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MOUNT BISCHOFF TIN MINING CO. WARATAH

Report on the ore deposits, case presented by the  
Tribute parties, milling practices, power supply  
and immediate and future production possibilities.

June 1942.

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ORE DEPOSITS

The four ore deposits regarded as offering the most encouragement for the continuance of operations at the present rate and to provide a possible increase in the immediate future are namely:

- (a) North Valley Lode
- (b) Slaughter Yard Lode
- (c) Queen Lode
- (d) Main Tunnel

These occur in two distinct types; although the first three are true fissure fillings, each presents individual characteristics which in effect are equivalent to 4 distinct types.

North Valley Lode:

The North Valley Lode has been traced for a distance well in excess of 2000 feet at surface, and one adit, No. 5 has been driven some 1700 feet. It ranges from negligible width to 14 feet and some of the stoping is 500 feet in length.

The average width as supplied by the Mines Superintendent is 33 inches. However it was not deemed necessary to undertake complete measurements of ore width, but the average of mine samples taken indicate a width of 4.07 feet.

The ore is essentially a quartz - pyrite - pyrrhotite one in which the pyrite occurs largely in cellular form, while the pyrrhotite is massive, dense and predominately in the centre of the channel. In parts there is a definite selvage of gilbertite, altered muscovite and abundant fluorite.

The variation in width is due to a differential effect of the fissuring, the banded structure indicating a re-opening of the fissure.

There appears to be little if any wall rock alteration. Irregular splitting in the quartzite beds has led to apparent splitting in which case the tin content appears to be confined to one leg only.

The ease with which such splits can be missed in driving is sufficient evidence to warrant some method of lateral prospecting such as drill holes in the neighbourhood of the competent beds. This is clearly indicated on No. 4 level.

Slaughter Yard Lode:

This is a narrow, flat, dipping quartz sulphide lode; the sulphides consist essentially of pyrite, pyrrhotite, zinc blende, var. marmatite and arsenopyrite with quartz and some altered muscovite or gilbertite and fluorite constitute the principal gangue minerals.

No mineographic work was attempted as it was regarded as being beyond the scope of this report, therefore only brief and general statements are possible regarding ore characteristics, paragenesis, etc.

Main Tunnel Lode:

This deposit is one of the fissure - replacement type and is quite different from any of the other prospects under consideration. It consists essentially of dolomite and pyrrhotite. The mineralisation and dolomitization does not indicate selective replacement, the characteristic condition being massive, irregular replacement. Two more or less vertical shoots of ore apparently occurred along the line of lode, one in the main tunnel X cut and the other some 180 feet south-west. The proposed development would test the block of ore remaining between these two occurrences.

There is little or no underlay.

Queen Lode:

This lode is entirely different in mineralogical character from any of the other prospects. Partly oxidised cellular pyrite and quartz constitutes the major portion of the ore. The average width would not be less than two feet where exposed, while the underlay is to the south-west at approximately 25 degrees.

Ore Deposits and Reserves:

The necessity for detailed mapping of the geological structure of the Mount Bischoff ore - bodies is apparent before a clear interpretation of the relationship of the various types of ore - bodies with certain structural features is possible

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MINE SAMPLES

Tin Assay Values of Mine Samples obtained by Mr. Q.J. Henderson, Field Geologist, from leases of the Mount Bischoff Co. during May 1942.

The percentages of tin are also shown by the vanning assay. With this determination the recoverable cassiterite should be higher as overgrinding in a laboratory disc pulverisier is unavoidable.

<u>Reg. No.</u>	<u>Mine and Description of Sample</u>	<u>Percent Tin</u>	
		<u>Total</u>	<u>Vanning Assay</u>
<u>North Valley</u>			
469	1. No.5 level 1300' stope W. side across back 6' sect.	1.35	1.3
470	2. Ditto W. wall side 3' "	2.61	2.3
471	3. Ditto Eastern vein 18" cut at 40 1' "	3.43	2.95
472	4. Ditto Eastern wall drive 4'4" "	2.93	2.48
473	5. No. 3 level face (Stope) East 7'3" "	1.47	1.45
474	6. Ditto West 4'3" "	0.48	0.43
475	7. Ditto 50' (?) South drive in back 2'9" "	1.82	1.5
476	8. No. 4 level (face) 2' "	0.34	0.3
477	9. No. O.O. level (Yard's) 6' "	1.56	1.36
<u>Weighted Average</u>			
<u>Slaughter Yard Lode</u>			
478	1. No. 1 level, floor 1'6" "	2.42	1.84
479	2. Ditto face 0'4" "	0.54	0.31
480	3. Ditto ---- 0'6" "	4.91	3.77
481	4. 15' ahead of No. 2 level, 10' below No. 1 level. Stope Western end 1'6" "	2.51	2.31
482	5. No. 2 level (face) 4 1/2" "	1.43	1.14
<u>Weighted Average</u>			
		2.51	
<u>Main Tunnel X-cut</u>			
483	1. S.W. 5' high face 5'3" "	0.61	0.54
484	2. S.W. face (bottom) 4'0" "	1.32	0.97
485	3. S.W. Grab sulphidic portion ----	0.79	0.57
<u>Queen Lode</u>			
486	1. 17' from Western end 1'3" "	0.18	0.07
487	2. West 6' from end 1'1" "	0.92	0.56
488	3. West 11' East of No. 1 sample 1'7" "	0.16	0.10

