INTERIM REPORT

ON THE DISCOVERIES OF COAL AT BARN BLUFF, AND ON THE PROGRESS OF THE MINERAL FIELDS OF THE COUNTY OF MONTAGU, MOUNT ZEEHAN, MOUNT DUNDAS, MOUNT REID, MOUNT HEEMSKIRK, MOUNT LYELL, &c.

Geological Surveyor's Office, Launceston, 11th April, 1893.

SIR,

I HAVE the honor to submit to you a preliminary or interim Report dealing generally with the state of the Mining Industry on the West Coast as observed by me during a recent visit. Later on I hope to send you a more detailed account, but this will take some little time to prepare.

Having been instructed to visit the discovery of Cannel coal at Barn Bluff, I determined to take this on my way to the West Coast, and accordingly went overland from Chudleigh to Zeehan; going first to Liena, thence over Gad's Hill and the Emu and Mackenzie Plains to the head of the River Forth, thence round the foot of the DuCane Range and Mount Pelion to Barn Bluff. From here the route followed ran over Granite Tor, thence to the south of Sophia Peak, across the Murchison River a few miles above its junction with its branch which comes from Lake Selina, and on to Moore's Track on the eastern slope of Mount Reid. The country, though hilly, is fairly free from scrub, not more than four miles in all of really dense bush being passed through on the route between Liena and the eastern foot of Mount Reid, and is therefore not difficult to travel through. A pack-track could be got right through to connect with the Mount Reid to Zeehan track without great trouble or expense, and the prospecting of an important stretch of country would be greatly facilitated thereby.

In my detailed Report I shall describe the geological features of the country traversed at some length, but at present it is sufficient to say that from the head of the Forth to Mount Reid the main rock is quarzite, with occasional belts of schist and conglomerate. It is not yet clear if this quartzite formation is of the same age as the slates and sandstones of the Dundas silver field, or if it is older, as is more likely. Lying in horizontal beds on the edges of the older strata we find round Mount Pelion, the Eldon Range, the Du Cane Range, and Barn Bluff conglomerates and fossiliferous shales and sandstones of Permo-Carboniferous Age, part of our Coal Measures series. These again are overlaid by immense beds of diabase greenstone, whose columnar structure gives to the peaks carved from it their characteristic jagged precipitous outline. A most interesting and important geological fact in connection with this portion of the country is established by very complete evidence seen near Lake Eyre at the head of the River Forth, namely, that at a comparatively recent period large glaciers have existed, and I have no doubt that the deep gorges of the Forth, the Fury, and other rivers have been in the first instance cut out by the tremendous erosive action of slowly moving huge bodies of ice. Mr. T. B. Moore has, I believe, found plain proof of the former presence of glaciers in the neighbourhood of Lake Dora also, and no doubt evidences will be multiplied as the country is further examined.

Coal Discoveries.—In the coal measures lying at the base of all the big peaks at the head of the River Forth coal has now been found at three different places—on East Mount Pelion, on Barn Bluff, and on the range connecting the latter with the Cradle Mountain. The older discovery to the west of Lake St. Clair further south very probably belongs to the same horizon: I have not seen it, however. The seam at East Pelion is small and of poor quality. My guide not knowing where this was I did not see it either. The principal discovery is that at Barn Bluff. Here we have a narrow plateau lying between the gorges of the Forth and Fury Rivers and extending from Mount Pelion to Barn Bluff and the Cradle Mountain. The plateau consists of horizontal beds of coarse conglomerate resting on schist and quartzite unconformably. The lower parts of the slopes

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of Mount Pelion and Barn Bluff rising from the plateau consist of beds of shale, sandstone, and mudstone, carrying numerous marine fossils characteristic of our coal measures. These marine beds extend on Barn Bluff right up to the superincumbent capping of greenstone, and no doubt underlie it. At the base of a spur entirely composed of them, running south east from the peak, numerous fragments of cannel coal are found mixed with the broken débris of other rocks, and extending over a considerable distance. Near the foot of the spur where the fragments are most numerous several holes have been sunk and trenches dug, and in one of these a flake of coal over sixteen feet in diameter was struck; this was thought to be the seam *in situ* at first, but on cutting through it it was found to be resting, not on solid rock, but on loose fragmentary material similar to the stuff lying above it. Fragments of the coal in this loose stuff below the main sheet proved clearly that the whole mass was moved from its original bed. It is evident that all this broken material has been accumulated by the action of ice when the country was covered with glaciers as above-mentioned, and I have no doubt that the large flake of coal found was torn from a seam somewhere close by by the same agency and carried to its present position. Good sections of the conglomerate forming the base of the coal measures are seen everywhere at the edge of the plateau, and the trenching done by the prospectors on the spur above the coal find has laid bare the solid rock for a considerable distance higher, but in neither these lower nor upper strata has the seam yet been discovered. The lowest strata seen in the hillside are black shales, which are overlaid by fossiliferous marine deposits. In loose pieces of exactly similar shale found with the coal I saw specimens of a large *Glossopteris* and a *Nœggerathiopsis*, which prove that the strata belong to the lower coal measures of this Colony. Between the conglomerate at the base of the measures and the black shale in the hillside trench there must be about 50 feet, perhaps more, of strata not exposed by any natural section so far as I could see, and I do not think there can be any doubt that the coal seam lies somewhere in this part of the formation. In other parts of the Colony the coal seams of the lower measures are overlaid by fossiliferous marine deposits, and we should therefore expect to find the coal below these in this instance, and not above them, as would be the case with seams belonging to the upper measures. When I left the ground boring-rods had been sent for to bore through the black shale down to the conglomerate, and I have little doubt that this work will soon result in cutting the undisturbed seam.

