REPORT UPON THE PRESENT POSITION OF THE TASMANIA MINE, BEACONSFIELD.

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Government Geologist's Office, Launceston, 8th May, 1903.

SIR,

Agreeably to your instructions, I proceeded to Beaconsfield on the 30th April, in order to carry out the wish of the directors of the Tasmania Gold Mining and Quartz Crushing Company Registered that I should examine the mine, and give an opinion upon its present state and requirements so far as these relate to the special reports recently furnished by the general manager. I understand that the Board does not require me to supply an exhaustive and full report, but only one which shall cover the questions involved in the special reports mentioned. Consequently, I need not describe the company's property, its history, its geology, or the characteristics of the reef, or other well-known features of this important mine. It is sufficient for the present report to recall that, from the inception of the work to date, £772,071 15*s.* dividends have been paid on the extraction of 563,307 ozs. of gold.

The handling of the water in the reef has always formed a serious task. For the last nine years, since the cutting of the reef at the 600 and 700 feet levels, three million gallons per 24 hours have had to be raised, the water-level being lowered about 25 feet per annum. In driving on the reef at the 1000-feet level, a burst of water took place in August last, which stopped work there, and increased the water raised in that half-year by 240,000 gallons a day. The sinking plant in the new main shaft was unable to cope with the increase of water, which rose in three days to the 818-feet level, and which at the present time appears to be standing at about 64 feet below the 818-feet level.

Under these circumstances the company has to decide whether to attempt to overcome the water for a time by readjusting the pumping plant of the different shafts, or to provide for a fuller and more economical development of the mine by the installation of plant adequate to both present and future requirements.

ORE RESERVES.

The necessity for prompt decision is apparent from the present state of the ore-reserves. The estimate of ore existing above the 818-feet level, made 30th June, 1901, by Mr. Joseph Davies, the late general manager, and those made by Mr. C. F. Heathcote, the present general manager, in his half-yearly reports, are nearly co-incident. The ground still unworked above this level may be relied upon as containing

about 15,000 tons of stone, which, opened up and extracted, will keep the battery going at the present rate for seven months. There has been rarely sufficient stone available to keep the 105 heads of stamps going; last half-year the number of stamps averaged 55, and there are now only 30 head at work. The mine, therefore, must be considered as nearly exhausted above the 818-feet level.

The future of the mine as an ore-repository, consequently, depends upon the quantity and quality of stone existing below the 818-feet level.

WORK ON THE REEF BELOW THE 818-FEET LEVEL.

This consists of—

1. Five winzes in course of sinking from the 818-feet level, the deepest of which is now down 64 feet. Careful assay sections have been kept of the reef in these winzes, and show the average gold contents of the stone to be as follows:—

Winze. No.	Depth assayed. ft.	Average width of stone assayed. ft. in.	Average assay yield. ozs. gold per ton.
2	18	4 6	0·8109
3	10½	5 0	1·152
4	27½	6 0	1·075
5	43	3 8	1·826
6	4½	1 0	6·477

The latest assays show that No. 6 winze, as it is descending, has entered a part of the reef, averaging 2½ ozs. gold per ton. They are as follow:—

Winze. No.	Depth of assay. ft.	Width of stone assayed. ft.	ozs. gold per ton.
5	61	5	1·404
6	6	2½	2·766
6	8½	4	2·425
6	11	4½	2·318
2	26	5	0·823
4	44½	7	0·359

Having examined these winzes, I find the reef going down strong with stone, ranging from 5 to 8 feet in width, corresponding in all its physical features with the reef which has been worked above the 818-feet level, and showing no signs whatever of deterioration at the deepest point attained. The winzes are well-designed, as they not only prove absolutely the value of the stone at that depth, but will also provide the means of putting men immediately on ore-winning when the further development of the mine is decided upon.

2. *Drive on the reef for* 50 *feet at the* 1000-*feet level.*—I examined this as well as was possible with the heavy flow of water. The east drive, which is 22 feet in length, shows a lode-channel of 7 feet in width, with 3 to 4 feet of quartz,

of a kindly, laminated appearance, closely resembling the stone in the upper parts of the mine. The west drive, 19 feet, shows in its end the apparent beginning of a horse in the reef. The large quantity of water prevents thorough examination of these drives, but I saw enough to satisfy myself that the reef is living and strong at this depth. This reef was cut 29th January, 1902, and samples taken while driving, and assayed at the mine, yielded the following results:—

East Drive.

