REPORT ON THE PROGRESS OF THE MINERAL FIELDS IN THE NEIGHBOURHOOD OF ZEEHAN; VIZ.:—MACKINTOSH RIVER, MOUNT BLACK, MOUNT READ, MOUNT DUNDAS, MOUNT ZEEHAN, STANLEY RIVER, AND MOUNT HEEMSKIRK.

Geological Surveyor's Office, Launceston, 15th May, 1895.

SIR,

I HAVE the honour to submit the following Report on the above fields, embodying the results of my observations during a short visit in the months of January and February last. To examine all these mineral localities with any approach to thoroughness would take a very long time, four to six months at least, and would require a large number of assays and analyses, a good deal of surveying, and the employment at times of more than a little manual labour in breaking out ore and prospecting. The number of mineral discoveries is so large and the extent of ground so great that I was unable in the time at disposal to do more than run over the fields, and this Report cannot therefore go into many details as to the mining properties visited, but will deal with them in a general way, giving the results of the impressions received by me while hurriedly looking over them. No doubt more complete investigation would in most cases modify these, and in submitting this Report I have to ask it to be taken with the foregoing explanation, and not to be regarded as the outcome of a thorough study of the various mineral occurrences. To avoid going a second time over ground already traversed, it should be read with my previous Reports on the same districts, of which the following have more or less bearing upon the matter of the present one :—

(1.) Report on the State of the Mining Industry on the West Coast, 25th April, 1890.
(2.) Report on the progress of the Mount Zeehan and Mount Dundas Silver-Lead Fields, 25th November, 1890.
(3.) Report on the Country traversed by the Route of the proposed Waratah to Zeehan Railway, 4th February, 1892.
(4.) Report on the Progress of the Mineral Fields of the County of Montagu, 20th May, 1893.
(5.) Report on the Country between Mole Creek and the Mount Dundas Silver Field, 13th June, 1893.
(6.) Report on the Corinna Goldfield, 9th April, 1894.

Leaving the Burnie-to-Waratah railway at the Hellyer crossing, or 40-mile station, on the 15th January, a southerly course was followed for about ten miles to the head of the Que River; this was all pretty level country of basaltic formation, portion of the Waratah plateau, and very open, being easily traversed by horses. Towards the head of the Que the basalt disappears, and, as far as may be judged from occasional outcrops through the covering of "button-grass" and peaty soil, the country rock is a schist, most likely of Archæan age; a similar schist is seen on Meredith's track from the junction of the Huskisson and Pieman rivers to Waratah, at a point considerably south of the Que River. Thus far my route had lain only a little to the east of the surveyed route of the Waratah-to-Zeehan railway, but it now diverged to some miles east of the latter, following the western edge of the Mackintosh valley for about seven miles through dense green "bush," which might well be called jungle. The rocks noticed here were slates and sandstones similar to those of the Dundas field, and a huge dyke of serpentine penetrating these, met with some two miles after leaving the Que River, made the resemblance of the geological structure of this district to that of Dundas still more close. The occurrence of similar slates, sandstones, and serpentines further south west on the track from Waratah to Zeehan along the Huskisson River has been previously noted in my Report on the Route of the Waratah-to-Zeehan railway. All this district between the Huskisson and Mackintosh rivers being likely country for silver-lead lodes, it deserves more thorough prospecting, especially as it is comparatively easy of access from Waratah. In one creek that was crossed on my route a large quantity of barite (heavy spar) was noticed that most probably had been broken away from a lode, and though no mineral of value was seen with it, still its common association with such should encourage further exploration in the vicinity.

MACKINTOSH RIVER DISTRICT.

On the morning of the 16th January the Mackintosh River was reached, at a point about three miles above the junction of the Sophia River with it. Here Mr. T. H. Farrell had a camp, and was engaged in opening up a deposit of Copper pyrites in a large creek running into the Mackintosh from the north side. The discovery is some 18 chains up the creek from its junction with the main river, and consists of a number of veins of quartz and copper pyrites running through a light

greenish coloured argillitic schist rock. The general strike of the country rock is about N. 10° E., and the mineral veins conform with this pretty closely, but at times are seen to cross the laminæ of the schist. In a distance of about a chain up the creek-bed three or four veins of quartz from 12 inches up to 30 inches in thickness, but of very variable size, have been observed, carrying a good deal of copper pyrites and sometimes bunches of pretty pure ore: a little malachite and cuprite are at times seen in the outcrop. Higher up the creek about two chains another parallel vein of quartz about 18 inches thick is seen, also carrying some copper pyrites, and there are several other small veins visible in the creek bed. The whole occurrence closely resembles that of the Mount Read and Mount Black deposits, the argillitic schist rock being very similar, as is also the manner in which the pyrites occurs in it apparently replacing parts of its substance. None of the veins up till now laid bare are large enough or rich enough to work, but there is a considerable likelihood of there being, as at Mount Read and Mount Black, larger and more defined pyrites bodies to be found in the same belt of schist, and when the country becomes more accessible, this will be well worth further prospecting. The pyrites in Farrell's find are said to carry both gold and silver, but, owing to the unfortunate loss of a bag containing these and other samples on my return from Zeehan, I am unable to quote assays of the ore taken for the purpose of testing.

On each side of the creek the spurs are capped with a deposit of river gravel, forming a terrace about 100 feet above the level of the Mackintosh River and 550 feet above sea level; this terrace runs for some distance along the north bank of the river, and appears to agree in altitude with a considerable extent of gravel flats seen on the south side in the Sophia River valley. In elevation these high gravels agree with some of those seen in the neighbourhood of Corinna lower down the Pieman Valley, described in my Report on the Corinna Goldfield, in which also is given an explanation of the circumstances of their deposition which goes far to account for the terraces higher up the river as well. The stones in the gravel are mostly granite, serpentine, metamorphic slate, quartzite, and mica-schist, derived from the older rocks of the upper Mackintosh basin; no gold has been yet found in them, but little if any search has been made for it, and prospecting for alluvial gold is recommended. The tracing of Farrell's find along its strike is to a large extent prevented by this overlying covering of gravel, and to develop it further it will be necessary to drive into the spurs forming the sides of the valley, following the course of the ore-veins and crosscutting at intervals. However, as the locality lies low down in the Mackintosh Valley, and is at present very difficult of access, the prospects do not seem to me to justify much mining work for some time to come. Should the railway from Waratah to Zeehan be constructed it would be possible to get a road down from it to this place by following the valley of the creek in which the ore-veins have been found: this would not probably be more than 5 or 6 miles in length, and would have a practicable gradient, and would be the means of opening up a region which promises well for future developments.

About two miles eastward from the copper deposit there is a galena discovery, on the south side of the Mackintosh on the White Hawk Creek, a large branch of the Sophia River. An 80-acre section, 892-91M, has here been granted to Mr. T. Farrell as a reward claim, and the outcrop of the lode is in the centre of it. A cut has been made from the side of the creek across the lode showing it to be about six feet in thickness, composed of soft iron oxide gossan containing a little galena on the footwall, a band of shattered country limestone containing much calcite and a good deal of disseminated galena in the centre, and on the hanging wall about twelve inches of gossan containing a good deal of very pure galena in veins through it. The lode strikes N. 10° E. as far as can be seen in its present unopened state, and underlays about 1 in 1 to the eastward. The country rock is limestone, having much the same strike as the lode, but dipping westerly; it is a hard dark blue rock with occasional large veins of white calcite, and shows at times on weathered surfaces indistinct traces of fossils, probably corals. The discovery is at present too difficult of access to be worth working, but when the country becomes better opened up it will be well worth testing by mining, as its present appearance justifies the hope that payable ore will be found. If it were on the Zeehan or Dundas field it would be worked without any hesitation. Several mineral leases have been taken up in the vicinity of this discovery, but most of them have been abandoned.

About half a mile to the eastward granite country is met with similar to that of Granite Tor and the Meredith Range. It is not known as yet if this outcrop is traceable right through to the Granite Tor, but it is probable that they are more or less connected. This is a coarsely crystalline porphyritic granite, not at all like the dense fine-grained porphyry and felsite met with in the Mackintosh below the junction of the Sophia River. The occurrence of granite increases the probability of this district being found mineral-bearing, as it is the favourite matrix of tin ores, and the country immediately surrounding outbursts of it is often rich in other metallic minerals as well. The limestones, schists, slates, &c. found in the Mackintosh in this district seem most likely to belong to the Gordon River series, and so to be portion of the great Lower Silurian system of rocks which is so notable for mineral wealth, and there is great reason to expect that valuable mineral discoveries will in course of time be made in this part of the country. All the upper Mackintosh basin requires prospecting, but under existing circumstances there is little inducement for men to go out there, as there are no tracks and the bush is very dense and difficult to penetrate, and there is little prospect of being able to send out ore without heavy expense in making roads. Should an exceptionally rich mine be found, or several very promising

discoveries be made, no doubt the country would be opened up pretty quickly, but, as is shown in the cases of Mr. Farrell's discoveries above described, it may be a long time before anything can be done with fairly good finds that in more accessible localities would at once be worked. The chance of a prospector getting a reward for his labour depends therefore either on his getting something unusually rich, or on his being able to demonstrate that the district is worth making a road into, and it cannot be wondered at that most men prefer to work in places where there is a greater probability of immediate profit. It is in cases such as this that the State can best encourage mining development and improve the public estate by cutting tracks through likely country so as to enable prospectors to get into it in reasonable time and without much expense; for if a region is made fairly accessible dozens of prospectors will explore it thoroughly where now only one penetrates at rare intervals and with great hardships. The value of the district is thus soon ascertainable, and it can be judged if it is worth the further outlay of opening by roads and tramways. The lower part of the Pieman Valley, up to the junction of the Murchison and Mackintosh Rivers, is now fairly accessible to prospectors, but from the Sophia River junction upwards it is very hard to get into. Mr. Farrell's present track is by no means an easy one, being often little better than a blazed line, and would not be the best route to follow to open up the country. A good line for a track, that might subsequently develop into a road or tramway, could be got from Meredith's Waratah-Zeehan track and the railway survey line by following down the valley of the creek in which is the copper discovery to near the main river, and then going up the valley of this, ultimately coming out about the Vale of Belvoir and joining the V. D. L. Company's track. The distance would not be more than about 30 miles and would open up the whole of the upper Mackintosh basin to prospectors. Much of the high country surrounding this basin both on the northern and south-eastern sides is fairly open and not difficult to get through, and if there were a track up the main river it would not be difficult for men to break their way out from it in all directions on to this easier country, and thoroughly explore a district which deserves much attention.

Leaving Farrell's camp on the morning of the 18th January, the Mackintosh River was followed downwards, the intention being if possible to keep to it until the mineral discoveries in the Mount Black District were reached. It will give an idea of the difficulty of penetrating this rough part of the country that, though the distance between the two places is only about eight miles in a direct line, it took three days' hard travelling to get over it; it might, however, have been done in two days had we known the right place to cross the river. From the Sophia junction down to Mount Black the stream runs in a deep gorge, with steep rocky sides covered with dense scrub, and numerous deep branch gullies furrow the slopes and make travelling very laborious. Seeing that the river, however, cuts across the general strike of the older strata of the West Coast, its gorge exposes a splendid section of the country, and one which, when thoroughly studied, must add greatly to the knowledge of the geology of the region. On this trip there was no time for more than the most casual examination, but a few features were noted that are worth recording. A short distance above the Sophia River junction blue crystalline limestone crops out in well defined strata in the bed of the Mackintosh, with strike N. 5° E. and dip to the eastward. This may be the same limestone as above noted at Farrell's galena find, the two outcrops being on opposite sides of a syncline, as is shown by their dipping towards one another. It is full of fossils, principally corals and crinoids, and I also observed what were probably *orthoceratites*. There can be little question as to its belonging to the same group as the Gordon River limestones. Calcite veins are rather common, and in some of these were seen prominent crystals of galena, exposed by the calcite dissolving from around them. In all this portion of the Mackintosh basin the strike of the strata appears to be to the east of north from 5° to 15°.

Between the Sophia and Murchison Rivers there is a rugged rocky range, which does not appear yet to have been named, terminating at its north end in a high saddle-shaped craggy bluff, which rises very steeply above the Mackintosh gorge. For this I propose the name of Mount Farrell, after the pioneer prospector of this wild and little-known district. The top of the mountain is composed of conglomerate, similar to that forming the tops of Mount Owen, portions of Mount Lyell and Mount Pearse, and it is here plainly seen that the conglomerate is a younger formation than the Lower Silurian strata visible in the river bed. It is, probably, of Upper Silurian or, perhaps, Devonian age. Not very far below the Sophia junction an igneous rock is found penetrating the Lower Silurian series; this is usually a fine-grained felstone, but occasionally shows porphyritic crystals of orthoclase, and, more rarely, hornblende, and in parts has an approach to the normal granitic structure. It may be called a porphyritic felstone with sufficient accuracy until it has been more closely examined. The whole of the gorge seems to be through this rock, down to a point north of Mount Black, and it is seen also as far north as the Que River. It lies, likewise, on the east side of the mineral sections taken up in the vicinity of Mount Black, and therefore covers a very considerable area of country. It is plainly intrusive through the Lower Silurian strata, but its relation to the conglomerates is less certain, though it seems as if they are of later formation. This large mass of felstone may possibly belong to the volcanic series from which the tuffs of Lynchford and Mount Owen, and of the Zeehan field, have been ejected. In the eastern part of the Rosebery Company's ground, and to the east of Messrs. Karlson's and Balstrup's sections, the plutonic rock has a greenish appearance and contains much hornblende, looking more like a syenite or diorite than the rock seen in the Mackintosh Gorge; but it is all probably the

same igneous mass. While crossing it on the bare rocks along the bed of the Mackintosh no signs of mineral veins were observed, and from its dense tight nature it would not appear to be likely country for lodes; still it is quite possible that they may exist. In the Silurian formation near it several mineral discoveries have been made, notably those at Mount Black, which are close to its western boundary. In the Silurian sandstone country, on its eastern side also, in the Sophia River close to where it empties into the Mackintosh, a lode of quartz about six feet wide was noticed, containing pyrites and looking rather "kindly" for gold, but owing to our having no appliances we were unable to test any of it by crushing and washing, and a sample that I brought away was afterwards lost, with my other Mackintosh specimens, as previously explained.

MOUNT BLACK DISTRICT.

Mount Black is a high wooded hill, forming the north-western peak of a range running N.W. from Mount Murchison. The north-eastern peak of the same, close to the junction of the Murchison and Mackintosh Rivers, has been given the name of Mount Sale by the engineers of the Waratah to Zeehan railway survey. On the west side of this range there is a considerable stream heading from the south-west side of Mount Murchison, which is known locally as the Koonya River. On a recently issued map of the mineral leases held in this district the name of the Stitt River has been applied to it, but the other has at least two years' local priority. The gap between Mount Read and Mount Murchison, at the head of the valley of this river, seems likely to be an important pass into the interior country to the east of Mount Read and Mount Dundas.

Of late there has been much activity in this neighbourhood owing principally to mineral discoveries in the properties held by the Rosebery, South Rosebery, and Mount Black companies, and a great many leases have been taken up. The first discovery made in the district was towards the end of 1890, when Section 3387-87M was taken up under mineral lease by the Hauraki P.A. on account of large outcrops of iron gossan running through it. Soon afterwards sulphide of bismuth was found on Section 1134-91M associated with copper and iron pyrites and fluorspar, and this section was granted as a reward claim for bismuth to Messrs. Allom and Feldheim. A little gold is known to have been found about this period, but owing to depressed times and the inaccessibility of the place the ground was practically abandoned. More recently attention has been again called to the district by the discovery of gold in the surface soil over a considerable area, and further prospecting soon resulted in the laying bare of several bodies of sulphide ore, consisting of pyrites, copper pyrites, blende, and galena, carrying gold and silver, which bid fair to become very important. They are more or less comparable with the deposits of sulphides at Mount Read, and to some extent with those at Mount Lyell.

Sections 138-93M and 127-93M.—These are adjoining sections taken up on the north and south sides respectively of the Koonya River, on the line of an ore deposit, which is seen in the bed of the stream about four chains from their eastern boundary line. The first-mentioned belongs to the Mount Black P.A. The country is a greenish white argillitic schist, like that at parts of the Mount Read mines and at Farrell's copper discovery above described, and the mode of occurrence of the ore is likewise similar to these in many ways. There is no regular lode, but rather a mineralised belt of the country rock, about 14 feet in width, which appears to be portion of the schist impregnated with pyrites, and more or less replaced by quartz, siderite, and iron and copper pyrites, specimens being said to have given returns of silver on assay of as much as 700 ounces to the ton. At times there are fairly distinct veins of quartz and siderite, containing vughs with crystals of siderite, tetrahedrite, and, rarely, apatite; these have nearly the same strike—N. 10° E.—as the laminæ of the schist country, but often cross them at small angles. They seem, however, to split up soon and merge in the mass of less thoroughly altered ore-bearing matter. The dip of the deposit is about 70° to westward, as far as at present seen. Though rather nice-looking blocks of pyritous ore are obtainable, very little of the stuff as seen by me was fit for smelting treatment without concentration, and in practical working nearly the whole of it would have to go through a mill. There is a very excellent supply of water from the Koonya River, and only two or three chains above the mine there is a waterfall between 30 and 40 feet in height, so that water-power for driving machinery would be cheaply obtainable. The ore-bearing rock strikes into the steep hillsides on each bank of the stream, and could be readily followed by tunnelling, or worked, if rich enough, by open quarrying.

Half a chain down the river there is another outcrop of pyritiferous schist not yet cut into, and some three chains further are some veins carrying blende and a little siderite, said to have given assays of 20 ounces of silver and 1½ dwts. gold to the ton. The schist in the bed of the river is much impregnated with pyrites, and ironstained on surface, and it is quite likely that trenching across it would reveal numbers of other veins. The whole belt of schist seems more or less mineralised, and judging by the Mount Read and Rosebery occurrences there is much likelihood of search along it revealing solid bodies of sulphide ore fit for mining.

The main body of stuff in the river had only been but little cut into at the time of my visit, and a fair representative sample of it was not obtainable without giving up more time than could be

spared. A sample of what was believed to be the best ore was, however, taken and sent to the Government Analyst for examination, but gave a very poor result, as follows :—

Gold, per ton.	Silver, per ton.	Copper, per cent.
Traces.	4 oz. 18 dwt.	0·9

On concentration by vanning the stone yielded 35 per cent. of its weight of sulphides, mostly iron pyrites, which gave an assay of 0·8 per cent copper, 2 ozs. 6 dwts. 17 grs. silver per ton, and 1 dwt. 15 grs. gold per ton, there being therefore a loss of both copper and silver in the process of concentration. This is a matter that will require careful attention in future. These results are very far from payable, but as some very good assays are said to have been obtained from the deposit, it is possible that my samples happened to be unusually poor. The discovery may lead to something better if followed up, and though so far it is not payable there is much reason to continue prospecting in its neighbourhood.

Duggan's Lode.—About eight chains S. 72° W. from the south-west angle of Cox and Karlson's section 58-93M, there is a strong outcrop, traceable for over four chains in length, of dark silicious lode-stuff, with oxides of iron and manganese and a little iron pyrites; but it has not been cut into, and is not known as yet to contain any metal of value. Course N. 7° W. It is evidently a fairly strong lode, and is worth prospecting. At the time of my visit there was a notice of application for lease of 20 acres posted on this lode in the name of Joseph Duggan, but the application does not seem to have been gone on with.

Section 58-93M.—In the centre of the south portion of this section there is a large gossan outcrop, consisting mostly of iron and manganese oxides with much barite. Some prospecting trenches have been cut on this by the former owners, the Hauraki P.A., and by Messrs. Karlson and Cox, who now hold the ground, and a good deal of iron pyrites has been found; but though it is plain that there is a large lode of some sort here, none of the holes have been deep enough to cut properly through the gossan capping, and a few good deep prospecting shafts are much required. This gossan seems likely to be connected with the bismuth-bearing lode in the next section to the south, and with the sulphide deposits of the South Rosebery and Rosebery holdings, for a line of lode-matter can be traced with little interruption from P. M. Balstrup's section 141-93M northward through 1134-91M, 88-93M, 59-93M, and 58-93M to the South Rosebery. Whether it proves eventually that there is only one lode along this line, or, as is more probable, that there are a number of contiguous ones forming a chain or belt, it is clear that there is a mineral-bearing zone passing through these sections, and there is much likelihood of valuable discoveries being made along it.

About five chains from the north boundary of 58-93M there is seen in a small creek a belt, over a chain in width, of argillitic schist impregnated with much galena, blende, and pyrites, and containing a great many strings of quartz. Mr. Karlson told me that a piece of the galena from one of the purer veins had yielded, on assay, 62 per cent. of lead, and 16 ounces of silver and 6½ dwts. gold per ton. It would seem as if the country schist had been penetrated by ore-bearing solutions and impregnated with sulphides and quartz along the planes of lamination, and more or less altered in parts to metallic sulphides by metasomatic replacement. Again, on the north boundary of the section, four or five chains from the north-west corner, a long trench has been cut across the same sulphide-bearing schist country, which is here capped on surface by iron oxide gossan, but in neither of these places is it likely that the material exposed at present is rich enough to pay for treatment. It would have to be concentrated, and experiments should be made to ascertain the percentage of sulphides recoverable by concentration, and the value of the concentrates so obtained, in order to know how far the treatment is possible. Sinking to some depth on the pyritiferous zones, or boring on them with core-yielding drills, is also desirable to be done, in order to find out if they improve going downwards.

Section 62-93.—This is held by the South Rosebery P. A., who have laid bare a very solid body of sulphide ore at a point about 2½ chains south of the centre of the northern boundary of the section. As usual in this district, the ore is disposed conformably with the bedding of the enclosing argillitic schist, and shows a somewhat laminated structure, the layers striking N. 20° W., and dipping N.E. 67°. In a trench cut across the ore-body the latter measured horizontally 15 feet in width, and consisted of a dense mixture of blende, galena, and pyrites, with very little schist gangue, but with a few small quartzose bands. Towards the west end of the trench the oxidised surface matter gives fair prospects of gold by panning, and contains a great deal of barite, in this closely resembling the auriferous gossan on the outcrop of the Mount Lyell Company's pyrites mass at Mount Lyell. A shaft had been begun on the hanging wall or eastern side of the deposit, but at the time of my visit it was only down a few feet, and had not long struck the hanging wall of the solid ore. A sample taken by myself, by taking chips from the shaft, and at frequent intervals from all across the ore-body laid bare in the trench, was examined by the Government Analyst, with the following results :—

Gold per ton.	Silver per ton.	Copper.	Lead.	Zinc.
4 dwt. 21 grs.	22 oz. 4 dwt. 6 grs.	0·64 per cent.	12·5 per cent.	28·0 per cent.

The composition of this ore is very similar to that of the Mount Reid Company's sulphide body, as shown by another analysis quoted below in describing the latter.

There is a fine solid body of ore exposed in the workings, and the value in gold and silver as shown by the assay is considerable: the high percentage of zinc is, however, greatly against easy metallurgical treatment. The gold and barite in parts of the outcrop are probably partially concentrated there by the formerly enclosing sulphides having been more or less thoroughly oxidised and removed in solution; it is possible, however, that richer veins of ore carrying more gold than the average may exist.

The outcrop is nearly on the top of a spur, which falls very rapidly to the north-west, the angle of slope being nearly 45°. A tunnel could be put in from this side at a depth about 150 feet below the outcrop, which would cut the lode, which dips easterly, in about 400 to 500 feet. This would be an excellent piece of work both for prospecting and working purposes, and besides testing the known deposit would run a good chance of exposing others not yet known in the same schist country further westward; it should therefore be undertaken as soon as possible. The shaft now being sunk will go at an angle through the lode from hanging-wall to footwall if continued deep enough, and if sinking should be stopped by reason of water gathering too strongly, it will be easy to cross-cut from it at whatever depth it may be possible to reach, and so well test the value of the stuff in sight. The property bids fair to be a very valuable one. In opening it out a great deal of assaying and analysis of the different grades of ore will be required, in order to know foot by foot the gold, silver, copper, and lead present, and not only these but the average percentage of zinc, as the amount of this last may determine the whole matter of the metallurgical treatment. Experiments should be made to find out how far the zinc can be mechanically separated out without serious loss otherwise, and it would also be advisable to ascertain the possibilities of extraction of the gold by cyanide of potassium.

Rosebery Mine.—The Rosebery Company hold sections 59-93, 60-93, and 61-93, and have applied for some neighbouring land in addition. Towards the south-west angle of section 60-93 there are three trenches cut in a south-easterly direction down a gently sloping hillside, in which, for a length of quite 100 feet, the argillitic schist country is more or less impregnated with iron pyrites, copper pyrites, galena, and blende, and carries occasional small quartz veins. Here the surface stuff gives small prospects of crystalline gold all over, evidently set free from the bedrock, and the question arises whether it might not be possible to crush and concentrate the latter *en masse*, it being a simple and easy matter to get huge quantities of the rock by open quarrying. To get some idea as to whether it was possible to do anything of this sort, a few samples of the schist were taken, the assay value of which was determined by the Government Analyst to be:—*Gold*, 1 dwt. 15 grs. per ton; *Silver*, 2 ozs. 2 dwts. 11 grs. per ton; and *Copper*, 0·1 per cent. On concentration by vanning the stuff yielded 57 per cent of sulphides, but the valuable constituents were lost in the process, the assay of the concentrates being only traces of Copper and Gold and 16 dwts. 8 grs. of silver to the ton. It would therefore seem hopeless to try to work this very low-grade stuff. Had it been possible to get fairly valuable sulphides by concentration something might be done, but the above test seems to show the contrary.

