valley Creek lead. The most important group of mines were those on the Cascade River lead, and included the Briseis, Brothers' Home, Brothers' Home (No. 1), (afterwards the New Brothers' Home), Triangle, North Brothers' Home (Brothers' Home Extended), and Ringarooma Tin Mines. The majority became wholly or partly worked out, and are all now included in the Briseis Mine, the workings of which are being steadily advanced down the Cascade River lead.

816149



On the Main Creek lead the Mutual Hill Mine has been worked, but not with success.

The Echo Mine has been opened up on the Weld River lead, but not worked on a large scale. Boring operations are being carried out on this lead at the present time.

The Pioneer Mine has been successfully worked on the Wyniford River lead, and is still operating.

Future prospects of successful mining depend upon following the leads down their course towards their junction with the Ringarooma River lead. This involves the removal of a larger thickness of drifts and basalt overburden, and causes higher operating costs. The question of following of these leads therefore becomes an economic one, depending upon the cassiterite content of the drifts, the cost of working, and the market value of the recovered material. The same applies to the Ringarooma River lead itself, which is buried under the deepest overburden of all along the greater portion of its length. The most favourable localities to test this main lead have been discussed above.

There are thus portions of the tributary leads and the main lead itself which have not yet been worked, and which contain large supplies of alluvial tin ore. The question as to whether these can be successfully worked is entirely an economic one, depending upon the factors referred to above.

P. B. NYE, M.Sc., B.M.E.,
Government Geologist.

Hobart, September, 1924.

816150

# GEOLOGICAL SURVEY OF TASMANIA.

## LIST OF PUBLICATIONS.

### BULLETINS.

* No. 1.—The Mangana Goldfield, by W. H. Twelvetrees 1907

* No. 2.—The Mathinna Goldfield, Part III., by W. H. Twelvetrees 1907

* No. 3.—The Mt. Farrell Mining Field, by L. Keith Ward, B.A., B.E. 1908

* No. 4.—The Lisle Goldfield, by W. H. Twelvetrees 1908

* No. 5.—*Gunn's Plains, Alma, and other Mining Fields, North-West Coast*, by W. H. Twelvetrees 1909

* No. 6.—The *Tinfield of North Dundas*, by L. Keith Ward, B.A., B.E. 1909

* No. 7.—Geological Examination of the *Zeehan Field*. Preliminary Statement, by W. H. Twelvetrees and L. Keith Ward, B.A., B.E. 1909

No. 8.—The Ore-bodies of the Zeehan Field, by W. H. Twelvetrees and L. Keith Ward, B.A., B.E. 1910

No. 9.—The Scamander Mineral District, by W. H. Twelvetrees 1911

No. 10.—The Mt. Balfour Mining Field, by L. Keith Ward, B.A., B.E. 1911

* No. 11.—The Tasmanite Shale Fields of the Mersey District, by W. H. Twelvetrees 1911

No. 12.—The X River Tinfield, by L. Keith Ward, B.A., B.E. 1911

* No. 13.—The Preolenna Coalfield and the Geology of the Wynyard District, by Loftus Hills, M.Sc. 1913

No. 14.—The Middlesex and Mt. Claude Mining Field, by W. H. Twelvetrees 1913

No. 15.—The Stanley River Tinfield, by L. Lawry Waterhouse, B.E. 1914

No. 16.—The Jukes-Darwin Mining Field, by Loftus Hills, M.Sc. 1914

No. 17.—The Bald Hill Osmiridium Field, by W. H. Twelvetrees 1914

No. 18.—Geological Reconnaissance of the Country between Cape Sorell and Point Hibbs, by Loftus Hills, M.Sc. 1914

* No. 19.—The Zinc-Lead Sulphide Deposits of the Read-Rosebery District, Part I. (Mount Read Group), by Loftus Hills, M.Sc. 1914

*Publications marked * are out of print.*



No. 20.—The Catamaran and Strathblane Coalfields and Coal and Limestone at Ida Bay, Southern Tasmania, by W. H. Twelvetrees 1915