2 ft.	east of crosscut,	hanging wall	2 ft.	0·489 ozs. per ton
12 ft.	,,	,,	1 ft. 6 in.	1·161 ,,
23 ft.	,,	,,	2 ft. 6 in.	2·193 ,,

West Drive.

4 ft	west of crosscut,	face	2 ft. 6 in.	0·371 ozs. per ton
7 ft.	,,	,, ...	2 ft.	0·244 ,,
12 ft.	,,	hanging wall	3 ft.	0·032 ,,
	,,	footwall	1 ft. 6 in.	0·299 ,,
19 ft.	,,	hanging wall	2 ft.	0·146 ,,
	,,	footwall	2 ft	0·489 ,,

Boreholes 3 to 5 feet were put into the lode when it was first struck, and the stone assayed, with the following results:—

305 *ft.* 4 *in. to* 309 *ft.* 8 *in. from shaft.*
1 oz. 7 dwts. 10·56 grains.
1 oz. 0 dwts. 21 grains.

309 *ft.* 8 *in. to* 310 *ft.* 8 *in. from shaft.*
9 dwts. 3·52 grains.
2 dwts. 14 grains.

Estimates of the average width of the reef in the Tasmania Mine have been made from time to time by competent persons. The reef in its widest part is 26 feet across, but the calculations of average width are from 5 to 8 feet. It would appear therefore that its size at the 1000-feet level is equal to the average of the higher levels.

Quality of Stone.

The published returns of the crushings are, of course, tabulated in order of date only, and do not afford the means of ascertaining the returns from individual levels. Consequently, the yield from the upper parts of the mine have to be stated with reference to the time when they were worked. A further difficulty arises in connection with the corrections for tonnage, but, beginning with a rate of 7 per cent., and increasing to 19 per cent., the yield of the reef in ounces per ton of retorted and smelted gold has been as follow:—

From 1877 to April, 1894, 1 oz. 3 dwts. 19 grs.
To September, 1900, 18 dwts. 21 grs.
To January, 1902, 1 oz. 2 dwts. 14 grs.
To December, 1902, 14 dwts.

The recent falling off in the quality of stone is due to the poorer nature of the reef in the west end of the mine above the 818-feet, where it was also poor above the 700-feet, though said to have been good at the 600-feet. There are only 270 feet to drive west at the 818-feet level, when the main crosscourse will be reached, and the present run of stone terminated. But from September, 1900, to date, the average yield, according to the best means at our disposal for ascertaining it, has been below 18 and 19 dwts.; and using the same means of calculation for the whole period of six years' work before that, from May, 1894, to August, 1900, the yield was the same (within a few grains).

The records which have been kept of the output from the 818-feet level, subjected to such tonnage corrections as it is possible to apply, show that the reef between the 718 and 818 feet levels has yielded an average of between 17 and 18 dwts. retorted and smelted gold, of a value of £3 15*s.* 6*d.* per ounce.

While, therefore, the general manager is strictly correct, having regard to the uncertainty of the corrections for tonnage, in refraining from an opinion as to decrease or increase in the average value of the reef from the surface downwards, I believe the nearest approximation to the facts would be that for the last nine years the mean yield has remained about the same. The fall to 14 dwts. for the last year must not be taken by itself, but included in the average of recent years. In the present year the average yield from quartz and concentrates has decreased to 11 dwts., and that from the mine output exclusively to between 10 and 11 dwts. This is perhaps what might be expected for a time, while at the poor end of the reef, and when the quality cannot be reinforced by stone from ground opened up elsewhere (except a trifle from the current breakings in the lower winzes).

Production.

The 818-feet level will have returned over 94,000 tons of quartz from the reef between it and the 718-feet, and, as the reef-chute in the distance between the two levels has increased in length by 75 feet, viz., from 1475 feet to 1550 feet, it is reasonable to suppose that the increase will continue as the reef descends. The General Manager expects the reef between the 818 and 1000 feet to yield 180,000 tons quartz, irrespective of any increase in the length of the reef. This is a conservative estimate, and in basing his calculations on 90,000 tons as the probable output of each 100-feet level, I am of opinion that he has taken a just and moderate view.

