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EXTRACT FROM THE ASSISTANT GOVERNMENT GEOLOGIST'S REPORT ON THE TIN ORE DEPOSITS OF MT. HEEMSKIRK.

September 5, 1902.

The Federation Mine.

Sections 3689, 3688, 3919, and 4143—93m; total area, 256 acres; charted in the name of J. S. Munro. This mine is situated about two miles south-west of the peak of Mt. Agnew. The sections comprise most of the land held by two old companies, namely, the Cumberland and the West Cumberland. Both of these companies owned batteries in the old days, and on the ground held by the former the well-known Cumberland Dam was constructed, which affords a good supply of water all the year round at a high elevation. This is now reserved from leasing, and the water is available to any company requiring it.

More genuine mining work was done on the Cumberland and West Cumberland mines than on any others in the Heemskirk field. Both mines produced a considerable amount of tin, but it is difficult now to obtain reliable information. The sections were held for a number of years after the Heemskirk boom, but eventually the West Cumberland became forfeited, and this was taken up by Messrs. Fowler and Dunne. This party worked the mine successfully for some time, supplementing the five-head battery of the old company by ten additional head, which they purchased from the Montagu Company. This plant was worked by steam, a most expensive method in this district where firewood is scarce, and although the stone was rich, averaging 6 per cent. of tin ore, I understand there was not a large amount of profit left after paying expenses. When the shoot of ore was worked out the mine was put into a larger company, which, unfortunately, spent nearly the whole of the available capital in the re-erection of the battery, and in bringing in a race from the Cumberland Dam. It appears to have crushed some stone, but no provision had been made for a continuous supply, and it eventually closed down. The sections were again abandoned,

and finally they were taken up by the present owners. The latter have worked the mine with some success, but the whole arrangements for mining, handling, and milling the stone are inadequate, and it has become evident that more capital is required to put the mine on a firm basis.

Plate 2 gives a topographical sketch-map of the mine. The country is all granite, much of it being rather fine-grained, and composed principally of quartz and white felspar, with very little mica. Quartz-tourmaline nodules are very abundant in much of this rock. There are numbers of large quartz-tourmaline reefs running through the sections. Most of these strike a little E. of N., but there are several notable exceptions to this rule. Some of these reefs consist largely of white quartz, with small veins of tourmaline running with them; others consist of a mixture of quartz and tourmaline. The tourmaline is of two varieties, the common black, or iron tourmaline, and the green alkali tourmaline. As in other parts of the field, the green tourmaline appears to be the most favourable for tin. Tin is contained in the reefs, both in the form of a central seam of rich ore, and also distributed in small grains through the stone. It is not an invariable constituent, but appears to occur in shoots, some of these being of considerable length.

The Western Workings.—These are mostly the workings of the old West Cumberland Company. They are now connected with the battery by a self-acting tramway, erected by the present owners of the property. Most of the tin obtained by the old company was won from a mass of ore between the 530-feet level and the 450-feet level. This ore was taken out in a large chamber, which has since been filled up, and could not be examined. It was situated below and a little to the south of the open cut, at the 450-feet level. It was an open chamber when Messrs. Fowler and Dunne took up the property, and Mr. Fowler informs me that the tin had cut out, both in the roof and floor. By an accidental fall of earth, however, a second mass was discovered above the one which had been worked out, and it was from this that Messrs. Fowler and Dunne obtained their tin. In working out their second mass of ore, the open cut, at the 450-feet level, shown on their plan, was made. There is not a great deal to be seen at present to indicate the presence of the ore-body, the only indications being a number of small veins showing in the face of the cutting. The stone is described as having been composed of an iron-stained decomposed rock, containing a good deal of brown iron oxide; when this was absent, the stone was always