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## TRIBUTORS' CASE

### DEVELOPMENT

#### (1) Slaughter Yard Lode

Suggested extension of No. 2 level 150 feet north west is necessary for a continuance of production at the present rate, otherwise, it is estimated by the Mine Superintendent that a cessation of mining operations would occur within six months. Estimated cost £450. Clarké's tribute party is prepared to undertake the work themselves, and estimate that a period of nineteen weeks would be required.

As the proposed development is driving on the lode no interference with existing production would occur.

The proposed development would make available 3.7 tons of metallic tin and would represent approximately five months mining on the basis of 1941 production. This development would also make additional ore available.

#### (2) Main Tunnel Lode

The proposed work will provide Allen's tribute party with opportunity to continue mining operations when the present place (Brown Face) is exhausted, which, the Mine Superintendent estimated, will be in approximately three months.

However, insufficient data are available to enable a true assessment of the possibilities of this prospect to be made, but some idea of the potential amount of metallic tin which may be made available by the proposed development is indicated by the estimated tin content of 32 tons. It is estimated that not less than a period of 24 weeks would be required, with a cost of £500.

#### (3) Queen Lode

This work has been suggested as a possible place for future development. No tribute party is working this lode anywhere, now, although much of the lode has been mined in the past. There remains a block of ore on the north west side of, and above the main Stanhope Adit level. It extends north west for a distance of approximately 500 feet and rises about 175 feet on the underlay, which is very flat, approximately 25 degrees. The average width appears to be about two feet.

Although sampling on the level indicates comparatively low grade ore, the lode channel is so well-developed that there is little doubt that additional prospecting may reveal payable ore, so that some prospecting can be justified here.

It is estimated that some 18,000 tons of ore remain in this block, but the average grade is unknown.

Estimated cost £175.

#### (4) North Valley Lode

The proposed development is not essential to maintain present production rate, but would have many advantages in any proposal to increase production from this mine. The limited amount of development proposed will make available approximately 18 tons of metallic tin.

This is insignificant when compared with the potential reserves of this lode which has been partly developed over a length of 2000 feet, with a vertical range of not less than 800feet.

It is estimated that there would be sufficient ore for three years production at the proposed increased production rate of 500 tons a week or nine years at the present rate.

It must be remembered, however, that additional development in keeping with normal mining practices would be required to maintain the proposed increased production rate.

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Tribute parties treating bailings and slimes desire assistance for continuance of production. These re-treatment plants produced 11.97 tons of tin (metallic) during 1941.

J. Housego (4 men producing 4 to 7 bags concentrate per week)  
400 yards of hardwood rails  
400 " " fluming.

Estimated cost £65.

A. Packett (2 men producing half a ton of concentrate per week)  
Quarter mile of fluming.

Estimated cost £40.

V. Canton (2 men producing half a ton of concentrate per month)  
400 yards of track. Cost was not estimated, but it was not stated that a supply of S.H. rails may be available at Zeehan.

North Valley Alluvial

W.G. Stevens and party, 4 men. 1941 production 5.2 tons Tin (Metallic).  
Repairs to Head race are desired at an estimated cost of £100.

The Mine Superintendent stated that the effective working of this tribute cannot be attained with less than 18 men, and application for additional men has been made to the Man Power Officer.

To assess production possibilities of the North Valley Alluvial, competent investigation is recommended. Investigation of Boulder removal by modern mechanical methods is indicated.

DRILLING

A drilling campaign should be preceded by a detailed geological investigation, and we have no doubt that additional ore reserves could be located by such methods.

ADDITIONAL PLANT

Several Tribute parties have stated that compressors and rock drill need overhaul and/or replacement, also probable re-location with re-conditioning of the installed compressor or replacement with one of higher capacity at the North Valley Mine.

All these proposals for additional plant in connection with the tributors case are regarded as matters which should be determined by or in collaboration with the Board of Management.

REMOVAL AND RE - BUILDING CALCINERS

Estimated Cost £3000

Proposals for replacement of this plant have been made elsewhere in the report, and as we are of the opinion that flotation can be successfully applied, it is suggested that no expenditure be incurred until such time as a determination of the future treatment has been made. Repairs to the 27 rabble calciner were of an urgent nature.

The site of the Calciners for an extended continuance of present operations is economically unsound, and in the event of a decision to retain the method of treatment, consideration should be given to removal to a site offering:-

- (1) the lease transport costs for the low grade concentrates
- (2) improved disposal of furnace gases and isolation from residential areas.

It is evident that locations of mining, milling, grade and tonnage of ore reserves are major factors affecting this and other determinations.