At the S.E. angle of Section 59–93 two trenches, running one north, the other west, show a large quantity of big waterworn boulders, forming a superficial alluvial deposit which has not been cut through. The boulders comprise conglomerate, granite, hornblendic granite, and greenish rock of dioritic appearance, which is probably from the formation above described as, in the main, porphyritic felstone, which is seen *in situ* about four chains to the eastward. The occurrence of this alluvial matter will be considered later on when dealing with other alluvial deposits on this property. Some of the boulders are of very large size, indicating the fact thereby that the stream which carried them must have been of considerable magnitude. At 161 feet west from the S.E. corner-peg of Section 59–93, we find the lower end of a deep crooked trench running on the whole north-westerly, and cutting obliquely across a large body of sulphide ore more or less intermixed with country schist. To the east of this we see black slate, but where the sulphides are found the argillitic schist above described again comes in. The strike of the layers of schist is N. 15° to 20° W., and the dip to eastward 50°, and numerous observations show that this is about the mean strike of the country throughout the district, that at the Mount Black Prospecting Association's mine being exceptional (viz., N. 10° E.). The bands of sulphides are conformable with the layers of the schist, and seem to be replacements of them to a large extent; their strike is therefore the same. Measured at right angles to the line of strike the trench exposes the following bands, counting from the hanging-wall or eastern side towards the footwall or western one:—

(1.) A somewhat irregular band of nice-looking copper pyrites with iron pyrites, rather granular, with a little schist gangue through it. Assay—*Gold*, 1 dwt. 15 grains per ton; *Silver*, 4 oz. 14 dwt. 18 grains per ton; *Copper*, 9·0 per cent.	Visible width, 12 inches, but may be wider.
(2.) Layers of pyrites and blende intermixed with a good many thin bands of schist, but on the whole mostly sulphides	Visible width, 36 feet.

(3.) Mostly quartz and black blende, but with a good deal of pretty pure galena, copper pyrites, and black sulphide of copper towards the western side. The black soft coppery matter containing galena is about 4 feet in width, and is said to have given bulk assays of about 36 ounces of silver to the ton. This part of the ore-body is more like ordinary lode matter than the bulk of the deposit, and it is noticeable that it occurs towards the centre of the latter	Width, 14 feet
(4.) Pyrites with bands of schist.....	Width, 22 feet.
(5.) Schist very heavily impregnated with pyrites, and containing layers of nearly pure copper pyrites and blende.....	Width, 9 feet.
(6.) Schist very heavily impregnated with copper pyrites, and containing nearly pure layers of this. Assay of an average sample—*Gold*, traces; *Silver*, 8 dwts. 4 grains per ton; *Copper*, 14·0 per cent.	Width, 3 feet.
(7.) Soft schist footwall with a good deal of pyrites through it, and containing some solid layers of sulphides of iron, copper, and zinc	Seen for a width of over 12 feet; total width unknown.

The assays just quoted were made by the Government Analyst, Mr. W. F. Ward, from samples taken by myself. He also made assays of samples of the pyrites and blende taken from all along the trench, the two minerals being separated from each other as much as possible in picking the samples. The blende gave 3 dwts. 6 grains *Gold* and 5 oz. 9 dwts. 10 grains *Silver* per ton, also 0·4 per cent. *Copper*, 5·0 per cent. *Lead*, and 48·4 per cent. *Zinc*; the pyrites, 3 dwts. 6 grains *Gold* and 3 oz. 5 dwts. 8 grains *Silver* per ton, also 0·3 per cent. *Copper*, and 2·4 per cent. *Zinc*.

The trench, 162 feet long, exposes a width of 86 feet of ore-bearing material, measured at right angles to the strike. It is not quite deep enough to cut well into the solid ore-body, the surface covering of gossany matter with enclosed heavy waterworn boulders having proved rather thick, averaging from eight to ten feet deep. A little gold is found throughout this superficial matter. The ore deposit requires cross-cutting from the black slate hanging wall westwards into the argillitic schist footwall as far as the latter shows any considerable impregnation with pyrites, as it appears at times to contain solid layers that might be payable to work.

At the time of my visit a shaft had been begun on the hanging wall side, and it was intended to sink about 50 feet, and then drive westwards across the ore; this would be a very good way of testing the deposit. In cutting through it the stuff should be constantly assayed and tested in various ways to ascertain the best method of metallurgical treatment, and great attention should be paid to noticing how far it is possible to separate the different layers of ore during working in order to get the various sorts of sulphides as much as possible each by itself. If no attention is paid to sorting the ore, it seems likely that the bulk will contain too much zinc for easy metallurgical treatment, but there seems a great likelihood that, with a little care, different classes of ore might be obtained, thus :—

(i.) Copper pyrites and cupreous iron pyrites.
(ii.) Galena.
(iii.) Blende.
(iv.) Mixed sulphides of copper, iron, lead, and zinc, not separable by hand-picking.
(v.) Poorer ore, consisting of intermixed schist and sulphides, requiring concentration.

Experiments should also be conducted to ascertain how far the ore is suitable for separation of its various metallic sulphides by processes of ore-dressing. In some parts the mixture of sulphides seems so intimate that it is probable that the separation by mechanical means must necessarily be attended with heavy loss, but in a great deal of the ore there should not be very much difficulty in getting fairly clean products of each. The bulk values will necessarily determine how far work of this sort can be expended upon the ore with profit. It may be here noted, that in the case of the highly zinciferous sulphide ore of Broken Hill, New South Wales, of all the methods that have been tried, the separation of the constituents by wet concentration has come nearest to being a success, obtaining a profitable smelting product, though at the loss of a very considerable percentage of the originally contained silver.

There is evidently a large ore-body here, and huge quantities of stuff could be cheaply mined by open quarrying without underground works, while a tunnel for access and drainage at lower levels could be put in from the west side at a considerable depth : this would test the argillitic footwall also for other parallel deposits. The surface soil contains a little gold all over the ore-body,

not much, but enough to help to pay for stripping it off and exposing the bed-rock. As will be seen below it is probable that the ore found in the alluvial workings to be mentioned presently, which is much harder and more solid, and also has given much better assay returns than that seen in the above described trench, comes from a portion of the ore-bearing belt some distance further to the north: it is therefore advisable to trace it northwards by numerous shafts and trenches and by stripping the surface of vegetation and soil where possible. By so doing there would be an excellent chance of finding the source of the good ore boulders. The property is very likely to become an important mine, but to be profitable it will have to be worked on a large scale, as complicated metallurgical processes will be required for treatment of the ore that cannot be thought of on a small scale. Hence it is most necessary that the preliminary examination of the proposition should be most thorough in order that no mistake should be possible either as to the quantity of ore available, its value, or the methods by which it is to be reduced. It will therefore be requisite for the owners to first of all prove that a large enough quantity of ore exists for keeping a large metallurgical plant going for a reasonable time, and to demonstrate that the values in sight are such as will yield a profit on the mode of treatment required. This means a very considerable outlay in proving the mine before any return can be expected. The prospects, however, to my mind quite warrant this preliminary expenditure, as there is much reason to believe that it will result in showing that the deposit can be profitably dealt with.

On the 5-acre section, 61-93, there is a very interesting deep alluvial deposit on which a good deal of work has been done. Commencing at a point about 100 feet south of the southern boundary and 4 chains west of the S.E. angle, a cut has been taken in westward for a distance of about 150 feet. The bottom rock at first met with was white slate, not appreciably pyritiferous, but before going far this dipped westward underfoot at an angle of about 1 in 1, and for the remainder of the way the cut was in drift material and not bottomed. Another cut was then driven northward along the eastern edge of the old channel a distance of some 70 to 80 feet, but did not reach the gutter. In the north end of this the alluvial matter is 40 feet in depth. The wash is composed of well waterworn boulders, many of them very large and heavy, of conglomerate similar to that on Mount Farrell and parts of Mount Read, and from the porphyritic felstone formation, some of these having quite a syenitic, others a dioritic appearance. Stones of jasper, sandstone, and quartzite are also common. Through the gravel are found large numbers of well waterworn boulders of metallic sulphides, blende, pyrites, galena, and copper-pyrites, and laminated solid mixtures of all these minerals. The blende stones are especially numerous, the stuff being very dense and solid. A little Fahl-ore is also said to have been found, and boulders of micaceous iron are not uncommon. One of the galena boulders is reported to have given assays of 80 ounces silver to the ton. All these metalliferous stones are very heavy, and it would require a strong current of water to cause them to move, but the whole nature of the drift shows that the stream which deposited it must have been a large and swiftly flowing one. The lead has been traced to the north-west over 20 chains, but has been very little prospected; it seems worth testing more thoroughly. An effort should be made to drive into the gutter somewhere below the Rosebery workings, and then to follow it up. The lead seems to run along the foot of a spur which separates the alluvial workings from those on the sulphide body in Section 59-93, so it seems probable that the metallic boulders have come from further north than the latter, very probably down some branch lead running south-westerly. Prospecting up the lead would not only look for gold, but also would probably soon determine pretty closely the position at which the sulphide boulders come in; in the few shafts sunk higher up the lead they have not been observed in any quantity. Where these stones have come from the ore-body is evidently very solid, and as the assays of them have given very fair results, much better than those quoted by me above from the southern find, it is highly desirable to make every effort to find their source.

It is rather curious to find a deep lead in this position, situated as it is on the slope of the country from Mount Black into the Pieman River, and apparently cut off at both ends. As there is evidence lower down the Pieman however (see Report on the Corinna Goldfield) of the river systems of the country having formerly run at a much higher level than at present, it is not at all improbable that this large channel is an old bed of the Pieman River itself. At the bottom of the Rosebery alluvial workings an aneroid observation gives the height above sea level as about 700 feet, so that this gravel deposit corresponds very well in elevation with the high gravels of the Lucy Spur and Brown's Plains. Since the time of their deposition the river has cut deep down into the country, and there has been great erosion of the slopes of its valley, so that it is not surprising that only a small portion of the old high channel has been preserved. The other heavy gravel deposits seen in Section 60-93 probably had some connection with the same old river system.

Near the head of the lead, to the N.W. of 61-93, there is a large flat round valley, where a very good dam could be built without much expense. This opportunity of storing water would be of much service for working the lead or for power purposes in connection with mining.

Scott's Application, 191-93M.—In a section, not surveyed at the time of my visit, lying N.N.W. of the Rosebery blocks, the same line of pyritiferous schist country is again met with. In a small creek, at the top of a little waterfall, some nice solid bands of pyrites were observed, and there is

an excellent opportunity for proving the ground by driving a tunnel under the fall quite a short distance. Two or three specimens of the pyrites were sent by me for assay to the Government Analyst, the return being—gold, a trace; copper, traces; silver, 6 dwt. 12 grs. to the ton. The country here appears to be merging into the black slate seen in the eastern wall at the Rosebery workings, so it is probable that the bulk of the ore-bearing formation lies more to the westward. A trench up the creek, or a tunnel, would prospect it very easily. Further east we get angular boulders of igneous rock of dioritic appearance, probably again the fringe of the porphyritic felstone formation.

Sections 59-93M, 88-93M, 1134-91M, *and* 141-93M.—It has been already remarked that the zone of mineral matter running through the Rosebery and South Rosebery sections seems to be continued southward through Sections 58-93M, 59-93M, 88-93M, 1134-91M, and into 141-93M. Very little work has been done along the line, but there are a succession of outcrops of lode-matter all along it, which can easily be followed, as the ground is free from bush. There seem to be three or more parallel lines of lode, in a width of about 2½ chains. About three chains north of the centre of the southern boundary of 59-93M two shallow cuts have been made into the middle lode, showing it to be over 6 feet in width. Strike N. 15° W., dip easterly 56°. The lode is made up of parallel layers of quartz and silicified country rock, with much tourmaline in minute crystals; there is a great deal of iron pyrites, some copper pyrites, and in one vein quite a large quantity of sulphide of bismuth and copper pyrites in a matrix of purple and greenish fluorspar. Wolfram and chlorite are also seen in some parts of the lode. Assays are said to have given a little silver and gold in this lodestuff, but so far the most valuable metal present seems to be the bismuth. The mixture of bismuth and copper pyrites with fluorspar would probably sell well to smelters on account of the fluxing properties of the fluorspar, and in some of the stuff the quantity of copper and bismuth that would be obtained is considerable. The lode has not been opened out enough to allow one to form a very definite opinion as to its value, but there is a very good prospect, and every inducement to go on working to develop the mine. The bismuth-bearing vein seems to be from six inches to twelve inches in thickness. Though this deposit appears to conform to the stratification of the country (argillitic schist), the nature of the veinstuff is quite of the fissure-lode character, especially the fluorite vein, and there can be no hesitation in referring the occurrence to this class. It is interesting to speculate upon the possibility of similar defined veins being found in depth beneath the sulphide bodies and pyritiferous schists further north on this same mineral zone. The fluorspar, tourmaline and wolfram found in this lode are more usually associated with tin ores than with those of silver and gold, and it is possible that cassiterite will yet be found. Mr. J. G. Stitt, of the Zeehan School of Mines, informed me that tin ore had been found with some of the alluvial gold got on the Rosebery property. In this connection the occurrence of gold, silver, tin, and copper all together in the Commonwealth Company's pyrites lode is noteworthy.

To the west of the cuts on the middle lode there is another outcrop containing much oxide of iron and dense silicious tourmaline rock, and on the east side there is also an outcrop showing iron oxide and tourmaline. To the southward the outcrops are usually quartz densely impregnated with tourmaline, occasional micaceous iron ore, and sometimes magnetite; in one, in Section 1134-91M, a little carbonate and sulphide of bismuth were observed. The general strike of the outcrops to the southward is S. 7° E. Most of the line is in rather low-lying country, and to get any depth on the lode shafts would be required. From the cuts in Karlson's section there is considerable flow of water, so that it is not unlikely that pumping machinery would be required in sinking.

All the way along the line of lode the igneous porphyritic felstone rock is seen quite a short distance to the east, and is strongly developed in Section 141-93M. In parts it has a somewhat schistose structure, and there is a possibility that when minutely investigated it may prove to be really a highly metamorphic rock instead of an igneous intrusion; it seems most likely, however, to be the latter, probably somewhat altered along its contact with the schists by partial fusion and assimilation of their material. Though the igneous rock is not in direct contact with the lode so far as seen, it is very probable that there is a close connection between the occurrences, the way that the line of mineral matter runs parallel and close to the contact being probably more than a coincidence.

Section 96-93M.—I was unable to visit this section, which lies mostly on the western slope of a long spur running down from Mount Read. Very little work has been done, but there is said to be a very large outcrop of magnetite discovered. Sections have been taken up along a line from this northwards to the Mt. Black P.A.'s find, and it may be that there is another line of lode parallel to the Rosebery line running through here.

In the neighbourhood of the Mt. Black deposit the schist dips westward, and along the Rosebery line it dips eastward. It seems rather likely, therefore, that the argillitic schist found along both is in reality the same bed seen on opposite sides of an anticline. If further observations, as the country gets more opened up, confirm this hypothesis, it may have an important bearing upon the theory of how the mineral matter has been deposited. It will also be important to trace the argillitic schist country northwards and southwards. To the south it probably connects

more or less directly with the line of similar country seen in the Mt. Reid and Hercules mines, and on the north side across the Pieman River it is said to reappear again, and to carry auriferous pyrites in some quantity. Burning off the bush along the pyritiferous zone is much required, as it would assist prospecting immensely.

The Mount Black district, as will be seen from the above description, is still in a very undeveloped stage, but discoveries have been made which give promise of its being an important mining centre. Since my visit several very important developments have been reported. None of the mines can be said to be yet far enough advanced with their preliminary operations to make it certain that they can be profitably worked, but their prospects are so good that there is great hope of ultimate success, and every reason for perseverance in their development. Most of the country is yet densely wooded with almost impenetrable scrub, and as this gets cleared off there is little doubt that other discoveries will be made, and that it will become more clear what are the best routes for tramways and water-races, and the best positions for shafts and tunnels. It must be remembered that till very lately the locality was inaccessible to horses, and all provisions and stores had to be carried on men's backs from the Grey Ore Camp on the Ring River: within the last three months, however, a track for pack-horses has been cut from the Rosebery mine to the Grey Ore to connect with the Government track from Dundas. Still even now it is inaccessible for any heavy machinery or anything that cannot be carried on horses. Opening up a new district under such conditions is a matter of time, but it should now be possible to do enough work in the way of sinking and tunnelling to prove the ore-bodies thoroughly. When they come to the next stage, that of requiring machinery for raising and reducing the ore and of sending out the marketable product, — and I have much confidence that this will be reached before long, — the question of means of transport will become of great moment. Much will depend on whether there is any prospect of construction of the proposed Waratah-to-Zeehan Railway. Several lines were surveyed for this, and from information given to me by one of the engineers engaged on the work and other sources, I gather that the best route found was as follows:— Leaving the Emu Bay to Bischoff line at the 40-mile station, the line would run south over very easy country to the head of the Que River, thence along the divide between the Huskisson and Mackintosh basins to the head of a large creek running into the latter, which creek was followed down by the survey nearly to the main Pieman River. The north bank of the latter was then followed and turned out to be on the whole rather easy country, there being for long distances a sort of high terrace, perhaps 200 feet above the river, which gave a good route. The site chosen for crossing the Pieman was some little distance above its junction with the Ring River, this being considered preferable to the first one surveyed, which was just above the junction of the Huskisson. From the crossing the line would run to the Argent River near the Renison Bell mine and thence follow the Argent valley up to the Razor-back hill on the North Dundas road, where there would be a tunnel through to flat easy country leading in to the junction with the Strahan-to-Zeehan Railway at Zeehan. The portion of the line from the tunnel to the Pieman crossing is said to be the most difficult in the whole route, but none of it is in reality very formidable, though the tunnel and the Pieman Bridge are necessarily heavy items. This line is quite close to the mines of the Mount Black district, being not more than a mile west of them on the opposite side of the river, and if it should be constructed it would be by far the easiest outlet to the district, giving communication both with Burnie and Strahan, the line being somewhere about 65 miles to the former and 45 to the latter. From a point about opposite the Rosebery claim some 16 miles of line would be required to connect with the Zeehan-to-Strahan Railway, and about 25 to join the Waratah-to-Burnie one. It would probably be cheaper to build the line to connect with the Waratah Railway than that to Zeehan, the latter including the worst country, and the Pieman, Ring River, and Argent bridges, and the tunnel, and if freights per mile were equal on the two lines it is questionable whether the advantages of Burnie over Strahan as a shipping port would not counterbalance the somewhat longer traction. It has yet to be ascertained if the line could be brought up the south side of the Pieman instead of the northern one, so as to make the main river crossing somewhere near the Mt. Black field: I should think that it is practicable enough, though probably more costly than on the easier country on the north side, which is not so much cut up by big creeks. Should this variation of the route not be found advisable, the difficulty would remain that the mines would be on the south side of the river and the railway on the north, and a second bridge would be required to connect them. As the Pieman runs in a deep gorge and is subject to great rises during floods, the bridge to cross it will have to have long spans to allow of free passage of the enormous drift timber that comes down, and must be at a rather high elevation, and will consequently be a heavy undertaking. It would probably be better, therefore, to spend more upon the section of the line on the south side, and have only one big bridge close to the Mt. Black mines than to have two bridges. Till surveys have been made to determine exactly what is possible in this matter it is premature to be positive as to the best way of overcoming the difficulty. Crossing the river near the junction of the Koonya River would, however, have two very great advantages that have not yet been mentioned: firstly, it would permit a branch line four or five miles long to be made up the leading spur which runs northward from Mount Read, which would serve the Hercules, Mount Read, and neighbouring mines; and secondly, a branch could be run up the Koonya Valley through the low pass between Mounts Read and Murchison into the likely line of country connecting Mount Lyell and Mount Read. From my knowledge of the country it seems to me probable that both these

lines could be constructed without the use of steep grades, but of course surveys might show that the Abt or some other similar system might have to be adopted. The branch to Mount Read would be right along the belt of argillitic schist which seems to be the matrix of all the large sulphide ore deposits. Should the lower crossing of the Pieman, as at present surveyed, be adhered to, and should it prove that a second bridge to connect with the Mount Black mines would be inordinately expensive, it would not be very difficult to construct an aerial tramway as a temporary measure which would be capable of carrying the ore to a reducing-works close to the railway on the north bank, and strong enough also to take in all the machinery required for mining, milling, and concentrating on the south side. A tramway could still be constructed to Mount Read to help to feed the railway.

Leaving the railway out of account, what would be the best way of connecting this field with Zeehan? The experience that has now been gained has proved that under West Coast conditions there can be no hesitation in deciding that tramways must be chosen in preference to ordinary roads, as the latter cannot be made of a character to stand heavy traffic except at an inordinate cost. Light railway lines, such as the Western, Tasmania Crown, and Oceana tramways, are far preferable, and are very suitable for the country, as they permit the use of pretty steep grades and sharp curves. Three routes seem to be practicable; first, down the Pieman to connect with the Owen Meredith tramway; second, following the route of the present pack-track; and third, over the Ring River Deep Lead saddle. The first has the advantage that if the Waratah-Zeehan line should be constructed it would intersect it, but for present purposes it would be a very roundabout route, and further, would necessitate the use of the Owen Meredith tramway, and its probable purchase and partial reconstruction; also, as this tramway terminates on the North Dundas Road, a further section would have to be constructed to connect with Zeehan or with the Zeehan-Dundas line. The second and third routes would have their first section in common, from Zeehan or some point on the Zeehan-Dundas Railway up the Madame Melba Creek to a saddle on the divide between the Argent and Henty watersheds, thence down into the Ring River Valley to somewhere near the Grey Ore mine, following very much the route of the present corduroy pack-track. This section might prove difficult of construction, as a rather high saddle has to be got over. From the Grey Ore mine the two proposed routes would diverge, one running northward along the western slope of a big hill separating the Ring River basin from that of the Natone Creek, and gradually working round it and across the head of the last-named stream, the other running up the Ring River past the alluvial gold workings and across the Deep Lead Saddle to rejoin the former route near the head of the Natone Creek, thence running on to the Rosebery mine. Either of these routes would open up promising country, but the latter one seems at present to have the better line as regards ground known to be mineral-bearing, as it goes past the Fahl Ore mine, near Curtain's new discovery of argentiferous bismuth, and through the Ring River gold workings, the deep lead of which is sure to be sooner or later worked. It would also be easily connected with the Hercules and Mount Reid Co.'s workings by inclined or aerial tramways. The importance of the whole district thoroughly warrants the construction of a tramway, and until one is made there can be no hope of real development, as the expense of getting in machinery and supplies and sending out ore on pack tracks is quite prohibitive. I would strongly recommend that surveys should be at once undertaken to determine the best route for a tramway to open up this part of the country, and that the line should be made as soon as possible. This tramway would be a most useful one even if the Waratah-Zeehan line were constructed, as it would serve a lot of valuable country that the latter does not readily command. The route up through the Ring River goldfield would be preferable to the more northerly one following the pack-track to Mount Black, for the reason that it would not interfere with the Waratah-Zeehan line, if for no other.

The mines of the Mount Black district are fortunately situated in respect of supply of water and water-power, for not only is the Koonya River a very considerable stream, capable of affording a good supply for most purposes, but also the main Pieman River itself is close at hand. It runs in a succession of rapids and must therefore have a considerable fall, so that water-races could be made to take water from it without having to go very long distances. According to my aneroid measurements the fall in the river between points opposite Farrell's discovery and the Rosebery mine is about 300 feet in a distance of probably 15 miles. This would not allow of high pressure water being obtained without going a long way for it, but the volume of the stream is so large that great power could be developed by the use of large quantities of water under lower pressure; numerous large creeks are also available. The Pieman lying very low down in the country, the best way of utilising its power would be by electricity, a generating station low down in the gorge sending power through wires up to the mines and mills at higher levels. The availability of the splendid supply of energy existing in the Pieman River is sure to be a great factor in the development of the district.

The metallurgical treatment of the mixed sulphide ore of these mines, as above indicated, will require much experimenting and consideration; it will probably resolve itself into dressing the ore by hand-picking and by machinery into copper, lead, and zinc-bearing products and smelting of each separately. The high percentage of zinc in much of the ore is the most formidable difficulty now in sight, but there is reason to hope that it can be got over to a large extent by dressing, and in any case, in the present undeveloped state of the mines it is not necessary to regard it too seriously, as

further exploration may render it of little account. It would be advisable also to have well-conducted experiments made with the cyanide process, for though this is generally regarded as unsuitable for sulphide ores containing copper, still good results are in some cases obtainable, and it might prove possible to attain success by this line of investigation in dealing with the portions of the ore unfit for smelting. The possibilities of chloridising roasting and lixiviation with hyposulphite (thio-sulphate) solutions should also be considered.

MOUNT READ DISTRICT.

