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## REPORT ON THE MOUNT LYELL MINE, COUNTY OF MONTAGU.

*Geological Surveyor's Office, Launceston, 6th April, 1893.*

SIR,

I HAVE the honour to forward to you a Report on the Mount Lyell Gold Mining Company's mine at Mount Lyell, which I examined on the 26th and 27th of February last.

The property is situated on a ridge connecting Mount Owen with Mount Lyell, about 1000 feet above sea level, and distant by road about 30 miles from the port of Strahan. The road is a fairly good but narrow cart-road for 23 miles, as far as Lynchford, and from here onwards is a sledge-track very steep in places. The mine is situated on the eastern slope of the range, being at the head of one of the branches of the Linda Creek, an affluent of the King River. The lowest adit and the battery are about 180 feet below the saddle over which the road from Strahan comes in, and the top of the outcrop is about 230 feet above the adit. A route for a railway is now being surveyed from Strahan to the mine, and I understand that it is intended, if found practicable, to bring it over the saddle to the mine itself. It would be possible to reach the deposit by a tunnel from the Queen River Valley on the western side of the range, and this would prove the mine to a much greater depth than can be attained by any adit from the eastern slope. No surveys had been made up to the time of my visit to determine the distance that would have to be driven, but it is expected to be very considerable, and this tunnel is therefore not contemplated for the present unless unexpected trouble should be met with in getting the railway line over the saddle. This saddle is about 1160 feet above sea level by aneroid measurement.

The mine was discovered in 1886, gold having been traced up to it from the Linda Valley. On section 14-86 an immense outcrop of hematite was found, and proved to contain gold: this got the name of "The Iron Blow." Up till 1890 it was worked with varying success as a gold mine, the stuff from the outcrop being crushed and amalgamated in an ordinary stamp battery. The workings soon disclosed the existence of a large mass of pyrites standing in close connection with the hematite, and as development proceeded it has become evident that this pyrites really constitutes the main body of the deposit. Analysis having shown it to contain copper, gold, and silver, it was recognised at last that the treatment most suitable for the ore would be the process of smelting for copper, by which all the contained valuable metals would be recovered.

The outcrop consists of hard, dark, dense hematite mainly, which has a somewhat shaly or fibrous structure. With this there is, however, much yellow and brown friable and pulverulent oxide of iron (*Limonite*), which is much mixed with pulverulent baryte (sulphate of barium). The dense hematite also contains occasional veins of baryte, and sometimes lumps of some size. The limonite carries more gold than the hematite and is often very rich both in gold and silver. It frequently is found between blocks of the hematite, the main mass of which appears to be more or less shattered, but is in greater quantity towards the north-east side of the outcrop, where it forms a body lying between the hematite and the pyrites. The latter has been exposed on this side by several trenches, and appears as a solid mass of iron sulphide, but blue stains of sulphate and green ones of carbonate of copper every here and there testify that this metal also is present. The pyrites is generally covered, as might be expected, with a thin superficial capping of brown iron ore,