It is true that the quartz has been exposed in the 1000-feet level only for a length of 50 feet, so far, but the

regularity in its occurrence at so many levels, in its contents and general features, its size and value in the winzes below the 818-feet, and its aspect and value in the 1000-feet where driven upon, render its full development in unimpaired quality at the 1000-feet almost certain.

Water.

The water now apparently stands at about 64 feet below the 818-feet level, having been lowered by that vertical distance during eight months' pumping. The history of the mine is that in the course of driving on the reef intermittent bursts of water occur, followed by easing off after draining away the influx. A heavy burst took place about six years ago in the 600-feet level, when it took nine or ten months' pumping to drain the water, which rose above the 500-feet level. At the 718-feet level west a burst stopped developmental work in that end for nearly three years. In the 1000-feet level, last August, the water broke out of the face, filling the drive, and rising in the reef to the 818-feet within the space of three days.

Much of the country driven through is open and fissured, affording numerous channels for the passage of water, which flows into the levels by tricklings, or even strong gushes, as driving on the reef proceeds. As the reef traverses the strata, it naturally collects the water along its walls, and often receives it into friable or fissured portions of its own substance. The tighter parts of the reef and strata hold back the water till it is suddenly released by driving, and sometimes with inconvenient results. A good deal of the water may have found its way thither from the main cross-course, which in its turn received it from the limestone-beds at each end of the mine, though I am inclined to believe that the Blyths Creek or eastern belt of limestone is responsible for most of it. Limestone is the most soluble rock in the district—the subsidence of limestone country in the neighbourhood of the mine, presumably—though the Tasmania drainage is well known. The burst in Dally's United proved the limestone line of country to be heavily charged with accumulated water, and the east end of the Tasmania Mine used to be wet, though most of the water has been in the western part. Although the mine is so near the Tamar, the water is not an infiltration from the river, as the strata are dipping towards the latter, and not away from it. The drainage of the Little Wonder Mine strata by the Tasmania shows some of the flow to have taken place from that direction. The Tasmania water-logged strata may be regarded as a channel of rather open country, running north-west and south-east, flanked by a highly-permeable broken sandstone and limestone belt on the east, and less pervious

slates on the west. Unfortunately, the store of underground water in the reef-channel shows at present no indication of approaching exhaustion. The signs of drainage of the surrounding country encourage the hope that the continued pumping is having some effect on the great subterranean reservoir. The subsidence of some of the limestone country appears to be due to the work at the Tasmania, but some of the superficial drying-up of swamps, &c., may be due to the succession of unusually dry seasons during the better part of the past decade. The constant pumping certainly is lowering the level of the ground-water in the mine. The permanent ground-water in any district is the residue of the rainfall not discharged at lower levels, or by streams or by evaporation, but percolating downwards through the strata until it is arrested by some impermeable rock. It then becomes stationary, or moves gently in the direction of easy flow. In the Tasmania there must come a time when, at an increased depth, the country will become tighter, the fissures which now act as water-conduits will close up, and the rock will be found comparatively dry.

How soon this will happen cannot be predicted; it may be at no great depth below the deepest level, or a good deal lower. But, obviously, it would be unsafe to lay out the work of the mine on the assumption that the water will henceforth begin to be a negligable factor.

There is therefore nothing for it but to proceed steadily with the attempt to obtain command of the water, under conditions that will admit of profitable working. It is possible that, by readjusting the present plant, the normal water-store may be handled, and work, after a certain delay, and at an undesirable cost, be carried on for a time as now; but this expedient would be temporary, and subject to the following drawbacks:—

1. Although the normal water-supply could be controlled, the same liability to heavy increases would continue as at present.

2. The average crushings for the last five years have not exceeded 30,000 tons per annum (the highest, 34,389 tons, last year). The standing charges can only be reduced by increasing the output, and opening the mine by two levels at a time.

3. In a few years the present state of things would recur, and the question of providing permanent plant would have to be faced, with this serious disadvantage, that there would be no proved reef underfoot, as now, to rely upon as the warranty for future expenditure.

