

INTRODUCTION

The Razorback Tin Mine is located on the north-eastern flank of Mt. Razorback along and east of a low south-east trending spur of that mountain. Immediately to the east of the mine area lies the Dundas Flat. The outcrop of the lode occupies mainly the crest of the ridge, has been traced for 2,600 feet and rises from the level of the flat to an elevation of 400 feet above the flat at the northern end. The Dundas Rivulet flows in a south-west direction at the southern end of the spur and two south-east flowing creeks along either side of the spur join the main rivulet. The area is mainly covered by second-growth scrub on the crest and along the north-east side of the spur. On the south-west side the growth is primary forest.

The property consists of two 20 acre leases Nos. 2M/40 and 3M/40 on the northern portion of the outcrop and a 5 acre lease No. 45M/39 on the southern end all charted in the name of W.J. Hodge. In addition, a further area of 20 acres (No. 38M/50, W.J. Hodge applicant) has been applied for between 3M/40 and 45M/39. The positions of these leases are shown on the accompanying plan.

The site of the old mill is located on the bank of the Dundas Rivulet on the southern end of the spur. The buildings have been burnt and the mill abandoned. The present mill is located below the open-cut near the centre of the eastern boundary of lease No. 3M/40. This mill is distant approximately nine miles from Zeehan, the nearest town, and is reached by travelling along the Zeehan - Maestri's road to a point half a mile past the site of the old Dundas Railway Station. The last half mile from this road up to the mill is along a rough track negotiable only by four-wheel drive vehicles.

A wooden tramway was constructed to connect the opencut workings with the old mill and was subsequently extended to the northern workings. The total length is about 3000 feet. The rails have since been removed and the formation only remains. A water race over a mile in length was constructed to bring water from the Dundas Rivulet to the old mill. This race is now in bad repair much overgrown, and several flumes have collapsed. A considerable amount of work would be necessary to put it into working order.

The field work on which this report is based was carried out during the latter part of September, 1951. During that period, the whole of the accessible workings were surveyed by theodolite and tape, the traverses being tied on to four of the lease pegs. Sixteen samples were taken for assay which was carried out by the Mines Department Laboratory in Launceston. On the accompanying plan, the workings have been located by survey and are in correct position. The streams, water race, tram and access track have been sketched in from a previous plan and may not necessarily be in correct positions. Form lines have been sketched in from spot heights calculated from survey. The south-east corner peg of lease No. 3M/40 was taken as datum and an assumed R. L. of 800 feet assigned to this point.

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HISTORY OF THE MINE.

The early history of the mine from its discovery in 1909 up till 1924 has been briefly outlined by A.M.Reid in G.S.Bulletin No.36 pages 49 - 50 and also a description of the work performed on lease No.3756/M (Now 2M/40) by Peter Hodge up to the same date. The subsequent history of the mine has been rather chequered and difficult to trace. Various parties have from time to time worked portions of the area mainly in the northern section but no spectacular results have been recorded. A.M.Reid records that the production from 1909 to 1924 was 13 tons 2 cwt of tin concentrate of average content 68 per cent metallic tin valued at £1546. The records of production since that time have not been available to the present writer but the figure is believed to be low. The present party under the leadership of W. J. Hodge of Zeehan has been mining underground in the main workings for the past two years and have produced tons of tin concentrate of average content per cent metallic tin. A small mill has been erected at the mouth of No.2 tunnel. The ore is put through a ball mill after being hand picked, passed through a simple classifier and thence over a curvilinear table the fines passing over strakes. Water for milling operations is obtained from a dam erected in No.2 tunnel. The efficiency of the mill is not high and the lessee intends to improve the system shortly.

MINING DEVELOPMENT.

A surprising amount of exploratory work has been carried out along the lode and consists of tunnelling, trenching, rising and opencutting. In all ten tunnels of varying length have been driven and eighteen trenches cut. Of the tunnels, all are accessible except No.5 which is blocked at the entrance. No.7 was driven many years ago before tin was discovered in the area. It could not be found during the course of the present survey and is not shown on the accompanying plan. Reid records, however, (p.43) that in 1924 this tunnel was blocked 70 feet from the entrance. Many of the trenches are quite small and shallow and can only be found in the scrub with difficulty. It is likely that some were not discovered during the present survey. An old plan of the Razorback area, of uncertain date and origin, shows two opencuts close together. It is apparent that, since this plan was drawn, the two opencuts have been merged into one as only one now appears.

GENERAL GEOLOGY.

The geological structure of the area is simple. On the eastern side of the lode, the country rock is green serpentine which extends across the Dundas Flat almost to Maestri's Mill. The serpentine is typical of that developed at many places on the West Coast and has been sufficiently described in previous reports.