resulting from its oxidation. The width of the outcrop is from 280 to 290 feet. The stuff crushed in the battery for gold all came from the soft portion of the deposit lying between the pyrites and the main hematite mass. When I formerly visited the mine in 1890 ("Report on the state of the Mining Industry on the West Coast," April 25th, 1890), 1530 tons of material had been crushed for a return of 1480 ounces of bullion, about half of which was gold and half silver. Since then there have been some few small crushings of which I have not obtained particulars, but nothing of much consequence. The gold being very light and scaly, and the gangue of oxide of iron and baryte very heavy, there was great loss in amalgamation on the battery-plates, and I was not surprised to learn from Mr. Schlapp, the present manager, that his assays of the tailings saved in the tailings-dams ran up to more than an ounce of gold to the ton. By the battery treatment all the silver, amounting to as much as 30 ounces to the ton, was allowed to escape into the tailings as well. In getting out the stuff for crushing in the battery an open quarry has been worked into the outcrop; this is now nearly 50 feet in diameter in the floor, and the highest part of the face is about 30 feet high. An adit known as No. 1 adit has been driven westward across the ore body from the foot of this face. After going for 64 feet through gossany material solid pyrites was struck, and continued to be found to the end of the drive, 72 feet in. This adit does not penetrate to the western wall of the ore-body, which, indeed, has not yet been reached in any of the adits. Some 26 feet lower down another adit, known as No. 2, has also been driven westward; but I did not go into this, it being now used as an explosives magazine. No. 3 adit is 60 feet below No. 2, and is driven across the course of the ore, that is, south-west. The first part of it is in country rock, mostly hard sandstone, and the eastern wall of the ore-body was reached at 128 feet in. It has been driven a total distance of 420 feet, or 292 feet into the pyrites. For all this distance the ore is a solid mass, absolutely free, as far as can be seen from a fairly close examination of it, from gangue, other than occasional streaks of baryte, and from country rock. The pyrites, however, appears to lie in ribs or layers parallel to the wall of the deposit and also parallel to the stratification of the enclosing country rock. Towards the end of the drive the ore became poorer in copper than in the first part, and the last 100 feet would not be mined to begin with, though when all works were in thorough going order it might pay to take this portion out also. At present the engineer in charge, Dr. E. D. Peters, jun., only counts upon treating the first 200 feet passed through. On the eastern wall there is some hematite, which would go to show that the pyrites body has been partly decomposed at its contact with the country rock by solutions passing through the latter and down the wall. From the adit or cross-cut a drive has been put in to the south east along the eastern wall of the ore for a distance of about 450 feet (on the date of my visit), and from this two cross-cuts, one 50 and the other 13 feet in length, have been put into the ore-mass without going through it. In these cross-cuts the ore has the same character as in the main one, namely, dense solid pyrites free from gangue, lying in layers parallel to the wall. Close to the wall some galena, blende, purple copper ore and copper pyrites are occasionally visible distributed through the mass of iron pyrites; but even when no copper pyrites are distinguishable by the eye there is always copper in the ore. At this level some very good copper pyrites was being taken out at the time of my visit for a smelting test at Argenton.

No. 4 adit is 97 feet below No. 3, and goes in from beside the old battery. For 343 feet sandstone country rock was passed through before the wall of the ore-body was reached. The strike of the strata is from N.W. to N.N.W., agreeing with that of the ore deposit, and conforming to the usual course of the older sedimentary strata all over the West Coast. For the first 20 feet the ore contains some hematite and a good deal of baryte, also a little galena, but not much copper. This portion would be mainly rejected in working the mine. Just on the wall, however, there is in it a vein of quartz carrying tetrahedrite (Fahl ore), assaying from 300 to 600 ounces of silver to the ton, and rich ore of secondary deposition appears to exist more or less all along the wall, for at a cross-cut 92 feet further south a winze has been begun in a belt of somewhat oxidised hematitic ore six to eight feet wide, lying between the pyrites and the country wall-rock, which belt for about four feet in width is very rich in silver. Where this changes into pyrites the tetrahedrite is again seen, this time not in quartz, but in a band from half to one inch wide disseminated through the pyrites. Bornite (purple copper ore), carrying as much as five or six per cent. of silver, has also been found. This is rather a mineralogical curiosity, as bornite does not generally contain more than traces of silver. The chemical action resulting from the passage of water along the wall appears to have caused a partial oxidation of portions of the ore, and solution and redeposition in fresh compounds of some of the silver and copper. This enrichment of parts of a lode at the expense of others is a well-known feature of many copper mines. The drive along the foot-wall (as the eastern wall has got to be called, though the underlay is almost nothing) has been extended 165 feet to the south east, and a cross-cut has been put in at the winze for 35 feet, all except the first few feet above-mentioned in dense solid pyrites. The main adit was in 411 feet at the time of my visit, and work was still proceeding; from 363 to 411 feet was solid pyrites the whole way.

Another adit could be made from the Linda Valley to cut the ore-body some 200 feet below No. 4, but would probably have to go through country rock for about 1000 feet before striking it. As above mentioned, still lower tunnels could be driven from the Queen River valley, so that the facilities for obtaining natural drainage of the mine to a depth which will not be reached in twenty years of work are very good.