The present pumping machinery is distributed between Hart's shaft and the main shaft. At the main shaft the Cornish plant (two 24-inch columns with three sets of 24-

inch plungers), of 3,500,000 gallons capacity, raises from the 718-feet level the water delivered to it by two 24-inch hydraulic pumps at the 818-feet. At Hart's shaft the water is raised to the 600-feet level by a Cornish plant (of 1,000,000 gallons capacity), and then transferred to the main shaft, 718-feet level, whence it is pumped as mentioned above. The pair of Riedler pumps (each 500,000 gallons capacity) are used as auxiliaries during stoppages. All these plants, as the general manager points out in his last half-yearly report, are dependent on one another in such a way that if any stoppage happens to one of them the output of ore is immediately affected.

The water at present being raised each 24 hours amounts to something less than 3,000,000 gallons. Any new scheme for equipping the mine with a permanent pumping plant for continuous work, regardless of water, and on a scale commensurate with the requirements of the mine as a dividend-paying concern, must provide for a pumping capacity of from 6,000,000 to 8,000.000 gallons per day. Discussion of the particular description of plant, and of its motive-power, is not within the scope of this report.

Costs.

The yearly crushings of quartz for the last few years have been—

In 1898	26,370	tons
1899	23,350	„
1900	22,340	„
1901	24,930	„
1902	36,609	„

and the last half-year's mining, battery, and general charges have been £2 8*s*. 1*d*. per ton of quartz, equal to £3 10*s*. 5*d*. per ounce of gold.

Mr. Heathcote's estimate, that the gross cost will be reduced to £1 17*s*. 10*d*. per ton of quartz when the mine is properly equipped, appears to me to be based upon reliable factors. The last half-year's costs, as ascertained from the books at the mine, appear in comparison with it, as follows:—

	Half-year ending 31 Dec., 1902, on 18,893 tons quartz.				Mr. Heathcote's estimate of cost on 62,400 tons per annum.			
	£	*s*.	*d*.		£	*s*.	*d*.	
Mining.....	1	17	6	per ton	1	8	3	per ton
Reduction Works ...	0	8	3½	„	0	7	4	„
Head Office and Management	0	2	3½	„	0	1	7	„
Total.....	£2	8	1	„	£1	17	10	„

As the value of the quartz taken out from between the 718 and 818 feet levels has been (at 13·68 dwts. gold per

ton) £3 6*s.* 3*d.* per ton, the profit per ton of quartz and ounce of gold is readily seen. A further reduction of 3*s.* 5*d.* per ton is estimated as possible when the output reaches 90,000 tons per annum, which, as said above, is expected to be the product of each 100-feet level.

I have gone through the description of the mine, and all the estimates of production and cost given in the General Manager's special report, and have carefully compared them in detail at the mine with the data upon which they are founded. I can endorse them as being substantially and reasonably accurate.

Summed up, the position is this, that between the 818-feet and 1000-feet levels there is every reason to believe that 180,000 tons of quartz exist, which, provided the mine is properly equipped with pumps, can be profitably extracted, and will give three years' work for the battery (of 105 heads).

The crosscut at the 1100-feet has not reached the reef yet, so that the only data for anticipations of the yield from greater depths are the past returns from the mine, and the appearance of the reef at the 1000-feet. If the reef descends with the regularity which it has always observed so far, many years' working may be predicted as the outlook for the future.

From my examination of the mine, I arrive at the conclusion that it can only be worked to advantage when it is equipped with appliances for raising the quantity of water indicated in this report. It has been shown to me that for this purpose the directors have invited competitive designs from large manufacturers of pumps and machinery in Europe, America, and Australia; and I understand that tenders for plant, based upon the full requirements of the mine, are now due at the office of the company's London agents. In order that the best engineering advice may be secured, the designs submitted will, I am told, be referred to the most eminent professional authority available in London, and that the final order is only to be given after the guidance of such opinion has been obtained. I am of opinion that this is a highly judicious and effective safeguard.

I have the honour to be,
Sir,
Your obedient Servant,
W. H. TWELVETREES,
Government Geologist.

W. H. WALLACE, *Esq.*,
Secretary for Mines, Hobart.

JOHN VAIL,
GOVERNMENT PRINTER, TASMANIA.