REPORT ON THE BLUE TIER TIN FIELD.

Geological Surveyor's Office, Launceston, 5th November, 1889.

SIR,

IN accordance with your letter of the 12th October, 1889, I have visited the Blue Tier District and examined the tin deposits there, and I have now the honor to report thereon.

The district has been reported upon previously by Mr. G. Thureau, F.G.S., and I have pleasure in saying that my observations confirm his report and judgment of the field in almost every particular. Since his Report was written so little work has been done on the field that it is practically in the same state as when he saw it. Much of my Report must therefore be only a repetition of what Mr. Thureau has already said.

The following properties were examined by me on this occasion:—Lottah, Ethel, Anchor, Full Moon, Full Moon Extended, M'Gough's, W. L. Crowther's, Blue Tier, Giant, and Wellington. These are all situated towards the eastern end of the Blue Tier range, which is here about 2500 feet above sea level. The Lottah, Ethel, and Anchor properties lie on the southern slope of the range, on the head waters of the Ransom River, and the slopes to Crystal Creek and the Groom River. This side of the range falls rapidly to the Groom River, and in this respect presents a great contrast to the other side of the range, where the ground falls very slowly to the Wyniford River. As a consequence of this configuration of the ground, the holdings lying on the northern slope of the mountain are difficult to work to any depth by means of adits, and will probably have to be worked from shafts.

The general country rock of the district is a grey granite, composed of quartz, black mica, and white or pinkish felspar. Large crystals of felspar are common throughout it. This granite would make beautiful ornamental stones if cut and polished. It appears to resist the action of the atmosphere very well, as the large boulders commonly occurring show only a superficial honeycombing from the removal of felspar and mica, without being altered to any depth. In some of the cuttings alongside the roads, however, the granite was seen decomposed *in situ* to a considerable depth, showing that parts of it are easily attacked by surface waters.

Tin ore is found throughout the district in three distinct modes of occurrence—(*a*) as alluvial tin ore, (*b*) in true lodes and veins, and (*c*) impregnated through dykes of a granite of different character from the grey country granite above mentioned.

(*a.*) *Alluvial Tin Ore.*—The Blue Tier District has for many years been a very rich alluvial field; but the best and most easily accessible portions are now worked out, and European miners are rapidly giving place to Chinese. With systematic conservation of water and hydraulic sluicing it is still, I believe, possible to obtain a rich harvest, but this I shall deal with later on. Much of the alluvial tin ore is but little worn, and some of it shows no signs of having been carried by water, being quite bright, and with sharp angles. The tin ore is found almost everywhere over the surface of the mountain in greater or less quantity, and in quite shallow ground, not, as a rule, more than from one to five feet in depth. In the valleys and along the course of the streams the deposits are perhaps deeper, and in the Anchor ground there is some pretty deep alluvial matter in the Groom River Valley, but, as a rule, I was struck with the evenness with which a shallow layer of tin-bearing surface stuff was spread over the whole of the ground, ridges as well as basins. I do not think that much of the ore has been spread in this way by the action of free-running water, as the appearance of the tinstone shows that much of it has never been rolled in the bed of a stream. It seems rather to have been derived from the gradual wearing away of the underlying country rock, under the solvent influences of water charged with carbonic and humic acids. The sharp angular grains of quartz found all over the country would also be accounted for in this way, being the insoluble portion of the granite. Wherever the underlying granite has been bared by sluicing it has been found to be traversed by numerous small veins of quartz, often carrying good tin ore. These veins, so far as I have seen, are not anywhere so numerous as to convert the rock into a stockwork; still they are common enough to account for a great deal of tin ore, and it is quite possible that stockworks may yet be found. There does not appear to be any evidence of the existence of enough large lodes in the district to have produced the surface tin ore. Much tin ore has also doubtless been set free from the stanniferous dykes to be mentioned later on, and many of the best finds of tin have been directly on these dykes, and resulting from their disintegration. It will be seen from these remarks that I do not consider the existence of large tin-bearing lodes to be at all necessary to explain the presence of the rich deposits of alluvial tin that have been found.

(*b.*) *Lodes.*—Besides the small tin-bearing veins which, as above mentioned, are very commonly found traversing the granite, there have been discovered in the Lottah, Full Moon, Ethel, and Wellington properties veins which, from their size, persistent strike, and mineral character, must be considered to be true fissure lodes. These have been developed in the Lottah mine more thoroughly than anywhere else in the district, and there can be no doubt as to their nature. The lodes in the Lottah show a very marked banded structure, sometimes as many as eight or ten separate bands being visible. Some of the bands are quartz, the others being granite more or less altered by the infiltration of the lode solutions. The quartz carries cassiterite (tinstone), but, as far as I could observe, not so much of it as is to be found in the dark altered granite immediately enclosing it. With the tinstone in the Lottah I observed a little wolfram, a little fluorspar and calcspar, a good deal of molybdenite, a very little copper pyrites, and a few specks of native bismuth. Felspar forms a considerable part of much of the veinstone. Green talc and altered mica (chlorite) are also common. A few vughs were observed in the quartz lined with the characteristic quartz crystals. Traces of combed structure in the quartz were also seen in a few places. In the lode in the Ethel ground there was much wolfram, bornite, and indigo copper ore along with the tin ore. I have no reason to doubt that the Lottah lodes will be permanent to any depth to which they may be worked. Very rich stones of tin ore have been obtained from this mine. The other mentioned lodes in the district have not had much done to them, but good tin ore has been obtained from all of them, giving encouragement to prospect them more thoroughly.