Mr. O. G. Schlapp, who has been mining manager for over two years past, was good enough to show me his assay-book, containing records of hundreds of bulk assays made by him during the progress of the work. He has worked out the average values as follows:—

The limonite and pulverulent baryte gossan contains from 20 to 25 ounces of silver and from 20 to 25 pennyweights of gold to the ton.

The solid pyrites in No. 1 tunnel yields from four to five per cent. of copper, about two ounces of silver, and three pennyweights of gold to the ton.

The pyrites in No. 3 tunnel (rejecting the last 90 feet, which contains less than one per cent. of copper) contains nearly four per cent of copper, and from one to two ounces of silver and two to three pennyweights of gold to the ton.

The pyrites in No. 4 tunnel (rejecting the first 20 feet as too much mixed with baryte) yields about the same values in copper, gold, and silver as in No. 3.

The general average of all of the pyrites is calculated to be about  $4\frac{1}{2}$  per cent. of copper, two ounces of silver per ton, and three pennyweights of gold per ton, or a gross value of about £2 19s. a ton for these three metals.

Though a good deal of work has been done, it is not yet possible to form any very accurate estimate of the amount of pyrites in sight, the levels driven having penetrated to such an insignificant distance as compared with the entire mass of the deposit. The end of the No. 3 adit is a little further west than the apparent edge of the ore on surface, so that there seems to be no sign of the latter getting thinner going down; rather the reverse, for in the winze from No. 4 adit the wall is underlaying a little to the east. The ore-body would therefore appear likely to be wider underground than it is on surface, where it is close on 300 feet across. Let us take the width as 200 feet, seeing that the ore is of the average value for that distance in No. 3 adit: it has been driven on to the south for 450 feet, and to the north it has been exposed on surface for over 350 feet, making a total known length of, say, 800 feet. Let us call the average height of the surface above the level of No. 4 adit 180 feet; we may say that the ore is pretty fairly exposed for a block 800 feet long, 200 feet wide, and 180 feet high. This would contain a little over one million cubic yards, or, say,  $3\frac{1}{2}$  millions of tons. Below No. 4 level it is reasonable to expect quite as much ore as above it, so that above the level of the Linda Valley there should be quite  $7\frac{1}{2}$  millions of tons. These are large figures, but the estimate is quite a conservative one. Taking only one-third of the quantity as payable, there would still be enough ore to supply 1000 tons a day for seven years. The very uniform quality of the pyrites wherever it has been cut into entitles us to be confident that there will be no great variation from the now known values when the mass is further exploited, and the quantity exposed is so large that there need be no hesitation in at once proceeding with the erection of smelting works. Should it be thought desirable or necessary to have still further proof as to the quantity and quality of the ore, a series of bores with a diamond drill would yield it in a very short time equally well as extensive underground mining.

The method of mining to be adopted will depend to some extent on where the railway comes in. If it can be brought over the saddle and down to the level of No. 4 adit the mass will probably be worked from the south side as an immense open quarry, but if the outlet has to be by means of a tunnel from the Queen River valley the system adopted will no doubt be a combination of underground and open-cast working, the surface and the lower levels being worked simultaneously. The width of the ore is so great that open quarrying is sure to be one of the principal methods of winning it for a depth of at least 200 feet from the surface; below this level difficulty would probably be experienced in preventing heavy slips of the country wall-rock. There are excellent facilities for open-cast workings, as faces can be opened at a great many different points along the slope of the hill, and there is plenty of room for getting rid of waste rock. The steepness of the hillsides on each side of the ridge is also very favourable for easy transport of ore, either by self-acting grades or by overhead wire-rope tramways. When the railway is completed from Strahan, and the disadvantage of inaccessibility now experienced is thus removed, it would be difficult to imagine a mine better situated for economical working.