It is only about 4 to 5 miles from the sections near the Rosebery mine to those in the vicinity of the Mount Reid Company's workings, but to walk from one to the other is not at all an easy matter as yet. The western spur of Mt. Read may be followed all the way, but there is no regular track, and progress is slow and difficult. It was my good fortune to meet with Mr. F. Brennan, who was kind enough to show a blazed track through to the Ring River alluvial workings, which could easily be improved into a pretty fair route. This track goes up the western spur of Mt. Read as far as sections 106-94 and 107-94, then turns off and crosses the Deep Lead Saddle to the Ring River workings; from these there is a good but very steep track, not passable for horses, up to the Mount Reid mine. Between the Ring River settlement and the top of the track there is a rise of some 1800 feet.

Sections 106-94 and 107-94.—On one of these sections a few shallow holes have been sunk on a not well defined reef of quartz and oxide of iron striking about N.N.E., from which prospects of gold are reported to be obtainable. Not having any tools I was unable to test the reef on the spot, and some specimens brought away for assay were lost with my Mackintosh River samples.

Near this place there was a lot of conglomerate on the top of the spur, probably a small remnant of a much larger sheet formerly connected with the Mount Farrell and Mount Owen beds; it appears to overlie the schist formation unconformably.

Ring River Alluvial Workings.—Very little is now being done at the Ring River, mostly on some of the higher terraces, and in rewashing the bed of the river for the third or fourth time. A few men still manage to make a living. The project of further testing the deep lead where it runs under the shaly clay described in my last Report has not advanced since then, the impossibility of getting pumping machinery on to the ground until roads or tramways are made being the great obstacle. It is still my opinion that the best way of attacking this lead would be from the north side of the saddle, where the outlet into the Pieman Valley ought to be able to be found. The deep lead seems likely to be well worth opening up, and further pospecting is sure to be undertaken some day; were there a tramway into the district, as suggested above, the enterprise would probably very soon be gone into.

Mount Reid Mine, 3302-87M.—This lies near the top of Mount Read, at an elevation of 2850 feet above sea level. The ore-body is in many respects like that at the Rosebery mine already described, consisting of sulphides of iron, copper, zinc, and lead, carrying gold and silver, impregnating and replacing argillitic schist rock, and forming frequently solid layers of ore of considerable size, which preserve a laminated structure conformable with the enclosing schists. In my former report the theory was favoured that the sulphides were contemporaneous in formation with the enclosing rock, having been laid down as sediments at the same time as the materials of the schists, but after examining the better exposures now available, and the ore-bodies of the Mount Black district, I now think that this explanation is untenable, and that the true one is that the sulphides have been introduced in solution, and have replaced portions of the rock by metasomatic change; and if this is the case in these instances it probably is also true for the exceptionally large and solid ore-body at Mount Lyell as well. Towards the south end of the Mount Reid deposit there is much quartz and chert, evidently closely related to the ore, which reminds us of the huge masses of quartzite found in the West Mount Lyell Company's ground on the strike of the big pyrites body. These silicious masses are much more readily accounted for the theory of metasomatic replacement than by that of original deposition.

The deposit has been more or less opened by surface stripping and trenches for a length of seven or eight chains, and proved to be upwards of 100 feet in width. This is not saying that there is 100 feet of solid ore, but that for about 100 feet in width the schist seems more or less heavily impregnated with sulphides, and often contains strong layers of them of considerable thickness, very free from gangue. The northern end has been well laid bare by the surface soil having been sluiced off by alluvial diggers, who obtained a good deal of gold by so doing, and in the southern portion there are several trenches. The general strike appears to be from N. 15° W. to N. 20° W., dip easterly about 70°, but in the south end it is only about N. 10° W., the line of strike curving more to the west going northward. The surface of the ground at the southernmost trench is about 185 feet higher than at the north end, so that a tunnel driven from the latter point along the course of the ore would attain a considerable depth before going very far, and in working large faces could be opened as quarries; by going westward deep tunnels could be taken in from the steep slopes into

the Ring River valley. The ore varies a good deal in different parts: in places there is much galena, elsewhere blende predominates, and at other parts we get bands of pretty pure pyrites containing more or less copper. As at the Rosebery and Hercules mines, there are also banded ores consisting of intimately mixed layers of all these sulphides. Much of the ore is very free from gangue, but most of it is too much a mixture of minerals to be directly treated by smelting, the large quantity of blende being very deleterious. It will be necessary to separate the different minerals as much as possible when mining them, and to get rid of as much of the blende as practicable by concentration.

Two shafts have been sunk, each about 25 feet deep, but these were full of water at the time of my visit: they were towards the footwall of the ore body, and a large quantity of very solid laminated ore containing a good deal of galena had been raised; there was also a good deal of gossany ore containing considerable cerussite and giving very good assay results for gold and silver. In the gossan the small quantities of gold existing throughout the sulphides are concentrated to a great extent, just as at the Mount Lyell mine. A good deal of this gossan has been put through a small 2-stamp battery with very successful returns.

In order to test this property thoroughly it will be necessary to do a great deal more work than has yet been done, and constant assaying of the sulphides will be required: I understand this is now being done, a new shaft being sunk and the stuff brought up assayed every day. The returns that have been obtained show a valuable deposit of somewhat low-grade ore, difficult of treatment on account of the amount of zinc obtained, and requiring extensive and expensive dressing and reduction works for the extraction of the valuable contents. It is therefore incumbent on the owners to follow the good example set by the Mount Lyell Company under similar circumstances, and systematically lay open and test the ore-body, so as to prove the existence of large tonnage of stuff of ascertained value. It is clear that the amount of ore present is very large, and the assays of the superficial portions show an average value which, though small, can probably be recovered with profit, but still more definite proof of the continued value of the stuff in depth has to be obtained. By further prospecting, also, there is hope that rich secondary deposits may be unearthed similar to the one which has proved so serviceable to the Mt. Lyell Company. While going over the mine I took from all parts of it a large number of chips of ore that would give something like an average of the stuff now in sight, and this sample has been tested by the Government Analyst with the following results :—

Gold per ton.	Silver per ton.	Copper.	Lead.	Zinc.
dwts. grs.	ozs. dwts. grs.	per cent.	per cent.	per cent.
4 21	17 14 10	0·72	12·8	26·4

The sample was taken for the purpose of getting some idea of the average value of the ore, but practically speaking it would never go in this shape to the reduction works; the different sorts of ore would be kept each by itself as far as possible, and the assay value of each would have to be found out. There can be no doubt that the Mount Reid mine bids fair to be a valuable one, and that the difficulties of treatment of the ore will either disappear as development proceeds, or else be eventually overcome. It may be noted that the average value of the Mount Reid sulphides shown by the above test is considerably higher than that of the zinciferous sulphide ores of Broken Hill, New South Wales, which are now being handled with some success, and from inspection I should anticipate less difficulty also in mechanically separating out the deleterious blende. Every effort should be made to open the mine out thoroughly, and to investigate carefully all the conditions governing the metallurgical treatment.

Hercules Mine.—The principal workings of this Company are on J. Will's Section 100-94, lying a little over quarter of a mile N.N.W. from the Mount Reid deposit. From the strike of the two it seems probable that the Hercules ore-body is not a direct continuation of the Mount Reid one, but a parallel deposit lying more to the east, a feature very noticeable in mining districts in other parts of the world where similar pyrites lenses have been worked. The ore-body discovered on this property had been found only a short time before my visit, and there had not been much time to open it up: a trench had, however, been cut in the direction S. 75° E. across the ore for a measured distance of 32 feet, revealing a very solid mass of dense sulphides very free from gangue, the mixture consisting of galena, blende, and iron and copper pyrites. The ore has a laminated structure parallel to the layers of the enclosing argillitic schist: course at this trench N. 35° W., dip to N.E. 67° The deposit is capped with oxide of iron gossan, which gives very good prospects of gold when panned off, several tests tried at different parts all giving payable results in my trials. The gossan seems to extend over a considerable area, but the dense bush prevented an estimate of how much being formed at this stage, and there had not been enough holes sunk through it to give any idea of its average thickness: it can be said, however, that the quantity is considerable and valuable. The discovery is on the slope from the western spur of Mt. Read down into the Ring River, and the ground falls very steeply for over 1000 feet: a better location for testing and working by means of tunnels could not be chosen. A tunnel is now, I understand, being put in to cut the ore at some depth. Since my visit I have been informed that the trench has been continued eastward some distance, showing the ore-body to be much wider than when it was seen by me, and

a valuable belt of ore was found in which the blende, galena, and copper pyrites instead of being intimately mixed as in the western portion, were in thickish veins separate from each other, permitting the easy picking out of each sort of ore. Specimens of very clean galena, pure blende, and pure yellow copper pyrites have been shown to me from this discovery, some of the galena being reported to assay 80 per cent. of lead and 50 ounces of silver to the ton. The ore shown to me was fit for immediate bagging and shipment. I am not aware, however, of my own knowledge of this new development, and cannot vouch for particulars as to the size of the veins. Samples of the mixed sulphide ore from all along the 32 feet of trench seen by me, and fairly representing the bulk then in sight, were taken by myself, and have been analysed by the Government Analyst with results following :—

Gold.....	4 dwts 21 grains per ton.
Silver	5 oz. 1 dwt. 16 grains per ton.
Copper	0·9 per cent.
Lead	13·5 „
Zinc	28·8 „

These figures are very similar to those above quoted as averages of the South Rosebery and Mount Reid deposits. Near the middle of the same section, somewhat to the east of the line of the ore-body, a small gossan vein has been cut on the side of the track that gives remarkably good results in gold both by panning tests and fire assays. When I saw it this was only 1½ inches thick, but it is said to have widened out since very much on being sunk upon. The vein lies in the strike (here N. 15° W.) of the schist country, and probably represents the oxidised outcrop of a sulphide layer. The first assay from it is reported to have given 9 ozs. 11 dwts of gold and 123 ozs. of silver to the ton. To check this I myself took a sample from the vein, and the Government Analyst obtained from it an even higher assay, viz., 13 ozs. 14 dwts. 21 grs. of gold and 188 ozs. 19 dwts. 21 grs. of silver to the ton. It has lately been reported in the newspapers that 80 bags of this ore have been sampled and given as good results as the above.

The Hercules mine seems a most important discovery, and its development will be watched with great interest. The sulphide body is very large and free from gangue, and in a most desirable position for cheap mining, and the large quantity of auriferous gossan not only is itself a valuable asset, but also gives testimony as to the gold present in the sulphides from which it is derived. It would be well worth while for the owners to have some parcels of the gossan packed out and sent to a testing works to be tried by amalgamation in pans, with help of heat and chemicals, according to the methods very successfully practised in many mills of the Comstock and other districts of the United States and elsewhere, for treatment of mixed gold and silver ores. It is probable that a high per-centage both of the gold and the silver contents could be extracted by this process with very little cost, and as the plant required is not very expensive, and could be laid on the ground even under existing conditions of transport, the owners would be enabled to deal with this portion of the mine's product so as to get an immediate return from it. From a purely technical point of view it would be very undesirable to do anything with the gossan ores except smelt them with the sulphides, and if the owners can see their way to open the property and provide it with the large and expensive plant required for dressing and smelting the ore, without dealing with the gossan in the meantime, it would be best not to attempt amalgamation. In view of immediate necessities, nevertheless, it is advisable to find out by practical trial on the working scale what success is attainable by simply milling with mercury. At Mount Lyell the ordinary battery treatment was not at all successful with the gossan ore, the tailings containing over 50 per cent. of the original values, but though Wheeler pans were used there to some extent, the usual methods of pan amalgamation suitable for mixed gold and silver ores were not practised, and from the nature of the stuff both at Mount Lyell and Mount Read much better results may be confidently expected from proper milling in pans than from the ordinary battery.

Barlen's Section 30-92.—This lies due north of Will's Section, and near the middle of it a tunnel has been driven easterly a distance of about 80 feet through argillitic schist containing much pyrites. Two or three bands of pretty pure pyrites have been cut, one of them about two feet thick. The strike of the country in the tunnel is N. 35° W., dip N.E. 72°, so that it is probable that the line of the Hercules ore-body is farther to the westward than the present workings in this section. Being on the steep slope to the Ring River Valley, this ground could be easily proved by tunnelling.

The pyrites up till now found in this section is of little value, a sample taken by myself and tested by the Government Analyst yielding only 1 dwt. 15 grains gold and 2 ozs. 9 dwt. silver per ton, with 0·4 per cent. copper. As in the cases of some of the pyrites from the Mount Black and Rosebery mines, quoted above, there is no improvement by wet concentration, but a heavy loss instead, the trial yielding 63 per cent. of sulphides recoverable by vanning, which showed on assay only traces of gold and copper and 1 oz. 11 dwt. 1 grain silver per ton. These examples emphasize the necessity of having careful trials made of the suitability of the ore for wet concentration in the case of the larger and more important deposits as well.

A little south of the tunnel on the track to the Hercules a vein of barytes is seen with a little galena, blende, and pyrites associated, apparently crossing the laminæ of the schist somewhat; as this is of the nature of a lode, it should be cut into and examined.

Sullivan's Reward, Sections 2-92 *and* 3-92.—These lie right on the top of the western spur of Mount Read, immediately east of Barlen's and Will's holdings. A tunnel has been driven 114 feet eastward under the crown of the ridge, on which there is an irregular-looking outcrop of ironstone and somewhat silicified country rock. Several small veins of iron pyrites were cut in the tunnel, but nothing of any value. On surface there are many veins of oxide of iron, probably originally pyrites, through the country (argillitic schist), and a little gold is said to be obtainable in some of these. The strike of the schist here is N. 20° to 30° W., and dip to eastward 60° to 70°.

The discoveries at the Mount Reid and Hercules mines are so important that there should be every expedition used in opening up the district so as to enable machinery to be brought into it. There is a good deal of ore now obtainable which would find ready sale to the ore-buyers in Zeehan if it could be sent in cheaply, but which is not good enough to leave any profit after paying expenses of packing. As the ore bodies are striking obliquely across the slopes of the hill downwards into the head of the Ring River valley and as successively lower working tunnels must be from this side, and further, as the only available water supply for power and concentration purposes close at hand is the Ring River, it is pretty clear that the works for treatment of the ore must be situated in the Ring River valley. The only alternative seems to be to take it by a railway down the spur to works near the Koonya and Pieman Rivers in the Mount Black district, and if the Waratah-Zeehan railway were constructed this would be worth consideration. The advantages of the Mount Black district in the matter of water supply and power have already been considered. Supposing works to be established in the Ring River valley, the steep slope of the ground down from Mount Read is most favourable for cheap lowering of ore by means of inclined tramways, either ground or aerial. The tramway or light railway above recommended to be made up through the Ring River goldfield would then serve for transport of material to and from the reducing works.

On the pack-track from the Mount Reid mine to Dundas the strata as far as the Pimple strike from N. 10° W. to N. and S. and even, towards the south end of Mt. Read, a little east of North. Between the Pimple and the Dundas township the strike is from N.W. to W.N.W. and the dip easterly for about half the distance down, then westerly, showing an anticlinal fold. Along the top of Mount Read the country rock is usually the argillitic schist, and at the South Mount Read mine workings (surface trenches) there is also a greenish felspathic rock that may be either a highly metamorphic one or an intrusive; it is so much weathered where seen that a definite conclusion cannot be arrived at by mere inspection. It is possible that this is an igneous intrusion of the same nature as the porphyritic felstones to the east of Mt. Black. Not far from this point there is seen on the track a small patch of conglomerate lying unconformably on the edges of the schist; there was no time to examine this closely, but judging from its general appearance it probably belongs to the Permo-Carboniferous formation, seen well developed further eastward round the Eldon Range, Mount Pelion, and Barn Bluff. At the south end of Mt. Read, near the Pimple, slate country is seen on the track, and occasional layers of sandstone and conglomerate conformably bedded therewith, and near the Pimple store there is much of this conglomerate. On the Pimple itself there is also conglomerate, but it seems to belong to the widespread younger Mt. Owen formation, and I doubt very much if it is really the same as the conglomerates seen interbedded with the slates. Further light on the relations of the strata about this part is, however, very much required. Between the top of the range and Dundas township there is much variety of country rocks, the most prominent being a thick series of dolomites and dolomitic slates lying west of the conglomerates above mentioned. Nearer Dundas we find micaceous schists, and close to the Comet mine there is a change to white sandstones and softer slates belonging probably to the later Zeehan formation.

MOUNT DUNDAS DISTRICT.

During the last two years the greater number of the leases taken up in the Dundas District have been forfeited, and on many of those which are still held little or nothing has been done. There are more causes than one for the abandonment of so much ground that was once thought highly of, such as the great fall in the price of silver, want of capital, the diversion of speculation and popular favour to other fields, and the realisation of the fact that on account of the difficulties of access and other unfavourable conditions, such as many of the lodes being oxidised down to the water-level, it would be a tedious and expensive matter to bring the mines to a paying condition. Want of means of access seems to me to have been really the most fundamental objection to continuing to hold the leases, the owners being unable to see their way to make any profits without making long roads or tramways for transport of material. Had the various interested parties combined to make these, the difficulty might have been got over; but it is notoriously a hard matter to secure such combination, and without it separate owners are nearly helpless. The construction of main arteries of traffic therefore falls in most cases upon the State. Many of the abandoned mines have lodes on them of much promise, but requiring machinery for further development, but under existing circumstances it is impossible to place it on the ground without great expense. The further

opening of the country by roads and tramways is a necessity for progress, and there is every reason to be confident that their construction would lead to a revival of proper mining work in this district and a great increase in its output of ore.

Throughout the Dundas district great disappointment has resulted from finding that the numerous large lodes are in many cases completely oxidised and deprived of their metallic contents down to and below water-level, so that they cannot be worked by adits, but require winding and pumping machinery. From the first the greatest interest has attached to the workings of the Maestrie's Broken Hill and Comet mines, both on account of payable ore having been found in the former above the water-level, and of the huge size of the gossan mass. After much work at the lowest level attainable by adits, it was recognised that no good results could be got without sinking deeper, and the Comet shaft was after many delays and difficulties sunk to a depth of 100 feet below the adit, and it was hoped that the lode would be cut below the zone of oxidation. Judging from the depth to which the gossan had been found to extend in the Adelaide mine, I said in my last report, "This renders it very doubtful if the low level of the Comet mine will prove to be low enough to be below the oxidised lode-matter," and so it has proved, the stuff being as thoroughly changed to gossan at the deep level as at the surface. How deep it will be necessary still to go to get below the gossan there is no evidence to determine, and trial alone will decide. It seems pretty clear that the oxidation of the lode material must have taken place at some period in past time when the water-level and the conditions of superficial circulation (the so-called "vadose" circulation) of water were quite different from those now prevailing. The reason of the occurrence of veins of galena in the Comet and Maestrie's, in the Mount Dundas mine, and in the Adelaide mine, as lodes traversing the gossan in the same way that most run through ordinary country rock, is yet unexplained, and will not be certainly known until it is seen how they behave towards the unoxidised portions of the main lode mass; at present it seems most likely to me that they will prove to be really younger lodes traversing older ones. Nothing has yet been proved as to the occurrence of deposits of secondary ores between the great gossan cappings and the unoxidised portion of the lode beneath, but from the numerous cases on record in which such secondary deposits have been found, and often very rich, we are justified in entertaining great hope that good ore will be found below the gossan. What we should expect the lode-stuff itself to prove to be in depth is also an interesting and uncertain speculation; it may be mostly carbonate of iron, but it seems to me that there is much reason to think that it will be largely pyrites and other sulphides. There is a strong possibility that cupreous and even nickel-bearing pyrites may underlie the gossans when we consider that in the cases quoted the lode-stuff lies almost on the contact between the serpentine intrusive rocks and the sedimentary series. At the Nickel Prospecting Association's mine the body of nickel-bearing cupreous pyrites seems to lie in this position, and similar bodies of ore elsewhere appear to be always similarly situated. In my last Report the use of a diamond-drill to test some of these questions was advocated, and I still think that great and necessary knowledge that would immensely assist the development of the mines would result from its use. There is a possibility that some of the gossan masses may be partial replacements of belts of limestone country, and in that case there would be no lode beneath them, though there well might be a valuable deposit of ore. This chance also would be thrown light upon by the use of the drill.

Maestrie's Broken Hill Mine. –Very little has been done in this since my last Report, except that the old ore-heaps have been picked over and several parcels of saleable ore taken from them. The mine has been let on tribute to the Comet Company, and the south-eastern drive from their shaft is now some distance into the Maestrie's ground. The mines are both on the same lode, and will be much better worked together than separately.

Comet Mine.—The older workings in this were referred to in my last Report, so it will not now be necessary to again describe them. At the bottom level (261 feet) the cross-cut to the south east has been driven to a winze sunk close to Maestrie's boundary: the lode-stuff in the western part of the mass was thoroughly oxidised gossan of next to no value, but much of it of very promising appearance for what may be found at greater depths; then the drive entered very hard dolomite, in which also the lower part of the winze was sunk. About 200 feet from the shaft a drive was next made to the south from the main cross-cut in some likely-looking gossan which had been cut through, and after going about 19 feet the end of a course of ore running north-westerly was met with: this has been followed south east into Maestrie's ground, and very fine ore obtained from it. It has been stoped upwards to an intermediate level 40 feet higher. In the drive and stopes the galena has been at times as much as 13 feet wide, of nearly pure ore, and at the time of my visit there were several very excellent faces in work. The ore seems to lie in gossan between two bands of dolomite, and the vein-stuff consists of oxide of iron, siderite, and galena. The relations of these minerals are at times somewhat peculiar, there being an appearance occasionally as if the galena were in the act of replacing the siderite. Blocks of siderite, for example, are seen crusted with galena and oxide of iron and traversed by veins of the same along fissures or cracks. As the lode-stuff is very porous and easily traversed by water, as shown in the mine workings, it is likely that various secondary reactions have gone on from time to time leading to solution and deposition, now one, now the other, of the component minerals of the lode.

At the time of my visit to this mine there seemed to be some doubt as to whether the ore chute found was identical with that worked at higher levels by the Maestrie's Company, or a parallel one separated from it by a band of dolomite; this is not yet quite settled, but it seems to me that the two most likely are identical. Occasional cross-cutting to N.E. and S.W. across the line of the ore-veins is however to be recommended, as in the upper workings there were two or more of these parallel to one another.

The dolomite bands are larger and more distinct at the bottom level than in the upper workings, but still seem to run parallel with the ore-veins, agreeing in strike with the general run of the Upper Silurian strata on the West Coast, which is from N.N.W. to N.W. However, in the Comet adit, or No. 1 Level, the country strata strike N.E. so that there must either be some great dislocation about here, or else the dolomite belts cannot be original beds of the same formation.

The mine has now a considerable output of ore and should be able to keep it up for some time to come, and there is much hope that by continuing the driving to the south east fresh bodies of ore will be laid open which can be worked above the present level. Sinking the main shaft has been resumed, and should be carried on with all possible despatch in order that the next lower level may be opened before the present stopes are worked out. The prospects of success at lower levels are excellent, and no hesitation should be felt in pushing on with the work of opening them.

On surface an ore-dressing shed has been built at the mouth of the main adit, and connected with the Zeehan-Dundas Railway at Maestrie's station by a light tramway. The appliances are very crude, consisting only of screens to separate out the fine ore from the coarser, and hand-jigs for roughly dressing the screenings; they are very useful so far as they go, but much better ones will have to be provided in order to do justice to the mine. At present the ore is sold by public tender to the ore-buyers at Zeehan, but it is to be hoped that the time is not far distant when this mine and some of its neighbours, the Mount Dundas mine more especially, will be able to maintain a smelting works at Dundas and treat the mines' product on the spot. There is a great deal of excellent smelting ore in the Dundas mines which is not rich enough to send away for sale and not fit for concentration, and local smelting is the only thing that will successfully deal with it. When, therefore, the owners of these mines consider the question of putting up concentration works for the purpose of getting clean ore for sale they should also look at this aspect of the matter and think whether it would not be better to build smelting-furnaces. Below the level of oxidation, wherever that may turn out to be, it will probably be necessary to concentrate the poorest ore and any portions that may contain zinc, even if smelters were on the ground, but all the present product could be best treated directly in the furnaces. The losses of silver in concentration, which will be referred to towards the end of this Report, should also be taken into account when considering this question. The present system of sending out only the best ore is to a great extent " picking the eyes out " of the mine, a course sure to lead to much future regret, and, though present circumstances compel its adoption, every endeavour should be made to bring about a better one at the earliest possible moment.

In erecting a concentrating mill for these mines the possibility of obtaining considerable water power should not be overlooked. At present the large quantity of water raised by the Comet pumps runs through the adit northward to a small creek and is used in the dressing-shed, and a good deal of water could also be stored in reservoirs higher up this creek. The best stream for water supply is, however, the one on the south side of the ridge on which the shaft is sunk, and by bringing this through the hill through the Maestrie's tunnel a really good supply could be got. The fluming of this creek for some distance above the workings in order to bring it into the tunnel would also have a very beneficial effect on the mine in another way, for it would almost certainly diminish the quantity of water required to be raised by the pumps. There can be little doubt that much of the water met with underground comes from the creek running over the outcrop of the lode above, and though a short flume has been put in with some good effect, it is still pretty evident that much of the water gets into the mine. By fluming it and taking it through the hill to the dressing works two purposes could thus be served with the same expense. By putting the mill a little lower down the creek than the present shed, which would also be nearer the railway, enough fall could be obtained to get a very considerable amount of power from water stored in a dam near the northern end of the Maestrie's tunnel.

