REPORT ON THE PROGRESS OF THE MINERAL FIELDS OF THE COUNTY OF MONTAGU.

Geological Surveyor's Office, Launceston, 20th May, 1893.

SIR,

I HAVE the honor to forward to you the following Report on the state of the Mining Industry on the Mount Reid, Mount Dundas, Mount Zeehan, and Mount Heemskirk mineral fields. On the 11th April last I had the honor of submitting to you an *interim* Report on these fields, together with some observations on the coal and other discoveries near Mount Pelion, but the present more extended one will not deal with the latter, but leaves them for a separate Report. As I have also sent in a seperate Report on the Mount Lyell mine, dated April 6th, 1893, it is not further remarked on in the present one, though Mount Lyell field is in the County of Montagu.

Geological Structure.—In my previous Reports of the 25th April and 25th November, 1890, I have touched briefly on the geological structure of the Zeehan and Dundas fields, and it seems desirable now to go into this subject a little more fully. The time at my disposal when visiting the district was however so short and so much taken up with an examination of the mines from an economic aspect, that I have not yet been able to make any general geological survey for the purpose of mapping the various formations and for tracing out their relations to each other; the following account is therefore only a very general sketch. Like many other mineral districts, the Zeehan and Dundas fields have a somewhat complicated structure, consisting of ancient slates, sandstones, limestones, and other sedimentary rocks, much folded and contorted, and broken by igneous intrusions of various ages. The sedimentary strata, though much twisted, appear on the whole to have a strike about N.N.W. and S.S.E., parallel to to the West Coast Range and the West Coast line itself, but vary very much in dip. Rocks of very similar composition are found with very unlike lithological characters, some of the sandstones for example being hard, dense, and much metamorphosed, while others are soft and friable. This variability makes it very difficult to determine whether the strata belong to only one or to more than one geological period, though it seems most probable that the latter is the case. If so, the beds belonging to both the younger and the older formations have much the same strike and often resemble each other lithologically, so that their separation must be very difficult in the absence of fossils. Further south the limestones of the Gordon River have been referred to the Lower Silurian system, and the sandstones of the Queen River to the Upper Silurian, on pretty good palaeontological evidence, and very possibly both these formations are represented among the non-fossiliferous beds of the silver fields. On the Zeehan field fossils are found rather plentifully on the Despatch Company's section in limestone, and on the Silver King Company's ground in slate and sandstone, and the limestone near the Oceana mine also yields a good many species. These have not yet been examined and named by any professional palaeontologist, but seem likely to be Upper Silurian or perhaps even Devonian in age. The non-fossiliferous beds conformably associated with the fossil-bearing layers are not distinguishable on lithological grounds from some similar ones intercalated in the more metamorphic rocks of the Mount Dundas and Mount Reid Range, which again pass eastward into highly crystalline mica-schists and quartzites, so that it is not certain that the latter much older-looking beds are not also Upper Silurian. It seems to me most probable, however, that the Dundas and Reid Range, Mount Murchison and the West Coast Range, are of older date than the rocks of the Zeehan field, and that the latter lie on the flanks of a ridge of more ancient origin.

The fossiliferous beds are found at intervals up the Huskisson River, on the track from North Dundas to Waratah, and again at the Heazlewood Field, showing the latter to be of the same age as the Zeehan one.

The strata of the Dundas and Mount Reid Range seem more crystalline than those of the Zeehan Field on the whole, but otherwise do not differ much from them. They consist of slates, schists, sandstones, and conglomerates, of various colours and textures, much contorted and dipping generally at high angles. The conglomerates found near the saddle between Mount Dundas and Mount Reid, contain pebbles of quartz and numerous ones of older jasperoid slates. Lower down the slopes of the Range, along the North Dundas Road, and near the Dundas Township, beds of angular conglomerate or breccia occur in some quantity, chiefly formed of quartz and fragments of older archæan slates also, but differing from the previously mentioned conglomerates in the distinctly angular shape of the majority of the component pebbles. These breccias appear most likely to have been formed in the first instance by a volcanic outburst, which has shattered older rocks and distributed the fragments over the

surrounding country, a well-known phenomenon in the earlier phases of volcanic activity, and then carried into the sea and laid down in bedded form by ordinary aqueous action. The loose fragmentary materials thrown out by volcanoes are rapidly carried away by rains and streams, and the finer dust and sand are separated to some extent from the coarser particles. Not being subjected to prolonged attrition in the streams and on the sea-shore, the angular shape of the particles is to a great extent preserved, and we thus have bedded deposits of tuffs and breccias formed in layers interstratified with the ordinary slates and sandstones. I am not yet clear as to whether the breccias of the Dundas Township are stratified or not conformably with the main body of the strata, having come across no clear section showing their relations, and it is possible that the former are younger, and belong to the earlier stages of the volcanic activity which afterwards produced the serpentine dykes to be spoken of later on. With these breccias there are also tuffs of similar composition but finer texture, which are, doubtless, the finer dust and sand produced at the same time as the coarser angular fragments. Till these rocks have been miscroscopically examined it will not be certain that they are of volcanic origin; but I do not think there can be much doubt about it.

In the Western mine, at Zeehan, there is a belt of somewhat soft clayey country rock, often showing a distinctly brecciated appearance, and containing numerous fragments of apparently pumiceous and scoriaceous character. The rock is much altered by the decomposition of its felspathic constituents, but appears to me to be clearly a tuff-bed. The enclosing black slates are in this neighborhood very much contorted, and some of the sections exposed in the mine would almost give one the idea that the igneous rock was intrusive through them, but after a careful examination I became fairly satisfied that it was not so, but that the tuff-bed was conformably enclosed in the slates. In other parts of the Zeehan Field, in the Balstrup's, Manganese Hill, Maxim, Silver Queen Extended, Sylvester, and Silver Queen No. 2 mines, there are also tufaceous rocks which appear to be conformably bedded with the slates, and there can therefore be little doubt that layers of volcanic ejectamenta occur among the ordinary slate and sandstone strata. If the slates of Mount Dundas prove to be of the same age as those of Zeehan, it is therefore probable that the breccias and tuffs in the former district will be found to be intercalated among the ordinary sedimentary strata also.

Limestone occurs in several parts of the Zeehan district, near Argenton, at the New Pyramid Mine, on the Oceana section, on the Despatch ground, at the Comstock Mine, on the Mariposa, and also near the Success Mine at North Dundas. The Argenton limestone was used for flux at the Zeehan and Dundas Smelting Works during their run, and found very satisfactory.

Intruded through the sedimentary formations are igneous rocks of three distinct varieties, granite, serpentine, and diabase. The latter is quite unimportant: it forms the top of the peak of Mount Dundas and one or two dykes in its vicinity, and is probably of Mesozoic age, belonging to the extensive doleritic flows which form the great Central Plateau of Tasmania and the principal mountains of the Eastern side of the island. The other two formations are of great importance, and have probably had much influence on the formation of the metalliferous lodes. The granite forms the peaks of Mount Heemskirk and Mount Agnew, and further north reappears in the Meredith Range; the isolated Granite Tor to the north-east of Mount Reid also probably belongs to the same plutonic outburst. In the North Dundas Field also granite is found, and possibly elsewhere not yet noticed. Dykes of quartz porphyry, doubtless connected with the main granite masses, penetrate the slates of the North Dundas Field in more than one place, much in the same way as similar ones break through the slates and sandstones of Mount Bischoff, and the tin ore lately found there is no doubt due to their influence as at the latter place. In the vicinity of the granite of Mount Agnew some of the sedimentary rocks are very much altered to hard splintery stone, often like hornstone, which is probably a result of contact with the igneous mass. The granite country everywhere seems to be favorable for lodes of tin throughout Tasmania, and this district is no exception, tin being found wherever there is granite, but it seems not to have any connection with the silver-bearing lodes. The other igneous rock found on the West Coast, viz., the Serpentine, appears to stand, however, in a very close relation to the argentiferous lodes, which often are enclosed in it. It is found round Trial Harbour, on the westward slope of the Comstock Hill, on the west side of the Zeehan Field, on the Maxim Section as a small isolated patch, on the Adelaide, Bonanza, Anderson's, and Central Dundas Sections, and others in their vicinity, and in a large mass on the North Dundas Road. On the track from the Pieman River to Waratah up the Huskisson Valley, it crops out in two places, and in the Heazlewood and Whyte River Silver Field it is again largely developed. It is a rock which varies very much in composition and texture, but usually contains a good deal of serpentine, and occasionally is almost altogether composed of this mineral. In some parts it is not greatly altered, and shows its original state to have been a dolerite or gabbro. The serpentine generally contains some magnetic iron ore and occasionally chromite, and at the Heazlewood the hydrated carbonate of nickel (zaratite) has been found in it in some quantity. Where lodes containing galena pass through it their oxidised cappings generally contain a good deal of chromate of lead (crocoisite), the chromic acid of which is doubtless derived from the serpentine. In the Whyte River Field this rock is plainly intrusive through the slates and limestones, and is therefore younger than them, but I am not yet aware of any evidence that would show whether it is younger or older than the before-mentioned granite outbursts.

Lodes.—The Zeehan and Dundas Fields are traversed by a great number of lodes which may be divided into two groups, a north-westerly set and a north-easterly set. The former generally have a strike between N.W. and N.N.W., the latter between N.E. and N.N.E. The relations of each of these groups to the other have not yet been made out, and we cannot tell whether one is older than the other, or if they are contemporaneous. Neither group can be said to have proved richer than the other as yet, and the veinstuff filling them is very similar in both cases. The north-westerly lodes appear to have been traced over much longer distances than the other set, and are likely to prove the main lines of the district. Having a strike from N.N.W. to N.W., they lie very much in the planes of bedding of the country rock, and have therefore sometimes been considered to be layer-lodes, but I do not think this is the case. The lodes do not appear to follow the contortions of the enclosing strata, but cut right through

them, so that though agreeing in strike with the enclosing rocks, they do not do so going downwards: This point will, however, be better settled when the mines are deeper. The walls of the lodes of both groups are often striated and smoothed, having thus the most notable characteristic of "fissure veins," and the nature of the veinstuff is also in favour of their being considered to be of this type. The gangue consists largely of carbonate of iron, with sometimes also carbonate of manganese, together with quartz and lode-slate, while the metalliferous minerals are galena, blende, iron pyrites, copper pyrites, and a little Fahl-ore (Tetrahedrite) and other sulphides. The galena and Fahl-ore carry the bulk of the silver, the other sulphides being very poor. The lodes often have their contents arranged in layers parallel to the walls, showing a "banded" structure, and at other times are "brecciated;" these two types of structure being very characteristic of "fissure" lodes. Near the outcrops a great deal of chemical alteration has frequently taken place in the lode-stuff, owing to the action of surface waters containing air, carbonic acid, and organic matters in solution, the carbonates of iron and manganese being changed to oxides, and the sulphides of lead, iron, copper, and zinc to sulphates, carbonates, and oxides, while many of the compounds formed have been leached out altogether. The ferruginous gossans are in consequence usually poor in lead and silver, and the unaltered lode-stuff is not met with till sinking has proceeded to well below the water level. In some instances rich argentiferous material has been met with, carrying chloride of silver and carbonate of lead, before getting down to the unaltered galena, which indicates a redeposition at a lower level in the lodes of the metallic materials dissolved from the gossans. There is much reason to hope that this feature will be found beneath many of the large gossan outcrops so common throughout the Dundas district, and if so, we may expect some very rich deposits. In some of the large gossan lodes at Dundas it would appear as if galena was redeposited by secondary chemical action; for we find veins of it enclosed in walls of brown iron ore, and it is possible that some of the very rich pure galena found in some of the Zeehan lodes near the surface, and which did not live down, is similarly a secondary product concentrated from the higher parts of the veins now destroyed. I do not, however, think that this is very generally the case, for the arrangement of the sulphides and gangue in the lodes near the surface is usually the same as at greater depths, and the value of the surface galena is not appreciably higher than at the lowest levels. If the upper portions were enriched by solutions percolating from above we should expect to find a different arrangement of the constituents and a higher value of the ore near the surface than deeper down. It is more probable that the dying out of some of the patches of ore cropping to surface is simply due to their being of limited extent, and that in the same way when other patches are found in the lodes they also will die out in all directions. The rich portions of a lode cropping to surface are naturally the first to be worked, and their coming to an end at a small depth implies only that the valuable constituents are likely to be distributed throughout the vein in patches, and not that the ore is confined to a short distance below the surface. If we take a sheet of paper to represent a lode, and splash upon it a number of large blots of ink, the dark portions of the paper will exemplify the ore in the vein, and the white paper the barren matter. Let the paper be held on edge, the upper edge representing the outcrop of the lode, and the blotches which reach the edge will stand for the croping out patches of galena: they will soon be mined out, but if shafts are sunk and levels driven in the lode, other patches will be encountered. If we now draw a brush with ink across the paper from the upper edge downwards several times in roughly parallel strokes, we get a diagram of the occurrence of "shoots" or "chutes" of ore, which are bodies of more or less restricted length, but fairly continuous in depth, Such shoots are very common in lodes and often constitute the only portions worth working. None of the Zeehan mines are yet of such depth that the shoots can be said to be *proved* to be living downward, but so far as the evidence goes it is satisfactory in this respect, and there is no reason to believe that the Zeehan lodes will not behave in the same way as those that have been longer proved elsewhere: there will be shoots and patches of rich ore down to great depths, separated by poor lodestuff containing little or no ore and their value will depend upon the relative quantities of the poorer and richer portions. We can only judge of the probable amount of richer ore by the portions exposed by actual working, and though this is yet a very small fraction of the known area of the veins, it is, in my judgment, sufficiently rich to justify sanguine expectations as to the high average value of the lodes when more extensively opened up. I do not see the slightest ground for supposing that the lodes will not continue downwards as far as mining can follow them, nor for anticipating any considerable enrichment or impoverishment of them in depth unless a change in the character of the country rock should be met with: on the contrary the character of the lodes should lead us to expect them to be very persistent going downwards, and there seems to be no good reason why they should not maintain the same average ore-value as we know them to have in the present workings.

On the Zeehan field the lodes are generally of not very great width, averaging from about two to six feet from wall to wall, though often both larger and smaller than this. Many of them crop out in low ground, and are practically below the water-level from the surface downwards, and are not much oxidised at the outcrop. Some, however, like the Balstrup line of lode, the Sylvester main lode, and the Silver Queen No. 2 lode, have a considerable portion of their material lying above the water-level, and in these the upper portions are strongly oxidised, and the valuable metals once contained have been dissolved out to a great extent, leaving occasional patches of pyromorphite, and in a few instances chloride of silver, to testify to their former presence. The larger the lodes the more thorough appears to be the oxidation, the large Balstrup lode, for example, being more thoroughly converted into gossan above the water-level than the smaller Sylvester lode or the still smaller Silver Queen No. 2 one. In the Dundas field, which is more rugged and hilly than the Zeehan one, very few indeed of the lodes show galena at surface and then only in the case of small veins, or, when they are larger, when the lodes have been deeply cut into by creeks and watercourses. Above the water-level the oxidation of the lode matter is generally very complete, and instead of the hilly nature of the ground facilitating the opening of mines as is usual, it has hindered progress, as working by means of adits has been found to be not very usually possible, and the ruggedness of the ground has stood greatly in the way of transporting machinery on to the mines. Much money has been spent in driving tunnels below gossan outcrop, only to find the lodes still oxidised and valueless. This has been discouraging, as there was much reason to hope that many of these mines could have been raising ore from adits without requiring

to get expensive machinery. The consequence of this difficulty is that very little has yet been done towards determining the value of the lodes lying beneath the huge gossan outcrops so common in the Dundas District. The most important evidence on this question has been yielded by the workings of the Oceana, Balstrup's, Manganese Hill, Adelaide, Central Dundas, Dundas P.A., Comet, and Maestrie's Broken Hill mines. These will be described in detail later on, and it will be sufficient now to say that in every case rich ore has been found beneath the poor gossan when the water-level was neared or reached. None of these mines are yet deep enough to be quite below the zone of oxidation, and are, in fact, only coming upon the top of the ore deposits; but their success, only partial though it may be, augurs very well for the value of the lodes at lower levels. No doubt some of the large gossan outcrops simply result from the alteration of carbonate of iron; but as this mineral throughout the district seems always associated with galena, there is every hope of even those that may be barren siderite when first struck becoming good mines when opened up so as to discover the shoots of galena.

Access.—Towards the end of 1891, the Railway from Strahan to Zeehan was completed and opened for traffic, and shortly afterwards that also from Zeehan to Dundas. The latter has two branches, one ending close to Maestrie's Broken Hill and the Comet mines, and the other near the Adelaide Proprietary mine. A projected branch from Argenton to the Mariposa and other South Dundas mines has been begun, and the earthwork has been partly finished, but, owing to various causes, has been abandoned, for the present, at any rate. A small branch line runs from the Zeehan Station to the Zeehan and Dundas Smelting Works. Grubb's mine is also connected with the railway by means of a light railway which passes close to the Central Balstrup shaft, and has a short branch to the Nubeena workings. The Oceana and New Pyramid mines connect at Argenton with the Strahan to Zeehan Railway by means of a narrow-gauge iron tramway capable of carrying a small locomotive, and the Silver Bell nearer Zeehan by means of a wooden tramway. Not connected directly with the railway system, but coming into the main street of the town of Zeehan, are tramways from the Argent and Silver Queen Extended (Mount Zeehan, Tasmania, Silver-Lead Mines, Limited) mines, the Sylvester mine, the Tasmanian Crown, the Western, and the Montana mines. Yet another tramway has been made from the New Tasmanian mine to the Zeehan to Remine road, joining the latter near the Comstock mine. It will thus be seen that the field is becoming pretty well opened up by tramways, and that much money had been spent on these. The lines are of a substantial character in general, and will be of the greatest service in getting in supplies and machinery, and getting ore out. It is now pretty generally agreed by practical men at Zeehan that tramways are both cheaper and better than roads, if the latter are to be anything better than mere sloughs and to be of a character to sustain heavy and continuous traffic. The tramway system is likely therefore to become very much extended in the course of a few years.

The road from Trial Harbor to Zeehan is still much used, especially between the latter place and the Comstock; it has been extended out to the Dundas township, and a branch from this extension goes northward towards North Dundas for some four miles. From the end of this there are very rough pack-tracks to the Success mine, the Pieman River crossing, and the Commonwealth mine. A corduroy pack-track has also been made from it to the Madam Melba and Grey Ore mines, and is continued on as a rough track to the Fahl Ore. Another pack-track has been made from the end of the Dundas road at the Comet mine to Mount Reid; this is laid with corduroy as far as the Pimple, but from there onwards is very rough. From the Pimple a very steep and bad track, unfit for pack-horses to travel, leads down to the Ring River gold field, and another similar one goes from this to Mount Reid. The great bulk of the Dundas sections are still only to be reached by means of bush tracks connected with these various better opened lines. A great deal of track-cutting and road-making has therefore yet to be done before much mining can go on.

The projected Waratah-to-Zeehan Railway would be a great boon to the northern portion of the Dundas field, even if only carried from Zeehan to the Pieman River to begin with. Pending a definite settlement as to whether it is to be constructed or not, owners of sections along its route do not know what to do; they do not want to wait indefinitely for the railway, and at the same time do not care to incur the expense of putting in tramways of their own, which would become useless as soon as the railway was made. The very promising Success line of lode is quite locked up owing to this consideration; and others also would attract much more attention if there was any reasonable probability of their being able to send away their ore when raised. A silver field differs very considerably from a tin or alluvial gold field, for the latter can be worked in spite of great difficulties of access, little or no machinery being required, and the mineral produced being of small bulk and high value. It is one thing to pack out tin ore worth from £50 to £60 a ton over bad bush tracks, and quite another to do the same with ore worth under £10 a ton. The now proved fact that in most instances in the Dundas field it is necessary to go below water level to obtain ore, and therefore is impossible to mine without machinery for drainage, is another essential difference to be borne in mind when comparing this with, say, the North-East Coast tin fields, which were opened up under great difficulties of transport. In the latter case labor only was required, not heavy machinery. A very little consideration shows that the very first requirement of a mine requiring engines for its development is a road by which they can be brought on to the ground, and practically all the North Dundas mines are in this category. Either the railway or an extension of the North Dundas road to the Pieman River, is therefore urgently required. Possibly, a light narrow gauge line along the route of the surveyed railway would be sufficient in the first instance, and could be enlarged and re-laid to standard gauge later on if the development of the mines justified the outlay. The principal objection to this solution of the difficulty that I can see at present is, that there is a considerable tunnel to be made through the watershed between the Henty and Argent Rivers, which would have to be made even for the narrow-gauge line.

While, therefore, the means of access to the Zeehan and Dundas Fields have been immensely improved during the last two years, a great deal yet remains to be done before mines at a distance from the railways and roads can become producers of ore. As, however, the area of the fields is, roughly speaking, one hundred square miles, it is unreasonable to expect them to be completely laid open for

many years to come, both time and capital being required for even the preliminary work on so much ground, and under the circumstances it seems to me that the progress made is highly creditable to the Colony.

Progress of the Mines.—The severe depression in business of all sorts which has existed throughout the Australian Colonies for the last two years, has told very heavily against the rapid development of the mines that was so confidently expected formerly. It has led to an almost complete stoppage of the supplies of capital required for the preliminary deadwork, and caused the abandonment of hundreds of mineral leases. Then the delay in raising ore, generally due to the want of adequate machinery being provided in time, had a very bad effect upon the public mind, as investors generally believed that as soon as the railway was completed there would be an immediate output of ore, and their confidence was destroyed accordingly. The conditions of mining on the West Coast have not yet been generally realised by investors, and the expense of gaining access to the mines, opening them by underground works, and fitting them with necessary machinery, has been altogether under-estimated, while the value of the lodes has been almost always rated far too high. In most instances, the working capital provided has not been anything like sufficient to put the mines on a producing basis, and their consequent failure to realise expectations has so disappointed the shareholders that more money could not be raised, and many promising ventures have therefore been shut down. A frequent consequence of the want of capital has been that cheap machinery has been provided, which soon proved unable to do the work required of it, and the failure of the mines in these instances, though plainly due to bad management, has too often been ascribed to the inherent worthlessness of the properties. If the ardour of genuine investors was thus damped by delays and disappointments, what shall I say as to the enthusiasm of the great crowd of mining speculators once so busy with West Coast shares, who care for nothing but the rise and fall of the market: it was extinguished altogether. For some time past the consequence of the revulsion of feeling against the West Coast fields has been that, except in a few cases, money could not be obtained from the shareholders in the mining companies, and the mines have been thrown on their own resources. Many had to shut down, but those that were in a position to put out ore well justified the confidence formerly put in them, and not only paid their way, but also in several cases paid off old debts as well, and the output has been so good for the last six months or more that the fields are being restored to public favor. Some particulars of the amount of ore produced will be given later on, but at present I wish to point out that the greater part of the produce has been first-class ore, of value to pay for shipment to smelting works in Australia and Europe: it is only quite lately that concentrates from the second-class ore have largely swelled the returns. It speaks very highly for the district that so much high-grade ore should be so easily obtained, and gives great confidence that when the lodes are properly worked, and the poorer stuff taken out as well as the richer, the results will be highly payable. In most settled mining districts the mainstay of the mines is not the rich ore which is generally in comparatively small quantity, but the large masses of low-grade stuff requiring concentration, and no doubt it will be so at Zeehan also. The present output from quite a few mines in all may be looked on as an earnest of the success which will follow when a great many more are opened up so as to become producers. The great want now is capital to extend present workings and open new ones, and it is too much to expect that the mines themselves will be able to produce all that is required: it will mostly have to be subscribed outside in the first instance. The district is doing very well out of ore raised, but still wants much help from the public in order to show still better results. Even those that are paying their way would mostly be greatly benefitted by the expenditure of some more money upon them to enable them to get more ground open for stoping and better appliances for dealing with the stuff raised. The Western mine and Grubb's mine are in a position to pay for everything they require out of ore raised and in sight, but all the other producing mines, though probably able to keep going in many cases without help, would be the better of a little more working capital. Of course they may, perhaps, strike rich ore and require no assistance from the shareholders, but on their present average value they cannot be expected to provide funds for extensive deadwork, while fully warranting the owners in expecting a good return for their money if they do this out of capital. The Silver Queen, Argent, New Tasmanian, Silver King, Adelaide Proprietary, Dundas P.A., and Maestrie's Broken Hill mines have been for some time past considerable producers of ore, and have been getting enough to pay working expenses, and yield perhaps a little profit, but all require development work, especially opening at deeper levels. The Mount Zeehan Silver-Lead Mining Company have lately been forced to shut down, but have a property that a further expenditure of a moderate capital would most likely make payable. The Oceana mine is in very much the same state, and others might also be mentioned. Several claims worked by tributors are yielding payable returns, but will have to be provided with machinery before the lodes can be worked to any depth, and therefore also require capital. I dwell upon this at some length as the good returns of ore lately yielded by the field might lead to a belief that the mines ought all now to be self-supporting, which is very far from being the case. The present production is a sample of the value of the lodes and a guarantee that they will be remunerative when more extensively exploited, and should give confidence to investors that the money they may sink in so exploiting them will bring them in a good profit.

