REPORT

OF THE

SECRETARY FOR MINES

FOR

1895-6,

INCLUDING THE REPORTS OF THE COMMISSIONERS OF MINES, THE INSPECTORS OF MINES, THE GEOLOGICAL SURVEYOR, THE MOUNT CAMERON WATER-RACE BOARD, &c.

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REPORT OF THE SECRETARY FOR MINES.

Office of Mines, Hobart, 27th July, 1896.

SIR,

I HAVE the honor to submit my Report of the Mines Department for the year ending the 30th June, 1896.

Appendices.

Appended will be found Reports from the various Commissioners of the condition of the Mining Industry in the Divisions under their charge; the Reports of the Inspectors of Mines; the Annual Report of the Geological Surveyor; the Annual Report of the Mount Cameron Water-race Board; and the Geological Surveyor's Report—

(1.) On the Mineral Fields of the Gawler River, Penguin, Dial Range, Mount Housetop, Table Cape, Cam River, and portion of the Arthur River Districts, dated 29th July, 1895.
(2.) On Mineral-bearing Country near Quamby Bluff, dated 24th January, 1896.
(3.) On the Zeehan and Dundas Mineral Fields, in February, 1896, dated 8th May, 1896;

With Returns of the operations of the Diamond Drills and Examination Papers set at the Examination for Mine Managers' Certificates: together with Tables showing the yield of Gold, Silver, Tin, and Coal; the number of persons engaged in Mining; the number of Leases and Area of Land held under Lease for Mining purposes; the number of Mining Companies registered during the year, and the net Revenue paid to the Treasury from Mines.

General remarks.

It is to be noted with satisfaction that the general progress of the industry which was recorded in last year's Report has been fully maintained this year. Not only has the yield of our principal metals and minerals—Gold, Silver, Tin, and Coal—increased considerably, but the progress of development has been most marked in all parts of the country, and the year closes with a brighter outlook than usual. This cheering aspect of affairs is not taken in view of the large amount of company-mongering and scrip-jobbing which has characterised the year's proceedings, but is the result of a calm and dispassionate analysis of the energetic and systematic mining works which are now going on throughout the mining districts. The hopes of the country are just now centred in the West Coast, especially in the region of Mount Lyell, and there would appear to be every justification for the belief that those hopes will be fully realised. So far everything seems to indicate that the success which will attend the skilful and energetic opening up and treatment of the vast stores of ore which the parent mine of that region contains will go far to revolutionise not only the West Coast, but the whole of Tasmania. Apart from Mount Lyell, but in the same mineral belt, there are numerous other mines of great promise, but, as yet, in the very early stages of development. Tracks, tramways, and railways, which are rapidly following in the wake of these discoveries, will shortly give ready access to a line of country which contains vast stores of wealth waiting to be unearthed. The Mount Lyell Railway, starting from Teepookana on the shores of Macquarie Harbour, near Strahan, to Queenstown, where are situate the reducing works of the Mount Lyell Company, is approaching completion; the rails are laid, and already passengers and light loads are carried along it.

Mount Lyell Railway.

N.E. Dundas Tramway.

The light steam tramway or railway from Zeehan, some 16 miles into the Mount Reid country, which was spoken of in last year's Report as contemplated, was duly authorised by Parliament, and is now progressing rapidly, and in a few months hence will be completed. These two lines will greatly facilitate the operations of the miner.

Waratah-Zeehan Railway.

A Bill is now before Parliament to revive a lapsed authority previously given to a company to construct a railway from Zeehan *viâ* Waratah to the shipping port at Burnie. This line will traverse mineral country from end to end, and will open up a large area of promising country, with great mining possibilities, besides affording a comfortable overland route to the mining fields of the West Coast.

With works such as these in progress and in contemplation, a large increase in the output and in the employment of labour may naturally be anticipated in the very near future.

The appended Reports of the Commissioners of the various mining centres will give details of the progress of the several localities; but a brief glance at the present condition of affairs may not be out of place here.

Mount Reid.

Much has been done in this District and the N.E. Dundas neighbourhood in the way of prospecting and preparation work. Here are situate the Rosebery, the Hercules, and the Curtin-Davis group of mines, which, with others, are vigorously preparing to take advantage of the Mount Reid Tramway by sending out the vast stores of mineral wealth which they are known to contain.

Dundas.

This locality is resuming its former activity. Some of the mines here, notably the Comet, are giving promise of being early on the dividend list.

Zeehan.

Steady advance is being made on this field. The neighbourhood is assuming a settled business-like air; the older established claims, such as the Western, the Silver Queen, the British Zeehan, are "getting down," and proving the permanence of the field; and the output is increasing month by month.

Tributing is largely carried on on this field to the decided advantage of both tributors and mine-owners. There is much room for difference of opinion as to the merits of the tribute system; doubtless it requires regulating, and will shortly require to be seriously and carefully dealt with; however, it is unquestionable that without tributing Zeehan would not have been in the prosperous condition that it is to-day; lessees could not have held their land; it therefore behoves them to well consider the question of letting fair and reasonable tributes so as to enable the system to continue.

Labour Covenants of Leases.—It is becoming a serious question as to how far lessees may be permitted to systematically disregard the very lenient covenants of their leases in respect of labour, and there are indications of the Government shortly requiring a more close observance of these conditions than has hitherto been the case. There is much to be said upon the subject. Defaulting lessees may plead work done in the past; the desirability, for financial reasons, of a temporary suspension of operations; the heavily-timbered rugged nature of the country; the absolutely impossible means, from want of roads, of getting materials to or from their mines, and so forth. All these reasons have, and rightly so, to be fairly considered, but it is not to the interest of the country that they should be given undue weight to.

Heemskirk.

This old field is practically dead, temporarily only it is thought, for there are doubtless large deposits of tin-bearing stone there, but they would be costly to mine, and the low price ruling for tin for a long time past has not afforded encouragement for speculation in that direction.

Corinna.

The developments at this locality, which were referred to in last Report, have not, so far, resulted successfully.

Rocky River.

A large amount of prospecting work is going on here, but it is early yet to speak of the probable result.

Mount Bischoff.

The premier tin mine of the Colonies maintains its customary output, and continues to pay its monthly dividends. During the twenty-three years of its existence the yield to 30th June last from this mine has been 48,500 tons, and dividends amounting to £1,419,000 have been paid, equal to £118 12*s.* 6*d.* per share. Outside the Mount Bischoff mine but little mining work has been done during the year.

North-West Coast.

So far there has been no systematic regular work done in this region, although a considerable and valuable deposit of iron ore is known to exist and to be held under lease at the Blyth River, and there are valuable deposits of gold, tin, bismuth, and galena of greater or less extent in the vicinities of Table Cape, Penguin, Mount Housetop, Mount Claude, Bell Mount, Middlesex, the River Forth, and other localities, on all of which some desultory work has been done, but, so far, none of them have been developed with that energy which their indications would seem to warrant. The coal deposits in the neighbourhood of the Mersey and Dulverton continue to be worked on a small scale.

Beaconsfield.

This field still holds its own, and much and encouraging work has been done there during the year. The Tasmania Mine, from which, during the 19 years of its existence, over 11 tons of gold have been won, shows no signs of being worked out; on the contrary, the management has been encouraged to add extensively to its equipment, and recently a fine Luhrig concentrator and chlorination plant has been erected, electric light installed, and other additions effected. During the year 30,093 ounces of gold have been won. From its inception this mine has paid £616,275 in dividends.

Lefroy.

This field is not so prosperous as it was at the date of last Report; it is now undergoing one of those temporary lulls to which all mining fields are subject the world over, but, with the energy that is persistently displayed, it is confidently anticipated that in the course of the coming summer there will be a revival. It is in contemplation for the leading companies on the Volunteer line of reef to join forces and sink a few hundred feet deeper, in the hope of again picking up richer stone.

North-Eastern and Eastern Districts.

The alluvial tin-fields have maintained their average yield for the year, and there is evidence that there are yet large deposits of tin to be won, although, of course, it is not to be expected that the large output of past years is to be continued. Lode tin-mining is yet in the experimental stage. That the tin is there is undoubted; the problem to be solved is, can the capital be found to provide suitable appliances for its profitable extraction?

Scamander.

The copper deposit at the Scamander is opening up satisfactorily, and bids fair to become a successful venture.

Mathinna.

Great energy is being displayed here, incited by the success at what is known as "the model mine" of the Colony—the Golden Gate. A considerable amount of that much-desired commodity—capital—has found investment on this field. Excepting active exploratory work there has been no profitable result at present; but it is early yet to expect it. The Golden Gate mine has yielded a total of 75,800 ounces of gold, and has paid £117,600 in dividends; its average yield has been 17 dwts. 13 grs. of gold to the ton of quartz.

Mangana.

It is satisfactory to note that this locality, for a long time practically deserted, is reviving again. During the year several new mines have been opened, with fair promise of success.

Mount Nicholas Coal-field.

The coalfields at this Range have somewhat increased their output this year. The coal is used by the railways and for domestic purposes throughout the Colony. The consumption is purely local, the long railway haulage prohibiting export at a profit.

Details of the foregoing matters are more fully set forth in the attached Reports of the various local Commissioners; they are merely touched upon here as evidence that the mining interest of the Colony is advancing.

Prospecting.

A very encouraging feature in the year's work is the large amount of prospecting which has been going on in all directions. At no period has it been exceeded, and, considering the dense impenetrable forests and the rugged nature of most of the mineral portions of the country, too much praise cannot be bestowed upon or encouragement given to the hardy intelligent men who undertake the arduous work of prospecting.

Mine Managers' Examinations.

One certificate only has been issued during the year. The scheme is generally approved by mineowners and by the more intelligent class of miners. Some complaint has been made that the examination is rather stiff; but it will be recognised that to be of any value the possession of a Certificate must be gained only as the result of a thorough examination, and, moreover, that it is a valuable credential of competency in any part of the world. It will be well for uncertificated managers to bear in mind that at no distant period the law may, and probably will, require the possession of a certificate as a necessary qualification for holding the position of manager of a mine.

Schools of Mines.

The only attempt which has been made in this Colony towards the formation of these desirable institutions has been at Zeehan, where the miners, by themselves, and unaided, established a school in a comparatively small way a year or so since. They have voluntary lectures, and the course includes Mineralogy, Blow-piping, Chemistry, Analytical Chemistry, Assaying, Mathematics, Elementary and Applied Mechanics, Mine Surveying, and Mechanical Drawing. There are now 49 students on the books of the school. Examinations of the last term shewed very satisfactory progress, and it is gratifying to note that the one candidate, who passed a very creditable examination, and gained a First Class Mine Manager's Certificate at the last examination, gained much of his knowledge at this school. Parliament has seen fit to recognise the value of such an institution by granting a sum of £100 in aid for this year, and a proposal is before Parliament to make the vote for 1897 £200,—a useful recognition, which will be much valued by the Zeehan miners.

Mining Accidents.

It is satisfactory to note that the number of these for the year is somewhat below the average: as is usual, the majority of these accidents were due to the carelessness of the men themselves.

Production.