(*c.*) *Dykes.*—These are to my mind the most important occurrences of tin ore in the district, and on their economical treatment the future of the field will greatly depend. They are dykes of a granite of different nature from the country rock generally. The dyke granite varies so much in its mineral character that it is somewhat difficult to give it an appropriate name. In parts it is mainly composed of rounded and subangular grains of quartz, but occasionally felspar predominates, and in other places there is much mica. The name "Quartz Porphyry" is the one most applicable to the rock taken as a whole. Portions of it consisting mainly of quartz and mica with very little felspar might almost be called "Greisen," but as a rule the rock contains too much felspar to go by this name. Many of the differences in appearance shown by this dyke-stone are due to decomposition of the felspars and micas. This is best seen in the Anchor mine workings where the stone has been opened up to some depth. The lowest parts of the rock consist of quartz and felspar and mica, both the latter showing signs of alteration, and here and there impregnated through the stone may be seen specks of tin ore, molybdenite, and copper pyrites. At a higher level the felspar and mica are much more decomposed, and at the surface the rock consists of quartz imbedded in a clayey matrix, which is all that remains of the felspar and mica. I was not able to get any of the rock free enough from alteration to determine the exact species of the felspar. It is one that is evidently much more easily decomposed than the orthoclase of the country granite, and it may prove that a plagioclase felspar will be found at a greater depth, in which case the rock would be called a "Granitite." The commercial importance of this dyke-rock lies in its being more or less impregnated with tin ore throughout. Samples were crushed and washed from all parts of it during my examination of the district and there was always some tin ore in it, thought not always in payable quantities. In many places the porphyry was richly impregnated with tin ore, and a great deal of it should be payable. These porphyry dykes were found in all the properties examined, except the Lottah. The principal workings of the Full Moon and Anchor mines are on this description of rock.

Basalt Dykes.—In various parts of the district dykes of black basalt are encountered. In the Lottah and Wellington mines these are found to cut right through the lodes without faulting them to any extent; they are plainly of much later origin than the lodes, and could hardly have any connection with their formation or filling with minerals.

I shall now give a short account of my observations on each of the properties visited, with a few remarks on each.

Lottah.—This property comprises 384 acres, and is situated on the southern slope of the Blue Tier range, on the head waters of the Ransom River. The ground slopes steeply, and can therefore be readily worked by means of adits. The Ransom River affords a good supply of water for tin dressing, though not enough for water power. Unfortunately, the ground does not permit of the water being easily caught in a reservoir higher up, or there would probably be plenty of water for power, as during rains the creek rises very much. Parts of the surface of the ground have been worked for alluvial tin ore with very good results. The Breakneck Creek gully is said to have been very rich; this is close to the lodes that have been opened upon, and probably derived much ore from them. There are two parallel lodes on which mining operations have been carried on, known as No. 1 and No. 2 lodes. Three levels have been driven, the lowest, along the course of No. 1 lode, being 904 feet in length. The middle drive, also on No. 1 lode, is 158 feet above the lowest one. Two cross-drives have been put in from this to the eastern side to cut No. 2 lode, and about 60 feet has been driven on the course of No. 2 lode. The middle and lowest drives have been connected by means of an inclined winze, which has been continued above the middle drive to the surface; this winze is sunk on a cross-course which heaves the lodes at the lowest level. A

short intermediate level 70 feet in length has been opened out to the north of the winze between the middle and lowest levels. Besides these works a short surface drive has been put in on the course of No. 1 lode 89 feet above the middle level; this is now fallen in, and I could not therefore examine it. About four chains to the eastward from the mouth of the upper drive there is another old drive in about 70 feet on a small vein; this drive, known as Simson's, is at present inaccessible. The No. 2 lode has been trenched upon and bared for about four chains to the northward from the mouth of the upper drive—its bearing on the surface is 10° W. of N. (magnetic). In the underground workings the compass gave the bearings as from 15° to 17° W. of N. wherever I tried them on this lode; the dip varied from 65° to 75° in a westerly direction. The No. 1 lode is about parallel to No. 2, but stands more vertical, dipping about 80° westerly. On account of the difference in inclination, No. 2 lode passes through No. 1 in the lowest level. No. 1 lode is here small and rather disordered, and more work must be done at this level before it can be seen what is the effect of the meeting of the two lodes. At the surface and at No. 3 level the No. 2 lode is better defined than the No. 1, but in the No. 2 level the reverse is the case, the No. 1 lode there being the better defined; continual alterations of this sort are to be expected in lodes. The accompanying plan and section showing the underground workings in this mine will serve to elucidate the above description. The map also shows the cross-course on which the winze above mentioned is sunk and a basalt dyke which cuts through the lodes in the northern part of the workings at all three levels; this dyke has a slight underlay to the northward, and its course is easterly and westerly, varying somewhat in the three levels. Another basalt dyke is met with to the westward of the entrance to No. 3 adit; a drive has been put in for about 30 feet along its N.E. side; it is about 15 feet wide. The dyke met with in the mine is from one to two feet thick; a similar dyke is found in the Wellington mine.

The lodes in the Lottah mine consist of from about one to about four feet of tin-bearing stuff, consisting of a main vein of quartz from 4 to 8 inches thick and several parallel quartz veins from 1 to 2 inches thick, separated from the main vein and from one another by bands of altered granite of a dark gray colour; both quartz and granite contain tinstone, molybdenite, &c., and very good patches have been met with. It would be hard to find finer specimens of tin ore than have been taken from this mine. Lying outside the mouth of No. 2 adit there is a heap of about 40 tons of stone saved while putting in the drive. The manager of the mine informed me that a tributer had picked this heap all over and obtained twelve tons (*sic*) of black tin simply by "bruising" and washing the ore. Now that the Full Moon Company have erected crushing and dressing machinery it would be well worth while for the Lottah Company to arrange to have this heap and another one that is lying outside the entrance to No. 3 adit crushed, so that an estimate might be made of the value of the ore extracted from the adits. The heap lying at the mouth of No. 3 adit contains eight or nine tons and shows excellent ore. This mine is not at present working, but there seems to me no reason, as far as the prospects in the mine itself go, why working should not prove successful. The mine is now sufficiently opened up to begin stoping from both No. 2 and No. 3 levels, and a comparatively trifling expenditure would show what the lode is worth now that the dead work is done. I think that it well deserves a trial, and can recommend it as a legitimate and promising mining venture.

About 10 chains to the northward of the present workings, and higher up the hill, a large body of white quartz has been met with, carrying occasional crystals of tin ore. Along with the quartz there is a great development of felspar in large pieces. Some of the quartz showed impressions of what had been large bunches of mica, and also contained cavities with crystals of quartz in them. The stone has not been exposed enough to render its nature evident, and I cannot say in what direction the quartz is running or what is its dip. It looks like lode quartz, and may be part of a large lode, but it might be one of the segregations of quartz and felspar not uncommon in granite. As it contains some tin ore, it is worthy of further prospecting, which would soon prove if it were part of a lode. A somewhat similar mass of quartz is found in the Full Moon Company's ground.