The depression from which the West Coasts Fields have been suffering is a phase in the history of mining districts quite familiar to mining men, having been seen repeated over and over again in other countries. The almost universal experience may be briefly summed up as follows :—First, there is the period when new discoveries rapidly follow one upon another, and excite ever-increasing expectations ; land is taken up in every direction, companies are floated in scores, speculation is rampant, there is a " boom," everything is over-valued, a great deal of desultory and badly arranged work is done, and real mining is confined to a few properties ruled by cool and judicious management. Next comes the reaction ; the output of ore is not up to expectations, returns do not come in upon the money spent, investors see no chance of recovering their expenditure, the cry goes forth that the field is an utter failure, shares are thrown up in all directions, and work is at a standstill except in a few cases, as before, where mining is steadily pursued. Lastly comes the revival of confidence ; the mines which have gone on working through both good and bad times put out increasing supplies of ore, and prove that payable returns follow judicious investment and prudent management, and gradually the field settles down to steady work on a reasonable basis.

The very large number of promising lodes and the wide area of country over which they have been found add greatly to the cost of opening up the West Coast Mineral District, necessitating the starting of a great many separate enterprises, and the spending of much money on roads, machinery, surveys, and surface works of all sorts. The field is much too big for the small Colony of Tasmania to develope all at once, and our efforts will have to be concentrated for a time on a few of the more likely looking ventures. As time goes on no doubt the whole of the lodes will be tested and foreign capital brought in to work them, but in the meantime it is rather a matter for regret that so much money has been spent in taking up ground that cannot be worked. Some idea of the amount of money that would be required to thoroughly prospect the whole field may be arrived at from the following calculation:—In the Zeehan and Dundas Districts over 80,000 acres of land have been taken up for mining purposes, or say 1000 eighty-acre sections. Now a sum of £1000 does not go very far in prospecting an eighty-acre section, and is quite insufficient if much driving, sinking, trenching, and so on have to be done to prove the lodes found on it; but if there were an expenditure on an average of £1000 on every eighty-acre block it would require one million sterling to prospect the whole of the district; and probably when the entire cost of roads, railways, shafts, and engines, and all other preliminary expenses are added up in future, it will be found that the opening of these fields came to an even larger sum.

While going over the field I obtained from various sources statements of the quantities of ore sent out from the mines. These were up to different dates, some to the end of 1892, some to date of giving the information, and some to the end of the first quarter of 1893, the latter being obtained since my return. With the aid of the reports appearing from time to time in the newspapers I have attempted to estimate the total production of the field up to the end of March, 1893, and find that approximately 13,800 tons of ore have been either smelted locally or exported in the raw state, the average gross value being not less than £10 per ton. We may reckon accordingly that up to the end of March, 1893, the Zeehan and Dundas Fields have exported silver and lead in bullion, concentrates, and raw ore, to the value of, say, £140,000. There has been produced, besides, a large quantity of second-class ore, which is on the ground awaiting treatment. The Government Statistician, in the "Handbook of Tasmania, 1892," page 34, shows galena and silver ore in the table of exports from the colony for the first time in 1889, in which year 202 tons of galena and silver ore were sent away. In 1890, 554 tons are recorded, and in 1891, 2359 tons, making a total up to the end of 1891 of 3115 tons. Some of this was probably from the Heazlewood Field, but we shall be pretty safe in estimating the produce of Zeehan and Dundas at 2600 tons. I have not been able to get the exact figures for 1892, but if we deduct from the total of 13,800 tons the above 2600, and also 3347 tons exported during the first quarter of 1893, we get approximately 7850 tons as the export in 1892. The following figures would therefore indicate generally the progress of production of the district:—

In 1889	say	200	tons	were	exported.
„ 1890	„	500	„	„	„
„ 1891	„	2000	„	„	„
„ 1892	„	7800	„	„	„
„ 1893 (first quarter)		3347	„	„	„

(Or at the rate of 13,400 tons per annum.)

It does not seem likely that there will be any difficulty in keeping up the present rate of production, and it will probably continue to show a rapid increase.

Though none of the mines are yet deep, a fair start has been made, there being about twenty mines which have shafts of over 100 feet in depth, and nearly thirty that are provided with steam machinery. The deepest shaft is that of the Comet Company, 270 feet; next to it coming the Silver Queen No. 1 shaft, 222 feet; the New Tasmanian, 186 feet; and the Adelaide, 176 feet. The best winding and pumping machinery on the field are the plants provided at the Grubb's and Silver Bell mines. A great many companies have provided steam pumps of the Worthington type in their shafts, but the experience of the field has proved decidedly unfavourable to their use; for though of great capacity for the steam used in comparison with the Cornish pump, they have shown themselves very liable to get out of order, especially when sinking.

Concentrating Mills.—In my first Report on the Zeehan Field (April 25th, 1890) the necessity of having the poorer ore concentrated was pointed out, but it was not till nearly two years later that this patent fact appeared to come home to the directors of mining companies, and a start was made at erecting mills. The New Tasmanian Company were first in the field, with a plant made by Green of Aberystwith, Wales, a description and plan of which by the manager, Mr. R. Provis, appeared as an Appendix to the Secretary of Mines Report for the year ending June 30th, 1892. Another mill by the same maker has been erected at the Argent Mine by the "Mount Zeehan (Tasmania) Silver Lead Mines, Limited" Company. The Silver Queen and Mount Zeehan Silver-Lead Mining Companies have provided themselves with mills made by May Bros. of Gawler, South Australia; the Silver King Company are putting up one by Messrs. Parke and Lacy, of U.S. and Sydney; and the Western Company one designed by C. Lührig. In Green's Mills the ore is broken first by a stonebreaker and then by rolls; the crushed material is sized by trommels; the coarser portion is treated on jigs with sieves of different degrees of fineness of mesh: the sand and slimes are separated by a hydraulic classifier, and the former washed in one set of centre-head buddles, while the latter are concentrated separately in another set of buddles. The treatment is thus fairly complete, but the buddles are not very efficient machines, requiring much time and labour. It seems to me that much more attention might with advantage be paid to sizing and classifying the ore before concentrating, though I quite recognise that there are commercial limits to the economy of doing so. I did not take any samples of the tailings of these mills, so cannot tell what percentage of the total value of the ore they were losing; but I was surprised to find that regular tests were not being made to determine this. In my opinion, any dressing works worthy of the name should regularly sample the escaping tailings, so as to know exactly the loss that is going on. As the tailings issue from several different machines, and it is somewhat difficult to determine the proportion coming from each, the same end is attained if the ore is carefully sampled and assayed

before going into the mills so that the percentage saved can be at once estimated on cleaning up the concentrates. An automatic sampling machine ought, therefore, to be placed so as to catch the ore coming from the stonebreaker, so that regular and correct assays may be obtained. Rule-of-thumb work is getting out of date in ore concentration as in other technical processes, and the sooner it is superseded by scientific methods the sooner will the mills improve in efficiency. Directors of mining companies should insist most strongly on getting daily, or at least weekly, accurate returns of the losses in their reduction works, as a very salutary check would thus be established upon the work being done. None of the Zeehan Mills at present know exactly what percentage of the value of the crude ore is being saved, and in such an important matter something better than rough estimates should be made. Automatic sampling machines can be erected at quite small expense, and the labour attached to attending to them and assaying the product is nothing in comparison with the importance of the result.

Messrs Parke and Lacy's and the Luhrig concentrators were not erected at the time of my visit; the former plant is to consist of stonebreaker and rolls for crushing, jigs for treating the coarser crushed material, and Frue vanners for the sands and slimes: the latter will use Luhrig vanners, and is to be the most complete and elaborate plant on the field. The Luhrig vanner has the advantage over the Frue for treating mixed sulphides, such as occur at Zeehan, that different classes of concentrates may be obtained separate from each other, while the Frue vanner only yields "headings" and "tailings," or concentrates and refuse. Either blende and pyrites must be saved on it with the galena, giving a bad smelting product, or the washing action must be so violent that these heavy minerals are sent into the tailings, in which case there must be heavy loss of galena as well. The Luhrig vanner acts on much the same principle as the well-known Rittinger Percussion Table, but differs from it in that the surface on which the washing of the material is effected, is a revolving endless belt and not a fixed table.

The two mills erected by Messrs. May Bros, at the Mount Zeehan and Silver Queen mines, are very compact and well-arranged plants, but are by no means complete. The material, after being crushed by stonebreakers and rolls, is jigged on sets of four-sieved jigs and is not then further treated, no attempt being yet made to concentrate the sands and slimes. Only the first stage of dressing has thus been reached, and the mills will require many additional appliances before they will be able to extract the maximum possible amount of silver and lead from the ore. They have answered their immediate purpose by returning to the companies owning them a large quantity of clean marketable galena from their accumulated piles of second-class ore, but it appears to me that the loss in doing so has not been seriously enough considered. Take the Silver Queen experience for an instance:—According to Mr. Brockmann's report to the shareholders at the half-yearly meeting on the 31st August, 1892, "The various ore heaps at the No. 1 and No. 2 shafts were very carefully measured in my presence by Mr. G. P. Sinclair, the mining manager, and his two sons, and found to contain close upon "4000 tons of excellent concentrating material, the metal contents of which vary from 24oz. to 30oz. of "silver, and 25 to 30 per cent. of lead per ton of ore." At the following general meeting, on 28th February, 1893, the Chairman of Directors reports:—"Since the concentrator was started on January "9th, about 1800 tons of second-class ore have been put through the machine, giving a result of about "500 tons of clean concentrates,, the average assay of which has been—Lead 65 per cent, and silver "54oz. per ton." Now taking the 1800 tons of material treated at the lowest value mentioned by Mr. Brockmann, namely, 24oz. silver and 25 per cent. of lead, the total silver contained was 43,200oz. and lead 450 tons. The 500 tons concentrates contained 27,000oz. of silver, and 325 tons of lead. The loss in treatment was therefore 16,200oz. of silver and 125 tons of lead, or 37½ per cent. of the total silver, and 27·8 per cent. of the total lead. If we reckon the value of the crude ore at the higher values given by Mr. Brockmann, the loss is still greater, being 50 per cent. of the silver and 39·8 per cent. of the lead. These are very heavy losses, but not greater than anyone conversant with the performance of concentrating machines would expect from such an incomplete plant: indeed, it speaks very well for Messrs. May Bros'. machines that the result is so good as it is. The percentage loss may also be arrived at in another way, and it will be found that this confirms the above result, namely, by assay of the tailings. I took some trouble to take tolerable correct samples of the tailings from the Silver Queen mill, taking small portions with a sampling auger from all parts of the heaps. Two samples were obtained in this way, one (No. 1) of the coarse tailings from the jigs, and the other (No. 2) of the sands and slimes collected in the settling pits. These were sent to Mr. W. F. Ward, Government Analyst, to be analysed, assayed, and concentrated by panning, and returned the following results:—

Analysis.	No. 1. Per cent.	No. 2. Per cent.
Lead...	7·92	17·50
Zinc	15·00	5 63
Iron (as sulphide)	4·83	5·67
Oxide of iron } Oxide of manganese }	16.10	13 40
Sulphur	11·00	15·50
Silica, etc., insoluble in acids	34·70	34·10

Carbonic acid, moisture, etc., not determined.

Fire Assay.	No. 1.	No. 2.
Lead per cent.	4·00	10·5
	oz. dwt. gr.	oz. dwt. gr.
Silver per ton	11 5 9	21 19 8
Gold „ „	Traces	Traces

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Results obtained by Washing.	No. 1.	No. 2.
Concentrated sulphides per cent.	4·91	13·8
Lead in concentrated sulphides per cent. ...	45·35	47·82
	oz. dwt. gr.	oz. dwt. gr.
Silver „ „ ton	35 18 6	44 2 0
Silver in rewashed tailings per ton	9 16 0	17 4 15

In this last test the galena was washed as free as possible from all other sulphides.

I had no means of finding out what percentage of the whole of the ore treated went into the heap of tailings from which No. 1 sample was taken, and how much into the settling pits. An estimate of one-sixth of the whole as going away as sands and slimes is, however, likely to be lower than the truth, so I take it in getting an approximation to the average value of the whole of the tailings, thus:—

5 parts at 7·92 per cent. = 39.6
1 „ 17·5 per cent. = 17·5
} therefore average lead = $9\frac{1}{2}$ per cent.

5 parts at 11·27 oz. = 56·35
1 „ 21·96 oz. = 21·96
} „ „ silver = 13·05 oz.

Taking these values, and the values of the concentrates as before, we find the value of the 1800 tons treated to be as follows:—

500 tons concentrates at 65 per cent. lead and 54oz. silver, contain 325 tons lead and 27,000oz. silver.

1300 tons tailings at $9\frac{1}{2}$ per cent. lead and 13·05oz. silver, contain $123\frac{1}{2}$ tons lead and 16,965oz. silver.

Therefore 1800 tons of ore contained $448\frac{1}{2}$ tons lead and 43,965oz. silver, an amount which agrees very well with the lower estimate given by Mr. Brockmann, namely, 450 tons of lead and 43,200oz. of silver. Calculating percentage losses as before, we find a loss of $27\frac{1}{2}$ per cent. of the lead and 38·6 per cent. of the silver. It is therefore very clear that the efficiency of the mill is by no means what it should be, and that the tailings are quite rich enough to pay for further treatment: the sooner the concentrating appliances are added to, therefore, the better for the company.

A very much worse result than the above was obtained in treating a parcel of ore from the Tasmanian Crown mine at the Mount Zeehan mill. The parcel was ten tons, and a bulk assay of it yielded 12 per cent. of lead, and 15oz. of silver to the ton: it therefore contained in all 1·2 tons of lead and 150oz. of silver. The return from the concentrator was 13cwt. of galena, assaying 75 per cent. lead and 52oz. 11dwt. and 20gr. of silver to the ton, that is an actual return of ·4875 tons lead and 34·185oz. silver, being a loss of 59·4 per cent. of the total lead, and 77·21 per cent. of the total silver.

Such losses as proved by the above figures, would never be borne with equanimity by mining investors if they were generally known; but instead of this being the case, the belief is, to my own knowledge, very general that the mills are doing excellent work, and that it would not pay to put up further appliances for saving the supposed small quantities lost in the tailings. The results quoted show the absolute necessity of checking the mill returns by assays of the crude ore in bulk, and of the tailings, not only now and then, but regularly and systematically. No business man will willingly remain in a fool's paradise, yet most assuredly those do so who are content to take for granted that any stamp battery, concentrating mill, or smelting works, is doing perfect work, without the clear proof afforded by regular bulk assays of the crude ore and the residues after treatment.

The confidence shown in the results of work done by the concentrating mills is largely due to the pernicious and ignorant practice of estimating the lead in poor tailings by fire assay alone. The fire assay method is an excellent one for rich galena, but when the lead ores are associated with a large amount of foreign sulphides and earthy matter, it always gives results much below the truth. Take for example the two parcels examined by Mr. Ward: chemical analysis shows them to contain 7·92 and 17·5 per cent. of lead respectively, while the fire assay yielded only 4 and $10\frac{1}{2}$ per cent. It is idle to urge that as lead ores are always sold to smelters on fire assay, this should be the method used for testing tailings; for tailings are never sold to the smelters, but only the concentrates and richer ores, in the case of which the small loss of lead in the assay is to some degree commensurate with the smelting loss on a large scale. The loss of lead by fire assay amounts to, say, 1 or 2 per cent. in the case of a rich ore, one containing 80 per cent. of lead yielding say 79 per cent. in the crucible, but in case of poor tailings it is often 50 per cent. or more of the total lead present. An example will serve to show the absurdity of valuing tailings by fire assay for lead. Suppose we have a parcel containing in reality 8 per cent of lead, but returning only 4 per cent. by fire assay: this is concentrated on a good machine and yields 80 per cent. of the total lead: we thus get an actual saving of 6.4 per cent. of lead, or 160 per cent. according to fire assay, while the tailings contain 1·6 per cent, or 40 per cent. of the fire assay, in addition.

Mr. May, who was in charge of the Silver Queen mine at the time of my visit, was good enough to show me the assays of tailings made from time to time by the Company's assayer, Mr. M. M. Sinclair. These results are lower than the average sample taken by me from the tailings heap yields, but as the

return from the latter agrees with the sampling before treatment made by Messrs. Brockmann and Sinclair, I prefer to regard it as the more correct. Mr. Sinclair's assays are as follows :—

				oz.	dwt.	grs.	
Slimes.	*Lead*	1½	per cent. *Silver*	8	9	20	per ton
	,,	11	,, ,,	18	3	20	,,
Jig Tailings.	,,	2	,, ,,	6	13	22	,,
	,,	5	,, ,,	10	0	0	,,
	,,	4¼	,, ,,	8	0	20	,,
	,,	4¾	,, ,,	9	16	0	,,
	,,	2	,, ,,	6	4	3	,,
	,,	3½	,, ,,	8	3	8	,,
	,,	2½	,, ,,	8	2	8	,,
	,,	2	,, ,,	7	0	11	,,
	,,	2	,, ,,	7	3	17	,,
	,,	2½	,, ,,	6	17	4	,,

The mean of these ten assays of jig tailings is Lead 3 per cent. and silver 7oz. 16dwt. 5grs. per ton. As the lead was determined by fire assay we may safely say there was in reality 6 per cent. present,

Some very interesting results may be deduced from the above figures, bearing on a question of great importance in the problem of concentration, namely that of the proportions of silver contained in the galena and other sulphides respectively. Taking mean results from the above we find that

				oz.	dwt.	grs.	
When Lead = 4¼ to 5 per cent.,	1 unit of lead is associated with			1	19	19	of silver
,, ,, = 3½ per cent.,	1	,,	,, ,, ,,	2	6	16	,,
,, ,, = 2½ ,,	1	,,	,, ,, ,,	2	19	21½	,,
,, ,, = 2 ,,	1	,,	,, ,, ,,	3	7	18½	,,

Apparently, therefore, the proportion of silver to the unit of lead increases as the quantity of lead decreases, and this must mean that an appreciable quantity of silver is carried by other minerals than the galena. To determine this point Mr. Sinclair had made some assays of pieces of blende, siderite, and pyrites, as free from other minerals as he could find them :—

							oz.	dwt.	grs.	
Clean Blende	yielded	*Silver*	...	...	...	...	2	0	0	per ton
	and	,,	...	...	...	...	1	19	4	,,
Clean Pyrites	,,	,,	...	...	...	...	1	10	8	,,
	and	,,	...	...	...	...	3	10	8	,,
Clean Siderite	yielded	,,	...	...	...	...	1	6	3	,,
	and	,,	...	...	...	...	9	16	0	,,

Silver might also be present as chloride, and in other combinations incapable of being saved by concentration. The tailings assays, however, afford data for approximately determining the proportion of silver carried by the unit of lead, and also that in each unit of the other constituents of the ore taken as a whole. Taking the mean of of Mr. Sinclair's results as before, we get

			oz.	dwt.	grs.	per ton	
(A.)	When Lead = 2 per cent.	Silver =	6	15	13	=	6·7773oz.
(B.)	,, = 2½ ,,	,,	7	9	18	=	7·4876oz.
(C.)	,, = 3½ ,,	,,	8	3	8	=	8·1667oz.
(D.)	,, = 4½ ,,	,,	8	18	10	=	8.9209oz.
(E.)	,, = 5 ,,	,,	10	0	0	=	10·0000oz.

Let x = No. of ounces Silver per unit of Lead

then	(A.)	contains 2	x ounces in Lead and	6·7773		$2x$ in other constituents	
	(B.)	,,	$2\frac{1}{2}x$,, ,, ,,	7·4876	$- 2\frac{1}{2}x$	,, ,, ,,	
	(C.)	,,	$3\frac{1}{2}x$,, ,, ,,	8·1667	$- 3\frac{1}{2}x$	,, ,, ,,	
	(D.)	,,	$4\frac{1}{2}x$,, ,, ,,	8·9209	$- 4\frac{1}{2}x$	,, ,, ,,	
	(E.)	,,	$5x$,, ,, ,,	10·0000	$- 5x$	,, ,, ,,	

Let y = No. of ounces Silver per unit of constituents of ore other than Lead

then (A.) $y = \frac{6{\cdot}7773 - 2x}{98}$

(B.) $y = \frac{7{\cdot}4876 - 2\frac{1}{2}x}{97\frac{1}{2}}$

(C.) $y = \frac{8{\cdot}1667 - 3\frac{1}{2}x}{96\frac{1}{2}}$

(D.) $y = \frac{8{\cdot}9209 - 4\frac{1}{2}x}{95\frac{1}{2}}$

(E.) $y = \frac{10 - 5x}{95}$

therefore $\frac{6{\cdot}7773 - 2x}{98} = \frac{7{\cdot}4876 - 2\frac{1}{2}x}{97\frac{1}{2}} = \frac{8{\cdot}1667 - 3\frac{1}{2}x}{96\frac{1}{2}} = \frac{8{\cdot}9209 - 4\frac{1}{2}x}{95\frac{1}{2}} = \frac{10 - 5x}{95}$

from which set of equations we get the mean values

$x = 1{\cdot}1$

$y = {\cdot}046$

that is, if a sample of ore contains 30 per cent. of lead for example, it will contain 33oz. of silver in the lead and 3·22oz. in the remaining 70 per cent. of other constituents. The results are, however, vitiated

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by the fact that the returns of lead in the assays quoted only represent about one-half of the actual amount. Taking Mr. Ward's analyses in the same way, let us again calculate the values of x and y.

No. 1. 100 tons ore contain 7·92 tons Lead and 1126·89oz. Silver
4·91 „ concentrates „ 2.227 „ „ „ 176·331oz. „
∴ 95·09 „ tailings „ 5·693 „ „ „ 950·559oz. „
∴ the tailings contains 5·987 per cent. Lead and 9·9964oz. Silver per ton.

$$(A.) \qquad y = \frac{11{\cdot}2689 - 7{\cdot}92x}{92{\cdot}08}$$

$$(B.) \qquad y = \frac{9{\cdot}9964 - 5{\cdot}987x}{94{\cdot}013}$$

Therefore $x = {\cdot}719$, $y = {\cdot}0605$

No. 2. 100 tons ore contain 17·5 tons Lead and 2196·68oz. Silver
13·8 „ concentrates „ 6·6 „ „ „ 608·58oz. „
∴ 86·2 „ tailings „ 10·9 „ „ „ 1588·10oz. „
∴ the tailings contain 12·64 per cent. Lead and 18·423oz. Silver per ton.

$$(A.) \qquad y = \frac{21{\cdot}9668 - 17{\cdot}5x}{82{\cdot}5}$$

$$(B.) \qquad y = \frac{18{\cdot}423 - 12{\cdot}64x}{87{\cdot}36}$$

Therefore $x = {\cdot}821$, $y = {\cdot}092$

The mean of the two results is probably the nearest approximation to the truth that we can obtain, namely $x = {\cdot}77$, $y = {\cdot}076$, so that if the ore contained 20 per cent. of lead we should expect it to carry 15·4oz. silver in the lead and 6·08oz. in the other constituents of the ore. The portion carried in the lead would be possible to be saved by concentration, but the residue would all be lost. Of course a certain amount of loss of lead, and with it silver, is inevitable, as well as the loss of silver in the lighter minerals. It is noticeable that the mean assay of the 500 tons of concentrates from the Silver Queen mill, viz., 65 per cent. lead and 54oz. silver, gives ·83 ounces of silver to each unit of lead, a result which agrees sufficiently closely with the proportion calculated from the tailings assays to show that the fine galena which escapes carries silver in just about the same proportion as the coarser stuff saved on the machines.