PROPOSED INCREASED TIN PRICE

In the tribute parties' case it is stated that production from surface faces during 1941 resulted in a recovery of 5.5 lbs. of tin concentrate per ton (0.17% metallic tin at 70%) with an average value of 9/2 per ton of ore, or at the June 1942 price 10.54/- per ton calculating the value at 62/- a unit nett. Apparently the surface faces gave lower recoveries than the total recovery of metallic tin as 0.298% and of a value of 16.18/- per ton. At 62/- per unit this value per ton is 18.47/-. This higher average recovery is due mainly to North Valley ore with an average of 0.56% Tin for last year.

The suggested price of £400 per ton of Tin is presumably gross and would approximate 78/- per unit nett. At this price the value of the average ore treated during 1941 would be 23.24/- per ton and in the case of the surface faces set out in the Tributors' Case, the value would only be 13.26/- per ton of ore.

Although the suggested price increase would afford some relief, examination of several treatment costs, including charges by the Company for plant and power rentals and stores, indicate that there would be little, if any, margin above the basic wage treating ore of the 1941 average.

Continuance of past operation by the tribute system can only be justified if more efficient methods cannot be established. Increased production possibilities are discussed elsewhere in the report.

MILLING METHODS

The mining and milling operations at Mount Bischoff are conducted under a tribute system. Three parties, namely K.G. Crawford's (North Valley Mine), N.G. Clarke's (Slaughter Yard Face), W.C. Fraser's (White Face), mine and concentrate ore and transport pyritic concentrate to the Claciner at Waratah. E. Allan's (Gossan Face) truck ore to the Company's mill at Waratah (Mill "40") and the pyritic concentrate flows by launder to the Calciner in the vicinity below the mill. The trucks are hauled back to the mill with horses.

W.G. Steven's party is working the alluvial at North Valley.

Three parties are treating tailings in the Waratah River (A. Packett, V. Campton and J. Housego). The treatment in all cases consists of coarse screening for removal of waste rock, undersize fed to stamp batteries, concentrated on shaking tables and roasted in rabbled calciners having an approximate hearth areas of 36 square feet and capacities of 1 1/4 cwt. per hour. The roasted concentrate is re-concentrated to produce a saleable product. All operations are conducted in proximity to the tribute areas owing mainly to the extreme difficulty and cost of transport from the Waratah River gorge.

Ore concentration plants are owned by the Company, and are leased to the tribute parties.

Electric power is utilized in all cases with the exception of two parties treating tailings, who have installed water power.

Generally, the ore dressing treatment throughout the four plants is similar, and consists of:-

1. Ore as mined is fed by man power to stamp batteries. Oversize is napped
2. Battery discharges (12 mesh screens being universal) are roughly classified with Spitzluttet, and also in one case (Allen's) a Spitzkasten and concentrated on on Card Tables to produce pyritic concentrates containing from 3 to 7% Tin.
3. These concentrates are transported in lorries by road to a position above the Company's calciner, where they are hydraulically conveyed by Launder to the settling pits at the Claciner situated in the valley of the Waratah River.
4. At the Calciner, the wet concentrate is dried and roasted in two Edwards furnanes, classified and tabled to produce a finished concentrate assaying approximately 70% Tin.

Plant details, treatment rates, etc., are shown in Table No. 1.

TABLE 1

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	<u>PARTIES</u>			
	Crawford's	Clarke's	Fraser's	Allen's
Mine	North Valley	Slaughter Yard Face	White Face	Gossan Face
Location of plant	do	do	Happy Valley	Mill "40"
Men employed	30	8	6	6
Type of ore	Hard P' and Pyrite	Quartz, Pyrite	Soft, Pyritic	Soft Mullocky
Tons of Ore treated/week	160	40	90	120
Tons Pyritic conc./week	25	8	6 - 8	6
Percent Tin in pyritic conc.	3 - 4	5 - 7	4½ - 7	4 - 6
Miles, Plant to Calciner	4½	1½	1½	¼
Transport cost/ton Pyritic conc.	4/- to 5/-	2/6	2/6	laundere
Stamps No./Weight lbs.	10/900;1000	5/900;1000	4/500?	6-9/900
Stamps D.P.M.	98	96	98	100
Screen Mesh	12	12	12	12
Type Classifier used	var. Spitzlutte	var. Spitzlutte	var. Spitzlutte	var. Spitzlutte & Spitzkaston.
No. Tables/speed	7/220	4/216	4/220	5
Hours worked/week	120	40	88	app. 32
Installed Elec. Horsepower	28	25	17½	81
Installed Elec. Horsepower for Compressor	30	+ 15	5 (winch)	(50)
Plant Rental/wk.	£9	£2.10.0	£1.16.0	-
Calciner Rental/week	£5 plus several extras and (wages of six men).			
Royalties payable on value of CT after leaving Basic Wage	24%	24%	24%	24%

P' = Pyrrhotite; + also Electric Winch 7½ H.P.

(The Company's Superintendent requested that the last three items be regarded as confidential, and if required otherwise, that the permission of the Board of Management be obtained.)