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One feature more or less peculiar to the Dundas Flat is the fact that here the original pyroxenite has been completely converted to serpentine. Elsewhere, notably at the Argent Tunnel, Spero River, Asbestos Point and the X River kernels of unaltered pyroxenite occur scattered through the serpentine. The serpentine, being an easily eroded rock has been worn down by mechanical processes to a local base level of erosion and has thus formed the Dundas Flat.

The country rock to the west of the lode is slate of the Dundas Series of Cambrian age. The slates are dark grey to brown and are extremely compact. They appear to form the main mass of Mt. Razorback. On the northern lease (2M/40) some grit bands occur in the slates.

The contact between the slates and the serpentine is fairly obviously faulted. At numerous places slickensides occur and the general strike of the slate does not agree with that of the contact. Elsewhere in the district the serpentine-slate contact is a normal one and it is considered that, in the present instance, the amount of movement on the fault has not been great.

THE LODGE SYSTEM.

The fault contact between the slate and serpentine has provided a line of weakness along which mineral bearing solutions have percolated. The source of the solutions cannot be indicated with complete certainty. However, igneous rocks of acidic composition are known to occur to the north of the Razorback area at Pine Hill. This latter hill consists of a knot of quartz porphyry from which two narrow dykes of the same material extend northwest to Renison Bell and south-east towards Ringville. The presence of this quartz porphyry indicates the presence of granitic rock at no great distance below the present land surface. Indeed the porphyry may be regarded as an apophysis of a larger granitic mass below. It is, therefore, logical to postulate that other dykes of acidic composition exist below the surface in and around the Dundas area and that these dykes have carried mineralising solutions which have penetrated along lines of weakness in the adjacent rocks to form lodes.

The association of tin with serpentine at the Razorback Mine is admittedly an unusual one and has been the subject of much speculation in the past. In the present writer's opinion, the association is quite accidental. The mineralising solutions have been derived in a perfectly normal manner from an acidic magma and have been emplaced, again in a normal manner, along a line of weakness - a fault. The fact that one wall of the fault happens to be serpentine is purely coincidental and the serpentine has merely become the host rock of the ore.

The lode is of the fissure-replacement type. In the northern portion of the area, the lode occupies mainly the contact zone, towards the south it appears to be wholly confined to the serpentine but still paralleling the contact. However, outcrops in this

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section are poor and it is possible that the lode material occurs along the contact for the whole of its exposed length.

The slates being a dense, compact mass, provide a fairly clear footwall to the lode. The serpentine, on the other hand, is cut about by numerous slipping planes produced during the increase in bulk of material consequent on the serpentinisation of the original pyroxenite. Each of these slip planes has provided a channel along which solutions have penetrated. The serpentine has, therefore, been impregnated and altered by mineralising solutions and no true hanging wall can be determined in any of the workings. In the northern face of the opencut, the western fifteen feet is mostly gossaneous while the eastern twenty-five feet consists of talcose material. There is no sharp line of division and the whole of the exposed face is mineralised. It appears that alteration and impregnation of the serpentine has proceeded to a distance of up to one hundred feet from the hanging wall.

Apart from the impregnation of the serpentine by mineralised solutions, three distinct alteration products of serpentine occur - dolomite, talc and silicified serpentine. The dolomite is best developed in No. 2 tunnel where it is met at a distance of 90 feet from the portal and occurs over a length of 40 feet. It is a massive grey-white rock with vague brownish patches up to half an inch in diameter distributed throughout. These probably represent patches of material where the magnesium is partly replaced by iron and manganese and thus grade to ankerite. The rock is extremely dense and compact. It is looked upon with disfavour by the miners as it is most difficult to drill and does not shatter easily. Dolomite may also be observed in the east wall of the opencut, in the main workings and in No. 3 tunnel. It does not appear to occur elsewhere on the property. The dolomite appears to undergo a further alteration as, in the first crosscut of the main workings and on the extreme eastern wall of the open cut a softer material apparently derived from the dolomite occurs. In the alteration product, the original structure of the dolomite is visible but the material has become a soft friable yellowish rock rather resembling gossan but with a distinctly gritty feel. No opinion is offered as to the process by which this alteration occurred.

Talc is typically developed adjacent to the true lode filling in almost all the workings. It is a distinctly yellow-brown product, quite compact but readily broken out with the pick. In all exposures, the talc is seen to preserve the original structure of the serpentine and is thus completely pseudomorphous after serpentine. The talc has obviously a relatively high iron content and is considered unlikely to be of commercial value.

In the southern section of the lode between No. 6 tunnel and the old mill, much of the serpentine on the western fall of the spur appears to be silicified.

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Indeed, in some places, it has been converted to massive quartzite. This feature does not appear in the northern section of the lode. The silicification is not regarded as of economic importance.

MINERALOGY OF THE LODGE.