Mineral.	For the Year 1894–5.		For the Year 1895–6.		Increase.	Decrease.	Total Increase.
	Quantity.	Value.	Quantity.	Value.			
		£		£	£	£	£
Gold.....	58,301 ozs.	218,629	63,861 ozs.	239,479	20,850	...	...
Silver.....	19,665 tons	196,650	21,360 tons	213,600	16,950	...	...
Tin.....	4236 „	275,340	4198 „	260,270	...	15,070	...
Coal.....	30,563 „	24,450	36,274 „	32,647	8197	...	...
Totals.....	...	715,069	...	745,996	45,997	15,070	30,927

Gold. The yield for the year has been 63,861 ozs., against 58,301 ozs. for the previous year, an increase in value of £20,850.

The several fields have contributed as follows:—Beaconsfield, 33,686 ozs.; Lefroy, 10,160 ozs.; Mathinna, 15,663 ozs.; other localities, 7365 ozs.

Silver. The increase in the yield of this ore has been 1695 tons.

" There has been a decrease of only 38 tons of this ore.

Coal. The increase in the output was 5711 tons.

Division of the Colony. For departmental convenience the Colony is divided into Districts as follows:—The Northern and Southern, comprising the country on the right and left banks of the River Tamar as far west as the River Forth, and on the east to the Scottsdale District, with such mineral country as there is in the southern portion of the Colony, and includes the gold-fields of Beaconsfield, Lefroy, and Lisle. The North-Eastern District comprises the whole of the north-eastern country, including several important tin-fields, with the gold-fields of Waterhouse, Warrentinna, and Mount Victoria. The Eastern District comprises the eastern portion of the Colony, and includes the tin-fields of Weldborough, Blue Tier, Gould's Country, Ben Lomond, and St. Paul's River, the extensive coal-bearing country around Fingal and Seymour, with the gold-fields at Mathinna and Mangana. The Western and North-Western District embraces the wide area of country extending from the River Forth northwards, southwards, and westwards to the sea; it includes the celebrated tin deposits at Mount Bischoff, the River Iris, an extensive area of tin-bearing country at Heemskirk and Cox's Bight, the silver-fields at Heazlewood, Zeehan, and Dundas, the gold-fields at Mount Read, Mount Lyell, and the Linda, with other more or less important mining centres.

Departmental Staff. The increase in the work of the Department has necessitated a slight addition to the clerical branch, some of it of a temporary character only. With the exception of one regrettable instance in the Launceston branch, resulting in the dismissal of the officer, it affords me pleasure to record my thanks to the several officers of the Department for the able, loyal, and willing assistance afforded during a year of exceptional pressure.

Mount Cameron Water-race. The Report of the Board which has control of this Race is annexed.

Diamond Drills. Details of the work done with these machines are appended.

In conclusion, I have satisfaction in reporting that the work of the year affords evidence of distinct progress, and justifies the anticipation so freely expressed on all sides that there is a prosperous mining outlook for the future.

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

F. BELSTEAD, *Secretary for Mines.*

The Honorable the Minister of Mines.

REPORTS OF COMMISSIONERS.

Commissioner GLOVER, in charge of this Division, writes:—

Northern and Southern Division.

"In reviewing the events of the twelve months ended 30th June last on the Northern Gold-fields, I have the honor to report that the fluctuations of success and disappointments inseparable from the progress of undeveloped mining fields have duly characterised the fields of Lefroy and Beaconsfield.

Lefroy.

Twelve months ago the intense mining excitement which had prevailed at Lefroy was rapidly subsiding, though leaving behind it tangible indications of the good as well as the evil of its existence. Whilst the scores of fraudulent or fictitious mining operations had reached the limits of their influence and disappeared from the scene, many ventures which had been founded in *bonâ fide* enterprise remained in activity. Nearly twelve months have now elapsed, and of these new undertakings some fourteen are now still in active operation, besides the original six mines which were previously in work. Three of these, up to near the middle of the year, were paying dividends. These last, however, having carried their operations below the comparatively surface levels of payable stone—about 400 feet—which have hitherto characterised the reefs at Lefroy, are now devoting their energies to the necessary work of sinking to deeper ground. One of these, on the line of reef known as the 'Pinafore,' has attained a depth of 860 feet, and one on the Volunteer line a depth of 650 feet, and all three are proceeding hopefully with the work of reaching much deeper levels. Whilst all of the new ventures are being worked with energy, two or three of them have met with payable stone, small trials of which have been reported as satisfactory. The field is therefore at present in a tentative condition, though with much promise of success, and prospecting is being actively carried on. The quantity of gold obtained from Lefroy for the twelve months was 10,160 ounces, value £41,712.

Beaconsfield.

The past period of 12 months has witnessed the progressive development of the only considerable source of gold production at Beaconsfield—the Tasmania Mine. The completion of the appliances for increased crushing power, now amounting to 105 stampers, has augmented the Beaconsfield contribution of gold by an increase in the last quarter compared with the yield of the first quarter of the year of 7502 ounces, the first being 3616 ounces, and the last 11,118 ounces; and a still further increase of yield must shortly result from the "concentrates" from the Luhrig apparatus on the completion of the chlorination works now nearly available. During the past 12 months some excitement arose at Beaconsfield through a promising discovery on one of the prospecting claims now known as "North Tasmania," which caused a large number of claims to be marked off for leases, as well as many prospecting claims, and with the usual accompaniment of disputes and litigation. Although the process of development is proceeding vigorously on the claims in question, nothing definite has yet been arrived at. It is expected that the Ballarat Company, whose enterprise of testing the deep lead at the base of Cabbage Tree Hill was, after the expenditure of many thousands of pounds, suspended on the failure of the Victorian banks, will very shortly be resumed. The total quantity of gold yielded by Beaconsfield for the past 12 months was 53,686 ounces, value £123,368; that of the previous year being 20,433 ounces, value £77,404.

Lisle.

The old and once largely productive gold-field of Lisle still continues to retain its average of 50 diggers, who contribute some 1000 ounces of gold per annum to the general yield.

Golconda, Denison, and Panama.

The adjacent country of Golconda, Denison, and Panama Creek is now again attracting many prospectors, which justifies the expectation of discoveries in this highly auriferous region, which only needs efficient exploration to ensure success.

Middlesex.

At Middlesex much interest seems to have been excited lately in exploring that neighbourhood, and many prospectors are now at work there.

On the whole I am justified in expressing my opinion, that at no previous period have the Northern Gold-fields presented a more hopeful aspect."

Mr. Commissioner O'REILLY reports as follows:—

The North-Eastern Division.

Gold.

"The state of gold mining in the locality of Mount Victoria has exhibited marked activity during the past year. Although the crushings and returns therefrom have not been so large as in the previous year, a large amount of preparatory work has been done at several of the claims, and is being still continued, the prospects so far being considered very satisfactory and encouraging. A considerable amount of foreign capital has been introduced, and is being expended judiciously in the preliminary work of opening out the mines. The prospects of this mining field are considered very satisfactory and encouraging. At Warrentinna but little has been done during the past year; the principal claims there are almost all held by companies who, apparently, are not possessed of

sufficient capital to develop the resources of their mines. I understand that efforts are being made to introduce capital for the working of several of the principal claims, and should such be successful there are reasonable grounds for looking forward to satisfactory results from its judicious expenditure in developing the claims. A good deal of prospecting work has been done in new ground, and several 'finds' of an encouraging and hopeful character have been made, and which will, no doubt, be fully tested during the coming year.

Quartz crushed	1053 tons.
Gold won	682 ounces.
Average number of men employed.....	70

Tin.

The state of the tin-mining industry in this district during the past year does not exhibit any marked improvement over the previous twelve months, beyond an increase in the output of 90 tons; indeed, any material improvement in this industry cannot reasonably be looked for so long as the present low prices for tin ore continue. There still remain extensive deposits of alluvial tin, but such deposits are not sufficiently rich to mine profitably at the present low prices obtained for the ore. Many of the old claims continue to maintain a steady output of tin ore, and give promise of satisfactory returns for many years to come. There are but few of the claims on which miners are employed on wages, the largest proportion of tin being raised on tribute and by the holders of Miners' Rights. English capital is being expended in developing the tin lodes known to exist on the 'Nugget' claim at Ringarooma, and so far the prospects are reported as being very favourable; machinery for crushing the lodes is being erected, and in a short time will be at work. A considerable number of men are now employed on this claim.

Tin ore raised	1296 tons.
Average number of men employed—	
Europeans.....	226
Chinese	295."

Eastern Division.

Mr. Commissioner Dawson reports:—

Alluvial Tin.

"There is a decrease in the yield of tin-ore from the alluvial compared with last year. The low price of tin still prevents the poorer areas from being worked by persons holding Miners' Rights. The year, too, has been exceptionally dry until quite lately. Leaseholders are also prevented from working their poor ground. For fully nine months of the present year many claims were stopped for the want of water. Now things are looking better, as there is a good supply of water all over the district.

Lode-mining.

I regret to inform you that no progress during the year has been made in lode-mining. The Australian Mine (late Puzzle) has entirely collapsed, not that the lode-stuff will not pay, but because the machinery used has proved a failure, both in crushing and saving the tin-ore. From reliable information I have received, nothing like the estimated quantity of stuff could be treated. Even the stuff that was put through the grinders was very imperfectly crushed, and in addition to this the tin-saving machinery was a failure. The works are now at a standstill.

A large amount of work has been done at the Anchor Mine in laying down a new tramway, water-races, &c. There is also a large quantity of machinery on the wharf awaiting transit to the mine. About 20 hands are employed on the various works. I venture to think it will be some time before this mine will make a start to crush any stuff.

Gold from quartz.

This industry appears to be progressing steadily at Mathinna, and, I may add, at Mangana. The Golden Gate still keeps up a good record, and prospecting is going actively along over a large area of the district.

As I said in my last Report, alluvial mining is practically a thing of the past.

Copper at the Scamander.

I am unable to report anything very definite as to this industry up to date. I am of opinion that it will take a considerable time yet before the success or otherwise of this industry can be determined. It is just a case of prospecting, which is being very carefully done by various holders of ground.

Coal.

I have nothing special to report as to this established industry. The output keeps up from both mines, and the quality of the coal keeps satisfactory."

The North-Western Division.

Mr. Registrar Tegg reports:—

"As regards the mining industries in this Division during the last 12 months, I have the honor to report as follows:—

Tin.

The Mount Bischoff Company's mine continues its regular output, and there is nothing to indicate that it will not continue to do so.

The Stanhope mine for some time past has been worked on tribute, but with indifferent success.

The West Bischoff is not working, but it is said the proprietors are endeavouring to form a company to work it.

The Waratah Alluvial is being worked with payable results, as is also the 80-acre section formerly known as the "Phœnix," but now leased by Harcourt & Tippett.

Silver.

Mining in the Whyte River and Heazlewood Districts has been, to some extent, at a standstill, but the prospects of both places are beginning to brighten up, and there are indications of a revival setting in shortly.

At the Magnet Silver mine, formerly Godkin Extended, and at the Heazlewood S.M. they are busily employed in erecting machinery. At both mines the prospects are good.

At Bell's Reward, at the present time, no work is being done, but this, I understand, is pending the flotation of a company.

At Mount Stewart, formerly Hamilton Hay, and at the Magnet, and on several other sections, work is being actively carried on.

The 40-acre section formerly known as "The Silver Cliff," and distant about two miles from Waratah, has again been taken up, and a company floated to work it.