Clarke's concentrates flow by launder approximately 1/4 mile to settling boxes at North Valley Road. Fraser's tribute crush ore at the mine and the Battery discharge flows by launder a distance of approximately 8 chains to the concentration plant and the concentrate is hauled a short distance by electric winch to the North Valley Road for transport to the Calciner.

CALCINER

Capacity of this plant is 10 tons of pyritic concentrate per 24 hours, and two men are employed per shift. Fuel is required only to commence roasting. Cost of treatment per ton of pyritic concentrate is approximately 14/-. Five tables were in operation.

Operations during 1941

Operations of the Tribute parties during 1941 are given in Table 2, and are based on information supplied by the Company. Tin values in all tables are expressed in terms of metallic Tin.

Tonnages and production periods are calculated from stated recoveries per ton and concentrates produced. The information supplied is not in agreement with the quarterly returns of the Company.

Although the estimated production of metallic Tin is 13 tons less than that shown in the quarterly returns the table gives approximate conceptions of the grades of ores mined and vales of recoveries at various prices per unit.

The stated tonnage treated at the North Valley Mine is 8000 and represents a recovery of 0.51 percent Tin based on the stated production. At 56/- per unit this value is equivalent to 28.56/- per ton. It will be noted that the North Valley (Crawford) calculated figures in table 2 are 0.56% and 31/- respectively.

Item "A"	is the approximate price	during 1941 at	Launceston
" "B"	" "	" "	" of June 1942
" "C"	" "	" "	" suggested in the Tributer's case of April 1942.
" "D"	" "	" "	" in the Company's case of May 1942.

The fifth item in the table is shown for comparison, and represents the result of Departmental sampling of May 1942.

TABLE 2

OPERATIONS 1941	PARTIES			
	Crawford	Clarke	Fraser	Allen
Ore treated/tons	7375	3166	4676	---
Weeks operated	46	52	51	---
Tin recovered/ lbs. ton of ore	12.6	5.4	3.75	7.6
Tin recovered %	0.56	0.24	0.17	0.34
Tin recovered % (May sampling)	0.62	0.64	0.54	0.24
Tons Tin produced	41.3	7.6	7.95	---
Value of tin produced at 56/- unit/per tributer year	£385	£266	£371	---
"A" app. value recovered/ton at 56/- unit.	31/-	13/-	9/-	19/-
"B" app. value recovered/ton at 64/- unit.	36/-	15/-	11/-	---
"C" app. value recovered/ton at 80/- unit.	45/-	19/-	13/-	---
"D" app. value recovered/ton at 85/- unit.	47/-	20/-	14/-	---

CALCINATION AND CONCENTRATION PLANT

This plant consists of 1 - 22 and 1 - 27 rabble Edwards Roasters. The roasted product from each furnace is separately classified in Spitzluttens and Spitzhastens and the spigo products are fed individually to flour tables which produce finished concentrates, middlings and bailings. Overflows from the Spitzhastens go to waste. The middlings are fed to a Forwood Down Pan by hydraulic syphons; the overflow is classified in a 10' x 6' x 5' "V" box. Spigot products (2) are fed to one table producing a finished concentrate and a middling which is returned to the Pan. Pan overflow to waste. Six tables are installed and 5 were in operation. Finished concentrate is hauled from the valley with an electric winch.

Size and Quantities of Tin in Pyritic Concentrate

TABLE 3

B.S. Screens

North Valley Concentrate

Screen Size	Percent	Tin Percent	Tin Distribution	
			Percent	Percent Cumulative
+40	13.25	2.82	11.53	11.53
60	15.0	2.49	11.53	23.06
80	14.85	2.99	13.68	36.74
-80	56.90	3.61	63.26	100
Composite	100	3.24		

Sampling of Concentration Plants (1-65.42)

Head and tailing samples were obtained at each plant. Sampling times ranged from 3 to 6 hours. The samples can be regarded with some reserve owing to the short periods of tests and difficulty of sampling. Special precautions were taken in the treatment of samples to ensure the total recovery of the finest fractions; pulps were sampled at 15 minute intervals throughout the test periods. Concentrate and indicator samples were also obtained.

TABLE 4

Plant Recoveries and Concentration Ratios

Party	Ratio of Concentration	Tin Percent Recovery	Tin Percent Recovery as Indicated by Vanning Assays
Fraser's	8.6	56.7	76.2
Crawford's	5.2	62.7	74.8
Clarke's	8.4	64.7	80.1
Allen's	15.9	66.3	74.8
Calciner	18.6	91.2	94.7

Fraser's concentrate has been credited with middlings recovery.

Sampling of the Calciner concentration plant is not regarded as satisfactory indication of recoveries for the following reasons: Two samplings of feed were obtained, one being feed to calciners and one calcine discharge. The calciner feed after roasting contained only 4.1% tin as compared with the discharge containing 5.21% tin. The two tailings, general and pan settler overflow, could be sampled collectively. Transport, dusting and fuel losses are not taken into account.

Screen analyses, percent Tin in sizings and Tin distributions of Head and Tail samples are shown in tables to follow, also Tin values of various samples.