Investigations such as the above are of great importance for determining how much of the silver can be expected to be saved by concentration, and should be frequently repeated with very carefully analysed samples representing average ore, so that a reliable result might be arrived at. Of course the galena and gangue vary considerably in their amounts of contained silver ; for example, when the lode is barren of galena it will probably be found that the other constituents are also barren of silver or nearly so; but by investigating the distribution of the silver in bulk samples of average ore it is likely that the variation will not greatly affect the mean result, and that very valuable information will be obtained.

At the Mount Zeehan mill Mr. W. H. Wesley has obtained some very interesting results, which I give in his own words :—"I beg to enclose you statistical result of our dressing plant, from the 1st September to the 30th December 1892, as follows :

" Machinery worked... ... ... $783\frac{1}{8}$ hours
" Lode stuff treated ... ... $3249\frac{13}{20}$ tons
" Lode stuff treated per hour ... ... 4 tons 2cwt. 3qr. 24lb
" Yield concentrates... ... ... 415 tons
" Yield of Galena per ton of stuff... ... ... 12·7 per cent.
" Assay value of concentrates—Lead ... ... 66·2 per cent.
" Assay value of concentrates—Silver ... ... 65·37oz.
" Collected products for future treatment from No. 3 Jig, that require grinding, 500 tons, assaying Lead 4·7 per cent., Silver 10oz. 18dwt.
" Value of assay, Galena in the 500 tons when dressed, Lead 75 per cent., carries Silver 58oz. per ton.
" This leaves over 7oz. in the tailings after extracting all the galena.
" Slimes collected 80 tons, assaying Lead 8·5 per cent., and Silver 13oz. 17dwts. The galena in slimes carries 53oz. Silver to each 70 units of Lead. Thus the tailings from slimes contain over 8oz. of Silver per ton, but not associated with lead in the form of Galena.
" Tailings vary in assay value from lead 0·75 to 1·5 per cent., and silver from 3oz. to $5\frac{1}{2}$oz. From a bulk sample of our concentrates, 7000 grains, when graded, gives the following, showing the different classes of ore concentrated together in our direct treatment system, and the percentage of each.

	grs.	
" Portion No. 1 not go through 5 holes to lineal inch ...	762	= 10·88 per cent.
„ No. 2 „ „ „ 24 „ „ „ „ ...	3571	= 51 „ „
„ No. 3 „ „ „ 60 „ „ „ „ ...	1286	= 18·03 „ „
„ No. 4 will go through 60 „ „ „ „ ...	1376	= 19.65 „ „
Loss in manipulation	5	

" The following is the assay of each portion as graded above :—

Portion No. 1, coarse ...	Lead, 63 per cent.	Silver, 66oz.
„ No. 2	„ 62 per cent.	„ 61oz.
„ No. 3	„ 70 per cent.	„ 67oz.
„ No. 4	„ 66 per cent.	„ 59oz.

"By the above it is clearly shown that it is possible to crush too fine, and that care must be taken to promote the best interests of the Company in getting the most silver and lead value from the lode stuff.

"We have crushed to date for Company 4801 tons, yielding 574 tons concentrates, and crushed for public 1302 tons, making total treated 6103 tons. Have changed cracker jaws once and wire netting around cylindrical sieves once."

The data given by Mr. Wesley allow of an approximate estimate being made of the percentages of the lead and silver saved by the mill, though not so satisfactorily as in the case of the Silver Queen, where the heaps of ore had been sampled before going through the dressing works. Allowing for the difference of the lead shown by fire assay and that actually present at about the rates shown by Mr. Ward's analyses and assays, and reckoning that as much slime escapes as has been collected, which is probably an under-estimate, we find that there have been produced from 3250 tons treated :—

(i.)	Concentrates ...	415	tons,	with	66·27	per cent.	Lead	and	65·37	ozs.	Silver
(ii.)	From No. 3 Jig	500	„	„	8	„	„	„	10·9	„	„
(iii.)	Slimes ...	160	„	„	14	„	„	„	13·85	„	„
(iv.)	Tailings ...	2175	„	„	3	„	„	„	4·00	„	„

Therefore (i.) contains 274·73 tons Lead and 27,128·55 ozs. Silver

(ii.)	„	40·00	„	„	„	5450·00	„	„
(iii.)	„	22·40	„	„	„	2216·00	„	„
(iv.)	„	65·25	„	„	„	8700.00	„	„
Total	...	402·38	„	„	„	43494·55	„	„

The ore to begin with therefore carried about 12.4 per cent. Lead and 13·4 ounces Silver to the ton. In Mr. Wesley's report of 2nd January, 1892, he estimates the ore at surface at 1300 tons, containing 13·86 per cent. of Galena and 17 ounces of Silver to the ton, so that the above calculation is probably pretty correct. The stuff from No. 3 Jig being rather poorer than the crude ore cannot be considered to be a valuable product saved by the machine, but only as so much poor ore to be treated over again, so we may take it that 274·73 tons of Lead and 27,128½ ounces of Silver have been saved out of 402·38 tons of Lead and 43,494½ ounces of Silver actually in the ore—that is, the extraction of Lead amounts to 68·3 per cent. and of Silver to 62·4 per cent. of the total. The percentages of Silver and Lead lost, 37·6 per cent. of the former and 31·7 per cent. of the latter, do not differ greatly from those found in the case of the Silver Queen, and it is probably pretty near the mark if we say that both these mills lose nearly 30 per cent. of the Lead and 40 per cent. of the Silver in the ore treated.

The Silver in minerals other than galena appears to be higher in proportion to that in the lead ore in the Mount Zeehan Mine than in the Silver Queen. This is probably due to the presence of fahlore, small quantities of which, very rich in silver, are pretty frequently seen. Being a very friable mineral, it is easily crushed to fine powder and carried away in the slimes. It is very likely also due to this mineral that the coarser galena is found to be richer than the more finely ground, as shown by Mr. Wesley's assays of the different grades of concentrates, for the grinding would tend to pulverise the fahlore more than the galena. Analyses of the different grades of concentrates for copper and antimony would show if this theory is correct.

The cost of crushing and concentrating at the Silver Queen plant, was given to me as follows by Mr. May :—

Trucking from heap to crusher at the rate of 28 tons per shift of 8 hours ...	£0	18	8
Wages of man feeding crusher per shift	0	10	0
„ „ two men at jigs, @ 10s.	1	0	0
„ „ one engine driver, @ 10s....	0	10	0
Firewood, oil, etc., per shift	0	11	4
Total	£3	10	0

or equal to 2s. 6d. per ton of ore treated. If the ore were sent direct from the mine brace to the crusher floor, and this cost charged to mining account, the cost of crushing and concentration would fall to 1s. 10d. a ton.

Besides the six larger mills that have been or are being erected, several small hand jigging machines have been put up at various mines to enable a little of the best galena to be saved from the second-class stuff, The work done on these is very crude and inefficient, but is a help to the owners.

It is quite evident that every mine will produce more ore requiring concentration than rich stuff needing none, and it comes to be an important point for consideration whether each mine should have its own dressing works, or whether several should unite in supporting one belonging to all in conjunction, or to a private individual, or company. When a mine is producing enough ore to keep a concentrating plant at work, it is without doubt most satisfactory to the owners to possess a mill of their own, but when the output is small it would probably pay them better to have their ore-dressing done by a "customs" works. In order to have the best results, a concentrating mill must be on a scale large enough to keep all the men employed in it constantly busy at their several sorts of work, and to make it worth while to have elaborate appliances for treating and re-treating the material so long as the metallic contents will pay for further handling. Such a plant will require from 600 to 1000 tons of ore a week, or even more. Smaller mills are not able to work so cheaply, nor to obtain so high an extraction of ore, and it, therefore, seems to me that it would be better for the district to have a few well equipped dressing-works of large capacity, located so as to be able to get ore from several adjacent mines, than for each mine to have its own small and probably inefficient mill. The competition between

the different works for the ore would be sure to lead to improvements in dressing practice, as every mill-manager would be on his mettle to get better results than his neighbors, and so get more custom. Whether the concentrators are owned by private parties, or by companies formed out of those supplying the ore, I should strongly urge that in the contracts for milling entered into between the parties owning the mines and mills, the latter should be made to guarantee the extraction of an agreed upon percentage of the value of the ore as shown by bulk assay prior to treatment, or else that the mills should buy the ore outright on its assay value. The latter would probably be the better plan, as then parcels of ore, however small, might be taken in and treated without the necessity of cleaning up the whole or a great part of the mill for each.

Most of the ore from the unoxidised portions of the lodes of the Zeehan and Dundas fields is, as far as I have seen, very suitable for concentration. Some of the very fine black pulverulent galena found mixed with clay in some of the mines may prove difficult to deal with, and will certainly require slime-tables, and other appliances for treating very fine ore, but the great bulk of the ore should be easily dealt with in the dressing-works. There are cases, however, where it will be a question for careful calculation, whether it will be better to smelt a somewhat low-grade ore directly, or to concentrate it before smelting. When both mills and smelting works are in the district it will not be difficult to determine which treatment gives the best commercial result in such cases.

The oxidised portions of the lodes carrying oxides of iron, manganese, and lead, silica, carbonate sulphate and chromate of lead, galena, chloride of silver and oxidised silver compounds, etc., are not generally fit for concentration, the silver escaping into the tailings, but fortunately, are very usually excellent smelting ore, and most valuable in the furnaces as flux for more refractory stuff.

Smelting Works.—Two smelting companies have made a start with furnace work at Zeehan, having put up works at Argenton and at Zeehan itself. Very little smelting has been done at Argenton, and not a very great deal at Zeehan, and both works were soon shut up. The principal reason of their failure appears to have been that neither company had sufficient capital to buy ore and lie out of their money until the product was sold, and consequently they were only able to undertake smelting at fixed charges, the owners of the ore receiving back the argentiferous lead, and selling it themselves. The most considerable parcel of ore dealt with was one of 3073 tons (dry weight) from the Maestrie's Broken Hill mine at Dundas, which was smelted at the Zeehan and Dundas smelting works. The bulk assays before smelting showed the parcel to contain 80,087 ounces of silver and 1189 tons of lead, and the yield was 76,844 ounces silver and 866 tons of lead, the loss in smelting being therefore 3243 ounces of silver, or 1·055 ounces per ton of dried ore, and 323 tons of lead, or 10½ per cent. per ton of ore. Otherwise expressed the loss of silver was 4·05 per cent. of the total in the ore, and of lead 27·16 per cent., the latter being higher than it probably would be in continuous working, when the slags and flue-dust would be from time to time retreated.

The greater part of the ore exported from Strahan lately has been bought at Zeehan by representatives of the Queensland Smelting Co., and the Hamburg Metal Co.; the Western and Silver Queen Companies have, however, lately been shipping to Europe on their own account, and about a year ago the latter also sent a good deal of ore to the Clyde Works in Sydney. Only first-class ore, concentrates, and good fluxing ore of low silver value, have been exported. It is a question of great moment to the district, and to the Colony, whether it would be better to have the smelting done at Zeehan or Strahan or to continue exporting the ore, and a little discussion of this will not be amiss. Mr. Augustus Simson, Manager of the Western Co., has been good enough to let me have a copy of the Hamburg Metal Co's. tariff, dated 8th July, 1892. It is as follows, the ore being delivered at Zeehan :—

"SILVER LEAD ORES

"*Containing over 50 per cent. of Lead and less than 7 per cent. of Zinc.*

"*Silver*—To be paid for at rate ruling in London for standard silver during the week in which assay is agreed upon.

"The following deductions will be made from the contents found by assay, to cover losses in smelting, realization, etc. :—

30	ounces	and	under,	deduct	5oz.	per	ton.
40	"	"	"	"	6 "	"	
50	"	"	"	"	7 "	"	
65	"	"	"	"	8 "	"	
80	"	"	"	"	9 "	"	
100	"	"	"	"	10 "	"	
120	"	"	"	"	11 "	"	
140	"	"	"	"	12 "	"	
160	"	"	"	"	13 "	"	
180	"	"	"	"	14 "	"	
200	"	"	"	"	15 "	"	
225	"	"	"	"	16 "	"	
250	"	"	"	"	17 "	"	

"*Lead*, at 60/- per ton, less than rate ruling in London for soft Spanish lead during the week in which assay is agreed upon, 12 per cent. to be deducted from the contents found by assay to cover loss in smelting, etc. The sum of £3 per ton of ore will be deducted to cover all charges such as smelting, sampling, assaying, freight, etc.

"*Fractions* of an ounce of silver and unit of lead, not allowed for.

"*Moisture* deducted.

"*Terms.*—Cash on delivery of agreement of assay.

"*Ore* to be in approved bags and marked as may be directed."

Mr. Armstrong, the local agent of the Company at Zeehan, told me that the charge for smelting, freight, etc., was £3 15s. 0d. per ton of ore, so that it would appear that the Western Coy. have been able to get better terms than usual; he also explained that the 12 per cent. deducted from the assay value in lead was not $\frac{3}{25}$ths of the number of units shown as might be supposed, but actually 12 units from whatever the per centage might be. The Company do not care to buy any ore containing less than 40 per cent. lead and 40oz. silver per ton, or 50 per cent. lead and 25oz. silver per ton, their great anxiety being to secure stuff rich in lead to aid them in smelting their own ore. The value of the lead on the field has varied from £6 7s. 6d. to £7 a ton, and of silver, from 3s. 1½d. to 3s. 4d. an ounce. Let us see what ore of the above minimum values yields to the seller, taking lead at £7 a ton and silver at 3s. 4d., the most favourable figures:—

(i)	40 per cent. Lead—12 per cent. = 28 per cent. @ £7 =	£1	19	2	a ton.
	40 ounces Silver—6 ounces = 34 ounces @ 3s. 4d. =	5	13	4	,,
	Total =	£7	12	6	,,
	Deduct	3	15	0	
	Net return to seller =	£3	17	6	,,
(ii)	50 per cent. Lead—12 per cent. = 38 per cent. @ £7 =	£2	13	2	a ton.
	25 ounces Silver—5 ounces = 20 ounces @ 3s. 4d. =	3	6	8	,,
	Total =	£5	19	10	,,
	Deduct	3	15	0	
	Net return to seller =	£2	4	10	,,

Out of these returns, the mine-owner has to pay all expenses of mining, sampling, bagging, and transporting the ore to Zeehan, which does not leave him much profit; yet stuff of these values must be considered very fairly rich, and is considerably above the average of the second-class ore on the field. It is clear, therefore, that only very good stuff and concentrates will pay for export at these rates.

The Oceana Company having a quantity of excellent fluxing ore averaging about 14½ ounces of silver, 39 per cent. of lead, and 25 per cent. of iron, were able to get rather better terms than the above from the Queensland Company for it, but it netted them not quite £2 a ton, and left a very small margin of profit. A heap of good fluxing ore at the Dundas P.A. Mine, assaying 28oz. silver per ton and 25 per cent. lead, could not, however, be sold at all, and had to be thrown to one side for the present. Yet it was of almost the same value as the ore from the Maestrie's Broken Hill mine which was smelted at Zeehan, and quite equal to the average grade of ore put through the furnaces at the Broken Hill Proprietary mine at Broken Hill, N.S. Wales. The Maestrie's ore returned a profit on smelting, so it is clear that a local furnace can handle ore which it would not pay the ore buyers to export. Let us take the figures supplied by the Maestrie's test, as given in the half-yearly reports of the directors of the Company at the general meetings of July 28th, 1892, and 31st January, 1893, and try to find out from them where the profit has arisen.

3490 tons of ore as sent from the mine contained 11·95 per cent. of moisture, and was equal to 3073 tons of dried ore. It contained 80,087oz. of silver and 1189 tons of lead, or 23oz. silver per ton of undried ore, and 34·1 per cent. of lead (38·7 per cent. lead and 26oz. silver per ton of dried ore).

Freight from Dundas to Zeehan cost 6s. a ton, and shunting charges from Zeehan to the Smelting Works 2s. 6d. a ton, the actual amount paid for these items being £1483 8s. 10d.

The ore yielded 866 tons bullion, containing 76,844 ounces (= 2·35 tons) of silver and 863·65 tons of lead, or at the rate of 22oz. silver and 24·8 per cent. lead per ton of undried ore (= 25oz. silver and 28·1 per cent. lead per ton of dried ore). The smelting losses were at the rate of 1 ounce silver and 9·3 per cent. lead per ton of ore as mined, or 1 ounce silver and 10·6 per cent. lead per ton of dried ore.

The freight on 866 tons of lead bullion from Zeehan to Strahan at 14s. 6d. a ton and 2s. 6d. shunting charges, and from Strahan to Hobart at 4s. 2d., amounted to £915 8s. 10d., equal to to 5s. 3d a ton of undried ore.

The freight from Hobart to London and realization charges there were estimated at 12½ per cent. of the value of the bullion, or £2907 12s. 3d., equal to 16s. 8d. per ton of raw ore.

Insurance on the bullion came to £206 9s. 9d., or 1s. 2d. per ton of ore.

The smelting account was £6976 16s. 10d., and charges for receiving, checking, assaying, and sampling at the works £180 0s. 5d.; total, £7156 17s. 3d., or £2 1s. per ton of undried ore.

Collecting these items we have the following expenses per ton of ore as sent from the mine:—

Freight to Smelting Works	£0	8	6
Sampling and Smelting Charges	2	1	0
Freight to Hobart	0	5	3
Freight to London and Selling Charges	0	16	8
Insurance	0	1	2
Total	£3	12	7

Had it been sold to the Hamburg Metal Company in accordance with their tariff, the expenses would have been as follows, the ore being sold delivered at Zeehan :—

Freight to Zeehan	£0	6	0	per ton
20 Bags, @ 3s. 6d. a dozen	0	5	10	„ „
Filling and Sewing Bags	0	1	9	„ „
Tariff Deductions { 5oz. Silver, @ 3s. 4d....	0	16	8	„ „
Tariff Deductions { 12 per cent. Lead, at £7	0	16	10	„ „
Smelting and Freights Charge	3	15	0	„ „
Total	£6	2	1	per ton

The ore at 3s. 4d. an ounce for Silver, and £7 a ton for Lead, the highest local prices quoted by Mr. Armstrong, has a gross value of only £6 4s. 5d. a ton or only 2s. 4d. more than the export charges. The actual return from the furnaces at the same rates amounted to £5 8s. 1d. per ton, leaving a profit on the local smelting of £1 15s. 6d. per ton of ore as sent from the mine, without drying. A not inconsiderable item in the saving shown by local smelting over foreign export is that while the ore buyers deduct 5 ounces of Silver and 12 units of lead for smelting losses, the actual furnace returns showed a loss of only 1 ounce of Silver and 10·6 units of lead, the difference in favour of the mine owners, at the above prices, being 15s. 4d. per ton. When we further consider that the loss of lead was abnormally high, and would be reduced in continuous working by the re-smelting of the slags, flue-dust, and other bye-products, it is seen that the deductions made by the ore buyers represent a great deal more than the actual furnace losses. No European smelter would like to admit that such very high losses actually took place in his furnace practice, and I think it would be fairer if the ore buyers made the deductions as nearly as possible what the actual losses come to, and increased the lump sum charged for smelting, freights, and realization. Also, instead of paying for the Lead and Silver at rates considerably lower than current London prices, it would appear to be fairer, as the product is sold in Europe, to pay, say, 2s. 6d. an ounce for Silver, and £6 10s. per ton for Lead at the time of sale, and the balance of the money three months later at the then prevailing market prices. The seller would then get full value for his Silver and Lead; if the buyers cannot do this without increasing their general charges for smelting, freights, &c., by all means let them do so, and thus make the items of their tariff more clearly intelligible. At present it appears to me that the charge of £3 15s. a ton does not cover the freights, smelting charges, expenses of realisation, profits, and other sundry items for which it ostensibly provides, but that a considerable portion of these is met out of the differences between the deductions for smelting losses and the actual loss, and between the prices paid for Lead and Silver in Zeehan and those at which the metals are sold in Europe. As will be seen from the tariff, the Zeehan price of Lead is £3 a ton less than the London price, and the price of Silver is taken at the London value of standard Silver. But standard Silver is not pure Silver, but an alloy containing 925 parts of pure Silver and 75 parts of Copper in 1000, and the value of pure Silver is, therefore, 1·0811 times that of standard Silver per ounce. When bar Silver is quoted at 3s. an ounce the value of pure Silver is 3s. $2\frac{7}{8}$d., and when the former is 3s. 4d. the latter is 3s. $6\frac{3}{4}$d. As the Silver shown by the assays of ore is pure Silver, not standard, it will be seen that the ore buyers gain nearly threepence an ounce by buying at the latter price. Of course they take the risk of the market falling before the shipments can get to Europe, but it seems to me that it would be more satisfactory if they would adopt the above-mentioned suggestion, and pay the sellers in full only after the ore had got to market, then giving them full value for the metal extracted from the ore, and charging a sufficient lump sum for profit and all expenses. The present tariff seems purposely designed to make the expenses of transport and reduction appear considerably less than they are in reality.

In smelting on the field a great gain arises through the reduction in weight of the stuff treated from that of the crude ore to that of bullion; in Maestrie's case for example, from 3490 tons to 866 tons. Charges for freight are consequently much reduced, though a little higher per ton on account of the greater value and marketability of the product. With concentrated ore the gain is not so great, but is still quite considerable. Local smelting would yield not more on an average than two-thirds ($66\frac{2}{3}$ per cent.) of the total weight of ore as bullion, and probably rather less, but let us take the figure as $\frac{2}{3}$rds for comparison. In transit from Zeehan to Strahan, one ton of concentrates would cost 12s. 1d., while the $\frac{2}{3}$rds of a ton of bullion therefrom, at 14s. 6d. a ton, would cost 9s. 8d., a difference of 2s. 5d. to the mine-owner. Moreover, the ton of concentrates would cost 7s. 7d. for bags, and filling and sewing them in addition: but there is no reason why concentrates should not be carted or trucked to the smelting works without bagging, if suitable trucks be provided. The expenses from Strahan to Europe for bullion would be somewhat greater than for concentrates *per ton;* probably only one-fourth instead of one-third less than the latter, therefore, for equivalent quantities. On Maestrie's bullion they were close on £4 a ton: a corresponding parcel of galena would cost say £3 11s. 1d. a ton, but there would be half as much again in weight of it as of the bars. Equal quantities of lead carried as bars and as galena would therefore cost £4 and £5 6s. 8d. respectively. There would thus be a difference of £1 9s. 1d. per ton of lead in freights and other charges in favor of sending it in the metallic form instead of as concentrates from Zeehan to London; and, adding bags and bagging, £1 16s. 8d. In the case of rich ore carrying less lead, the saving would be still greater, as the quantity of lead bars carried would be less.

If local smelting works were reducing all the ore from the field and selling the product, I have no doubt that they would be able to make better terms with selling agents, shipping companies, and the desilverizing and refining works, in Europe, than could be obtained by each mine-owner selling his own bullion, and business competition would soon reduce realisation expenses to their lowest limit. Once in thorough working order the cost to the Smelting Company of marketing their lead bars would probably be much less than the Maestrie's Broken Hill Company had to pay, and the difference in favor of local smelting would then be even more marked than above shown.