Copper.

A very rich lode, carrying gold and silver, has been found at Nine Mile Creek, Brown's Plains. The ore, I am told, is equal and similar to that of Mt. Lyell. The prospectors have sunk 30 feet on a good body of ore, and which is said to be highly payable.

Gold.

At the Specimen Reef mine they are still driving to cut a reef at the low level.

At Long Plains there is a quartz formation, in some places very rich in gold. A good deal of work has been done, but operations have now ceased pending flotation into a company.

On the Rocky River G. M. Co.'s property a great deal of work has been done, and some fairly good stone got near the surface. They are now driving at a low level, and expect to cut a payable lode. During the last 12 months this company has driven about 1000 feet through hard country.

The Savage River Company are busily engaged in driving to cut a lode supposed to be connected with an iron formation.

At the Rio Tinto mine they have a very large iron lode, and which is getting well prospected, some 500 feet of tunnelling having been done during the last six months. Some very good assays of gold and copper have been obtained.

On several other sections in the above localities prospecting is being actively carried on.

Hydraulic Sluicing.—Operations so far have not been a success, for out of six companies four have ceased operations. Two, the Corinna and Brooklyn, are let on tribute with fair results. The Frenchman's Peak Company are still sluicing, but have not yet had a clean up.

During the last six months some 200 ozs. of gold have been won from Paradise Creek, nuggets ranging from one to seven and a half ounces having been got.

On the whole, the prospects of the mining industry in this Division seems to have taken a turn for the better, and a more hopeful spirit prevails.

Western Division, Northern portion.

Mr. Commissioner HALL thus writes:—

"I am glad to be able to say that the district is monthly showing signs of increased prosperity. The export of silver for the quarter is slightly under what it was last quarter, but the decrease is owing to the fact that for some time output from the Western was stopped owing to an accident to the machinery; and at the Oonah the widening of the main shaft lessened the quantity that would otherwise have been sent away. The total amount sent away is, excepting that from the Comet, contributed by the mines in and around Zeehan, and the same mines individually contribute about the same proportion every month. There is so far nothing coming from the lodes that have been discovered and are now being opened up in the more distant portions of the district, nor do I anticipate that they will increase the output for some time yet, as, although they are being vigorously opened up and prospected, still it will take time to develop them, and returns cannot be expected for many months. Prospecting operations are being extended north, south, and east of Mount Reid, and, so far, with good promise. The greatest drawback is difficnlty of access, and if that were made easy I have no doubt many important discoveries would be made in that locality.

There is not much gold being won now. The Ring River district has no one working it for gold, and what is bought by the banks comes from the Melba Flats, where there are still a few fossickers.

Tin-mining shows no sign of improving, and is not likely to revive in this district as long as the price is so low.

The N.E. Dundas Railway has the rails laid now for a distance of about six miles from Zeehan."

Western Mining Division, Southern portion.

Commissioner FOWELL reports:—

"I have the satisfaction of being able to assure you that from now there is every reason to believe mining in its true sense will steadily proceed.

It has been proved beyond all question that the deposit upon the Mount Lyell Mining and Railway Company's property can be treated successfully. This must give a great impetus to the

surrounding properties, upon which minerals are known to exist, to at once go to work and develop them.

The railway being almost completed will be of great advantage to those companies who desire to get machinery upon their claims.

The thorough and practical way in which the Mount Lyell Company have carried out their work, and the able men whom they have in charge of their various departments, deserve all the praise which can be awarded them, and that they may meet with good returns for their enterprise and labour must be the wish of everybody who has an interest in the West Coast.

Much more activity in prospecting has been observable during the year, and there are few properties in the vicinity of the Mount Lyell Mine that have not been prospected sufficiently to warrant more extended work; consequently holders of leases must expect they will be required to carry out the labour covenants of their leases in a more satisfactory manner than they have hitherto done.

A large area of entirely new land has been applied for under Gold and Mineral Leases, and as the country gets opened up by tracks and tramways, this must continuously be the case.

Several applications have been made by prospectors for extended claims to enable them to prospect for gold at a depth, and this is very much required. From the broken and disturbed nature of the surface of the country it is absolutely necessary to get below it to find anything permanent.

There is still a large extent of country to prospect, and I most respectfully suggest the desirability of cutting tracks during the summer months, which afterwards could be made use of by prospectors. I feel sure such work would be reproductive."

ANNUAL REPORT OF THE CHIEF INSPECTOR OF MINES.

Mining Accidents.—The number of accidents that have taken place in and about mines whereby persons have been injured or killed has been rather less than usual, being 23. The figures for the last six years are as follows:—1890-1, 27; 1891-2, 19; 1892-3, 29; 1893-4, 27; 1894-5, 28; 1895-6, 23.

The number of fatal accidents this year has, unfortunately, been more than the average, seven men having lost their lives. Of the remaining sixteen cases six were attended with severe and serious injuries to the men hurt, and ten were of a less serious nature. The following table shows the accidents due to various causes:—

Cause.	Fatal.	Not fatal.		Total.
		Serious.	Not serious.	
Falls of earth, stone, coal, and trees	3	...	3	6
Falls from staging in batteries	...	...	3	3
Jammed by trucks	...	...	2	2
Falls down shafts and winzes	2	2	1	5
Cleaning machinery in motion	1	2	1	4
Caught by cage	...	2	...	2
Explosions	1	...	...	1
TOTAL	7	6	10	23

None of the persons injured were Chinese, so that the usual classification into Europeans and Chinese does not this year appear in the table.

One of the fatal accidents was due to a man falling down the shaft of the Colebrook colliery, which was not at work at the time, and was insufficiently protected. The man had no business at the shaft, and the acccident can scarcely be considered a mining accident in the usual sense of the term. Another fatal accident from a fall in a shaft was due to the deceased with some others descending into the mine by the ladderway to try the state of the ventilation, the men of the previous shift having been driven out by bad air; in returning up the ladders this man was overcome by the bad air and fell away. The fatal accident due to an explosion was caused by the deceased's own foolhardiness in returning to a shot which he thought had missed fire within a few minutes of lighting the fuse. Two fatal accidents from falls of earth were entirely due to the men's own neglect to properly secure the ground, and no blame could be attached to anyone but themselves. Another, from the fall of a tree upon a man working in an alluvial claim, appears to have been such as could not have been prevented by any ordinary amount of prudence and foresight, and the Coroner's jury saw no reason to attach blame to any person.

One of the truck accidents, fortunately of a trifling nature, was due to one man following with his truck too closely upon another with a preceding truck. The man who was in fault was discharged by the mining manager. Of the remaining cases, two or three at most were unpreventible mishaps, but the great majority were due to some carelessness and often folly of the men themselves, no blame attaching to the managers of the mines or to want of proper appliances.

Inspection of Mines.—As in last year, my time has been too fully taken up with the work of Geological Surveyor to give much attention to the regular inspection of the mines, only such being examined as could be taken in the course of the geological survey work. Mr. Harrison, Inspector of Mines for the West Coast, has, however, made two trips round the mines of the eastern and northern parts of the Colony, in December, 1895, and June and July, 1896, which have had a good effect in securing proper attention being paid to the provisions of "The Mining Act, 1893." Only in a very few instances was serious fault to be found with the methods by which work was being carried on, and usually these were due to ignorance and want of money rather than to purposed negligence. Warnings were given to the owners of the mines in these cases to amend their style of working, but it has not been thought necessary to resort to legal proceedings.

"*The Mining Act*, 1893."—The provisions of Part VI. of this Act, relating to the Regulation of Mines, are on the whole well observed in the mines of the Colony. Frequent inspection is, however, necessary in order to keep mining managers up to the mark in this respect, there being always a tendency towards relaxation of vigilance, and especially to allowing considerations of expense to over-ride those of safety. The authority of the Inspector is often required in the case of mines which are not paying, to enable managers to procure necessary safety appliances which the owners keep putting off providing.

By dint of much trouble and the sending out of circulars drawing attention to it, owners of mines have this year been induced to pay more heed to Section 91 of the Act, which requires the registration of mining managers; great improvement in this matter is, however, possible and very desirable, as the successful administration of the Act depends very greatly upon there being a directly responsible person in charge of each mine.

The plans of mines required to be furnished in accordance with Section 97 of the Act have been satisfactorily received this year; but a great deal of correspondence has been required in order to get them all in within reasonable time.

Section 102 is, on the whole, well observed. More attention should often be given for providing proper ventilation, especially when driving long tunnels and cross-cuts. Sub-sections XL. and XLI., providing for records being kept at the mine of the state of the appliances and workings from week to week, and for having copies of the General Rules posted up at the mines, and copies of the Act itself kept there, are often badly carried out at the smaller mines; these provisions are very useful and necessary, and the Inspectors have done all in their power to have them strictly kept."

West Coast District.—Mr. Harrison, Inspector of Mines at Zeehan, has sent in his Report of work for the year, which is enclosed herewith."

Inspector HARRISON (stationed at Zeehan) reports:—

"I regret to state that during the year there have been two fatal and five serious accidents. Accidents.

Fatal.—Through returning to a supposed missfire a few minutes after lighting the fuse. Cause of same.
Fatal.—By being drawn into the gearing of an engine while in the act of oiling.
Serious.—One while oiling water-wheel in motion.
One getting his hand in the rolls of an ore-mill.
One putting his head into a shaft while the cage was in motion.
Two from falling off ladders.

Numerous complaints have been received from miners and others, and promptly attended to. Complaints.

During the year cages and ropes have been submitted to practical tests. One cage and several ropes were condemned. Safety appliances.

Proceedings were taken against a plat-man working in the Western Mine, for neglecting his duties in having the ketches shut at one of the levels, thereby endangering the lives of four men that were travelling on the cage at the time. A verdict was obtained. Legal proceedings.

The class of explosives supplied to the field is a decided improvement on previous years, being principally gelignite. Magazines are in clean condition. A new one has been erected at Mount Lyell. Explosives.

I am pleased to be able to state that my remarks in last year's report respecting the anticipated increase in the mining industry have been abundantly verified. In all directions fresh claims are General remarks.

being taken up and worked, especially in the Mt. Lyell, Mt. Tyndall, Mt. Reid, and N. E. Dundas districts. At the former, the success attending the smelting operations now being carried on at the Mount Lyell Mine should remove any doubts that may have been held as to what the ultimate results will be from this most extensive and valuable property ; while the tramway now under construction to the N. E. Dundas district cannot fail to give a considerable impetus to mining both there, Mt. Reid, and also the Rosebery field.

In conclusion, I can have no hesitation in stating that the mining industry of the West Coast was never in such a healthy condition as it is at present."

ANNUAL REPORT OF THE GEOLOGICAL SURVEYOR.

Mines Office, Launceston, 1st July, 1896.

I HAVE the honor to submit my Annual Report for the year ending 30th June, 1896.

During the year the following Reports have been prepared and forwarded to you :—

(1.) On the Mineral Fields of the Gawler River, Penguin, Dial Range, Mount Housetop, Table Cape, Cam River, and portion of the Arthur River Districts, dated 29th July, 1895.
(2.) On Mineral-bearing Country near Quamby's Bluff, dated 24th January, 1896.
(3.) On the Zeehan-Dundas Mineral Fields in February, 1896, dated 8th May, 1896.
(4.) On a supposed Mineral Discovery in the vicinity of the White Kangaroo Rivulet, dated 18th May, 1896.