The pieces of coal found loose are from six inches to twelve inches thick, and the large flake averages a little over eight inches; the thickness of the seam will therefore be not less than about eight inches, and may be more. The coal is black, with bright shining conchoidal fracture, almost like pitch, is very tough, and burns very readily on application of a light. In appearance it closely resembles the cannel coal of Hartley and Joadja Creek, in New South Wales, rather than the cannel coal of Scotland. Analyses and tests will be given in my detailed Report hereafter. On distillation the coal yields a very high percentage of gas and oil, and should be very valuable for the manufacture of the latter, of paraffin products, and for enriching illuminating gas from less highly bituminous coals. There is a good deal of pyrites in thin seams in the coal, which is decidedly detrimental, but this may be only a local feature, and not characteristic of the whole seam when opened up.

The second discovery of coal is about half a mile north-east from the peak of Barn Bluff and over a mile to the north of the cannel coal find. It consists of nearly 12 inches in thickness of bright, brittle, highly bituminous coal, free from bands. The seam crops out in solid strata on the side of the ridge connecting Barn Bluff and the Cradle Mountain, and has been traced a few chains along it. Dark micaceous shale with indistinct impressions of *Glossopteris* forms the roof and floor of the seam, which is on much the same level as the cannel coal discovery. From this and its position between the conglomerates and the higher fossiliferous mudstones, I incline to the opinion that this seam is identical with the one yielding the cannel, and that the difference in quality and appearance is due to the distance of the outcrops apart, it being a very common occurrence to find different parts of the same coal seam varying considerably in composition. It is possible that the seams are different, but if so they must lie very near to one another.

There is an area of probably three or four square miles in the neighbourhood of Barn Bluff likely to contain the seam of coal, and as the strata seems very little, if at all disturbed, working should be simple and easy. All the mining could be done without difficulty by means of adits, and without expense for mechanically raising water. Should the value of the coal, after practical tests by a manufacturer skilled in the production of oils and paraffins, be demonstrated to be sufficient to bear the cost of mining so thin a seam and carrying the coal to the Coast, I do not anticipate that there would be any difficulty in getting a sufficient area of it to be worth working. The seam is likely to be found again further south, in the measures at the base of Mount Pelion, the DuCane Range, and the Eldon Range, and the area of the probable coal-field is therefore very considerable. The coal basin appears to be getting deeper going southward, and I am therefore sanguine that thicker and probably better seams will be found in this direction than nearer Cradle Mountain, which seems to be the edge of the basin. Prospecting in this direction is therefore to be recommended.

At present it is true that these coal fields are practically inaccessible, but I do not think that this should be allowed to discourage prospecting them, as after all they are no great distance from the sea-board, and a railway could be got to them if they turn out worth the making of it. The

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Mole Creek-to-Zeehan line of railway has been partly surveyed as far as Mount Pelion, and so far, I understand, presents no extraordinary difficulties, and between Mount Pelion and Barn Bluff the country is very easy. Men who know the country well say it would also be possible to find a route down the west side of the Forth Valley from the Cradle Mountain; and a route from the Cradle along the watershed to the head of the Hellyer seems likely to be practicable also, and would connect with the proposed Waratah-to-Zeehan Railway.

There being a large stretch of likely coal country in the vicinity of Mount Pelion and the Eldon Range, and this having already been found to contain coal, and some at least of this coal being of the most valuable sort (cannel), while all is bituminous, there is every inducement to continue prospecting, and great hope of making very valuable discoveries by doing so.

The above discoveries of coal have been made by the Mole Creek and Zeehan Mineral Prospecting and Exploration Company, Limited, who still have parties of prospectors out in the neighbourhood of Barn Bluff looking for coal and other minerals. The country rock exposed in the deep river gorges is likely to carry metallic minerals, and some have been already discovered. Near East Mount Pelion (often known as The Pretty Sugar-loaf) some mineral leases have been taken up on ground containing veins of quartz heavily charged with iron and copper pyrites, arsenical pyrites, blende, and a little galena, and carrying a little silver. These do not at present appear to be of much importance, but are worth opening up a little so that a better idea of their value may be obtained. Near the foot of Mount Pelion I noticed also a quartz reef carrying a good deal of pyrites, and of rather a "kindly" appearance for gold, but none has yet been found in it. In the granite country near Granite Tor traces of tin have been got, and prospectors are at work following these up. Gold, tin, copper, lead, and silver are all likely to occur in the granite and schist and quartzite formation, and the labours of exploring parties will no doubt in time be rewarded by finding payable lodes of one or more of these minerals.

ZEEHAN AND DUNDAS FIELDS.

Since my last visit to these fields in October, 1890, great progress has been made. The railway from Strahan to Zeehan has been completed, and a branch line made to Dundas, and roads and tramways have been made to a great many of the mines, rendering access to all parts of the fields much easier than in former times. Much, however, has still to be done in providing means of access to the mines, especially in the outlying parts, as many of them have still nothing but rough pack-tracks to them, over which it is not possible to carry the machinery required for properly opening them. As will be shown in my detailed Report, several promising mines are at a standstill in consequence.