It is proposed to have smelting works in the Queen River valley, within a mile and a half in a direct line from the mine. Good water-power for driving blowing-engines and for mechanical handling of material can be got from the Queen River, and as there are numerous other considerable streams in the district this could be supplemented if required by electrical power transmitted from generating stations within a few miles of the works; the Queen River, however, is probably able to supply all the power required. As for fuel, coke and coal can be got from the seaboard in not more than 25 miles of railway carriage, and the whole of the Queen River valley is covered with thick forest, which will give ample supplies of wood for the roast-heaps for many years. The ore being very rich in sulphur, averaging over 45 per cent. of it, does not require much fuel in roasting, only enough to start the combustion. Should the process of pyritic smelting, that is, smelting pyritous ores direct without roasting by means of the heat caused by the combustion of the contained sulphur, become a commercial success—and there seems to be a very great likelihood of this being so—the Mount Lyell ore ought to be very easily smelted by it, almost without fuel at all, for it is so pure and so rich in sulphur as to be an ideal ore for this process.

When I visited the mine a roast-heap of some 65 tons was being burned, the object being to ascertain beyond doubt by a practical test that the ore would roast well without decrepitating or falling to powder when heated. This trial was quite successful, the roast going on very satisfactorily. At the same time 100 tons of ore were being taken down to the smelting works at Argenton to be reduced to matte and sent to England for further treatment. This ore was mostly picked copper pyrites of good quality from No. 3 tunnel, much richer in copper than the general average of the ore, the object being simply to produce a few tons of 65 per cent. matte to show interested parties the quality of the product, and allow the best method of refining to be determined. This being the case, it would be absurd not to pick out the richest ore conveniently obtainable, especially as it had to be carried out from the mines on pack horses, over a poor track. This explanation has to be made in order to prevent misapprehension as to the nature of the test: there is no intention of treating an average sample of the ore, but only of making the required parcel of matte in the shortest and cheapest manner. At the same time a few tons of the very rich oxidised ore from the winze in No. 4 tunnel is proposed to be separately run down into a specially rich matte to pay the expenses of the test.

The owners of the Mount Lyell mine are to be complimented on their enterprise and wisdom in obtaining the services of so well known and high an authority on copper smelting as Dr. E. D. Peters, jun. It is evident that the mine must be worked on a very large scale, as its average value is not very high, and it is only a man of high standing in the copper world and great experience in copper mining and smelting who is competent to pronounce with authority on the prospects of the mine, and design and lay out the reduction works. It is very satisfactory to know that Dr. Peters expresses himself as convinced of the payable nature of the mine. He proposes to build works capable of treating 500 tons a day at first, to be later on increased to 1000 tons daily capacity if required. There is no doubt as to the ability of the mine to supply the quantity of ore with ease, and the average quality has been sufficiently proved by numerous tests. The ore is about double as rich as that of the celebrated Rio Tinto mine in Spain, which contains only from  $2\frac{1}{2}$  to 3 per cent. of copper, about 1 ounce of silver to the ton, and only traces of gold. As will be shown below there are many features in common in the Rio Tinto and Mount Lyell deposits, and there is every reason to believe that the latter will yet rival the fame of the great Spanish mine. In calculating the profit on the treatment of the Mount Lyell ore, Dr. Peters, in a report to the shareholders, takes no account of the rich silver ore that has been found, or of the valuable auriferous gossan on surface, basing his figures only on the average value of the main pyrites body. The rich ores are, however, an important factor in the profits of the Company, and there is a great probability of their considerably raising the general average yield of the mine of gold and silver. The policy of disregarding them in making an estimate of the results to be expected in working is highly commendable as a conservative and cautious one—the poor average ore alone is relied on, and any rich stuff will be a gift to the owners superadded to their regular profits. The richness of the gossan, and of the decomposed and altered ore on the eastern wall, indicates that there has been extensive chemical action on the outskirts of the ore body, and it is very likely that the quantity of richer material will prove to be very considerable.