Zeehan is really very well situated for the establishment of local smelting works, having a seaport only twenty-nine miles away, and all necessary fluxes on the field. There is not much to choose between Zeehan and Strahan as to which is the better site for reduction works, but at present railway rates between the two places it is probably cheaper to smelt at Zeehan, for the carriage of coke up and bullion down amounts to less than that of the raw ore down to Strahan. It is possible that it might pay some of the Dundas mining companies better to have furnaces on the mines than to send their ore even to Zeehan, but it would be inadvisable to put them up just yet, until the fields are more fully developed and it is seen that there is plenty of ore to keep them going. The smelting problem depends largely on the expense with which the low-grade fluxing ores can be carried to the smelting works, and as the bulk of these as yet discovered are at Dundas, it will rest very much with the management of the Zeehan and Dundas railway whether local smelters are established there or not. If the ore is carried at low rates, it can be taken to Zeehan and smelted there, but at present figures it will probably have to remain in the mines till there are furnaces close at hand. This is very much against the best interests of the district as a whole, for the use of these fluxing ores is very desirable in smelting those that are less easily dealt with, and would reduce the cost of doing so very considerably. In the Maestrie's Broken Hill mine it is estimated that there are some six or seven thousand tons of ore above the tunnel level and at grass, assaying from 16 to 20oz. silver and 15 per cent. lead, of good fluxing quality. In the Dundas P.A. mine the manager stated to me that he could take out the ore thirty feet in width if there were a furnace on the ground. The Comet, Adelaide, Mariposa, and Oceana mines could also supply a good deal of ore of this class, and the Balstrup line of lode, when opened up, would almost certainly also yield a large quantity. Considering the beneficial effect of this sort of ore in assisting the reduction of richer stuff, it seems to me that it would be good policy for the railways to carry it at specially low rates. The same might be said of ironstone flux, limestone and coke: the more the expenses of getting these to the smelters can be lowered, the greater will be the output from the latter of rich lead bars, on which high rates of freight may be legitimately charged. Local smelting works are now, in my opinion, among the most urgent needs of the West Coast silver fields, and I would strongly recommend that every assistance should be given by the Government to their establishment.

With furnaces on the field it will pay to smelt ores which now must be concentrated before export. It is a question, for example, whether it would not have paid better to smelt the second-class ore of the Silver Queen mine above spoken of directly, instead of concentrating it, the loss of lead and silver in the latter process going far to make up for the greater cost of smelting the crude ore, as compared with that of treating concentrates. The second-class ore at the Western mine, too, would probably be just as profitably smelted as concentrated. It is likely that in course of time the local furnaces will be found treating all ore as it comes from the mine that contains over 30 ounces of silver and 30 per cent. of lead, and that the concentrators will be kept working upon the grades poorer than this, down to figures which at present could not be touched. Such a lowering of the grade of immediately marketable ore will undoubtedly result in great extension of mining operations. Let us hope, therefore, that it will not be long before there is a local smelting company in the field as buyers of ore, with capital sufficient to be able to pay cash down to the miners in the same way as the foreign companies.

Mines Visited.—The length of my stay in the district did not permit of making close examination of each mine, and the following notes upon them are rather intended to give a general idea as to their present position and prospects, than to afford accurate information as to details.

Silver Queen.—This mine is worked from two main shafts, known as No. 1 and No. 2, one close to the south boundary of section 1636-87M (No. 1), and the other in section 1638-87M (No. 2). Both the main lodes, to work which these shafts have been sunk, run to the east of north; but there are several others known to exist in the property, on which a little trenching has been done, and some of these belong to the north-easterly, and others to the north-westerly series of lodes. The workings from the No. 1 shaft have been on the whole somewhat poor, though a good deal of rich ore has also been obtained: at the time of my visit, however, a winze below the bottom level was showing some rich ore, giving hope of an improvement. The lode is strong and well defined, but consists largely of carbonate of iron and slaty gangue: towards the north end it seems to be either very much disordered or lost altogether, a large irregular-looking reef of quartz and iron pyrites, which appears on the western side of the drive in two or three small crosscuts probably having much to do with this disturbance. A good deal of work may be required to find the continuation of the ore in this direction. The shaft is 222 feet deep, and has two levels opening from it, No. 1 at 105 feet, and No. 2 at 208 feet. The main crosscut west at No. 2 level is in 236 feet, and east 200 feet. As there are other known lines of lode both east and west of the shaft, it would appear advisable to continue cross-cutting both ways in order to cut these or other parallel lodes not yet discovered. The present levels being somewhat poor, it is also desirable that sinking the main shaft should be resumed as soon as possible, so as to open up new ground and find better ore. A few chains to the north-east from the shaft on surface an outcrop has been lately cut into which reveals a nice body of concentrating ore, 5 or 6 feet wide, with some good bunches and streaks of pure galena in it. This had only been sunk upon 15 feet at the time I saw it, and was not well exposed, but it seemed to be running about N.N.W., and would be cut by the eastern crosscut if extended.

The No. 2 shaft is about 170 feet deep, and has two levels opened from it at 115 feet and 155 feet. From No. 1 level to surface the ground has mostly been stoped out for a length of 225 feet. All this ground was very good, the ore being rich galena and siliceous pulverulent matter carrying carbonate and oxide of lead and chloride of silver. At the bottom level the lode was poor, but appeared to be improving a little in both the north and south ends. Here as in No. 1 workings the only policy to pursue is to drive and sink on the lode in the hope of again coming upon good ore. A few chains east of the main shaft another lode running N.15° W. has been cut in some trenches and prospecting holes: it should run into or cross the main lode to the north of the shaft, and seems good for a consider-

able supply of concentrating ore. There are altogether more than twelve known lodes in the Silver Queen Company's property, and several of them very promising ones: it seems to be only a question of time and money to open them up so as to produce plentiful supplies of ore.

Up to the end of 1892 the Silver Queen mine had exported 2601 tons of first-class ore, which yielded 876½ tons of lead, and 251,215oz. silver, or a cash return of £40,246 13s. 11d.; 319 tons of second-class ore were also sold for a net return of £293 5s. 1d.

Montana Mine.—(Section 2154-87M)—40 acres). At the time of my visit work was confined to sinking a main shaft, and I did not see the lodes. A good deal of ore has been already extracted from this ground, and when I saw it previously I formed a very favorable opinion of its prospects, which seems to be shared by those who have watched its further development.

The New Great Eastern Mine.—This is situated in section 1666M, formerly belonging to the Silver Queen Company: the same owners also hold section 841-87M. A main shaft was sunk, but the flow of water was so great that it overcame the steam pump provided, and the mine was shut down. At the time of my visit a little prospecting was going on on section 841-87M, but without result up till then.

Despatch Mine.—(Section 243-87M). The owners of this mine also were unable to overcome the water met with in sinking their shaft, and had to stop working. Some parties of tributors were getting some nice-looking galena on the the southern part of the section, from some of the lodes which run into the Mount Zeehan Company's ground, but no other work was in progress at the time I saw the property. The surface prospects have been described in my former reports.

Western Mine.—(Sections 754-87M, 755-87M, and 756-87M). In my former reports I described the work then done on two north-westerly lodes that had been cut by means of two adits. Since then a much larger lode has been discovered running north-easterly, and has been driven on for about 750 feet at No. 1 level. A main shaft has been sunk to a depth of 153 feet, and levels opened at 55 feet and 120 feet. In the lower level the lode looks just as well as in the upper one. A good deal of stoping has been done above the upper level with very satisfactory results, the ore being clean galena of high silver value. Near the main shaft the country is the tufaceous and brecciated rock above mentioned, but in both ends of the workings the lode passes out of this into black slate, and does not diminish in size or value in the latter, though the southern workings have been extended into it some two or three hundred feet. The tufaceous rock is soft and easily worked, but stands well without much timber, and seems to be very favorable for veins of galena, several of which have been passed through in the crosscuts. There seem very frequently to be small veins and lodes close to the main one, and parallel to it, or joining it at a very acute angle, and it will therefore be necessary to crosscut pretty often while working out the ore so as not to miss these bodies. The lodes worked in the adits, if they had kept their course and size, ought to have been cut in driving on the main lode, but it does not appear certain that they have been met with, though some veins of galena crossing the No. 2 crosscut at the bottom level, are probably part of No. 2 lode. If so, the latter would appear to join the main lode without passing through it. A small lode known as No. 4, some 480 feet south of the main shaft, might possibly be a continuation of No. 2, on the east side of the main lode. It seems probable that the whole of the ground in the vicinity of the main lode has been more or less fissured, and that there are numerous strings and veins of ore through it, some perhaps continuous for considerable distances, others quite short. When the Nos. 1 and 2 lodes have been followed up to the main lode it will probably be seen whether they join it or are faulted by it. Throughout the whole length of the workings the main lode has been more or less payable, the ore being fairly continuous. In the Junction Company's ground to the south of the Western mine, tributors are working a lode which I take to be identical with the main lode of the latter, which would show that the end of the ore going southwards has by no means yet been reached. The mine promises very well, looking likely to continue ore-bearing considerably deeper than the present bottom level at any rate. Sinking is to be continued when the pumping machinery ordered has been fixed in the shaft, and it should soon be proved whether or not the lode is as good at 200 or 300 feet as at the upper levels. The ore-body in this mine is by far the longest yet proved on the field, being over 750 feet in length at the least, and if it lives in depth also, as there is every reason to believe it will, the mine will be a very valuable one. The quantity of ore at grass and in sight in the stopes is even now very considerable, and from my examination of the mine, though I did not myself measure the ore, I am quite prepared to accept the mining manager's estimate of 15,000 tons in sight, as in no way excessive. In his report to the chairman and directors, read at the half-yearly meeting of the company on the 28th April, 1893, he says:—"*Reserves.*—There are now fully 3010 tons of second-class ore at surface. These piles have been very carefully sampled, and the following are the average results obtained:—

2400 tons at No. 1 and 2 shafts, silver 44oz., lead 23 per cent.
400 tons at main shaft, silver 46oz., lead 26 per cent.
60 tons at No. 3 shaft, silver 58oz., lead 29 per cent.
150 tons at lower tunnel, silver 27oz., lead 22 per cent.

Total ... 3010 tons at surface.

"The winzes below the No. 1 level prove the lode of a greater average width than I anticipated, and I now estimate the available ore proved to exist between the Nos. 1 and 2 levels at 9500 tons, and remaining above the No. 1. level 2500 tons, or an available total of about 15,000 tons of ore in sight on the main lode only.

"After making allowances for cost of mining and timbering mine, loss in concentration, cost of concentration, weighing, bagging, and smelters' charges, I estimate the net value of the reserves at £60,000."

Up to the end of March, 1893, the mine has exported 1418 tons of first-class ore, assaying on the average a little over 100 ounces of Silver and 58 per cent. Lead, which has realised £19,345 14s. 0d.

net value. The 3000 tons of second-class ore on surface have been raised while taking out this richer stuff, and if the proportion of each sort of ore remains the same in the ground not yet stoped the first-class ore alone should realise more than the mining manager's estimate, so that this may be looked upon as safe and conservative. This mine has paid its way out of ore raised from the beginning, and will soon be provided with a very fine dressing plant also paid for out of produce; and, as its prospects underground are as good or better than they have ever been hitherto, there is every reason to expect for it a highly profitable future.

Junction Mine—(Section 819-87M: section 818-87M is also held by the same owners.)—About two chains South of the southern boundary of the Western Co's. ground a shaft has been sunk on the line of the latter's main lode to a depth of 56 feet. At 50 feet a level has been opened, a cross-cut being driven about 37ft westward to the line of lode, which has then been followed for about 60feet to the South and 30ft to the North. At the time of my visit very little galena was visible in the lode in the level, but in the stopes there were from two to twelve inches of very clean good ore, exactly like that in the Western mine. The course of the lode is N. 20° E., and its position agrees very well with the line where the continuation of the Western main lode might be looked for. As it is also drained by the Western Co.'s workings I do not think there can be much doubt as to its being the same lode. The galena is likewise of similar high value. The mine is being worked by tributors; at the time of my visit they were just beginning to get the ore, but since then they are reported to have sent out several parcels of extremely rich stuff.

About 3 chains S.E. of the shaft some work has been done on a small lode known as No. 3, running about N.30°,E. A quantity of very siliceous gossany ore has been raised from this, and also some siliceous galena. As there is no sale for dry ores of this sort on the field at present, the tributors were not working this lode.

The Oonah lode crosses the south boundary of this section, and working through their neighbor's tunnel the Junction tributors are said to have been able to get some very good ore from it: they then drove a branch tunnel to intersect the lode, but had not been successful in finding ore at the time of my visit.

The prospects of this property are pretty good, and should encourage the owners to sink a main shaft and put machinery on it.

Oonah Mine.—(1110-87M and 1111-87M.)—This mine is also in the hands of tributors, who were fortunate shortly after taking it in finding very good ore in a vein passing through the company's prospecting tunnel near the Junction boundary. The country is black slate and brecciated tuff as in the Western mine. The lode runs about N.10°.W., but bends a good deal: it had been driven on about 135 feet to the south at the time of my visit, and up to the Junction boundary to the north. In the Oonah workings the lode has been from twelve inches to five feet wide, consisting in the upper portions of rich oxidised gossan, and lower down of galena, veins of the latter up to 12 inches in thickness having been found very pure, while there was a good deal of concentrating ore in addition. The ore from this mine has been of very good quality, one parcel of 11 tons averaging 535oz. of silver per ton, and 20 per cent. of lead, and another of 18 tons 7cwt., giving 109oz. 8dwt. 16gr. of silver per ton, and 71 per cent. of lead.

About 2 chains from the mouth of the tunnel down a small creek passing through section 1110-87M., another small lode of very pure galena, 2 inches to 8 inches in width, was cut in making an excavation for the foundations of a small hand-jigging machine. When I saw this about 6 tons of ore had been raised from it, assaying 100oz. of silver to the ton, and 83 per cent. of lead.

I have not been able to obtain the total amount of ore raised by the Oonah tributors. The mine promises exceedingly well, and is likely to be a very considerable producer. Driving southwards on the lode the height of backs above the level increases from 45 feet at the end of the tunnel to 100 or 150 feet. The lode may not rise to surface, but there is a probability of there being a good deal of ground still to be stoped above the tunnel level. When the tribute party's time has expired, the company should at once sink a shaft and prepare to work below the water level.

It is noticeable that the tufaceous rock is found in close connection with the Western, Oonah, and Silver Queen No. 2 lodes, all of which have been rich, and special attention should therefore be given to this class of country.

Tasmania Crown Mine.—(Formerly known as the Silver Crown, 197-87M, 198-87M, 199-87M, 736-87M, 201-87M)—Work on this property was confined at the time of my visit to the field to sinking the main shaft, with which good progress was being made. Several lodes are known to exist in the sections, and the mine has very fair prospects. As the ground is mostly low-lying and wet, it has not been possible to raise much ore from the outcrops of the lodes. One parcel of 40 tons yielded, on concentration at the Mount Zeehan mill, 11 tons 9cwt. of galena, assaying 92oz. 2dwt. 9gr. of silver, and 71½ per cent. of lead per ton. Another of 10 tons yielded 13cwt. of concentrates, with 75 per cent. of lead, and silver 52oz. 11dwt. 20gr. per ton. The main shaft is now down about 200 feet, and the results of driving for the various lodes will be watched with much interest.

New Silver Stream.—(1642-87M, 3224-87M.)—This mine is situated towards the western side of the Zeehan field, not far from the contact of the slate and sandstone formation with the granite of Mount Agnew. A little further west, in the Tasmanian Silver Prospecting Co's ground, the sedimentary rocks show strong evidence of contact metamorphism, and it is probable that the magnetite in the large lode of this mineral, which runs through sections 1919-87M and 2661-87M into 1642-87M, is due to metamorphism also, siderite or limonite having been changed to the magnetic oxide of iron. In the lower tunnel of the Silver Stream mine a good deal of very dense quartzite was passed through, also a metamorphic rock, and in the lode and near it further evidence of alteration is found in the presence of epidote and garnet. The outcrop of the magnetite lode is very strong and well-defined, and should indicate a large lode

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below : its course is about N.W. and S.E. In the New Silver Stream workings it seems probable that the large broken formation met with has some connection with this north-westerly lode, for it is full of similar magnetite, sometimes pulverulent, and sometimes dense, but the galena veins run about N.10 ° E., and it is therefore not at all clear whether the latter are separate lodes passing through an older one, or if they are ore-bodies lying obliquely across a large lode mass in the same way as the galena appears to occur in some of the Dundas lodes. Two shallow adits have been driven to test the ground: No. 1 is 252 feet in length, and there are about 250 feet of branches and crosscuts from it. Throughout this level the stuff passed through is soft and weathered, and it would be hard to say whether a great deal of it is lode stuff or rotten country rock. In a winze from this adit to the No. 2 one, which is 28 feet lower, some very nice solid galena is exposed, the ore-bearing body being from 18 inches to three feet in width. The upper adit is only about 40 feet below the surface of the ground at the shaft first sunk on the galena vein. The underlay of this seen in the winze is about 1 in 3 to the eastward. The lower tunnel is 596 feet in length, and from it a drive has gone 66 feet on the course of what is called No. 2 lode. A short distance from the mouth of the adit a lode formation carrying much magnetite, mostly pulverulent, was passed through, and then hard slate and quartzite were met with. At 532 feet what is called No. 1 lode was encountered, containing a good deal of galena and blende, some copper pyrites and a little pyrrhotite. At 546 feet No. 2 lode was cut, containing the same minerals, and from this onwards to the end of the tunnel a more or less broken mullocky lode mass was passed through. In fact we may say that from No. 1 lode in to the face is all lode matter, containing a little galena all through it, but with the greatest amount of it concentrated in the two shoots or lodes. Much magnetite occurs at intervals throughout the mass. A fairly large quantity of ore could be extracted from above the adit, but most of it would require concentration. Quite a strong stream of water flows from the lode, and it is evident that powerful pumps will have to be provided before it will be possible to sink on it. The adit being very shallow it would not be worth while to put up concentrating machinery for the ore that could be got above its level, and the future of the mine therefore depends on whether the owners can raise the capital required to open it at a depth : the prospects quite warrant spending the money necessary to do so.

Should the work in the Silver Stream mine result profitably, there will be great inducement to sink under the large magnetite outcrop in the Tasmanian Silver Prospecting Company's ground as well.

Forty-six tons of galena, averaging 23oz. of silver per ton, and 41 per cent. of lead, have been sold from the New Silver Stream mine, realising £267 2s. 1d., and there is a considerable stock of second-class ore on hand waiting for concentration. A tramway to connect with the main Remine to Zeehan road and the New Tasmanian Company's tramway, is one of the first requisites for opening up the mine.

Comstock.—(712-87M).—This mine has been let to a tribute party, who are raising all the first-class ore they can get from the outcrop, and as deep as their rather primitive appliances will allow them to go. The lode runs almost along the bottom of a small valley, in which there is a constantly running stream of water, consequently the workings are pretty wet. It has now been proved ore-bearing for some 7 or 8 chains, and the tribute party have taken from it some £400 to £500 worth of clean ore. The second-class ore, which is much more plentiful, they had not been able to touch when I saw the mine, but they intended getting some simple crushing and jigging appliances. The total amount of first-class ore sold since the mine started is 298 tons, which realised £3923 16s. 7d. The average assay is about 60oz. of silver per ton, and 50 per cent. of lead.

The work now being done on the outcrop will necessitate fluming the creek for a long distance by and by, when the mine comes to be worked in the regular fashion. The company ought to have driven from their low level tunnel along the lode to below the known ore-carrying portion of it long ago, but lost heart.

Boss.—(1240-87M.—No work was being done on this property when I visited it, except by the caretaker. A little galena is said to have been obtained in a shaft now full of water from a lode running N.10° E. A trench cut across this course two or three chains south of the shaft has revealed a lode of pyrites and dense blende, about 4 feet wide, and also the ferruginous and silicious capping of what is probably another lode. There are three or more large ironstone outcrops also on the section ; one of these near the north-west corner is a well-defined lode outcrop, running N. 25 ° W. Two small shafts and a small tunnel have been made to test this, but have got nothing but oxidised lode matter. The section deserves prospecting more thoroughly below water level.

Sylvester (820-87M., 821-87M., 877-87M., 878-87M., 879-87M.).—Two tribute parties were at work in sections 878-87M. and 879-87M. raising galena associated with much pyrites: I did not see the underground workings of these. The Company's workings are in section 820-87M. on a north-easterly lode. An adit has been driven from the bottom of a valley to cut the lode : this was met with at 74 feet, and the drive was then continued to 300 feet without meeting more lode matter. The lode has been driven on to the northward about 290 feet ; at first it was barren, but before long it improved and carried a good deal of pyromorphite and chloride of silver. Some 38 tons were taken from the stopes assaying 76ozs. silver and 40 to 50 per cent. of lead per ton, and there is still a good deal of ore in them containing up to 50ozs. of silver that would pay to take out if there were smelting works at Zeehan. In the end of the drive on the lode carbonate of iron suddenly took the place of the gossan up till then passed through. When I went through the mine a winze had been sunk below the adit level, and from this some nice galena, assaying over 100ozs. silver to the ton had been extracted ; the vein was about eighteen inches wide of galena streaked with oxide of iron, and looked very promising.

A main shaft is being sunk, and was down 46 feet below the adit level when I saw it ; the tunnel is 60 feet below the collar of the shaft. When this is sunk and the mine is opened from it there is ground for expecting good returns from the lode. A good deal of tufaceous rock occurs in the Sylvester mine.

Mount Zeehan (559M. and 909M.).—The main workings of this mine are on one of the north-easterly series of lodes. This has been opened to 60 feet in depth from a shaft now used as an air shaft, and to 124 feet by a main shaft. At the 124 feet level the lode has been followed north and south about 300 feet each way; at the upper level it has been driven for about 200 feet to the south and 400 feet to the north. At the bottom level the lode has been generally very poor, but in several places ore was found in the floor of the drive and rising up into it a foot or two, as if it had been just too shallow to strike new shoots of ore going downwards. The lode is very well defined with smooth walls; it has now been noted however, in several cases in the Zeehan field that where the walls are smooth and hard the lode is poor in ore. In the upper level the ground was richer, and near the air shaft a good deal of stoping has been done. On the whole, however, the workings have not been profitable, and the mine has lately been shut down.

While this work has been very discouraging, the Company should not by any means lose confidence in their property. There are a great many lodes in it not yet touched except by surface trenches, and some of these give very much better prospects on surface than the one to which work has been confined. Towards the north-east angle of section 909M six lodes of various sizes, all running about N.N.W., have been discovered; one of these crosses the main street of Zeehan in front of the Telegraph Office, and from the cap of it, 2½ feet in width, two large stones, one 2 tons, the other 2½cwt in weight, were taken, containing galena and carbonate of lead: assay of galena:—Lead, 76 per cent., and silver 73ozs. per ton. This lode has been traced for several chains, and is undoubtedly well worth a mining trial. Unfortunately for the Company the corner of their section containing these lodes is in one of the busiest parts of the town of Zeehan, and they will have some difficulty in securing a suitable site for their shaft and machinery. The whole of the six lodes in this part of the property will be able to be worked from one main shaft. In the western part of section 909M there are some four known lodes, including the one that has been worked; and in section 559M the No. 4 lode of the Argent mine has been picked up, and three or four other veins which may prove of importance, some of them north-westerly and others north-easterly in their courses. In order to know what is in these two sections it will really be necessary to drive right across them, and three main shafts at least will be required to work them. With so many lodes it is difficult to decide on which to begin working first, and a good deal more surface trenching ought still to be done to trace the position of each before coming to a decision. A good deal of capital must clearly be sunk before the ground can be properly opened up, but with so many lodes and such good surface prospects to warrant the expense, there need be no hesitation in recommending this property as well worthy of attention from mining adventurers.

The yield of ore from this mine has already been quoted above; I understand some 40 tons or more had been previously exported in addition, containing about 76ozs. silver per ton and 59 per cent. lead.

This mine belongs to "The Mount Zeehan Silver Lead Mining Company, Limited," a Tasmanian corporation, which is not to be confounded with the one that owns the next mine to be mentioned.

Argent Mine.—(Section 192-87M, belonging to "The Mount Zeehan (Tasmania) Silver Lead Mines, Limited," Company.) The English Company owning this property hold several other sections in addition, but work has been practically confined of late to the Argent and Silver Queen Extended sections (as they are locally called, from the names of the Companies that first held them). The Montana section, 2154-87M, which formerly was also held by the above Company, has since been made over to a separate one, "The Zeehan Montana Silver Mine, Limited."