Before settling the site for reduction works, however, it will be necessary to consider if the main shaft is in the best position for working the mine, which cannot be determined till one or two more levels have been opened, and the behaviour of the lode at greater depths ascertained. Should the ore remain confined to the now known chute and continue to make southward and not northward, the main shaft would be too far away from its work, and another one in the valley to the south, nearer the Kozminsky's, Comet, and Maestrie's joint shaft would be more centrally situated, and all the works in connection with the dressing and smelting of the ore would be best here also, only the marketable products being sent through the tunnel to the Railway Station. The use of the diamond drill might give valuable aid towards deciding these questions.

Mount Dundas Prospecting and Silver Mining Company's Mine.—(This is generally known locally as the Dundas Prospecting Association Mine.) Since my last Report the company have ceased working at the lower levels, and they are full of water to a depth of some 60 feet, but a little work has been done above the water level by tribute parties. The men who were working at the time of my visit had some very rich ore, galena and cerussite, with native silver and chloride of silver, lying in a vein penetrating the main gossan in a north-westerly direction, quite similarly to the occurrence of the Maestrie's chute or vein. They were working, however, under great difficulties through not having the ground properly opened up, but nevertheless had been able to earn very good wages.

This mine has excellent prospects and ought to be working, there being every reason to expect that when opened from a properly equipped main shaft it will be very payable. Besides the clean galena ore, there is also a large quantity of poor gossan in it, fit only for smelting on the spot, which should pay well for local treatment. Machinery for the main shaft is now the great necessity for this mine, and there would be no difficulty in getting it on to the ground.

The Central Dundas Mine has been shut down for a long time; it would be best amalgamated with and worked with the Mount Dundas Mine.

The Adelaide and Anderson's Mines ought also to be worked as one; they were both shut down at the time of my visit. Much difficulty has been experienced with water, a more powerful pump being required.

Hassett's Mine has also been shut down for some time: it is on a strong gossan formation that requires trial.

Planet West and Planet South Sections.—A little prospecting was going on on sections formerly known as the Planet Company's, to the west of the Dundas township, where a small lode running N. 30° W. has been traced some 10 chains in length and cut in two small creeks. At the old Planet tunnel a galena vein 2 to 4 inches thick has been found by sinking about 4 feet in the floor of the approach cutting: the lode has smooth walls and appears to be a defined fissure. In what used to be known as the South Planet Section, a trench has been cut on it without finding ore. Though this lode is small it seems worth prospecting a little, but there is a good deal of water to contend with in sinking on it. The enclosing country is mostly slate.

South Dundas Field.—So far as I could learn there was no work going on in any part of the Southern Dundas field, and it was therefore not visited on this occasion.

North Dundas Field.—Success and Owen Meredith Mine.—I did not visit this, learning that no underground work was going on, pending the completion of the tramway, and that the mine was in consequence full of water. It has been taken on tribute by a party who have very pluckily undertaken a heavy piece of work in making a tramway from the North Dundas road to the mine, a distance of over four miles; this will permit them to get proper sinking machinery to the mine and enable ore to be sent to Zeehan at reasonable cost. The party deserve every credit for having done what none of the companies had the enterprise to attempt, and their conduct is the more courageous in that they have not a very long term in which to work the mine and recoup themselves for their trouble. The lode has always promised well, though the chutes of ore seem shorter than they were at first hoped and believed to be, and everyone will wish success to the plucky tributors who have gone so well to work to deserve it.

Renison Bell South Mine, Section 2751-87M.—The vicinity of the Commonwealth mine has been for the last two years the part of the North Dundas field to which most attention has been paid. The pack-track to it crosses over a high ridge separating the Argent Basin from that of the Ring River, and near the highest point on the track are seen the workings of the Renison Bell South Company, now abandoned. A large outcrop of gossan runs about north and south down the steep northern slope of the hill, and some 85 feet from the top a tunnel has been driven south 30 to 40 feet along the west side of a dyke of blue-grey quartz-porphyry. Along this the slate country seems as if it had been subjected to hydro-thermal action, and there is much gossan; in the trench on the outcrop on top of the hill a little pyrites was observed. This lode was taken up for silver, but judging from its position along the contact of the slate country and the quartz-porphyry it seems more likely to be one that would carry tin ore; the occurrences of tin ore in the vicinity to be mentioned presently give colour to this supposition. The work that has been done cannot be said to have tested the lode in any way, being practically none.

On Section 1683-91M east of this, on the fall to the Argent River, a little tin ore has been found in lode stuff consisting of quartz and tourmaline, but not enough work has been done to show if there is a lode, or if the stones are only loose in the surface soil.

Gormanston Mine, Sections 1741-91M *and* 1742-91M.—Going from the track across the N.W. angle of Section 1680-91M into the S.W. part of 1742-91M, we meet with a good deal of quartz-

porphyry, carrying much bluish tourmaline in fine hair-like crystals. A small creek passes through the south-western portion of this section, which has yielded a good deal of tin ore, and towards the head of it, about two chains from the south boundary, some very fine and large blocks of tin ore have been found, including the "Gormanston" boulder which was shown at the Hobart Exhibition, weighing about 19 hundredweight, and containing, as well as can be ascertained without breaking it up, about 11 per cent. of metallic tin. The tin-ore boulders were found in loose superficial detritus, and have most probably found their way down the slope of the hill to the S.S.W. of where they were obtained, from Section 1680-91M. The stones seen with them are rough little-waterworn fragments of jasperoid slate (probably the altered rock on the contact with the porphyry intrusion) with veins of quartz and tourmaline, and of the tourmaline-bearing quartz porphyry seen *in situ* further west. The country rock in this part of the bed of the creek is a rather soft slate. Much oxide of iron is found throughout the superficial material binding it together, and probably indicating the proximity of lodes or veins of pyrites.

About a chain south of the southern boundary of 1742-91M in Section 1680-91M some long trenches have been cut through similar loose material intermixed with much oxide of iron, with the result of showing that the source of the tin ore must lie still further south.

The boundaries between the quartz-porphyry and the surrounding slate country have not yet been traced out, but it appears that there is in the western part of Section 1680-91M and in the eastern portions of the Renison Bell South sections (2750-87M and 2751-87M) an intrusive mass of the former which has a close connection with the tin occurrences. In some of the creek "wash" stones of porphyry are found with slate attached to them. The occurrence is quite similar to that at Mount Bischoff, where a very similar quartz-porphyry breaks through similar slates and other Silurian (?) strata, and the great tin ore deposit of the Mount Bischoff mine is at the contact. The ore found in the Gormanston Creek has quite the same peculiar characters as the Bischoff tinstone, and the associated minerals are also very much the same, so there is every reason to believe that the contact of the two rocks will here also turn out to be the home of the ore. For this reason the Renison Bell South lode especially requires to be thoroughly tested for tin. The line of contact of the two formations should be traced out, and the ground well prospected for some distance on each side of it.

Going down the bed of the creek to the workings of the North Dundas Company the country rock shows occasional veins of magnetite and chrysotile, and often exhibits signs of metamorphism, no doubt due to the proximity of the igneous intrusions. One of the veins of magnetite appears to be of a lode character (strike N. 25° W., dip 45° to S.W.), but has not been worked upon, though cut into a little along the outcrop by the sluicing operations. Another one contains some quartz and blende. In working this creek several heavy rounded boulders of very pure tin ore, in masses of densely aggregated crystals, were sluiced out, including two of about one hundred-weight each.

Commonwealth Mine, Section 2959-87M.—In my last Report on this district the finding of a new lode in the creek was mentioned, consisting largely of pyrrhotite and pyrites, which was afterwards proved to contain a good deal of tin. Since then work has been mostly concentrated on this, the long tunnel in the N.E. angle being stopped when it had reached a distance of 532 feet without cutting the expected lode under the big gossan mass on surface. The tin-bearing lode has now been traced with some interruption south-westerly into the North Dundas Company's section, 1641-91M, and gives in many places excellent prospects of tin. The creek in which the lode was found falls very rapidly to join another branch which comes down from the Gormanston section 1742-91M, and from close to their junction a tunnel has been driven S. 85° W. a distance of 60 feet (2nd February, 1895). The strata passed through strike about N.N.W., and dip easterly about 60°, and consist of hard limestone, slate, quartzite, and metamorphic sandstone, with veins and impregnations of iron pyrites, arseno-pyrite, pyrrhotite, and copper pyrites, the whole being very hard and expensive to drive through. At the time of my visit the lode had not been cut, but it was met with very shortly afterwards, and is now being followed along its course.

In the creek above the tunnel the lode has been cut into along its outcrop for close on 300 feet, and is seen to be composed of a dense mixture of quartz (often chalcedonic), pyrrhotite, arseno-pyrite, and pyrite, in which fine tin ore (cassiterite) is often visible in greyish and brownish patches. The ore-body in this portion averages about 8 feet in width, and shows well-defined smoothed and striated walls. A sample was taken by me by picking chips from all over the exposed surfaces in the creek bed and from the stuff that had been blasted out, endeavour being made to get a parcel which would represent as fairly as possible the average value of the bulk of the ore, and was sent for assay to the Government Analyst, Mr. W. F. Ward, with the following result:—The stuff was found to contain *gold* at the rate of 3 dwts. 6 grs. to the ton; *silver* at the rate of 13 dwts. 1 gr. to the ton; *copper*, a trace; *tin*, 2·1 per cent.

The presence of gold and silver in the ore was quite unexpected, and adds considerably to its value. It now remains to be discovered whether the precious metals are in the same portions of the ore as the tinstone, so that it will be possible to pick out the richer stuff and get a product of

higher value than the above. As far as the tinstone is concerned, by judicious picking while the stone is being broken out a good deal of stuff included in my general bulk sample could be rejected and a more valuable material retained, but how far this selection could be practically carried without undue loss remains to be ascertained. At present prices the value of the run of the stuff according to the above assay would be about 40*s* a ton, which does not leave much, if any, margin of profit over the costs of mining and reduction. To get the tin out the ore will have to be thoroughly roasted: this would also be the necessary first step towards extracting the gold by chlorination. The next treatment would be the taking out of the gold by the chlorine or bromine process, and the tailings from the vats would then go to tin-dressing jigs, vanners, &c. I am somewhat doubtful as to whether ore of the above average value could be made to pay for this treatment, but have some hope that by the use of the best modern methods and appliances, and by dealing with the material on a somewhat large scale the operations might be made to result profitably. There is a large quantity of the pyritous ore in sight, and if the tunnel proves it to continue downwards and to maintain its value it will be well worth while for the owners to have a most thorough and careful investigation made as to the best method of dealing with it.

The lode has been found again in several trenches and cuttings towards the south boundary of the section, here having a course about N.N.E. instead of N.E. as in the creek. The average width of lode-stuff right through seems to be about eight feet, but as it is only seen in the southern part in quite shallow workings where the surface of the rock and outcrop of the lode are both somewhat shattered, we can hardly say definitely what is the true width, which will be seen better when the lode is cut in the solid country lower down. At any rate it is a big strong lode. In most of the trenches good tin ore is found in veins traversing the lodestuff, some of these being nearly pure ore, very rich. Where the pyrites has been oxidised a good deal of tin could be got without much trouble, but the depth to which oxidation extends seems to be very slight. The country towards the southern end of the lode is mostly slate, much softer than the quartzite and limestone seen in the creek.

Just above the tunnel the lode is faulted by a cross-lode running N. 20° to 25° W. and dipping N.E. 80°, which has been followed northward for some 12 feet by a shallow surface trench. This consists of quartz, siderite, and pyrites, with a little blende and galena, and is said to carry a little silver. The footwall is striated and smoothed. In the tunnel this lode has been passed through, but carries only specks of ore: as it is of the general strike of the silver-bearing veins of the Dundas district it would be worth while to trace it along its outcrop to see if any chutes of ore can be found in it.

The normal effect of the fault should be to heave the lode on the north side of it to the westward, but it has not yet been picked up on this side. As it is not seen in the creek between the new tunnel and the old long one in the northeast angle of the section, it seems likely that the heave has been a considerable one. Should the lode return to the more north-north-easterly course which it seems to have in the south part of the section, and also be heaved some little distance west, it would go right under the huge gossan capping under which the long tunnel was driven, and it seems very probable that the gossan is really the capping of a big pyrites lode. So far as I could learn it has never been systematically tested for tin or gold, but there is every reason to do so perseveringly. It would be advisable also to continue the long tunnel some distance further in order to cut well under the big gossan mass, and to sink some shafts in this to test it.

The mine is admirably situated for working by tunnels and for getting good water power for machinery. The outcrop of the lode at the south boundary is 277 feet above the level of the upper tunnel, which could be driven all the way to the boundary on the course of the lode. The upper tunnel again is about 70 feet higher than the older long one, and if this latter cuts the lode when extended, which seems very probable, it would lay open another huge block of ground. In this instance, unlike most at Dundas, it is to be hoped that the lode under the big gossan mass, if really the tin lode, is thoroughly oxidised for a great depth, as both tin ore and gold would be thus set free for easy working, just as in the great gossan masses of Mount Bischoff and Mount Morgan (Queensland.)

I am satisfied that the Commonwealth mine has an uncommonly good prospect of proving very valuable. It has been found to contain very good ore for a long distance, though it has not yet been demonstrated that on the whole it is payable. The difficulties and expenses of the treatment of the pyritic ore must be considerable, still there is much reason to be sanguine as to ultimate success, and every incentive to prove the property thoroughly.

The best way of getting access to this mine will probably eventually be by a tramway down the Ring River Valley to join the Waratah-Zeehan Railway somewhere near the Renison Bell mine: this would be a somewhat roundabout route into Zeehan, but the topographical features of the locality do not admit of a direct one. Going up the Ring River Valley to meet the proposed tramway to the Mount Black district previously mentioned would also be a very circuitous route.

North Dundas Tin Mining Company's Sections.—The Company holds several leases, of which 1639-91M. and 1641-91M. are at present the most important. The Commonwealth lode strikes right into the latter section, and has been cut in some trenches on the north boundary of it, in which some very nice tin ore may be seen, some small veins being very rich. The work done is not deep enough to cut properly into the lode, but there is no doubt of its going into the section and of its carrying tin, so it is well worth opening up, and a tunnel should be driven from the boundary south along its course. There is a possibility that this may be connected with the South Renison Bell lode, whose favourable position and appearance have been already referred to, and an attempt should be made to trace both through the section.

In the northern part of section 1639-91M. there is a hill largely composed of alluvial matter, probably deposited when the river systems of the district ran at a much higher elevation than now. The top of this is about 680 feet above sea level, thus agreeing closely with the elevation of the Rosebery alluvial gravels above described and with the high gravel deposits lower down the Pieman in the neighbourhood of Corinna. Towards the north of the section some shallow ground has been stripped by sluicing, but the water supply failed owing to the summer coming on before a face could be cut into the deeper wash lying further up the hill. Some shafts put down hereabouts have shown a considerable depth of nice-looking wash and given, it is said, encouraging prospects. Towards the south of the section a shaft has been sunk 35 feet about three chains north of the Gormanston boundary: the stuff was very clayey, but some good tin-ore is said to have been got on the bottom of the shaft. The bottom dips to the westward, or into the hill, showing that the deepest ground has not yet been touched. A race has been brought in to work this ground 68 feet above the shaft and 15 feet below the top of the hill; it takes its water from the Commonwealth Creek on the South Renison Bell hill. A siphon 9 inches in diameter and 430 feet long had to be used to get the water across a gully on to the alluvial hill, and instead of taking the race round this as has been done it seemed to me that it would not have required a very deep cut to have gone straight over the top of it, even if there was not sufficient head on the siphon to have carried it over without cutting, which seems likely to be possible.

There is a large amount of alluvial matter on this section, and from the prospects seen by me on a former visit, and the reports I received on this occasion, it seems likely that much tin will be got when sluicing is fairly started. The Company is now in a position to work very cheaply, and when the bottom is reached and the best wash exposed there is great reason to hope for profitable results. Some trouble should be taken to ascertain the course of the old gutter under the hill so that the main face opened may be brought right up it so as to work to the greatest advantage.

In the wash on this section I did not notice much of the blue-grey quartz-porphyry seen in the Gormanston workings, the gravel being mostly well-rounded sandstone, quartz, hard slate, &c., from the harder rocks of the Ring River and Pieman basins. It seems very probable that there will be some gold found along with the tin ore.

Renison Bell Mine.—There is a very large outcrop of gossan mentioned in my former Report of 25th November, 1890, on the Zeehan and Dundas fields, running through Sections 2537-87M, 2536-87M, 2534-87M, and 2535-87M, and on Section 2536-87M a tunnel has been driven S.E. from the side of the Argent River into it. The mouth of the tunnel is in gossan, which continues to be found for about 40 feet, after which laminated soft slate and sandstone country is met with and continues to be passed through up to the end of the tunnel, 208 feet in. At 200 feet a cross-cut has been put in to the N.E., 65 feet, the last 11 feet being in dolomitic and quartzose lode-matter, with iron and arsenical pyrites, the latter especially on the western wall, which strikes about N.W. and dips a little to the N.E. Towards the western wall also there is a good deal of quartz and siderite with the pyrites, but in the end of the cross-cut it is nearly all dolomite with pyrites impregnated through it. The lode has not been cut right through, operations apparently having been abandoned without doing more than breaking into the western wall for a distance of 11 feet. This cannot be regarded as any test of its value; it should be cut right through, and then drives should be made along its course, before it can be regarded as having been at all well tried. In prospecting a lode the work really only begins when the vein is cut, all preliminary operations such as driving adits, &c., being merely for the purpose of arriving at a point where the lode can be attacked with advantage.

In the river on the east side of the tunnel, for a width of about 50 feet, the outcrop of the lode is seen as a body of dense quartz with a little pyrites through it, and veins of pyrites. It is evident that in driving the tunnel was kept too much to the west, and it would have been better, when it was found that the clean country was coming in, instead of going straight on, to have cross-cut at once to the east, to get back to the lode, and then to have driven along the western wall of it as at first intended.

The lode is admirably situated for working, there being a good supply of water for power and dressing purposes in the Argent River, right at the mouth of the adit, and splendid facilities for tunnelling on the course of the vein. The surveyed line of the Waratah-Zeehan Railway also runs just over the top of the tunnel.

The work that has up till now been done is no test of the mine, and I should recommend further prospecting by driving along the lode in the tunnel, and by sinking shafts in the outcrop. Continual tests should be made for tin and gold as well as for silver, as both these minerals are rather likely to be found in the lode and its gossans. The character of the Silurian country seems to me to be favourable for gold. Again, quartz-porphyry is seen on the top of the hill to the south, which renders the finding of tin-ore in its neighbourhood rather probable, and the occurrence of so much arsenical pyrites in the tunnel seems to point to the lode being one of similar sort to that of the adjacent Commonwealth Company rather than the ordinary silver lodes of the Zeehan District. It is by no means certain that the whole of the Ring River field is not rather gold and tin country than silver.

North-East Dundas.—On the 24th January, before going to Mount Read, I went in company with Mr. S. Karlson westward from his camp near Mount Black, on Section 58-93, to visit some sections in the vicinity of the Natone Creek, a large creek running northwards into the Pieman from near the Natone Prospecting Association Mine. In the low ground near Lynch's Section 140-93M, a good deal of conglomerate in large boulders was noticed, and it seems probable that there is a deep run of alluvial matter about here, possibly an old terrace of the Pieman River, but which might be part of the Ring River deep lead, which must come out somewhere in this direction. On C. Green's Section, 3514-87M (now forfeited), at the centre of the ground a large gossan outcrop was noticed running, as far as could be made out, about N.N.W., consisting of quartz, and oxides of iron and manganese. No work had been done on it, but it appears to be well worth prospecting, and could be easily tried at some depth by means of a tunnel, as it is on steep sideling ground.

Quinn's Section, 216-93M (formerly 3736-87M). On this we found Mr. P. P. Quinn at work, prospecting a huge lode of very promising appearance. It crops out on the top of a high hill, and can be traced a considerable way to the northward along a steep sideling. Where broken into it was fifteen feet wide and not cut through, and the lode-stuff consisted of gossan, copper pyrites, arsenical pyrites, pyrrhotite, a little quartz, some chrysotile, and a great deal of an unusual mineral which proves to be axinite, though apparently less rich in boric acid then is usual with this species, giving the flame reaction with difficulty. Mr. W. F. Ward, Government Analyst, has been good enough to make a partial analysis of the mineral, as follows:—

Silica, SiO_2	45·5	per cent.
Ferrous and Manganous Oxides, FeO + MnO	14·7	„
Alumina, Al_2O_3	16·0	„
Lime, CaO	18·8	„
Magnesia, MgO	1·2	„
Loss on ignition, H_2O	0·8	„
Undetermined constituents, including Boron trioxide, B_2O_3, &c.	3·0	„
Total	100·00	„

Specific gravity, 3·23.

The crystals are mostly too much broken to be of service in determining the species, but have all the physical characters of axinite. The mineral has also been found at Mount Ramsay, where it is associated with similar sulphides to those accompanying it in this case, and with bismuth and gold.

The sulphides are found almost at surface, the lode apparently being quite unlike many of the Dundas lodes in this, as the latter are often converted into gossan to below the water level. The course of the lode is about N. 20° W. with apparently a slight underlay to the east. There are most excellent facilities for proving the lode by tunnels on account of the steepness of the hillside. At the time of my visit no metal of value had been recognised in the ore, the quantity of copper being insufficient to be of consequence, but as such a mineral mixture might carry several valuable metals, I sent a small parcel of it to be tested by the Government Analyst, who found traces of gold and silver, 3·1 per cent. copper, no bismuth, no tin, but about one per cent. of nickel and cobalt. It seems extremely likely that this lode will be found in one part or another to carry tin, bismuth, gold, silver, copper, lead, and nickel, but which of them will be of the greatest value, and whether any of them will be present in payable quantities, are questions not yet answerable. With such a mixture of sulphides there is great hope that chutes of valuable minerals will be found when the lode is opened up, and it should therefore be well and perseveringly prospected.

On the west side of the lode there is an apparently volcanic rock, containing veins of greenish chrysotile; it is most probably a variety of the igneous serpentine rock seen so frequently in the Dundas field, and which is said to crop out on this same hill some two miles further south on the brow overlooking the Ring River. All the volcanic rocks of this district require minute investigation, and their relations to the ore-bodies are of much interest. The dense bush prevents much

examination of their mode of occurrence at present. In this instance there is some appearance of the lode being of the contact type, but more work will have to be done before there will be any certainty of this.

Section 3298-43M.—This used to be known as Lewis's section, and the big hill on which it and Quinn's find are situated is often called locally Lewis's Hill. A shaft has been sunk some 60 or 70 feet beside a very big outcrop of iron and manganese gossan running, roughly, north and south. Some pyrolusite occurs in the gossan, which, on the whole, has a favourable appearance. The shaft does not appear to have been sunk below the zone of oxidation, and though nothing was found in it of any value it by no means follows that the lode has been proved worthless. Some day, no doubt, it will be tried again, as it is likely somewhere to carry good ore.

Natone P.A.—The sections formerly held by this company were 81-91M and 1250-91M. On one of these was a large outcrop of quartz and gossan, with a course about N. 15° W. A tunnel has been driven 100 feet through iron-stained argillitic schist to cut the lode some 40 to 50 feet below the outcrop, but seems only to have reached the side of it, and a lower one has also been started. Work had all been abandoned and the ground given up at the time of my visit. Some assays giving good results in gold are said to have been obtained while working.

Karlson's lode.—Some distance from the Natone sections lower down the creek Messrs. Karlson have cut into an outcrop of quartz, siderite, and pyrites, containing a little copper pyrites, blende, and galena. It is not at all well exposed as yet, and very little can be said about it, except that it seems worth spending a little work on to lay it open.

Curtain's Discovery.—Just before leaving Zeehan on the completion of my visit to the districts round about it I was shown some bismuth ore (oxide and carbonate of bismuth) said to assay very well for silver, found by Mr. Curtain in the Ring River district not far from the Fahl Ore mine, but I was unable to find time to go out to look at it. Mr. Curtain gave me two samples of the material, which were analysed by the Government Analyst with results following :—

No.	Gold per ton.	Silver per ton.	Copper.	Bismuth.
	dwts. grs.	oz. dwts. grs.	Per cent.	Per cent.
1	trace	1056 15 8	0·1	14·1
2	2 10	90 14 0	trace	26·8

This is very valuable ore, and the lode should be well worth development.

Fahl Ore Mine.—This once promising mine turned out poorly when opened up, and has been shut down, but sooner or later it is sure to be tried again, especially if the tramway comes through the district.

Nickel P.A.—On Section 1956-91M, on the low ground between the Dundas hills and Zeehan, an important discovery has been made of copper and nickel-bearing pyrites. At the time of my visit the owners unfortunately had just left the mine when I arrived, and there was no one there to give information as to what had been done. Two shallow shafts have been sunk close to each other, and are kept unwatered by a small pump worked by a water-wheel. Nothing could be seen of the lode at the bottom of the shafts, the faces having been slabbed up preparatory to resuming sinking operations. On surface there is a big hole from which a good deal of ore has been taken, but there was no opportunity of ascertaining the size or appearance of the ore mass. Mr. R. G. King, who was in charge, informed me afterwards in Zeehan that the shoot (or chute) was about 30 feet long and from two to eight feet wide, but irregular and bunchy, and lay between slate and a dioritic rock. The latter is almost certainly the serpentine formation which is seen on surface to the eastward close at hand, and forms a big mass on the North Dundas Road. The ore consists of pyrites carrying good per-centages of copper and nickel. Mr. G. F. Beardsley, speaking from memory, says, in a letter to me of 9th April, 1895 :—"To the best of my knowledge there were three lots of ore sent away last year, two lots, which totalled 46 tons, assaying 14 per cent. and 11 per cent. nickel respectively and 5 per cent. copper; the other was a trifle over 50 tons, and assayed 14 per cent nickel." Some samples are said to have assayed as much as 28 per cent. nickel. The shipments are generally reported to have given a good profit to the owners.