poor. Quite lately a seam of similar stone, about 6 feet in width, has been exposed on the western side of the open cut. This contains a good deal of brown oxide of iron and some black tourmaline. A dish of dirt taken by Mr. Yates for a width of 4 feet yielded 3 ozs. of tin ore, equivalent to about 1 per cent. I believe that this soft stone results from the decomposition of granite, the felspar of which has been partially converted into pinitoid by the solutions which deposited the tin. As regards the tin contents of the stone, Mr. Fowler tells me that his party saved an average of 6 per cent. of tin ore from the whole of the stone treated. The facts of the case are therefore as follows:—Two considerable masses of rich tinstone have been mined at this place. Both of these were practically self-contained, being only connected with each other by small veins of quartz-tourmaline and pinitoid. With the exception of the drive at the 450-feet level, nothing has been done to ascertain whether other masses of stone exist on the same line of lode. It is not unreasonable to suppose that, just as the upper mass of tinstone was separated from the one below it by a blank space, so the latter may be separated from others below or alongside it by similar spaces of barren rock. It is not an uncommon phenomenon in connection with tin lodes for the good stone to occur in considerable masses, tapering out to nothing in every direction, only to come in again just as strong a little further on, or a little deeper. There can be no doubt that the masses which have been worked were highly payable, and it is certainly worth while further exploring the line of lode in which they occur.

The only other development of importance in these western workings is a lode which has been discovered in and above the 500-feet level. The latter has been driven along a quartz-vein of somewhat unfavourable appearance, but at about 100 feet from the entrance good stone was met with. I believe this is another lode, striking nearly E. and W., and cutting the ore that was driven on at an angle of about 30°. The level at this point is connected with the surface by a shaft which was sunk on the lode. A short intermediate level has been driven, and a little stoping has been done by a party of tributors, who mined 330 tons of stone. This parcel yielded 5½ tons of concentrates, carrying from 63 to 69 per cent. of metallic tin. The stone near the surface was free-milling, and the concentrates were sold to the Bischoff Smelting Works in Launceston; but in the lower stopes a little pyrites is present in the stone, and here tin could not be dressed clean. The product could not be

treated at Launceston, and it was thought for the time that it was worthless. So the tributors abandoned their claim. It was not till some months afterwards that a market was found for the product in New South Wales, where the parcel was sold at a remunerative price to Messrs. Kelly and Co. The parcel contained 63·5 per cent. of tin, and the price obtained was equivalent to £54 12*s.* 6*d.* per ton. Beyond a little pyrites, there was nothing of a refractory nature in the ore. This lode is 6 feet wide in the stopes, just above the 500-feet level. The length of the shoot is at present unknown, but there is evidently a considerable body of payable stone ready for stoping.

The 570-feet level was driven below the 500-feet level on the same quartz-tourmaline vein. One small shoot of ore was met with on which some stoping has been done, but, on the whole, the lode is of the same unfavourable appearance as in the upper level. The productive lode on which the stoping was done in the upper level has not been cut at this level.

The 450-feet level was driven from the open cut. Nothing definite appears to have been followed, but several makes of quartz rock were cut. One vein contained a little bismuth ore, and a little stoping is said to have been done. In the end of the tunnel a large oxidised tourmaline lode was cut, striking about 50° W. of N. This carries a little bismuth oxide, but is poor in tin. The tourmaline is the black variety, which, I think, is unfavourable.

To the north-west of these workings there is a very strong reef, striking 22° N. of E., on which a prospecting shaft has been sunk 30 feet in depth. A trench put across the lode at this point has exposed a wide tin-bearing formation, which looks promising. The stone from the shaft also carries tin. This is all low-grade ore, but under favourable conditions might well be payable. Four hundred feet to the N.N.E. a trench has been put across another reef, striking a little E. of N., in which some really good stone is exposed. The tourmaline here is of the green variety, and the whole formation is of a favourable appearance. A tunnel driven from the creek-level, along this lode, would effectually prospect it, and might be continued, to cut the other lode a little to the east of the shaft. The contact of the two lodes is a likely place for discovering a good shoot of ore.