Anchor Mine.—This property comprises 280 acres of ground extending from the township of Lottah down to and across the Groom River. A good deal of alluvial ground has been worked on it, and still alluvial tin is being obtained. At the time of my visit thirteen men were engaged on the ground, sluicing through ground-sluices. The whole of the surface being worked was payable, the black tin being obtained, according to Mr. Robinson, the manager, at a cost of about £20 a ton. Near the Groom River the ground was deeper and more difficult to work. The shallow ground was from one to three feet in depth, and when bared revealed a large mass of the quartz-porphyry previously described, throughout the whole of which tin ore could be seen freely disseminated. As water is plentiful, in the winter at least, and can be obtained at a high enough level to give good pressure, it would be cheaper to "hydraulic" the ground than to sluice it. I could see no reason why hydraulicing should not be resorted to. In the flat below the battery alongside the Groom River there ought to be very good alluvial tin. The ground has not been bottomed on account of water, and is too deep to sluice away. It is said that the washdirt obtained from holes sunk in this flat has always been good. This ground could be worked cheaply by means of Perry's Hydraulic Elevator, a simple contrivance much used in the alluvial mines of New Zealand. It would probably pay very well.

A great deal of money has been spent on this property in the erection of a large crushing and dressing plant, unfortunately of a cumbrous and unsuitable description. A very good tramway has

been laid to the battery, the trucks running on to a wooden staging behind the battery and into tipping frames from which the stone is tipped into large wooden hoppers. From the hoppers the stone is fed by hand into the coffers of a 40-stamp battery. The feeding arrangement is very bad, and an automatic ore-feeder ought to be put in, such as Hendy's Challenge Ore-feeder, for example. The battery is of the ordinary description, but is in a very dirty state. From the battery the crushed ore went to four Lewis' Separating Tubs. As these were not at work I could not judge of their efficiency, but according to report they were not a success. The stuff was next treated on eight 22-foot Lewis' buddles, but these have been altered so as to be no longer self-discharging. The buddles were in pairs one above another, which is a bad arrangement, as the lower one is not properly accessible while at work. Besides these buddles there were three hand-buddles, 16 Alve's concentrators with ½-inch square gratings, and a number of slime tables. The machinery did not give satisfaction, and has been altered by successive managers, and allowed to fall into bad repair till now it is in a deplorable condition. I doubt if any of the concentrating appliances are now of any use, and would recommend them to be all cleared out and well-proved types of machinery erected in their place. The whole of the machinery is driven by means of a 60-foot overshot water-wheel with 4ft. 6in. breast. This is a fine piece of work, but it is a great pity a cheaper and more modern type of motor was not erected in its place. The water-race bringing water to the wheel is a good piece of work and of sufficient size to supply far more water than is required, being 4 feet wide in the bottom. Reviewing the machinery, I may say that there is a good water-wheel, a good tramway and set of hoppers, a good water-race, a fair battery, and a fair battery-house, the rest being useless.

The stone crushed was obtained from four or five faces or open quarries in the quartz porphyry. During the two years the battery was at work it crushed 18,427 tons of rock, and obtained 154 tons of black tin, or ·835 per cent. Taking the black tin as being worth £54 a ton, the average value of each ton of rock milled is 9*s.* 2*d.* Under the circumstances of ease in getting the rock and good water power, this ought to yield a good profit on treatment. The newly opened quartz porphyry, laid bare by sluicing operations, is to all appearance better than that worked before. From the large quantity of tin-bearing rock in sight, I am convinced that, with good management, this is a most payable property; but the arrangements must be such that the rock can be quarried and run into the battery at the lowest possible figure, and the crushing and dressing plant must be large enough to deal with a very large amount of rock. With proper arrangements, I think that the mining and milling expenses ought not to exceed four shillings a ton at the outside This would allow of the treatment of rock of half the value of that already milled at a small profit. In making this calculation I have taken no account of the tin that was lost in the tailings from the old mill. Having seen the appliances that were in use, I am quite prepared to believe the local reports that there was heavy loss; but as no regular assays of the tailings appear to have been made, I cannot form any opinion as to the amount of it. With better machinery the stone crushed would doubtless have given a better average yield.

The quartz-porphyry in this ground must be of very considerable width, having been stripped for about five chains up the hill without reaching the northern edge of it. The southern side, at its junction with the granite, has an east and west bearing, but it is impossible at present to say if this is the true bearing of the porphyry dyke. The tin ore in the porphyry appears to be more abundant in the joints of the rock than elsewhere. Little veins traversing the rock show now and then very good ore. In Perry's face a small leader of quartz, carrying a little tin and some talc and mica, is seen, bearing 5° N. of W., and dipping 35° to the northward. On the general map of the district accompanying this report I have marked the quartz-porphyry formation wherever I have met with it.

Full Moon Mine.—This is at present the busiest mine in the district, there being twenty men at work on it at the time of my visit. It comprises 262 acres of ground, lying on the north-western slope of the range, on the head-waters of the Wyniford River. Very rich alluvial tin has been obtained from this ground, it having at one time been one of the most famous claims in the district. This property contains deposits of tin ore of all the three sorts described, and more or less work has been done on all three of them. The alluvial ground has been well worked, but very little has been done to the lodes or to the dyke formation as yet. Two shafts, one 120 feet in depth, the other 60 feet, have been sunk to test the lodes. From the 120-foot shaft I am informed that about 700 feet of driving has been done in one direction and another; but the workings are now full of water, and the plans are said to have gone astray, so that I could get no accurate information as to the underground work. The heaps of stuff drawn from the shafts showed that the vein stuff must have closely resembled that in the Lottah mine, consisting of quartz with dark granite casing, and carrying tinstone, molybdenite, fluorspar, and copper pyrites. Loose stones of basalt lying about the heaps show that a dyke, similar to that in the Lottah, must have been encountered underground. In the vicinity of the shafts are a great number of small leaders of quartz, bearing from 15° to 65° to the W. of N., and having on the average a N.E. and S.W. course. Many of these have proved very rich on the surface, and have been worked, where soft enough, by tributers working the alluvial ground. One of the best defined veins has nearly the same strike and dip as the No. 1 Lottah lode. The best alluvial deposits of tin ore were found over these little veins, and were, without doubt, derived from them. Though the alluvial ground has already been worked over more than once, I think it would be advisable, as a prospecting measure, to trench across the course of the veins in

several places, so as to obtain more accurate information about them, which might direct subsequent mining work. At the same time I think it is highly probable that this trenching would show patches of untouched alluvial ground that would pay for the work. At any rate, this work would give data to prove if it would pay to systematically sluice over again the whole of the alluvial ground. There is very good hope, in my opinion, that this would prove payable, the ground being washed in ground sluices, fed from shallow dams constructed at intervals up the flat valley in which the wash is found.