A visit was also made to the Sandfly Coal mine on 29th January, 1896, and a short *interim* report made as to the results proved by the borings effected with No. 1 diamond drill.

Geological Survey of Lefroy.

The principal work of the year has been in connection with the geological survey of the Lefroy goldfield, a progress report upon which is forwarded herewith. As soon as possible it is my intention to complete this survey, and forward a full report upon it.

Zeehan Fossils.

On the 20th June last I had the pleasure of sending to the Department a very valuable paper by Mr. Robert Etheridge, jun., Curator of the Australian Museum, Sydney, descriptive of a collection of fossils from the Zeehan and Heazlewood districts sent to him by myself in 1894. The paper is accompanied by a sheet of drawings of several of the species, and is a most useful contribution to our as yet limited knowledge of the Palæontology of the Older Palæozoic rocks of Tasmania. The specimens were mostly from the Despatch Limestones and Silver King Sandstones at Zeehan, and from the Godkin and Godkin Amalgamated Mines at Heazlewood. (See *post.*)

Enquiries as to mineral deposits.

Inquiries have lately been somewhat frequent as to the occurrence of various minerals of economic value in the Colony, especially iron ores fit for use as flux in lead-smelting, magnesite, wolfram, and graphite. Inquiries as to wolfram have been frequent for some years past, a considerably increased demand for the mineral being anticipated. At the present price, which would be about £18 a ton at port of shipment in this Colony, it is doubtful if any of the wolfram deposits yet known could be worked at a profit; but the attention of prospectors might with advantage be given to this mineral, as it is pretty widely distributed throughout the island, and might be found in payable quantities.

Treatment of Zinciferous Sulphide Ores.

The question of dealing with the zinciferous sulphide ores of the Mount Read and Mount Black districts was referred to in my above-mentioned Report on the Zeehan-Dundas fields, and is a most important one for the West Coast and the Colony in general. During a recent visit to Sydney I was able to make enquiries as to the progress made in erection of the large works of the Smelting Company of Australia at Lake Illawarra, and of the Sulphide Corporation at Cockle Creek, near Newcastle, both of which intend to treat the zinciferous silver-lead ores of Broken Hill on a very large scale. At both places the companies are busily engaged in the erection of their works, but it will probably be quite a year before either is ready to buy outside ores. The main principles of the process to be used at Lake Illawarra were outlined in my above-mentioned Report. The Sulphide Corporation are to use the Ashcroft process, which has been very successful in experiments on a working scale carried on at Gray's, near London. The main features of this process are extraction of the zinc by lixiviation and electrolysis, but by different methods from those to be used at Lake Illawarra. Both companies are very confident of success, and if either or both of them can treat the Broken Hill zinciferous sulphides at a profit, there can be little doubt that the Mount Read and Mount Black ores can be similarly dealt with. One great reason for taking the Broken Hill ores to the coal districts of New South Wales is that from two to three tons of coal must be expended in generating the electrical energy required for the electro-deposition of one ton of metallic zinc, besides the coal used in roasting and smelting. On our West Coast the splendid

water-power available in the Pieman and Murchison Rivers could be made to generate the electricity required, and there is not, therefore, the same necessity for sending the ore to a coal-field to be reduced.

Diamond Drills.—The No. 1 Diamond Drill has, throughout the year, been engaged in boring at Sandfly, for the purpose of proving the coal field there; the third bore is still in progress, but should soon be completed. Sections of No. 2 and 3 bores are appended hereto; that of No. 1 bore was printed with last year's Annual Report. The bores have demonstrated that there is at least one good seam of coal of workable thickness extending over a very considerable area, but have also made it very probable that nearly all the outcrops of coal seen on surface (enumerated and described in my Report on the Sandfly Coal Mine, of 12th April, 1893) are really portions of one and the same seam, which has been much broken by faults. Diamond drills.

Much trouble has been experienced during the progress of these bores on account of breakages of the machinery, much of which is now very old and nearly worn out. It will be necessary to have extensive repairs and renewals effected before long if the plant is to be kept in working order.

The No. 2 Drill has not been in use during the year.

REPORT OF THE MOUNT CAMERON WATER-RACE BOARD FOR THE YEAR ENDING 30TH JUNE, 1896.

SIR,

THE Board has the honor to report as follows:—

The Board has met as frequently as necessity required, and occasional visits of inspection of the Race and works have been made during the year.

The Staff consists of a Manager and three watermen and channel-keepers, whose time is fully occupied.

The Race is in fair order, but some of the flumings in the old portion of the Race are in an advanced stage of decay; much loss of water by leakage is a consequence, and it is only by constant care and watchfulness, especially in stormy weather, that serious accident is averted. It is proposed to substitute earth channels for these flumings where practicable, as being less costly in the first instance and cheaper in subsequent maintenance. For that purpose a small vote will be asked of Parliament, which vote, however, will probably shortly be saved by the increased carrying capacity of the Race.

Under the operation of the new regulations passed last year the whole of the available water is now used.

The price of water is dependent upon the market price of Tin, and as the latter has been persistently low during the year, the revenue has to some small extent suffered.

It is satisfactory to note that there is no falling off in the tin yield of the district, although there have been no phenomenally rich claims, as claims are worked out other ground of the like productiveness is opened out.

The Statistics for the year are as follows:—

Average per week of claims supplied			26
Greatest number supplied in any one week			32
Present number supplied			19
Total number of heads of water supplied			6228
Tons of tin-ore raised			165
Average number of miners employed—22 Europeans; 41 Chinese			63
	£	*s.*	*d.*
Total receipts for the year	1028	10	11
Cost of maintenance and management	886	13	8
Paid to Public Debts Sinking Fund for the year 1895	337	1	8
Total cost of purchase and construction	33,286	0	0
Rate (for the year 1895) of interest upon the cost of purchase and construction	1·012 %		

F. BELSTEAD, *Chairman of the Board.*
C. O'REILLY,
A. MONTGOMERY,
JNO. SIMPSON,
S. HAWKES,
Members.

The Honorable the Minister for Mines.

DIAMOND DRILLS.

Statement of Work done to 30th June, 1896.

Year.	Locality.	Direction of Bore.	No. of Bores.	Total Distance bored.	Average cost per foot, inclusive of Labour and Fuel.
	No. 1 Drill.			feet.	£ s. d.
1882–3	Back Creek—For Gold	Vertical	7	1330	0 10 9
1883	Lefroy—For Gold	Ditto	4	1011	0 5 3
1884	Tarleton—For Coal	Ditto	1	401	0 5 6
1886	Longford—For Coal	Ditto	2	1585	0 4 0½
1886–7	Harefield Estate—For Coal	Ditto	1	725	0 6 5
1887	Cardiff Claim, Mount Malcolm—For Coal	Ditto	1	562	0 17 11¾
1888	Killymoon Estate—For Coal	Ditto	1	504	0 4 7¾
1888–9	Seymour—For Coal	Ditto	5	2266	0 7 8½
1889 } 1890 }	Beaconsfield (Phœnix G. M. Co.)—For Gold	Ditto	1	781	2 0 2
1890	Beaconsfield (East Tasmania G. M. Co.)—For Gold	Ditto	1	978	0 14 9½
1891	Spring Bay—For Coal	Ditto	4	937	0 6 10
1891	Ravensdale—For Coal	Ditto	1	114	0 11 1½
1891–2	Back River, Prosser's Plains—For Coal	Ditto	2	854	0 6 1¾
1892–3	Lefroy (Deep Lead Syndicate)—For Gold	Ditto	4	979	0 15 9
1893	Lefroy (East Pinafore Co.)—For Gold	Ditto	1	317	0 10 3
1895–6	Sandfly—For Coal	Ditto	3	1740	Abt. 0 9 4 (in progress).
	Total	...	39	15,084	
	No. 2 Drill.				
1882	Beaconsfield—For Gold	Horizontal, underground	1	68	No record.
1883	Mangana—For Gold	Ditto	1	546	0 15 1
1884	Guy Fawkes Gully, near Hobart—For Coal	Vertical	1	612	0 5 6
1885	Malahide Estate, near Fingal—For Gold	Ditto	5	1397	0 5 6
1886	Carr Villa, near Launceston—For Coal	Ditto	1	571	0 5 4
1886–7	Waratah (Mount Bischoff Alluvial T. M. Company)—For Tin	Ditto	7	1548	0 6 1½
1887	Waratah (Mount Bischoff T. M. Co.)—For Tin	Ditto	7	841	0 11 8
1887	Ditto	Horizontal, underground	1	53	0 7 8
1888	Old Beach—For Coal	Vertical	1	593	Abt. 0 10 9
1888	Campania—For Coal	Ditto	1	600	0 7 7½
1888	Richmond—For Coal	Ditto	1	500	0 5 1¾
1889	Back Creek—For Gold	Ditto	4	787	0 8 5½
1891	Macquarie Plains—For Coal	Ditto	2	989	0 4 5½
1891	Jerusalem—For Coal	Ditto	1	344	0 4 9½
1892	Langloh Park—For Coal	Ditto	4	1249	0 5 3¼
1893	Southport—For Coal	Ditto	1	612	0 5 3
1894	Zeehan (Tasmania Crown S. M. Co.)—For Silver	Horizontal, underground	2	319	1 0 2½
	Total	...	41	11,629	

Aggregate number of bores..... 80
Total distance bored ..... 26,713 feet.

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

Launceston, 6th July, 1896.

No. 1 DIAMOND DRILL.

Report of Strata passed through in boring for Coal at the Sandfly Colliery.

BORE No. 2.

Boring commenced, 26th August, 1895; finished, 29th October, 1895.

