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REPORT ON THE RENISON BELL TIN-FIELD.

Government Geologist's Office,  
Launceston, 18th December, 1906.

SIR,

I HAVE the honour to submit the report of a brief visit to the Renison Bell Tin Mine, in accordance with your instructions, on the 23rd to 27th of last month. The present report will not extend beyond a preliminary statement of the geological and mining problems met with at the northern or Renison Bell end of the Dundas tin-bearing belt, leaving a more extended report on the whole belt till a further visit to the district is made.

Deposits of tin ore occur in the North-East Dundas district, within a zone of country roughly estimated at about a mile in width, and coursing in a persistent line from N.W. to S.E. for about 3 miles in length.

Though some of the lodes strike north and south, or to the east of north, their bearing for the most part is north-westerly, which is the direction of the cleavage planes of the country rock.

This linear direction of the metalliferous belt must not be ignored. The lode occurrences have not been haphazard, but have been in obedience to some orderly physical process, which not only serves to indicate the directions in which prospecting may be carried on usefully, but also very strongly suggests that a good deal about the ore occurrences remains to be learned.

Acid eruptives being the true source of tin, the origin of the Dundas tin deposits may quite naturally be ascribed to neighbouring granite. Examination of the various lodes of this part of the West Coast leads irresistibly to the belief that underlying granite is responsible for much of the ore-deposition which has taken place. Most of the country rock at the northern end of the belt under review is slate or crystalline sandstone, or quartzite, the geological age of which has not been defined precisely, but it is nearly certain that it is Lower Silurian or Ordovician. Prof. T. S. Hall, of Melbourne, has identified some graptolites in slates from the North-East Dundas Railway, near the Ring River, and also at 12½ miles from Zeehan on the

same railway line, but he pronounced the discovery of no great value for determining the age of the containing rocks. We have, however, good reason to believe that the Dundas series of stratified rocks are older than those at Zeehan, which are known to belong to the Upper and Middle Silurian.

In various parts of the North-East Dundas district the sedimentaries are penetrated by basic eruptives, such as gabbro and serpentinitised olivine and pyroxene rock, *e.g.*, on the Penzance and Goldstraw's sections. With these basics may be connected concentrations of copper, lead, nickel, and iridosmine, as regards the former epigenetically, and the latter by a magmatic process, but tin-deposition evidently took place subsequently to their consolidation, and accompanied the intrusion of tourmaline quartz-porphry dykes. These dykes have pierced both the serpentinous rocks and the sedimentary strata, but tin has not been found, and is not likely to be found, in the former, for this metal appears all over the world to be associated genetically with only acid eruptives (granitic plutonics or their geological equivalents).

My attention during this visit was confined to the country immediately contiguous to the Renison Bell Mine, and I first endeavoured to learn all that could be ascertained about the occurrence of igneous rocks in the neighbourhood.

Isaacson's Creek is a small creek which rises in a vacant section north of 1215-m, C. Brumby, and flows for a mile north-easterly by the side of the Emu Bay railway line, eventually emptying into the Ring River. Mr. Gilham took me to this creek, the sand of which gave prospects of gold, tin, and iridosmine (osmiridium). I was informed that about  $\frac{1}{2}$ -dwt. or 1 dwt. of the latter mineral is present in each cwt. of tin ore from the creek. The chocolate-coloured slate on the banks of the creek shows a development of serpentine (sometimes slightly asbestiform) in the joint or cleavage planes, and it is highly probable that serpentine rock exists somewhere in the hill situate to the south-east. In the creek bed I also saw a greenish granitoid rock, the precise nature of which needs microscopical identification; but it was not fully exposed, and I could not say positively whether it is *in situ* or not. Search for granite should be made in the hill above this creek.

Lower down the Argent River, north-west of the Renison Bell, and also on the line of McKimmie's tramway

towards the Tasmanian Smelting Company's lease, serpentine is also reported to be present. From the latter direction Mr. Gilham brought to me some stones of granitoid rock found by him in prospecting. All this shows that the northern end of the metalliferous line connected with the eruptive rocks has not yet been seen.