About four chains to the south west from the 120-foot shaft there is an old working in which a hard quartz porphyry rock has been struck, containing a vein of about six inches of hard white quartz. The work done is not sufficient to allow of an accurate measurement of the strike and dip of this vein, but it appears to run nearly north and south, and to stand nearly vertical. I saw no tin ore in the quartz, but numerous specks of native bismuth were visible. This vein being of the true lode nature, and larger than the majority of the others yet discovered, is worth further prospecting.

It is impossible for me to give an opinion as to the payable nature of the veins that have been worked upon, as I could not examine them. Excellent specimens have been obtained from them, both on surface and in depth, but I could obtain no really reliable information as to the quantity of payable ore available. According to local report the ore obtained from the underground workings was tampered with or stolen, so that doubt is thrown on the record of a crushing that was made. All I can say is that the surface show is sufficient to warrant the expenditure of some money in prospecting the veins more thoroughly.

As in the case of the Anchor mine, the future of the Full Moon depends very greatly on the successful treatment of tin-bearing quartz porphyry. There is a considerable quantity of this rock laid bare in the flat ground just below the battery. The general direction of the course of the quartz-porphyry dyke is N.E. and S.W. as far as I could ascertain, and its width is probably three or four chains. Owing to the ground not having been trenched or tested in any way, I could not get observations to establish either the course or the width of the formation with any accuracy. In the cutting for the tramway to the battery the bearing of the edge of the quartz porphyry where it joined the granite was found to be 65° W. of S., and it also showed an irregular dip to the southward, as much as 58° in one place, but vertical in another.

The rock has been pretty well prospected on surface by a long drainage trench, and by several pits and trenches. It is nearly everywhere tin-bearing, though care will have to be exercised in selecting the stone for crushing. To work economically it will be necessary to have a good many openings in the rock at work at the same time, so that payable ore may always be supplied to the battery. A careful record of the occurrences of good stone should be kept, in order that there may be data to discover if the impregnations of tin ore have any regularity that might lead to more economical working. At present I can see no sign of anything of the sort, the good stone and poor stone being scattered about among each other without any apparent reason or law. Very rich stone has been obrained from many parts of the formation, and with careful management I do not anticipate any difficulty in getting enough payable ore to keep the battery in constant work. The mill now in the possession of the Company is large enough to allow of thoroughly testing the ground, but in order to work to the best advantage it should be increased to five or six times its present capacity. The output from a small mill-treating low-grade ore may be too small to give a profit over expenses of mining, milling, and management, but when the amount of rock crushed is increased, and expenses per ton are reduced to a minimum by the use of labour-saving machinery, the same ore will frequently yield a profit.

The Full Moon Company have just finished the erection of a battery or mill of a type not yet common in this country, though in successful use elsewhere. It is a very neat and well arranged mill. The ore from the mine is drawn from below the battery by a short inclined tramway, which was not finished at the time of my visit, to a feeding floor, from which it is put into one of M. B. Dodge's (U.S.) "Giant" Rockbreakers, 10″ × 8″ aperture. Mr. S. W. Vale, of Messrs. Park & Lacy, of Sydney, who have supplied all the crushing and dressing machinery, informed me that this machine was reckoned to treat 50 tons of hard quartz in 24 hours, breaking it to 1½ inch gauge. It requires 4 horse power when working on hard quartz. Price £105 f.o.b. Sydney. This rockbreaker will in one shift crush enough stone to feed the Huntingdon mill for 24 hours. A large wooden hopper has therefore been placed beneath it to receive and store the crushed rock. From the hopper the stone is fed into the Huntingdon mill by means of an automatic "Challenge" Ore-feeder. This costs £45 complete, f.o.b., in Sydney. The Huntingdon "Centrifugal Roller Mill" is a machine now in common use in many parts of the United States, where it has given much satisfaction to those using it. It is recognised to be one of the most formidable rivals of the stamping battery, and is increasing in popular favour. The mill in question is five feet in diameter, and is capable of crushing from 20 to 25 tons of rock in 24 hours. The gratings are No. 8 diagonal slot gratings, equal to punched gratings of 140 holes per square inch. The mill costs £375, f.o.b., Sydney. The large ringdie can be removed when worn out and replaced with a new one, which costs £12 15*s.* in Sydney. The ringdies on the centrifugal rollers are of chilled steel, and cost £12 12*s.* per set. The crushed ore from the mill passes to the Frue vanners, of which there are three. These cost £140 in Sydney. A new style of Frue vanner has lately been brought out, which has the revolving indiarubber belt corrugated instead of plain. These new vanners cost £230 each, and are said to do the work of three of the old ones, but require the ore to contain a fair percentage of

heavy concentrates in order to do their best work. The three vanners in the Full Moon mill will be worked to their full capacity to take the material from the Huntingdon mill. They are to be worked at 200 strokes a minute to begin with. To drive all the machinery there is a 12 h.p. (nominal) Porter Engine with 9-inch cylinder and 12-inch stroke. This cost £90 in Sydney. It is provided with a Gardner governor, which in case of a belt breaking shuts off the steam and so prevents further damage. The engine is supplied with steam from a Tangye 12 h.p. upright boiler with 4 Galloway tubes, costing £130 in Sydney. The main driving belt is 10 inches wide, the mill and rockbreaker belts each 8 inches wide. Both mill and rockbreaker have fast and loose pulleys. The belts are of leather. The pulleys on the line of shafting are all of wood, made by the Dodge Manufacturing Company, U.S.A. These pulleys are very light, strong, and easily fixed, and are claimed to transmit 20 per cent. more power than iron ones. The whole of the machinery is thoroughly good and well set up. A small water-race has been brought in to the back of the battery to supply the boiler and machinery.