Strata.	Thickness.	Total Depth.
	ft. in.	ft. in.
Surface shaft, earth, boulders, &c.	12 0	12 0
Very firm grey sandstone	4 0	16 0
Very hard black clod	1 0	17 0
Grey sandstone	9 0	26 0
Blue shale	1 5	27 5
Grey sandstone	12 7	40 0
Brown shale with petrified wood	2 0	42 0
Sandstone, grey, 8′ 0″, brown, 3′ 0″, grey, 22′ 10″	33 10	75 10
Blue shale	5 0	80 10
Fine sandstone	2 0	82 10
Blue shale	10 7	93 5
Fine sandstone	1 6	94 11
Blue shale with fern markings	3 3	98 2
Sandstone	2 0	100 2
Blue sandy shale	5 0	105 2
COAL	0 1	105 3
Clay	0 1½	105 4½
COAL	0 10½	106 3
Shale, dark, 1′ 9″, blue sandy, 2′ 0″	3 9	110 0
Sandstone, grey, 35′ 0″, brown, with veins of calcite, 5′ 3″, hard grey, 8′ 7″, brown, with veins of calcite, 7′ 2″, firm grey, 32′ 2″	88 2	198 2
Blue shale	5 6	203 8
Clod and earthy COAL	3 4	207 0
Blue sandy shale	0 7	207 7
Hard black clod	0 6	208 1
Grey sandstone	11 4	219 5
Hard dark shale	1 4	220 9
Grey sandstone	41 5	262 2
Clod and COAL	4 1	266 3
Clay band	0 2½	266 5½
COAL	1 7½	268 1
Fireclay	0 8	268 9
Fine sandstone	0 5	269 2
Fireclay	2 0	271 2
Sandy shale	2 0	273 2
Fine sandstone	1 7	274 9
Blue shale	1 9	276 6
Fireclay	0 9	277 3
Clod and COAL	2 6	279 9
Clay band	0 2	279 11
Bright COAL	0 4	280 3
Sandy shale, dark, 2′ 6″, blue, 2′ 3″	4 9	285 0
Shale, with fern impressions, 3′ 3″, blue sandy, 2′ 0″	5 3	290 3
Grey sandstone	37 10	328 1
Blue shale	3 1	331 2
Clod	0 7	331 9
COAL	0 1	331 10
Light band	0 1	331 11
Bright COAL	0 1	332 0
Light band	0 1½	332 1½
Bright COAL	0 3	332 4½
Shale, dark blue, 3′ 9½″, blue, 2′ 6″	6 3½	338 8
COAL	0 4	339 0
Clay band	0 2	339 2
COAL	0 8	339 10
Fireclay	2 7	342 5
COAL	1 0	343 5
Clay band	0 0½	343 5½
COAL	0 5½	343 11
Sandstone band	0 1	344 0
COAL	0 6	344 6
Dark shale	0 6	345 0
Sandstone, dark, 2′ 3″, grey, 4′ 8″	6 11	351 11
Blue shale	2 4	354 3
COAL	0 4	354 7

BORE No. 2—*continued.*

Strata.	Thickness.	Total Depth.
	ft. in.	ft. in.
Clay band	0 1½	354 8½
COAL	0 9½	355 6
Shale, dark blue, 1′ 0″, blue, 2′ 0″	3 0	358 6
Fine sandstone	3 6	362 0
Blue shale	1 9	363 9
Grey sandstone	49 3	413 0
Hard grey rock	5 6	418 6
Grey sandstone	16 4	434 10
Coaly clod	1 2	436 0
Hard grey shale	0 6	436 6
Coaly clod	0 4	436 10
Grey sandstone	14 9	451 7
Firm dark sandy shale	6 6	458 1
Dark sandstone	3 4	461 5
Dark sandy shale	5 6	466 11
Dark sandstone	9 6	476 5

BORE No. 3.

Boring commenced, 13th December, 1895; still in progress on 30th June, 1896.

Strata.	Thickness.	Total Depth.
	ft. in.	ft. in.
Clay and stones	4 11	4 11
COAL	0 8	5 7
Clay band	0 2	5 9
COAL	1 9	7 6
Grey shale	7 0	14 6
Sandstone, fine soft, 2′ 0″, firm grey 15′ 4″	17 4	31 10
Firm dark-blue shale	8 3	40 1
Hard grey sandstone with calcite veins	18 11	59 0
Very hard grey rock	1 9	60 9
Hard grey sandstone	22 3	83 0
Conglomerate of shale and sandstone	2 0	85 0
Hard dark shale	1 0	86 0
Hard grey sandstone with vertical fracture	25 9	111 9
Hard grey rock	1 0	112 9
Firm grey sandstone	6 9	119 6
Grey rock	0 9	120 3
Firm grey sandstone	15 9	136 0
Firm dark shale with calcite	1 0	137 0
COAL	0 4	137 4
Firm shale, dark, 3′ 0″, blue, 2′ 0″	5 0	142 4
Grey sandy shale and fine-grained sandstone	9 8	152 0
Fireclay	1 3	153 3
COAL	0 9	154 0
Blue shale	2 6	156 6
Grey sandstone, with vertical fractures and calcite veins	43 1	199 7
Sandstone, brown, 6′ 3″, grey, 3′ 6″, brown, 13′ 0″, grey, 4′ 0″, brown, 4′ 0″ grey, 8′ 9″	39 6	239 1
Black clod	0 2	239 3
COAL	0 5½	239 8½
Dark shale	1 0	240 8½
COAL	0 1	240 9½
Dark shale	1 1½	241 11
Sandstone, grey, with vertical fractures and veins of calcite, 21′ 6″, very jointy brown, 11′ 11″, grey, 32′ 2″	65 7	307 6
COAL	0 9	308 3
Soft clay band	0 1	308 4
COAL	1 7½	309 11½
Fireclay	0 6	310 5½
Dark shale with fern impressions	1 2	311 7½
Grey sandstone	2 10	314 5½
Dark shale with fern impressions	2 8	317 1½
Grey shale	0 3½	317 5
Dull COAL	0 5	317 10

BORE No. 3—*continued.*

Strata.	Thickness.	Total Depth.
	ft. in.	ft. in.
COAL	3 7	321 5
Shale, dark, 8′ 6″, grey sandy, 8′ 1″, dark fossiliferous, 13′ 6″	30 1	351 6
Grey sandstone	0 9	352 3
Dark fossiliferous shale	10 5	362 8
COAL and clod	1 4	364 0
Dark shale	12 0	376 0
Carbonaceous sandstone	21 6	397 6
Black clod	1 3	398 9
Grey sandy shale	12 0	410 9
Grey sandstone, firm, 3′ 6″, broken, 7′ 9″ firm, very jointy, 18′ 11″	30 2	440 11
COAL	0 11½	441 10½
Dark shale	0 6	442 4½
Dark sandstone and shale	26 1½	468 6
Very jointy grey sandstone	22 11	491 5
COAL	0 6	491 11
Very jointy blue shale	3 11	495 10
Jointy grey sandstone	3 8	499 6
Dark shale	0 11	500 5
Coaly clod	3 2	503 7
Dark shale	0 6	504 1
Sandstone broken, dark, 2′ 3″ grey, 0′ 9″	3 0	507 1
Coaly clod	1 0	508 1
Dark broken shale	1 9	509 10
Dark jointy sandstone	5 9	515 7
Dark mullocky shale	3 7	519 2
Hard white rock	0 9	519 11
Hard dark jointy shale	3 8	523 7
Hard dark jointy shale and sandstone	12 6	536 1
Firm dark jointy micaceous shale	10 2	546 3
Firm dark micaceous jointy sandstone	8 10	555 1
Grey sandstone	10 5	565 6
Hard grey rock with calcite	1 0	566 6
Grey sandstone	9 4	575 10
White rock, with pyrites	0 9	576 7
Grey sandstone	7 9	584 4
Grey rock, with calcite	4 10	589 2
Grey sandstone	2 9	591 11
Still in progress.		

Compiled from the Foreman's weekly reports.

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

MINE MANAGERS' EXAMINATION.

March 23rd, 24th, and 25th, 1896.

QUESTIONS SET.

Section A.—MINING.

	No. of Marks obtainable.
1. How would you test the state of air in an abandoned shaft, and how would you remove the vitiated air?	25
2. Make a sketch of a masonry dam, fitted with floodgate, for confining water in a level underground. What are the chief precautions to be observed in constructing such a dam?	40
3. Describe a method of distributing motive power from one generating centre to a number of small independent working centres.	35
4. What, in round numbers, is the usual height of the draw-lift and of the plunger-lift in deep workings? Why are rigged joints and faucet joints avoided in fixing the columns of pumps?	35
5. Explain the action of usual safety appliances adopted in mining winding-gear.	25
6. Why are frozen nitro-glycerine explosives dangerous for use? How would you treat such before using them?	40
7. Make a diagram showing the face of a level bored with a rock drill for a simultaneous blast for the whole face.	30
8. What do you understand by natural ventilation in distinction from artificial ventilation? Give examples of each.	30
9. What conditions would you observe in fixing pitwork in a deep shaft in order that the strain on the main rod shall be as equally divided as possible?	40
10. Prepare specification for re-timbering a portion of a three-compartment shaft from 300 ft. to the 400 ft. level. The shaft is 16′ × 4′ 6″ in the clear, and the pressure is normal.	30
11. How many gallons per stroke is delivered by a 14″ pump, the pumps working at 4′ 3″ stroke? How much would you increase the capacity of the pump by lengthening the stroke to 5 feet?	40
12. Describe two precautionary measures which can be adopted to keep the ground from falling in while stoping is in operation.	30
	400

SECTION B.—ORE-DRESSING AND SAMPLING.

	No. of Marks obtainable.
1. Describe in general terms the process of extracting gold from rebellious ore by means of chlorination.	25
2. What are the more important considerations upon which the effective capacity of a battery of gravitation stamps depends? State briefly your opinion upon the merits and defects of the gravitation stamps.	25
3. Describe any machine you know in which the principles of centrifugal force is applied for the concentration of ore.	25
4. Explain the theory upon which the principles of jigging are based. What do you consider the minimum and maximum of size of fragments which can effectually be treated by jiggers?	40
5. Under what conditions would you employ a concave buddle in preference to convex buddles, and *vice versâ*?	25
6. Describe the principal mechanical process employed in extracting tin-ore from free milling lode-stuff.	35
7. What method would you adopt in sampling ore of a very changeable character when you wish to give as accurate a result as possible?	25
	200

SECTION C.—MINING GEOLOGY.

	No. of Marks obtainable.
1. Explain the mode of formation of alluvial tin ore deposits—(*a*) shallow modern drifts, (*b*) gravel terraces, (*c*) deep leads covered with basalt. Illustrate with diagrams.	20
2. Explain the terms—*fault*, *dyke*, *contact lode*, *stockwork*, *breccia*, *conglomerate*, *quartzite*, *mica schist*, *coal measures*, *unconformability*.	20
3. In driving northward along a lode striking north-and-south, and having an underlay of 1 in 1 to the westward, it is found to be cut through by a fault striking north-west and south-east, and underlaying 1 in 5 to the north-east. Show in what direction you would drive to pick up the lode on the other side of the fault, and explain your reasons for doing so.	20
4. Describe the usual sorts of deposits in which the following minerals occur:—*Asbestos*, *platinum*, *diamond*, *gold*, *stibnite*, *marble*, *galena*, *hematite*, *magnesite*, *copper pyrites*.	20
5. Give briefly your views as to the origin and mode of formation of metalliferous lodes.	20
	100

SECTION D.—MINING SURVEYING.