The Argent main shaft is 140 feet deep, and levels have been opened from it at 72 feet and 132 feet. There are five known lodes in the section, four running north-easterly and one north-westerly, but only two, known as Nos. 4 and 6, are being worked from the main shaft as yet. Both of these lodes were looking very well at the time of my visit, being strong bodies 4 to 8 feet in width with well-defined walls, and in both payable ground was being stoped out, much of the galena being very pure. The value of the galena in silver is very much the same as in the adjoining Mount Zeehan claim, rarely less than 65ozs. to the ton.

An underlay shaft has been sunk on the north-westerly lode to the south-east from the main shaft, and shows it to be a strong vein carrying a good deal of ore. This should join or intersect Nos. 4 and 6 lodes to the south of the main shaft, and may thus be worked from the latter.

The Silver Queen Extended main shaft in section 189-87M. has been abandoned for the present, it being intended to work mainly from the Argent shaft, from which crosscuts will be made to intersect the other lodes. Another shaft towards the western boundary of this section will probably be utilised in course of time as an air shaft, the main western crosscut terminating at it. A crosscut from the Argent main shaft to this one will cut the Balstrup lode and the Silver Queen Extended lodes, and will prospect a lot of very likely ground. After it is completed it will be readily seen what would be the best position for one or more new main shafts to work all the lodes to a depth.

Balstrup's Manganese Hill mine (section 1209M.) has also fallen into the hands of "The Mount Zeehan (Tasmania) Silver Lead Mines Company," and is a very important addition to their property. Two long tunnels have been driven on the lode above water level with the effect of showing that it is a strong and well-defined vein up to 12 and more feet in width in parts, but consisting almost entirely of oxidised material. In several places rich oxidised lead ores were found carrying chloride of silver, but always going under foot and not rising above the tunnels, and it became clear that there was no use expecting any quantity of ore until greater depth was attained and the lode was struck below the zone of oxidation. But by the time this work was done the shareholders had lost faith in the mine and the Company went into liquidation, with the result that the English Company bought the lease of this section. I still have much faith in the future of this mine, the work done having proved nothing to its detriment, and given many indications of its probably carrying good ore below the gossan. A main shaft was begun by the old company and carried down, I believe, to some 60 feet below the level of the lower

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adit, but I understand it is not intended by the manager of the company now owning the ground to go on with this shaft, but rather to prospect the lode from the Argent shaft after intersecting it in the main western crosscut.

The Argent, Silver Queen Extended, and Balstrup's blocks, comprising several important lodes, form a valuable property which should be remunerative when opened up. For the sake of the district I should like to see it worked from more shafts than one, so as to be developed more rapidly than will be possible from the Argent shaft alone. In all, about 470 tons of ore have been sent from the English Company's sections.

Balstrup's Central Mine (741-87M.)—This was shut down at the time of my visit, and the main shaft, said to be 110 feet deep, was full of water up to the adit level. The outcrop of the lode is very distinct and over 12 feet in width: it is traceable with ease from Balstrup's Manganese Hill through the north-east corner of 724-87M. into this section. A great deal of driving and trenching has been done on this property on the lode, but only to find that it is thoroughly oxidised above the water-level. The gossan is of a very favorable appearance, stalactitic, botryoidal, and full of vughs, showing extensive chemical action: it consists of limonite and oxide of manganese mainly. The property deserves a thorough mining trial at a depth below the zone of oxidation.

South Balstrup's Mine (1055-87M).—This also is at a standstill, and the shaft, some 140 feet deep, is full of water. Some rather nice-looking galena mixed with siderite was lying near the shaft, but I did not learn what was the size of the lode from which it came.

Grubb's Mine (1562-87M. and 1580-87M).—This was at the time of my visit one of the best producing mines on the field and has every prospect of soon being in a dividend-paying condition. The owners deserve success, having spent £11,356 on the mine, and £13,549 on connecting it with the Zeehan-Dundas Railway by the Grubb's tramway. The mine has been provided with an excellent winding and pumping plant, and is being opened out in a style which does credit to the management. The main shaft was 145 feet deep at the time I saw it and sinking was proceeding: it has since, I believe, been carried down to 215 feet and a level is being opened out at 200 feet. An upper level has been driven at 130 feet and connected by a rise with the prospecting shaft and the 80ft. level driven therefrom: this 80ft., or intermediate level, is 50 feet below the main adit first driven on the lode. The course of the latter is about N.W.; it has been cut again in what are known as the western workings across the creek (a branch of McClean's Creek) which traverses the property. In these a winze has been sunk 70 feet below the level of the adit in which the lode was cut and a level has been opened from it at 54 feet corresponding pretty closely with the 80 feet level in the main workings. The lode in the western workings has been smaller than in the eastern, but has yielded a good deal of very clean high-grade galena. In the main workings the lode has rarely been less than 18 inches in width and often up to six feet or more: it has very well-defined smooth walls in places, and is plainly a fissure lode. In the 130ft crosscut a mass of stuff coloured green by a light green serpentinous mineral, was passed through, which appears to belong to the lode, though not carrying ore to any extent. The intermediate level has been driven north-west 210 feet and the 130ft. level 236 feet from the prospecting shaft, and the latter level also 41 feet to the south-east from it. Some portions of the lode passed through have been poor, but there is a good deal of stoping ground opened up, especially near the shaft, where the ore seems to form a shoot. The western workings are in another shoot. Only first-class ore and very good seconds have yet been sent away, and the reserves in the mine will yield a great deal more than has been yet raised when the ground comes to be stoped out. As the Company does not yet possess a concentrating mill, the policy of the management has been only to raise the first-class, immediately saleable ore, at present, together with such poorer stuff as had to be taken out along with it, leaving that requiring dressing in the mine, to be stoped out later on, when there is an ore-dressing plant at hand. Previous to the formation of the Company about 75 tons of ore had been raised and sold, realising £750; including this there have been sent away from the mine up to the 31st March, 1893, 562 tons of first-class ore (running from 65 to 80 per cent. lead and 70 to 120ozs. silver per ton), which realised £7,086, and 25 tons of rather poorer stuff (47 to 67 per cent. lead, and 45 to 55ozs silver per ton), which gave £182, or a total of 587 tons, worth £7,268 net, a very good result indeed from so small an extent of stoped ground. The manager estimates that he has at grass 500 tons and in the stopes 1,500 tons of second class ore, which will require concentration: this does not seem to me to be an over-estimate. There is sometimes a good deal of blende with the galena in this mine, and rich fahlore has also been obtained: if it should turn out that there is much of the latter, slime tables will be a necessity in concentrating.

Nubeena (2230-87M).—This mine has been connected with Grubb's tramway by a short branch line. A small lode has been discovered running north and south: it is from 3 to 8 inches wide, but consists of very pure galena, assaying up to 100ozs. of silver to the ton. Very little underground work has yet been done, only a small adit and short drive on the course of the vein. At this level there is not so much galena as on surface, the vein being a mere string. A party of tributors are working the ground.

New Tasmanian (1467-87M., 1468-87M., 1469-87M., 1470-87M., and 1688-87M).—There are two separate sets of workings in this property, from shafts known as No. 1 and No. 2 shafts, a considerable distance apart, and on separate lodes, both of which have a north-westerly course. At the No. 1 workings a main shaft has been sunk 57ft to the level of the adit first driven on the course of the lode, and 120 feet below this. At 60 feet below the adit a tunnel has been opened: in this the lode is very poor towards the north end but fair towards the south, and the ground between here and the adit has been mostly stoped out. At the time of my visit a new level was being opened out at 120 feet in conglomerate country.

The North or No. 2 shaft is 72 feet deep, or 60 feet below a shallow adit driven on the course of the lode. A winze has been sunk from this adit to the bottom level, and the ground between the two levels is being stoped out. The lode is from 6 inches to 4 feet in width, and averages perhaps 18 inches. In the stopes the ore has been found rather patchy, coming in and going out again very suddenly: there is a good deal of blende with the galena.

In both these lodes the galena does not carry as much silver as the generality of those above described, which makes it considerably more difficult to get payable returns. It is possible that the silver value may improve in depth, though there is no certainty that it will do so. Though the mine has had a hard struggle to pay its way as yet it seems to me to be worth further exploration, as the lines of lode are strong and continuous over long distances, and better shoots may be found any day in them.

The total amount of ore sold from this property up to March 6th, 1893, was 870 tons, of which 620 tons were sold during the six months immediately preceding that date. The average assay is given as 64 per cent. lead and 36ozs. silver per ton. Almost all the ore raised passes through the concentrating mill, as it is found impossible to separate the blende satisfactorily by hand picking.

Oceana.—(419-87M., 420-87M., 421-87M., 422-87M.)—No work was being done in this mine at the time of my visit. The lode is a large one, running about N. 30° W., and on surface is almost entirely composed of gossan, in which a little carbonate of lead is often seen. Three prospecting shafts have been sunk and connected by a drive along the lode about 700 feet in length. A main shaft has also been begun, but is only down 45 feet, and has not yet been provided with machinery; it is proposed to sink it when work is resumed and open out at 100 and 150 feet. The present level is only 32 feet below the surface at the main shaft, and 54 feet at the northernmost prospecting shaft. Three shoots of ore have heen passed through; the southernmost or carbonate shoot beginning about 30 feet north of the main shaft; this was stoped out for 60 feet in length and 14 feet wide nearly up to surface, the square-set system of timbering being employed. The best ore contained in bulk 17ozs. of silver per ton and 47 per cent. of lead, and was of very good fluxing quality on account of containing a large percentage of oxide of iron. Some native silver was occasionally found in it. The second shoot was small, and consisted of galena in black clayey matter; it was found about 170 feet north of the main shaft. The third shoot was met with about 450 feet north of the main shaft, and from it were taken 270 tons of galena, assaying 18ozs. of silver per ton and 66 per cent. lead, and the ore is said to be improving in quality going downwards. The lode is of unknown width, and must be very large; one crosscut is said to have been driven eastward 70 feet from the level before it struck the wall, which proved to be limestone, but the other wall has not yet been driven to. At the north end of the level a crosscut proved the lode to be 38 feet in width without reaching either wall.

Altogether some 1000 tons of ore have been sold from this mine, averaging about 14½ozs. of silver per ton and 39 per cent. of lead, and realising to the mine owners about £2 a ton. At the present level there is still a large quantity of low-grade ore containing a little lead and silver, which will not pay for export, but which would be most useful flux for local smelters. The low value of the ore in silver has been unfortunate for the Company, but may improve lower down. The lode deserves a trial at a greater depth, and I have little doubt will well repay the owners for putting machinery upon it.

In my former report I took the limestone rock which occurs on this property to be of Carboniferous Age, on the strength of some very fragmentary fossils; the further evidence now obtainable, however, shows it to be of the same period as the rest of the field, probably Upper Silurian, but possibly Devonian.

The Oceana mine is connected with the Zeehan to Strahan Railway by an iron tramway or light railway, on which a small locomotive can be run, which joins the main line at Argenton.

New Pyramid (370-87M.)—No one was working here at the time of my visit, the mine having been shut down for some time. A shaft has been sunk, but I do not know to what depth, and a very small winding engine, altogether inadequate for serious work, has been provided. As the mine is certain to be a wet one no development can be hoped for until a good pumping engine and plant have been put upon it. Several tons of ore were lying about the surface, all ready bagged, but I was informed that the stuff was too poor in silver to pay for removal at present prices, containing only from 8 to 15 ozs. of silver per ton. There are two strong lodes in the property, both containing a good deal of galena, and though this as yet has been poor in silver, it is premature to assert that this poverty will continue throughout the mine in depth. Already on the field we have instances of the value of the galena in contained silver varying very much at different points; for example, in the Adelaide mine the value was very much higher at the lowest level than at surface. Again, the galena from the Sunrise lode, which is almost certainly identical with that of the Silver Bell, is much richer in silver than that of the latter.

A theory which seems to be believed in a good deal locally, is that in the neighborhood of the bands of limestone the galena is poor in silver, the low grade of the Oceana and New Pyramid galenas being cited in support of this, but it does not appear to me that the evidence is at all conclusive, for poor galena is found in several mines where no limestone is known to exist, and rich galena is found in limestone or with this rock in the near vicinity, at the Comstock, Success, and Godkin mines.

Section 1659-91m.—Some prospecting lately done on this section has resulted in finding what are taken to be two separate lodes in close proximity to one another, right alongside the railway line. On the day of my visit both the small shafts were full of water and I could not see the lodes. I was informed that one contained galena for eighteen inches in width, and the other for about eight feet in width. The galena is very pure, assaying 80 per cent. lead and over, but is very poor in silver, the smaller lode only having some 4ozs. of silver in the clean ore, and the larger 15 to 25ozs. The country rock is not exposed much, but there appears to be a belt of limestone somewhere close by, as pieces of this rock are not uncommon. These finds are pretty well on the line of the Balstrup lode, and may be portion of it. The find deserves further working in spite of the poor quality of the ore.

Sunrise.—The Sunrise P.A. hold several sections, but the only work of any consequence is that done on Section 534-87M., where a tribute party have been working on a continuation of the Silver King and Silver Bell line of lode. The lode was found in the bed of the Little Henty River, and has been somewhat difficult to work in consequence, but by making a race and water-wheel the tributers have been able to work a small pump and sink about 26 feet. The lode is about 2 feet wide in the face in the

workings from this shaft, and shows from two to eight inches of very pure galena. About 30 tons of ore have been raised and sold up to the end of February last, assaying from 69 to 73 per cent. of lead and 80 to 90ozs. of silver per ton. This seems a nice shoot of ore, and worth working on a larger scale than is possible for the tributors with their limited means.

New Silver Bell.—(298-87M. and 480-87M.).—Very little has been done to develope this mine for the last two years. A main shaft has been begun, and a very good winding and pumping engine partly erected, but otherwise the property is in very much the same state as when I reported on it formerly. The ore heaps taken from the drive on the lode did not, I understand, turn out nearly so well either in quantity or quality as they were estimated. 450 tons sent to the Mount Zeehan Mill yielded 116 tons of concentrates, assaying 70 per cent. lead and 30ozs. of silver to the ton. One hundred tons were also smelted at the Zeehan and Dundas Smelting Works, and some more at Messrs. Kennedy and Son's furnace in Hobart, but I have been unable to procure the results of these trials.

Silver King.—I was unable to see the underground workings of this mine as it was full of water at the time of my visit, and the only work in progress was the erection of the concentrating mill. It is to to be hoped that the Company will now push on vigorously with the work of exploring their mine: it is one of the most important lines of lode in the district.

Other Zeehan Mines.—I did not visit the Monte Christo, Silver King Extended, Austral, New Maxim, and several other mines in the Zeehan district on which no work was in progress. From what I saw on my former visits I am convinced that several of these are very likely properties, and deserve to be worked. I was informed that tribute parties were anxious to work one of the lodes in the Silver King Extended ground in which galena is showing, and if so, the refusal to allow them to do so is not creditable to owners who have done so little work themselves.

Dundas District.

Maestrie's Broken Hill Mine.—(Sections 2355-87M. and 2356-87M.). A great deal of interest attaches to this and the adjacent Comet Mine, which is on the same lode, for several reasons, the principal one at present being that there is a great likelihood of its soon being seen in the crosscut from the Comet shaft at the bottom level what is the nature and value of the lode matter lying beneath the enormous ironstone outcrop. The size of the lode, the value of the ore found in it, and the excellence of the indications of more beneath, have led most people who have seen these mines to entertain high expectations as to what will be found on sinking below the oxidised outcrop, and a great deal depends on the success of the work now in progress, for this is looked upon as a test case. If good ore is found below the gossan, other large outcrops will be worked, but if not there can be no doubt that the exploration of the Dundas lodes will receive a very severe check. The lode also excites interest on account of several peculiarities: though very wide it has not been traced for any great length, and there is still a great deal of doubt as to its course; again, its outline appears to be very uneven, and unlike that of most lodes, the wall seemingly being very irregular; and further, the ore veins appear to be of later formation than the main mass of the gossan, lie in it like lodes in ordinary country rock, and not appear to coincide in strike with the main lode. I shall, therefore, give a somewhat more detailed description of these two mines than of the others in the district, first describing the Maestrie's workings, and then those of the Comet mine, and then proceeding to remarks on the lode generally.

The workings of the Maestrie's Broken Hill mine are situated in the south-west angle of section 2356-87M, and consist of three levels, known as the main tunnel level, the intermediate level, and the lower level. The first is that which was put in on the first discovery of the mine: its entrance is 90 feet from the western boundary of the section, and about 320 feet from the southern one. It runs N. 13° 38′ E. for 441 feet, and then branches, one branch going N. 36° 55′ E. for 210 feet, and the other N. 44° W. 246 feet, to connect with a prospecting shaft sunk in iron oxide and other lode matter: from here it goes N. 17° 16′ W. for 236 feet, and comes out to daylight once more, having penetrated right through the high spur which runs east and west through the section. A tramway runs from this northern end of the tunnel to connect with the Zeehan and Dundas Railway at the Maestrie's station.

The southern entrance to the tunnel was in lodestuff, galena and cerussite occurring pretty freely through the oxides of iron and manganese which composed the main body of material. This ground has been stoped out for about 65ft from the mouth of the tunnel. At 20 feet in, a winze has been sunk 47 feet: opposite this in the tunnel there is a body of somewhat broken country slate, which is also seen again at the two lower levels, and is no doubt a "horse," or block of country rock enclosed in the lode matter. At 90 feet in, a vein of galena from ½ to 24 inches wide has been followed south-east for 60 feet; it has been stoped out for about 12 feet above the level, but runs out in the face and does not appear to go into the floor, so it has not yet been driven for in the lower levels. This vein like the other galena veins nearer the tunnel mouth, has walls of ironstone gossan, and is practically a lode within a lode. At 120 feet from the entrance a band of carbonate of iron was struck running about N. 25° W.; so it would seem that in this part of the tunnel everything points to the course of the lode being from N.N.W. to N.W. Certainly this is the general direction of strike of the shoots of ore. After passing through the band of siderite the lodestuff is denser and more earthy than before, and appears to lie in bands running roughly east and west, and this also is the course of the footwall of the lode, which is met with at 210 feet in, dipping south 30° to 40°. This dip, however, does not appear to be permanent, for a main shaft which is on the east side of the tunnel at 169 feet in, was in country rock for first 60ft before it reached the lodestuff, which would show the dip to be to the north or east, making the the eastern wall the hanging wall instead of the foot wall. This is only one of the contradictory features presented by this lode. The main shaft is 93 feet deep down to the tunnel level, and 126 feet to the bottom: it has not yet been equipped with winding or pumping machinery. From the footwall in to the end of its north-eastern branch, the tunnel passes through stratified slate and sandstone country, a

good deal broken and stained with oxide of iron. At 85 feet back from the face, a small lode consisting of from 2 to 5 feet of manganic ironstone was passed through, and this has been followed on a course nearly due east for 78 feet: it contains a little silver, and is probably a "leader" or branch vein from the main lode. In the north-west branch of the tunnel, the stratified country rock was passed through for 155 feet, after which lodestuff was once more met with. The wall at this point runs across the drive about N. 30° E. The lode matter consists mainly of oxides of iron and manganese, similar to the stuff passed through in the first part of the tunnel: it is gossan of a sort that would generally be considered favorable for deposits of ore beneath it. The drive passes through it for about 230 feet, and then gets into slate and sandstone country once more. Two small seams of "canary ore" (mainly oxide of lead) were passed through, one of which runs about N. 10° W. across the tunnel, the other I did not take the course of: these contained silver. From the huge size of this lode, and its proximity to the other huge mass first passed through, there can be little doubt that both are closely connected: in fact, when the work in the Comet mine is also taken into consideration, it is pretty evident that they are one and the same lode, and its course would therefore be on the whole north and south, or perhaps a little to the east of north.

The intermediate level is 14 feet below the main tunnel, and has been driven from a point as low down in the bed of the creek as it was possible to get with an adit. It is connected with the main tunnel by the winze near the southern entrance to the latter. About 30ft east of the winze it struck country rock, and was then turned northward, and sandstone country was again struck on the east side in two crosscuts, bearing out the idea that the lode is running a more or less north and south course. West of the winze a drive has been extended nearly to the Comet boundary, and from the point where this drive is intersected by the adit from surface, another drive has been put in to the north 154 feet. All through this level there was more or less lead and silver in the ore, the lead being commonly in the form of carbonate; but still the main bodies of rich ore were in shoots running a little west of north, and underlaying westward, and in these the best ore was galena. Several bodies of dolomite were met with in the workings, locally called "intrusions;" these are in all probability simply portions of the original lode, which from their composition have not suffered chemical change through oxidation, as they do not contain any constituents capable of further oxidation.

The lowest level is 33 feet below the main tunnel, and also connected with it by the winze. About 50 feet east of the winze the country rock was met with as in the intermediate level, the underlay of the wall of the lode being here, therefore, 20 feet in 19, or say 1 in 1 to the eastward: this agrees with the main shaft in giving an easterly underlay to the lode. The principal drive at this level is one running about N. 30° W., nearly to the Comet boundary, a total distance of over 260 feet: it runs right under the mouth of the main tunnel, and ends 30 feet to the south-east from this, with good ore underfoot. The drive followed a shoot of ore which was over 12 feet wide at first, and averaged perhaps 2 feet right through. The galena lay between walls of iron oxide gossan, containing a great deal of carbonate of lead in crystals, but not rich enough to take out at present. This gossan would be very good flux for the smelting furnaces. Towards the north end of the drive the ore dipped underfoot, and could not be followed deeper till the country was drained. This level is about 4 feet above the No. 2 level of the Comet mine, with which it has been connected.

About 18 feet above the main tunnel and 18 or 20 feet east of the top of the winze, a small drive has been made from the side of the hill into the ironstone capping, following a vein of canary ore, which in about 12ft made into galena. This has been followed for 110 feet on a course about N. 30° W., and has been from six inches to two feet wide, averaging about ten inches. It has been stoped up to 30 feet above the main tunnel: the canary ore is very rich, assaying from 200 to 300 ounces of silver. The underlay is to the westward, so it corresponds pretty well with the shoot followed at the bottom level, and like it, and also the other shoots in this mine, it lies between walls of ironstone gossan—just as most lodes lie between walls of ordinary country rock. The explanation of this feature is not very satisfactory at present for the want of sufficient evidence as to the behaviour of these shoots in depth, and when they reach the wall rock of the main lode, across which latter they appear to run obliquely: it would almost appear as if the galena veins had been formed subsequently to the oxidation of the lode mass to gossan, but any theory on this line seems to me very hard of acceptance, and I should rather incline to believe that the galena has remained unoxidised, while the carbonate of iron has changed to oxide. I have frequently observed in the outcrops of the Mount Zeehan lodes that partially oxidised specimens of siderite contain unaltered galena, the oxidation of the former apparently therefore preceding that of the latter; if this is the case on a larger scale also, it is possible that veins of galena might remain unoxidised for some time after the enclosing gangue had been pretty thoroughly converted into gossan. On this theory the shoots of ore in the gossan capping would probably correspond with those in the lower unaltered parts of the lode.

The ore raised and smelted from this mine has already been mentioned above, but since the stoppage of the furnaces a little ore has been raised and sold in addition. Up to the end of January 1893, some 60 tons had been disposed of at a net price of a little over £7 a ton, the average assay being 55oz of silver and 49 per cent, of lead per ton. It is estimated that there are some 1200 tons of second-class ore at grass, and 7000 tons in sight in the mine, that would be worth smelting if furnaces were close at hand.

This seems likely to be a good mine, but of course requires to be opened out at a depth below the water level. Even if the large gossan capping covers nothing but low grade concentrating ore, the quantity of stuff in the lode is so great that, probably, very poor material might be made to yield a profit. In this connection it has occurred to me that a good deal of prospecting could be cheaply done by means of a diamond drill. In cases where lodes are small, boring with this machine is liable to give very unsatisfactory results, as the lode may be passed through where it is small or broken up, and very little information gained, but in this instance, with a lode mass 200 to 300 feet or more in width, there would be little fear of a series of ten or twelve bores failing to yield reliable samples of the average contents of the lode, and much information would probably be gained as to the shoots of ore, the underlay of the lode, and other points of value in laying out the mining works.