The mill was not quite ready to start work at the time of my visit, but Mr. Vale promised to let me have samples of the tailings and concentrates when work was started. I have since received from him three samples, which have been assayed by Mr. Ward, Government Analyst, with the following results :—Sample 1, of concentrated tin ore, was obtained from stone from the flat in front of the battery ; this stone yielded 3 per cent. of concentrations ; Mr. Ward's assay shows these to contain 56 per cent. of metallic tin. A good deal of molybdinite copper pyrites and quartz is visible in the sample, and it would require another dressing before going to market. Sample 2 was of dressed ore from fine sand ; this was separated from the bulk of the crushed ore by means of a V box, and dressed on a vanner by itself ; the result is unsatisfactory, as the dressed ore contains only 17½ per cent. of metallic tin. Sample 3 was of the tailings from the vanners ; this is most satisfactory, as the analysis shows only minute traces of tin. Mr. Ward says, "No. 3 is all but absolutely free from tin." This shows what good work the vanners are capable of doing. I have no doubt that in a short time it will be found possible to dress the ore more thoroughly without losing anything of consequence in the tailings. The poor result in the case of the fine sand treated is most likely due to the vanner having been set to treat the general bulk of the sand and not adjusted for the treatment of very fine stuff, which requires a different speed and different number of strokes to be given to the belt. The rapid and simple working of the vanners must always recommend them in preference to the slower and more costly jigs and buddles, and a result of saving ore dressed to 56 per cent. in one operation without any loss in the tailings is one that any machine might be proud of. I have great hopes of this mill leading to a great revival of mining at the Blue Tier.

Haley's Lease.—This ground comprises 60 acres held by Messrs. M'Gough and Young. It has produced very good alluvial tin ore in its time, and still gives a living to its owners from this source. It is most noteworthy, however, as containing a very well marked dyke of quartz porphyry carrying tin. This dyke extends throughout this property and southward into Mr. Crowther's and the Ethel Company's holdings, and northward through the Blue Tier Company's ground into the Full Moon Extended—see attached map. Near the northern boundary a shaft 16 feet deep has been sunk in the porphyry, and some remarkably rich stone has been obtained from this. This shaft encountered very hard ground, and there was difficulty in keeping it free from water, so further sinking was abandoned, and the shaft is now full of water. The general course of the dyke is not far from north and south, and it is generally about a chain in width. The rock is similar to the tin-bearing rock of the Full Moon and Anchor holdings ; the central portion appears to be the richest, but wherever I tried it the rock contained some tin, and many excellent prospects were obtained. Through the centre of the dyke there is for some distance a small quartz vein running the same course as the dyke itself ; very rich tin ore has been got from this little vein at several places along it. From a hole on it about 30 feet long, 8 feet wide, and 20 feet deep, Budgeon and party obtained, it is said, about 5 tons of black tin, and from another about half the size of the last, from 5 to 6 tons were got. These holes were put down in soft parts of the rock where the tin ore was free enough for working in a sluice-box ; where the stone required crushing machinery it was left alone. Another vein carrying in places very rich tin ore has lately been found running through the granite to the westward of the dyke and gradually coming into and crossing the latter ; it has been exposed in several trenches, and seems to be a true lode, though it consists mostly of altered granite similar to that on the walls of the Lottah lodes, without much quartz ; in one trench remarkably fine crystallised tin ore is easily obtainable ; this vein should be prospected still further and, if possible, sunk and driven upon.

An adit has been driven upon the course of the dyke for about 245 feet, and two shafts, 29 feet and 41 feet in depth respectively, have been put down to make communication with this adit. The last 66 feet of the adit has been driven by some mistake into the granite country instead of along the dyke, so a branch drive 56 feet in length has had to be put in to follow it. Fair prospects are obtainable all along this drive.

As in the case of the Full Moon and Anchor mines, the treatment of low-grade ore in large quantity is the problem to be solved by the proprietors of this company. They have an immense mass of tin-bearing rock, which will have to be worked on a large scale and at the lowest possible cost. The ground is very flat, and will probably therefore require pumping machinery to work it to any depth ; there is, however, enough stone above the level of the present adit to keep a battery

going for a long time, and by opening the dyke all along its surface it would be well prospected. I anticipate that there may be some trouble in getting enough water to supply a large reduction works here, and care will have to be taken to conserve it as much as is possible. I believe this property to be a good one, and a fair field for profitable investment; it certainly promises well enough to warrant a thorough trial.

Traversing the granite in this ground, as is the case generally with the whole district, are numerous small quartz veins, often carrying tin ore. Many very rich specimens of tin ore have been picked up in the alluvial ground, which have probably come from some of these. Extended trenching is desirable to prove the ground with respect to these veins, as a good lode may perhaps be found.

A basalt dyke is met with in the northern part of the ground, with a course about 30° W. of S. It is about 3 feet wide.

Blue Tier.—This company holds 260 acres of ground, which has proved very good in alluvial tin ore. A good deal of sluicing is still going on. Several small quartz veins have been found, and there are also, as seen on the map herewith, several occurrences of the tin-bearing quartz porphyry. The most important of these is part of Haley's dyke, above described, which passes through the easternmost part of the holding, and continues on into the Full Moon Extended Company's ground. This dyke has been cut across in three or four places by trenches, from which fair prospects are obtainable. In a few places very fair ore has been cut. As this is part of the Haley's dyke, I see no reason for supposing that it will prove any less valuable than the part which I have above recommended as worth investing in.

This company has much better water supply than the Haley's Lease or Full Moon Companies, and the stone would not have to be carried very far to be dressed. The dressing works for the Haley's Lease would be also more advantageously situated if on the Blue Tier ground, and connected with the stone by a tramway.