No. 21.—The South Heemskirk Tinfield, by L. Lawry Waterhouse, B.E. 1915

No. 22.—Catalogue of Publications issued by the Government of Tasmania relating to the Mines, Minerals, and Geology of the State, to 31st December, 1914, compiled by W. H. Twelvetrees 1915

No. 23.—The Zinc-Lead Sulphide Deposits of the Read-Rosebery District, Part II. (Rosebery Group), by Loftus Hills, M.Sc. 1915

No. 24.—Reconnaissance of the Country between Recherche Bay and New River, Southern Tasmania, by W. H. Twelvetrees 1915

No. 25.—The Gladstone Mineral District, by W. H. Twelvetrees 1916

No. 26.—The Tin Field of North Dundas, by Hartwell Conder, M.A. Camb., A.R.S.M., *London* 1919

No. 27.—The Bangor Mineral District, by W. H. Twelvetrees 1919

No. 28.—The North Pieman, Huskisson, and Sterling Valley Mining Fields, by A. McIntosh Reid 1919

No. 29.—The Mining Fields of Moina, Mt. Claude, and Lorinna, by A. McIntosh Reid 1919

No. 30.—The Mt. Pelion Mineral District, by A. McIntosh Reid 1919

No. 31.—The Zinc-Lead Sulphide Deposits of the Read-Rosebery District, Part III. (Metallurgy and General Review), by Loftus Hills, M.Sc. 1919

No. 32.—Osmiridium in Tasmania, by A. McIntosh Reid 1920

No. 33.—The Silver-Lead Deposits of the Waratah District, by P. B. Nye, M.Sc., B.M.E. 1923

No. 34.—The Mount Bischoff Tin Field, by A. McIntosh Reid 1923

### REPORTS.

* No. 1.—Preliminary Geological Report upon the Mt. Balfour Mining Field, by L. Keith Ward, B.A., B.E. 1910

No. 2.—The Silver-Lead Lodes of the Waratah District, by L. Keith Ward, B.A., B.E. 1911

No. 3.—Preliminary Report on the Zinc-Lead Sulphide Deposits of Mt. Read, by Loftus Hills, M.Sc. 1914

No. 4.—On Cement Materials at West Arm, by W. H. Twelvetrees 1914

Publications marked * are out of print.

## RECORDS.



## MINERAL RESOURCES.



81619





## UNDERGROUND WATER SUPPLY PAPERS.



John Vail, Government Printer, Tasmania

N · / STRALIA

PROFORMA

816152

# STATEMENT OF VALUE

*Lot No.*....................................

*For*...................... *Bags/Drums* TIN CONCENTRATES *Branded*........................................ *Received*........................................

*On Account of*..........................................................................................

..........................................................................................

| | Kgs. |
|---|---|
| Gross Weight ... ... ... | |
| Tare @ ... ... ... ... ... | |
| Weight of Moist Ore | |
| Moisture..................% | |
| Net Dry Weight ... ... | |
| Tonnes Decimal | |

Agreed Assay:

| | | | | | |
|---|---|---|---|---|---|
| Sn | 73.8 % | Bi | Trace | Pb | Trace |
| As | Trace | WO3 | 0.1 % | Cu | Trace |
| S | Trace | Zn | Trace | Sb | Trace |
| | | | | Fe | 0.9 % |

Price Basis: Average of daily official prices for Refined Tin ruling in Malaysia from 28.2.77 to 5.3.77 inclusive, as advised in our letter dated 7.3.77.

Average Price: $1575.850 Straits Dollars per picul.

Calculation:

Agreed Assay Sn 73.80 %
Less Penalty for Fe –

73.80
Less Unit Deduction 1.12

72.68 % of $1575.850 = $1145.328 Straits Dollars per picul.

$1145.328 Straits Dollars per picul converted to Australian currency @ 2.7509 Straits Dollars = $A1.00 = $A 416.347 per picul

16.5345 piculs @ $A 416.347 per picul = $A6884.08 per tonne

Less Treatment Charge $A 117.30
Penalty for Impurities $A -
Ore Bag Charges $A 5.00 = $A 122.30

$A6761.78 per tonne delivered Sydney.