One valuable constituent of the ore will not be realised upon for some time to come, namely, the sulphur, unless it is found profitable to ship raw ore to Europe as ballast. The pyrites contains over 45 per cent. of sulphur, and is worth a little over a pound a ton in England for this constituent, so it seems possible that an export trade might be done in the raw ore. The Spanish and Portuguese pyrites sent to England is first of all burned by the sulphuric acid manufacturers, then treated by wet processes for copper, silver, and gold, extremely small quantities of the noble metals being profitably extracted, and finally the residual oxide of iron has a ready sale. The utilisation of the sulphur for making sulphuric acid in the Australian Colonies is, I am afraid, still in the future, the demand being small, principally for the manufacture of superphosphates. It is a great pity to waste the sulphur of a first-class sulphur-yielding pyrites like that of Mt. Lyell, and no doubt the management will devote attention to the possibilities of dealing with it profitably when once they have got their works fairly started.

The Mount Lyell ore deposit is very similar in its mode of geological occurrence to many other well-known masses of pyrites, the most famous perhaps of which are the Rio Tinto mine, in Spain, and the Rammelsberg, in the Hartz Mountains, Germany, both of which have been worked for many centuries. There has been a good deal of difference of opinion as to the mode of origin of these deposits, some authorities regarding them as true lodes, others as bedded or stratified layers contemporaneous with the enclosing country: the latter opinion being now generally considered the more correct one. The Rammelsberg ore deposit consists mainly of iron pyrites, but contains also galena, copper pyrites, fahlore, blende, and heavy spar, while quartz is quite rare: the ore-bed is stratified conformably with the enclosing slates, and shares their foldings and contortions. It is noteworthy that at Mount Lyell the same minerals occur, though galena is not of such importance there as at the Rammelsberg, and that the principal earthy mineral is baryte, quartz being almost absent. The pyrites too is, as far as can yet be judged, in layers parallel to the layers of the country rock. The Rio Tinto deposits of cupriferous pyrites consists, according to J. A. Phillips (*Ore Deposits*, page 371), "of a series of more or less continuous lenticular masses running parallel with

the bedding of the enclosing slate, sometimes extending to a great length, occasionally having a width extending fifty fathoms, and composed of an intimate admixture of iron pyrites with a little copper pyrites, through which strings of the latter mineral sometimes ramify." Quartz is present in very small quantity, and the drusy cavities so characteristic of lode deposits are exceedingly rare. The average value of the pyrites is about  $2\frac{1}{2}$  per cent. of copper. The celebrated Tharsis copper mine, near the Rio Tinto, is quite similar to the latter.

Cases are known in which iron pyrites containing a little copper is forming at the present day in lagoons in swampy ground, the rate of growth being in some instances quite perceptible in a few years. The formation of the mineral is explained thus:—Iron and copper pyrites exist in small quantities in the country rocks and become oxidised to soluble sulphates which are dissolved out by surface waters and washed into the lagoons; in these the sulphates are deoxidised by the powerful reducing action of decomposing vegetation and the insoluble sulphides reprecipitated. The sulphur often present in decomposing vegetable, and more particularly in animal matter, is also liable to combine with the iron always present in swamp water as carbonate. The common occurrence of iron pyrites in coal seams is an instance of the formation of this mineral through the agency of organic matter. Under favourable circumstances, therefore, heavy deposits of pyrites could be formed in swampy localities where the waters were charged with soluble sulphates. The common occurrence of numerous lenticular masses of pyrites in the neighbourhood of the main deposits of this ore favours this explanation of their formation, the deposition of mineral having gone on simultaneously in numerous detached lagoons. In course of time these have become covered over with layers of silt, which have hardened into rock; and in progress of ages the strata have been crumpled and contorted till we now find them standing on edge instead of in their original horizontal position. At Mount Reid, in what appears to be the same belt of country in which the Mount Lyell mine is situated, a somewhat similar pyrites deposit has been found, and in this case the ore seems very plainly interlaminated with the country rock. There are reported to be several deposits of pyrites in and near the line of country connecting Mount Lyell with Mount Reid, which would go far to bear out the theory of their sedimentary origin.