Full Moon Extended.—This company holds 80 acres on the line of the quartz-porphyry dyke, passing through M'Gough's and the Blue Tier properties just described. A large number of trenches have been cut across the dyke, showing it to still possess the same character as in the above. A shaft has been sunk to a depth of 34 feet on the dyke, the stone improving as the shaft got deeper. Some very nice ore was obtained from this shaft. The small pump used for keeping down the water proved quite incapable of performing its work, and operations had to be suspended. An adit was then begun from the Wyniford River towards this shaft. There would be 65 feet of backs above this adit at the shaft, and 99 feet in the highest part of the ground. The adit was driven 105 feet through hard grey granite country. The manager informed me that he struck the soft dyke formation in the end of this drive just before having to stop work. It is a great pity that this work was not continued.

The porphyry dyke was not visible in the Wyniford River as I expected, and the manager of this property informed me that he had never seen it anywhere in the river, but that it occurred further north again.

This company should make arrangements to get 100 or more tons of stuff from the various trenches crushed and dressed, so as to afford a test of the ground. If this trial should prove favourable, the adit should be extended and dressing works put up on the Wyniford River, which is here large enough to give a fairly good supply of water all the year round.

The property does not deserve to stand idle. A basalt dyke about 3 feet thick crosses the third trench north of the shaft, bearing 27° W. of S.

W. L. Crowther's Section.—This is 20 acres of ground lying to the south of Haley's Lease. It is very flat, and lies on the watershed between the Wyniford River and Crystal Creek, draining to the former. It is worked on tribute for alluvial tin ore, the ore being found in the shallow surface soil about two feet in depth. The tributer, Mr. Willing, told me he had got 7 tons of black tin in three months at a cost of £5 a ton. Owing to the flatness of the ground, the stuff has to be sluiced by hand in boxes. The tinstone is sharp and angular. Willing says that he considers that there is hardly an acre of this ground that would not pay to sluice if there was water to be had. The granite laid bare by the working of the surface is full of little quartz veins, often carrying good tin ore. The dyke formation found in Haley's Lease passes through this section, but nothing has yet been done to prove its value.

Ethel T. M. Company.—Haley's dyke passes south from Crowther's section into the Ethel Company's ground. About five chains south of their northern boundary a shaft has been sunk to a depth of about 60 feet, fair tinstone being met with throughout it. It is now full of water. Several trenches have also been dug exposing the porphyry. The dyke is here over a chain wide, and further south it is said to widen out to 9 or 10 chains, and to be traceable for three-quarters of a mile. Its course is still about north and south. Good prospects are obtainable from it in many places, and it always carries some tin ore, while really good stone is often seen in it. The head of a branch of the Crystal Creek has been worked for alluvial tin ore by tributers, exposing the porphyry for a considerable distance. Lower down the hill a party of tributers were working at the time of my visit hydraulicing with a ¾ in. nozzle. They had not a good pressure of water, but this was

owing to bad arrangements, as this ground falls rapidly and it is easy to get good pressure. They were also working far too narrow faces for this method of work, and, in consequence, had much trouble in moving large stones and trees, which, with wider working faces, they might go round. The whole of their sluicing arrangements were of a primitive description. There is no reason why this ground should not be easily dealt with by hydraulic sluicing, but some dams and races would have to be constructed. Better tail-races than those now in use on the ground are also required, for it is simply absurd to use a couple of boxes from 8 to 12 feet long, only fit for hand sluicing, as the only tin-saving appliance when hydraulicing. The sluicing operations have laid bare a good many thin tin-bearing quartz veins in this ground, as in other parts of the district.

In the lower part of this Company's property a tunnel was driven by the Lottah Company when this ground belonged to it. This adit is about 100 feet in length, and is driven to cut a small lode. This carries a great mixture of minerals, amongst which I noticed bornite, copper pyrites, indigo copper, wolfram, talc, and tinstone. The veinstone is quartz, but, as in the Lottah, there is a band of altered granite on each wall, and this appears to carry most of the tin ore. The wolfram is more in the quartz. This ore would be a very difficult one both to dress and to smelt owing to the number of heavy minerals.

Subsequently to my visit to this property I was told by Mr. C. Symons that there is a large quartz lode crossing the porphyry dyke about 10 chains south of the 60-foot shaft above mentioned, with a bearing 70° W. of N. This should be trenched on and prospected, as the almost universal occurrence of tin ore in the small quartz veins throughout the field renders it very probable that a strong quartz lode will also carry tinstone. At its crossing across the tin-bearing porphyry would be an especially likely place to find good ore.

Wellington.—Eighty acres of ground are held by this Company. Hydraulic sluicing had only been commenced the day before my visit, but a good start had been made. The nozzle in use was 1½″ in diameter, but was rather large, and was shortly replaced by a 1″ one. About 1½ sluice heads of water were being used, and this under a head of only about 40 feet. Much better progress would result from using higher pressure and more water. There is a large extent of shallow tin-bearing ground to be sluiced. The heavy trees on the ground are troublesome. If this venture proves successful a great deal more similar ground throughout the district can be worked in the same way, namely, ground that is shallow and too poor to pay by ground-sluicing, but of wide extent. The work of the Wellington Company will therefore be watched with interest.

Numerous quartz veins of from 1″ to 6″ in thickness as a rule are found throughout this property, and the sluicing will doubtless lay bare others. Some of these in the eastern section have been worked upon at some considerable expense. Two shafts, one 37 feet, the other 80 feet deep have been sunk, and an adit 494 feet in length has been driven. The first 370 feet of this adit were through hard granite, and the work is said to have cost about £2000. The remainder of the drive is in soft country. Two lodes were met with, No. 1 at 370 feet from the mouth of the drive, No. 2 at 407 feet. At 455 feet a soft decomposed sort of granite was met with, and the drive was continued in this to the face at 494 feet without passing through it. This soft granite carries a little tin ore, running, it is said, about ½ per cent. on the average of black tin. I cannot vouch for the correctness of this estimate, but the prospects shown to me render it probable enough, and from the ease with which it could be mined and dealt with, even this small percentage might be made to pay. The No. 1 lode has an E. and W. course, and is nearly vertical. The north wall is hard and well defined, and has a slight clay flucan. Next to this is a small quartz vein about 3″ wide; then there is soft decomposed granite for about 8 feet, said to have been tested and found to contain 1½ per cent. of black tin, and then on the South wall is another small quartz vein; these quartz veins are somewhat micaceous, and appear to be granite infiltrated with quartz in solution and thus altered, the felspar being removed at the same time that the quartz was deposited. The No. 2 lode is about 1½″ of quartz, with about 6″ of soft granite on each side of it, both carrying some tin ore. This lode runs about E. and W., and underlays a little to the North, so that it is not unlikely to join No. 1 lode in depth. It is quite likely that these lodes will become more solid and better defined at a greater depth. The shafts yielded some very good ore. On the surface the lodes make their appearance as several small veins carrying excellent tin ore. Several of these have been worked successfully by simple sluicing, the hard stones being thrown away. In the tunnel, about 16 feet before coming to No. 1 lode, a dyke of basalt 30 inches thick was cut through, and it was also met with in the side of the bottom of the 80-foot shaft. This dyke cuts through the lodes. Loose stones of basalt are found lying on the surface in quantity near the water-race that brings water to the hydraulic workings, showing that another dyke is somewhere in that neighbourhood.