At 140 feet from the south-west angle of the Renison Bell Section 2536, Porphyry Creek crosses the boundary line. Its bed is quartz-porphyry, containing scattered needles of tourmaline, a little iron pyrites, and fluor stains. The apparent direction of this quartz-porphyry dyke is north-westerly, consequently parallel to the general trend of the lode-belt. Going south-easterly a similar rock outcrops on the boundary line between Section 165-93m and Section 1963-m, 1000 feet above the railway line, intrusive into slate. The distances between the exposures are so great that I could not satisfy myself whether this is the same dyke or not. Tourmaline quartz-porphyry and tourmalinized slates are intimately associated with tin ore deposits in other parts of the district, and consequently it is not surprising that the tin lodes on the Renison Bell ground should be accompanied by this intrusion. It would appear that the dyke forms an intrusion extending along the western side of the tin-bearing belt all through that ground. At the same time, it is not the only occurrence of quartz-porphyry in the district. I noticed a small quartz-porphyry dyke 3 feet wide in the centre of a 50-foot pyritic formation in the south-east angle of Section 1342-m, 75 acres, in the name of J. Craze, which was discovered a few weeks ago. The formation with the dyke has a bearing N. 35° W. Further south on the Penzance and Goldstraw's sections there is a good deal of quartz tourmaline porphyry, and there can be little doubt that its intrusion all through was an integral part of the process which introduced the tin into this area.

A further indication of the granitic source of the tin present in this district is in the well-known vein of axinite in the Cornwall (New Dalcouth) and Commonwealth sections. The question whether this vein has faulted the lode there or has been the channel of mineralisation is of interest, and even of some importance, to the owners. Different views exist, but in the short time at my disposal I was unable to arrive at any definite opinion in the matter. It seemed to me, however, that the direction in which the ore-body should be developed is along the line of lode, notwithstanding that the bearing of the axinite

vein corresponds more with the general trend of the other lode outcrops in this belt. I could not, however, investigate the whole of the data bearing on this point.

I have been informed that as far as can be ascertained fully 200 tons of tin ore have been sent out from the North-East Dundas district during the last fifteen years from alluvial and detrital deposits. In some parts of the field much of the ore has been found as large nuggets, 7 lbs. to 14 lbs. in weight; sometimes boulders of pure tin ore a hundredweight each have been met with in sluicing, and one large boulder weighing nearly a ton of ore is in the Tasmanian Museum, Hobart. These boulders indicate the existence of rich tin veins up to a couple of feet or more in width.

The tin is invariably in the form of oxide (cassiterite), but apart from that found in connection with quartz-porphry, it is in the majority of instances associated with sulphidic gangues (pyrite, arsenopyrite, or pyrrhotite). It is this that has probably mainly contributed to the stagnation of lode-mining in this field. The treatment of ore stuff from which pure oxide of tin, as on the East Coast, can be easily removed is so simple and inexpensive that the separation of tin stone from these contaminating sulphides has been a bogey which has frightened adventurers.

The exact metallurgical treatment cannot be settled off-hand, but there is no inherent difficulty about it (comparable, say, with the zinciferous sulphides of Mt. Read, &c.). Mr. J. D. Millen of the Mt. Bischoff Smelting Works states that he has made several experiments on the sulphide ore at the Renison Bell, and is satisfied with the result.

Mr. Donald Clark, in his "Australian Mining and Metallurgy" (p. 224), seems to think that the ore at the Cornwall Mine, which is mainly pyrrhotite with a little pyrite and arsenopyrite, could be roasted and concentrated for 15s. per ton. Mining costs would probably be between 8s. and 10s. per ton; development 4s. to 5s. Altogether, with tin at its present price, sulphidic ore of 1 per cent. quality might be expected to pay working expenses. If these properties are ever to be exploited seriously, it is manifest that the present is a highly favourable time.

I paid a visit to the Commonwealth section, now E. Flight, 271-m, 77 acres, where the tunnel has been driven into the Cornwall (New Dalcouth) property to the south. The tin-bearing pyrites in this tunnel appears to have a

trend east of north, while the axinite vein bears west of north.

The tin ore is scattered visibly in places through the pyrites. Outside the tunnel entrance (on the Commonwealth ground) is a rich face of lode-matter composed of oxidised iron, quartz, tourmaline, arsenical pyrites, pyrite with visible crystalline tin ore. Lower down an open drive was begun by optionees, apparently with a view of opening up the lode at a lower level; but work here was abandoned by them for some reason or other.

I visited the exposure of the large lode on the creek on the Commonwealth, consisting of pyrrhotite, arsenopyrite, pyrite, with some copper pyrites. Mr. Montgomery's samples from this outcrop assayed 2.1 per cent. of tin and 3 dwts. 6 grs. gold per ton. The ore is evidently mixed with arsenopyrite in considerable quantity. Very careful selection is necessary here to determine any payable zones of metal. On this section (Flight's) an alluvial or surface formation is being sluiced very successfully in the central and north-western part of the property.