T @ $ PER TONNE GROSS PROCEEDS $

LESS

ADVANCE $

RAILAGE $

$

NET PROCEEDS $

FOR AND ON BEHALF OF

ASSOCIATED TIN SMELTERS PTY. LIMITED

SYDNEY,..........................................................19........

EXPORT CONTROL (Cont'd.)

Clause 17: Payment.

Should the Buyer elect to receive any concentrates for storage only, or for smelting and refining only as provided for in sub-paragraphs 2) and 3) respectively of the preceding proviso then payment for such concentrates shall not become due until they have been priced.

81654

During any period of restriction on the export of Tin and the stocks of Tin imposed by the Commonwealth Government in accordance with the provisions of The Fifth International Tin Agreement the provisions of the undermentioned clauses of the attached Offer to Purchase shall be construed as being subject to and governed by the additional terms and conditions set out herein:-

<u>Clause 1</u> : Quantity and Duration of Offer to Purchase

<u>Clause 11</u>: Pricing

1) During any Control Period declared by the International Tin Council concentrates shall be deemed to be delivered to the Buyer for the purposes of export control at the time they are received into Buyer's Works at Alexandria, N.S.W.

11) During any such Control Period the Buyer can only agree to receive and purchase a total tonnage of concentrates as shall be equivalent the sum of -

a) the Domestic Quota for that period allocated to the Seller by the Government department responsible for controlling the exports and stocks of Tin.

and b) any Export Quota similarly allocated to the Seller and transferred to the Buyer by the said department. <u>Provided that</u> if at any time the Buyer is restricted as a result of export control in selling or delivering refined tin to markets within the Commonwealth of Australia or overseas the Buyer may elect, upon giving 14 days notice in writing to the seller, to take any one or more of the following courses of action:-

1) Refuse to receive further concentrates.
2) Agree to receive further concentrates for storage only at the cost and risk of the Seller.
3) Agree to receive further concentrates for smelting and refining but deferring the pricing of such concentrates until such time as the restriction no longer applies.

c) Tonnage of Mine Stock Quota produced during a Control Period available for delivery to the Smelter at the beginning of the subsequent period shall only be received, for pricing and payment purposes, in tonnages spread over the approximate number of weeks the Vendor would normally deliver such tonnage during periods not subject to Export Control.

**Sulphur** - Up to 0.15% - Free
Over 0.15% but not over 2.5% - $5.00

When the percentage of Sulphur contained is in excess of 2.5% an added penalty of $5.00 per tonne is charged for each additional 1.0% or part thereof in excess of 2.5% up to a maximum of 5.00% contained Sulphur.

**Arsenic** - Up to 0.1% - Free

Over 0.1% up to 0.2% - 50 cents per tonne for each 0.1% or part thereof.

Over 0.2% up to 0.4% - $2.50 per tonne for each 0.1% or part thereof above 0.2%

Above 0.4% - The parcel may be rejected at Smelter's option.

**Tungstic Oxide** - Up to 0.5% - Free
Over 0.5% - $1.25 per tonne for each 1.0% or part thereof present.

Copper )
Lead ) $1.25 per tonne for each 0.1% or part thereof present
Bismuth ) with minimum charge of $7.50 per tonne .
Antimony ) Note: No penalty is charged where the combined
Zinc ) impurities total less than 0.05%.
(Combined) )

Where separate elements exceed 0.05% an additional charge will be made as shown below:-

**Copper** - Above 0.05% - A charge as follows -

From 0.05% to 0.20% - $0.50 per tonne for each 0.01% above 0.05%

From 0.20% to 0.30% - $0.75 per tonne for each 0.01% above 0.20%

Above 0.3% - The parcel may be rejected at Smelter's option.

**Lead** - From 0.05% to 0.1% - $1.00 per tonne for each 0.01% above 0.05%

From 0.10% to 0.2% - $4.00 per tonne for each 0.01% above 0.10%

Above 0.2% - The parcel may be rejected at Smelter's option.