It is important to arrive at a conclusion as to the origin of any ore deposit, so as to have some guide in reasoning out its probable behaviour in strike and depth. If the above explanation is correct, we may expect to find the ore-masses of more or less lenticular shape, purest in the middle, and becoming more and more mixed with bands of country rock towards the edges of the lenses. They may not go to any great depth before narrowing and gradually thinning out, but it is just as likely that the present surface of the ground may be far above the centre of the lenses, and that they will increase in size going down. It depends altogether on the size of the original basins of deposition how far the ore will extend in strike and in depth; in the case of a huge ore-mass like the Mount Lyell one, it is reasonable to expect a great extent, comparable to the Rio Tinto and Rammelsberg mines, which have been worked to great depths. It is probable that numerous other lenses will be found along the line of strike of the main mass, and it is quite likely that some of these after pinching nearly out will be found to swell out again into fresh bodies of ore. Though the lenticular shape is rather characteristic of pyrites masses, therefore, there is no reason to consider them less reliable sources of ore than true lodes; the contrary is indeed the case, an ore-bed being much more likely to carry ore throughout its extent than a lode in which it is usual for large blank spaces free from or poor in ore to exist.

The mining work in the Mt. Lyell mine having proved the existence of a mass of pyrites nearly 300 feet in thickness without any enclosed bands of country rock, it appears to me, on geological grounds, that it is likely to prove a very large and extensive deposit, the purity of the ore being, to a great extent, a guarantee that it was deposited far from the shores of the original basin, just as coal seams are generally most free from bands towards the centres of the basins. Another important deduction to be made from the theory of sedimentary origin is that the value of the ore in metals is likely to be very uniform throughout each layer, the mineral having been precipitated from uniform solutions. The experience of long-worked pyrites bodies confirms this reasoning, the metallic contents having been found to vary but little from the general average. In saying this I must except, however, those portions of the ore-bodies which have been subjected to a secondary chemical change, as in these the values are liable to vary very greatly, some constituents having been removed and others enriched by additional matter brought in in solution. During the ages that have elapsed since the ore was first laid down, a good deal of secondary chemical action is only to be anticipated. For example, the pyrites under the outcrop at Mt. Lyell is generally richer in copper than at the lower levels, an almost inevitable consequence of the leaching of the copper from the gossan above; and the rich ore on the eastern wall has already been ascribed to secondary action.

A peculiarity of the Mt. Lyell deposit which is difficult of explanation, and which has led to some extraordinary theories as to its origin, is that part of the outcrop is hematite and part is limonite; the latter is easily accounted for by the oxidation of the pyrites, but it is not so easy to explain the presence of the hematite. So far as I know, pyrites never alters directly to hematite,

but always to the hydrated oxide of iron (limonite), and bodies of hematite are generally considered to be limonite from which the combined water has in course of time been expelled. The mass of hematite is found running down into the ground along-side of unaltered pyrites, and much deeper than the gossan or limonite. Two explanations seem possible—first, that bog-iron ore was deposited below or above the pyrites in the original lagoon, and that the hematite is a bed contemporaneous with the pyrites; this, however, does not seem to me to meet the circumstances of the case; and second, that at some long past period the ore-body has been subjected to atmospheric oxidation and partly converted into limonite, and then buried again under newer strata which have since been removed; while so buried the limonite would gradually change to hematite. There is evidence that the coal measures (permo-carboniferous) formation has extended all over the older rocks of the West Coast, though now almost entirely removed again by denudation, and it seems possible that the ore was partially oxidised prior to their deposition.

While going over the mine I took a number of samples for analysis and assay, which have been examined by the Government Analyst in Hobart. The following description explains what each is:—

No. 1.—This sample was taken by picking up small fragments all over the heap of rich ore from the winze in No. 4 tunnel; it was therefore not a fair bulk sample, as parts of the interior of the heap might differ materially from the outside portions; still it should approximately represent the value of the whole. It yielded on assay 462 ozs. 3 dwts. 12 grs. of silver and 13 dwts. of gold to the ton.