Since my last Report on the Dundas field, gold, tin, bismuth, and copper have been found in it, in addition to silver and lead, and alluvial mining for tin and gold has been undertaken as well as lode mining. The head of the Ring River has been the principal gold-field, and has given employment to a large number of men for more than a year. The present Ring River cuts through an older alluvial deposit, now known as the Ring River Deep Lead, and appears to have derived most of its gold from this source. The "Alluvial Terrace" claim appears to be the upper part of the lead, the bottom of which rapidly falls going northward, until in the Deep Lead Company's ground it is a long way below the level of the creeks intersecting it. The course of the old lead appears to run to the northward, in almost fairly the opposite direction to the creek which now flows over the surface of the ground, and probably will be traced out to the north towards the Pieman River. In the Deep Lead Company's ground there is a thick surface deposit of thinly-bedded fine sandy clay, with the layers quite horizontal, indicating that the sediments had been laid down in still water. The clay exactly resembled some of the glacial clays found deposited in lakes in South Canterbury, New Zealand, and it is very possible that the old river valley became dammed by ice, and that this was the cause of the diversion of the water into its present channel. In some of the claims higher on the lead the auriferous wash is seen running under the bedded clays, and there is good reason for thinking that an auriferous gutter will be found under them for a long distance. The clay affords a simple and easy way of tracing the course of the deep ground, and should be followed to the northward in order to find, if possible, the old outlet of the lead into the Pieman River Valley, or perhaps it would be more correct to say the place where the modern Pieman Valley has intersected the old lead. It might be possible to find a place where the old river channel could be drained by an adit, which would greatly facilitate its working. Want of proper machinery for unwatering the ground is at present causing an almost complete suspension of work on the deep lead. The bed of the river has been pretty well worked out now, and the principal body of auriferous material remaining is the alluvial terrace. This occupies the top of a ridge between two creeks, and will last some months yet, as it cannot be worked away very quickly on account of the poor supply of water not allowing of hydraulic sluicing. The discovery of high terraces of wash at a height of from 50 to 100 feet above the present creek beds should lead to further prospecting of the slopes of the hills, for it is clear that the auriferous gravels belong to an older river system than the present one, and there is a likelihood of remains of the gravels of these older rivers being found in patches every here and there over the hill sides. Such high terraces have often been rich in gold elsewhere.

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The Ring River Lead appears to have had its source in the slopes of Mount Reid, and gold has now been found in lodes *in situ* near the top of the range. In the Mount Reid Silver Mining Company's lease, 3302-87M, gold was found in the shallow surface soil, and as this was stripped away a lode was discovered also containing gold. The lode runs about N.N.W., and is in places 25 feet in width. It consists of quartz and oxide of iron on the outcrop, and lower down a few feet of iron and copper pyrites and blende, with a little galena. Towards the south end the lode-matter is wider, but appears to contain much country schist in enclosed bands, the whole mineralized belt being as much as 70 feet in width. The sulphides are found in layers parallel with the bedding of the enclosing schists, and it is very probable that this is a bedded deposit, and not a true lode: it has many features in common with the Mount Lyell "lode," which is almost certainly a layer or stratified deposit. Specimens from the Mount Reid lode have given high assays for both gold and silver, and gold can be washed freely from the oxidized capping. Johnstone's party obtained four ounces of gold from 26 cwt. of the gossan by crushing in a small portable battery. The gold contains about 33 per cent. of silver alloyed with it. The Ring River gold also is alloyed with a good deal of silver, and brings a low price per ounce in consequence.

To the north of the Mount Reid Company's workings there are several other discoveries of sulphide ores containing gold. These were not being worked at the time of my visit, and I did not go to them. The copper pyrites from M'Guinness's find is said to assay over an ounce of gold to the ton. On the Hauraki Company's block, 3387-87M, bismuth and sulphide of bismuth are found associated with quartz, specular iron ore, iron and copper pyrites, and fluor-spar. The deposits all along the line of country between Mount Lyell and Mount Reid as far as discovered show a preponderance of iron and copper pyrites in their composition, and it seem very likely that they are all similar in origin. It is altogether premature with so few proved facts at command to form any decided thereon as to their correlation, but it may aid prospecting to suggest one that on present data seems feasible. Both the Mount Lyell and the Mount Reid deposits appear to be bedded within the layers of the enclosing schist country, and the strike of both is about N.N.W. and S.S.E., corresponding with the general strike of the sedimentary strata of the whole of the Montagu County fields. It is probable that the sulphides were originally sedimentary deposits laid down contemporaneously with the enclosing strata, and subjected with them later on to the great earth movements which have tilted them on edge, and to the heat and pressure which have resulted in metamorphic change. If this be the case this belt of strata is likely to contain numerous lenses of sulphide ores, and search should be made along it for them. Besides those mentioned above there have been discovered near Lake Dora some large bodies of copper pyrites containing more or less gold, which also, from the description given to me, appear to be of bedded character rather than fissure lodes, and these are not much to the east of the line from Mount Lyell to Mount Reid. This seems likely to become a very important and valuable belt of country.