In his recent book on the Ore Deposits of the United States, and in a paper read in October, 1894, before the American Institute of Mining Engineers, Professor J. F. Kemp discusses the various sorts of nickel deposits, and points out that one type exemplified by the great nickel mine of Sudbury, Ontario, and Lancaster Gap mine, Pennsylvania, consists of "bodies of nickeliferous pyrrhotite and chalcopyrite with very subordinate pyrite, in the outer portions of basic igneous rocks. . . . . The type is of world-wide distribution, as noted by Vogt, and is well known in Norway, Sweden, and one or two other European localities." In his paper Professor Kemp brings out more fully than in the above quotation from the "Ore Deposits of the United States" the fact that deposits of this type are found only on the contact of basic igneous masses with the surrounding strata through which they have been intruded. Except that the Dundas occurrence seems to have pyrite instead of pyrrhotite with the chalcopyrite and nickel-bearing sulphide (not yet certainly

determined as to exact species), it would exactly fall in with the above type of deposits. The serpentine is a basic igneous rock, probably an altered gabbro, and at the Heazlewood *zaratite* (hydrous carbonate of nickel) and *pentlandite* (sulphide of iron and nickel) are found in it in some quantity. The nickel in Quinn's lode also bears evidence to the presence of this metal in the vicinity of the serpentine. It seems probable therefore that at other points along the outskirts of the serpentine intrusions there will be similar deposits of nickeliferous ore, and careful prospecting of the boundaries is therefore to be recommended. It may turn out that some of the large gossan masses near the Dundas township really cover deposits of this class instead of silver-lead ores.

STANLEY RIVER DISTRICT.

On the 4th February I went out to the Stanley River tinfield from Zeehan, returning a few days later *viâ* the Heemskirk fields. The route to the Stanley from Zeehan follows open button-grass country nearly all the way, there being only a belt of bush in the valley of the Pieman River. At the Stanley field itself, however, we again get into heavy green bush. A good road could be made all the way without much expense, the country being hard and sound, but a good deal of side-cutting would have to be done to make it fit for wheeled traffic, and longish grades would be required on each side of the Pieman River, where also a good punt would have to be provided. At present supplies may be packed to the river from either side, but there is a very steep and difficult track on the north bank which requires altering to be really fit for horses. There is a cage running on a wire rope over the River, by which men can cross, but horses have to be taken round by Corinna and the Whyte River Bridge, a very roundabout way. If a punt and proper approaches to it were made there would be no difficulty in taking pack-horses from Zeehan to the Stanley camps in a day.

On the track from Zeehan to the Pieman a great deal of quartz rubble is seen about the surface, and the country is mostly sandstone; this part of the field seems rather likely to be gold-bearing. On the north side of the Pieman there is a big area of open country of the same nature which also seems promising for gold. Nearing the Pieman Valley from the south side some high terraces of very much water-worn gravel were noticed, similar to the Brown's Plains gravels described in my report on the Corinna goldfield. An aneroid observation showed that the highest of these that were seen lay at an elevation of close on 600 feet above sea level, corresponding thus pretty closely with the high gravels of the North Dundas and Rosebery Cos.' sections, and with the high terraces lower down the Pieman.

The Stanley River tin discoveries are situated close to the junction of the granite country of the Parson's Hood and Mount Livingstone with the Silurian formation, but the lodes that have been found are all in the granite, so far as yet known. The granite is very similar to that of Mount Heemskirk and the north-eastern tin districts of Tasmania, being a somewhat coarse-grained porphyry. A few instances were noticed in which the large felspar crystals had been replaced by bundles of tourmaline needles.

Reward Claims—1940-91M *(Albury and Mitchell) and* 1941-91 *(Upchurch).*—These are situated on the Stanley River itself, at and below its junction with two tin-bearing creeks coming in from the east and west sides. The river here runs through somewhat extensive flats that have not been bottomed on account of the quantity of water in them. Some chains below the boundary between the above two claims there is a sandstone bar in the river that might be cut through so as to drain a good deal of this flat ground. In the river payable prospects of tin are obtainable by digging into the gravels of the bed ("blind stabbing"), the best being on a layer of pug which forms a false bottom, the true bottom not being seen for some distance above the sandstone bar. The wash is mostly of granitic origin, and contains much quartz-tourmaline rock from veins in the granite. Topazes and sapphires are sometimes found in it along with the tin ore, and there is a great deal of heavy yellow sand very difficult to separate from the tin. This heavy sand is, probably, mostly zircon, but requires analysis, as it might possibly contain some of the more valuable rare minerals, monazite for example.

For the greater part of the year the Stanley River is a big stream, and it would not be possible to work its bed without diverting it from its present course. From the amount of tin seen in the river it is probable that there is also a great deal in the flats, and there is a good prospect that a company or strong party, with some capital to do necessary dead-work, could operate here very profitably. It is worth trying, at any rate. A deep tail-race of some length would have to be brought up, and a new straight channel cut for the river; in doing this work tin would probably be obtained. The river having been diverted into the new cut, the present bed and the remainder of the flats might be worked. If it proved that the ground was too deep for ordinary sluicing, it would be best to bring in a high-level race from some little distance up the Stanley (which rises very fast into the hills), and use hydraulic elevators. With these there would be no difficulty in working the whole of the flats. It is unlikely that their aid can be dispensed with, and as they would be very useful in cutting the new channel for the river and in thoroughly testing the flats, it would probably be best to begin work by bringing in the high-level race first. It would be well to have it say 300 feet above the river flats, so as to have plenty of pressure for the elevators if the ground should turn out to be much deeper than is expected.

A somewhat long and wide flat runs north-westward from Section 1940-91M through 1944-91M and 2002-91M, and the junction of the granite and Silurian country is seen to go up this, keeping rather to the N.E. side. In this flat the gravel is composed of a mixture of vein-stones from the granite, especially quartz with tourmaline, and hard slates and sandstones from the sedimentary formation. Towards the south-west angle of Section 1940-91M a shallow hole through the wash has bottomed on white granular limestone, possibly a result of alteration of the blue Silurian limestone seen elsewhere in the district by contact with the intrusive granites. A tail-race has been opened from the river for some chains up this flat, but has not, as a rule, been deep enough to get on true bottom. What sluicing has been done has been on a false bottom of pug, containing chalcedony, mountain leather, and pyrites. The wash here gives fair prospects of tin. Two shafts have been sunk close to the race, one 19 feet deep, without reaching bed-rock. Sufficient fall not being here obtainable for proper sluicing of the ground into the river, the use of a hydraulic elevator would be the best and easiest way out of the difficulty.

Near the western boundary of Section 1940-91M there is a gossan formation on which some work has been done, and which seems to run very much along the contact of the granite and Silurian country. Some of this yields really excellent prospects of very ragged tin ore. This lode requires to be much more thoroughly tried and, according to the prospects obtained by me, is well worth spending some money upon in doing so. It is mostly oxide of iron, and probably will turn to pyrites in depth. There is a large body of the gossan.

At the head of the flat, a little north of Section 2002-91M, there is another large outcrop of gossan consisting mostly of fibrous limonite with the structure characteristic of tourmaline aggregates, and probably resulting from the alteration of tourmaline. Some magnetite is seen also, and the whole deposit affects the magnetic needle strongly. This must be close to the contact of the granite and slate formations. It has not been tried for tin, but seems worth prospecting, being possibly the same lode as is known to be tin-bearing further down the flat as above described.

Throughout the flat, wherever the wash can be got lying on the true bottom it contains good tin, and there is a strong probability that the ground could be profitably worked once provision is made for sufficient fall for tailings through a deep tail-race, or after a high-level race and hydraulic elevators have been provided.

East of Section 1940-91M a short distance a small lode 12 inches wide of quartz and tourmaline not showing any tin ore has been cut in granite country within three chains of the contact of the granite and limestone,—course N. 10° W., dip to westward. This had only just been cut when I saw it, and requires further trial.

New's lodes.—Several sections have been taken up on the small creek which comes from the eastward into the Stanley River at Mitchell and Albury's Reward Claim. A good deal of alluvial tin has been got from this creek, and several lodes have been found towards the head of it. In going to these a belt of blue limestone country is passed over, and at some old workings known as Stubbings' in the creek the contact of this with the granite is seen, and it is clear that the latter is intrusive through the limestone. This is a good deal altered at the contact by development in it of felspar and hornblende, giving it much the appearance of a volcanic rock. The granite at the contact is much finer grained than usual.

Several likely-looking lodes of quartz and tourmaline have been cut in the country near the head of this creek, some of them of considerable size, up to 3 or 4 feet wide. They have well defined walls, and seem to be fissure lodes and run from N 5°W. to N. 25° W. None of them so far show much tin ore, though some very rich stuff was got on the outcrop of one of them, and there is a good deal of alluvial tin in all the creeks which must have come from the adjacent hill-sides in which the lodes lie. A good deal more prospecting is required, and there is every inducement to go on with it.

Upper Stanley River.—Further up the Stanley River several sections that were taken up have been abandoned, as it was found that when the river was in flood it was almost impossible to get to them. A good track up the Stanley Valley to afford access to the country along it and to the east and south east of the Meredith Range would be of great service to the district, and would be sure to bring about numerous mineral discoveries in this little known but very promising locality.

At the time of my visit tracks were being cut to connect the Stanley field with Meredith's track from North Dundas to Waratah on the east side, and with the goldfields near the Lucy River on the west. The latter will eventually allow the tin from the Stanley field to be packed out to the Meredith or Nancy landings on the Pieman, from which it can be taken by boat to Corinna to be shipped; it will also open up the country round Mount Livingstone. The eastern track will assist prospectors to get into a piece of country near the Wilson River that is most likely to be metalliferous, seeing that it is known to be formed of granite, slate, and serpentine similarly to our most valuable West Coast fields. The country between the Huskisson River and the Meredith

Range seems all most likely for minerals, and should be opened up by good tracks to enable prospectors to examine it thoroughly.

MOUNT HEEMSKIRK DISTRICT.

Leaving the Pieman crossing on the Stanley River track on the 7th February, the river was followed down for about a mile, and then a spur was crossed which brought us into the deep valley of the Pine Creek, a short distance above its junction with the Pieman; the latter was then followed down to the mouth of the Heemskirk River. In Pine Creek and the Pieman the general strike of the Silurian strata is about E.N.E. and W.S.W., but in one part a band of slate was seen running N. 20° W., and dipping S.W. I am inclined to believe that a close examination of the sections in this locality would show the younger Zeehan formation resting upon the older Gordon River series of rocks. A short distance below the mouth of the Pine Creek there is a large intrusive mass of diabase greenstone, quite the same as that so frequently found throughout the eastern half of Tasmania, which continues to below the junction with the Heemskirk River, and forms the cliffs at the Heemskirk Falls.

Electric Light Works.—At the Falls on the Heemskirk River, which are only two or three hundred yards above where it joins the Pieman, it has been projected to put up works for the generation of electricity for supply of light and power to Zeehan. The falls are over 150 feet in height, and there would be something like 180 feet of vertical pressure obtainable on the turbines or Pelton wheels used at the foot. For the greater part of the year a very fine water-power is available, but in the driest months it is doubtful whether an adequate supply could be obtained without making several storage reservoirs along the course of the river. At the time of my visit I estimated that there were not more than 10 heads of water going over the falls. A very large dam could be made by raising the present one only a few feet, and I have little doubt that, with attention to conservation of water, a good supply could be got at all times. The present works consist of a weir, and a flume from it to the edge of the cliffs; it was proposed to have wrought-iron pipes from the flume down the face of the cliff, but it seems to me that there would then be great difficulty in efficiently supporting the column. A much easier and quite as effective a way would be to run the line of pipes down the spur a little further east, when a good bed on the ground could be got the whole way. For the present the scheme has been abandoned. There is no question that a fine water-power could here be obtained, and that it could be satisfactorily transmitted by electricity to Zeehan. The commercial aspects of the venture are not now under review.

Electric Tin Mining Company, Sections 34-93M *and* 35-93M.—The tin lode on these sections differs from most of those known in Tasmania in being in clay schist country instead of in granite, the nearest outcrop of the latter rock being some three miles distant. The vein has been previously worked upon many years ago by the old Pieman Extended Company, who sank a shaft 100 feet deep, and made several trenches and shallow workings along the outcrop. This is traceable for a long distance on surface, and consists of quartz and brown silicified country rock in curiously wavy curly bands, with small tourmaline crystals and occasional tin ore in the vughs. The 100 feet shaft is about 7 chains west from the centre of the east boundary of Section 34-93M, and the lode can be traced S. 75° W. through both sections. Some tin is visible in the stones round the old workings on the outcrop. A tunnel has been driven N. 7° W. from a branch gully running into the Heemskirk River, about 115 feet below the surface at the old 100 feet shaft and 125 feet below the outcrop on the crown of the ridge on the line of the tunnel. It passes through clay schist with occasional hard bars striking about E.N.E. and W.S.W., agreeing pretty closely with the strike of the lode. At 317 feet from the mouth of the tunnel a small lode carrying much pyrites and a little tin ore was met with, but no driving was done on it; at 390 feet the main lode was cut, and the tunnel was then driven about 90 feet further, making the total distance 480 feet. The lode has been driven along 23 feet to the east and 63 feet to the west. In the east end it is about 8 inches wide and in the west only 2 or 3 inches, but it is said to have been as much as 30 inches in some parts. The quartz has the same curly streaky appearance as at the surface, and contains a little blende and pyrites; in the east end there is a vein ¼ to ½ inch wide, very rich in tin ore. In the stuff taken from the lode lying at the mouth of the tunnel it is seen that this vein must have been at times much larger and very rich, but the average value of the heap would be small.

There is a very nice vein of tin in the lode in the tunnel, and there is also a good deal of tin in parts of the outcrop: it therefore appears quite a good show for further trial. The tunnel has been put in by a small party of 12 shareholders, half of whom worked and the other half paid in, but a stronger company is required to carry on the work. Though the lode is small in both the present ends, it will no doubt open out again here and there when followed along, and there is much hope that payable chutes of ore may be found. Water for power for crushing could be got from the Heemskirk River without much difficulty, and the locality, though rather out of the way, would not be very difficult to bring machinery to.

In the gully to the north of the 100 feet shaft there is a large outcrop of quartz and tourmaline which has not been cut into enough to expose it properly. It is composed of very much

the same sort of material as the main lode, but it is not known to carry any tin ore. Some prospecting on it might, however, be done with advantage.

Eureka Mine.—South east of the Electric Company's sections about quarter of a mile we come on the workings of the old Eureka Company, now abandoned, on Sections 1555M, 1556M, and some others adjacent. Here are found low rounded hills capped with alluvial gravels at a height of about 600 feet above sea level, thus corresponding with the high gravels north of the Pieman and with those seen on the track from Zeehan to Stanley River. Numbers of shafts have been sunk all about the place, but as far as I could learn the deepest ground has never been bottomed. The gravel is generally of small size, very thoroughly rounded, and consists mostly of pebbles from the Archæan and Silurian formations, with also quartz-tourmaline rock from the granite. On the other side of the Heemskirk River Mr. M'Namara informed me he was working a similar deposit, in which one shaft had been sunk a depth of 40 feet, containing some tin ore and gold. In the Eureka workings also there was some gold with the tin, and in one part garnets were very common. Several large patches of the shallower gravels on the hillsides at the Eureka have been laid bare by sluicing, the Company having had a long water-race from the Heemskirk River. This race was said to carry 40 heads of water, and comes on to the highest part of the ground, but is now in bad order, one high fluming close to the mine in particular being badly broken down. Towards the top of one of the hills where the deepest wash is found a face has been sluiced out 30 feet deep, but the bottom was found to be dipping westward. Two tunnels were driven through the rim-rock to try to tap the lead, but were not successful, though some very rich tin is said to have been obtained where they came upon the side of the lead.

To form any reliable judgment on the prospects of this property being successfully worked it would be necessary to get authentic records of the results of the sluicing that has been done and of the work in the tunnels, and to have a number of shafts sunk and carefully prospected. On this visit I had no time or appliances to make any tests, and I have not been able to get the above records; but going by what has been told to me on good authority, it would seem that there are very enticing prospects to be obtained, and that the difficulty which has caused one owner after another to abandon the ground has been their inability to get to the bottom of the deep wash. Shafts cannot get down on account of heavy water in the lead, and the tunnels have not been deep enough to properly drain it. It seems very probable that there is a true lead, but the surface configuration gives no help in locating where it is, but rather misleads us. To get the information necessary for proper working it would therefore be best to carry out a systematic series of bores which would determine the extent and depth of the deep ground and the position of the gutter; we should then know whether it would be possible to get in a drainage adit from any of the gullies in the neighbourhood, or if it would be best to sink a shaft and provide pumps to cope with the water. Considerably deeper tunnels could be driven than have yet been tried, and it seems most probable that a shaft would not be necessary. Judging only by the hearsay reports that have reached me as to the prospects of the ground it would seem that a strong company might make a success of this mine yet by going to work to open it out in a systematic manner. Once a tunnel was got into the lead to serve as a tail-race, or even as only a drainage race, it would be easy to work an open face up to surface and sluice the deep gravels by the cheap and effective hydraulic method instead of by blocking out, if it were found that there was anything in the upper gravels of value to pay for their removal.

Coming south-west from the Eureka along the track to the St. Dizier and Granville mines, a belt of diabase greenstone is passed over in the Forest Reserve shown on the map of the district.

Tasman River District.—A good deal of work has gone on of late about the head of the Tasman River on the St. Dizier and Tasman creeks, where a great deal of tin has been obtained from time to time. There are some curious problems here as to the distribution of the alluvial matter, which will best be considered while describing the various properties.

Smith and Bates's Section, 136-93M.—This is situated in a flat at the junction of two branches of the Tasman River. The owners have cut a long drainage race, and were employed at the time of my visit in erecting a small water-wheel to drive a Chinese (or Californian) pump for the purpose of draining their workings, which are on the eastern side of a branch of the river running southerly. Several holes have been sunk to depths of 9 or 10 feet within about 3 chains of the outcropping bedrock to the east of the flat, and good prospects of tin are obtainable here, but the ground is very wet and to the westward seems to get much deeper. The wash is quartz, sandstone, and quartz-tourmaline rock, often very much waterworn, and the bedrock is Silurian sandstone and slate. Some 13 or 14 chains higher up the river there is said to be an old shaft and bore 80 feet deep, through alluvial matter, and lower down also, near the junction of the two branches of the river, there is another equally deep bore-hole. It would seem, whether these bores are correctly reported or not, that to the west of Smith and party's workings the ground gets much deeper, and it seems probable, from all that has been learned, that nearly all the flat ground here is deep. With their existing appliances the owners can only hope to work the shallower portions of the deposit, and will do so under many disadvantages, much manual labour being required. The deep ground

continues down the river to the Granville claim, and from the prospects that have been obtained there is great hope that there is a very valuable alluvial deposit in these flats. The best method of working them, however, is still a question. According to my aneroid the height of the flats above sea-level is about 415 feet, and of the old Eureka workings, which are commanded by the Eureka race, close on 600 feet, so that it would be possible to bring the Eureka race on to this country at a level some 150 to 180 feet above the flats: some long pipe-lines and high flumings might, however, be needed, this point requiring investigation. With a pressure of 150 feet it would be possible to work the flats with hydraulic elevators to a depth of 20 feet without difficulty, and by using two lifts 40 feet deep might be attained. Should the main gutter lie much deeper it is doubtful if it would be possible to work it effectively with hydraulic elevators, and it would be necessary to put a ladder-dredge or chain of buckets elevator in the bottom of the excavation to take out the lowest wash. With the hydraulic elevators it would be easy to work all the higher and shallower gravels such as those now being treated by Smith's party, and to make cuts across the flat that would determine if the whole of the upper layers of wash could be made to pay for handling.

Swenson's Workings:—To the east of Smith and party's ground on the east side of the eastern branch of the Tasman River there is a knoll covered with gravel, the top of which is about 490 feet above sea level. This has been worked by Mr. Swenson, who, single-handed, has made a race 3½ miles long to command it, deserving great credit for the perseverance and pluck with which he has carried out a heavy undertaking. The wash on this high terrace is from 2 feet to 7 or 8 feet in depth and contains much angular quartz and sandstone, but the tin found in it is much water-worn. There does not seem to be any "lead" in this deposit, and probably it is only a relic of the old high-level river terraces or perhaps sea beaches of the end of the Palæogene Tertiary period. The bedrock here is sandstone.

Tasman Mine (formerly known as the Granville mine,) *Section* 1428-91M.—The flat above mentioned becomes narrow in this section, and the river runs over granite bottom. A deep race 9 chains long has been cut up the stream through the bedrock to try to drain the flats, but it is evident that the old "gutter" runs much below the present stream. It has been proposed to put in a long tunnel from some distance down the river to effect drainage, but as yet there appears to be no certainty that one could be got in low enough to be really useful at any reasonable cost. If the depth of the deep bores above mentioned is correctly reported it is very unlikely that any tunnel could be made to drain the gutter. At the head of the drainage race a paddock has been worked to a depth of about 15 feet by the use of a centrifugal pump worked by a small engine. Some very good returns of tin are said to have been obtained. The lead is here about 4 chains wide, and its greatest depth is not known.

To the south of these workings on the west side of the river, alluvial gravels are seen on some low hills, and it seems possible that the old lead might have run to the north of the present stream, nearer Donnelly's Look-out. I have not examined the country any distance in this direction. From the peculiar features exhibited by the St. Dizier mine, however, there is a probability of another explanation, namely, that the lead has been cut off by a fault, which has thrown down the deep part now seen in the flats below the level at which it used formerly to drain to seaward: if this should be so, the lead would simply cut right off against a smooth wall of granite and have no outlet.

The remarks above as to working Smith and party's flats apply equally to the Tasman mine. In both cases what is now most urgently required is a systematic testing of the depth of the deep ground by bores, and survey of the surrounding country to determine the possibility of getting in a drainage tunnel, and of bringing in a high-level copious supply of water. The possible working methods are confined to three: drainage by a low-level tunnel; working by hydraulic elevators; and working by mechanical elevators. The hydraulic system would probably be the best from all points of view. Any of these methods means a large expense, but there is much hope that it would be reproductive.

St. Dizier Mine.—In the lower part of the St. Dizier Creek, near its junction with the Tasman River, there are several sections, 1515-91M, 1658-91M, and 1438-91M, held by Messrs. M'Kimmie and Ormiston, on which a great deal of work has been done from time to time, and from which a large quantity of tin ore is said to have been taken. The creek gravels are shallow and have long been worked out, but there is also some deep ground which may be portion of the same old lead as in the Tasman flat, or may be a branch of it, bearing the like relation to the old Tasman lead as the present St. Dizier Creek does to the Tasman River. A long tail-race, 10 or 12 chains in length, has been cut into the deep ground from the Tasman River valley, and a very instructive section is laid bare in it. In the lower end the granite is seen, then softish sedimentary beds of sandy clays and gravels containing much brown iron oxide with pyrites and seams of lignite are cut into, striking N.N.E. to N.E., and dipping S.E. at steep angles. Next black quartz wash full of lignitic matter and containing some tin ore is found, dipping similarly, and then the race passes into a long stretch of basaltic tuff of grey colour, weathering spheroidally. Then we find gravel and clay (probably tufaceous) and thinly laminated clays; also gravel and lignitic matter containing occasional large

logs of lignitised wood. The face of the workings, 15 feet deep, at the head of the race shows quartz gravel near the surface, then tufaceous clays, next a layer of "wash" dipping northerly, and giving good prospects of tin ore, then in the bottom a succession of beds of gravel dipping northerly, much iron-stained and containing a good deal of fine rather cemented material, but the true bottom has not been reached, the tail-race not being deep enough. At the north side of the face the granite is seen cropping to surface close at hand, and the beds forming the lead are much twisted. The section shows on the north side a streak of lignitic matter, then on it a seam of iron-stained gravel dipping southerly at an angle of about 60°, then laminated clays lying on the gravel conformably, but showing a synclinal curvature, and on these the grey basaltic tuff. On the south side of the face the beds dip northerly, so it is pretty clear that on the whole they form a syncline. At the top of the working face the granite is seen again in the head-race bringing in the water for sluicing, and it would seem that the wash must cut out altogether, but after a little it suddenly appears again in the race, and a hole was sunk some depth on a seam of tin-bearing gravel, going downwards with a steep dip. Further east again, nearer the St. Dizier creek, the old workings were shallow and on a false bottom of conglomerate, which has more lately been sunk through to a depth of 20 feet without reaching the true bedrock. This deep ground does not seem to be connected with that in the main working face, as the granite is seen in the race between them. On the other side of the creek the country is Silurian slate and sandstone.

