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PRELIMINARY REPORT

on

THE BLUE TIER TIN MINES NO LIABILITY

Preliminary Statement

The Primary object of this report is to place before the Company a brief account of the results of the recent investigation in order that they may be able to modify the design their works to the best advantage. In this account an endeavour is made to give a description of the ore-bodies, their mode of occurrence and structual relations, and an idea of the extent and value of the deposits.

In addition certain recommendations are made as to further equipment of milling and concentrating appliances, methods of excavation, and means of transport.

Production

From this mine, operated intermittently since the early eighties has been produced over 2000 tons of concentrated tin ore. Unfortunately some of the records have been lost, but records of the earlier and later operations are available for reference.

Prior to 1892 over 288 tons of tin ore was saved in the treatment of 30,734 tons of lode stone or at the rate of 0.937 per cent. It is evident from this record that the richest stone was selected for treatment.

During 21 months ending June 1901 the record shows a concentration of 434 tons of tin ore from 111,167 tons of lode stone, or at the rate of 0.39 per cent. The falling-off in the proportion of tin in the stone is remarkable; but during that period no attempt was made to select rich ore, the hanging-wall rock or overburden only being discarded as valueless.

The scale of operations varied greatly under the control of the several companies. At present operations are performed on a very small scale and only the richest ore available is selected for treatment.

In order to convey an idea of the grade of stone being mined it may be stated that during the last quarter 1126 tons yielded 4½ tons of concentrated tin ore, or at the rate of 0.4 per cent. That is certainly a satisfactory yield and the work may be regarded as a fair sampling of that part of the deposit: the northeastern upper part as shown on the plan of the open-cut.

Just before the closing of the mine by the Anchor Company some years ago the grade of the stone in the ore-body as a whole had fallen to 0.19 to 0.17 per cent - too low to allow of profitable operation under the mining conditions and market rates of that time.

General Geology

The fundamental rocks of economic importance are the granite and its apophyses of Blue Tier Range. This rock is intrusive into the sandstones, slates, volcanic tuffs and breccias of Cambro-Ordovician age represented in outcrops near Pyengana, St. Helens, Mt. Rattler, and elsewhere in the neighbourhood. The intruded sedimentary and other stratified rocks have been metamorphosed and mineralised along the lines of contact, and are difficult to recognise in their altered conditions.

The granite varies greatly as regards texture and composition from point to point. In some places the rock is a normal biotite granite consisting of biotite, quartz, and the felspars othoclase and plagioclase; the components equidimensional and rather coarse in texture, and with hyp-idiomorphic outlines.

In other places the rock is decidedly porphyritic in texture and is composed almost wholly of felspars and quartz. At Blue Tier and at Weldborough the rock is a coarse grained granite porphyry, with crystals of felspar one to three inches in length, idiomorphic in outlines and generally unaffected by agents of decomposition. The parellelism of the longer axis of the felspar is indicative of flow structure.

The first of the component minerals to assume crystallin form was the mica, then came the felspars, and finally the quartz. This order is exhibited in many specimens where biotite is found encased in felspar and quartz is found occupying the interstitial spaces.

As the ore bodies are approached the rock is less porphyritic and consists almost wholly of quartz and kaolinised felspars with very little biotite. In this rock the felspars appear interstitial, but are probably contemporaneous.

The granitic rock containing the metallic minerals is of quite different type. It is not of coarse texture, not strikingly porphyritic, but is of more even grain and of medium texture. The biotite is changed into silvery and greenish muscovite by the abstraction of the iron constituent and talc is formed from the liberated magnesia. The felspars undergo many changes. In some parts where mineralisation has not been intense the alteration is into Kaolin; in other places these minerals have suffered extreme silification and the rock is hard and quartzose; and again it has been converted into the soft waxy, pale-green mineral pinite, or into silvery and pearly green micas. Pseudomorphs of dark green mica after felspar are common. Where mineralisation has been greatest, the transformation of the minerals of the containing rock has been greatest, and the presence of some of these secondary minerals is a guide to the determination of the relative proportions of tin ore in the several varieties of rock. For instance; pegmatites of quartz and mica are invariably accompanied by cassiterite (tin ore) and molybdenite; tin ore is always associated with pinite and secondary micas formed from felspars and fluorspar is present in all rich deposits. In all of these transformations fluorine has been the most active agent. In fact that mineraliser has been largely responsible for the dissolution and deposition of the metallic ores.