Tin Ore Discoveries.—Within the last few months much interest has been aroused in the discoveries of tin ore in the neighbourhood of the Commonwealth and Star of Dundas Companies' holdings on the Ring River. Several parties are now at work on the ground with very fair prospects. The tin-bearing wash is generally shallow and easily worked, but is of sufficient extent to support a considerable number of men for the next two or three years, and I have no doubt that in the wet season, when water for sluicing is available, there will be a very noticeable addition to the produce of the Zeehan-Dundas field from this source. Besides the shallow wash, however, there is at least one large gravel hill or high terrace which contains tin,—no doubt a relic of that older river system which deposited the Ring River deep lead as well,—and there is a likelihood of there being other such terraces yet undiscovered. The top of this gravel hill is over 200 feet above the Ring River, and the depth of the wash on it is yet quite unknown. Fair prospects are obtainable in all the small hollows in its slopes where the gravel has been subjected to natural sluicing in watercourses, and there is every reason to believe that there is here a large body of tin-bearing stuff, which should be prospected thoroughly. The wash contains numerous large well waterworn boulders, some of quartzite and quartz, others of hard granite, and others of a mixture of quartz and fine tourmaline. Granite is also found in the wash in some of the creeks now being worked, but is not very common. The quartz and tourmaline rock, however, is nearly always present with the tin. I am not certain as to its nature, whether it is derived from a large lode or is a variety of quartz-porphyry highly charged with tourmaline. It occurs plentifully in angular unwaterworn fragments in Karlson's sections, on the high hill running up to the Confidence Silver Mining Company's section, 2770-87M (now 1690-91M). With these angular fragments angular tin ore is also found, and I am inclined to think that this rock is the principal matrix from which the ore is derived. I did not see any true granite *in situ*, but it must be present, as boulders of it are found in the creeks. A quartz-porphyry dyke, however, is seen on the pack-track to the Commonwealth mine, and again on the track from the North Dundas Road to the Grey Ore mine; it is very similar to the quartz-porphyry found at Mount Bischoff. The tin ore, too, is often very like the Bischoff ore in appearance. There are, without doubt, an intrusive mass of granite and one or more dykes of quartz-porphyry forced through the slates and sandstones of the silver-bearing formation in this part of the district, and the occurrence of tin is due to their presence. In Hanlon's tribute workings, however, on the Commonwealth Silver Mining Company's ground, specimens of lode tin ore, evidently not long separated from their parent veins, are found in a wash

which contains neither granite nor porphyry, nor the quartz and tourmaline rock, and as work lays bare the slate bedrock I have no doubt that tin-bearing quartz veins will be found in it also.

The tin ore is of fairly good quality, the principal impurity being quartz disseminated through the bunches of fine crystals, of which most of the nuggets are composed. In some places in the vicinity of the large gossan outcrops so numerous in the Dundas district, there is apt to be a good deal of brown iron ore with the tin; but this can be greatly got rid of by careful streaming.

As time goes on it is very likely that lodes will be found carrying tin, especially near the contacts of the intrusive granitic masses with the slate and sandstone country. In Bennett's workings, on Section 2804-87M, a number of loose pieces of quartz carrying arsenical and iron pyrites and tin ore have been picked up, evidently not long broken away from the parent lode, and it is probable that a week's work devoted to search for the latter would lead to its discovery. The association of iron and arsenical pyrites with the tin ore in this case brings to mind the fact that in the North Valley lode at Mount Bischoff also these minerals occur together. Pyrrhotite also occurs freely there, and it is suggestive that in the long tunnel being driven by the Commonwealth Silver Mining Company from the side of one of the creeks in which the alluvial tin occurs, we find pyrrhotite, arsenical and iron pyrites, and copper pyrites in veins of quartz which also carry some fluorspar at times. No tin has yet been seen in these veins, but there seems a strong possibility of its being found. The gossans of the lodes in this part of the district should be carefully examined for tin.

Most of the tin discoveries have been on creeks running into the Pieman River, but a little tin has also been got in the "Madame Melba Flat," the head of one of the feeders of the Little Henty River.

Silver-Lead Mining.—The Zeehan and Dundas fields have suffered severely from the general commercial depression which has prevailed during the last two yars. This has caused an almost complete stoppage of the supplies of money necessary for the opening of a new field, and has led to the abandonment of mining operations on large numbers of promising sections. In the majority of cases it has come to this, that if the mine is not able to pay its working expenses out of the ore raised it is shut down. It needs but little investigation into the circumstances of working on these fields to convince anyone that it is far too much to expect of most of the mines that they should be able to pay from the beginning: they have first to have a lot of expensive dead-work done on them. Roads and tramways have to be made, shafts have to be sunk, and winding, pumping, and ore-dressing machinery to be provided before it is reasonable to expect dividends. The expense of equipment of a silver-lead mine has not been generally realised by the investing public, and the majority of the companies have in consequence began work with an altogether insufficient working capital. The inevitable result has followed: cheap and bad machinery, small cramped shafts, and generally an insufficient mining outfit. have been all that the money in hand could provide, and the consequent failures and disappointments in mastering the water and other difficulties have disheartened shareholders and caused them to allow their shares to be forfeited. The large area of the fields and the great number of known lodes, too, though both factors of the highest importance in ensuring a great future to the district, have been to begin with rather detrimental to progress, as an immense amount of money has been frittered away in taking up mineral leases, having sections surveyed, and roughly prospecting them without real mining being done, that would have sufficed to equip and open up a large number of good mines if its operation had been more concentrated.