There seems to me to be only one possible explanation of the peculiar features presented by the deep gravels of this locality, and though it is a somewhat unusual one in connection with the alluvial deposits, it is by no means without precedent, and in older geological formations would be thought nothing out of the way: it is, that the deposit has been cut through by a series of faults, which have thrown down portions of the gravels beneath the general level of the surface of the granite bed-rock. There are no evidences elsewhere throughout Tasmania, so far as I know, of there having been any earth-movements in Tertiary times that would cause crumpling of originally flat strata into steep-sided synclines such as we see in the tailrace, and as this is quite a local occurrence we must look for a local cause. The synclinal bending of the soft sedimentary strata by the subsidence of a wedge of country into an enclosing trough of granite is quite in accordance with numerous known instances of bending of strata in the neighbourhood of faults, and is no doubt the reason of the contortion of the beds seen in this instance. The occurrence of faults cutting through the old gravels seems also the only way of accounting for the sudden cutting out and coming in again of the wash as seen in the headrace. In the workings of the Mt. Arthur P.A. at the Lisle Goldfield a similar instance was recently noted by me, a wedge of granite being apparently thrust upwards through the bottom of an old alluvial deposit; in this instance the actual fault surfaces were exposed, and there could be no mistaking the nature of the occurrence, and as the old Lisle alluvials belong probably to approximately the same period as those of the St. Dizier (the end of the Palæogene division of the Tertiary Period) there is no reason why a similar feature should not be found in these. The lignite found in the gravels is a proof of their considerable age, and if I am right in considering the grey tufaceous matter seen overlying the gravels to be basaltic tuffs, it is probable that these belong to the series of basaltic eruptions which seem to have been prevalent at the end of the Palæogene and beginning of the Neogene Period. Dykes or flows of basalt, it may be noted, are seen on the Remine to Corinna road to the north-west from here. The volcanic outbursts would be a very probable cause of the fracture of the country rock by faults.

The practical consequence of this explanation is that the gravel deposits cannot be expected to show the usual regular features; we may get patches of deep ground with no outlet from them, and every now and then the gravel will be found to terminate abruptly against smooth, steep, clean-cut walls of granite. The curvature of the beds of gravel also makes working conditions different from the ordinary ones. As the main fault in the St. Dizier appears to be running north-easterly and to have a downthrow to the south-east, it is quite possible that the gravels of the Tasman flat are thrown down by it also below the level of their original outlet over the surface of the granite. Seeing that this may have an influence on the decision as to the best way of working the ground, it would be well to ascertain by a few trenches and holes if the gravel really does terminate abruptly against a smooth face of granite to the south of the flat.

So far as the St. Dizier mine is concerned it is clear that some valuable gravels exist in the deep ground, but owing to the peculiar circumstances it is very doubtful to what extent, and in working it will be difficult to make sure of getting tail-races deep enough to drain them. With hydraulic elevators the patches of deep ground could be sluiced out pretty easily and cheaply, and, there would be no need of much expense in shifting them from hole to hole as there would be with mechanical elevators, so I think that there can be no doubt that they would be far and away the best means of exploiting these gravels. It may be noted that in the lower end of the main tail-race, where stratified clays and so on are passed over, it is clear, from the section seen in the face, that the stanniferous gravels, if not cut out by the fault, must lie underfoot, and it would be advisable to deepen the outlet and try to work down to these.

Smith, Tolland, and M'Auliffe's Sections, 117-93M *and* 118-93M.—These lie little over quarter of a mile higher up the St. Dizier Creek than the last described workings, and have been taken up

in order to work a tin-bearing lode running north and south and underlaying westward about 1 in 8, on which a shaft has been sunk 24 feet deep near the centre of section 117-93M. In this the lode is seen to be from 15 to 20 inches wide, consisting of quartz and tourmaline, and carrying a really excellent show of tin ore. The stone raised from the shaft would be quite payable to work. More work has yet to be done on it to prove the extent of the chute of ore before it can be said that there is much promise of a payable mine being developed, but present appearances are very favourable, and the vein is well worth opening up. There is a good deal of water in the ground, which makes it rather a heavy undertaking for the present owners to continue working without machinery.

About 8 chains S.E. of the shaft there is an outcrop of another lode running N.W. and S.E., consisting of three bands of quartz and tourmaline, two from twelve inches to twenty-four inches thick, and one about three feet thick, separated by two and four feet respectively of soft granite. The outcrop has been cut into to a depth of 8 feet, but is a good deal broken. Tin ore is seen in some of the stuff, especially in the tourmaline-bearing and chloritic portions, but on the whole the veins are poor so far as yet laid open. It deserves further prospecting, however, as do also some other lode outcrops which have not yet been cut into. This property is well worth attention from mining adventurers able to spend some money in thoroughly testing and developing it.

New West Cumberland Mine.—From the St. Dizier district a walk of about 6 miles over "The Gap" brings us to the New West Cumberland Mine, granite country being traversed all the way. In my former Report of 20th May, 1893, the position of the lodes in this property was described: since then a new battery has been erected and work in the mine continued, unfortunately with but poor results. The battery is well constructed and equipped, and consists of a stonebreaker, 20 heads of stamps, several spitzlutten to separate the sands from the slimes, 4 corrugated belt Frue Vanners, 4 smooth belt Frue Vanners, one convex slime-table, several classifying-boxes, slime-tanks, and other accessories. The battery is driven by a Pelton wheel fed with water from a race and pipe-line from the New Cumberland dam, and a smaller Pelton wheel drives the vanners. The stonebreaker and 5 heads of stamps have not required to be used. The ore from the mine is brought to the mill by an aerial tramway 900 feet long, which works by gravitation, but may also be started at any time by means of a belt connected with the driving shaft of the battery: conversely, when the tramway is working it may be made to help drive the battery.

The principal workings of the present owners have been on the No. 1 or eastern lode, which has a course about N. 15° E.; two tunnels have been driven on this, known as No. 1, or the upper, and No. 2, or the lower adits. At the entrance to No. 1 there was a quantity of very good tin stuff obtained, as mentioned in my former Report, and an open cutting was taken in on the course of it: it was also stoped out downwards half way to the No. 2 level, and then the ore seemed to cut out. The chute proved very short, being all taken out by open working in the part above No. 1 adit, and in the stopes below it was also short. From the open working the adit was driven along the lode a distance of 199 feet, the vein stuff being generally soft granitic matter containing quartzose veins. At 87 feet it widened out to 18 feet of lode-stuff with one little seam of tin ore, then got narrow again. At 140 feet a chute of ore was met with containing, not tin ore, but quartz and tourmaline with native bismuth and sulphide and carbonate of bismuth: this proved only about 5 or 6 feet long and 18 inches to 2 feet wide, and was stoped up 26 feet and sunk upon for 20 feet, going pretty nearly vertical. The tin ore chute at the mouth of the adit was also nearly vertical. In the end of this adit a lode 3½ feet thick of dense tourmaline and oxide of iron has been cut running W.N.W. and E.S.E. crossing the main lode, but neither of them has been followed from this point. On surface the cross-lode is again seen, and seems to course about N. 60° W.: a shaft has been sunk on it nearly over the point where it is cut in the tunnel, and about 4 chains to the N.W. of this there is a trench on it in which some tin is to be seen. The vein stuff in this trench is mostly quartz, but it appears to lie in rather flat seams, and the trench is not deep enough to say what is the size of the lode going downwards. The same lode is said to have been cut in the end of the easternmost tunnel, some 80 feet east of the No. 1 adit.

The No. 2 adit is 70 feet below the No. 1, but is on a portion of the lode lying to the south of that worked in the latter, the end of the No. 2 drive being about 50 feet south of the mouth of No. 1; it was 162 feet long at the time I saw it, and contained no ore of any value. At 80 feet from the entrance there is a pass by which the stuff from No. 1 tunnel was thrown down to this one to be taken out to the tramway, and at 145 feet there is a pass to the intermediate level and stopes under the open face at the mouth of No. 1 adit. Between these passes the lode, which is a big body of quartzose stuff in the mouth of the adit, is not seen, and may lie somewhat to the east, the drive having made a bend to the westward. There are some smooth joints in the granite hereabouts which may be faults. The tin ore chute seen in the upper workings was not cut at this level, but from inspection of the mine plans it seems possible that the tunnel is not yet advanced far enough to the north to cut it. It would be advisable to drive forward to get right under the mouth of No. 1 adit and then to cross-cut to each side to make sure that the chute has not been heaved. It is not at all unlikely that the chute of ore has been cut off by a fault, and has not simply died out; at any rate the chance is worth trying.

The western or No. 2 lode has a course about N. 55° W., and two adits have been driven on it at higher and lower levels without developing any payable ore. Most of the work here was done by the former owners many years ago, but the present company have extended the lower drive 100 feet, and then cross-cut 50 feet to look for No. 1 lode, but without success. The end of the cross-cut is only about 9 feet to the east of the line of No. 1 lode in No. 1 adit, so it is possible that the latter has underlaid a little to the east, and that the drive is not yet far enough forward to cut it. It might be continued a little further with advantage.

The prospects of the mine at present are not at all bright, the shortness of the ore chute and its cutting out so quickly in depth having been great disappointments. It is advisable, however, to do some prospecting at the No. 2 level on the No. 1 lode in the hope of again getting the ore chute, and to sink on the tin seen at surface on the cross-lode to try if it is worth anything. Should this latter be at all payable it would be worth while to drive along the cross-lode from the end of No. 1 adit.

Mr. R. A. Dunne, manager of the company at Zeehan, has been good enough to let me have the output from the mine since the present owners took it over, viz:—38 tons 8 cwts. 3 qrs. 24 lbs. of ore, realising on sale £1169 16*s.* 8*d.* The dressed ore contained from 39 to 66 per cent. of metallic tin, and usually ran about 60 to 63 per cent. Some of the bismuth ore was hand-picked and shipped away, and some was crushed and dressed. Mr. Dunne says:— "We concentrated 33 tons of crude ore which gave on assay 6 to 8 per cent of bismuth. From the 33 tons we obtained 15 hundred-weights of concentrates, which assayed 39 per cent of bismuth. The parcel of 15 cwts, has been sent to Great Britain to see what price will be given for it." At 6 per cent Bi. 33 tons of ore contain 39·6 cwt. of metal, and at 39 per cent Bi. 15 cwt. of concentrates yield 5·85 cwt., so it would appear that only 15 per cent of the metal has been saved by concentration: from the appearance of the ore I saw being put through the mill I should question, however, very much if the quoted assay of 6 to 8 per cent was taken from a truly representative bulk sample.

The occurrence in the same lode of a chute of tin ore without noticeable bismuth in it, and of another of bismuth ore without appreciable admixture of tin, is of considerable scientific interest. In the Bell Mount field, in Shepherd and Murphy's lode, cassiterite and sulphide and carbonate of bismuth are found intermixed one with the other.

Cliff Mine, Section 1084-91M.—In the earlier days of the Heemskirk tinfield a lode was found close to the coast near the "Pulpit Rock," and a battery was erected by the Cliff Tin Mining Company near the mouth of a small creek where it falls over a steep high cliff into the sea. The battery consists of 5 heads of stamps and frames for another 5, two Borlase buddles and some ties, with an overshot water-wheel as motor. It is not in such bad order as might be expected after lying unattended for so long, and could be made to work without much repairing The water supply being scanty in fine weather, several small dams had been built up the creek to conserve it, but these are now all broken and would require extensive repairs. If any work were done here again it would probably be best to bring in the waste water from the New West Cumberland battery, which is at more than 400 feet higher elevation than the Cliff one. The rocky slope beneath the battery is very steep, but if saving of power were an object it would be possible to put the battery down close to the sea, which is quite 120 feet below its present site, and get a great deal more power from the existing water supply by using a Pelton wheel or turbine.

Close behind the battery there is a big outcrop of quartz and tourmaline on which a cutting has been made and a shaft sunk, but the stone seemed very poor. Though so close to the edge of the cliffs, the shaft was full of water. The stone lying in the battery seemed very poor also, and consisted of quartz with tourmaline and chlorite; it appears to have come from a cutting on a lode 7 or 8 chains up the creek, which consists of a set of 14 or 15 small parallel veins lying close to one another in a width of from 15 to 18 feet. Each vein is a small fissure with from 1 to 6 inches of quartzose material on each side of it: the general strike is N. 15° W. At this point I saw no tin in the stone, but about 15 chains to the northward, along the line of lode, the outcrop of which is easily traceable, Mr. Wooding has lately made a cut into it, 4 to 8 feet deep and about 30 feet long, in which there is some fairly good ore. Here the lode is about 3 or 4 feet wide, and consists of 12 or more closely parallel fissures with quartz tourmaline and chlorite walls. The best tin ore seems to be on the faces of the fissures. The strike here is about N. 15° E., so on the whole the lode runs N. and S. At this trench the show of ore is quite good enough to warrant continuation of working, sinking on the chute being especially advisable. A good deal of alluvial tin ore is said to have been got about this neighbourhood. Further to the north there is an old shaft in which lodestuff containing pyrites has been obtained. The prospects of resuscitating this property are not at all good, the only place where there seems to be anything approaching payable ore being at Wooding's workings. Here, however, the lode does want a trial, and gives a certain amount of promise of success. The facilities for working are rather good, access being very easy and water-power obtainable without great expense. No deep sinking on the lode seems to have yet been tried.

Montagu and Wakefield Mines.—I was unfortunate in my time of visiting these mines, there being no one to be found on either who could point out what was being done. At the Montagu a

crude crushing appliance, a "dolly," was noticed in the creek near the old company's shaft, and near it there were some good specimens of tinstone, evidently brought to be crushed. Some alluvial work had also been in progress. At the Wakefield a small battery has been erected to work the ore found in a lode, but I did not know where to find it until too late.

Lord Clyde Claim.—Some workings on a lode lying close to the road from Trial Harbour to Zeehan on Section 110-93M are known by this name. The lode has been cut only in some shallow trenches in which it appears to be from 18 to 24 inches wide, composed of quartz and tourmaline, with a little tin ore; course N. 70° W. or thereabouts. It seems very poor, but being tin-bearing might be worth sinking on in the hope of improvement.

ZEEHAN DISTRICT.

The workings of many of the more important Zeehan mines are now becoming so extensive that a detailed description would require a much more thorough examination of them than I was able to make on this short visit, and would only be intelligible by means of numerous illustrations, plans, and sections which I have had no opportunity of preparing. In the portion of this Report dealing with these mines, therefore, I shall speak only in general terms of the progress that is being made. The time is come, however, when it would be of much service to the field to have a fairly minute geological survey made of it, for the purpose of throwing as much light as possible on the conditions of the occurrence of the ore-bodies. There are a great many questions in connection with the lodes that require elucidation, and though it is not in the least likely that much light can be thrown on many of them even by the most minute study of what is now visible and ascertainable, the progress of exploration alone being able to decide them, still if only a few problems were rendered clear much benefit might result. It is impossible to say beforehand in just what directions the greatest advantage would arise from a careful examination and correlation of the available data, and in recommending the survey I should put it on the general ground that such investigations of mining districts have, in nearly all cases where they have been made, proved very useful, and in some have been of immense value, rather than on the expectation that any given problem would be satisfactorily solved. Further, that it is important that from an early period there should be a reliable record of the general and peculiar features met with in each mine. On this latter head it should be remarked that the progress of mining work often rapidly obliterates and renders inaccessible valuable evidence as to peculiarities of behaviour of the lodes, disturbances, changes of country rock, and many other important particulars which become lost sight of if not noted early and recorded from time to time as work progresses. A first geological survey of the district at the present stage would record what has been learned up till now, and form a basis for later observations. There is one geological question in particular which concerns the mines very closely and which can only be made plain by a rather elaborate investigation of the district, viz., that of the relations to the lodes and to the main body of the country rock of the beds of volcanic material locally known as "white country." It has been found that the galena is generally richest in silver when in this rock, and it seems to be specially favourable also for the occurrence of considerable bodies of ore. This conclusion requires rigid examination as to its truth or otherwise. If true, the mapping of the outcropping areas of the favourable strata and determination of their probable position in depth at points where they do not outcrop become at once matters of great importance as enabling operations to be directed so as to cut the lodes in this productive country; but, on the other hand, if it should be found that the evidence does not justify it, the investigation would nevertheless be useful in having done away with a misleading theory which might prevent exploration of valuable ground. According to my present knowledge there is great reason to believe that the "white country" is really very much more favourable both for quantity and value of ore than the slate, sandstone, and limestone country; and the positions at which it may be expected to be encountered by various lodes seem therefore to be of much importance. Its relations are by no means clear, and I am in some doubt as to whether we have only tufaceous material and ancient lava-flows interbedded with the usual sedimentary materials, or if there are not also corresponding igneous dykes, penetrating the lower sedimentary beds. It is rather probable, *a priori*, that both will be found to exist, as dykes must be expected as concomitant with lava-flows and ash deposits. The bulk of the "white country" seems to me, however, so far as known, to be tuffs and lava-flows very much decomposed. Some of the tufaceous material is a breccia, showing pumiceous and scoriaceous fragments and with much of a greenish secondary mineral, probably *delessite* or some of its congeners. The state of extreme decomposition of all the rock prevents it from being yet accurately named, but the term *rhyolite* is sufficiently comprehensive to include it. It is not yet known with certainty whether there are several different beds of the rhyolitic tuffs enclosed in the Zeehan strata, or if the various zones of it are different outcrops of one and the same stratum, brought to surface at different places by curvature of the beds: this is one of the many points of interest to be determined by a survey. At Leslie Junction cutting on the Zeehan-Dundas Railway, on the same line close to the brewery, on the North Dundas road, and elsewhere along the line of country between the Zeehan and Dundas fields, there are again other beds of tufaceous material, sometimes very distinctly stratified, conformably bedded with the strata of the Zeehan formation: these as yet have not proved to have any influence on the ore in the lodes, and are lithologically very unlike the rhyolitic tuffs of Zeehan, still it will be of interest to ascertain if there is any relation between them.

At one time I thought they might possibly be a younger formation altogether than the fossiliferous Zeehan beds, and possibly connected with the serpentine intrusions which penetrate these, but with the better sections now available it is pretty certain that this is not the case, and that they are conformable members of the Zeehan series.

Mount Zeehan (Tasmania) Silver-Lead Mines.—Argent Section.—The work from the main Argent shaft has unfortunately proved very unproductive, the chutes of ore being soon worked out and succeeded by long stretches of barren ground. The lodes are well defined strong bodies of banded veinstone, mostly carbonate of iron, with often smooth solid walls and every appearance of permanency in depth: from the way in which the galena occurs in them often in banded layers interlaminated with siderite, pyrites, blende, &c., I cannot believe that it is in any way the result of a chemical concentration of the lead contents of higher parts of the lodes now destroyed by erosion of the land surface, but think that undoubtedly it must have been part of the lode-filling from the first. As the levels now open have been poor it would probably be best to sink to some considerably lower depth, say 600 feet, before opening out again, so as to make the next trial of the lodes in quite a different stratum of country. The deepest level now is 192 feet. It is noteworthy that the main chutes of ore in the lodes, Nos. 4 and 6, worked from the Argent shaft were almost opposite one another.

To the southward of the main shaft a strong lode 4 to 6 feet wide, consisting of banded carbonate of iron with a little galena and pyrites, has been opened by means of a small steam plant, but so far has not been payable, though of very favourable appearance and giving expectation that good ore may be met with any day: this is known as No. 3 or Griffith's shaft. Close by it is another rather smaller lode, from which a tribute party has been raising some good galena. On the boundary of Section 1209M (formerly Balstrup's Manganese Hill Company's) yet another lode has been found, and was just being opened at the time of my visit: a few feet of it towards the surface were oxidised and contained cerussite and chloride of silver in the gossan, yielding some very rich ore, and lower down there was good galena. The southern portion of Section 192-87M seems to be full of lodes, and it would be desirable to have a main shaft sunk in it, especially as the "white country" comes in hereabouts.

To the west of the Argent shaft, at the creek in Section 1643M, is another small pumping shaft known as No. 8, worked by a wire rope from the central machinery station: some good galena has been got here, and the lode promises rather well. On surface it appears as a large lode of pyrites running a little east of north, very similar to Clarke's lode on the Silver Queen Section 1637M, with which it is probably identical. This lode should be worth tracing north and south through the property.

Several tribute parties are working on various other lodes and veins on this Company's sections, and raising a good deal of ore. The concentrating mill has been improved since I last saw it, and does very fair work, milling the ore from the Zeehan-Montana Company as well as the local mine product. The Company owns a large area of ground known to contain a great many lodes, but has not yet been able to develop anything to give dividends. The tribute parties are doing a lot of prospecting of the shallow parts of the lodes, but will not be able to go down to any depth on them, but their work will go far to show which deserve to be opened up on a more extensive scale. There is really so much prospecting to be done on the numerous lodes that it is a question where best to begin, and in order to test all that show promise of ore a considerable outlay would be required for the sinking and equipment of several separate main shafts. At present the southern portion of the Argent Section 192-87M seems to me the most likely place for successful working, and I am of opinion that a main shaft should be sunk there and furnished with a really good winding and pumping plant fit to test the lodes to a depth of at least 500 feet. Though the work has been anything but successful hitherto, the owners have no need to despair of yet being able to recoup their losses, as they have a large area of really most promising ground, and it seems only a question of time and prospecting when they will get on to payable ore. More attention, it seems to me, might with advantage be given to the further exploration of Balstrup's lode, which has had a lot of money spent on it by its original owners without much knowledge being gained of its real value.

Smith's Section, 943M.—This ground is being worked by tribute parties, the owners, so far as I could learn, doing nothing themselves. In M'Kay's tribute a shaft has been sunk 85 feet, and levels driven at that depth and at 55 feet. The lode is from 12 to 48 inches wide, and has contained a good chute of galena which has given over 300 tons of ore, said to be worth about £8 net to the tributors. The course of the lode is between N.E. and N.N.E. The tributors have a small steam pumping plant, but their appliances are not very good, and much better will have to be got in order to go to any depth. The shaft also is too small for a main shaft. There is a tram to the Mt. Zeehan Company's mill on section 559M where the second class ore is concentrated.

On French and party's tribute a shaft has been sunk 50 feet, and is kept unwatered by a very small engine. The lode is 18 inches to 3 feet wide, and runs about N.N.W. Most of the stuff is second class ore requiring concentrating, but the party complained that the heavy royalty charged

by the owners and expenses of freight and milling rendered this unprofitable to raise, and much useful ore was therefore being thrown as waste into the stopes for filling purposes. At the time of my visit the tributors were paying 30 per cent. of their produce for the right to work the ground, being 5 per cent. to another party whose tribute they had taken over, and 25 per cent. to the owners, far too high a royalty altogether. They had raised 6½ tons of hand-picked ore which sold for £44, and 45 tons of second-class stuff which, when put through the mill, yielded 6½ tons of galena, worth about £11 a ton.

This section is a very good one, but requires to be worked in a very different fashion in order to have justice done to it.

Mount Zeehan Silver-Lead Mining Company, Limited.—All work underground from the main shaft has been at a standstill for a long time, but several tribute parties from time to time have been raising a little ore from the shallower parts of some of the lodes. The mill occasionally works, crushing for the public. The property is well worth more energetic handling.

Silver Queen Prospecting Association.—On this extensive property several lodes are being worked, some on tribute, some by the Company. The most westerly workings are those of Chalmers' tribute, the tribute block being 60 feet deep on the lode, and 300 feet along it. A small engine and 6in ch drawlift pump have been put in by the tributors, who have to supply themselves with all necessary appliances. The lode runs N.N.E., and averages about 3 feet in thickness, and shows very distinct banded structure, the vein stuff being mostly galena, blende, pyrites, and carbonate of iron between well-defined walls of rhyolitic tuff country. Some very good ore has been got from this tribute, but at the time I saw it the most of what was being obtained required concentration, and was being roughly crushed and jigged by hand at surface. The lode seems well worth opening up more extensively. The tributors were paying 20 per cent. of their produce to the Company, but formerly had to give 30 per cent.

In what is known as No. 3 tunnel there are two tribute parties, Easterbrook's and Hosking's. The former had a winze down 53 feet, and had struck in it a good vein of gossan ore, dipping east; there was also a small vein of galena said to carry 104 ozs. silver to the ton, but bunchy, and at times containing much blende and quartz. At the time of my visit it was not possible to be sure if the party had found a true lode or only a small vein. The country is the rhyolitic tuff. Hosking's party were likewise sinking a winze below the tunnel to cut a likely-looking vein of gossan containing pyromorphite seen in it, but had not got down to it.

At the No. 2 main shaft, which is now 220 feet deep, they were opening out at the bottom level, and had there cut a lode, mostly composed of siderite, which may be the "magazine lode" seen at surface not far from the shaft. At the 157 feet level the drive has come to the junction with No. 3 lode, and followed this to within 60 feet of the workings from No. 3 shaft. The junction did not prove rich in ore, and it would seem that the lodes join one another but do not intersect; this, however, requires some more work to be done on the lines of each lode to be definitely established. The ground has been stoped where ore-bearing above this level on the No. 2 lode on the continuation downwards of the rich chute of ore first met with in the surface tunnel, and as it went underfoot at this level, the next one should soon open up a good block of ground. This lode runs north-easterly.