The Central Workings.—The most important developments which have taken place since the mine came into the hands of its present owners are in this portion of the pro-

perty. As will be seen by reference to the plan, there is here a very large outcrop of quartz-tourmaline stone. It appears to have been produced by the junction of several reefs. The very wide part at the north end is much disturbed, and is evidently not in its original position. There are probably several bands here, which have fallen over, and to some extent slid downhill. As the granite surrounding them is quite decomposed, this is not an unlikely thing to happen. Several small trenches have been made at the north end of this blow, exposing a very favourable quartz-tourmaline rock, in which tin ore is visible in almost every piece that is broken. The tourmaline is of the favourable green variety, and is evenly distributed with tin ore through the stone. There appears to be a very large quantity of this class of stone here; it is low-grade, but should be payable if worked economically. To the west of these trenches the 85-feet level tunnel has been driven. This passes through decomposed lode-matter for 40 feet, when the south wall was reached. This was then driven on N. and S. for some distance. The tunnel was continued, and cut another band of hard quartz rock. For the first 15 feet the stone in this tunnel yields a fair prospect of tin, but towards the south wall it becomes poor. The 115-feet level, below this, is not driven far enough to cut the lode. The stone is showing 6 feet above the tunnel, but this has evidently slid downhill, and its continuation is to be sought further in. To the south-west of this tunnel is a small open cut, which exposes the north-eastern portion of the formation. I took a sample from the western wall of this cutting, representing a bulk of 9 feet 6 inches, measured across the lode, which yielded 1 per cent. metallic tin; 150 feet to the south-west of this open cut another (larger) cutting, known as the Black Face, has been made. The formation here is composed of soft, black, partly-decomposed lode-stuff, with bands of hard quartz-tourmaline stone running through it. I took a bulk sample across 12 feet of the soft lode-matter, at this point, which yielded 2¼ per cent. metallic tin. Another sample from the hard bands, totalling 5 feet 8 inches in thickness, yielded 0·35 per cent. This gives an average of 1·64 per cent. metallic tin for a width of 17 feet 8 inches. From this face 720 tons of stone have been treated in the mill, yielding 12 tons 18 cwts. 22 lbs. of concentrates, and containing from 58·7 to 69·4 per cent. metallic tin. This is equivalent to about 1 per cent. of metallic tin in the crude stone. The result is lower than that obtained by my sampling, in part due, no doubt, to loss in concentration,

which was heavy. I believe that, with more efficient machinery, this loss could be to a great extent avoided. I may mention that the tailings from the battery are now being re-treated at a profit by a tributor. On the north side of the Black Face there is a considerable body of ironstone, which carries good tin. Samples which have been assayed yielded from 2 to 3 per cent. metallic tin. One hundred feet S.W. again, what is now known as Munro's Shaft has been sunk on the formation for a depth of about 25 feet, and from the bottom of this a crosscut has been driven to the eastern wall, a distance of 16 feet. There were no means of getting down this shaft at the time of my visit, so I could not examine it. The ladders have, however, been put in since, and Mr. Yates informs me that he found the whole of the stone to be tin-bearing, though it is low-grade. He estimates it to carry an average of 1 per cent. of tin. About 80 feet south of Munro's Shaft an underlay shaft has been put down, which, however, is under water, and has not been examined by the present owners of the mine. Mr. G. Thureau, former Government Geologist, reporting on the mine in 1881, states that from the bottom of this shaft a crosscut was driven, and proved the lode to be 14 feet wide. Of this 2 to 3 feet is described as being rich, and the remainder probably remunerative when operated upon in large quantities. The stone from this shaft was crushed by the old company. This formation also appears to have been cut in the long tunnel from the low ground to the E. This tunnel is now blocked up by a fall of earth, a little over 600 feet from the entrance. At about this point, according to Mr. Thureau's report of 1884, a quartz reef of unfavourable character was cut. The tunnel was continued for 300 or 400 feet further, and here a more promising lode was intersected, containing rich bunches and pipes of tin ore; this lode was only driven on for 90 feet. The stone was treated in the battery, but I have been unable to ascertain the results obtained. At the mouth of the tunnel there are several heaps of what appears to be discarded lode-matter. It is very silicious, and contains a little tourmaline and fluorspar. A bulk sample taken by me from the whole of the stone in these heaps yielded 0·25 per cent. of metallic tin; while a bulk sample from a large quantity of hard stone from the heaps taken by Mr. Yates yielded 1·05 per cent. metallic tin. I think there is little doubt that this formation is the continuation of one of the reefs which junction near the Black Face. There are 280 feet of backs

above the long tunnel. The lode must have been cut 300 feet to the south-west of the Black Face, and 550 feet south-west of the northern portion of the outcrop. For this distance, therefore, the lode has been proved to be tin-bearing. The successful treatment of the deposit depends, I believe, on the treatment of the low-grade ore. I think we have reason to believe that there are, in this portion of the mine, very large bodies of stone, which will average about 1 per cent. of metallic tin. A good deal of it, no doubt, will go higher than this; but to work the mine economically it will not be possible to take only the richer ore. The low-grade material must be treated, for it will be by following up and mining the latter that the rich shoots will be discovered. As will be shown later, the mine is exceptionally favourably situated for economically handling the stone.