Accessory minerals are cassiterite, molybdenite, wolframite, scheelite, galena, chalcopyrite, pyrite, and fluorite. Tourmaline is very rare, topaz is present, and sapphires zircon, and pleonaste are abundant in the accompanying gravels having been released from veins of pegmatite.

In some parts of the body (the pegmatite parts) molybdenite in large flakes is common and in fairly high proportion. It is always associated with chalcopyrite which is found in blebs and fine crystal aggregates. Wolframite, scheelite, galena, and pyrite are everywhere present but in such small proportion as to be regarded as negligible.

Fluorite is a common component of pegmatite, but is also found in abundance filling joint planes and fissures, and likewise in the body of the altered rock. Evidently the lime of the fluorspar was derived from apatite which is a common accessory of the contiguous granite.

The Origin of the Ore body

Thureau and Montgomery regarded the tin bearing rock of Blue Tier as a dyke traversing normal biotite granite. Ulbrick described it as a stockwork or mineralised zone of the granite. Twelvetrees thought that the formation was due to greisenisation along joint planes in the granite.

It appears to the writer that not one of these hypotheses fully accounts for the formation of such an enormous body of completely and heavily mineralised altered granitic material.

The evidence at hand goes to show that this extraordinary body represents the "acid extract", as it were, of the cooling granite magma. In this body were collected the mineralisers while it was still in a state of flux but after the main granite mass had already solidified. The minerals this residual body under the action of such strong mineralising and fluxing agents as fluorine and chlorine succumbed to the attack, were completely transformed, suffered decomposition and were converted into other compounds. In consequence of the permeation of this great body by mineralisers the original components susceptible to attack either gave place to ores or were converted into secondary rock-forming minerals. That the pervading corroding action of these agents began while the body was still in a condition of flux is indicated by the following evidence:

1. The body as a whole has suffered greisenisation in a varying degree.

2. The walls of the body are sharply defined;

3. The wall-rock is unaltered;

4. The tin ore is distributed throughout the body, but in greater proportion along certain belts;

5. Fluorine compounds are found not only on joint planes but in the substance of the stone.

Certainly greisenisation continued after the permeation of the main body as exemplified by the numerous tin-bearing mica veins coursing generally north-eastward and dipping south eastward, and by the bonanzas found close to the hanging wall. In addition to the comparatively narrow but rich mica veins, there appear to be certain distinct zones which are above the average in richness.

At the eastern side of the workings where stone is being broken at present a fairly rich body extends underneath seventy feet of hanging-wall rock or overburden. The overburden is of granitic rock (decayed felspar and quartz) and is quite soft in comparison with the underlying ore-body. The line of demarkation is sharp and the hanging wall rock is almost unaffected; but the greatest degree of mineralisation is exhibited in the 12-inch band of pegmatite immediately below the hanging-wall. This band of pegmatite is seen to be continuous along the strike and the dip in all mine openings and natural exposures.

The Extent and Value of the Ore-body and Distribution of the Ore.

The quality of the tin ore from the mine is excellent. A little wolframite, scheelite, chalcopyrite galena and molybdenite appear but in such low proportions as to be of little detriment. These minerals occur particularly in the hanging wall band of rich ore - very little in the bulk of the stone.

In the early days of mining here the Blue Tier ore was thought to be the poorest, but this opinion was formed on the basis of the grade of stone mined. The Blue Tier stone was not selected, but broken in the faces and passed unsorted to the mill.

An examination of the ore-body revealsthat it is variable as an ore carrier and that certain north easterly trending belts of tinstone are separated by wider belts of almost barren material. A closer investigation shows that the variability of quality and the distribution along certain belts are due directly to north-east lines of greisen along major structure planes. Moreover, it will be seen that in some places the lines of greisen are sharply marked by veins of mica in others by quartz pinite, or the rock is almost completely silicified. In the poorer or inter-tinstone belts secondary talc (not unlike pinite) after biotite is the only remarkable alteration. From this it may be conceived that by a careful inspection of the ore its value can be estimated.