**Bismuth** - Above 0.05% - A charge of $5.00 per tonne for each 0.01% up to a maximum of 0.10%

Above 0.10% - The parcel may be rejected at Smelter's option.

**Antimony** - Above 0.05% - A charge of $5.00 per tonne for each 0.01% up to a maximum of 0.10%

Above 0.10% - The parcel may be rejected at Smelter's option.

**Zinc** - Above 0.05% - A charge of $0.20 per tonne for each 0.01% up to a maximum of 0.20%

Above 0.20% - The parcel may be rejected at Smelter's option.

**SCHEDULE OF PENALTIES FOR IMPURITIES** for attachment to Terms of Purchase — Tin Concentrates letter dated
addressed to:

In accordance with the following tariff:—

<u>Iron</u> — Up to 4.5% — Free

Over 4.5% up to 8.5% — 1/12th of Fe content in excess of 4.5% to be deducted from the ascertained tin assay.

Over 8.5% — Where the Fe content exceeds 8.5% the penalty for Fe as above is increased by deducting 1/6th of the Fe content of such excess from the ascertained tin assay.

Above 12.5% — The parcel may be rejected at Smelter's option.

In accordance with the above, the scale of deductions is as follows:

| % Fe | Deduction from Tin Assay % | % Fe | Deduction from Tin Assay % | % Fe | Deduction from Tin Assay % |
|---|---|---|---|---|---|
| Up to 4.5 | Nil | 7.2 | .23 | 9.9 | .56 |
| 4.6 | .01 | 7.3 | .23 | 10.0 | .58 |
| 4.7 | .02 | 7.4 | .24 | 10.1 | .60 |
| 4.8 | .03 | 7.5 | .25 | 10.2 | .61 |
| 4.9 | .03 | 7.6 | .26 | 10.3 | .63 |
| 5.0 | .04 | 7.7 | .27 | 10.4 | .65 |
| 5.1 | .05 | 7.8 | .28 | 10.5 | .66 |
| 5.2 | .06 | 7.9 | .28 | 10.6 | .68 |
| 5.3 | .07 | 8.0 | .29 | 10.7 | .70 |
| 5.4 | .08 | 8.1 | .30 | 10.8 | .71 |
| 5.5 | .08 | 8.2 | .31 | 10.9 | .73 |
| 5.6 | .09 | 8.3 | .32 | 11.0 | .75 |
| 5.7 | .10 | 8.4 | .33 | 11.1 | .76 |
| 5.8 | .11 | 8.5 | .33 | 11.2 | .78 |
| 5.9 | .12 | 8.6 | .35 | 11.3 | .80 |
| 6.0 | .13 | 8.7 | .36 | 11.4 | .81 |
| 6.1 | .13 | 8.8 | .38 | 11.5 | .83 |
| 6.2 | .14 | 8.9 | .40 | 11.6 | .85 |
| 6.3 | .15 | 9.0 | .41 | 11.7 | .86 |
| 6.4 | .16 | 9.1 | .43 | 11.8 | .88 |
| 6.5 | .17 | 9.2 | .45 | 11.9 | .90 |
| 6.6 | .18 | 9.3 | .46 | 12.0 | .91 |
| 6.7 | .18 | 9.4 | .48 | 12.1 | .93 |
| 6.8 | .19 | 9.5 | .50 | 12.2 | .95 |
| 6.9 | .20 | 9.6 | .51 | 12.3 | .96 |
| 7.0 | .21 | 9.7 | .53 | 12.4 | .98 |
| 7.1 | .22 | 9.8 | .55 | 12.5 | 1.00 |

Clause 18

Force Majeure: In the event of Force Majeure such as strikes, lockouts or other differences with workmen, accidents, damage to plant, interferences caused by revolution, insurrection or intervention of constituted authorities or any other contingency beyond the control of the Buyer or Seller hindering or preventing the Seller from forwarding, shipping and/or delivering or the Buyer from receiving, smelting or dealing with the concentrates or the resultant metal in the ordinary course of business, shipments and/or deliveries may be suspended until such condition cease to exist on written notice being given by and to the contracting parties.

