REPORT ON BELL HILL TIN, WELDBOROUGH

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The object of this report is to advise or suggest to the leasees:-

1. The most economic method to adopt for the further development and productive running of the tin bearing lodes on the property.
2. Methods of treatment, type of crushing and concentrating machinery considered to be most suitable for the separation of the tin oxide from the stone.

Previous reports of recent date have been furnished on this property by officers of the Mines Department. The latest of these is by Mr. A. McIntosh Reid, Director of Mines, dated 27th November, 1925.

Since that time no further developmental work has been carried out on the lodes so that the mine, as far as the latter are concerned, is in the same position as then.

Under the heading "Estimate of Value" Mr. Reid in his report, refers to the fact that having only two days alloted to the work of examination of the property, no attempt could be made to sample the ore exposed in the various workings, so that an estimate of its value could not be made.

Ore Extraction

In a mining property of this description where a number of parallel lodes occur which have been to some extent developed by tunnel workings and a rise to the surface on one of them, the obvious procedure would be to make the fullest use of these openings.

The tunnel has been driven south-westerly, obliquely across the lodes a distance of 550 feet, at the intersection of No. 3 lode a rise connects with the surface, the distance through being 200 feet. This appears to be the only connection by a rise to the surface.

In all, four lodes were intersected in the tunnel in addition to a number of veins three to eighteen inches wide.

The lodes are of good stoping width, averaging 5 feet across the smallest being 3 feet and the widest 8 feet. In the further development of this mine with a view to obtaining regular ore supplies for milling, it would be advisable at the outset to connect tunnel with surface by rising on Nos.1,2, and 4 lodes - a rise has been put up from the latter at end of tunnel but its extension is unknown - by this means large quantities of lode material could be obtained by surface working on the various lode and vein outcrops, trucked to the rises for delivery to tunnel level, thence transported to milling plant. During the period occupied in working ore available by surface openings, developmental operations could with advantage be carried on at the tunnel level by driving on the various lodes, rising, and generally undertaking all preparatory work in readiness for stoping above present tunnel level.

While such operations are in progress, systematic sampling of the ore developed should be made and detailed records tabulated, in order that when the ore is blocked out a fairly accurate estimate of the quantity and value may be computed.

In the process of mining ore of this character which invariably carried erratic values in tin it is very necessary to have as many working faces as possible in order to maintain milling supplies at an average grade. Some portions of the lode may carry insufficient tin to be payable - which should be rejected as milling stone - although under certain conditions it is necessary in the ordinary course of mining operations to remove it, to render payable parts of the lode available. Per contra sections of the lodes may carry very rich stone: it is just as essential to be in a position to reduce the output from a rich portion of the mine as to reject unpayable stone. An average grade of stone for milling purposes should not be arranged by reducing the tin content in adding stone that would not pay to crush by itself.

Mr. Reid's report refers to the presence of copper pyrites in the ore in association with the tin oxide. It is very improbable that the stone at or near to the surface will carry sufficient quantity to interfere with milling operations without special appliances to deal with it.

In carrying out the development work as suggested, information respecting the quantity of this mineral will be gained and if found that it is likely to be a deterrent in making a marketable product of tin ore in the ordinary process of concentration, consideration can be given for dealing with it by the introduction of special methods.

1. Oil flotation
2. Calcination

Mr. Reid in his report mentions that while copper pyrites is promising tin ore is present in small quantities. This is important from a milling point of view and suggests that those parts of the lodes contaminated with copper pyrites may be avoided, entirely or discarded if necessary for removal for economic mining reasons.

Connection by rises from tunnel level to the surface will serve the dual purpose of providing ventilation and as passes for ore mined at the surface as well as for mullock for filling depleted stopes.

Mining Methods

The system to be adopted for mining the ore from the tunnel workings will be a great extent depend upon the distribution of tin in the stone. If it is found on development that fair sized blocks of ground of good average payable grade can be made available the rill system of stoping could with advantage be instituted.

The various lodes being steeply inclined with the added advantage of the one being fairly hard, cost of handling will be comparatively cheap. Good material in the shape of easy working granite at the surface is available for filling ground as it is worked out. A minimum quantity of timber will be necessary for mining purposes. These advantages in addition being able to exploit the lodes to considerable depths below the surface by tunnel workings give an added value to the mine.

Ore treatment

The ore of this mine where disassociated with pyrites is very favourable for milling. Separation of the tin oxide from the crushed ore can be effected by the use of the simplest forms of concentration.

In the order of importance the first question to be decided is the degree of fineness to which the ore should be crushed to obtain the best results in the way of percentage recovery of tin. In some of the lodes the tin oxide occurs more or less irregularly distributed through the stone in form of comparatively large sized crystals whilst in others it is present in vein like form comprised of very fine particles of oxide. In the same lode it is not uncommon to find both fine and coarse particles of tin.