TABLE 5 Fraser's Tribute Party

- " 6 Crawford's " "
- " 7 Clarke's " "
- " 8 Allen's " "
- " 9 Calciner, treating Crawford's party's ore from North Valley Mine.

TABLE 5

Fraser's Tribute Party

1/5/42 White Face

<u>HEADS</u>				Tin Distribution	
Screen Size	Percent	Percent Cumulative	Tin Percent	Percent	Percent Cumulative
+20	0.9				
40	12.7	13.6	0.44	6.0	6.0
60	8.9	22.5	0.68	6.0	12.0
80	6.4	28.9	1.02	6.5	18.5
100	4.7	33.6	1.39	6.5	25.0
150	5.0	38.6	1.52	7.6	32.6
200	6.1	44.7	1.66	10.1	42.7
-200	55.3	100	1.04	57.3	100
Composite	100		1.0	100	
Composite (Vanning Assay)			0.74		
<u>TAILS</u>					
+20	0.9				
40	10.9	11.8	0.34	8.1	8.1
60	7.9	19.7	0.49	7.7	15.8
80	5.6	25.3	0.57	6.5	22.3
100	4.0	29.3	0.54	4.4	26.7
150	4.2	33.5	0.49	4.2	30.9
200	5.1	38.6	0.55	5.7	36.6
-200	61.4	100	0.51	63.4	100
Composite	100		0.49		
Composite (Vanning Assay)			0.20		
Pyritic Concentrate 1/5/42			7.05		
Indicator Middling " "			1.64		
" "by Vanning Assay			1.28		

TABLE 6

Crawford's Tribute Party

4/5/42 North Valley Mine

<u>HEADS</u>					
Screen Size	Percent	Percent Cumulative	Tin Percent	Tin Distribution	
				Percent Percent	Percent Cumulative
+20	1.9				
40	16.4	18.3	0.68	12.0	12.0
60	11.2	29.5	1.06	11.5	23.5
80	8.5	38.0	1.15	9.4	32.9
100	6.5	44.5	1.21	7.60	40.5
150	6.9	51.4	1.56	10.4	50.9
200	6.9	58.3	1.68	11.2	62.1
-200	41.7	100	0.94	37.9	100
Composite	100		1.04	100	
Composite (Vanning Assay)			0.84		
<u>TAILS</u>					
+20	1.7				
40	13.9	15.6	0.26	8.5	8.5
60	8.5	24.1	0.24	4.3	12.8
80	5.8	29.9	0.23	2.8	15.6
100	4.2	34.1	0.14	1.2	16.8
150	4.5	38.6	0.38	3.6	20.4
200	5.2	43.8	0.19	2.0	22.4
-200	56.2	100	0.66	77.6	100
Composite	100		0.48		
Composite (Vanning Assay)			0.26		
Pyritic Concentrate			3.38		
No. 2 Table Indicator (1st Middling)			0.33		
" " " " do. Vanning			0.31		
" " " " (2nd Middling)			0.50		
" " " " do (Vanning)			0.41		
Pyritic Concentrate Settler Overflow			3.53		

TABLE 7

Clarke's Tribute Party

5/5/42 Slaughter Yard Face

<u>HEADS</u>					
Screen Size	Percent	Percent Cumulative	Tin Percent	Tin Distribution	
				Percent	Percent Cumulative
+20	0.8				
40	8.4	9.2	0.5	4.6	4.6
60	8.9	18.1	0.73	6.4	11.0
80	8.1	26.2	1.10	8.8	19.8
100	6.3	32.5	1.38	8.6	28.4
150	6.8	39.3	1.73	11.7	40.1
200	6.8	46.1	1.73	11.7	51.8
-200	53.9	100	0.9	48.2	100
Composite	100		1.0		
Composite (Vanning Assay)			0.72		
<u>TAILS</u>					
+20	0.7				
40	8.9	9.6	0.19	4.6	4.6
60	8.8	18.4	0.19	4.2	8.8
80	7.4	25.8	0.20	3.7	12.5
100	5.4	31.2	0.21	2.9	15.4
150	5.6	36.8	0.28	4.0	19.4
200	5.7	42.5	0.38	5.4	24.8
-200	57.5	100	0.52	75.2	100
Composite	100		0.4		
Composite (Vanning Assay)			0.16		
Pyritic Concentrate 5&6/5/42			5.45		

TABLE 8

Allen's Tribute Party

6/5/42 Gossan Face

<u>HEADS</u>				Tin Distribution	
Screen Size	Percent	Percent Cumulative	Tin Percent	Percent	Percent Cumulative
+20	1.2				
40	10.1	11.3	0.16	4.6	4.6
60	7.3	18.6	0.48	9.1	13.7
80	5.9	24.5	0.64	9.6	23.3
100	4.4	28.9	0.75	8.4	31.7
150	4.7	33.6	0.78	9.3	41.0
200	6.1	39.7	0.84	13.0	54.0
-200	60.3	100	0.3	46.0	100
Composite	100		0.39		
Composite (Vanning Assay)			0.3		
<u>TAILS</u>					
+20	2.0				
40	17.6	19.6	0.1	13.7	13.7
60	9.4	29.0	0.16	10.5	24.2
80	6.0	35.0	0.16	6.7	30.9
100	4.2	39.2	0.14	4.1	35.0
150	4.4	43.6	0.12	3.7	38.7
200	5.1	48.7	0.12	4.2	42.9
-200	51.3	100	0.16	57.1	100
Composite	100		0.14		
Composite (Vanning Assay)			0.08		
Pyritic Concentrate 7/5/42			4.12		
Settler OverFlow:-					
+200	0.6				
-200	99.4		0.12 (0.03 by Vanning Assay)		