In spite of all drawbacks, delay in opening up the mines, poor machinery, want of capital, and loss of confidence on the part of investors, it is most satisfactory to be able to say that the fields have made wonderfully good progress. The quantity of ore raised is more than paying the cost of getting it, and is rapidly paying off the debts incurred by many of the companies for machinery. Those mines which have been persistently worked through both good and bad times have in almost every instance justified the faith put in them by turning out increasing supplies of ore, and the steady output is now doing much to restore public confidence. It is too much to expect that the product of the mines will supply all the capital required for the development of the fields from henceforth, for even the best of the mines are not yet properly in working order, and may be hard put to it for some time to procure better equipment without calls; but it may safely be predicted that several mines will be now self-supporting, and that it will be satisfactorily shown that the capital invested in the district has every likelihood of being reproductive.

In the present Report I shall only speak generally of the state of the mines, leaving more detailed information as to each particular one to my later more complete Report. The most important advance made has been the erection of several concentrating plants in the Zeehan field, the New Tasmanian and Argent mines having mills made by Green, of Aberystwith, Wales, and the Mount Zeehan and Silver Queen having those designed and erected by May Bros., of Gawler, South Australia. Messrs. Parke and Lacy, of the United States and Sydney, are supplying yet another type of plant to the Silver King mine; and a very complete mill, of C. Lühring's designing, is being erected at the Western. All four of these types of concentrating mills will soon be at work,

and it will then be possible to get accurate returns as to their comparative cost and efficiency. It would be advisable, therefore, for other companies that have not yet got mills of their own to wait a little till comparative trials have been made of the above before committing themselves to any one style of plant. There is always a tendency on mining fields to erect a needless number of mills, and it is well worth the consideration of mine-owners whether it would not be better to erect concentrators at a few convenient centres in different parts of the district, and to connect these by tramways with the mines than to build separate mills for each mine. Concentration of ore-dressing mills will allow of their being much more elaborately fitted out with slime-dressing appliances than if each mine has its own plant. Of the mills yet erected that at the New Tasmanian mine is the most complete; the two plants erected at the Silver Queen and Mount Zeehan mines by May Bros. having no appliances for concentrating the fine sands and slimes, though very good as far as they go. At several mines small hand-jigging machines have been erected in addition to the above more elaborate mills, and a good deal of clean ore is obtained by their aid. Till the concentrators began working the only ore fit for export was the picked clean first-class galena, and it says a great deal for the richness of the field that it has sent away so much as it has done of this class of ore. Many of the smaller mines even now can only send away their first-class ore, as they have no means of rendering marketable the poorer grades. But no mining field can be expected to pay profits for any length of time from the first-class ore alone, and the larger bodies of concentrating ore are the real mainstay of the district. A good deal of easily got first-class ore is being raised from near the surface by tribute parties, but the production from this source must be expected to fall off as the workings get deeper and require machinery, and the main mining work must be done by companies or strong co-operative parties able to do expensive deadwork.

The ore raised at present is mostly sold locally to ore-buyers representing the Queensland Smelting Company and the Hamburg Metal Company. Two local smelters have been erected, one near the Zeehan railway station and the other at Argenton, but neither has done much work. The main cause for their failure appears to have been want of capital sufficient to enable them to buy ore outright, and blend it and smelt it at their own convenience. There appears to me to be a good opening for a smelting works, for there is a large quantity of somewhat low-grade ore, consisting mainly of iron and manganese gossan, carrying from 20 to 30 per cent. of lead and 20 to 30 ounces of silver to the ton, which will not pay to send away, but could be profitably smelted on the spot, and would be most excellent flux for the other less easily smelted ores containing no oxidised matter. The Oceana, Dundas Prospecting Association, Maestrie's Broken Hill, Comet, and Adelaide mines are the principal possessors of this class of ore. The oxidised gossany ores do not concentrate well, the silver escaping plentifully into the tailings, so that smelting without concentration becomes imperative. Where, however, an ore can be concentrated to a rich metalliferous residue without great loss it is generally better to do so than to attempt to smelt it in the undressed state, for the concentration by smelting costs pounds where concentration mechanically costs shillings. It is therefore satisfactory to know that the most of the Zeehan and Dundas ore, so far as known, is either good concentrating ore or else, when not fit for concentration, is so full of oxides of iron and manganese that it can be smelted very easily. The silicious rich ore got in the Silver Queen No. 2 lode is, perhaps, the most notable exception to this statement.

On the Dundas field the question as to what is to be found beneath the huge outcrops of gossan is still far from satisfactorily solved. The country contains a great deal of water, and sinking has been consequently carried on under great difficulties and, at times, completely put an end to. It has been proved, however, that in the Maestrie's Broken Hill, Comet, Adelaide, and Dundas Prospecting Association mines there is good ore below the barren gossans, and the results of work, so far as it has gone, are very encouraging. Nowhere yet has the oxidised material been completely sunk through, and still deeper levels will have to be attained before the lodes are seen in their original unaltered condition, and there is great hope that a zone of richer ore than the average will be found resting upon the unaltered portion. Great interest attaches to the work now being done in the Comet mine, as the cross-cut now in progress is expected to strike the lode below the zone of oxidation. I am, however, somewhat doubtful as to its doing so, as the work in the Adelaide mine has proved the oxidised material to go a good way below the present water-level. The Comet mine is at present unable to be worked in the bottom level on account of a heavy inrush of water encountered as the lode was approached; but it is expected that constant pumping for a few weeks will gradually overcome the influx and enable driving for the lode to be resumed. The water-level in the Dundas mines appears to have varied a good deal in times past, as might indeed be expected from geological considerations, and a result of this variation appears to be the occurrence of lodes and veins of galena traversing the main masses of gossan more or less obliquely to the walls of the latter. These lodes within lodes are well seen in Maestrie's Broken Hill, the Dundas Prospecting Association, and the Adelaide mines.