On the same line further north-west is a section, 1215-m, 36 acres, in the name of C. Brumby (formerly North Renison Bell), near the southern boundary of which Evenden's tribute party is sluicing a rich tin-bearing formation, apparently consisting of disintegrated quartz and sandstone. The limits of this have not yet been exposed, and it is consequently too early to say what the deposit really is. Since my visit I have heard that a still richer discovery has been made.

#### *Renison Bell Tin Mine.*

The Renison Bell Tin Mine is the chief mine at the northern end of the belt, and is at present being worked by optionees, who are producing ore by sluicing operations, and are driving underground to intersect the large pyrrhotite lode a hundred feet below its exposure in the railway cutting. For this work they have made use of the adit which was driven from the Argent River, 200 feet along what is known as the No. 1 lode. This lode is cut through by the Argent River, which exposed on its south bank a face of gossanous and soft pyritic lode-matter, from which bulk samples were taken from time to time, returning from  $7\frac{1}{2}$  to 10 per cent. tin. Since my visit in 1900 this face, which was then about 20 feet wide, has been cut down and the material removed, reducing the width of lode to 6 or 8 feet, and showing that the outcrop at this point pro-

bably partook of the nature of a bonanza. The bearing of the lode is S. 60° E., and its dip at a high angle to the north-east. A drive has been put in in footwall country south-east for 200 feet, and crosscuts driven through the lode at 100 and 200 feet. The first crosscut intersected the lode about 9 feet wide of siliceous and pyritic nature, but poor for tin. The second crosscut at 60 feet in cut a pyritic band, succeeded by about 30 feet of carbonate of iron and dolomite, and finally passed through another band of pyrites 9 feet wide at the end of the crosscut. The level has been resumed on the east side of the lode for 120 feet, short crosscuts west being extended into the lode at 60 and 120 feet. The first crosscut or cuddy passes through the pyritic band into flat layers of dolomite. The tin contents of the lode here are stated to be 1.01 per cent. In the next crosscut about 8 feet of pyrites are exposed. A crosscut is now being driven north-easterly to intersect the parallel pyritic (pyrrhotite) lode shown in the railway cutting. This crosscut is now 100 feet vertically below that lode, but will have to be extended to cut it on its underlay.

The No. 1 lode is shown at surface at the west end of the railway cutting, with a width of 10 feet about 150 feet further west than its occurrence underground. This would indicate that its mean underlay above the level of the drive is about 35°. In the drive, however, it is much steeper. Taking into consideration the low grade of this lode, where it has been tested underground and at surface, combined with its good return at the Argent River face, it seems likely that its richest horizon is below the river level. It will have to be proved in depth by means of a shaft sunk on the hillside above the river.

The lode, however, which invites the first attention is the Big Blow Lode, which is probably the same as the pyritic (pyrrhotite) lode shown in the Emu Bay railway cutting. This identification is not absolutely certain, as from the distance between the two outcrops (1000 feet) some doubt may very well exist. As the Big Blow outcrop is fully 250 feet above the pyritic lode exposure, its underlay would seem to carry it at railway level to the east of the railway cutting altogether. But the Blow outcrop is so huge and irregular that it is uncertain what is the true lode strike, and this uncertainty will not be removed until more work is done.

The outcrop is a quartzo-ferro-manganese mass projecting 28 to 30 feet vertical from the hill-slope, and bearing

at its northern end nearly due north, but bending round south-westerly at its southern end. The slates forming the footwall of the gossan dip to the east. The outcrop forms a mass of oxidised lodestuff which extends along the hillside, not without some interruption, for upwards of 5 chains. At the southern end it forms a continuous wall for 167 feet in length, from 21 to 30 feet in width at the top, and decreasing to from 6 to 9 feet in width at tunnel level, and this is the block of ore-bearing material which the company relies upon as an available asset.

A tunnel has been driven below the outcrop at the south end for about 200 feet into the hill, showing the underlay of the ore-body to be flat, and indicating a change of the gossan to pyrite and pyrrhotite. I have no doubt that the oxidised matter will be replaced by these sulphides in depth. The crosscuts and rises from this tunnel have fairly well established that the ore-body descends to this level, and facilitate the formation of an idea as to what approximately may be expected to be won from this large block of material. I measured the Big Blow outcrop, and confirmed in a general way the measurements upon which the company's published estimates are based. The published samplings of this block show an average content of a little over 4 per cent. metallic tin, but this is a subject which is outside the province of my report. I was shown the bore-holes in the lode from which the various samplings had been taken, and I formed the opinion that the sampling had been carried out in a systematic and efficient manner. The crosscut from the main drive where a connection has been made with surface at the southern end of the outcrop in question (viz., at 150 feet in), shows pyritic lodestuff descending in unimpaired strength, and the assay value of the lode at this depth is stated as 2.75 per cent.