The Eastern Workings.—These are not at the present time an important part of the mine. A prospecting shaft has been sunk on a formation which appears to be a good deal broken up, but which carries some nice tin in places. There is green tourmaline in the stone, which may be regarded as a favourable feature. A few chains to the south-east of this shaft a green tourmaline formation is exposed on the track, from the rubble of which good prospects of grey tin are obtainable. This portion of the mine deserves further prospecting.

The present arrangements for the handling and treating of the crude stone are not satisfactory, and, in my opinion, will require to be completely reorganised before the mine can be put on a satisfactory basis. Before this is attempted, however, the mine should be opened up, so that definite information with regard to the quality and quantity of the stone available may be obtained. Only then will it be possible to decide upon the best surface arrangements, and the class of machinery which will be best adapted to the treatment of the ore. The long tunnel should be opened out, and the lode driven on to the N., and underground communication established between this drive and the workings on the hill. Intermediate levels should then be driven N. and S., and the whole formation thoroughly explored. The question will have to be considered whether it will be advisable to work the mine from the present long tunnel, or from a lower adit from the north side of the hill. The latter would be about 800 feet in length, and would gain about 150 feet more backs. From either of these tunnels a well-graded tramway could be made, connecting with a self-acting tram running to the mill. The present horse-

tram and self-acting tram are only temporary structures, and will require re-erection in any case. The mill also is badly designed, and will require rearrangement and additional concentrating appliances.

A splendid permanent supply of water, sufficient both for power and dressing, is available from the Cumberland Dam. The present race comes in 450 feet above the battery-site. The capacity of the dam might be increased many times at a very moderate cost, by increasing the height of the dam, so that, practically speaking, the water-power is unlimited, and could be used for winding, hoisting, powder-drills, &c., as required. To the north-west of the mine there is a fine belt of timber, 500 acres of which have been declared a timber reserve by the Government, and reserved from leasing. A short tramway could be made into this belt, and the requirement of the mine in the matter of mine timber and fuel cheaply supplied.

It will thus be seen that the facilities for working the mine economically are very exceptional. The mine can be worked for a long time by adits, thus avoiding the cost of sinking and pumping, and the latter, in this granite-country, will never be excessive. Mine-timber can be obtained cheaply, and ample water for treating the ore and supplying power to the mine and battery is available. The large masses of tin-bearing stone which have already been explored near the surface, and which have proved to be tin-bearing for a distance of over 500 feet, lead us to suppose that we have to deal with a very large formation indeed; and although we cannot expect the whole of this to be payable, there are indications that a considerable portion of it will be, provided the work is laid out, so that the stone can be mined and treated in an economical manner. In the western workings two considerable bodies of good tin-bearing stone have already been mined, and it is reasonable to suppose that others await development on the same line of lode. There is at least one known shoot of payable ore in another lode in these workings, which is now ready for stoping. Besides these, there are several other lodes on the property on which a little work has been done, and in some cases with most encouraging results.

I think, therefore, that the property is well worth a fair trial, and that it has every reasonable prospect of becoming a valuable mine.