	No. of Marks obtainable.
1. Write out a sample page of a level-book containing at least twenty entries, with back, intermediate, and foresights shown; also rises and falls, reduced levels and distances; all complete for plotting a section and check of calculations.	10
2. Describe instruments used in mining surveying, and methods of adjusting same.	15
3. The outcrop of a vein is known to be 200 feet above bottom of entrance of an intended tunnel; horizontal distance to the outcrop is 1000 feet; the vein drops towards the intended entrance at an angle of 20 degrees from the vertical, and the tunnel is to rise at rate of 1 in 100. At what distance from entrance of tunnel will the bottom be crossed by the vein?	20
4. From the bottom of a certain shaft a drive has been made on the bearings, and for distances given below (shaft to A, B, and C). On what bearing and in what distance can the drive be continued from C back to shaft— Shaft to A, 642 links N. 10° W. A to B, 370 „ E. 5° S. B to C, 550 „ S. 15° W. C to shaft, (to be found). NOTE.—*It is compulsory that Questions* 3 *and* 4 *should be answered.*	30
5. Two vertical shafts, A and D, are connected centre to centre on surface by the traverse ABCD, the true bearings and lengths of the lines being— AB, bearing 1° 23′, length 132 feet. BC, „ 15° 16′, „ 120 „ CD, „ 95° 36′, „ 150 „ What is the true bearing and length of the line AD?	25
6. In the above survey the surveyor next goes underground and connects the centres of the same shafts by a traverse AEFGHID. He *assumes* the bearing of line AE to be 180°, and carries out the traverse accordingly, thus— AE, bearing 180° 00′, length 23 feet. EF, „ 105° 13′, „ 87 „ FG, „ 3° 30′, „ 92 „ GH, „ 12° 18′, „ 78 „ HI, „ 43° 50′, „ 70 „ ID, „ 12° 32′, „ 72 feet 4 inches. What are the *true* bearings of the lines of this traverse?	50
7. Plot the preceding traverses by angular protraction to any convenient scale, and calculate the area by scaled measurements of the figure ABCDIHGFEA.	25
8. What is the length in chains of the side of a square containing 52 acres 3 roods and 14 poles?	5
9. Explain the method of correcting bearings in surveys made with magnetic needle over iron rails.	10
	190

Section E.—SURFACE WORK.

	No. of Marks obtainable.
1. Describe a practical and fairly accurate method of gauging the delivery of water in any stream.	5
2. What is theoretical H.P. obtainable by a delivery of 300 feet of water per minute under a head of 50 feet?	5
3. A beam uniformly loaded with a weight of 20 tons is found to be too weak, and can only be supported at the centre by a raking strut, the slope of which is in horizontal distance 12 feet and in vertical distance 7 ft. 6 in. What is the strain upon this strut?	5
4. Write out a complete and comprehensive working specification for the construction of a water-race through earthy formation in forest and thick scrub and on sideling ground (assuming size and fall).	15
5. Make rough drawings or sketches for the construction of about 20 feet in length of timber dam to support a depth of water 12 feet, and mark dimensions of timber on same.	20
Note.—*It is compulsory that Questions* 4 *and* 5 *should be answered.*	
6. A load of one ton has to be lifted by a winch having a chain or rope drum or barrel $4\frac{1}{2}$ inches diameter; chain, $\frac{3}{8}$ in.; handles, 14 in. radius; number of teeth in the pinion on the handle spindle, 13; number in spur wheel on barrel spindle, 81. What force will be necessary at the handles, taking the efficiency of the winch at 60 per cent.?	30
7. A steam winding-gear is observed to lift 1200 lbs. from a depth of 345 feet in 12 seconds. If 45 per cent. of the power is expended in overcoming wasteful resistances, what power is the engine working up to?	20
8. In a crab-winch the pinion on the handle shaft or spindle has 16 teeth which gears with a wheel of 120 teeth on the barrel axle; the barrel is $10\frac{1}{2}$ inches diameter, and the handles are 15 inches long. Required, the weight which can be lifted by a force of 36 pounds on the handles.	15
9. A crab-winch has a pinion of 12 teeth gearing with a wheel of 66 teeth upon a barrel 10 inches diameter. Find the velocity ratio of the two axles, and the length of chain coiled up after 50 revolutions of the handles.	10
10. A jack-head-pump bucket 14 inches diameter by 10 feet stroke, makes seven strokes per minute; lift of water is 60 feet. What will be the actual horse-power required? Allow 30 per cent. for the wasteful resistances and 4 per cent. for friction of connections between engine and pump-bucket.	25
	150

Subject F.—BOOK-KEEPING AND MINE ACCOUNTS.

	No. of Mark obtainable.
1. Explain the system of Book-keeping you would adopt in a large mine in order to be able at any time to give particulars of cost of supplies, labour, and various details of the work.	20

Subject G.—MINING LAW.

1. Describe the method of procedure to be adopted by an applicant for a mining easement.	5
2. In what manner is a leased claim required to be marked?	5
3. What conditions must be complied with in order that a claim held under miner's right shall not be deemed to be forfeited?	5
4. What are the duties of a mining manager with regard to inspection of the mine in his charge?	5
5. What are the provisions of "The Mining Act, 1893," with regard to the use of ladders in shafts?	5
6. What are the provisions of "The Mining Act, 1893," with regard to plans and sections of underground workings?	5
	30

APPENDIX.

No. 1.

COMPARATIVE Statement of Gold won during the Years 1880, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, 1891, 1892, 1893, 1894, 1895, *and the first Half-year of* 1896.

YEAR.	QUANTITY.	VALUE.
	ozs. dwts.	£
1880	52,595 0	201,297
1881	56,693 0	216,901
1882	49,122 6	187,337
1883	46,577 10	176,442
1884	42,339 19	160,404
1885	41,240 19	155,309
1886	31,014 10	117,250
1887	42,609 3	158,533
1888	39,610 19	147,154
1889	32,332 13	119,703
1890	20,510 0	75,888
1891	38,789 0	145,459
1892	42,378 0	158,917
1893	37,687 0	141,326
1894	57,873 0	217,024
1895	54,964 0	206,115
1896, for the first half-year	32,465 0	121,744

No. 2.

RETURN showing the Quantity of Gold obtained from Quartz during the Years 1880, 1881, 1882, 1883, 1885, 1886, 1887, 1888, 1889, 1890, 1891, 1892, 1893, 1894, 1895, *and the first Half-year of* 1896.

YEAR.	QUANTITY.	VALUE.
		£
1880	34,345 ounces	130,622
1881	45,776 „	174,956
1882	36,215 „	137,183
1883	36,672 „	138,060
1884	30,540 „	114,630
1885	33,266 „	124,234
1886	25,004 „	87,516
1887	33,427 „	123,453
1888	34,156 „	126,139
1889	33,069 „	116,517
1890	17,829 „	64,184
1891	33,659 „	126,221
1892	34,386 „	128,947
1893	30,163 „	113,111
1894	52,239 „	195,896
1895	51,628 „	193,605
1896, for first half-year	30,752 „	115,320

No. 3.

QUANTITY and Value of Coal raised during the Years 1880, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, 1891, 1892, 1893, 1894, 1895, *and the first Half-year of* 1896.

YEAR.	QUANTITY.	VALUE.
	tons.	£
1880	12,219	10,998
1881	11,163	10,047
1882	8803	7923
1883	8872	7985
1884	7194	6475
1885	6654	5989
1886	10,391	9352
1887	27,633	24,870
1888	41,577	37,420
1889	36,700	33,030
1890	50,519	45,467
1891	43,256	38,930
1892	36,008	32,407
1893	34,693	27,754
1894	30,499	24,399
1895	32,698	26,159
1896, for first half-year	19,557	15,646

No. 4.

COMPARATIVE Statement of Tin exported from Tasmania during the Years 1880, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, 1891, 1892, 1893, 1894, 1895, *and for the first Half-year of* 1896, *compiled from Customs Returns only.*

YEAR.	TONS.	VALUE.
		£
1880	3954	341,736
1881	4124	375,775
1882	3670	361,046
1883	4122	376,446
1884	3707	301,423
1885	4242	357,587
1886	3776	363,364
1887	3607½	409,853
1888	3775¼	426,321
1889	3764	344,941
1890	3209¼	296,368
1891	3235	291,715
1892	3174	290,083
1893	3128½	260,219
1894	2934	198,298
1895	2726¾	167,461
1896, first half-year	1317	77,568

No. 5.

RETURN showing the Number of Persons engaged in Mining during the Years 1880 *to* 1895 *inclusive, and first Half-year of* 1896.

YEAR.	NUMBER.	YEAR.	NUMBER.
1880	1653	1889	3141
1881	3156	1890	2868
1882	4098	1891	3219
1883	3818	1892	3295
1884	2972	1893	3403
1885	2783	1894	3433
1886	2681	1895	4062
1887	3361	1896, first half-year	4257
1888	2989		

No. 6.

RETURN showing the Number and Area of Leases held under "The Mining Act, 1893," *in force on* 30*th June of each year since* 1891.

Nature of Lease.	In force on 30th June, 1891.		In force on 30th June, 1892.		In force on 30th June, 1893.		In force on 30th June, 1894.		In force on 30th June, 1895.		In force on 30th June, 1896.	
	NO.	AREA.	NO.	AREA.	NO.	AREA.	NO.	AREA.	NO.	AREA.	NO.	AREA.
		Acres.		Acres.		Acres.		Acres.		Acres.		Acres.
For tin, &c. at a rental of 5*s.* an acre	1495	67,216	1857	89,962	1547	71,279	997	45,532¾	720	31,207	738	33,077
For coal and slate, at 2*s.* 6*d.* an acre rent	45	7255	47	6874	57	8963	23	4231	37	6551	37	5946
For gold, at a rental of 20*s.* an acre	245	2366a. 2r. 10p.	489	4606	501	4801	374	3532½	455	4366	602	5712½
Water Rights, Mineral and Gold	200	998 sluice-heads.	173	812 sluice-heads.	185	890 sluice-heads.	198	866 sluice-heads.	176	755 sluice-heads.	160	808 sluice-heads.

No. 7.

RETURN of the Number and Area of Leases under "The Mining Act, 1893," *in force on the* 1*st July,* 1895, *issued during the Year ending* 30*th June,* 1896, *cancelled during the Year ending* 30*th June,* 1896, *and remaining in force on* 30*th June,* 1896.

Nature of Lease.	In force on 1st July, 1895.		Issued during Year ending 30th June, 1896.		Cancelled during Year ending 30th June, 1896.		In force on 30th June, 1896.	
	NO.	AREA.	NO.	AREA.	NO.	AREA.	NO.	AREA.
		Acres.		Acres.		Acres.		Acres.
For Tin, &c., at a rental of 5*s.* an acre	720	31,207	263	11,825	245	10,045	738	33,077
For Coal and Slate, at 2*s.* 6*d.* an acre rent	37	6551	2	15	2	620	37	5946
For Gold, at a rental of 20*s.* an acre	455	4366½	313	2836	166	1490	602	5712½
Water Rights, Mineral and Gold	176	755 sluice-heads.	14	123 sluice-heads.	30	70 sluice-heads.	160	808 sluice-heads.

No. 8.

COMPARATIVE Statement of Net Revenue from Mines, being Rents, Fees, &c., paid to the Treasury.

YEAR.	AMOUNT.			YEAR.	AMOUNT.		
	£	*s.*	*d.*		£	*s.*	*d.*
1880	8944	5	11	1888	23,502	8	4
1881	20,936	5	5	1889	17,254	9	0
1882	23,077	1	9	1890	26,955	4	9
1883	15,439	14	5	1891	37,829	16	5
1884	6981	11	10	1892	17,568	18	4
1885	11,070	5	7	1893	16,971	9	2
1886	12,523	10	4	1894	15,323	1	9
1887	14,611	11	5	1895	20,901	13	2

The above Statement does not include Stamp Duties upon Transfers of Leases and Registration of Companies, or the Tax payable upon Dividends, from which sources large sums are derived.

TOTAL Number and Area of Leases in force on 30th June, 1896.

MINERALS.	NUMBER.	AREA.
		acres.
Gold	602	5712½
Silver	378	20,337
Tin	323	10,851
Coal	25	4064
Iron	4	265
Limestone	8	875
Lithographic Stone	2	417
Shale	1	160
Nickel	3	212
Wolfram	1	80
Marble	1	320
Cinnabar	1	20
Precious Stones	1	80
Copper	26	1199
Pyrites	1	43
TOTAL	1377	44,635½

AVERAGE Number of Miners employed during the Year ending 30th June, 1896.