Clause 19

Export Control: The terms of this Offer to Purchase and any ensuing contract are subject to there being no limitations of any kind imposed upon the Buyer by the Australian Government in accordance with its obligations under the Fourth International Tin Agreement In particular during any period of Export Control declared by the International Tin Council the provisions of Schedule No. 2 attach shall apply and shall be construed as forming an integral part of this Offer to Purchase.

Clause 20

Law Applicable: This offer and any ensuing contract shall be construed as being in accordance with and governed by the Laws of the State of New South Wales, Commonwealth of Australia.

For and on behalf of

ASSOCIATED TIN SMELTERS PTY. LIMITED,

Purchasing Manager.

We hereby confirm acceptance of the foregoing terms.

For and on behalf of:

..............................

DATE:

816158

**Treatment Charge:** $A117.00 per tonne nett dry weight basis 75% (seventy-five per cent) tin increasing by Australian cents 5 per tonne for each 0.2% (zero decimal two per cent) or part thereof of tin content below 75% and decreasing by Australian cents 5 per tonne for each 0.2% (zero decimal two per cent) or part thereof of tin content above 75%.

Clause 14

**Increased Smelting Costs:** Not Applicable.

Clause 15

**Ore Bags:** At the Seller's request, the Buyer will supply ore bags on loan ex Works, Alexandria for the sole purpose of transporting Tin concentrates ex mine to Buyer's Works.

A service charge of $A5.00 per tonne nett dry weight shall be made and such bags shall remain the property of the Buyer. The safe custody of such bags is the Seller's responsibility whilst they are in Seller's possession and the Buyer reserves the right to charge the Seller for any bags not returned.

Clause 16

**Insurance:** Not Applicable.

Clause 17

**Payment:** Payment shall be made in Australian currency and shall become due within twenty-one (21) days after arrival of the concentrates at Buyer's Works provided that if final payment for any delivery of concentrates has not been made within twenty -one (21) days of the date of delivery of such concentrates to the Buyer a provisional payment will be made on that day calculated at 80% of the estimated value. In addition, if such final payment has not been made within thirty (30) days of the date of delivery a further provisional payment will be made on that day calculated at 10% of the estimated value.

Clause 10

**Price Basis:**

The price in Australian Dollars per metric tonne shall be based on the official Malaysian Tin price as quoted by the Malaysian Market in Malaysian Dollars per picul (16.5345 piculs equals 1 metric tonne) on the days stipulated in the clause hereunder headed "Pricing" and coverted as follows:-

816159

(a) The Official Malaysian Tin Price shall be converted to Australian currency at the opening telegraphic transfer selling rate Malaysia on Australia as quoted by The Chartered Bank Ltd., Kuala Lumpur to the Australia and New Zealand Banking Group Limited and/or The Chartered Bank Ltd., Sydney on the days stipulated for pricing.

Provided that where concentrates are due for pricing upon a day for which there is no official quotation for Malaysian currency on Australian currency then the rate to be used shall be the mean of the last known opening quotation and the first subsequent opening quotation.

(b) The product of sub-clause (a) above, shall be multiplied by 16.5345 and the price so determined shall constitute the price applicable to this Offer to Purchase.

Clause 11

**Pricing:**

The pricing of each lot is to be on the average of the prices ruling during any one of the first, second or third calendar weeks following the arrival of the concentrates at Buyer's Works, Alexandria, N.S.W. provided that:-

1) the week nominated for pricing shall be at Buyer's option and such nomination shall be declared to the Seller on the day of arrival of the concentrates at Buyer's Works.

2) should the Buyer fail to nominate a pricing week on the day of arrival of any concentrates then such concentrates shall be priced on the average of the prices ruling during the second calendar week following the arrival of such concentrates at Buyer's Works.

Caluse 12

**Deductions from Assay:**

Payment shall be made on the basis of the full tin content less one unit plus or minus 0.01% for each 0.1% variation in the assay below or above 75.0%. Where applicable, a deduction shall first be made from the settlement tin assay in accordance with the iron penalty as set out in Clause 9 - "Penalties for Impurities".