TABLE 9

Calciner Concentration Plant

6/5/42 North Valley Concentrate

<u>TAILS</u>					
Screen Size	Percent	Percent Cumulative	Tin Percent	Tin Distribution	
				Percent	Percent Cumulative
+20	0.1				
40	6.8	6.9	0.15	4.6	4.6
60	11.5	18.4	0.17	8.6	13.2
80	7.1	25.5	0.20	6.3	19.5
100	5.0	30.5	0.23	5.1	24.6
150	4.5	35.0	0.24	4.8	29.4
200	8.8	43.8	0.21	8.2	37.6
-200	56.2	100	0.25	62.4	100
Composite	100		0.22		
Composite (Vanning Assay)			0.15		
<u>PAN SETTLER OVERFLOW</u>					
+40	0.3				
60	1.9				
80	2.7				
100	5.6	10.5	0.39	7.6	7.6
150	12.2	22.7	0.23	5.2	12.8
200	16.3	39.0	0.11	3.3	16.1
-200	61.0	100	0.74	83.9	100
Composite	100		0.54		
Composite (Vanning Assay)			0.3		
Unroasted Heads			3.04 (Roasted in Laboratory 4.1%)		
Roasted Heads			5.21		
Finished Concentrate			69.6		

CONDITION OF PLANTS

Sufficient attention has not been given to maintenance and in several cases batteries were in an indifferent state of repair. In one instance a mortar box was badly worn and pulp was passing through cracks in sufficient quantity to require temporary launders positioned in the foundations below the box in an attempt to recover same. The majority of electrical measuring instruments were not operating. Tables have been satisfactorily maintained. Lack of man power may be regarded as the main reason for the above, but the divided responsibilities of the Company and the Tributors is a contributing factor.

CONDITION OF CALCINATION AND CONCENTRATION PLANT

The 27 rabble furnace was in a very unsatisfactory condition and the roof in the central section of the furnace was regarded as unsafe. In this section a movement has taken place of approximately a foot in a westerly direction and also subsided a similar distance. The hearth is in a state of disrepair. Ventilation in the building is ineffective, and at the time of inspection it was impossible to remain on the furnace roof for a period in excess of one minute. Escape of portion of the furnace gases through the roof of the building is viewed with concern, as they contain Sulphur Dioxide and Arsenious Oxide, and prevailing winds convey them over a section of the town.

The condition of the 22 rabble furnace and concentration plant is satisfactory.

POWER SUPPLY

The Mt. Bischoff Company have their own hydro-electric plant. Two main and two subsidiary dams of a stated capacity of 500,000,000 gallons supply water for the power station in the Waratah River Valley. Race to the penstock is approximately two miles in length, and has a section of 4' x 2'. Surface velocity measured during May showed a flow of 14 cusecs, and the corrected flow would be between 11 and 12 cusecs. An eighteen inch diameter pipe delivers the water to the power station with a vertical head of 600 feet. Pressure at the power station is 250 lbs./sq.in.

The maximum output at present is stated to be 400 k. watts (536 H.P.), but could be increased to 630 or 980 Kilowatts gross with all machines operating. Increase of power output above 400 K.W. would necessitate raising the Magnet dam 2 to 3 feet and increasing the race capacity. As an additional supply, the Fossey River could be connected to the supply. The Company's Electrical Engineer is of the opinion that an increase in output above 400 K.W. would necessitate the duplication of the power station pipe line. Additional dam capacity would be required for increased storage only for, normally, 2 to 3 summer months. During 1941 the maximum demand was 300 H.P. and the installed transformer rating is approximately 400 H.P.

The horsepower of motors in operations amounts to 345, and power transformer capacity is 288. Power consumptions are much less than the installed power, but it is evident that a substantial increase in consumption above the present demand would necessitate additional transformer capacity.

DETAILS OF EQUIPMENT

Power Station: 2/350 K.W. A.E.G. Alternators 2300 volts.  
2/140 K.W. Wyss " " "

1/350 K.W. alternator is not in working order. The Electrical Engineer estimated the cost of re-conditioning at £200.

Distribution: 3 power lines 2300 volts.

- a. To North Valley sub-station: 3 single 30 K.W. Transformers to 550 volts.
- b. To Mount " : 6 single 30 K.W. Transformers to 550 volts.
- c. To Waratah Works " : 3 single 48 K.W. Transformers to 550 volts.