	Europeans.	Chinese.
Northern and Southern Division	1015	...
North-Eastern Division	311	303
Eastern Division	443	107
North-Western Division	356	...
Western Division	1625	...
	3750	410

MINING Companies registered during the Year ending 30th June, 1896.

Number of Companies.	Capital.
64	£168,885

TOTAL Area of Land applied for during Year ending 30th June, 1896.

Mineral.	No. of Applications.	Area.
		Acres.
Gold	502	4299
Silver and other Minerals	949	53,690
Tin	51	1721
TOTAL	1502	59,710

MINES Receipts for the Year ending 30th June, 1896.

Head of Revenue.	Amount.
	£ s. d.
Rent under "The Mining Act, 1893," for Gold	5636 9 10
Fees " " "	993 19 6
Rent " " for Minerals	12,237 6 3
Fees " " "	1992 12 7
Rent of Diamond Drills	41 5 0
TOTAL	20,901 13 2

REPORT ON THE MINERAL FIELDS OF THE GAWLER RIVER, PENGUIN, DIAL RANGE, MOUNT HOUSETOP, TABLE CAPE, CAM RIVER, AND PORTION OF THE ARTHUR RIVER DISTRICTS.

Geological Surveyor's Office, Launceston, 29th July, 1895.

SIR,

I HAVE the honor to forward to you the following Report on the above fields, which were visited by me during last month and the beginning of the present one. Only a short time could be devoted to each of the localities examined, and, furthermore, very little mining work was in progress on any of them, consequently the various mineral occurrences could not be minutely investigated. In a great many instances the mining work that has been done was carried out a good many years ago, and the workings are now inaccessible, or practically so. In order to make a thorough examination of the mineral discoveries it would be necessary to employ quite a number of men in re-opening fallen-in and covered-up workings, and also in opening out for the first time a large number of places where signs of the presence of ores have been noticed but no mining work done. In the course of the Report it will appear how far each occurrence could be examined at present, and it will be seen that in almost every instance much time and labour would have to be expended before it could be definitely said that there is or is not a reasonable probability of payable mining being possible. This Report has, in consequence, to be couched in very general terms, without going into details as to the value and prospects of the various discoveries.

The country traversed on this occasion lay mostly near the coast, between Ulverstone and Rocky Cape, though excursions were also made inland to the Dial Range, the vicinity of Mount Housetop, and the Arthur River. The geological structure of the region is rather complex, there being a considerable number of formations of different ages represented in it at one part and another, some of sedimentary others of igneous origin. It will be convenient to describe the distribution and relations of these before passing on to deal with the various mineral fields each by itself. They will be mentioned in chronological order, the oldest being taken first.

Lower Silurian or Cambro-Silurian System.—Older Palæozoic rocks, quartzites, schists, metamorphic sandstones, slates, and crystalline limestones, which may belong to the same system as the Cambrian beds of Caroline Creek in the Mersey District, or to the Lower Silurian Gordon River and auriferous slates formation, are found at intervals throughout the region under observation, and are very well seen in natural sections along the coast. So far as I am aware no fossils have been found in these strata, but from their position and lithological character they may pretty safely be classed as above. As there is some reason to believe that the Cambrian strata at Caroline Creek are conformable with the Lower Silurian Gordon River series, it seems best for the present to use the wide term Cambro-Silurian. Some of the highly micaceous crystalline schists seen in the Inglis River, and the quartzites of Rocky Cape, may be even older than the Cambrian, and may belong to the Archæan system, like those at the head of the Forth River, at Cradle Mountain, at Port Davy, and elsewhere. Generally throughout the district these ancient rocks are very much covered with later overlying ones, and are seen only in the river gorges and on the coast where the covering strata have been removed, but they crop out strongly in the Sisters Hills and the Rocky Cape Range. The localities where they are seen will be mentioned more particularly in the course of this Report when describing the country in detail. These rocks are much seamed with quartz, often carrying pyrites, and are probably auriferous in parts. Throughout the district their general strike is from N.N.E. to N.E., but the dip changes frequently from easterly to westerly, the strata being much folded and contorted.

Upper Silurian System.—The Zeehan and Heazlewood series of rocks of Upper Silurian age were not seen anywhere *in situ* in this part of the country, but are said to occur to the south of the Arthur River, not far from Kay's diggings. That they did exist in the vicinity in former times is, however, certain, as water-worn boulders carrying impressions of *Pentamerus Tasmaniensis*, *P. Knightii*, and other characteristic forms of this period occur in the conglomerates of Big Creek, near Wynyard. On the side of the road from Table Cape to Stanley, where it rises to cross the Rocky Cape Range, some rather soft well-laminated slates are seen, lying inclined at rather low angles to the horizon. These may prove to be Upper Silurian, but also might belong to the same formation as the Wynyard conglomerates, which I take to be most probably not older than Devonian. In the gravels of the Inglis River, some 2½ miles below the junction of the Calder River, large boulders were seen of conglomerate similar to that of Mount Owen, Mount Claude,

and Stormont, and it was said that the rock occurred *in situ* not far away, but I was unable to get to it ; if so, it probably belongs to the Upper Silurian system. It may be here noted that in this part of the Inglis district the gold is said to be usually found only where the conglomerate boulders are plentiful, giving some support to the belief entertained on many of our western goldfields that the alluvial gold is largely derived from the disintegration of the conglomerate, which is itself only a strongly cemented gravel drift.

The Dial Range series of conglomerates, slates, tuffs, felsites, and breccias, is referred by Mr. R. M. Johnston in his "Geology of Tasmania," tentatively to the Upper Silurian system, but he also remarks, on page 85, that, "as before mentioned, it is not improbable that the Dial Range and Table Cape conglomerates may yet be grouped among the Devonian rocks of Tasmania." The Dial Range formation is seen resting on the upturned edges of the Cambro-Silurian strata on the Penguin beach at the old Neptune mine, and there consists of highly indurated felsitic tuffs, breccias largely composed of angular fragments of quartzite, hornstone, and jasper, with occasional rounded pebbles of the same, and tufaceous indurated sandstones containing occasional waterworn pebbles, but otherwise closely simulating a crystalline rock. The decomposed portions of this last rock show it to be largely composed of felspathic particles, intermixed with hornblende or some similar ferriferous silicate. The formation is found right to the top of the Dial Range, but occasional exposures of the older Cambro-Silurian strata at varying heights show that it is resting on a bedrock which rises going southward. On the Dial Range we find extensive beds of conglomerate, the pebbles being well rounded, unlike the breccias at the Neptune mine. Tufaceous beds seem, however, also to be found to some height on the range, and a much decomposed crystalline rock of dioritic character was also observed, but I could not determine whether it was a dyke or a lava flow with any certainty. In some of the sandstone beds on the beach ripple-marking is very distinct, and from this and the common occurrence of conglomerates it would appear that the strata were originally laid down very close to the shore. The hematite found near the Penguin Creek seems to form a bed of this formation, and points to occasional lacustrine conditions. On the beach the strata sometimes show a slight amount of curvature, but on the whole the beds of the formation lie fairly horizontal. In parts, especially where containing much felsitic matter, they are extremely hard. Strong joints cut through the beds, often giving an appearance to them as if they were dipping at high angles, but close inspection shows the true bedding planes to be very flat. The pebbles of the conglomerates and breccias are shorn across by the joints. It is evident from the quantity of tufaceous matter that occurs intermixed with ordinary sedimentary material that volcanic dust and other fragmentary matter have been sorted to some extent by aqueous agencies, partly, perhaps, by being showered into the sea and there arranged by the action of the waves, and partly by being washed from land surfaces by rains and streams. So far as I am aware, no fossils have been found in the Dial Range beds which would give any clue to their age. The distinct jointing and great amount of induration point to considerable antiquity, while the amount of curvature is much less than is seen in the Upper Silurian beds of Zeehan, Heazlewood, Middlesex, and Fingal, yet distinctly more than is usual in our Permo-Carboniferous strata. In Victoria in the Devonian period there was great volcanic activity, forming series of rocks of much the same character as those at the Dial Range, and it seems very likely that the latter should be referred to the same age.

To the south of Wynyard the formation above referred to as the "Table Cape conglomerates" is seen over rather an extensive area between the Inglis and the Cam Rivers, and as far back as the Campbell Range and Arthur River. It is to be seen best in the deep gullies of the creeks running through the district, the tops of the spurs between them being formed of more recent basalt. As the name of Table Cape is inseparably connected with the fossiliferous Eocene beds found on the shore at Freestone Cove, it will be best to distinguish these older strata by a different appellation, and call them the Wynyard formation. Beds of conglomerate are very prominent in the series, often containing large boulders of quartz, quartzite, metamorphic sandstones and slates, schist, red granite, and porphyry, with occasionally, as above mentioned, fossiliferous sandstones from the Upper Silurian system. These boulders are usually enclosed in a mudstone matrix. Beds of mudstone (argillaceous sandstone) containing numerous small pebbles are also common, and there are also thick beds of laminated slates and shales and of white and yellowish sandstones (freestones). Some of the shales and sandstones are very soft. On the beach under the Eocene beds there are very slight signs of curvature in the bedding planes of the slate of this formation, but not more than might perhaps be due to slight irregularities in the original deposition of the sediments, and generally throughout the district the strata lie very flat. In lithological character and bedding they very closely resemble those of our Permo-Carboniferous and Mesozoic Coal Measures. The material is not nearly so much indurated as that of the Dial Range formation, the joints do not cut through the pebbles in the conglomerates as a rule, and so far as I have observed there is an entire absence of felsitic tuffs and other volcanic matter. The formation, however, seems remarkably destitute of fossils, not a trace of one being observed during my examination of it, though search was constantly being made for them.

The evidence in favour of the Wynyard formation being considered to be of the same age as that of the Dial Range is mainly that of position. The former is found from sea-level to the top

of the Campbell Range, the latter from sea-level to the summit of the Dial Range; both are nearly horizontally bedded, both consist largely of conglomerates, both are, so far as yet known, destitute of fossils, and the two are only some seventeen miles apart. On the other hand, the conglomerates of the Wynyard formation are composed of very different material from those of the Dial Range, and the volcanic products so characteristic of the latter seem to be absent, and there is not the same amount of induration and jointing. To the east of the Dial Range we find the Permo-Carboniferous coal measures of the Mersey District, also horizontally bedded, and lithologically more similar to the Wynyard formation than to the beds of the Dial Range, but highly fossiliferous. There does not appear to be much more reason for assuming the identity in age of the Dial Range and Wynyard formations than of the former and the Lower Coal Measures.