Comet Mine—(1794-87M and 1796-87M).—As in the Maestrie's Mine, work on the big lode was begun on the South side of the ridge running through both properties, an adit being driven from the bottom of the valley nearly due North 364 feet. The entrance to this is about 145 feet West from that to Maestrie's main tunnel. This adit, or No. 1 level, passed through lode matter mostly iron and manganese oxides, for its whole distance, and terminated within a few feet of the North-east corner of section 1796-87M. In the end some very much broken country rock was met with, which was very naturally taken for the wall of the lode, though as subsequent developments have shown, it is really nearly in the middle of it. Twenty-seven feet back from the end a winze was sunk, and soon plentiful crystals of cerussite (carbonate of lead) and some canary ore (oxide of lead) rich in silver began to be found. The winze is now down 37 feet and connects with the No. 2 level and with an intermediate level 16 feet above the latter. The ore in the winze corresponding with the position in which the shoot found in the mouth of Maestrie's tunnel ought to be found if it continued on its apparent course of N. 25° to 30° W., it was at this stage supposed that the lode ran in this direction, and an adit was begun from the North side of the hill in the expectation of soon cutting it. It was driven 712ft on a course about S. 7° W. through stratified slate and sandstone country without finding the lode however, the point at which it stopped being only 40 feet north of the south boundary and 333 feet west of the eastern one of the section (1794-87M). Its termination was, therefore, nearly due west of where the No. 1 adit had left off. At about 385 feet from the entrance to No. 2 tunnel a break in the rock was met with, not far from where the lode was expected, and as there was a considerable flow of water from this, which deposited much oxide of iron on exposure to the air, it was thought at the time to be probably part of the lode channel. The bearing of this break is N. 25° W. corresponding with the strike of the shoots of ore in Maestrie's mine, and it has an underlay to the S.W. similarly to these also. It appears to be a fault, the hard country rock to the South being cut clean off by it. It is very probable that this fault is very closely connected with the shoots of ore, it being very like to have passed through the big lode as well as through the country, and it is not unlikely that the shoots of ore are concentrated in the fissures caused by it, the galena being then leached out of the surrounding lode stuff and redeposited in these. If this is the case it is probable that the ore will follow this line of fracture into the country for some distance on each side of the main lode, and possibly, too, ore will be found along it at intervals elsewhere.

At 644 feet from the entrance to No. 2 adit, a branch drive was driven eastward from it straight to the winze from No. 1 adit, and on to Maestrie's boundary. At 150 feet from the adit the wall of the lode was reached, striking N. 55° E.. and underlaying westerly about one 1 in 1, the underlay being thus in the opposite direction to that of the eastern wall in the Maestrie's mine. The underlay will, however, be better ascertainable when the bottom level has reached the lode; it is already proved by this, that it is not as flat as 1 in 1, or the wall would have been met with before now. In the No. 2 adit, and east drive from it, it is noticeable that the beds of the country rock are striking about N.E. and S.W., which is nearly at right angles to the usual course of the sedimentary rocks of the district; this indicates great disturbance of the country, probably owing to the intrusion of the large masses of serpentine found about quarter of a mile or less further westward.

The western part of the lode matter passed through by the No. 2 level is rather clayey, a good deal resembling the eastern portion in Maestrie's tunnel just before the wall rock was first cut, but it gets better looking going eastward, and for the last 60 or 70 feet before reaching the boundary it has a very favourable appearance. At 295 feet from the main No. 2 adit, a drive has been put in to the northward, 183 feet through very nice-looking gossan. At 141 feet in this, soft slate was met with, and also again in the end of the drive; this country wall runs about N. 35° W., and dips N.E. about 1 in 2, increasing the confusion in which we find ourselves whenever we attempt to form a definite opinion as to the course of this lode. At the end of the East drive another drive goes northward in lode stuff all the way for 110 feet, crystals of cerussite and a little pyromorphite being found through the gossan, the former rather plentifully. Close to where this drive leaves the East crosscut, traces are to be seen of the broken country rock, in which the No. 1 adit terminated, and it is seen that this must be a crushed block of sandstone enclosed in the lode matter. Another drive has gone southward along the boundary or just West of it for 130 feet; at about 50 feet very good cerussite and canary ore was obtained on what is clearly a continuation of Maestrie's shoot. The shoot is about 3 feet wide, and runs about N. 10° W., underlaying westward 2 feet in 3. All through this southern drive crystals of cerussite in clusters of beautiful white glittering needles and spicules were plentifully obtained in the vughs in the gossan.

A main shaft has been sunk from the top of the ridge, about 35 feet south-east of the point where the eastern crosscut leaves the main No. 2 tunnel; it is 270 feet in depth. At 161 feet it is connected with the No. 2 tunnel, and at 261 feet a drive is being made eastward, parallel to the eastern crosscut at the upper level, through hard sandstone and slate. Towards the end of February last this crosscut had been extended a little over 100 feet from the shaft, when the water, which had all along been pretty heavy, burst in from the face, mastered the pump which was raising about 30,000 gallons an hour, and rose up to the 161 feet level in the shaft. A tank was put on to assist the Worthington steam pump, and water was raised at the rate of about 50,000 gallons an hour with both appliances, but though it was got down so low that it was possible to wade into the bottom level, it has not yet been drained low enough to allow of work being resumed. It is almost certain that the striking of this large quantity of water means that the lode is close at hand, as indeed we should expect from the position of the western wall in the level above. Since the lode has been drained by this work, winzes have, I understand, been sunk by both the Comet and Maestrie's Companies to some distance below the upper level, and it is probable that much useful knowledge will be gained by these, even if it is impossible to extend the bottom crosscut for some time to come. As a great deal of interest is being taken in this work, it is perhaps well to point out that all the western part of the lode in the upper crosscut was composed of rather poor and earthy gossan, such as would result from the oxidation of lode matter consisting mostly of lode slate and carbonate of iron, and that no disappointment should be felt if this is what is first obtained at the lower level. The good ore above lies over near Maestrie's

boundary, and it will probably be necessary to get well to the eastward of the western lode wall before valuable ore comes in. At the upper level the known shoot of good ore lies 300 feet east of the shaft,, and supposing it to underlay 1 in 1, it would therefore be necessary to drive 200 feet at the lower level or 100 feet past the present face; if the underlay is less the distance will be greater. Of course, however, it is also possible that there may be ore in the lode outside this shoot, and it is very much to be hoped that it will be so.

On the southern part of section 1796-87M, belonging to the Comet Company, very little has been done on the north-westerly lode exposed on the top of the high hill on the south boundary A shaft was sunk about 80 feet and some driving done in a mixture of gossan and siderite containing some galena. Two adits have been begun lower down the hill, but neither was carried very far on account of the very hard country rock met with, and the lode was not found in them.

About 38 feet S.W. from the S.W. corner of Maestrie's section 2356-87M, a shaft has been sunk 100 feet by the Comet, Maestrie's, and Kozminsky Companies in conjunction. The top of this is 110 feet below the top of the Comet shaft, and the bottom is therefore not so deep as that of the latter by 60 feet. The water makes in it at the rate of about 18,000 gallons an hour, but I have not heard whether this has decreased since the Comet Company got the burst of water. For 90 feet this shaft passed through black slate country, and then got into vesicular, cellular quartz, often so porous as almost to resemble pumice, a good deal stained with oxide of iron. This is still in the bottom of the shaft: some of it is almost like siliceous sinter. It probably is connected with the main lode in some way not yet clear.

The small creek that passes close to the entrances to the Maestrie's and Comet No. 1 tunnels passes over portion of the outcrop of the big lode. When the Comet and Joint shafts had drained the country beneath, a subsidence took place opposite the entrance to the Maestrie's tunnels, and the creek disappeared into this entirely. In the roof of the small cave formed the rock showing was dolomite containing galena, evidently portion of the lode. Dolomite is again seen in the bed of the creek a little lower down the stream. The subsidence was flumed over by a short fluming, but this accident appears to me to indicate the necessity for cleaning out the bed of the creek till solid rock is reached well above the crossing of the lode, and fluming down from there on to the solid rock on the western side of the latter. It is pretty certain that a large volume of water must otherwise find its way from the creek down into the workings, and it is very probable that by diverting this on surface the work of the pumps would be very materially lessened.

The course of the big lode is still not at all satisfactorily determined, though, as seen in the foregoing, there is now a good deal of evidence collected as to it. The western wall crosses Maestrie's main tunnel about 100 feet in from the Northern entrance; it is again seen in the end of the North drive of the Comet No. 2 level and crossing the east crosscut at the same level about 110 feet east of the main shaft. The eastern wall is seen in Maestrie's main tunnel, about 330 feet in from the North entrance, again at 210 feet from the south entrance, and in the ends of the drives eastward from the winze at the intermediate level. The general course of the eastern wall is about N. and S., but appears to be running W. of N. in the South part of Maestrie's mine and E. of N. in the North portion. The general course of the western wall appears to be N.E., but it bears much more to the E. of N. in the Comet mine than in the portion connecting the wall seen furthest North in this with that in Maestrie's North tunnel. Connecting the various known points on the map, the lode is seen to be about 150 feet wide, measured square across on a horizontal plane, where it passes through Maestrie's North tunnel, and over 400 feet in the main part of the workings of the two mines. But what becomes of it on the south side of the creek? It is not found in the Joint shaft as we should expect if it continued south on its apparent course, unless, indeed, the vesicular quartz be part of it, and it has not been seen on the high hill side on the Comet's south section, which has now been bared and prospected so much as to make its discovery almost certain if it had existed. In Kozminsky's section, 2332-87M, a large outcrop of gossan has been traced on a course a little west of north for some 16 chains: this would strike into the main lode body about Maestrie's main workings, and may be the north-westerly lode which yields the shoots of ore. The large lode body would have to turn round very sharply to the south-east, especially on the western wall, to get round to join this lode, and I am inclined to think that another branch going down the creek must also be looked for. The large mass in the Comet and Maestrie's mines might very well be formed by the junction of Kozminsky's lode with another one coming up from the big lode-mass in the Central Dundas property, and after joining a new course might be taken to the north-east, towards the Talune sections, in which there is a large lode of gossan running north-easterly on a line which, when continued southward, runs into the Comet and Maestrie's ground. It is clear that the lode-mass is a somewhat abnormal one in its behaviour, and the only way in which we shall be able to learn its course definitely will be by following it underground.

Seeing that the sedimentary formation is penetrated by large dykes of serpentine only a short distance west of the Comet mine, and that the strata in the latter are running almost fairly across the usual line (N.E. instead of N.N.W.), I have been led to speculate on the possibility of this lode turning out to be a contact mass lying between the slates and a buried dyke or intrusion of plutonic rock which has not come through to surface: this would explain the irregular features, but is only a speculation.

Kozminsky's.—(2332-87M, 2333-87M, and 2297-87M.)—No work worth mentioning has been yet done on these sections as far as I could learn, and I only speak of them now to add that about 7 chains east of the N.W. corner of 2332-87M a shaft was sunk 40 feet on about the line of the large gossan lode which, as above-mentioned, traverses this section, and a drive was put in 17 feet to the westward from this, which came upon a ferruginous loose body of stuff, considered to be lode matter. A large quantity of water came from this, and made progress impossible without machinery. This would confirm the idea that the gossan lode strikes into the Maestrie's main body.

Mount Dundas Prospecting and Mining Company, No Liability.—Sections 1708-87M, and 1724-87M.—This is the full title of the company generally known locally as the "Dundas P.A.," under which name I have referred to it several times in the foregoing. The workings on the boundary between the two

sections, described in my former report, have been abandoned, and the mine now to be spoken of lies near the south boundary of section 1724-87M, the lode being the same as that worked by the Central Dundas Company in section 1851-87M. It is pretty certain that there is a close connection between the lodes in this property and the serpentine dyke which also passes through it. In the old western tunnel the lode-stuff was at the contact between the slate and serpentine formations, and in some of the prospecting tunnels on the eastern side the same appears to be again the case. The ironstone outcrop goes through the Central Dundas property, into that of the Adelaide Prospecting Company, following the serpentine country also. The body now being worked crosses the southern boundary of 1724-87M about the middle, and then seems to fork into two branches, which run into the Hassett Company's section, 1783-87M. There is so much ironstone about the surface in this locality, however, that it is difficult to know how many lines of it there are, and a lot of underground work will have to be done before much knowledge will he gained as to these bodies. I suspect that they will prove to be mainly contact lodes lying betwen the serpentine intrusions and the enclosing slates.

The main shaft is down 110 feet, or about 70 feet below a tunnel put in from the side of the hill, which is connected with the workings at the bottom level by means of a winze. The shaft is in the Central Dundas Company's ground (1851-87M), and drives have been made from it into both companies' portions of the lode. Some rich gossan, found in the Central Dundas mine near surface, containing chloride of silver, has not, I believe, been found again at the lower level, but these workings were shut down at the time of my visit, and I was not able to get much information about them. Going northward the Mount Dundas Company found a great deal of chromate of lead in the gossan, and after a time came upon a vein or shoot of galena, running about N. 20° W., which has been followed for a considerable distance. In places it has been 4 feet wide, of good galena, and as in the case of Maestrie's shoots, it runs between walls of iron oxides. These walls carry a good deal of silver and lead through them, and the mining manager stated to me that he could take out ore for 30 feet in width if there was a local smelting works. At present he takes nothing assaying under 30oz. of silver, unless it is very rich in lead.

The gossan in the workings in the shaft is of a highly favorable appearance, and seems likely to lie upon ore. The mine requires more powerful machinery, and to have the shaft sunk down well below water level, so as to reach the unaltered parts of the lode. According to the surface tunnel the width of the latter is 70 feet.

The mining manager was good enough to allow me to examine his assay book, showing the results of tests made during progress of working: these were stated to be all bulk assays. The average of 31 assays of ore, described as "Ironstone and Galena," gave 66oz. 14dwt. 11gr. of silver per ton, and 31 per cent. lead; the highest and lowest assays in silver being respectively 129oz. 3dwt. 22gr., and 16oz. 6dwt. 16gr. per ton, and of lead 72 per cent. and 10 per cent.

The average of 18 assays of stuff described as "ironstone" and "gossan," was 21oz. 8dwt. 11gr. of silver, and 5 per cent. of lead: the highest and lowest silver assays were respectively 117oz. 5dwt. 17gr., and 5oz. 1dwt. 6gr. per ton, and of lead 19 per cent. and none.

The average of 17 assays of "ironstone and chromate" (of lead), was 18oz. 3dwt. 12gr. silver per ton, and 4½ per cent. lead, the silver ranging from 72oz. 10dwt. 9gr. to 3oz. 5dwt. 8gr. per ton, and the lead from 12 per cent. to none.

The average of 4 assays of "ironstone and canary ore" was 78oz. 12dwt. 9gr of silver per ton, and 8½ per cent. lead, the silver ranging from 134oz. 1dwt. 22gr. to 41oz. 12dwt. 16gr. per ton, and the lead from 19 per cent. to 4 per cent.

"Ironstone and siderite," 4 assays gave on the average 14oz. 5dwt. 20gr. silver per ton and 13 per cent. lead, the highest silver assay being 24oz. 3dwt. 11gr., and the lowest 6oz. 10dwt. 16gr. per ton, and the lead ranging from 18 per cent. to 9 per cent.

One sample of "chromate and galena," no doubt also containing much oxide of iron, gave 17oz. 9dwt. 12gr. silver per ton, and 6 per cent. lead.

Another of "ironstone and sulphate" (of lead) gave 18oz. 5dwt. 20gr. of silver per ton, and 3½ per cent. lead.

Two samples of "dressed ore" gave 106oz. 16dwt. 9gr. and 107oz. 16dwt. 0gr. of silver respectively, and 25½ per cent. and 35 per cent. of lead per ton.

One piece of "clean galena" yielded at the rate of 107oz. 2dwt. 22gr. of silver, and 75 per cent. lead per ton.

One of "siderite" contained 19oz. 12dwt. silver per ton, and 2 per cent. lead.

A picked specimen of "chloride and canary ore" yielded 16,922oz. 18dwt. 18gr. of silver per ton and 4 per cent lead.

These assays show the galena to be of very good quality, and that the ironstone does not, as a rule, contain much lead, though generally fairly rich in silver. It is good fluxing material, but would require the addition of rich lead ores. There may be more lead in it at a lower level.

Up to the end of February, 1893, this mine had sold 95 tons 8cwt. of ore, assaying on the average 94½oz. silver per ton, and 39 per cent. lead, the net prices realised per ton ranging from £8 15s. 0d. to £14 10s. 0d.

This property has, in my opinion, uncommonly good prospects, and should be vigorously worked. The lode being a wide one, diamond drill boring might be here resorted to for prospecting purposes, as in the Comet and Maestrie's mines, with much probable advantage.

Adelaide Proprietary Mine.—(2302-87M.)—In this section there are three or more lines of large gossan outcrops, which converge to a point on the north boundary, about 8 chains from the N.E. corner peg. A good deal of tunnelling was done without much result, and finally work was confined to sinking a main shaft and opening out from it. The shaft is 44 feet south of the northern boundary, and 595 feet west of the eastern one, close to the spot where the lines of gossan outcrops appear to come together. It is 176 feet deep, and levels have been opened from it at 116 and 170 feet. From the old No. 1 tunnel, which is some 90 feet east of the shaft, a winze has been sunk 32 feet, and some driving has been done from the bottom of this, forming the 32 feet level. The mine is pretty wet, lying almost under the creek which runs through this property, Anderson's, the Central Dundas section, and the Comet ground. The lode passes right under this creek into section 2303-87M (Anderson's S.M. Company's), and it has been found necessary to flume the water over it, as a strong stream kept pouring down into the mine till this was done. The Adelaide mine is said to be over 200 feet lower than Maestrie's Broken Hill workings, so that its main shaft is actually to the greatest depth yet reached in this part of the field. Still even at its lowest level the lode matter is yet much oxidised, and it will be necessary to sink still further in order to reach the parts of the lode unaffected by atmospheric influences. 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.

Though the workings at No. 2 level from the main shaft have gone 87 feet N.E. and 90 feet S.E. from it, the walls of the lode have not yet been met with, the stuff passed through being mostly gossan and dolomite; the lode must, therefore, be a very large one. At both No. 1 and No. 2 levels a vein of galena of good quality has been found striking N.W. and S.E., and dipping S.W. about 45°; this averages from 3 to 6 inches, but has been at times as much as 2 feet wide. Its walls are smooth, distinct, and slickensided, showing the vein to be of subsequent formation to the main mass of the lode. In its northwesterly strike it agrees with the ore-veins in Maestrie's Broken Hill, and the Mount Dundas mines; and this coincidence renders it somewhat likely that all the north-westerly veins in the Dundas District are of later origin than the lodes which run to the north-east. If so, there seems much probability that where they pass through the older lodes they will often be greatly enriched. In the gossan in the Adelaide mine, especially near the galena vein, very fine crystals of crocoisite (chromate of lead) and cerussite (carbonate of lead) are found somewhat plentifully, beautiful specimens being frequently obtained.

Since my visit the adjoining Anderson's S. M. Company, working on the same lode, are said to have got some good ore. Both companies will probably have to do a good deal of exploring work yet, but had best sink further before doing much more driving. I understand the Adelaide shaft is now being sunk deeper. The mine gives a good deal of promise, and deserves to be thoroughly tried. Since 1st July, 1892, up to 24th February, 1893, 214 tons 4cwt. of ore have been sold, realising £1828 1s 4d. An improvement is shown in the silver value of the ore as greater depth is attained, the average assay of the stuff from the 32ft level being 34oz. silver per ton and 44 per cent. lead, from the 116ft level 57oz silver per ton and 63 per cent. lead, and from the 170ft level 64oz silver and 63 per cent. lead. Some of the second-class ore is concentrated by hand-jigging, but a good deal more could be got if there were a concentrating plant at hand to treat it. There is also more than a little good fluxing gossan in the mine, carrying some silver and lead, which would be worth smelting if the works were close at hand. Inquiry should be made, too, as to the possibility of getting a price for the chromate of lead that would pay for its shipment to European chemical works, for the manufacture of bi-chromate of potash and other chrome chemicals.

Mariposa (2415-87M, 2416-87M).—In the north east angle of section 2415-87M. a lode has been found running about N. 30° W., which would soon take it out of the Mariposa Company's ground into the Alameda Company's section 1410-87M. on the North, and the Martini and South Nevada companies sections 3325-87M. and 2446-87M. on the South. The underlay being to the westward, however, the Mariposa Company would get an increasingly greater length upon it as greater depth was attained.

Two large surface excavations have been made on the outcrop, one on each side of the North boundary of section 2415-87M. In these the lode is about 8 feet wide, composed of oxide of iron, and a good deal of galena; the oxide of iron often carries much carbonate of lead. In the Mariposa ground a winze was sunk 23 feet on the lode, which was found to consist of galena, carbonate and oxide of lead, and iron oxide all the way down, showing the superficial oxidation of the vein stuff to have gone down some little distance. The outcrop being in a flat low-lying valley at the foot of a hill, it might have been expected that the unaltered lode would have been met with almost at once on sinking, and from the quantity of galena in it I am inclined to believe that the oxidation will not be found to go very deep.

A main shaft has been sunk about 3 chains from the northern, and one chain from the eastern boundary of section 2415-87M., its depth being 144 feet. In sinking it first 25 feet of sandstone were passed through, then soft black sand and mud full of pyrites and nodules of galena to 95 feet, after which hard blue limestone came in. At 130 feet a drive was put in to the eastward for 50 feet; at 21 feet the lode was met with, running N. 30° W. and underlaying westerly about 1 in $5\frac{1}{2}$ or 6; where passed through it was only 2 feet wide, but on being followed 4 feet to the South it opened out to 4 feet in thickness. There was not much clean galena in it at this point, but most of the ore would be worth concentrating; the gangue is siderite, dolomite, and calcite. Some doubt has been expressed as to whether this is really the lode seen at surface, but from its position, course, and underlay, I do not think there can be any question of their being identical.

When sinking the shaft in the limestone a heavy burst of water occurred, and mud and "slurry" with it; on pumping this out, a subsidence took place on the hillside above the engine-house, so that it is pretty clear that a fissure in the limestone must have been cut into. The black soft stuff passed through in the shaft may be really portion of the limestone from which the calcareous matter has been dissolved out; it is not uncommon for this rock to be so altered in places where water is able to circulate through it.

When I visited the mine the men were just beginning to drive on the lode at the bottom level, and very little could therefore be seen. The lode seems a strong one, and at the outcrop appears to contain a good deal of galena, so its further development will be worth watching.

The surface stuff is rather poor in silver, a bulk assay across the lode being said to have yielded 26 ounces of silver per ton, and 36 per cent. lead; the first assays from the lode in the bottom level were also poor, from 12 to 23ozs. silver per ton and 65 per cent. lead, but I have since heard that galena very much richer in silver was obtained later on. If so, the fact is interesting in connection with the theory mentioned above in my remarks on the New Pyramid mine as to the galena being poor in silver when in limestone country; if both poor and rich galena are got in the limestone at the Mariposa it is pretty evident that the silver contained in the lead ore does not depend alone on the sort of rock enclosing the lodes.

About 215 tons are estimated to have been raised from the winze and surface excavation on the Mariposa lode, mostly good fluxing ore, but not good enough to send away at present. The tramway or railway from Argenton to Dundas has been partly finished as far as this mine, and when completed would furnish it with an outlet, but as yet access is very difficult for horses and carts on account of the swampy nature of the country to be passed over, and no ore could be sent out just now if it had been raised, except at very heavy expense.

Alameda (1410-87M. and 2243-87M.)—On the Mariposa lode about 80 tons of ore have been mined and stacked from an excavation on the outcrop close to the south boundary of 1410-87M. Some 4 chains further North an adit was driven westward into a high hill in the hope of cutting the lode again, but was not successful in doing so. A large loose block of ironstone was met with just at the mouth of this adit, and I think that it is very likely that if a small shaft were sunk here the lode would be found close beneath.

Martini (Section 3325-87M.)—Starting near the N.E. corner of section 2415-87M. an adit was driven by this Company southward along the Mariposa boundary, and cut the lode, but found it very much oxidised. Some 20 or 30 tons of gossan ore were stacked at the mouth of this tunnel, but I did not learn what was its assay value.

The Mariposa lode seems a very promising one, and should have a good working trial. It is unfortunate, however, that it should happen to lie in such a way that neither the Mariposa nor the Martini Companies have any great length of it in their sections, and an amalgamation of interests would probably be for the benefit of all concerned.