Lighting: 240 and 110 volts.

Installed Power.

a. Sub-station:			H. P.	H. P.
	Crawford's Party			
		Compressor	30	
		Battery 25 & 3	<u>28</u>	
			58	
	North Valley Alluvial		<u>3</u>	61
b. Sub-station				
	Clarke's Party			
		Winch	7½	
		Battery	25	
		Compressor	<u>15</u>	
				47½
	Fraser's Party			
		Battery	10	
		Winch	5	
		Tables	<u>7½</u>	
				22½
	Packett's Party			
		Tailings Battery	3	
	Allen's Party			
		(Compressor 50 not in use )	50	
		(No. 2 Battery 30 not in use )	30	
		Pump for Mount Water Supply from race	<u>35</u>	
				<u>115</u>
				188.

<u>c. Substation</u>	H.P.	H.P.
"40" Mill No. 1 Battery	20	
" " " 2 "	25	
Grinding Pan & Tables	25	
No. 2 Tables	5	
Spare Tables	3	
Jigs	3	
	81	
 <u>Calciner</u>		
No. 1 Furnace	5	
" 2 "	5	
Tables	5	
Grinding Pan	15	
	30	
Yard Haulage	20	
Fitting Shop & Foundry 15, 3, 7½, 15	40½	
Electric Shop Generator	5	
	176½	
a. Substation		61
b. Substation		188
<u>Total installed</u>		425½ H.P.
Spare motors		30
Motors that could be repaired		116

ORE TREATMENT Innovations and Control.

With the exception of the North Valley Mine plant, all treatment rates are too small to offer favourable consideration for alterations to methods of treatment involving capital expenditure, beyond proper maintenance and extension of control of operations. Additional attention to classification is worthy of an extended test although the low ratios of concentration at present obtained favour good recoveries.

Control of the concentrate "cut" on tables is insufficient in all cases, and tests by roasting or acid treatment and vanning on indicator middlings at the end of the concentrate "cuts" could be established with advantage. Tests should be undertaken expeditiously and results obtained within an hour of sampling. Plant operators could be trained and intermittently checked by the Company's staff for this control. Fraser and party practise this control, but results are not available for approximately 16 hours.

CONCENTRATE TREATMENT

Alternative - Flotation

The sampling of the calciner concentration plant is considered as insufficient evidence on which to base a comparative recovery as compared with a change to flotation, and in the event of consideration being given to a change of treatment, a thorough sampling of the present plant would have to be undertaken. This could only be accomplished by installation of automatic samplers to obtain representative samples of Feed and Tailings. Table tailings, classifier and pan settler overflows would require to be totally fed to one sampler. It would also be desirable to separately sample feed to the pan.

As shown in Table 3, effective removal of the sulphides by flotation from cassiterite, etc., in pyritic concentrates would entail sizing and grinding of coarser fractions to approximately 60 mesh screen size. This operation could be accomplished in a Pan, but preferred treatment would be: Concentrate fed to a vibrating screen; oversize fed to a ball mill operating in closed circuit with the screen. An alternative for consideration is: Screen oversize to a jig and jig tailings to a ball mill in circuit with the screen. Examination of the concentrate referred to indicates that at least the majority of the cassiterite in the plus 60 mesh sizes is unattached.

Flotation tests conducted in the Laboratory, incorporating grinding of oversize in a ball mill and wet screening indicate that with a 3% Tin pyritic concentrate, the sulphides could be removed to the extent of 90 to 95% with the production of a flotation tailing containing 28 to 30% of Tin and 3 to 6% of Sulphur. The complete process of flotation and concentration of flotation tailings to a finished concentrate indicate recoveries of the Tin from 85 to 90%.

Metallurgical tests are being proceeded with, and will be the subject of a separate report.

High cost of treatment by roasting is caused mainly by low capacity of the calciners and consequent high labour cost per ton, and although a flotation plant of moderate capacity does not suffer from this disability, the labour cost would nevertheless be high at the present rate of treatment. Cost per ton for treatment of pyritic concentrate by flotation, sizing, grinding and concentration, at present outputs, is estimated at 9/-.

The successful treatment for removal of Sulphides by flotation at the Renison Associated Tin Mining Company's plant has been quoted as justification for the Mt. Bischoff Company to change from roasting to flotation. For the above reason it is considered advisable to compare the two ores and their relevant ore-dressing problems. The cassiterite in Renison Bell ores is of very small particle size; the majority being finer than a 200 mesh screen aperture and grinding to minus 150 mesh has been found necessary for liberation. Mount Bischoff ores contain comparatively coarser Cassiterite (as shown in tables) which is substantially liberated at 60 mesh. As 60 mesh sulphides can be effectively floated, grinding beyond this size is undesirable.