The obvious procedure when designing a scheme for treatment of the stone would be to recover as high a percentage as possible of the tin with due regard to the avoidance of sliming, thus minimising loss in tailings. With that objective it is recommended that coarse crushing with the use of jigs for the separation of the tin be adopted. Coarse crushing implies reducing the stone to a size that will detach the greater quantity of the coarse particles of tin from it.

The most suitable size of screen to use on the crushing machine will best be determined in actual milling work. Provision should then be made for fine grinding and the "seconds" product of the jigs, classification and concentration on reciprocating tables.

In any scheme of operations to treat the ore of a mine of this description, considering that the lodes and veins are so far as is known of comparatively high grade, it would be advisable to commence with a moderately small plant with provision to add to it if desired at any future time. The safest procedure would be to erect a pilot plant designed to treat 50 tons per day of 24 hrs. A few months trial run with a plant of that capacity would enable sufficient data to be gathered to decide the question as to whether additions or a second unit would be justified.

In the record of production referred to in Mr. Reid's Report (26 ; 11; 25) he states that a bulk sample of 100 tons of the surface stone represented in forkings from sluicing operations, treated in plant in an adjacent lease returned 1 ton 16 cwt. of tin ore equivalent to 1.8% recovery of oxide. Assuming that the stone on treatment returned 1% oxide, treating 50 tons daily would give an output of 10 cwt. daily or 3 tons weekly, which on the present market price for tin would realise an approximate net value - £500.

The estimated cost of treatment including ore breaking, mine development and milling including office charges, maintenance and depreciation should not exceed 15/- per ton. This would leave an estimated margin of profits equal to £275 weekly.

There is now a wide choice of crushing machinery to choose from; Gravity Stamp batteries for large capacity plants are practically obsolete. On a small mine where the initial capital outlay is to some extent experimental, the matter of deciding on the type of plant will no doubt be governed by the question of cost.

There are many disused stamp batteries available at very low cost which would serve a useful purpose on crushing stone at this mine. There is also the question of transport to be considered that is if a stamp battery could be secured in the district, the cost of erection of plant would be reduced.

An improved type of Chilian Mill for ore crushing has recently come into favour. The mills can be set to reduce the stone to any desired size, following a preliminary crushing in a rock breaker.

Particulars as to capacity, cost etc. can be obtained from Messrs. Anderson & Co. Engineers, Richmond, Victoria. For the various units of plant the following are recommended:-

(1) Gyratory or jaw crusher rock breaker with a capacity 7 tons per hour to reduce stone from 6 in. dia to pass through 1½ ring.

(2) 10 Head Stamp battery (1000 Stamps) or alternately Chilian Mill with a capacity to reduce rock of 1½ inches dia. to 6 mesh or finer at the rate of 3 tons per hour.

(3) One 5 ft. dia. Forward and Down Grinding Pan.

(4) Plunger jigs of capacity to deal with quantity of stone proposed to crush per hour.

(5) Classifiers

(6) Curvilineer Concentrating Tables (4)

Power

For the most available form of power a crude oil burning engine of Diesel type is recommended. One of 50 B.H.P. would be capable of working plant as above described.

If it is found that the presence of pyrites in the ore is adversely effecting the quality of the tin concentrates recovered provision should be made for further dressing treatment either by oil flotation or calcination and re-concentration of the calcines. The cost of a flotation unit capable of dealing with 30 cwt. of concentrates daily is approximately £150 for a calcining plant of similar capacity the cost would be at a minimum £1000.

If the concentrate can be successfully treated by flotation no further dressing of the tin is necessary. In the case of calcination re-grinding and re-concentration of the calcines must be carried out with an unavoidable loss of tin.

In making the above recommendations as to plant it is understood that the lessees are satisfied they have a sufficient quantity of payable grade ore to justify the expenditure in plant. From a brief inspection of the lode outcrops and of the fact that they have been explored to some extent by tunnel workings with satisfactory results the impression gained by the writer is that the property if equipped with an efficient plant and economical management shows every prospect of developing to a well payable lode mining venture.

Milling Plant Site

The most suitable position for treatment plant is in the valley of the Britannia Creek which slopes directly from the hill in which the lodes are situated. The ore from the existing tunnel or from any lower levels that may subsequently be opened up could be conveyed to the plant by self-acting ground tramway. In selecting a site at a low level at a convenient position in respect to the mine would have an added advantage with regard to water supply for dressing purposes.

Water Supply

From general observations and information obtained the quantity available would be quite sufficient for dressing purposes in the mill.

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Hobart.

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