M'Kimmie's Section (996-91M).—This lies considerably to the south of the Dundas District proper, being 4 miles S.E. from Eden Station on the Zeehan to Strahan Railway and 8 miles N.N.E. from Strahan. The country in this vicinity is much broken by deep ravines in which run various branches of the Henty River. Very little work has yet been done to lay bare the lodes which have been discovered, and though sufficient is seen to show that the ground deserves opening up and to give reason for hoping that it will be payable, it is still too little developed to allow more than this to be said in its favour. The country seems to be mostly sandstone in this vicinity, though I saw some impure limestone about quarter of a mile west of where the lodes are found. At the centre of the section a lode 8 or 10 feet wide is seen crossing what is now called "Lode Creek"; it is here that most work has been done. The course of the lode is about N. and S., and it underlays westward about 1 in 4; on the North side of the creek the excavation that has been made shows it to have become narrower, and to contain much lode slate. The galena is mainly confined to a streak from 8 inches to 2 feet wide on the western wall, but there are also veins and strings of it distributed through the rest of the lode matter. It is often very pure, but is very poor in silver. About 12 feet down the creek from this another lode, or more probably part of the same one, is seen crossing on a course about N. 17° W., and standing vertical; it is about 2½ feet wide, and consists mainly of quartz heavily charged with galena, and also containing a good deal of iron and copper pyrites and blende. It would be fair concentrating ore. About 4 chains further down the creek, that is to the south-west, some lodestuff has been cut, but is not exposed enough to say anything more about it, and another 3 or 4 chains lower we find another large lode mass in the creek. The nature of this is not at all clear at present; it seems to be the junction of two lodes, one running N. 5° E. and underlaying 1 in 2 to the west, and the other running N. 60° E., and also underlaying westerly about 1 in 2. The first ore shows about 18 inches on the hanging wall of galena and quartz, passing into quartzose lode-slate or altered country rock on the footwall side; the width of the entire formation is not evident, and some cutting should be done to prove it. This lode appears to go right across the north-easterly one, reminding us of the fact that in the Adelaide, Mount Dundas, and Maestrie's mines northeasterly lodes appear to be similarly cut through by later ones. The northeasterly lode is about 6 feet wide, and shows from 6 to 8 inches of galena and quartz along the footwall. The lodestuff is largely of a brecciated character, composed of fragments of country rock cemented together by quartz, and galena, blende, and pyrites are scattered more or less through the whole of it.

In all these lodes it is noticeable that the gangue is principally quartz, the carbonate of iron so plentiful in most of the Zeehan and Dundas lodes being absent or only in small quantity. There are at least two large and strong lode bodies, which would supply a good deal of concentrating ore, and the discovery is well worth following up. Should more silver be found there would be every probability of a good mine resulting, but at the present low value in silver it would be difficult to make galena pay. A concentrating mill on the property, or some little distance lower down the creek could, I think, be driven by water-power, but, of course, one visit is not sufficient to allow of a reliable judgment to be formed as to the quantity of water that would be available in the stream at the least favourable season of the year, and this matter would require further investigation before an opinion could be definitely expressed upon it.

Madam Melba, No. 1, (Section 2595 87M).—Work had been suspended for some time when I visited this mine, and I understand the Company had transferred their operations to a mine in Victoria. I was not able to pay more than a very short visit to the property, but from what I could see and learn it appears to me that it has been abandoned prematurely and without sufficient trial. The lode traverses serpentine country, and is distinct and strong, but the owners seem to have lost heart on finding that the known shoot of ore is apparently a short one, and that the galena is rather poor in silver. Some 10 or 12 feet below where the lode crops out in the creek, as described in my former report, a small tunnel has been driven, and the lode proved to be 4 feet wide; the outcrop has also been traced some distance on surface by trenching, but soon becomes gossany, though at times showing oxides of lead and antimony in the oxide of iron. The stuff won from the outcrop and the small surface tunnel mostly requires dressing, especially as there is a good deal of blende in it which cannot otherwise be removed.

I was not able to get into the drive on the lode from the small tunnel as an underhand stope had been taken out and was filled with water. I was informed that after driving 72 feet northerly along it, the lode pinched out, and 8 feet to the South of the tunnel it contained only a few strings of ore. About 240 feet North of this adit a shaft was sunk 70 feet on the lode, which was very poor, and then the flow of water became so great as to stop the work. A lower adit, about 80 feet below the first, and 267 feet below the top of the shaft was then driven straight towards the latter, and cut the lode at a distance a little over 400 feet in. The lode being poor at this point the mine was abandoned. After doing so much work to get to the vein it was surely worth while driving on it some distance before giving up; the shaft had already proved that there was a poor place in the lode at this part. Now that the tunnel is in, it is probable that sooner or later the lode will be followed along its course and till a good deal of work has been done in this direction there is no need to despair of success.

Section ?—On the right hand side of the track from the North Dundas road to the Grey Ore mine near the top of the watershed between the Henty and Ring Rivers, I noticed some workings which I have not been able to locate exactly. The men had gone away for the day, and I have not been able to, find in what section they were working. They had exposed a small galena lode running about N. W. and S. E., consisting of from 2 to 6 inches of pretty pure galena, and had cut an approach for a tunnel on the course of the vein. This is mentioned as showing the likelihood of there being on the Dundas as on the Zeehan field, numerous small veins of galena worth the attention of working miners, though not perhaps of sufficient importance for mining on a large scale, or to be worth spending much money on.

Grey Ore.—(3259-87M and 3260-87M.)—No one was at work here either when I visited the ground. A large flume has been built to carry water to a waterwheel which was to drive machinery in a main shaft. A start had been made to sink the pit for the wheel and to prepare for sinking the shaft, the site being at the junction of the Ring River with the Falls Creek (so called on account of a waterfall on it which is visible from considerable distances). On looking about for signs of mining operations, the only things I could see were one or two small shafts sunk in a bed of breccia, containing occasional specks of pyrites. This breccia is a country rock, one of the beds of the sedimentary series, interstratified with the sandstones and slates, and no more likely to carry payable quantities of minerals than the latter. I could not see anything whatever to induce the owners to go to the expense of making the flume and to think of opening a mine. If I am correctly informed, some little gold was found in the breccia where it crops out in the King River, and this was supposed to indicate that the formation was similar to that of the South African "bankets" or conglomerate beds which carry gold, but it seems much more likely that the gold had simply got into the crevices of the superficial portions of the rock from the sands of the river, which are more or less auriferous all along its course up to the Ring River goldfields.

Fahl Ore.—(3212-87M).—In this section a lode has been found crossing the bed of the Ring River several times, its course being slightly west of north, and its underlay about 1 in 10 to the westward. A small prospecting shaft had been sunk at the time of my visit, close to the river, and another larger one was being sunk a little further away from the water's edge. In the prospecting shaft the lode was seen for $2\frac{1}{2}$ feet in thickness, but might be really wider, the lode matter consisting mainly of lode slate, with iron and copper pyrites, arsenical pyrites, and fahl ore in bands and strings through it: a little green carbonate of copper was also sometimes visible. Some very nice solid lumps of fahl ore are obtained, but the bulk of the stuff requires concentration before it would be a marketable product. The ore is often very rich in silver, assays of from 200 to 500 ounces per ton having been obtained. Owing to the proximity of the river it was found that it was impossible to do much sinking without the help of machinery for drainage, and as the claim is in rather an inaccessible place, this was difficult to get on the ground. A flume and race 28 chains long were therefore constructed by which water was brought in from the Ring River, and a 4 feet Pelton wheel was procured. There is 47 feet in vertical height between the wheel and the race, and with the power so gained a small winding plant is worked by which baling and winding are very efficiently performed. The plant is very simple and cheap, and is a very creditable solution of the difficult problem of how to open a wet mine in a place where steam machinery cannot be procured. By going higher up the river for water and making a longer and more expensive race, water power could be obtained sufficient to work a good-sized pump, and open up the mine pretty thoroughly, but it is hoped that the present power will be able to conquer the water sufficiently to enable a good deal of prospecting work to be done.

About 5 chains south of the workings the lode again crosses the Ring River, and passes through into the Rich P.A. section, 1400-91M. A small cutting in the bank of the river shows the lode to be $4\frac{1}{2}$ feet wide, but poor, consisting mostly of lode slate and pyrites. North of the shaft about 6 chains, it once more crosses the serpentine course of the river, and is seen to be from 3 to 4 feet wide, but very poor. It would seem, therefore, that there is a shoot of ore close to the main workings, and it would be advisable to develop this first, and then drive on the course of the lode in search of other shoots. Going north along the lode the ground rises, and a tunnel could be put in on its course, which would have as much as from 500 to 700 feet of backs, according to Mr. Webb, the manager of the mine.

The country rock is mostly hard metamorphic sandstone and slate. The lode is a true fissure lode, and worth prospecting, but I am afraid a good deal of expense will have to be incurred in fluming the river at the places where it crosses the vein so as to keep it out of the mine. The company deserve much credit for the effort they have made in spite of the bad times to work their lode, and it is to be hoped that they will be rewarded by success.

Success and Owen Meredith Mines —(Sections 2922-87M and 2523-87M.)—The lode passing through these sections was originally discovered in the bed of a creek which runs into the Pieman River, and showed itself as three veins of mineral-bearing matter, lying about parallel to each other, and separated by bands of country slate. Galena rich in silver was found in the veins, and the lode looked uncommonly well. The work done later has proved that the three veins soon come together, going both north and south, and that the creek has happened to cut the lode in the very midst of an ore shoot, so that the portion exposed showed it at its best. A large amount of work has been done on the property with rather disappointing results, though there is no reason yet to despair of ultimate success. The lode runs on the whole about N. 27° W., but varies a good deal, and the underlay is about 1 in 1 to the eastward. From the creek a drive has been put in along the lode 470 feet to the southward, but in all this distance it has been rather poor, though there is encouragement in the fact that some shoots of nice ore were passed through, and that these appeared to be getting better going downwards. Above the tunnel level the lode soon becomes oxidised and barren, so it is quite possible that the drive is just a little too high to strike the ore. The walls of the lode are very distinct, and often slickensided and striated, and the lode matter is quartz, galena, siderite, iron and copper pyrites, and occasional stibnite and arsenical pyrites: native silver is not uncommon in the galena. In the north section the lode follows the course of the creek for about 3 chains, and is close alongside of it for some distance further, and two tunnels have been driven across it. In the more southerly of these, which is quite a short crosscut, the lode matter was struck right at the entrance: it consisted of 6 to 8 inches of siliceous galena on the hanging wall, resting on a smooth polished and striated false wall. Under this there was about 6 inches of poorer ore, and then about 2 to 4 feet of broken country, with carbonate of iron and a little ore. The rich vein on the hanging wall dips right under the creek. The false wall on which it rests is strongly slickensided, being very smooth, almost polished in parts, and distinctly striated: the striae are not vertical, but dip southward about 60°. The ore at this point appears to be a different shoot from that on the boundary between the two sections where the lode crosses the creek. The second tunnel is some chains further down the creek, and consists of a short crosscut to the lode, and a drive north along its course some considerable distance, over 100 feet. A lode from 2 to 6 feet wide was followed, but was poor: the distinct hanging wall rib is, however, still visible, though not rich. Throughout these tunnel workings, which have now proved the lode to extend a distance of something like 900 feet, it is a strong fissure, and has every appearance of permanency in depth. The striated walls indicate a certain amount of faulting of the country by it, but I could see nothing that would indicate the amount of displacement.

The tunnels having been unsuccessful in laying bare good ore in any quantity an attempt was made to sink on the lode at the mouth of the southern (Success) tunnel. The water soon proved too heavy for baling by hand, and machinery had to be obtained. As there is nothing but a very bad pack track to the mine it was impossible to get a heavy engine, but after much trouble a small steam pump and boiler were got on to the ground and enabled sinking to be continued. The shaft was sunk 38 feet vertical, at which depth it struck the lode, and was then continued on the underlay for 70 feet, the inclined portion making an angle of about 45 degrees with the horizon. The shoot of ore was followed down in this shaft and was found to pitch somewhat to the southward, but proved to be very short. At the bottom level it seems to have died right out, and been replaced by lode slate. At the 38 feet level a short drive has been made on the lode, but it is poor: on the hanging wall there is about eighteen inches of quartzose ore and then from 2 to 3 feet of broken country and carbonate of iron. In this shoot as in the one further north the hanging wall rib of the lode appears to carry the most of the ore. A little fahlore was found with the galena in these workings in addition to the minerals above mentioned. At the time of my visit the small pump could do no more than keep down the water that was finding its way into the workings, and it was pretty clear that these could not be extended far without a more powerful plant. It is now necessary to drive on the lode to get under the shoot known to exist to the north, and in the south end to see what becomes of the shoots seen in the Success tunnel, and it is a question whether it can be done with the present machinery. The only hope of doing so seems to me to lie in fluming the creek from above the crossing of the lode right down clear of it, and so shutting off one of the sources of the flow of water. As this will have to be done in any case whether more powerful plant is obtained or not, and can be done under present circumstances, I think it would be advisable to try it, and if successful, to go on driving on the lode from the shaft. By the time this is done there may be better means of getting heavy machinery on to the ground. It is quite plain that the best thing to be done, if it were posssible, would be to sink a main shaft and put a good engine upon it, but before this can be effected there must be means of getting the engine on to the property. A tramway will probably have to be made, and its course and location will depend mainly on whether the Zeehan-to-Waratah Railway is gone on with or not.

In spite of the poor success that has hitherto attended the operations of this mine and the difficulties of opening it up, I still think that it well warrants a trial at a depth. The prospects of the property are much improved when we consider that the Success Extended mine has also got good ore on what is probably the same lode.

I do not know exactly how much ore has been sold from this mine but believe that it is over 50 tons: it is very rich stuff, as it would require to be to pay for packing out on horseback. There is a good deal of second-class ore on hand that requires concentrating, and from its nature I think it is probable that good slime-saving appliances will require to be provided.

Success Extended (2912-87M).—This property was in the hands of tributors at the time of my visit. They were working the outcrop of the lode as deep as they could get for water, some 20 feet or so at the most. The lode runs N. 20 degrees to 30 degrees W., and dips easterly 1 in 1, corresponding in these

respects to the Success and Owen Meredith lode. Is is also like the latter in the nature of the ore contained in it, and has the same peculiarity of carrying the best ore in a separate rib on the hanging wall often separated from the poorer portion by a slickensided wall. The good ore is from two inches to two feet in thickness, and the whole lode from two feet to 8 feet. It has been worked at intervals for 7 or 8 chains from the south boundary of the section and has been more or less ore-bearing all the way. Machinery for drainage is urgently required as the shape of the country does not seem to permit of drainage by adits.

The tributors have sent out about 30 tons of galena realising about £8 a ton after paying all expenses but packing, which is done by themselves. A good deal of concentrating ore is lying about the workings, but at present nothing can be done with it. The ore both in this and the last-described mine is very free from blende, though this does at times occur in it.

Bon Accord (2843-87M., 2844-87M).—The lode worked in the Success Extended mine runs across its south boundary into the north-east angle of section 2843-87M., and has been worked for from 2½ to 3 chains in length by shallow shafts and trenches on the outcrop. The lode was from 2 to 4 feet wide and the galena vein up to 10 inches. Some native silver was found in the galena as in the Owen Meredith. Machinery for drainage is here again required. No one was at work on this property, and I have not been able to find out if any ore was sold from it.

Commonwealth (1619-91M. and 2959-87M).—On this property there is a huge outcrop of gossan, and two tunnels have been driven to find out what is in the lode below this. The upper one is 50 feet below the outcrop and has been driven 187 feet. In the mouth of it gossany lode stuff, dipping easterly very flat, was passed through for 25 feet, after which soft slate and sandstone country to 132 feet; then a body of gossan was cut into. The wall of this dips westerly 45 degrees, or even flatter. This lode was penetrated for 55 feet but was not cut right through, and its thickness is unknown. It was mostly oxidised matter, but some soft clay in it was found to carry iron pyrites, and a piece of carbonate of iron carrying iron pyrites was also obtained in the floor of the drive. The gossan is of a rather favorable appearance, full of vughs, and containing a good deal of manganese.

The lower tunnel is being driven from a creek 200 feet below the outcrop, and may be expected to reach the big lode at 650 feet if its underlay is 1 in 1 to the westward as supposed from the upper tunnel. It was in 407 feet at the time I saw it, through hard metamorphic sandstone and slate all the way. About 75 feet from the mouth of the tunnel a lode of quartz and oxide of iron 9 feet wide was passed through, running about N. 10 degrees W., and standing pretty vertical. About 210 feet from the mouth a soft flat-lying lode of iron oxide, running N. 55 degrees W. and dipping S.E. about 45 degrees, was passed through, corresponding very well with the estimated position of the first gossan lode struck in the upper tunnel. (The mouth of the No. I tunnel is about 370 feet west of that of the lower one, and 150 feet higher than it). In the face of the drive veins of quartz containing copper and iron pyrites, blende, and pyrrhotite were being passed through the day I saw it. This has been an expensive tunnel, the ground being very hard, and it is to be hoped that the lode will be valuable when reached, as a recompense to the company.

The two oppositely dipping lodes of gossan seen in the upper tunnel would come together on the top of the hill where the big gossan capping is, and this is probably therefore much wider than the main lode will prove to be below. What the nature of this will be when reached it is hard to say, though the carbonate of iron found in the upper tunnel renders it likely that it will be largely made up of this mineral, if found in an unoxidised condition. Near the centre of the south section however on much the line of the big lode an outcrop of lode matter has been found in the bed of the creek, consisting of quartz, iron pyrites, and pyrrhotite, and it is possible that this may be the main lode, and these minerals constitute its filling. This outcrop in the creek had not been cut into, and it was impossible to determine its course; it was extremely hard and siliceous however, and would not alter to a loose ferruginous gossan, such as is found on the main lode, so I rather doubt their identity.

I have learned from Mr. Harrison, Inspector of Mines, that since my visit two lodes have been found in the south part of section 2959-87M., containing tin ore, and running slightly west of north, a course that would take them under the big gossan outcrop. I shall have more to say about the tin ore found on this property later on, but at present only mention the existence of these lodes, and point out the possibility that the gossan covers a lode of tin instead of one of silver. If this is the case tin ore is probably to be found in the ironstone capping, as in the Brown Face at Mount Bischoff, and thorough search should be made for it. The veins of quartz and pyrites in the main tunnel, and the pyrites lode in the creek rather point to a tin lode than to a silver one, but on the other hand the gossan is not a highly siliceous one to all appearance, but closely resembles the other gossans found further south over the silver lodes.

Other Sections.—A good deal of work has been done on many other properties on the Dundas field besides those mentioned, but most of these had discontinued operations at the time of my visit, and as far as I could learn there were no important developments on any of them. With a revival of faith in the district it is probable that many more will be worked and valuable discoveries made. One other silver mine visited will be described later on when speaking of the Ring River and Mount Reid Goldfield, viz., the Mount Reid S.M. Company's property.

Ring River and Mount Reid Goldfield.

All the way from the Pieman River upwards a little gold is said to occur in the Ring River, though only in the upper portions has it been worth working. A dish of stuff from a crevice in the bedrock of the river on the Star of Dundas section, 2568-87M., which I saw washed, gave a good deal of pyromorphite from a lead vein in the crevice, several grains of tin ore, and a good many specks of gold. The stream has been worked from above the Grey Ore section (3259-87M.) up to its junction with a creek known as Scott's Creek, which comes down from Mount Reid; above this point it is said to be poor.

The principal workings are on the Conliffe S.M. Coy.'s section, 3026-87M. The river has yielded a good deal of gold; how much it would be hard to estimate as a good deal has been taken to the mint by the finders without being recorded; and the field has been of the greatest service in giving employment to numbers of men who were unable to find work through the depression at Zeehan. The bed of the stream is shallow and rocky, and was soon pretty well worked out, and work is now principally confined to occasional gravel-banks along the sides of the creek and to some larger deposits which appear to belong to an older river system, constituting what is now known as the "Ring River Deep Lead." This appears to have run from Mount Reid northward towards the Pieman River, across the course of the present Ring River, and the bulk of the gold in the latter has probably been derived from the re-washing of the older gravels. The upper part of the lead is seen in what is called the Alluvial Terrace claim, which lies on a ridge separating two creeks known as Baker's and Booker's respectively, both of which contain some gold. The ridge is a steep one, but right on the top of it is a gravel deposit 10 to 20 feet in depth, consisting of heavy wash of slate, quartz conglomerate, schist, etc., cemented and rusty, and covered with more or less gravelly clay. The workings show the gravel to be deepest in the centre of the ridge, so it appears that the present ridge is right over the gutter of the old stream that laid down the gravel. Gold is got along this spur for about 12 chains, and the ground has been rich enough to give good returns to the owners. If they had a copious water supply they would no doubt do very well out of it, but having but little water, have to break down the gravel by manual labour. Lower down, the lead is cut through by one of the above-mentioned creeks, and is next seen on the other side of its valley in Anderson's claim, at a considerably lower elevation. Here the lead runs northerly, in almost the opposite direction to Scott's Creek, and the bottom of the gutter dips so much that it becomes difficult to follow for water. In the north end of the workings the wash is overlaid by a deposit of clay, which is seen in much greater quantity in the Deep Lead Company's ground, still further north. Anderson's claim is said to have been a very payable one. In the next three claims following the lead the surface of the ground rises while the gutter falls, and shafts up to 50 feet in depth have had to be put down. The unwatering of these has proved difficult with the appliances available. The goldfield is in a very inaccessible place and can only be reached by pack mules with great difficulty, and almost everything has to be carried from the "Pimple," on the top of the Dundas and Reid Range, down on men's backs, a fall of over 1500 feet. It would be a very great help to the miners if the Grey Ore track were extended up the Ring River as far as the claims. The means of access being so bad, the only drainage appliances available are such as can be built on the spot and worked by water power, and unfortunately there is difficulty in getting enough water for this. Several claims have had water-wheels constructed to assist them in pumping out the water from the workings, but at the time I saw them there was no power to work them with. The most elaborate plant that has been erected is that of the Deep Lead Company, who have sunk a shaft 100 feet deep and built a 20 feet water-wheel to work their pump. This claim is the furthest to the north of any working on the lead, and has the deepest shaft. The position of the gutter is not yet accurately known, however, and a good deal of work may have to be done before it is found. The last 5 feet of the shaft are said to be in slate bottom rock, the pitch of the bottom being to the north. The top of the shaft is in the fine clay deposit which is seen covering the wash in the claims further south, but is here seen to the best advantage. It is a fine sandy clay, disposed in thin perfectly horizontal layers, and has clearly been laid down in very still water. It is evident, therefore, that the valley of the stream which laid down the heavy wash found in the gutter of the lead must have in some way become converted into a lake, which became gradually filled up with fine mud. This clay formation is seen for some distance further to the north, and appears to be going towards a saddle which divides the valley of the Ring River from that of another branch of the Pieman River. As it is without doubt an indication of the course of the old valley, in the bottom of which lies the lead, it should be carefully traced out, for it is probable that the lead will again be found emerging from under it. It is not likely to run lower than the bed of the Pieman River, as this seems to be rocky all down its course, and consequently should be found somewhere on the slopes of its valley. The limits of the clay deposit being ascertained, it would be best to bore to find the position of the gutter before sinking for it. In the soft clay boring should be very easily and cheaply done with ordinary boring rods. It would be very important to find the outlet of the lead from under the clay, as it would then very likely be possible to work up it instead of down, and so get natural drainage. The opening of an outlet would also do much to minimise the water difficulty in the higher claims. The amount of gold found in the upper parts of the lead quite warrants us in expecting that the deeper portion will also be payable.