The Mariposa lode had a gossan capping at the outcrop, but has changed in depth into galena and carbonate of iron, and it is noticeable that the galena at the bottom level is considerably richer in silver than near the surface. This lode however is comparatively a small one, and we should not expect the same amount of chemical alteration and solution and redeposition of the metallic contents to have gone on in it as in the larger bodies like the Comet lode.

In the North Dundas field very little work has been done to prove what underlies the large gossan outcrops. The North Dundas mine itself did not go deep enough to get out of oxidised matter; the Murchison Company did not find their lode probably from not going far enough; and the Commonwealth Company are still patiently and with admirable persistence driving through hard country to test their big lode at a depth. At Zeehan the Balstrup lode, which is exactly similar in character to the Dundas big gossan lodes, has not been well handled, an immense amount of work having been done all along the line in driving from superficial adits long after it had become patent that it was imperative to sink well below water-level in order to get the ore. Even this superficial work, however, revealed the existence of some rich ore, and showed that the lode was getting richer as greater depth was attained. The Oceana mine also found good ore and comparatively rich gossan by sinking below the poor outcrop; so taking the work done up to the present all together, we may regard it as demonstrated that good ore exists under the barren gossans in many instances, and consequently that there is a strong probability of finding it likewise under those which have not yet been tested.

There seems to be a notion prevalent that the lodes on our West Coast fields will not live in depth,—an intangible idea resting upon no foundation of fact or reason that I have been able to discover, but nevertheless widely spread and constituting an ever present bogey to frighten investors. None of the mines are any depth worth speaking of yet, but as far as they have gone the lodes have been strong and persistent and show every sign of permanency. The shoots of ore will no doubt, as elsewhere, be more or less variable in size and quality, but there is no reason to suppose that they will not be found as good in the lower levels as in the upper one. The majority of the lodes are distinctly of the "fissure vein" type, the most persistent of any, and why the ore should not live in them in the Zeehan field the same as in older long-worked mining districts like Freiberg and Przibram, where similar lodes and ores occur, I quite fail to see.

The great want both on the Zeehan and Dundas fields at the present time is capital for opening out the mines to a considerable depth before expecting immediate returns from them, and there is no doubt in my mind that there would be good returns for the money invested. A great deal of money has been already spent for which value has not been received on account of its being expended on useless work and inadequate machinery, but this ought not to be allowed to prejudice the mines themselves. The same money expended on ten of the more promising lodes would have been worth ten times more to the district; but it is now no use regretting that it has been frittered away, and it remains to us to profit by the experience and avoid the same mistakes for the future. Leaving the mistaken expenditure out of account, the field to my mind shows an uncommonly good return of ore for the quantity of work done and money expended in genuine mining work, and there is no need to fear that in the future it will not respond equally well and even better.

The principal mines now in active operation are the following :—

Western.—This fine mine is looking very well, and is turning out a large supply of ore of excellent quality. Preparations are being made for sinking the main shaft and putting in it a duplex plunger lift, and a start has been made with the erection of the Lühring concentrating plant. This is now without doubt the premier mine of the field.

Silver Queen.—There are two separate mines on this property worked from two main shafts known as No. 1 and No. 2. The latter is on the lode which in the upper levels yielded very rich galena and silicious ore, and enabled the Company to declare some dividends. At the bottom level, however, a blank patch was struck, but since leaving the field I hear that ore has come in again in the north end. At the No. 1 shaft the workings at the lowest levels have been poor in ore, but other shoots will no doubt be found when the lodes have been further driven on. On surface several lodes containing good ore are known to exist which have not yet been opened out. An ore-dressing plant of jiggers has been erected by May Brothers, of Gawler, and the second-class ore accumulated since mining work begun has been mostly put through this, with very satisfactory returns of clean ore. I was sorry to see so little work going on underground at the time of my visit, it being evident that the heaps of dressing-ore accumulated would soon be exhausted, and that then there would not be enough to keep the mill constantly employed. This is a good property, and from its position must contain a large number of lodes known to exist in the sections north and south of it, but from its extent and the number of its lodes it requires a large working capital to begin with. Worked under the present hand-to-mouth system it runs a very good chance of being a failure.

Montana.—Here a main shaft is being sunk, all other work being for the time suspended.

Sylvester.—This is a very promising mine, but is not yet deep enough to be below the zone of oxidation. In the lowest workings good galena and rich oxidised ore are just beginning to be obtained, and the next level should reveal payable stuff. A main shaft is being sunk, and it should not be long now before the mine is a producer of ore. In the western sections of this property two parties of tributors are at work getting out galena from two lodes; the ore is a good deal contaminated with pyrites, and requires dressing.

Mount Zeehan Silver-Lead Mining Company.—The growth of the town of Zeehan has interfered a good deal with mining on this Company's ground, several very promising lodes being known, which are not worked on account of legal difficulties. These, I understand, however, are being got over, and a start should soon be made with a new shaft. The underground work from the main shaft has not resulted satisfactorily, the lode having been poor. A May's concentrating plant has been erected, and the accumulated second-class ore dressed and sold, while a good deal of work has also been done with it for other companies. I have great faith in the future of this property, but unless a rich shoot of ore is soon struck it will have difficulty in carrying on operations without fresh capital. The Company deserves success, but has had very poor luck.