No. 3 shaft is an underlay one 117 feet deep on No. 3 lode, which runs north-westerly, and at the time of my visit they were just beginning to open out at the bottom level. The lode is a nice banded one, about 2 feet wide, with a good deal of galena. The new bottom level from No. 2 shaft will enable this lode to be worked from that centre as well as the No. 2 one.

No. 4 shaft is a new main shaft that was being sunk on the lode on which is Aird and Lamb's tribute. In a windlass shaft to the south of the tribute block there was about 18 inches of very good galena. The tribute party have a small steam plant, but their right to work does not extend below the 70 feet level, and the Company propose to go on working the lode themselves. The tributors are said to have sold over £600 worth of ore. The lode runs north-westerly.

In Section 1637M we find the workings of Clarke's tribute. A tunnel has been driven from the side of the Trial Harbour road to cut a big lode 4 to 6 feet wide with well-defined walls, running N.N.E. The vein stuff is mostly pyrites, but there is also galena, copper pyrites, and fahl-ore. The galena assays about 60 ozs. silver per ton, and some of the pyrites with 10 per cent. lead in it has yielded 50 ozs. silver per ton. It is from this lode that Mr. W. F. Petterd has lately obtained specimens of argentiferous stannite containing high per-centages of both silver and tin, a unique mineral. This lode seems very likely to be identical with the British Mount Zeehan Co's. No. 8 lode on Section 1643M. It is somewhat difficult stuff to deal with, and it would be worth experimenting to see if it could not be more profitably smelted directly than treated by concentration, especially as silver is contained in the pyrites to considerable value. The tributors at present pick out the cleanest ore and hand-jig part of the poorer stuff, but necessarily there is a great deal of

waste. Nearly all the tribute parties say that they cannot afford the mill charges for concentration, and do better by roughly cleaning the ore by hand-jigs: there is something wrong if this is the case.

At No. 1 main shaft an underlay shaft was in progress of being sunk in good ore by Clark, Compton, and M'Millan's tribute party, who are said to have done fairly well out of the stuff raised from it. They expect to get 60 feet of backs from this shaft on the No. 1 chute of ore.

Some other tributors have been working at one time and another in different parts of the Silver Queen property, but when I visited it these were not of much consequence and did not require description.

This property is one which is bound to come to the front sooner or later, having several good lodes to depend upon. The proper opening up of all these is a difficulty on account of the expense of equipment of each with necessary machinery, and possibly the best policy to be pursued would be to divide the ground into several blocks, each of which should be worked separately. A good deal could also be done by extending the tribute system, giving the tribute parties easier terms than at present, longer periods, and concessions as to ultimate purchase on resumption of approved mining plant. It is becoming a question whether to put a tramway to connect the workings in the neighbourhood of No. 2 shaft with the mill at No. 1, or to shift the dressing-works up to No. 2; a good deal may be said on both sides.

Zeehan-Montana.—This company has opened up its mine very well in an unusually short period of time, the extent of its workings comparing very favourably with most of the other mines of the field which have been longer at work. The system of drives underground is very complicated owing to there being workings on at least three and possibly four different lodes, all running north-north-easterly, which have been faulted by two intersecting sets of slides or faults, of which some five or six have been recognised. The tracing out of the lost portions of the lodes where cut off by these faults has afforded many puzzling problems, and the success with which they have been solved reflects much credit on the mine manager, Mr. Craze. Four or five chutes of ore have been met with in the lodes, mostly of no great length, but the mine has been able to work at a profit, this result being largely due to the high average value of the galena in silver, the mean assay being about 120 ozs. to the ton. Most of the work in the mine is done by contract, and in stoping ore a bonus is given to the men engaged according to the amount of ore won, which is a strong incentive to them to save it as much as possible. The best ore is very carefully handpicked by the miners to get a good bonus. This system seems to answer very well, suiting the interests both of the mine and of the workmen, and seems worthy of more general adoption. The country rock throughout the mine is mostly the rhyolitic tuff. It may now be hoped with some reason that many of the difficulties hitherto experienced on account of the breaking of the lodes by faults will disappear as the mine gets deeper, as the principal slides are dipping rapidly away from the workings, and these will soon be quite below their influence; the other smaller ones also have their position and amount of heave pretty well determined now and will not cause much trouble, as it will be foreseen where they may be expected to be met with and how far and in what direction they will heave the lodes. Two levels are now open from the main shaft, at 112 feet and 192 feet.

The main shaft is well provided with winding and pumping machinery, but there is no dressing-mill, the second class ore being sent by tramway to the Argent mill to be concentrated. This sort of ore should be smelted without concentration at as low a lead tenor as is profitable, as it loses silver heavily in the process of dressing, and only the poorest stuff that cannot be dealt with in any other way should be milled. This matter is dealt with more fully later on. The main shaft is close to the eastern boundary of the section (2154-87M) and is consequently not in a good position for prospecting the greater part of the block. Near the northern boundary a small lode has been found lately which has yielded some nice clean galena of good silver value, and the lode No. 2 of the Western mine seems to be making for the Zeehan-Montana ground; it would be advisable, therefore, to prospect the western portion of the lease. To do this a pumping plant would be required, and it would probably be best to at once sink a main shaft somewhere on the line of the Western No. 2 lode, and cross-cut east and west from it and from the present main shaft right across the section. Most of this cross-cutting would be in the favourable "white country" as far as can now be seen. The mine has been pretty successful as yet, and there seems every reason to expect a continuance of profitable working, especially if steps are taken to open up the yet unknown parts of the ground.

Western Mine.—Since my former Report of 20th May, 1893, this mine has continued working with great success. It has been fortunate in having ore worth stoping out, not in short chutes, as has been too often the case with most of the Zeehan mines, but continuously for a length of over 1000 feet, and the average value in lead and silver has been very good. Five levels have been opened from the main shaft at depths of 50, 110, 170, 230, and 290 feet, and at the time of my visit the shaft had been sunk to 360 feet, and preparations were being made to open out No. 6 level, sinking being resumed again immediately afterwards. Above No. 1 level the ore has been mostly worked out, though some rich clayey stuff from near the outcrop was still (February, 1895)

being obtained. The block between Nos. 1 and 2 levels was also mostly worked out. The lower levels have not shown such good ore as there is above No. 2 level, the falling off in value being quite marked, but still they show a large quantity of ore that will pay for handling, and there can be no question of the ability of the mine to maintain a good output for a long time to come. The progressive policy of the management in keeping the mine opened by levels well ahead of the stoping enables the value of each portion of the ground to be ascertained with considerable certainty a good while before it is called upon to furnish ore, and regular supplies can then be counted on. Nos. 4 and 5 levels have yet to be extended a long distance south to reach the Junction Company's boundary, and as there was good ore in the levels above in this part of the mine, there is reason to look for favourable developments as these are pushed southwards. In Nos. 3, 4, and 5 levels it has become clear that the lode worked between Nos. 1 and 2 tunnels, now known as No. 2 lode, really crosses the main lode, which renders it likely also that the West lode, seen in the end of the tunnels, will also be found to go through the main one. The main lode is one of the north-easterly series, the No. 2 and West lodes of the north-westerly one. On the east side of the main lode neither of the latter have been worked above No. 3 level, but are likely to be worth picking up and trying.

The Western Company have erected a very fine concentrating mill, using the Lühring arrangement of plant. The ore is crushed by stonebreakers and rolls, and sized in series of trommels, from which the coarser grades go to corresponding sets of jigs. The middle products from these are further crushed in a ten-stamp battery. All the finer crushed material is classified in spitzkasten, and then concentrated, each class by itself, on Lühring vanners. The plant has been more fully described in "The Australian Mining Standard" of 2nd December, 1893, by Mr. W. F. A. Thomae. There is no doubt that it is an excellent and very complete set of dressing appliances, but I should nevertheless like to see an extended comparative trial made between the vanners as slime-savers and the convex rotating tables used for saving slime-tin at Mt. Bischoff, the latter appearing to me to afford conditions more favourable for the catching of very fine slimes than the vanners. As will be demonstrated later on, this matter of saving extremely fine slimes is a most important one, this source of loss being probably by far the greatest one. In much of the Western ore there is very fine slimy black ore, very rich in silver, which remains suspended to a great extent in water, and is consequently very apt to be lost in wet concentration. For the successful treatment of very fine slimes good supplies of clean water are required, and it is likely that when the new dam now being constructed is completed and the slimes can be washed in cleaner water, there will be an appreciably greater saving. According to the Company's half-yearly report for the term ending 30th September, 1894, the mill had during the previous six months treated a total of 11,836 tons of stuff for a return of 1885 tons of concentrates, containing 181,385 ozs. silver and 1077 tons of lead, the average quantity put through weekly being 473·44 tons. The cost of concentration, bags, bagging of ore, and delivery at Zeehan station, is given as 7*s.* 7*d.* per ton of crude ore. The grand total of saleable ore raised from the mine to the same date is 10,681 tons 11 cwts. 2 qrs. 27 lbs., of value £121,737 9*s.* 10*d.* From these figures it is seen that the second-class ore on concentration has yielded 15·3 oz. silver per ton and 9·1 per cent of lead; the bulk assay of the stuff before treatment is not given, so the amount of loss is not calculable. It is a defect in the otherwise admirable reports issued to the shareholders by the management of this mine that this important item of information is withheld.

On the south boundary of Section 756-87M near the mouth of the No. 2 tunnel a small north-westerly lode has been recently cut, which has yielded some good ore, and passes to the southward into the property of the Tasmania Crown Company.

Throughout the greater part of the Western mine workings the white rhyolitic country is found, but there are also considerable belts of black slate: the best developments are in the former rock.

Silver Beauty, Section 892-87M.—If the two lodes cut by the Western Company's lower adit continue on their apparent courses of N. 12½° W. and N. 20° W., they would pass into this section about half a chain and 4½ chains respectively west of the south-east angle. A shaft has been sunk near the south-eastern corner 129 feet N. 43° W. from the peg to a depth of 90 feet, and drives made from the bottom one 40 feet to S. 70° E., the other due west about 66 feet, without meeting with any lode. The work has been done by a tribute party, who have provided a small steam pumping and hauling plant. The eastern drive is forward to about the point where the No. 2 lode of the Western mine might be expected, but should be driven on to the boundary, as the vein might have somewhat changed its course. The westerly drive will require to be extended between 240 and 250 feet before meeting the line of the West lode of the Western Company.

To the N.W of this shaft some little distance there is an old shaft in which some galena is said to have been obtained, but it was full of water, and the vein invisible.

Tasmania Crown.—A main shaft has been sunk by this Company in Section 199-87M and two levels opened at 100 feet and 170 feet, and a lot of prospecting work has been done unsuccessfully. About 200 feet N.N.E. from the main shaft there was at surface a well defined lode of

siderite with galena and blende, and it was expected that this would be cut in the workings from the main shaft. At the 170-feet level a cross-cut running N.W. was driven 210 feet, mostly through hard dolomitic limestone, and then a diamond drill bore-hole was put in horizontally a further distance of 266 feet, still through limestone and slate without finding any lodes. Driving eastward at the same level great trouble was experienced with bursts of water and slurry, and it was only after the water had been tapped by another horizontal bore with the diamond drill that any progress could be effected. The slurry often carried with it ragged pieces of galena assaying fairly well in silver. The diamond drill in this end passed through soft slate and then struck the lode-channel, such as it is, then passed into hard dolomite, which seems to be the eastern wall of the lode. A shaft was then sunk at the outcrop of the lode to connect with the 100-feet level from the main shaft, but as it got down the lode-stuff became replaced by slurry, much of which was removed by the pumps; occasional pieces of good ore were found in the soft material, but there was no regular lode. It would seem as if the junction of the slate and limestone country constitutes a natural water channel along which the limestone has been considerably removed by solution, leaving soft slurry in its place. More or less ore exists along the line of contact, which runs slightly west of north, and it is possible that it really is a lode-channel, and that at greater depth or at some other part of its course solid vein-stuff may be found; at present it looks very unpromising, and after having had a very good trial this part of the mine has been abandoned.

In Section 736-87M the tunnel driven south-westerly by the old Silver Crown Company, the previous owners, has been continued on a west-north-westerly course to a total length of 1033 feet. Three lodes have been cut in this tunnel; the first was worked by the Silver Crown Co., and some ore obtained from it; the second one runs N.N.E., and has been driven on for 50 feet on each side of the adit, and consists of silicious gossany material, not ore-bearing, but of by no means unpromising appearance; while the third, which seems to run a little west of north, and has been risen on to surface, shows a little nice clean galena. These three lodes are probably identical with three of the Zeehan-Montana Company's, and the most westerly one is nearly certainly that which has been cut again by the Western Company on the boundary of Section 756-87M. A tribute party has been working in the Tasmania Crown ground on this lode and obtained some fair ore, and the company had put in another tunnel from the western side of the hill and sunk a shaft 40 feet without cutting it; since my return from the field, however, it is reported that good ore has been struck. These lodes all seem rather promising and deserve prospecting, and it will probably be best for the company to dismantle their main shaft and remove the machinery to this section. The company have spent a lot of money in prospecting, opening their shaft, and making a tramway from Zeehan, and deserve better success than has hitherto been their lot.

Oonah Mine, Sections 1110-87M. *and* 1111-87M.—The Oonah mine is situated towards the N.E. corner of Section 1110-87M, on a lode running a little west of north and underlaying to the east. Up till near the end of 1894 the mine was worked by a tribute party with great success, a large amount of rich ore being obtained. The Oonah Company now have resumed possession, and are sinking the main shaft and preparing to open up the lode below the tributors' workings, which have been pretty thoroughly cleaned out. Four levels have been driven on the lode, No. 1 from the original adit put in by the Company some years ago, an intermediate one 30 feet below this, No. 2 level 81 feet below the adit or 127 feet below the mouth of the main shaft, and No. 3 level 30 feet below No. 2. Between the intermediate and No. 2 levels the ore was stoped out for a length of 224 feet, and above the adit level there was a southern chute worked for 175 feet: in the lower levels the latter seems to have given out, but may lie further south. The main or northern chute has been poor at the bottom level, but is going down beneath it at one part as a strong vein of very good galena, giving hope that it will make bigger again below. The shaft must be sunk deeper and another level driven before much can be known about the future of the mine. It is possible that what I have above called the southern chute is in reality only a part of the northern one, in which case the latter would appear to be rapidly pitching to the north going down, but it seems right to extend the bottom level to the south to explore the lode in that direction. It has been proposed to sink a new main shaft about 400 feet south of the north boundary of the section (*i.e.*, 335 feet south of the present main shaft), but, while this would be a very good position for testing the lode as a whole, it would be quite away from the known ore, and until ore is discovered on surface or by driving south on the present levels it does not seem to me advisable to make it. The record of the mine up to date is a really excellent one, and there is much hope that as it is opened up at deeper levels it will again become a large producer of ore.

Towards the north-western angle of Section 1110-87M a big lode of pyrites cut in the side of a creek has been driven along for 70 feet, running a little to the east of north. The lodestuff is mostly iron pyrites with a little copper, and as yet there has been no valuable quantity of silver or any other metal found in it; still it is worth prospecting. Clarke's tribute party's lode above described in the Silver Queen ground has shown that a very similar pyrites lode, running parallel to this one, may carry very valuable ore.

Junction Mine, Section 819-87M.—Comparatively little work has been done in this mine since my former report upon it, further than cutting down the main shaft and fitting it with winding and

pumping machinery. The outcrop portion of the lode has lately been found to contain valuable clayey ore similar to that got close by from the portion of it in the Western Company's ground. Levels have been opened at 50 feet, 100 feet, and 130 feet on this lode, and some good ore has been got, but on the whole the vein has been rather poor. This lode is known as No. 3: No. 2 is a short distance further to the east, and may be the Oonah lode, or possibly both it and No. 3 are branches from one main lode extending from the Oonah into the Western mine. No. 2 lode formerly supplied some silicious ore of good silver value, but has not been worked recently. No. 1 lode is a small galena vein still further east. The prospects of the Junction property are very good: with the Oonah lode running into it on the south side and the Western main one on the north, there can be no question as to the necessity for opening it up. The present main shaft is too near the Western Company's boundary to be permanently useful, though good enough to enable the north ends of Nos. 2 and 3 lodes to be prospected and worked, but in time, in order to examine the lodes further south, another more central main shaft will be required. The line of the lode from the Oonah shaft to that of the Junction Company should be vigorously prospected by sinking and crosscutting to try to pick up chutes of ore similar to those that have been found in the Oonah and Western mines.

Western Extended Mine, Sections 860-87M., 861-87M., 1057-87M, and 1062-87M.—A shaft has been sunk 30 feet towards the N.E. corner of Section 1062-87M., but was full of water at the time of my visit, the owners being engaged in putting machinery on it. Mr. J. Wisch, who was in charge of the underground work while it was in progress, informed me that a cross-cut was driven 50 feet east from the shaft which at 20 feet cut a lode running north-westerly, there being three feet wide of lodestuff, consisting of carbonate of iron, quartz, blende, &c., with lumps of galena assaying from 40 to 60 ounces silver per ton and 30 to 45 per cent. of lead. The lode was followed north for 30 feet, preserving the same character and size as where first cut. In the end of the cross-cut there was also a cross lode running East and West about one foot thick of pug with veins of galena and blende.

North-Western Mine, Sections 1341-87M., 955-87M, and 956-87M.—A main shaft has been sunk in the eastern portion of Section 955-87M., but the workings were not accessible at the time of my visit. The shaft was 118 feet deep and sinking in progress, the intention being to open out at 160 feet. At 100 feet a cross-cut has been driven 136 feet to the east and 78 feet west; at 30 feet a lode was cut running north-westerly, which has been followed north for about 100 feet and south 85 feet. The lodestuff is mostly carbonate of iron and quartz with a little galena and copper pyrites. An underlay shaft has also been sunk on the lode from surface, showing it to underlay pretty fast to the eastward. From their position this and the Western Extended lodes may well be continuations of the Western Company's No. 2 lode.

Sections 1888-91M and 841-91M.—In accordance with special instructions to look at what had been done on these leases held by Messrs. Mahony and Stevenson, I visited them in company with Mr. Stevenson. Several trenches have been cut in various places and a few traces of galena and blende found here and there, but nothing in the shape of a true lode has as yet been discovered, and as yet there is nothing whatever to indicate that there are any lodes in the leases, though from their position it is likely that some may in time be found.

New Silverstream Mine, Section 1642-87M.—It is much to be regretted that the owners of this very likely mine have not yet seen their way to put machinery on it to open it below the adit level. Very little has been done since my former Report to enable me to add to what was then written. The mine has lately been let on tribute to O'Neill and party for three years, the tributors paying 10 per cent. of the gross produce for the first year, 15 per cent. the next, and 20 per cent. the third, also 50 per cent. of any ore picked from the heaps raised by the company and lying at the mouth of the lower adit. The tributors have to find any machinery they may require. This is quoted as an example of many of the tribute agreements current on the field at the present moment. Under such conditions what can be expected other than that the tributors should take out all the ore they can readily lay their hands on and then throw up the tribute? No progressive development work is possible. The party at the time of my visit were working a vein of ore much mixed with clay and iron oxide lying above the adit, which seems to have been missed by the company when driving it; in places there were six feet in width of ore in this chute, and the men soon raised 35 tons of good galena fit for sale. From the quantity of ore that has been got above the adit level and is known to be going underfoot, it is pretty certain that as soon as the mine is furnished with drainage machinery it will be a large producer. In many respects this lode is more like the large ones of the Comet and Mt. Dundas Cos. at Dundas than the more regular ones of the Zeehan field, and it is noteworthy that it is similarly close to the contact of the Silurian and Serpentine areas. Much of the gossan in the adit is of a very promising appearance, likely to cover ore at greater depth. Though not very easy of access at present, a tramway could without much trouble be made to connect with the Zeehan to Remine road at Comstock, and with the New Tasmanian Company's tramway. It is a very great pity that more energy is not shown in developing this mine, for in many ways the chances of its being successful are among the best possessed by any mine in the district.

To the south-east of the main workings a large outcrop of magnetite is seen, probably connected with the large magnetite lode of the Tasmania P.A. further north-west. Mr. O'Neill proposes to put a tunnel in on this as low as one can be got, which seems well worth trying. This huge magnetite body is very likely to stand in close connection with valuable ore of some sort, and its exploration deserves attention.

Comstock Mine, Section 712-87M.—For the last two years or more various parties of tributors have been working the shallower portions of the lode with more or less success, sufficient to prove that it is a valuable one and deserving to be opened up in proper mining style. The present party have a shaft down 42 feet, which is only 17 feet below the previous level; they have a small steam pumping plant which enables them to keep down the water. At the time of my visit they were only preparing to open out to cross-cut the lode at the lower level, so nothing could be seen.

On the No. 2 lode Mr. O. Meredith had sunk a shaft about 30 feet on the underlay; the lode-matter was about four feet wide, but mostly clayey broken country rock with a good deal of pyrites and some galena. The stuff was nothing like payable, but work was being persevered with in the hope of finding something better. The Comstock mine, like the Silverstream, is worthy of a better fate than to be turned over to tributors, and with good machinery put on it there would be every expectation that it would become a good one.

Boss Mine, Section 2073-91M.—This section, now leased to Messrs. Fairthorne and Quiggin, was formerly held by the Boss Silver Mining Company, and is still locally known by that name. Towards the north-west angle a shallow tunnel has been driven some 70 to 80 feet across a large pyrites lode, which at surface shows as a strong line of gossan. In the tunnel the pyrites body is about 25 feet wide, and the course seems to be about N.N.W. On the western wall some very high-grade galena was obtained by a party of tributors, and also some very dense blende. A good deal of water flows from the tunnel, and in order to be able to sink on the lode a good pump will have to be supplied. The lode is traceable on surface for some distance, and some shafts and tunnels have been made in the oxidised portions of it, without getting any ore. Further to the south-east, on a former visit, I saw an outcrop of pyrites and dense blende similar to those found in the north-west angle, but am unable to say if they belong to the same lode. The discovery seems well worth following up, and an engine shaft should be sunk to test it. No one was at work at the time of my visit, the tribute party having given up when it came to be a matter of sinking on the galena.

Sylvester Mine.—Several tributes have been taken from time to time on the sections held by the Sylvester Company, but none of them were at work at the time of my visit, and the shafts were full of water. Several lodes are known to exist, and the property deserves more energetic handling.

New Tasmanian.—Work has been abandoned by the Company and the mine let to a tribute party, who were shifting the machinery from the south main shaft to the north or No. 2 one, and sinking this deeper to work out a shoot of good ore that they had found. The levels being reported to be full of water, dammed back while sinking was in progress I did not visit this mine.

Silver Queen Extended.—This property also is turned over to tribute parties, but as I did not hear of any work of consequence in progress it was not visited.

Grubb's Mine.—Since my last report on this mine a large concentrating mill has been erected for the treatment of the second-class ore. The stuff, after crushing by means of rolls, is jigged on a series of jigs, and the finer stuff is washed on Frue vanners. It is claimed that the mill is doing very good work, but there does not seem to be any practice of sampling the ore properly before it goes into the mill, and the percentage recovered is therefore doubtful.

The mine has now three levels below the adit, at 80, 130, and 200 feet in the main shaft, but was not looking so well at the time of my visit as on former occasions. A good many strings and small veins of ore have been found above the main intermediate level, and also some rich gossan ore, but the main chute of galena between Nos. 1 and 2 levels is nearly worked out, though a few good stopes still remain. Under No. 2 level there is ore fit for the mill to be taken out. The stoping has been allowed to overtake the development work, and the shaft should have been sunk another 100 feet by this time and had lower levels opened out: sinking is now in progress, however. It is also necessary to do more driving along the course of the lode to look for other chutes of galena. The record of the mine as an ore-producer is a good one, and there is no great reason to be afraid of its failing if the development work is kept well ahead of the stoping.

According to the Company's last half-yearly Report, during the six months ending 18th February, 1895, 748 tons 2 cwts. 2 qrs. 22 lbs. of ore were sold from the mine, realising £5755 2*s.* 5*d.* The total value of ore raised to the same date is given in the General Balance Sheet as £20,018 18*s.* 8*d.* This is a very good return from the amount of ground open, and should encourage the Company to develop the mine faster.

New Silver Bell Mine.—This mine is let to a large tribute party, who have done a great deal of work with very little success, having driven in all about 700 feet along the lode at the bottom or 115 feet level without getting much good ore. Several times, however, ore has been found going underfoot, leading to the belief that the ground will improve at the next level. Driving north a good face of ore was found just as the level reached the Silver King boundary, and the party had the hard luck to find that their work had only resulted in proving their neighbour's mine to be valuable. Close to the boundary, however, some fair ore was got, giving some first-class ore fit for sale without dressing, and a good deal of second-class stuff, which is crushed by hand by boys, hand-jigged, and buddled on surface. The galena sells for about £7 a ton. On the whole the bottom level has been a poor one, the galena in the level above having seemingly not lived downwards. There is however, a large quantity of second-class ore that would pay for extraction if there was a mill on the ground to dress it. The lode is strong and well-defined, with distinct walls, and consists of banded and brecciated siderite, quartz, blende, pyrites, galena, &c.

It is understood that the Company owning this mine is about to be reconstructed, and it is to be hoped that it will then be well opened up at several levels so as to give it a thorough mining trial.