The cause of the lead becoming buried under the clay deposit is not demonstrated, but I think the following explanation of it will agree with the evidence yet obtained. In the country behind Mount Reid there is ample proof of the existence of large glaciers at a comparatively recent period, and the erratic blocks of granite found rather plentifully down the Pieman River Valley point to it also having been largely scooped out by ice action. It is probable that the Pieman Valley was partly eroded before the ice period, and that the river of the Deep Lead ran into it, the configuration of the surface of the country being then considerably different from what it now presents. When the ice came down let us suppose it dammed the Deep Lead and converted its valley into a lake. Mount Reid would probably at this time be covered with sheets of ice, and from under these would rush streams of water, bearing with them the *debris* produced by the grinding action of the glaciers upon the underlying rock. The sand and mud so carried would soon fill up the lake and produce layers of sediment such as we now find. I may say that this explanation was suggested to me not only by the evidences of glacial action to the east of Mount Reid, but also by the strong likeness of the clay layers themselves to some in South Canterbury (New Zealand) lakes, which are now being laid down by streams issuing from under the glaciers of the Southern Alps. It is highly probable if this is the correct explanation of the formation of the Deep Lead, that after the filling of the lake the glaciers themselves descended still lower, and did much of the work of cutting out the present river valleys and so changing the shape of the country that when the ice again retired the drainage of the district was altered from what it had previously been.

The gold in the Ring River field is alloyed with a good deal of silver, and therefore brings a somewhat low price per ounce. There can be little doubt that it has been derived from the lodes on the

Mount Reid range, which yield gold of about the same quality. In this connection I may mention that a large boulder of heavy spar, impregnated with galena, blende, iron and copper pyrites, and a little gold, was found among the wash in the Alluvial Terrace Claim, pointing to the source of the gold being a deposit containing these minerals. Heavy spar (baryte) is one of the most notable minerals in the Mount Lyell mine, and its occurrence here strengthens a belief which I entertain that the Mount Reid lodes are of similar origin to the large deposit of pyrites at Mount Lyell.

On Mount Reid several discoveries of gold have been made, but the only one I visited was that on the Mount Reid Silver Mining Company's section, 3302—87M., which is close to the top of the range. Here a space of about 4 acres has been stripped of surface soil down to the bed-rock, an average depth of 12 to 18 inches, and sluiced, and a good deal of gold has been obtained. The stripping has laid bare an outcrop of a mineral deposit capped by gossan, this gossan being the lode relied on by the Mount Reid S.M. Co. in taking up the section. It contains free gold in parts, and has been worked for this metal by Messrs. Johnstone and Goldie, who have two men's ground, under Miners' Rights, on the outcrop. They had erected a small 2-stamp battery of very light stampers worked by a small water-wheel, and showed me a small cake of 4 ounces of retorted gold, which had been got from a crushing of 26cwts of gossan. The gold from their claim contains from 63 to 65 per cent. of gold, and the remainder is silver, coming thus under the mineralogical variety "electrum." Several trenches and surface holes had been cut in the gossan, and from them I saw some fair prospects of gold washed; some of the gossan also contains carbonate of lead. In some of the trenches pyrites underlying the ironstone was exposed at a very shallow depth, and I have no doubt that the oxidation does not go very deep anywhere. The sulphide ore exposed consisted of pyrites of iron and copper, blende, and a little galena, and some of it appeared almost solid blende. The strike of the deposit is from N. 20° W. to N. 40° W., and it appears to have an underlay of about 1 in 4 to the Eastward at one place, but this may be only local. The country rock is a soft greenish schist, and a rather hard somewhat schistose sandstone. The width of the mineral matter is from 25 feet in Johnstone and Goldie's claim to 70 feet in the workings further south of the Mount Reid S.M. Company, but in the latter it appears to be much split up by bands of country rock. These also appear, but to a less extent, in the first-mentioned portion. The Mount Reid Company were doing some trenching across the line of the deposit at the time of my visit, the work revealing more galena here than before. The veins or layers of sulphides are disposed quite parallel with the lamination of the country rock and themselves partake of it, and it is pretty clear that this is not a lode in the ordinary sense of the word, but either a bedded deposit or one in which the sulphides have been substituted, particle by particle, for the constituents of the original country rock, by "metasomatic" change as it is sometimes called. Common examples of this last feature are seen in the alteration of wood to pyrites and in silicified wood. It is not yet time to definitely decide to which of these classes this deposit should be referred, as it should be much more laid open before a reliable judgment can be formed, but at present I rather favor the theory that it is a bedded deposit, that is, that the sulphides have been laid down as chemical precipitates, or accretions from solutions, at the same period that the enclosing country rock was being deposited as mechanically derived sediments. It is known that at the present day beds of pyrites with copper pyrites and other sulphides in admixture, are forming in certain lagoons and lakes where solutions of sulphates of the metals come in contact with decomposing organic matter, and the great pyrites deposits of the world are very generally held to be so formed also. In cases where large and pure bodies of pyrites are so laid down it is probable that the deposition of the mineral took place in deep water far from the shore, where no quantity of sediment was deposited simultaneously with the sulphides, but nearer the shore the latter would necessarily be much mixed with mud and sand. I take it that it is likely that the Mount Lyell deposit is one which has had its origin in deep clear water, and the Mount Reid one in a place where from time to time layers of mud and sand were dropped on top of the sulphides.

For all mining purposes the deposit may be considered a lode, being a tabular deposit of mineral matter, different from the enclosing wall rock, dipping into the ground at a high angle, but the question of its exact classification as an ore-body is by no means without practical importance. Lodes are liable to vary very much in their value in different parts: deposits formed by metasomatic change are from their very nature apt to be irregular in shape and behaviour, depending as they do on rather obscure chemical re-actions: but bedded deposits are among the most permanent and even in value of any. If the Mount Reid "lode" belongs to this class we may expect to find the ore in lenses throughout the mineralised belt or layer of country, as well as disseminated through portions of the latter, and there is good hope that masses of considerable size and purity will be obtained. What will be the most prevalent ore it is rather hard to say, but it is likely that cupreous iron pyrites will be in much greater quantity than galena or blende. It seems, in my opinion, very probable that this is one of a number of bedded ore-bodies of somewhat similar composition extending from Mount Lyell to the Pieman River, and even further north, on a line running about N.N.W. As this is the general strike of the strata of the country, it is probable that the beds of rock along it were laid down about the same time and under much the same circumstances. We have on this line or close to it, the Mount Lyell deposit of cupreous iron pyrites containing gold and silver, with galena and blende in subordinate quantity, the Lake Dora copper and iron pyrites "lodes," also containing gold and silver, the Mount Reid "lode" with iron and copper pyrites, blende and galena, and gold and silver; and further north, still on about the same line, I believe that another deposit of auriferous copper pyrites has been found near the Pieman River.

The further development of this line of country and of the Mount Reid mine in particular will be of great interest. At the latter place the mine should be opened out with all expedition, but the owners should be prepared to lay out a good deal of money in underground prospecting before they put up machinery for reducing the ore, or expect dividends. The first thing to do is to prove the existence of large quantities of payable ore. While the prospects are decidedly promising, it would be foolish to venture an opinion in the present state of the mine that it would prove payable, and all I can say in its favor just now is that it is well worth trying. It is impossible yet to say whether gold, silver, or copper is likely to be the most important constituent of it from a commercial point of view.

North Dundas Tin-field.—In June 1890, when prospectors were ranging all over the Dundas field, Mr. Ringrose Nicholson discovered tin ore on the Ring River, and took up a section, No. 2568-87M, for alluvial tin, which has since been transferred to the Star of Dundas S.M. Company. No attempt was made to mine for tin ore and the discovery became almost forgotten, until hard times at Zeehan drove numbers of men to the bush to try to make a living by digging. One party prospected the vicinity of Nicholson's discovery, and finding the ground payable kept quiet about it for some months, till several of the sections were forfeited, when they took them up and began to work them. It has now been found that alluvial tin is to be obtained over a very considerable area, and tin-bearing lodes are also being discovered. In February last I made a short visit to the sections and saw the principal discoveries then made, but was not able to give the time required for a thorough examination of the whole locality. There is evidently a considerable mass of granite somewhere in the neighborhood, for stones of it are found in the alluvial wash, but I did not see it *in situ*. I was informed, however, that the high hill on the south of section 1680-91M (formerly 2880-87M) on the watershed between the Ring and Argent Rivers, was all granite. On the track from the North Dundas road to the Commonwealth mine, I noticed a dyke of quartz-porphyry cropping out,and a similar one crosses the Grey Ore track four miles from the North Dundas road. In section 1742-91M (formerly 2907-87M) there is a great deal of a granitic rock, composed mainly of quartz and schorl, and though I did not see this in the solid, I think it must form a very considerable amount of the bed rock in this vicinity. In some respects it is like lode-stuff, and I am not yet clear as to its nature, pending investigation *in situ*, but I expect that it will prove to be a variety of quartz-porphyry, in which there is an unusual amount of tourmaline in needles. Stones of this rock are very common in the wash, and it probably is very closely connected with the source of the tin ore, if it is not itself the rock which sheds it. The occurrence of granite and quartz porphyry dykes bursting through slates and sandstones is quite similar to what is seen at Mount Bischoff, where the great tin deposit seems certainly to owe its origin primarily to the granitic intrusion. It is noticeable that there is a further strong similarity between the ore at North Dundas and at Mount Bischoff, the nuggets of ore in both places being generally composed of aggregated bundles of fine crystals, and therefore presenting a rough hackly crystalline fracture when broken. Some of the larger nuggets that have been got at North Dundas (one of 25lbs. weight has been obtained) are quite indistinguishable in appearance from those that have been so often found in the alluvial portions of the Bischoff deposit. The slates and sandstones round Mount Bischoff are quite like those at North Dundas, and are probably of the same age, and again resemble them in being silver-bearing, as shown by the Silver Cliff mine. In the slate rock at Bischoff, in the North Valley lode, the tin ore is associated with much iron and arsenical pyrites and pyrrhotite; and as mentioned above these same minerals are found in the veins passed through in the Commonwealth tunnel, together with fluorspar, a most constant associate of cassiterite. Mr. Harrison, Inspector of Mines, has lately sent me some specimens from the tin-bearing lodes that have been discovered since I visited the locality, and in these I find rich tin ore with much iron pyrites and some fluorspar: in some other specimens obtained by myself there was tin ore and arsenical pyrites, but the lode had not then been found from which the loose specimens were derived. Mr. Harrison reports that two lodes have been found, one near the south boundary of section 2959-87M, west of Bennett and party's dam (217-91W), and the other at the north-east corner of section 1641-91M. The first "is a large pyrites formation, running so far as one can judge from the little that has been done on it, about 10 degrees W. of N., with easterly underlay: it carries a gossan capping which shows very good tin in places. Mr. Gatenby has cut across the lode from the hanging wall side about 15 feet without striking footwall." As to the second lode Mr. Harrison says, "it seems to run parallel" (to the first) "but there has been hardly anything done on it; there is some splendid stone on footwall in which fine tin can be plainly seen. A quantity of fluorspar is mixed with it." The position and strike of these lodes render it very likely that they are connected with the big gossan lode of the Commonwealth mine. The similarity of the whole occurrence to that at Mount Bischoff should give encouragement to have it very thoroughly prospected. It may be as well here, however, to remind investors that the presence of pyrites in the lodes is a great drawback, as the ore has to be roasted before the clean black tin can be extracted from it. It would therefore be a very important discovery if tin were to be found in payable quantity in one of the large gossan masses, as then roasting would not be necessary.

Most of the alluvial tin so far discovered has been along the course of the creek which runs through the Commonwealth ground into the Ring River. This creek heads from the ridge where the granite is said to crop out, but it is also worth noting that nearly all the discoveries are to the east of the line of the above lodes and below the latter, and therefore there is a possibility that these have been the main sources of the tin. It is yet too soon, however, to build any theory on this fact, and very probably other sources of tin will also be found.

Towards the S.W. portion of section 1742-91M (K. O. Karlson) a great deal of the quartz tourmaline rock is lying on the slopes of the hill, and holes sunk here and there in this part of the ground all yielded more or less tin ore, enough to make me consider that the ground would pay a working party, provided they could get a pretty constant supply of water for washing the dirt. The tin was here mostly crystalline and angular, not waterworn. In section 1668-91M, lower down the same valley, Robb and party were at work, and had got a good deal of tin. They were washing up the bed of the little creek, on slate and sandstone bottom, but the wash contained a good deal of granite and the quartz tourmaline rock. Some heavy nuggets of tin were obtained, together with much finer stuff. The wash was quite shallow, but the ground ought to pay very well. Sixteen chains lower down the creek on section 1641-91M (formerly 2804-87M), Bennett and party were getting some very fair tin when I saw their claim, and had a considerable area to work. About the centre of section 2959-87M. on a small creek which runs into the one on which the above workings are, Hanlon and party were getting some fair ore from very shallow ground. The tin ore in this case was nearly all angular, and often had much quartz attached to it, and from the shape and appearance of many of the larger lumps, I should think that it has been derived from small veins close at hand. In this creek I saw no granite in the wash and no tourmaline rock, so that the tin veins must be in the slate itself. Tin is found all the way down the creek to its junction with the Ring River, and also in another small creek towards the north of Glock's section, 3051-87M. Here, too, the ground is shallow, but yields very good prospects, and will no doubt keep a good many

men at work for some considerable time. Getting down into the valley of the Ring River the wash becomes deeper, and there is difficulty in getting down to bed rock, but from the prospects higher up I have no doubt that there must be a good deal of tin in these portions also; and it may be found worth while to resort to hydraulic sluicing. The creek workings are greatly hampered by dense forest growth, which requires much manual labor for its removal.

On section 3051-87M, and the north part of 1639-91M, there is a pretty high spur between the tin-bearing creek and the Ring River, the top of it being over 200 feet above the latter. This is covered with waterworn gravel, and appears to be more or less entirely composed of alluvial material, and almost anywhere over it prospects of tin are obtainable, especially in the small watercourses where there has been a certain amount of natural sluicing of the stuff. This deposit is comparable with the Alluvial Terrace higher up the Ring River, and is like it probably a relic of an older river system. As there appears to be a large quantity of tin-bearing stuff here, it would be advisable to have it thoroughly prospected by shafts, and if rich enough, it would then be necessary to get a supply of water for hydraulic working. I do not know the country well enough to say whether this could be easily obtained at the required elevation or not, but think it should be possible to bring a race from some miles up the Ring River if the ground warranted the expense. The finding of this high terrace of gravel renders it likely that there will be other similar deposits in the district, and this should be borne in mind by prospectors. Tin is said to have been found still further north, almost to the Pieman River, but I did not go to see these discoveries.

* It is evident that the lode and alluvial tin fields in this part of the Dundas district are of very considerable importance, and this winter, when water is plentiful and the track in from the North Dundas road has been completed, I expect that a good deal of tin will be sent out and quite a number of men find employment in raising it.

MOUNT HEEMSKIRK.

In 1875 tin was discovered at Mount Heemskirk by the late Mr. Charles Sprent, and in a short time a great rush took place to the field, and very high expectations were formed of it. Speculation was rife, but quite little true mining work was done, and before long the public lost all faith in the district, and it was all but totally abandoned. Many practical miners who prospected it have nevertheless maintained that valuable tin lodes do exist at Mount Heemskirk, and when times became bad at Zeehan a good many men went out again to it, and are once more bringing the field into notice. Several parties working alluvial ground are making a living, the difficulty in getting food and stores experienced in the old days having greatly disappeared with the better roads and other means of access now provided, but on the whole the alluvial ground is rather shallow and poor, and it is to the lodes that attention must be mainly directed. I am informed, however, that there are deep alluvials gravels in the north part of the Heemskirk field. I have only once visited the mines, and then only for a few hours, riding out from Zeehan and returning the same day, so what is now said is only what could be gathered from a mere flying traverse of the ground. The mines seen were the West Cumberland and New Cumberland lying on the ridge separating the head of Packer's Creek from that of the Cumberland Creek. A good deal of work has been done on both these properties, though, as is unfortunately too often the case, the erection of a battery and construction of a tramway to it have in each instance been gone on with before enough mining work had been performed to ensure regular supplies of ore for crushing. The West Cumberland mine has fallen into the hands of Messrs Fowler and Dunn, who now hold sections 1326-91M., 1327-91M., 1492-91M., and 1325-91M. The battery erected by the old company had fallen into great disrepair, but has been patched up by the present owners and has enabled them to concentrate some of the stuff previously mined: it now consists of 10 heads of stampers and three round buddles, driven by a water-wheel. As a tin-dressing plant it is very imperfect, and is to be substituted by more modern machinery as soon as the owners can provide it. It is situated on a small branch of Packer's Creek near the boundary between 1326-91M and 1327-91M, and is connected with the mine workings in section 1325-91M., which are some 400 feet higher up the hill, by a tramway and self-acting incline. These are now in bad order but could be put right without heavy expense. A small dam has been built behind the battery to give water for the water-wheel, but it is now intended to lay a line of pipes from the large dam on the Cumberland Creek, on section 101-87M., known as the New Cumberland dam, but now reserved by the Government. This is some 570 feet above the West Cumberland battery and quite a short pipeline will bring the water from it round the shoulder of a spur to a point over 400 feet above the machinery site, so that splendid water power to drive the dressing appliances will be easily obtainable.

Two lodes have been worked on section 1325-91M., both being strong veins whose outcrops may be seen plainly from a considerable distance standing out from the hill sides. There is therefore no difficulty in tracing the general course of the lines of lode, though of course the outcrops are not by any means always uninterrupted. On the western lode which runs N.E. and S.W. a tunnel has been driven about 280 feet: the lode is 4 to 6 feet wide with well defined walls, and consists mainly of quartz and tourmaline: numerous leaders come in from the walls and go out from them at intervals, and cross-cutting from time to time will therefore be advisable, as these may contain good ore. In the tunnel a small rise and shallow winze have been made on a shoot of good tin in this lode, but no stoping has been done. All this work was done by the old company, and Mr Dunn informed me that they had got about 11 tons of tin ore from it. I looked carefully over the lode stuff on the tip, but found it very poor, and I saw very little tin in the tunnel either except at the winze. Owing to the long time the workings have been standing however, the walls and roof of the tunnel are very dirty, and in order to fairly test the lode it would be necessary to break down several tons of stuff along the length of the drive, when an average sample might be taken. As far as I could judge, however, this lode was decidedly poor. From its course it should soon run into the next one, going north. On this, now called the main lode, a winze was sunk some 45 feet by the old company, and the present owners have squared up the old workings and extended them 20 or 30 feet each way from the bottom of the winze. They have crushed the stuff raised together with that got by the old company, which was lying at surface, and obtained about 20 tons of tin ore (according to Mr Dunn) reckoned to be about a yield of 6 per cent. from the stone treated. This lode runs N. 12° E., and in these workings consists of soft clayey and talcose stuff

full of little pieces of tourmaline, and containing extremely fine tin, almost slime even without crushing: there are also bands of hard quartz and tourmaline through the soft portion. In the winze the lodestuff was as much as 16 feet wide, but rapidly became narrow, going north and south. On following it however there is much likelihood of it again widening. The wall rock is granite, somewhat coarse-grained, and a good deal softened by decomposition. These workings are some 90 feet above a tunnel which has been driven on this lode a distance of about 150 feet.

Above these tunnels the ground rises going northwards for some chains, and then falls pretty rapidly into the valley of Packer's Creek. The top of the ridge is about 600 feet above the battery. In a gully about a quarter of a mile north of the ridge Mr. Dunn tells me he has got good tin on the line of the main lode.

Going to the north-east along the ridge the ground rises to a height of about 1000 feet above the West Cumberland battery, the highest point being in section 450-87M., and then forms a high narrow ridge between the valleys of Packer's and the Cumberland Creeks. On the top of this ridge in the New Cumberland Company's ground a shaft has been sunk in a large lode of quartz and tourmaline running N.E. and S.W. This lodestuff is quite black with tourmaline and frequently rather pulverulent. Lower down the hill to the N.E., some 65 feet below the shaft, a small crosscut has been driven across this tourmaline lode, a distance of about 30 feet, and then a drive has been put in along the granite wall, which is well defined, for a distance of 50 or 60 feet. In the mouth of the tunnel fine crystalline tin ore shows pretty freely in places. Another tunnel has been started some 50 feet lower down the hill to cut this lode but has been abandoned without reaching it. As it is a large lode and contains some tin at least, it is worth testing thoroughly. A long tunnel, said to be 900 feet in length, has been driven from the south side of the ridge some 300 feet below the top of it: I did not go into this, but was told that it was put in to cut a large quartz lode that is seen on the surface; it would not have to be extended more than some 300 feet before it would also cut the tourmaline lode. There are several outcrops of quartzose matter between the West Cumberland and New Cumberland mines which appear to be of a lode character but have not been opened up. The impression I took away from this hurried visit was that the main lode of the West Cumberland and the black lode of the New Cumberland mines were decidedly worth further prospecting, and that the work of the old companies has rendered this an easy and inexpensive matter.

From the New Cumberland tunnel a tramway still in not bad order, runs to the battery on section 1549-91M but I had not time to visit this to see in what condition the machinery was after its long idleness. It appears to be well housed however and therefore should not have suffered much.

One great advantage possessed by these two mines is their proximity to the New Cumberland Dam. This is quite a small lake and holds a very large quantity of water, the stream being dammed back for probably more than half a mile. A line of pipes used to take the water from this to the New Cumberland Battery, but I noticed that these were much rust-eaten, and very extensive repairs would probably be required. While it is very regrettable that the former owners spent so much money in erecting batteries, tramways, and dams, instead of well proving the lodes by underground work, there is no doubt that their successors will reap a great deal of benefit from their expenditure, and if successful in opening up payable ground will have but little trouble in getting crushing power, and connection with the batteries. The results obtained by Fowler and Dunn's party by actual crushing of a considerable parcel of stone show that there is payable tin in some portions of the lodes, and it seems to me that there is great hope of tin-mining being revived on a legitimate basis at Mount Heemskirk.

I have not been able to ascertain the exact amount of tin ore which has been raised from the Heemskirk District lately: in the Commissioners' reports for July and September, 1892, 24 tons are recorded as having been raised, while in December, 1892, and the first three months of 1893, 50 tons were exported from Strahan. Of this last amount some few tons should be credited to the North Dundas Tin Field, but we shall not be far wrong in saying that during the months mentioned the district produced about £4000 worth of tin ore.

Conclusion.—In concluding this report I have to express my conviction that the West Coast Fields have made real and permanent progress, and are rapidly coming to a self-supporting position. The generally good results that have followed legitimate mining work are very encouraging, and may almost be held to demonstrate already that the district is sure to become a very important producer of mineral wealth. Besides the silver-lead mines, we have auriferous and argentiferous copper on the east side of the field, and bismuth has also been found there; alluvial gold and tin at North Dundas, and lodes of tin ore at the latter place and Mount Heemskirk, as well as the alluvial deposits. Now that the country is being opened up, and is connected by rail with a seaport, it is beginning to be seen that it has many advantages of position over mineral districts remote from the seaboard, and as time goes on its really very good position as a smelting centre will become more and more recognised. At the risk of reiteration, I would remark that local smelting works and improved concentrating machinery are now the great desiderata, and I would once more draw attention to the great service that might be rendered in prospecting in depth by diamond drill boring, especially in the case of the large gossan lodes.

I have the honor to be,

Sir,

Your obedient servant,

A. MONTGOMERY, M.A.,

Geological Surveyor.

APPENDIX No. 1.

Estimated total Production of Ore Exported or Smelted locally, from mines of the Zeehan-Dundas Silver Field up to 31st March, 1893.

N.B.—This does not profess to be a strictly accurate return, but rather is an estimate for the purpose of showing the approximate production from the field and the relative position of the mines as producers.

Silver Queen...	3725 Tons.
Maestrie's Broken Hill...	3590 ,,
Western	1418 ,,
Oceana	1000 ,,
New Tasmanian	957 ,,
Mount Zeehan S.L. Mining Company	650 ,,
Mount Zeehan (Tasmania) Silver Lead Mines	605 ,,
Grubb's	587 ,,
Comstock	298 ,,
Adelaide Proprietary	252 ,,
Silver Bell	250 ,,
Mount Dundas Prospecting Company	110 ,,
Oonah	92 ,,
Success	50 ,,
New Silver Stream	46 ,,
Sylvester	38 ,,
Sunrise	35½ ,,
Success Extended	30 ,,
Junction	25 ,,
Tasmanian Crown	12 ,,
Comet	10 ,,
Sylvester, Despatch, and other tributes, say	10 ,,
Nubeena	8 ,,
Montana	7 ,,
Sacramento	1½ ,,
Total	13,807 Tons.