Another of the tin-bearing quartz porphyry dykes passes through this property in a north-westerly direction, and is said to have been traced on the Kent Company's land. Very little work has been done on this. If the Full Moon Company is successful in making a profit from this sort of stone it will doubtless receive much attention wherever it is found throughout the district.

Giant.—This Company is working a little at its alluvial ground. A quartz porphyry dyke is found in its western section, bearing about 10° E. of N., and showing a little tin ore in the trenches that have been dug across it.

Other Holdings.—After examining the above properties I did not think it necessary to further

explore the district, as from inquiries I found that the general character of it was similar to what I had seen. Besides, the ground not examined was not being worked, and I could not therefore get information about it on the spot.

Men employed.—I was sorry to see so few men employed on the large area of ground held by the various companies. The Full Moon and Anchor Companies alone were working with any vigour. From inquiries made, I found the number of men employed by the various companies to be as follows :—

Haley's Lease—two Europeans, three Chinese.
Lottah—one European (caretaker).
Full Moon Extended—no one.
Giant—one European (caretaker).
Blue Tier—eight Chinese.
Wellington—two Europeans, one Chinese.
Anchor—thirteen Europeans.
Ethel—three Europeans.
Crowther's—four Europeans.
Other Ground—eighteen Chinese.
Full Moon—twenty Europeans.

Or a total of 46 Europeans and 30 Chinese. This is a very small number of men for the extent of ground held. More vigorous working will be required before the Blue Tier regains its old position as a tin-producing district.

Conservation of Water.—Owing to the great height at which the tinfields of the Blue Tier district lie, the supply of water is only sufficient for sluicing purposes during the wet months of the year; and on the higher ground there is always difficulty in getting a good supply at a height sufficient to give pressure for hydraulic working, which, in my opinion, is now the great desideratum for the poor alluvial dirt still plentiful. I am confident that an immense area, yet untouched on account of its poverty, as well as much ground that has been already sluiced, could be worked by the hydraulic method with profit. I do not think that the conservation of the water in dams and reservoirs presents any very great difficulties; on the other hand, the configuration of the northern slope of the range is very favourable for the storage of water. The Blue Tier is one of the wettest places in the Colony, the mean rainfall from 1st January to 30th September for the last five years being 42·84 inches, an amount of fall only exceeded at Waratah and Corinna. The range itself gets a greater amount of rain than Gould's Country, where the observations are taken. Mr. R. S. Milles, the manager of the Full Moon mine, has observed the rainfall this year, and finds that in the six months between 14th April and 14th October, 1889, 48·40 inches of rain fell on the top of the range. This gives a very large quantity of water falling over the wide flat lying top of the mountain. Now, there are a great many places where low embankments will impound a wonderfully large quantity of water. The Full Moon Company have erected a small dam, which will give a large supply of water, and Mr. Milles informed me that he could impound 10 acres of water, or about 20,000,000 gallons, by raising this dam to a height of only 25 feet above the deepest point in the little creek. This embankment would be 288½ feet long, and have an average depth of about 13 feet,—quite a light work. The same gentleman has taken levels and measurements that show that on Wheal Tasman Flat a reservoir could be made with an embankment about five chains long and of about eight feet mean depth, that would contain something like 200,000,000 gallons of water. These figures give some idea of the ease with which large quantities of water may be impounded. There are many other places where smaller reservoirs could be made at a low cost, at different levels, almost to the top of the range. Lower down, along the Wyniford River and its tributaries, there are great numbers of good reservoir sites. One very good one is on the Giant Company's ground. Here there is a wide flat which has been worked for alluvial tin. The ground was so flat that there was great difficulty in keeping the workings free from water, and all the washdirt had to be washed in boxes, as there was not sufficient fall for ground-sluicing. At the lower end the valley narrows, and a dam about five chains long and not more than 25 feet deep in the middle would store the water in a basin probably 30 acres in extent. As the Wyniford in flood carries a large volume of water, there would be no difficulty in filling this dam.

A system of water storage on the Blue Tier would benefit all the tin-sluicing companies down the Wyniford River as well as the Blue Tier workers. In a short visit such as mine it is not possible to learn how much water could be stored, and exact data on which to base estimates of cost of storage and area of ground benefited can only be obtained by a careful contour survey of the district. Such a survey would be of great assistance to mining companies by showing exactly how far they would have to go to get water at any level, what fall they could get for tailings, and what distance they would have to drive in order to drain their mines to deep levels. This last is a matter of great importance for the future working of the field, as it would obviate the necessity for pumping machinery, with its constant heavy charges, if a deep adit were to take away the water. An adit a mile in length from the southern side of the range would drain the Lottah, Full Moon, Haley's Lease, and part of the Blue Tier ground to a depth of about 800 feet below the watershed. I do not know of anything that would do more towards directing mining operations into the most economical channels than a proper contour survey.

In conclusion, I have to say that I received the greatest courtesy and consideration from everyone connected with the mines of the Blue Tier district, and no trouble was spared by anyone to give me any information or to guide me to any part of it. I have particularly to thank Mr. Milles, Mr. C. Symons, and Mr. Thomas Budgeon for much valuable help.

I have the honor to be,
Sir,
Your obedient Servant,

A. MONTGOMERY, *M.A.*,
Inspector of Mines and Geological Surveyor.

The Secretary of Mines, Hobart.