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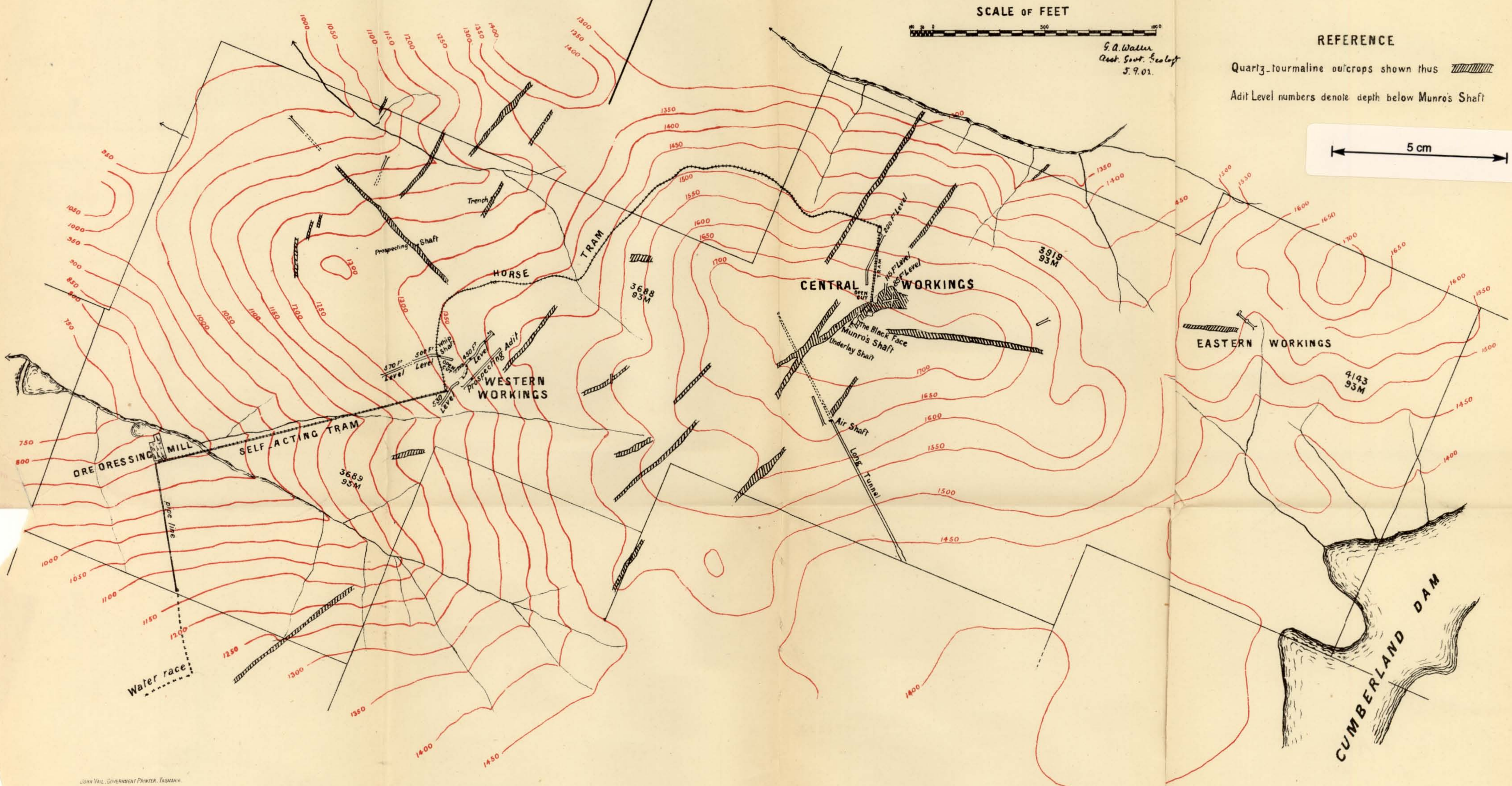
PLATE 2

SKETCH PLAN OF FEDERATION TIN MINE


SCALE OF FEET
500
1000
REFERENCE
Quartz-tourmaline outcrops shown thus
Adit Level numbers denote depth below Munro's Shaft
Prospecting Shaft
Trench
HORSE
TRAM
570 Ft Level
500 Ft Level
Whip Shaft
450 Ft Level
Prospecting Adit
530 Level
WESTERN WORKINGS
SELF-ACTING TRAM
ORE DRESSING MILL
Pipe line
Water race
3688 93M
3689 93M
CENTRAL WORKINGS
Black Face
Munro's Shaft
Underlay Shaft
Air Shaft
Long Tunnel
3919 93M
EASTERN WORKINGS
4143 93M
CUMBERLAND DAM

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