Silver King Mine.—A tribute party was working at the time of my visit at shallow levels close to the Silver Bell boundary, but there happened to be much foul air in the workings, preventing entrance and examination. Some fair galena has been got here on what seems to be the top of the chute struck in the north end of the Silver Bell bottom drive. Under existing circumstances it would probably be best for the tribute party to make terms with those of the Silver Bell, by which they might be allowed to work through the latter's main shaft.

The Silver King workings at the main shaft have been shut down for some time, though I was given to understand that several parties have been willing to take the mine on tribute. Seeing that the Company were unable to work it at a profit themselves, it seems rather curious policy for them to refuse tributes at royalties which, though low, would at any rate give them some profit.

GENERAL REMARKS.

Tribute System.—All over the Zeehan-Dundas field the system of working the mines on tribute has during the last two years come greatly into vogue; but while it has done a great deal of good for the district, there seems to me to be great danger that it will prove anything but a benefit before long, inasmuch as many companies are showing a tendency to become simply middlemen, living on the labour of their tributors, instead of shouldering their proper responsibilities and opening up their leases themselves. According to my lights it was never intended by the mining laws of any country that the person to whom a grant of mineral land belonging to the State is made should be allowed to farm out his concession to others without doing anything himself towards carrying out the conditions of his lease. Yet this is what is being done in several cases in the Zeehan District, and not only there but also on several other fields of the Colony: speculators take up leases and at once proceed to invite tributors to undertake the working of them, the tributors having to supply all machinery and other requisites for the work. The original lessee pays the small rent demanded by the State, and takes in return whatever he can screw out of the necessities of the actual workers. It is needless to say that the terms upon which such persons sublet their ground are very much more onerous than those imposed on themselves by the State; where the latter grants a lease for 21 years of large areas of ground at a low rental to any depth to which mining may be carried, the lessees give tributes lasting from only a few months up to, in extreme cases, five years, often on only 200 to 300 feet in length on a given lode, and to a depth in some instances of only 60 or 70 feet, and exact from 10 to 30 and even 50 per cent. of the value of the total produce as their share. From 20 to 30 per cent. of the gross produce is a usual payment by tributors to owners of mineral leases at Zeehan to-day, and the tributors have to open up the lodes and supply machinery for doing so at their own expense without any assistance from the owners, and without any compensation at the end of their term. Contrast these royalties with the terms on which the State offers the mineral lands to be worked, which may be seen by comparing the amount received in rents and fees with the value of minerals produced. The value of the Colony's output of minerals for 1893-4 was £707,852, and for the previous year £678,724. During the same two years the mines receipts were £16,732 and £18,639 respectively; the revenue from rents and fees, &c. amounting to only 2½ per cent of the gross value of the produce. This is a general average, in which the rents from sections not worked and from unproductive mines goes to largely swell the per-centage: if we take only the proportion of rent paid by producing mines to the value of their output, the royalty charged by the State becomes very small indeed.

In thus commenting on the tribute system as it exists at Zeehan at the present time, I have been referring only to those cases in which the owners have required the tributors to open the mines from their original state of nature, not to those in which a partially developed mine or part of one has been let on tribute. There are many reasons connected with the management and overseeing of the work and the saving of mineral that often enable

tribute parties to work successfully in ground which the owners cannot themselves work at a profit, and if the latter have opened the mines, erected machinery, and made tribute work possible, there is no good reason why they should not receive all the profit they can get from tributors' work. But it appears to me to be highly objectionable that any person should be allowed to get State mineral lands on the easy terms offered by the State and forthwith should sell the concession to the highest bidder, as is practically done by offering virgin ground on tribute. If a lessee is not prepared to comply with the conditions of his lease and work the ground himself, he should in my opinion be made to stand out of the way and make room for the people who are actually ready to do so: the men who now take tributes would then deal directly with the State without paying heavily to unnecessary middlemen, and much more benefit would result to the country; ground would be worked so long as it would pay wages instead of, as at present, wages plus royalty.

The tributors have done much excellent work on the Zeehan field, not only in working known lodes which the owners could not or would not touch, but also in prospecting for previously unknown ones. Being in most instances working parties of poor men without capital, they are not able to provide themselves with really good mining plant, and the field is dotted over with small, cheap, make-shift arrangements of which the best that can be said in most cases is that they enable the men to get out some of the ore lying near the surface, and are as good as they have means to provide. These little sets of machinery are only able to work the mines to very shallow depths, and will have to be replaced with better as the surface parts of the lodes become exhausted; they serve their purpose for the short periods of the tributes, and are useful in prospecting the lodes to an extent that enables it to be judged if they are worth putting more expensive plant upon. In many cases if the tributors were the owners of the mines they would make shift to procure better machinery, but it is not to be supposed that they will go to much expense when their leases are so short and so arbitrarily terminable as they usually are at present. Attention is called to this matter of working the mines by tribute parties because many mine-owners appear to expect that they will always be able to maintain their comfortable position of middlemen and get tributors to take all the risk and do all the work, whereas it is clear that the system must soon come to an end with the exhaustion of the shallow workings, when greater capital will be required for deeper mining.

Most of the tribute parties do not send their ore to the various concentration works, but prefer to take out what clean galena they can get by hand-picking and dressing with hand-jigs and buddles. On these latter crude appliances the losses are naturally heavy, but the men say that it pays them better to work in this way than to pay the mill charges and cost of carriage. In several cases that came under my notice it did not pay the tributors to take out what under more favourable circumstances would be good milling ore. In such instances it is evident that justice is not being done to the mines on account of want of capital and insecurity of tenure preventing the parties from erecting mills on their ground or making tramways to neighbouring works to ensure cheap carriage. For want of proper equipment the maximum value of the ore is not being secured. It seems to me, however, that instead of multiplying small mills, each of which will probably be more or less inefficient and uneconomical, it will be better for the district that the means of access should be improved to a few large and centrally situated dressing-works, in which the greatest efficiency could be secured at the least expense. It has been proposed that a system of narrow-gauge railways or tramways should be constructed throughout the field, and there can be no doubt that they would be a very great boon and promote development more than anything else.

Disposal of Ore and Local Smelting.—With I think only one exception, that of the Western Company, who ship their ore to Europe for sale, all the galena and other marketable ore now raised in the Zeehan and Dundas fields is sold to firms of ore-buyers, of whom there were three trading in Zeehan at the time of my visit. In some cases the ore has been sold according to its assay value, an example of the tariff being given in my last Report on this field, but it is now more usual for it to be disposed of by tender. The ore-buyers are notified that a certain mine will sample a parcel of so many tons on a given date, and are invited to be present. They send representatives to overlook the sampling, who each takes what is considered a fair sample: these samples are then assayed by each firm's assayers, and the buyers then offer whatever they may think fit for the ore, the highest bid being usually accepted by the mine. To check the prices offered the mine-owners generally also have a sample assayed. All the buyers are acting for foreign smelting establishments that require lead and must have it for the proper carrying out of their work; and in some, if not in all cases, the circumstances are such that it pays the smelter to give more for the lead in the ore than he can realise by its sale. For the like reason fluxing ores rich in iron are much desired by one establishment, as it is in the habit of dealing with silicious ores for the most part. Owing to considerations of this nature the ore-buyers claim that they can afford to give to the mine-owners better prices than they could obtain from a smelting establishment on the field. This I greatly doubt, always supposing that the local smelting works are conducted on a sufficiently extensive scale to be economical. The same staff of the more highly paid officials as is required for one is quite able to attend to four or five furnaces, and numerous economies are possible in a fairly large establishment that are not to be made in a small one. The output of the field at present is about 500 tons weekly, which is not enough to keep two 80-ton furnaces constantly going, but it must be remembered that

the output is all practically first-class ore, and that it represents a much larger quantity, at least double as much, of ore that would be fit to smelt without concentration. In this connection the remarks to be made later on as to losses of silver in concentration should have attention. When we add that there is in the field a very large quantity of low-grade oxidised ore not fit for concentration and too poor for export, but still payable to smelt on the spot, it is probable that at least four 80-ton furnaces could be profitably employed, and it seems to me that the saving by smelting on the field would far outweigh the advantages that the ore-buyers can offer. The local Smelting Works, however, would have to be strong enough financially to buy the ore outright from the mines for prompt cash as the ore-buyers do, as it is this feature of the latter's operations that especially commends itself to small owners anxious to realise at once on their mine's produce. Supposing that the local works were only able to compete on equal terms with the foreign establishments, it would be of immense advantage to the district and to the country to have the smelting done locally, and any movement towards that end deserves encouragement.

Sampling of Ore, and Railway Freights.—From time to time there has been much dissatisfaction expressed by mine-owners and others on the West Coast with the rates of freight charged on the Zeehan-Strahan Railway. It is not in my province to express an opinion as to whether or not these complaints are justifiable, but it has occurred to me that the introduction of *ad valorem* rates is not so difficult a matter as is generally supposed, and that a scheme can be devised which would permit them to be used with benefit to all concerned. At present each buyer attends the samplings at the different mines and tenders in accordance with his own assay, as above explained, and the sampling is done by hand. As the ore has all to come into the Railway Station to be put on the trucks it would be a great convenience if a public weighing and sampling works were established there, where for a small charge the ore would be accurately sampled with aid of automatic machinery. The establishment would supply samples to the ore-buyers, guaranteed as having been taken in accordance with a certain definite and approved method of sampling, and would also guarantee the weight of each parcel, thus doing away with a lot of bother now arising as to differences between the mine weights and those of the Railways. There would be no need for the buyers to send men to attend samplings at considerable expense, and the mines also would be saved the difference between the cost of sampling by machinery in a properly fitted up establishment and that of doing the work by hand on the mine, usually under difficulties. Also, as the sampling would be done by machinery under the supervision of disinterested persons, there would be no occasion for the incessant watchfulness over the process that has now to be exercised by the buyers to prevent tampering with the samples, and as the ore-bags would remain in the sampling-shed till put on to the Railway trucks there would be no opportunity of substitution of poorer ore for more valuable stuff, a risk that is difficult to avoid under the existing system. Should a mine-owner be in doubt as to whether a certain parcel of ore was good enough to be saleable, a case which sometimes arises, he would of course have to sample on the mine to ascertain this, so as not to run the risk of being unable to sell it after he had got it to the station. In most instances, however, the sampling at the mine could be dispensed with, and the weighing and valuing be done once for all at the Railway station. The works would be self-supporting, fees being charged to cover expenses, which ought to be less than the same work could be done for at the mines. It would not be necessary or advisable that the sampling-works should make assays of the material, it being better to leave this part of the business in the hands of the buyers and sellers of the ore, each of whom could then examine it for himself and determine what it would be worth to him according to his own business requirements. But a check sample of every parcel of ore passing through would be kept, and the Railway Department might then call on shippers of ore to declare its value and charge freight accordingly, from time to time checking the declarations by assays of say 10 per cent. of the check samples. In this way it seems to me that a cheaper and better system of sampling than now prevails could be introduced, and also *ad valorem* rates of freight on the railway. Should coke, fluxes, etc. be imported into Zeehan for local smelting it would still be handy to have them sampled in the Railway Station instead of in the smelters' yards, though of course the analyses would be done by the smelters, and the bullion produced would be sampled before being sent away. Much more accurate returns of the production of minerals than are now available would also be obtained. The system of establishing works for weighing and sampling is no new thing and works satisfactorily elsewhere, being found to be very convenient for both buyers and sellers of ores. The samplers guarantee only correct weighing and sampling, but do not interfere with the assaying and analysis of the ores, as it often depends on local circumstances and special business considerations whether a buyer finds certain constituents of an ore useful, neutral, or hurtful, and his tenders must depend on his own estimation of the value.

Concentration losses.—Closely allied to the question of local smelting is that of the losses sustained in concentration, a subject that has not yet been investigated at Zeehan with the thoroughness its importance deserves. In my last Report some pains were taken to show that in the case of two mills of which figures were available the losses were very serious, but on this visit I was not able to carry out a further examination in this respect. It has been noticed, however, that all through the field the proportion of silver to lead in the concentrated galena is regularly less than in the hand-picked ore from the same mines; this fact is now thoroughly well established. In the last report (half year ending February, 1895) of the Grubb's mine it is particularly well brought out, as shown by the following figures taken therefrom. In quoting these I wish it to be clearly understood that

no reflection is in any way made upon the way the work of concentration is conducted at that particular mill, for other mills' returns show just the same feature, but as the figures of this one are available for exemplification in a handy form they are made use of rather than others.

Ore raised and sold at the Grubb's Mine during the Half-year ending 18th February, 1895, quoted from the Directors' Tenth Half-yearly Report.

No. of Parcel.	No. of Lot.	Character of Ore.	Net Weight of Parcel.				Assay Value.				Net Proceeds.		
							Silver.			Lead.			
			tons.	*cwts.*	*qrs.*	*lbs.*	*oz.*	*dwts.*	*grs.*	*per cent.*	£	*s.*	*d.*
1	1	No. 1 Jig	15	0	3	0	75	2	16	71·32	529	15	6
	2	Concentrates	51	10	3	4	59	18	20	69·0			
2	3	Hand-picked	7	2	1	2	84	0	0	74·0	467	0	0
	4	No. 1 Jig	9	10	1	20	74	0	0	72·0			
	5	Concentrates	42	1	1	7	59	9	12	68·0			
3	6	No. 1 Jig	11	4	2	18	60	15	4	70·25	367	3	6
	7	Concentrates	40	4	3	17	54	0	11	68·38			
4	8	Hand-picked	4	11	3	5	89	16	16	75·1	449	9	0
	9	No. 1 Jig	7	5	1	26	70	4	16	73·7			
	10	Concentrates	44	6	0	11	53	8	4	68·5			
5	11	Hand-picked	12	12	2	1	92	13	0	74·1	621	10	0
	12	No. 1 Jig	9	10	1	2	72	7	22	71·9			
	13	Concentrates	45	14	2	1	54	17	14	69·1			
	14	Slimes	6	6	2	14	52	8	14	70·3			
6	15	Hand-picked	15	16	3	12	78	1	11	73·25	537	7	0
	16	No. 1 Jig	11	19	3	14	61	11	12	70·3			
	17	Concentrates	34	1	1	16	46	1	4	68·0			
	18	Slimes	3	14	2	11	53	1	16	72·0			
7	19	Hand-picked	17	12	2	4	88	10	2	75·25	603	9	6
	20	No. 1 Jig	10	11	3	17	72	3	20	72·75			
	21	Concentrates	35	14	3	5	51	12	6	67·2			
	22	Slimes	4	13	1	18	50	12	6	71·7			
	23	Gossan	3	0	1	5	52	5	8	16·0			
8	24	Hand-picked	4	15	2	16	79	1	1	74·4	371	3	6
	25	No. 1 Jig	8	1	1	23	67	18	22	71·0			
	26	Concentrates	28	8	1	22	55	10	16	69·2			
	27	Slimes	4	12	2	23	49	19	14	70·1			
9	28	Hand-picked	4	1	2	2	92	8	22	75·8	280	13	2
	29	No. 1 Jig	8	18	2	3	61	8	6	70·0			
	30	Concentrates	23	18	3	14	52	5	8	67·5			
	31	Slimes	3	7	3	5	48	13	11	72·6			
10	32	Hand-picked	3	13	0	19	73	16	12	70·4	274	15	6
	33	No. 1 Jig	6	4	3	27	64	0	12	69·8			
	34	Concentrates	28	19	1	16	53	11	11	65·7			
	35	Slimes	3	0	2	23	45	1	14	69·0			
—	—	Adjustment	—	—	—	—	—	—	—	—	19	15	8
11	36	Hand-picked	4	6	1	17	88	17	1	74.1	389	9	6
	37	No. 1 Jig	6	9	1	12	62	1	8	71·0			
	38	Concentrates	42	12	3	16	47	17	19	66·0			
	39	Slimes	4	10	3	17	51	12	6	69·3			
	40	Gossan	1	18	3	16	74	12	20	9·3			
12	41	Hand-picked	4	4	2	13	104	10	16	73·0	422	6	7
	42	No. 1 Jig	11	1	2	11	60	2	3	71·0			
	43	Concentrates	40	12	0	11	47	0	19	66·0			
	44	Slimes	3	19	0	27	48	6	22	69·0			
13	45	Hand-picked	1	15	1	1	92	15	11	73·0	421	4	0
	46	No. 1 Jig	8	9	0	0	65	6	16	70·0			
	47	Concentrates	39	15	1	1	50	6	3	66·5			
	48	Slimes	5	15	3	17	50	19	4	71·3			
			748	2	2	22					£5755	2	5

From the above figures we may obtain the following averages, taking the arithmetical means of the figures in the column of assay values as being near enough to the truth for purposes of comparison, without working out the strictly correct averages:—

	Silver per ton.			Lead per cent.
Hand-picked Ore	87 ozs.	13 dwts.	17 grs.	73·85
No. 1 Jig	66 „	14 „	3 „	71·16
Concentrates	52 „	15 „	9 „	67·62
Slimes	50 „	1 „	17 „	70·60

The mean of these percentages of lead is 70·8; let us now calculate the quantity of silver in each product, supposing them all to have the same (the average) content of lead; thus:—

				ozs.	dwts.	grs.		ozs.
Hand-picked Ore	73·85 per cent.	:	70·8 per cent.	:: 87	13	17	:	84·06
No. 1 Jig.....	71·16 „	:	70·8 „	:: 66	14	3	:	66·37
Concentrates.....	67·62 „	:	70·8 „	:: 52	15	9	:	55·25
Slimes	70·60 „	:	70·8 „	:: 50	1	17	:	50·23

The last column now fairly compares the relative value in silver of the four different products. It is seen that there is a regular falling off in the silver value as the material is more and more finely crushed and thoroughly washed. There can be no reason why the coarser lumps of ore should be richer in silver than the finer, especially as much of the finer stuff is simply the result of crushing larger pieces during working, in the mine as well as in the mill, and the only conclusion that can be come to is that part at least of the silver is in a form which renders it easily removable by washing. Mr. Johnson, assayer at the Grubb's mine, has made some direct experiments to ascertain if the loss is really due to washing out of silver, with somewhat startling results. A quantity of clean galena was broken into pieces the size of hazel-nuts or thereabouts and half of these were reduced to powder and assayed. The remaining half were enclosed in a small basket of wire netting and put into one of the jigs under the sieve where they would be constantly washed by the water passing through at every stroke of the plunger just as if on the sieve; after a time they were taken out, reduced to powder, and assayed. I have not a note of the exact figures obtained by Mr. Johnson, but they were something like these:—In one experiment the assay before washing was 120 ounces silver or thereabouts to the ton and afterwards was only 80 ounces; in another there was a reduction from about 220 ounces to 140 ounces. The experiments thus showed a very large loss of silver in consequence of the washing. It seems probable that the loss is due to the silver being present as very fine particles of sulphide of silver interspersed through the galena, which are carried away mechanically in suspension in the water. Being thus suspended they are not deposited for a long time, and consequently are carried clean away, and the loss is not shown by assays of the tailings heaps. Where these are depended upon to show the loss from the mill the important loss of silver in suspension in the water is disregarded, and the work is made to appear better than it really is. Experiments should be instituted by all the mines to determine the amount and nature of the loss and to find out the best way of overcoming it. At present the best solution appears to be to avoid crushing and washing the ore as far as is possible. Some of the tribute parties have found this out, and instead of dressing their ore as clean as they can before selling it, are in the habit of sending it to market as far as possible without concentration at the lowest lead content at which the buyers will accept it. By doing so they get perhaps a smaller price per ton but sell a larger quantity, and some at least of them claim that they make a better profit this way than by dressing to clean ore.

Local smelting, by permitting no ore to be concentrated that could be smelted without dressing, would go very far to do away with this formidable source of loss, and though the very poorest stuff would still have to go through the mills the loss would be minimised. This view of the matter is commended to the attention of mine-owners. Furthermore, even if they can get as good a price for their ore by concentrating it and selling to the ore-buyers, which I very much doubt, nevertheless if the local smelter can give them the same return he should have the preference, for it is better for the district and the colony that part of the value of the ore should be spent in labour and material at the furnaces than that it should be thrown away in the creeks. The net result to the owner from the closer extraction of the metallic values in the furnaces might be the same as from the cheaper but more wasteful concentration method, but a better technical result would be secured, and good done to the country in the process.

Returning to the quoted figures of the Grubb's mine, and assuming, as is reasonable, that the hand-picked ore shows the real average value of all the galena in the mine, say 84·06 ozs. silver per ton and 70·8 per cent. lead, let us try to arrive at what has been the actual concentration loss through the washing out of the fine sulphide of silver or whatever else it may be. During the period quoted—

The hand-picked ore was	80·6286	tons, or	10·9	per cent of the whole.	
„ No. 1 Jig „ „	124·4147	„	16·7	„	„
„ concentrated „ „	498·0397	„	67·0	„	„
„ slime „ „	40·0942	„	5·4	„	„
TOTAL	743·1754	„	100·0	„	„

(The gossan ore is left out of consideration.)

In every hundred (100) tons of ore therefore, taking the mean values of the different products as above (reduced to a uniform lead tenor of 70·8 per cent.), we have—

10·9	tons	hand-picked ore	at	84·06	ozs.	silver	per ton,	equal to	916·254 ounces.
16·7	„	No. 1 Jig	„	66·37	„	„	„	„	1108·379 „
67·0	„	concentrated	„	55·25	„	„	„	„	3701·750 „
5·4	„	slime	„	50·23	„	„	„	„	271·242 „
100·0			(average)	59·976	„	„	„	„	5997·625 „

Now it is difficult to imagine any good reason for believing that the average value of the hand-picked ore is not the average of the whole of the galena won at the same time from the same parts of the mine: assuming that it is so, and Mr. Johnson's experiments quoted above show that a loss takes place in washing that would quite account for the difference in the value of the mill products, 100 tons of ore ought to contain 8406 ounces of silver. The loss by removal of silver in washing would therefore amount to 2408·375 ounces in 100 tons of dressed ore, or no less than 24 ounces to the ton. Differently expressed, this loss amounts to 28·65 per cent of the silver originally present, which agrees pretty closely with the percentage losses experienced in Mr. Johnson's direct experiments. According to this showing, the Grubb's Company lost in the half-year quoted 17,900 ounces of silver, washed out of the ore in concentrating, or a value of over £2200.

It is hard to credit such a conclusion, but it seems the inevitable consequence of the data. To add to the seriousness we have to repeat that the loss appears to be as "float" silver, which cannot be saved by any process of wet concentration, and is not detected by assaying the settled tailings. It would be detected, however, if all ore passing into the mills was properly sampled and assayed, as advocated in my previous Reports, before being crushed and washed, for the difference between the [illegible] present at first and that saved by the mill would be at once apparent. The matter is of such extreme importance to the field that I would strongly urge that a minute and thorough investigation of it should be made, not only in each mill by the owners, but also in all the mills by the Government, to ascertain definitely and conclusively what the real losses are and what can be done to prevent them. At the same time the conditions surrounding the question of local smelting, which seems the best remedy, might be examined into. There have now been several cases at Zeehan of heaps of second-class ore which had been carefully valued having failed to yield on concentration anything like the amount of silver expected from them, and it has been customary to blame the first valuation, but there now seems to be another explanation possible.

The magnitude of the "float" loss, if the above conclusions are sustained, is very formidable: if the Grubb's Company have lost at the rate of over £4000 a year it is probable that the other mines have suffered in much the same proportion, in which case the annual loss from this cause must approach £150,000. It is fervently to be hoped that the loss is not so great as the figures appear to show, but there can be no question that a rigid investigation is most urgently required.

The loss just spoken of is the "float" loss, not that in the heavier tailings, which can be saved if necessary for further treatment; when the latter also is added the total loss by concentration is very serious. Instances of this were given in my last Report on the Zeehan field.

General Progress.—Though the development of the West Coast fields has not gone on so rapidly as was at one time anticipated, still substantial and permanent progress has been made, and there is every reason to be confident that it will continue. There are still large numbers of lodes that are known but not tested, some of which will in time come to the front, and new discoveries are constantly being made as the bush becomes cleared away. The region contains gold, silver, lead, copper, tin, bismuth, and nickel in various parts in payable quantities, and even the zinc, which is now worthless, will become of value in the future. Its excellent prospects cannot be gainsaid, the mineral resources being plentiful, varied, and valuable. The great question now is what is best to be done to encourage development so as to enable the latent wealth to be realised with the least delay. Improved facilities of transport are of the first importance, and the proposals that have been made to construct light railways and tramways throughout the district cannot be too strongly recommended. To begin with, the tram through the Ring River Valley to Mount Black and Mount Read, above discussed, and one from the Zeehan Town tram to the Comstock, are the most urgent. The opening up of unknown country by tracks should also not be neglected, and the following routes are recommended:—Up the Mackintosh Valley from the Waratah-Zeehan line or from the Mt. Black district to the Vale of Belvoir; up the Stanley and Wilson Rivers; from Mount Black up the Koonya River to Mount Tyndall and Mount Lyell, and from Mount Zeehan direct to Mt. Lyell. The matters of a geological survey of the Zeehan field, and of investigation into the losses by concentration, and possibilities of establishment of local smelting works, have already been fully gone into. Mention should also be made of the Zeehan School of Mines, which has made a very creditable start in spite of most adverse circumstances: this institution deserves encouragement and support, and if fostered will do much good to the field.

I have, &c.

A. MONTGOMERY, *M.A.*,
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The Secretary for Mines, Hobart.