816160

Clause 4

**Quality: (Cont'd)**

Impurities: The Buyer will accept Tin concentrates containing impurities within the limits of Clause No. 9 "Penalty for Impurities". Any lot containing impurities exceeding the limits as set out in Clause 9, or containing deleterious impurities not listed in that clause, will be subject to separate negotiations between Buyer and Seller.

Clause 5

**Weighing and Sampling:**

Weighing and sampling in maximum lots of fifteen (15) tonnes shall take place at the Buyer's Works. The Seller may elect to be represented at the weighing and sampling.

Clause 6

**Moisture:**

A sample for the determination of moisture shall be taken at the time of weighing each lot and the percentage of moisture so determined shall be deducted from the nett wet weight of concentrates. Should the moisture content of any lot exceed 5.00% $H_2O$, then an additional charge of $A2.50 per tonne nett dry weight for that lot will be made.

Clause 7

**Sampling Charge for Small Lots:**

$A10.00 per lot of less than 2 tonnes nett dry weight of concentrates.

Clause 8

**Assays:**

The Seller may elect to accept the Buyer's assays as final. If Representative assaying is required, Tin assays shall be exchanged simultaneously between Buyer and Seller. If the assays are within 0.50%, the average of the two results shall be taken as the settlement assay. If the assays differ by more than 0.50%, a reference sample shall be sent to an Umpire to be agreed upon. Should the Umpire's result fall between the other two or coincide with either, such Umpire's result becomes the settlement assay, but if otherwis the middle assay of the three is to be taken. Cost of reference shall be borne by the party whose assay is furthest from that of the Umpire.

When impurities are present, the Buyer's assays for such impurities shall be accepted as final.

Clause 9

**Penalties for Impurities:**

See Schedule No. 1 attached.

# PROFORMA

## TERMS OF PURCHASE - TIN CONCENTRATES

**Clause 1**

Quantity and Duration of Offer to Purchase:

Total production of Tin concentrates from the Seller's Mine at                    for the period commencing 1st January, 1977 to 30th September, 1977 subject to any limitations whilst exports and stocks of Tin are restricted in accordance with the provisions of Clause 19 - "Export Control".

**Clause 2**

Delivery:

Free into Buyer's Works at Alexandria, N.S.W.

**Clause 3**

Property in the Goods:

Property in the Tin concentrates shall pass to the Buyer on notification of Acceptance being given by the Buyer to the Seller in writing.

**Clause 4**

Quality:

Tin Content: The Seller shall supply concentrates having a minimum tin content of 50% and the Buyer shall have the right to reject any lot below this grade.

816162

# Associated Tin Smelters Pty. Limited

(Incorporated in the Australian Capital Territory)

Head Office and Works: 23-29 Bowden Street, Alexandria, N.S.W. Australia
Telephone 69 6856 (3 lines)
Telegrams and Cables: "Stannum, Sydney"
Telex: 25649
Postal Address:
Box 138, Post Office, Alexandria 2015

COPY TO: I.S. } ENC
K.P.
D.D.M.

KES/KT

9th March, 1977

Amdex Mining Limited,
119 York Street,
SYDNEY. N.S.W. 2000

Dear Sirs,

We refer to our telephone conversation (Messrs. K. Piggot/ K. Swan) when your interest in a Tin mining venture in North East Tasmania was confirmed. We were advised that production at an annual rate of approximately 250 tonnes to 300 tonnes of Tin concentrates was anticipated of a grade similar to that currently being produced by Mr. Vern Wood.

On this basis we would be prepared to issue Contract Terms and as a guide we enclose a set of proforma terms setting out various conditions in detail. Also enclosed is a proforma Statement of Value based on a typical assay of recent production from Mr. Wood and prices and exchange rates which were applicable to the week commencing 28th February, 1977.

We await your further advices with interest and should you decide to proceed with this venture we shall be pleased to confirm terms with you.

Yours faithfully,

ASSOCIATED TIN SMELTERS PTY. LIMITED,

K Swan

Purchasing Manager.

Encl.

# APPENDIX 7

Smelter Schedule, Associated Tin Smelters - Sydney