Mount Zeehan (Tasmania) Silver-Lead Mines.—Good progress is being made on the Argent section, where two lodes are being worked from the main shaft. When I saw the mine the lodes were looking very well and turning out a payable quantity of ore, and I have little doubt that they will continue to do so, provided that exploration work is kept well ahead of the stoping. A concentrating plant, by Green of Aberystwith, in Wales, has been erected, but was not working very well at the time I saw it owing to defects which probably have since been remedied.

New Tasmanian.—Two lodes are being worked in this mine from shafts at some distance from each other. On the No. 1 lode operations were confined to sinking the main shaft when I visited the mine. At No. 2 lode ore was being raised, and the lode looked fairly good. The ore, however, is not so rich in silver as in most parts of the field, and the mine has in consequence some difficulty in paying its way. When the lodes have been more thoroughly opened out there is every reason to hope for better results. Green's plant for concentrating the ore has been erected at the main shaft, and does very good work.

Grubb's.—This mine ranks next to the Western as an ore-producer at the present time. There is a large stock of second-class ore at grass and in sight in the mine, and first-class ore to pay all expenses is readily obtained. The main shaft is being sunk deeper, and the production of ore may be expected to increase. A tramway has been built at heavy cost from the mine to the railway station, and a very good winding and pumping plant provided, but no dressing-works as yet.

Silver King.—At the time of my visit the only work in progress was the erection of Parke and Lacey's concentrating plant of jiggers and Frue Vanners. No work was going on underground.

Oonah.—A tribute party who took this mine have been lucky enough to find a very rich lode containing rich oxidised ore in its upper portions, and good galena lower down; they have also found another small lode of pure high-grade galena. The mine promises to be a very good one, the main lode being strong and rich.

Junction.—This mine is also let to a tribute party, who have done some work on a lode containing rich siliceous ore, and also on a continuation of the Western Company's main lode; in the latter they have got some very good galena. There seems every probability of this being a good property, but it will never be developed by the unaided efforts of tributors; the Company will have to raise some money and put machinery on the ground before permanent success can be hoped for.

Tasmanian Crown.—A main shaft is being sunk, and a good deal of work done on surface in connection therewith; but mining work is at a standstill till the shaft is down.

Mariposa.—A main shaft has been sunk and the lode seen on surface, intersected by a cross-cut from the bottom of the shaft. A few months' work should now prove this mine fairly well. It seems to me to have a very good prospect of success.

Maestrie's Broken Hill.—Comparatively little work has been lately done in this mine, though a certain amount of ore has been raised all along. In the beginning of 1892 over 3000 tons of ore were raised and smelted at the Zeehan and Dundas Smelting Works, but this exhausted the main body of good ore available above water-level. The adjacent Comet mine having now lowered the water in the country, this mine is going to work again, and should shortly put out ore in some quantity.

Comet.—After doing all that could be done to prove their lode by means of adits, with the result of finding themselves only coming on the top of the ore bodies at the lowest level attainable, this company has sunk a main shaft and put in a cross-cut to the lode 100 feet below the lowest adit. In the face of this a heavy influx of water was struck, and the workmen have not yet been able to resume driving, though the water is being gradually mastered. This is a most important work to both the Comet and the Maestrie's Broken Hill companies, as there is good hope of the lode being cut below the zone of oxidation. As the only ore found in the adit levels was got towards the eastern boundary of the section, I do not think it probable that the lode when first struck at the bottom level will be rich, the shoot of ore being probably only reached after driving some distance through poor lode stuff. There seems to me to be every reason to expect that there will be rich

and important discoveries of ore in this and the adjacent Maestrie's mine at this level; but it is quite possible that even now the mine is not deep enough to get away from the gossan.

Dundas P.A.—This company is working on a large ironstone lode, which also goes into the Central Dundas company's ground. Very good galena is being got from a vein enclosed in walls of gossan, and in the vicinity of this vein the gossan is fairly rich, and would probably pay if it could be smelted on the spot. This mine is at the present time one of the most promising in the district, and could put out a large quantity of ore if equipped with better machinery. It is a property which deserves vigorous development instead of the present half-hearted working, and would in my opinion give a handsome reward to an enterprising proprietary who would put capital into it.

Adelaide.—A main shaft has been sunk and levels opened at 115 and 170 feet. The lode seems very large, for no wall has yet been found in the workings. Some veins of good galena are being worked, and the mine is paying its expenses, but the oxidised ironstone has not yet been got through, and the shaft will have to be sunk still deeper. There has been a decided improvement in the mine going downwards, and every encouragement for the Company to work on in the expectation of brighter days.