The flat layers of lode-matter connected with the Blow cause some doubt as to whether the main deposit may not prove to be in the shape of a floor following the stratification of the country. The horizontal banding of the lode material might be taken to imply this, and if this theory were correct the working of the deposit might prove awkward. It would mean that the extensions and undulations of the bedding planes would have to be followed indefinitely. I am rather disposed to look upon the horizontal layers as lines of bedding which are made visible by a replacement process taking place within a more steeply inclined channel of ore deposition afforded by the planes of cleavage. On this theory future work under-

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ground would consist in following the ore channel down to any depth to which it might lead.

A short tunnel a few yards to the east of the main tunnel shows disturbed country and pyritic lodestuff (a good deal of pyrrhotite). The position of this is not easy to connect directly with the Blow, and the lode being unoxidised it has been thought to be an independent occurrence. This, however, is not likely. The difference in character is probably due to the predominance of pyrrhotite, which oxidises very slowly.

As a general rule in this district, it is probable that where the lodes consist mainly of pyrrhotite the outcrop will be sulphidic, while the large outcrops of ferro-manganese indicate that the preponderating pyrites in the vein below is the bi-sulphide.

The distribution of the tin, both in the gossan and sulphide, appears to be sporadic, and variable within short distances. No general law of distribution has been discovered so far, consequently any forecast of the behaviour of the lode in depth would be founded on precarious data. Tin, however, being a metal of deep-seated origin, will certainly be found in the lode channel in sinking to a considerable depth from the present surface, which has a purely fortuitous connection with the tin ore in the upper part of the lode. There is therefore every inducement after turning the metal of the large outcrop into cash to prove the lode in depth.

The hill spur descends from the Big Blow to the railway cutting, and the form and direction of this spur lend great probability to the view that the same lode is exposed in the cutting as the pyritic lode. This is there cut through obliquely for 46 feet, which would be equivalent to a true width of about 40 feet.

The ore channel is steep and well defined, evidently parallel with the planes of cleavage and at nearly right angles with the flat bedding planes.

About 6½ chains south-east of the lode in the railway cutting is No. 6 lode, which has been trenched across its outcrop for about 1½ chain, and driven across underground for an oblique width of 26 feet. Its true width seems to be about 14 feet, and bearing, as far as can be judged, S. 70° W. It cannot be very far east of the Big Blow lode, and on my former visit I surmised that it might be identical with it; but I am now inclined to think that the two are distinct, and that this crosses the line of railway below the embankment. A useful piece of work would be

to put in a deep exploratory crosscut into the spur from this side, which would intersect all lodes coursing down the hill. It is a rather solid pyritic lode, with a considerable admixture of quartz, but not rich in tin at this level. Its dip is south-easterly, and it is conformable with the foliation planes of the country. It forms the slope as it were of the camp gully, and hence is easy of attack. Near the end of the drive some further pyritic veins have been passed through, and in the face flat replacement veins of pyrites occur which evidently mark bedding planes.

What is called the "White Lode," or a zone of white sandstone and conglomerate, has been intersected by the railway cutting for a width of some 48 feet. The same zone is prolonged 6 chains further south, where an underlay shaft and some trenches have been excavated in it. In sinking the shaft 25 feet, quartzite was followed by white conglomerate, and the latter by pug. Mr. Briggs informed me that he obtained prospects as much as 2 lbs. to the dish. A couple of chains from this a hole was put down from a trench passing through 15 feet of grit and quartzite, 3 feet of loose rubbly quartzite into soft yellow clay in which a 6-inch vein gave a rich assay. In the railway cutting the lode called the "Cross Lode" is believed to have junctioned with this one. This is a little problematical, but at any rate there is a wide belt of fissured country there which has been a channel for the ascent of stanniferous vapours or solutions, and which has contributed a good deal to the detrital formations which are being sluiced below the line.

The mineral solutions in this zone have doubtless ascended vertically, but the horizontal bedding planes give the replacement deposits their structural features. On the whole, this "White Lode" deposit is low grade, but it should be explored for locally enriched portions.

*Western Lode.*

A large ferro-manganese gossan outcrop crosses the boundary line between Sections 2606 and 166 in a north-westerly direction on the fall to Porphyry Creek. Its observed length is between 500 and 600 feet, and its surface width from 20 to 30 feet. On Section 2606 a short drive has been put into it for 25 feet, and 20 feet below the hard craggy outcrop. As is often the case below these outcrops, the ferruginous matter is much softer underground. Quartz veins or patches occur in it. The

enclosing strata, clay slate, lie rather flat. To test the lode at some distance down, a winze might be sunk following one wall, and adit crosscuts may be driven from the east fall of the hill to a considerable depth. There is nothing in this occurrence inviting urgent attention, but the probability is that the iron gossan outcrops so common in this district cover pyritic lodes, and the sulphides, as we know in numerous cases, are often accompanied by tin ore.