No. 2.—This was taken from a heap of gossan in the open quarry in the outcrop by taking small fragments from all over its surface. In this, as in all the other samplings, the whole of the stuff taken was crushed in a mortar and put through a sieve of about eight holes to the lineal inch before taking the sample for the Analyst. As in the former case, the interior of the heap may not have been of the same value as the outside from which the tests were taken. The assay gave 7 oz. 8 dwts. 1 gr. of gold and 32 oz. 9 dwts. of silver to the ton. The gold in this is much above Mr. Schlapp's average assays, and it is probable that a piece of unusually rich ore must have got into the sample; but I may say that after picking out part of the pulverised stuff to send to Mr. Ward, I washed the remainder in a pan and only got two very minute specks of gold, showing that there was no appreciable quantity of coarse gold to make the tests erroneous.

Nos. 3, 4, and 5.—These were samples of pyrites, and were analysed as well as assayed for gold and silver. No. 3 was taken by picking up small fragments from all over a heap of pyrites from No. 1 tunnel. No. 4 was taken in No. 3 tunnel by knocking off chips from the walls of the drive every yard or so for the first 200 feet; and No. 5 was similarly taken from the walls of No. 4 tunnel, from 363 feet into the face, at 411 feet, thus rejecting the first 20 feet of lode-matter known to contain much baryte and also streaks of rich secondary ores. The following analyses were obtained:—

	No. 3.			No. 4.			No. 5.		
	Per cent.			Per cent.			Per cent.		
Copper .....	9.6			5.3			4.6		
Lead .....	trace.			trace.			trace.		
Iron .....	40.3			40.0			39.0		
Barium Sulphate .....	0.8			2.5			3.0		
Sulphur.....	45.0			45.0			46.0		
Silica .....	2.8			4.6			5.8		
Silver per ton .....	oz.	dwt.	grs.	oz.	dwt.	grs.	oz.	dwt.	grs.
Gold „ .....	2	18	19	4	14	17	3	2	1
	0	1	15	0	2	14	0	2	1

The richness of No. 3 sample in copper, as compared with Nos. 4 and 5, is no doubt due to the copper leached out of the overlying gossan; the average of the two latter parcels, viz., 5 per cent., is nearer the truth as to the value of the main mass. The silica is much higher than Dr. Peters has generally found it, which may be due to dust on the surface heap and walls of the drives from which the samples were taken. He informs me that he has rarely found over two per cent. of silica in the pyrites, a fact which will necessitate the using of siliceous matters as a flux in smelting. Siliceous silver and copper ores would therefore be very useful to the Mount Lyell company as flux, and no doubt they will be large buyers of such ores when at work. The average of the three assays for gold and silver is two pennyweights two grains (2 dwts. 2 grs.) of gold and three ounces eleven pennyweights and twenty grains (3 oz. 11 dwt. 20 grs.) of silver to the ton, which is a trifle higher in silver and lower in gold than Mr. Schlapp's average above given. Taking the average copper at 5 per cent., the gross value per ton, viz., £3 4s. 6d., is 5s. 6d. higher than the manager's estimate, which is very satisfactory as a check on the latter, showing it to be a conservative one. The samples of the pyrites taken by myself and assayed by the Government Analyst therefore confirm the accuracy of the mine assays taken during the progress of driving the tunnels.

Taking the great size of the ore-body, its value, its proximity to a shipping port, and the excellent mining and smelting facilities into consideration, I have no doubt as to Mount Lyell being a paying mine when opened up on a large scale, such as is proposed by Dr. Peters; it would be simple folly to attempt working on a small scale. When equipped with the most modern smelting plant and connected by rail with the port of Strahan, the mine should be in a position to put copper into the European market cheaper than most of its largest competitors, which means that even should the price of copper fall this mine would be able to survive longer than less favourably situated rivals. It is pretty well known that very few indeed of the great copper-producing mines of the world could continue working if the price of the metal were to fall below £40 a ton, so there is a good assurance that there can be no great fall in value without a large shrinkage in production, unless very large and rich new mines are found or very great improvements in smelting methods discovered. There is, therefore, cause to congratulate the Colony on the possession of what is likely to prove one of the great mines of the world.

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

A. MONTGOMERY, M.A., *Geological Surveyor.*

*The Secretary of Mines, Hobart.*