Other Mines.—The above include all the more important mines now at work; there are several others shut down owing to financial embarrassments and the faint-heartedness of shareholders: a short mention of some of these must suffice for the present Report. Balstrup's Manganese Hill mine, after doing a great deal of work from adits, only to discover that the ore lay below them, went into liquidation, and the leases of the sections have been sold to the Mount Zeehan (Tasmania) Silver-Lead Mines Company. A main shaft has been begun and ought to be carried on, and the mine opened at a depth, for the prospects are indisputably good, and the work yet done has proved nothing against them, but has bettered them. That the mine has cost a lot of money is nothing to its discredit, but only to that of those who have had the management of it. The Central Balstrup's mine is in very much the same position—abandoned before proper mining has begun. On the South Balstrup's there is a shaft, but no mine opened from it. On the Silver Queen Extended a party of tributors are getting a little ore, the Company having ceased work. The Despatch Company, after sinking a shaft, were swamped out by water and gave up working, leaving a party of tributors to represent their mining force. The New Great Eastern Company also have a shaft full of water and are doing a little prospecting. On the Comstock mine a party of tributors are doing very well, raising the shallow and easily-got galena from along the outcrop of the lode; they are proving that there are good shoots of ore in the mine for an enterprising company to work. The New Silver Stream mine has a large quantity of ore-bearing material exposed, but is at a standstill pending negotiations for floating a new company in London. This mine has very good prospects, so it is to be hoped that capital to develop it will be obtained, for nothing can be done with it otherwise. On the Nubeena Section a party of tributors are raising good pure galena ore from a small lode. The Sunrise mine is in a similar condition; the tributors in this case have done a lot of work and obtained payable ore in reward for it. The Silver Bell mine is doing nothing; a main shaft has been started and a very nice engine procured, but disputes and legal complications have stopped all work for the time being. The Silver King Extended Company have made one or two abortive efforts to begin mining, but have done nothing worth mentioning; nevertheless the prospects of the property are very fair. The New Pyramid Company sank a shaft and put a ridiculously small winding and pumping engine upon it, and soon got beaten by the water, as was only to be expected. The New Maxim Company have never done any work of practical value to prove their lode. The Oceana Company, after doing a good deal of work and laying bare a large quantity of good fluxing ore of rather low silver value, ceased work, and it is understood have let the mine on tribute to the late Manager. This has every appearance of being an excellent mine, and work need never have been abandoned had the mining market been in an ordinarily healthy condition. The Austral mine was abandoned after a very short and insufficient trial. At North Dundas the Success and Owen Meredith mine has made a good attempt to struggle on in spite of difficulties of access, and has sent out a good deal of rich ore. Nothing of consequence will ever be made of this mine, however, until a main shaft is down and machinery upon it: this means either a road or tramway to be constructed several miles. The prospects of the mine's ultimate success are nevertheless good. The Success Extended has been worked by tributors, who have succeeded in raising some very good galena from the surface portions of the lode; they cannot, however, get down more than a few feet for water, and machinery will have to be provided before this will be a mine. The Commonwealth Company are driving a long tunnel under a huge outcrop of iron gossan; it is to be hoped that their perseverance will be richly rewarded. The Madame Melba mine has been abandoned after anything but a fair trial; its prospects are such as to well justify further exploration. The Fahl Ore mine is rather difficult of access, and requires machinery, which cannot be got in until there is a road: some very rich ore is found in it, and the lode is strong and distinct, but the length of the shoot is not yet ascertained. The Grey Ore mine consists of a shaft in a bed of breccia (country rock). I could see no sign of any lode, and cannot imagine what was being mined for. On the Kapi's claim a small vein of nice-looking galena has been laid bare by a tribute party. The Hassett's Company began sinking a main shaft to test the large gossan outcrops showing on surface, but could not cope with the water.

There are a great many other mines not mentioned on which some work has been done, but I think the above includes most of those that have either done a fair amount of work or show some signs of life. An opinion is abroad that a large number of Zeehan and Dundas mines have been tried and found wanting; perhaps the above synopsis of the state of the field will serve to show that this is not the case. There have been a great many insufficient and ineffectual attempts at opening mines, but no case can be pointed out where a promising lode has been properly tried and proved a failure, and, on the contrary, almost every mine on which mining worth the name has been done has shown great encouragement for proceeding with development. After a careful examination of the whole field I see no reason to alter the opinion formed of it over two years ago that it will prove an important, and on the whole, payable mining district. But the owners must be prepared to subscribe money for opening their mines, and must not expect them to pay their way from the start. An over-estimate of the value of the lodes and under-estimate of the cost of opening them have been the causes of the severe check the field has experienced almost as much as the general commercial depression.

Mount Heemskirk.—While at Zeehan I went out for one day only to look at the West Cumberland and New Cumberland mines at Mount Heemskirk, and was surprised at the prospects of tin that were visible on both properties. Neither has had a mining trial, though large sums of money have evidently been spent on batteries, tramways, dams, and other surface works. Lately, Dunn and party have been getting very payable returns from the stuff mined and left by the old Wst Cumberland Company, and there seem very good prospects of resuscitating this mine. Splendid water power is available, and the facilities for mining by adits, and transport of ore by gravitation are very good, so a low percentage of tin in the stone should pay. It should be borne in mind that the cost of living and of delivering goods of all sorts at Heemskirk is now much less than it used to be when this field was worked before, and that properties that would not pay then might pay now. A good many co-operative parties are at work in the district getting alluvial tin, with varied results, some doing well, others not making a living. My visit to Heemskirk was too short to allow me to form an opinion of much value as to its future as a mining field, but in the case of the two mines visited it certainly seemed to me that they had been prematurely abandoned, and that there is good hope of their yet becoming profitable properties.

Queen River District.—A good deal of alluvial gold mining has been quietly going on for some time past in the vicinity of the Queen River and its tributaries, but quartz mining is at a very low ebb. The Madam Howard mine has been shut down for some time, and so also have the Princess River and Princess River Extended. A little work is going on at Lynchford, on a quartz reef near the old King River mine, but as yet nothing of importance has been got.

Mount Lyell.—As I am forwarding to you in a day or two a full report on the Mount Lyell mine, it will not be necessary to describe it now.

I have the honor to be,
Sir,
Your obedient Servant,
A. MONTGOMERY, *M.A.*, *Geological Surveyor.*

The Secretary of Mines, Hobart.