In the southern part of Section 2534 above the Big Blow trenching has disclosed several iron gossan formations, about which little or nothing is known, but any one of which may cap payable lodes.

These numerous formations on the Bell property give large scope for prospecting work.

The alluvial or detritus deposit now being worked with profitable results forms a belt of detrital tin-bearing material covering the hill-slope for a width of about 200 feet, and extending down the hill to the Argent River on the one hand, and up the hill for about 400 feet from the railway cutting on the other. The deposit seems to be about 3 feet deep. I am informed that the average depth of the test bore-holes was 39 inches, and that the assay yield was equivalent to 13 lbs. per cubic yard. I was shown the test-holes which had been put down, and noted that they corresponded with those shown upon the mine plan. The productive work in progress is, I am given to understand, generally confirming the published estimates. The deposit in question is not a bed of waterworn stones, but consists almost entirely of angular detritus, and in a large measure seems to be the waste of lodes disintegrated *in situ*, the soft country rock being amenable to the pick. The process of deposit is simply the wasting away of the lode formations, and consequent liberation of the ore which remains *in situ* for sluicing.

Taking the alluvial and the Blow outcrop into consideration, it is obvious that the owners of this property have a quantity of ore in sight, or easily accessible, waiting to be handled. Any quantity beyond this can only be disclosed by developing the lodes. The outcrop and the work on the Big Lode at tunnel level lead one to expect that the ore body will continue remunerative to a greater depth, and certainly warrant expenditure in opening up and exploring the lode. At present nothing is known throughout the entire Dundas district as to how these lodes, which within that area have a pronounced family likeness

in common, will behave in depth, and the pioneer work of testing the question seems likely to devolve on the Renison Bell owners, who may be considered as possessing a valuable property, and of considerable potentialities in its undeveloped lodes.

*Lewers' Section.*

The North-East Dundas tin-bearing belt continues north-westerly from the Renison Bell into the adjoining section, R. D. Lewers, 37 acres, 4550-93m. The lodes continue as three large ferro-manganese outcrops within a few chains of each other, traversing the entire section and emerging from it at its northern boundary.

On the northern fall of the hill a wide outcrop of one of these lodes has recently been discovered by Mr. Gilham. It has a favourable appearance, as these outcrops go, consisting of the usual iron gossan with a little pyrites and a considerable quantity of quartz, some of it chalcidonic. I believe it is not tin-bearing so far, but a little tin has been found by assay in other outcrops of these lodes, and possibly tin in payable quantity will be eventually found somewhere on this property. The easiest way of testing some of these lodes would be by the diamond-drill, but unless the bores were very close together the results would be inconclusive, for we may anticipate that the ore concentrations will prove extremely irregular. As said above, there is reason to suppose that the gossan will be replaced by pyritic veins in depth, and having regard to the nature of this metalliferous belt I see no reason for doubting that some of them will be tin-bearing.

In concluding this report of my brief visit to the northern end of the Dundas tin district, signs and evidence support the view that the whole district is one of undeveloped wealth. The quantity of alluvial and detrital tin which has been produced, and which is increasing every week, shows that the tin-bearing formations are more numerous and better than hitherto supposed. The present price of the metal is acting as a stimulus to the efforts of working parties to sluice wherever possible. This must inevitably lead to attention being paid to the lodes. It is true that the lode cappings are in many cases, but not always, poor or barren, but it is not likely that that will be the last word on the subject. The scratchings and chippings upon which discouraging estimates have been based will have to be followed by more venturesome work in the shape of testing the lodes at a reasonable depth on

the quite reasonable ground that tin is an ascending metal. The pyritic lode-stuff will, of course, necessitate treatment to which our tin-mine owners have been unaccustomed, and in some cases the accessory minerals (arsenides, &c.) may prevent the ore from being easily amenable to profitable metallurgical treatment; but these instances are exceptional, and do not affect the prospects of the field as a whole. A very promising feature in much of the so-called alluvial of the district is that it is really the waste of lode capping *in situ*, and consequently that the fresh discoveries of alluvial which are now being made every month mean so many additional lode formations brought to light. With the present favourable market conditions, it would be a pity to let the time go by without making a serious attempt to test some of the lodes at deep levels.

I have the honour to be,

Sir,

Your obedient Servant,

W. H. TWELVETREES,

Government Geologist.

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