The tin, in the form of cassiterite, occurs in association with the sulphides, marcasite, pyrrhotite and arsenopyrite, the gangue being mangano-siderite associated with some quartz. Two distinct zones occur, viz. the sulphide zone and the oxidised or gossan zone.

The sulphide zone can only be inspected in three places :-

- (a) in the bed of the Dundas Rivulet below the old mill,
- (b) at the end of No.2 tunnel, and
- (c) various places in the main workings which appear to be located at the junction of the two zones.

Of these exposures, that in No.2 tunnel is the best occurrence. The true lode zone here is about twelve feet in width and consists of massive steel-grey marcasite probably trending towards lollingite. Previous work has shown that arsenopyrite occurs. This mineral was not definitely noted during the present survey but it is likely that some of the lollingite contains some arsenopyrite as these two minerals are closely related. No true pyrite was noted in this area. Cassiterite could not be determined in the hand specimens but assay has shown that it is present. Eastwards, the massive sulphides are succeeded by talc which appears similar to that seen in the workings at higher levels. The talc is succeeded eastwards by the massive dolomite described above.

The oxidised zone can be observed in all the remaining tunnels and surface trenches. The material is typical ferro-manganese gossan and, although cassiterite cannot be observed, assays indicate its presence. It is probably finely disseminated through the gossan. As mentioned above, the hanging wall of the gossan is extremely vague and often cannot be determined at all. The gossan merely grades into the adjacent talc. The talc has been impregnated by mineralising solutions but, whereas in the true gossan the cassiterite is finely disseminated, in the talc zone the solutions have been localised along slipping planes in the original serpentine. Thus, whereas the greater part of the talc is barren of cassiterite, there occur numerous vughs which may be richly mineralised. These vughs vary from a few inches to many feet in diameter. They are usually highly irregular in outline and consist of a relatively hard limonitic skin which is filled with loose gossaneous material usually containing cassiterite. Some are barren, however, and there appear to be no criteria at present for determining in advance whether cassiterite will be present or not. The cassiterite is usually a pale colour sometimes with a ruby tinge. Black tin is not often encountered.

The decomposition product of the dolomite appears also to be impregnated with cassiterite to a

certain extent. Sample 11 taken in this material shows 0.1 per cent of metallic tin. No vughs were noted and it is assumed that the cassiterite is finely disseminated.

Some galena is occasionally associated with the cassiterite. At the northern end of the main workings a lense of fairly pure galena was noted. Also, galena is sometimes noted on the table over which goes material derived from the talc portion of the lode. This occurrence of galena is of interest only. It is not considered likely that "makes" of galena of commercial importance will be encountered.

SAMPLING

Owing to the different occurrence of cassiterite in the true lode and in the talc, its erratic distribution in the talc zone, and to the vagueness of definition of the mineralised area, the sampling of the lode present a difficult problem. Channel samples were taken along the walls of the tunnels and, where possible, a distinction was made between gossaneous and talcose material. In some places the line of division was so vague that the division into two samples was more or less arbitrary. This applies particularly in the cases of samples 1 and 2, 3 and 4, and 12 and 13. The clearest division was obtained in the case of samples 7 and 8. In the case of the two northern tunnels, no distinction at all could be made as talcose material appears to continue right to the hanging wall. In these cases one sample only of each tunnel was taken.

As the investigation was intended to be a reconnaissance only, an extensive sampling programme was not instituted. For more detailed assessment it would be necessary to sample all the surface trenches as well. This was not considered necessary at the present time. Only one sample was taken from the sulphide zone, at the end of No. 2 tunnel.

Results of assays are shown in the table below.

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NO.	LOCATION	WIDTH	MATERIAL	PER CENT SN.
1.	No.6 Tunnel	60 ft.	Talc	Under 0.1
2.	No.6 Tunnel	20 ft.	Gossan	Under 0.1
3.	No.4 Tunnel	60 ft.	Talc	Under 0.1
4.	No.4 Tunnel	90 ft.	Gossan	Under 0.1
5.	No.3 Tunnel	76 ft.	Talc	Under 0.1
6.	No.8 Tunnel	50 ft.	Talc	Under 0.1
7.	Opencut	15 ft.	Gossan	0.9
8.	Opencut	25 ft.	Talc	0.7
9.	Main Workings Main Drive	70 ft.	Talc and Gossan	0.5

NO.	LOCATION	WIDTH	MATERIAL	PER CENT SN.
10.	Main Workings First X cut	40 ft.	Talc	0.7
11.	Main Workings First X cut	50 ft.	Decomp. Dolomite	0.1
12.	No. 1 Tunnel	130 ft.	Talc	0.1
13.	No. 1 Tunnel	15 ft.	Gossan	0.1
14.	Brock's Tunnel	110 ft.	Talc	0.4
15.	Hodge's Tunnel	60 ft.	Talc	0.3
16.	No. 2 Tunnel	40 ft.		