In the past the cuts have been opened along lines parallel to the strike and have been advanced at right thereto. In consequence the cuts have passed through successive belts of the north-east trending tinstone and the intervening bodies of almost barren rock. A glance at the plan of the workings shows that the farthest advanced cuts are into the tinstone bodies, and the accompanying table of analyses of ore taken from the western workings shows that the ore occurs in definite belts. From the foregoing it will be evident that a selection of ore is essential to success, and that the ordinary methods of open-cutting are not applicable.

Observations taken at the Blue Tier Tin Mines show that the strike of the ore-body is almost due east-west and that the dip is south at 8 to 10 degrees. There the hanging-wall only is exposed and until the survey has been extended to contiguous areas the width (or thickness) cannot be determined. The ore-body dips south underneath the bottom of the valley of Groom River and rises north with the slope of the hill towards Weldborough Road where it passes under the mantle of hanging-wall rock. East and west of the workings the hanging-wall rock of the sharply rising hills completely covers it, but half a mile westward along the lower water-race boulders of the tin bearing stone appear at surface. At Gorgh's house near Weldborough Road loose boulders indicate the near presence of the ore-body at that point.

Westward to Crystal Hill and Liberator Mines the tin-bearing body continues, and northward the rock of the Don, Puzzle, and Australian Mines is regarded as part of this body.

The Workings

The method of excavation is that of open-cutting. The length of the open-cut from East to west is 1200 feet, and from south to north is 700 feet, and it is divided into four levels of benches 30 to 50 feet one above another. Each trench has a very irregular outline owing to the practice of excavating the richer shoots of ore first or at time when the output from the poorer parts was lower than the average. Again, those sections of the ore-body covered with overburden were not attacked because of the added cost of excavation. In consequence of this lack of system, large indentations appear on every level and at every turn, and occasional "islands" dot the open-cuts adding to the irregularity. It is doubtful whether the richer material so obtained was a counterbalance to the increase in cost of breaking the stone. In the days of big outputs such methods were inexcusable. Today, with a very small plant, selection of richest ore is essential to success and therefore justifiable. However, when large scale operations are resumed the cost of straightening the workings will be rather heavy and the average grade of ore will be lower.

The trench system as operated here was not satisfactory, and the layout of the works in general was not conducive to efficiency. Haulage of ore in trucks from one bench to the next higher and then by horse to the milling plant cannot be regarded as an economical means of transport. All breaking was by hand, boring and spawling; and the raising of the broken material into the (trenches) trucks was by hand also.

Water - Supply

An adequate water supply is one of the first and most important considerations of any mining company. In that respect this mine is very well equipped. The whole of the available supplies have not been drawn upon yet, not even when batteries of 100 stampers were in operation.

For present requirements the lower level water-race from Groom River conducts sufficient water; but during summer the reservoir in the valley of Marie Louise Creek is drawn upon to augment the reduced supply from Groom River.

The main source of supply has never been tapped; namely the water-race to North Gorge River. This race is 26 miles long, and taps many tributary streams on the way. This may be regarded as a great reserve to be drawn upon when the Company is ready to operate on a very large scale. In the companies more extensive operations the supply (not including that from North George River) was insufficient to provide power and washing (in the milling and concentrating plants) for the 100-head plant. An average of only 34 heads of stampers was maintained during the year.

Milling and Concentrating Plant

The broken ore is delivered into a small hopper, whence it is passed into a jaw rock-breaker and on to the feed floor of a battery of 10 stampers (weight 790 lb. each), which crush the tinstone to 110 mesh. The pulverised material then passes direct to two Phoenix-weir concentrating tables.

No attempt is made at classification, with such a crude and incomplete plant the loss is high.

The concentrate is dressed in sluice boxes.

The Proposed Mining Policy

It is recommended by the Manager (Mr. W. Gorgh) to remove the milling and concentrating plant to the western side of the workings and attack the tinstone exposed in the western open-cut (A.) The average grade of ore in that part is not richer than that being worked at the eastern side, but it is more easily open to attack and is not covered with overburden. Moreover, the conditions for breaking, trucking and milling are much better. It is thought by the manager that a lower (10 feet) bench should be opened to get at the richer body of ore below the floor of the main bench. A large number of dish prospects from the floor stone indicate that the grade of the material is such as to allow of its profitable operation. Furthermore, the analyses a large number of samples taken from the face of main bench and from the bench directly above it show that some ore bodies of value are open to attack there.