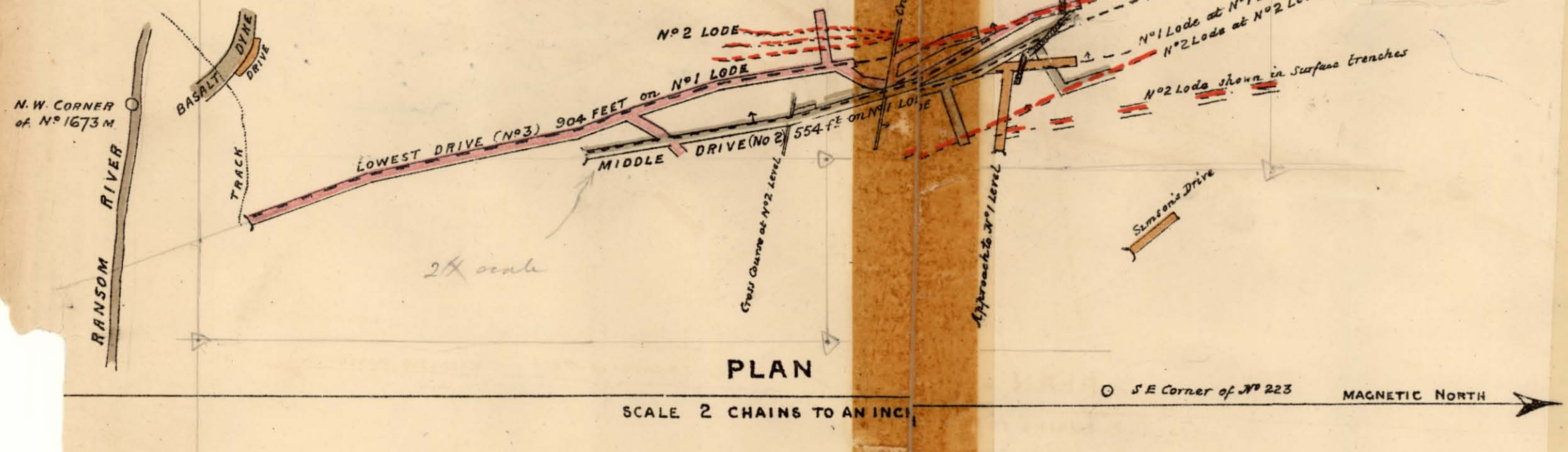
WILLIAM THOMAS STRUTT,
GOVERNMENT PRINTER, TASMANIA.

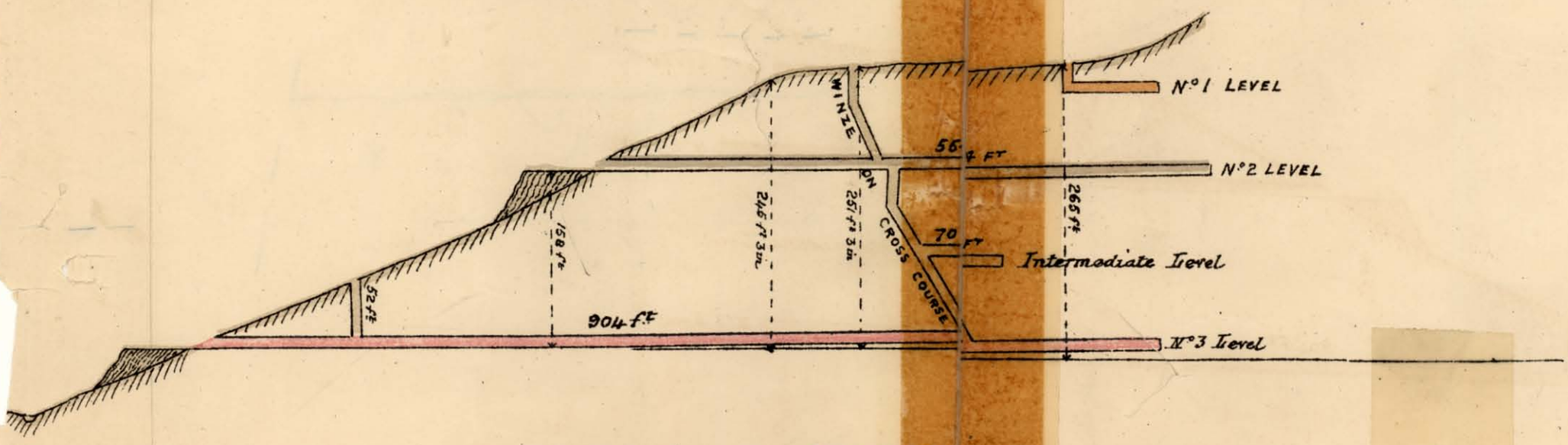
11/12

UNDERGROUND WORKINGS

LOTTAH MINE

BLUE TIER





LONGITUDINAL SECTION

5 cm

A. Montgomery M.A
Inspector of Mines & Geological Surveyor
28th November 1889

12/12

MAP SHOWING PORTION OF

THE BLUE TIER DISTRICT

COUNTY OF DORSET

SCALE 10 CHAINS TO AN INCH.

5 cm

A. Montgomery M.A.
Inspector of Mines and Geological Surveyor
28th November 1889

Rules Sheet

REFERENCE

QUARTZ PORPHYRY shown thus
LODES "
BASALT DYKES "

OFFICE OF MINES
NOV. 28. 1889.

WYNIFORD RIVER
PROPOSED DAM SITE
GIANT
FULL MOON EXTENDED
Basalt Dyke
Large Stone Porphyry
Quartz
Stream
PROPOSED DAM SITE
CREEK
CAMP
ADIT
CAMP
WELLINGTON
BUE TIER
SHAFT
SHAFT
ADIT
SHAFT
SHAFT
HALEYS LEASE (McGough and Young)
FULL MOON
SHAFT
SHAFT
120' SHAFT
80' SHAFT
PROPOSED DAM SITE FULL MOON
RANGE
ETHEL
W.L. CROWTHER
TIER
SHAFT
BLUE
LOTTAH
Quartz
Basalt Dyke
LAFFER RIVER
RANSOM RIVER
ETHEL
ADIT
CRYSTAL
CREEK
GROOM RIVER
ANCHOR