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ORE RESERVES.

Two divisions must be made - oxidised ore and sulphide ore.

(1) Oxidised ore. The reconnaissance sampling indicates that the lode material to the south of the opencut is of very low grade. Six assays in this area have all shown less than 0.1 per cent metallic tin. Between the opencut and Hodge's Tunnel the assays show an average tin content of 0.3 per cent. This is a marginal value but one which may be worth while. This section is 600 feet long and has an average elevation of 120 feet above the floor of the opencut. Assuming that a width of 60 feet covers the mineralised zone, there is a block of 160,000 cu. yds. of material of average tin content 0.3 per cent. On the basis of a specific gravity of 2.5 this represents 320,000 tons of material containing 960 tons of metallic tin. All this material could be opencut.

This is the only section of the oxidised zone which can be regarded as an ore reserve. The section south of the opencut is too low in tin content to be considered.

(2) Sulphide ore. With only two widely spaced exposures, no estimate of ore reserves of this material can be made. One point of difference between the two types of ore must be pointed out and that is that the sulphide zone can be expected to be fairly clearly defined and will be of the order of ten to fifteen feet in width. The single assay of 0.48 per cent metallic tin must be taken as an indication of value only and can in no way be considered representative. The sulphide zone could not be worked satisfactorily by opencut and normal underground mining methods would have to be employed.

FURTHER EXTENSIONS OF THE LODGE.

The present investigation has been confined to the portion of the lode system which has been exposed by workings. At the southern end, the lode appears to face out a little south of the Dundas Rivulet. The northern limit has, however, not been observed as the lode appears to be maintaining its width and value at Hodge's Tunnel. Pyritic tin ore is known to occur at the Grand Prize section on the southern flank of the Carbine Hill Range about a mile north west of Hodge's Tunnel and similar ore is said to occur on the northern flank of the range where it was cut during the putting in of the North east Dundas Tram. The latter exposure has not been examined by the present writer.

The two localities mentioned line in approximately with the Razorback lode and it is regarded as possible that they are all part of the one lode system. It is stressed, however, that this is a long range correlation and is offered as a suggestion only. A considerable amount of prospecting work would be necessary to test this theory as the country is very rugged and covered with primary forest.

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CONCLUSIONS

- (1) The razorback tin lode is of the fissure-replacement type occurring along and adjacent to a fault contact between slate and serpentine.
- (2) Cassiterite occurs as the only economic mineral sparsely disseminated in a gangue of manganese-siderite with a little quartz and associated with sulphides.
- (3) The mineralising solutions have been derived from an acidic magma located at no great distance below the present land surface.
- (4) In plan the lode consists of two parts:-
 - (a) A true fissure lode up to 15 feet in width.
 - (b) An impregnation of talcose and dolomitic material which have been formed as alteration products from serpentine by metasomatic processes associated with the formation of the lode itself.
- (5) In long section the lode again consists of two parts :-
 - (a) A sulphide zone of unknown depth, of width of the order of fifteen feet, reasonably clearly defined and succeeded to the east by a talc zone also probably mineralised.
 - (b) An oxidised zone of depth up to 120 feet with reasonably clearly defined foot wall but grading imperceptibly into mineralised talc and dolomite on the east.
- (6) Reconnaissance sampling has shown that the oxidised zone south of the opencut is of very low grade and no calculations of ore reserves for this portion are warranted.
- (7) Between the opencut and Hodge's Tunnel there occur approximately 320,000 tons of oxidised material of average content 0.3 per cent metallic tin: viz. 960 tons of tin.
- (8) Lack of exposures prevents any calculation of reserves of sulphide ore. The single assay of 0.48 per cent metallic tin is to be taken as indicative only.

RECOMMENDATIONS.

As a result of this reconnaissance investigation, the following suggestions for more detailed investigation are offered :-

- (1) Further testing of the oxidised zone south of the opencut by sampling all surface trenches.
- (2) A more detailed investigation of the section between the opencut and Hodge's Tunnel by a series of equal spaced trenches across the lode and subsequent sampling.

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- (3) The testing of the depth of the oxidised material in this section by means of diamond or churn drilling.
- (4) The tracing of the sulphide zone over the whole length of the lode by means of diamond drilling. The most convenient location for drilling would be along the old tram formation. Holes would need to be inclined at 45° on a bearing of about 210° and would be of the order of 300 - 400 feet in length.
- (5) The tracing of the lode northwards beyond Hodge's Tunnel.

(Sgd) B.L.Taylor, B.Sc(N.Z.)
A.M.A.I.M.M.
GEOLOGIST.

Zeehan.

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The Director of Mines,
HOBART.