The following analyses are generally representative of the grade of the material.

Table of Analyses.

Western Open - cut.

Reg. No.	Mine No.	Sample taken from	Tin content %	Remarks
1186	1	Extreme W side	0.28	
1187	2	10 feet E of 1	0.40	tin ore body
1188	3	10 " " " 2	0.70	
1189	4	10 " " " 3	0.15	
1190	5	10 " " " 4	0.15	
1191	6	10 " " " 5	0.20	
1192	7	10 " " " 6	0.15	
1193	8	10 " " " 7	0.18	
1194	9	10 " " " 8	0.07	
1195	10	10 " " " 9	0.30	silicified
1196	11	10 " " " 10	trace	
1197	12	10 " " " 11	0.15	
1198	13	10 feet east of 12	0.15	
1199	14	At present battery site	0.05	
1200	15	10 feet E of 13	0.07	Unaltered
1201	16	10 " " " 15	0.10	granitic
1202	17	10 " " " 16	0.12	rock
1203	18	10 " " " 17	0.28	pinitised felspar and secondary quartz.
1204	19	10 " " " 18	0.12	Pinite and secondary mica
1205	20	10 " " " 19	0.28	
1206	21	10 " " " 20	0.15	Talc
1207	22	10 " " " 21	0.10	prominant
1208	23	10 " " " 22	0.20	Ore body mica
1209	24	10 " " " 23	0.30	after felspar
1210	25	10 " " " 24	trace	
1211	26	10 " " " 25	0.15	Talcose
1212	27	10 " " " 26	0.05	
1213	28	10 " " " 27	0.05	
1214	29	10 " " " 28	trace	
1215	30	10 " " " 29	0.05	
1216	31	10 " " " 30	0.20	Molybdenite
1217	32	10 " " " 31	0.10	visible
1218	33	10 " " " 32	0.10	
1219	34	10 " " " 33	trace	Kaolinised felspar in
1220	35	10 " " " 34	0.18	granite
1221	36	10 " " " 35	0.25	Pinitised
1222	37	10 " " " 36	trace	
1223	38	10 " " " 37	0.15	north east end of Western cut

Reg. No.	Mine No.	Sample taken from	Tin Content %	Remarks
1224	39	SE end of W cut	trace	
1225	40	" " " " "	0.07	
1226	41	" " " " "	0.85	a mica body 18" wide
1227	42	On bench above A Western side	0.07	
1228	43	15 feet E of 42	trace	
1229	44	15 " " " 43	0.15	
1230	45	15 " " " 44	0.30	
1231	46	15 " " " 45	0.05	
1232	47	15 " " " 46	0.10	
1233	48	10 " " " 47	2.15	result too high to be representative
1234	49	15 " " " 48	0.05	
1235	50	a hole 20 feet North of 44	1.32	a rich make her
1236	51	bench slope North of 50	0.15	

Proposed Additional Plant

In connection with the proposal to dismantle the present plant and reconstruct it on another site the suggestion is made that essential additional plant should be provided. The following flow-sheet is explanatory:-

50-ton bin

crusher

two self-feeders

battery of 10 stampers

jig. grinding pan

classifiers and settlers.

Phœnix-weir tables (2) Wilfley or Curvilinean tables (2)

Vanner.

with the present inefficient plant it is useless to attempt to carry on. Mine is being worked for benefit of employees and there is no prospect of an improvement.

General Remarks

This report should be regarded as a preliminary statement only, because the work of investigation is still proceeding and doubtless more information will be obtained which will have a further direct economic bearing on the development of the ore bodies. Information is not available upon which an estimate of reserve could be based, but it may be stated that the quantity of ore available is very large. If it is desired to continue operations the provisions of additional plant becomes an urgent necessity. In fact it is futile to attempt to carry on successfully without it.

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DIRECTOR OF MINES.

Mines Department,
Hobart.

17th October, 1927.