#### North Valley Mine Plant Operations.

Treatment at this mine could be improved. The hard ore is not suitable, as mined, for feed to stamp batteries and installation of a primary crusher and a mechanical feeder is recommended. Output would be increased and battery maintenance decreased. The ore contains between 50 and 75 percent of sulphides and with the present method of treatment a low concentration only is obtained. Any attempt to materially increase this concentration would result in reduction of recovery. Flotation for removal of sulphides has a definite application for this ore and could be incorporated with advantage. The simplest application would be inclusion of conditioning and flotation prior to classification and tabling. Only partial removal of the sulphides would take place at the present sizing of battery discharge but this removal would be justified in view of the concentration obtained and improvement in table operation,

particularly as the tables are operating at present with an excessive quantity of sulphides, causing disturbance and loss of Tin. Flotation reagent costs for this or any more complete flotation would not exceed 2/- per ton. Previous comments on classification apply to this plant. The installed concentrate settler is not efficient since finely divided sulphide was collected in the overflow, the sample containing 3.53% Tin. Operation of mechanical battery feeders would obviate the necessity for increase in mill operators should primary flotation be included in the treatment.

IMMEDIATE PRODUCTION POSSIBILITIES

North Valley Mine

The problem of immediate and maximum production within the range of local plant and man power is considered the most urgent feature of this investigation.

The North Valley Mine is regarded as the best selection for immediate and increased production. Operations during 1941, mine and mill sampling all indicate that the recovery of Tin would not be less than 1941 recoveries. Extension of mining and milling from 2 to 3 times the present rate would result in the following production and employment. Tin production is calculated from 1941 figures supplied by the Mine Superintendent, and period of operations is taken as 46 weeks per year.

Ore		Yearly Production	Approximate number of men required
Tons/week	Tons/year	Tons Tin (Metal)	
160	7360	41.2	30
320	14720	82.4	50
500	23000	128.8	70

Treatment of 320 tons per week would result in a greater production than that of the total of the four tribute parties mining and treating ore during 1941, and 500 tons per week would exceed the total 1941 production by 35 tons.

Mining and Concentration of 500 tons of ore per week

Mining

A survey for this mining rate was not investigated. A detailed investigation of the mine relative to suitability for the suggested output, mining methods, plant location, etc., is considered essential, and it is recommended for this purpose that the services of one or more men who are actively engaged in mining be secured for this purpose in collaboration with Departmental officers.

Man Power

The tribute system would be unsuited to the proposed means of production, and man power at present employed on other tributes could be made available for extension of operations at North Valley. It is probable that sufficient man power for mining and concentration is available locally for the proposed scale of operations.

Plant and Power

Preference to the utilization of local plant is deemed advisable mainly for reasons of speed of installation and difficulty of procuring new supplies. Some items of equipment such as stamp batteries, tables, electric motors, shafting, etc., could be made available by the Company. As shown under "Power Supply", ample power is available but some alterations and additions would be necessary to increase transformer capacity. The horse-power that can be transmitted by the installed lines has been estimated at approximately 160. Power requirements for treatment plant including primary crushing, stamp milling, screening, grinding of oversize and flotation have been estimated at 100 to 110 H.P. Should the balance be insufficient for mining, etc., consideration would have to be given to either increasing the voltage at the power station with subsequent step down at the mine, or installation of additional transmission lines.

Recommended Milling Practice

The following crushing, grinding, flotation and concentration treatment is regarded as well suited to the ore: Ore fed to a jaw crusher, regulated by feeder with provision for by-pass of undersize. Crushed ore to a bin with mechanical feeders delivering to stamp batteries. Battery screens used at Waratah mills produce a product too coarse in part for flotation of sulphides, and this coarse material would either have to be reduced by finer screens or preferably by a sizing separation of the battery discharge. Vibrating screens are preferred. If screened, the oversize containing 23% of the total tin as indicated in Table 6 would either be ground in a small ball mill in closed circuit with the screen or alternatively could be concentrated in jigs and jig tailings reground and returned if of sufficient value. The desired maximum particle size for subsequent treatment is 60 mesh screen size. The sized pulp fed to a conditioner and from the conditioner to flotation cells for rejection of the sulphides. With one stage of cleaning the sulphides should be discarded with a tin content ranging from 0.15 to 0.3%. Flotation tailings would then be classified and concentrated on Tables incorporating the usual retreatment of middlings etc. Finally, elimination of residual sulphides from the Table concentrate for which batch operation is to be preferred.

Rejection of the sulphides before Table concentration has the following advantages:

1. Flotation results in a concentration, as indicated by samples, of over two to one, giving a feed to the tables of approximately double the tin content of the ore.
2. Tables would be fed with a "free milling" ore with advantages of control and improved concentration.
3. Increased table capacity relative to tons of ore.
4. Production of a marketable concentrate, elimination of roasting and reduction of treatment costs.

Actual results obtainable incorporating flotation can only be completely assessed by practical application, but with effective metallurgical direction and control such a process is capable of producing a concentrate of first class marketable quality which would result in the elimination of the present process of roasting and re-concentration with its many disadvantages.

In the event of a decision being made to concentrate on production at the North Valley Mine various developmental works proposed on other lodes would for the immediate future be of secondary importance but could be undertaken as deemed advisable otherwise lack of man power would be a difficulty if reorganisation and adequate subsidy the requirement of increased productions.

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