The following fact tends to make us think that the Wynyard formation may really be of much the same age as the Mersey coal series:—From time to time pieces of cannel coal have been found on the beach near Wynyard, and also pretty high up the Inglis River and the Seabrook Creek. These have always been only floating pieces, the parent seam not having been seen *in situ*, but the circumstances under which they are described on good authority as being found seem to allow no doubt as to their really having come from the neighbourhood. If so, they must either have come from small undiscovered patches of the Coal Measures or from the Wynyard formation itself, unless we also admit the unlikely hypothesis that they may have been derived from the Earlier Tertiary gravels underlying the basalts, to be described later on. Seeing that the conglomerates contain numerous boulders from the older rocks, the possibility suggests itself that the pieces of cannel coal also may have been imbedded fragments, in which case the formation would be younger than the Coal Measures. The coal is said to have been tested in Melbourne and found to be an excellent Cannel, similar to the Joadja "shale" of New South Wales, which is the best gas coal in the world. A similar Cannel coal has been found at Barn Bluff (*see* my Report "on the country between Mole Creek and the Mount Dundas Silver Field, and on the discovery of coal at Barn Bluff" of 13th June, 1893.) This is of the same age as the Mersey Coal formation, and is overlaid by fossiliferous limestones and shales. It is possible that the Wynyard formation is the base of the Coal Measures, and that high up in it the fossiliferous beds and the coal seam may yet be found. Both for scientific and commercial purposes search for them is desirable. In New South Wales it has been noted that both above and below the Greta Coal series, which corresponds with the Mersey Coal Measures of Tasmania, there occur layers of erratic boulders, probably deposited by ice during periods of continued low temperature in the Southern Hemisphere. These cold periods might supply an explanation of the paucity of fossils in the Wynyard formation, and ice action would likewise account for the occurrence of large and heavy boulders in it in a mudstone matrix instead of the more usual one of coarse sand and gravel, which is the ordinary result of the sorting of detrital material by wave action. During my examination, however, I did not see any boulders exhibiting ice striation, or of such size as not to be accountable for by the ordinary forces at work on every sea shore.

Devonian and Permo-Carboniferous Systems.—From the above considerations it seems better to place the Dial Range formation provisionally in the Devonian System and the Wynyard one near the base of the Permo-Carboniferous, but much more knowledge is required before any classification will be satisfactory.

Eocene System.—At Freestone Cove, close to the Town of Wynyard, occurs the well known cliff section of the Table Cape Eocene beds, well described at length in Johnston's Geology of Tasmania. They rest upon the eroded surface of the Wynyard formation, which itself is seen close by lying unconformably on the Cambro-Silurian slates. Tertiary basalt covers the fossiliferous beds. The formation is of small extent, being known to appear inland in only one or two places.

Palæogene Gravels.—In the Penguin and Wynyard Districts we very commonly find high terraces and sheets of rounded quartz gravel, lying upon the above older formations and covered by later flows of basalt. The Wynyard District must have been very generally covered with this gravel prior to the eruption of the basalt. It always seems to contain more or less gold, and is probably the source of most of the metal that has been found in the district. In former Reports on the Beaconsfield Goldfield, Gladstone District, Corinna Goldfield, &c., similar occurrences of high terraces of gravel have been described, and it has been pointed out that the northern and western parts of our island must have undergone a great subsidence in Palæogene Tertiary times, which led to great accumulations of gravel being laid down along the shores, followed by basaltic outflows, and a subsequent elevatory movement which has brought the gravel deposits up to a considerable height above sea level. The Wynyard District affords another example of the same features. The creeks have cut deep down through the basaltic covering and the gravel beds into the underlying Wynyard formation, and even down to the Cambro-Silurian bedrock below this in places.

Neogene and Recent Gravels.—The movement of elevation after the basaltic period having been a slow one, and probably at times interrupted, we find occasional newer terraces of gravel lying on the slopes of the hills. There are also along the coast from Ulverstone to past Wynyard raised beaches and comparatively recent gravel flats, which have been elevated above high-water mark at no very distant date in past time.

Eruptive Rocks.—There are numerous proofs of igneous activity at different periods of the history of the region, various eruptive rocks being found in it. *Granite* occurs at Mount Housetop and to the westward thereof, and is seen on the Emu Bay and Bischoff Railway line close to the Hampshire Hills station. It is probably connected with the occurrences of this rock at Mount Bischoff and the Magnet Range to the south-west, and with that at Bell Mount tin-field to the south-east. At the latter place the granite is later in age than the Upper Silurian system, as it is intrusive through the strata of this, so probably the Mount Housetop granite is also later than Upper Silurian. It seems possible enough that the felsitic tuffs of the Dial Range formation are the ash-beds from the volcanoes of which the granite areas represent the roots. The granite is older, however, than the Wynyard formation, as boulders of it are commonly found in this, proving that great erosion of the volcanic material had taken place, and the deeper seated granitic portions of it been exposed before the boulder beds were laid down. The occurrence of a decomposed rock resembling *diorite* at the Dial Range has already been noted: it requires further investigation both as to its composition and mode of occurrence before its exact rock species and age can be determined. *Diabase* greenstone, similar to that found so commonly in the eastern and central districts of the colony, and, therefore, probably of Mesozoic age, is seen between Burnie and the Hampshire Hills at some points on the Emu Bay to Bischoff Railway line, and also on the Campbell Range near the Inglis River. A somewhat similar greenstone, containing, however, a little mica and free quartz, and also occasionally traversed by small quartz veins, is seen in the Mill Creek near the township of Somerset, and also on the beach between Cooey Creek and Stony Creek not far from Burnie. It may be a diorite, but pending microscopic examination I am inclined to consider it a quartz diabase, and to look upon it as merely a local variety of the more general diabase (gabbro) formation. In Tertiary times, towards the close of the Palæogene period, there were extensive eruptions of *Basalt* and basaltic tuffs, which are continually being met with throughout the region now being described, forming the valuable agricultural areas for which the Penguin and Table Cape districts are famed. On the beach at frequent intervals black basaltic dykes and flows of lava with columnar jointing are to be observed. In the neighbourhood of the lava flows the gravels and superficial detritus covered by them are frequently found to be converted into hard conglomerates and breccias, no doubt cemented together by the action of hot mineral-bearing solutions emanating from the lavas: excellent examples of this are seen on the beach at Heybridge Creek and on the hillside west of the creek, the conglomerates in the latter place forming small cliffs in which are caves, these being due to washing out of uncemented portions of the original superficial drift. Inland the basalt caps most of the hills for some distance from the coast, extending with only local interruptions up to the Surrey Hills and Waratah plateau along the Burnie-Waratah railway, and back on to the Campbell Range to the south of the Table Cape District.

In describing the mineral occurrences examined it will be necessary frequently to refer to the different formations mentioned above, and their relations in point of age, position, and origin will require to be kept in mind. It may now be useful to mention briefly the minerals of economic value that are found in the district, and the formations in which they occur. *Gold* is found in veins and reefs in the Cambro-Silurian rocks, and with silver and copper in those in the Dial Range formation, also in alluvial deposits of Tertiary and recent age, in gravel beds buried more or less under the basalt, in gravel terraces, and in the beds of the modern water-courses. In the granite areas *Tin ore* is found in veins and lodes and as alluvial deposits, some of the latter being superficial, others buried under basalt. *Silver-Lead* ores have been found in veins which appear likely to penetrate both the Dial Range and the Cambro-Silurian strata; so also *Copper ores.* At the Blythe River there is a very large deposit of *Iron ore* (Red Hematite: see "Report on a deposit of Iron Ore at the Blythe River" of 5th March, 1894) in the Cambro-Silurian rocks, and near the Penguin very similar ore is seen in the Dial Range formation; there is also a large deposit of brown hematite at the "Iron Cliffs" in the Penguin District. In the same vicinity there is some *Oxide of Manganese*, which generally appears to be of comparatively recent deposition. The occurrence of drift pieces of *Cannel Coal* in the Inglis River and Seabrook Creek has already been referred to. *Lignite* has been found near Penguin and in the Table Cape District among the beds of the Palæogene Tertiary deposits. *Zircons* and *Sapphires* are found near Jacobs' Boat Harbour in recent alluvial drift which is probably derived from the Cambro-Silurian formation. There are also *Limestones*, building *Sandstones*, and *Basalt* fit for building and road-making in several localities.

GAWLER RIVER DISTRICT.

Only a very small portion of the Gawler River district was examined, a short visit being made to a gold-bearing reef that had been discovered about two miles from Ulverstone, close to the river. A hole had been sunk 8 to 10 feet deep on the reef at the edge of an alluvial flat formed by the stream, and in it was seen a lode consisting of from 8 to 12 inches thickness of quartz, and some 6 inches of clay, the latter being on the walls. The quartz has a vitreous appearance, and contains a good deal of iron pyrites with a little copper pyrites and blende. Strike about W.N.W. and E.S.E., dip 67° to the northward. The enclosing country rock is a blue schist, much like a good deal of the Lefroy ground, and the reef cuts across its lamination. Several prospects washed

from the quartz gave very poor results, though a little gold was seen, and it would appear that the reef is auriferous, but as yet nothing like payable. It might, however, be prospected further with advantage, and should be traced both east and west along its strike and tested at intervals to find if its gold contents increase. On the west side of the river there is a considerable hill into which a tunnel might be driven on the course of the lode after this has been picked up at the foot of it. On the hillside to the east another hole has been sunk some 12 feet through loose superficial soil without finding the lode, and a little crosscutting is required to pick it up. Any gold-bearing lode of this nature, carrying favourable minerals such as the sulphides here present, and occurring in a defined shape between distinct walls, is worth taking some trouble to prove, as it might turn out that it has first been cut in a poor or small part, and may improve on being followed; while very doubtful as to its being of value, it seems to me that it ought to be further tested on the chance of better stone being found.

About six chains east of this discovery, in a small branch creek, there is a shaft sunk some 27 feet on a mass of schist and quartz, 8 to 12 feet wide, which may be a sort of lode. The schist and quartz are much interlaminated, and there is no well-defined reef. A little gold is said to have been got on the surface from some of the quartz veins, and "colours" are reported to be got from here down to the Gawler River. From time to time it has been reported that a little gold occurs in the Gawler River itself. All the land in this locality is private property, and special arrangements have to be made with the owners by prospectors anxious to search for minerals. Though nothing of much consequence has yet been found, it seems probable that the locality is of a favourable nature for minerals, more especially gold, and is therefore worth some attention from prospectors. The slate country may be referred to the Cambro-Silurian system.

PENGUIN AND DIAL RANGE DISTRICT.

The Penguin beach exposes an excellent horizontal section of the Dial Range formation resting uncomformably upon the Cambro-Silurian rocks. Here the latter consist of hard quartzites, slates, and in one place limestone, and on a ragged eroded surface of these, beds of breccia, tuff, and felsitic ash, all somewhat mixed with ordinary sedimentary material, have been deposited. In several places there are dykes of basalt of Tertiary age bursting through the older rocks and lava flows covering them. The tufaceous beds are highly indurated, and sometimes very strongly jointed, and are somewhat bent into flat ridges and hollows, the strike being about N. 5° W. The steepest dip noticed was 45°, which was much higher than usual, the beds lying very flat as a rule. Between the Penguin Creek and the old Neptune mine the beach shows numerous mineral veins, and signs of alteration of the country rock by its being penetrated by mineral-bearing solutions. Parts of the rock are found very thoroughly silicified, and a great deal of it is impregnated with pyrites. Iron pyrites are very common; copper pyrites much less so; but some of the stuff also shows frequent films of native copper on the joints.

Neptune Mine.—About a mile and a half along the beach east of the Penguin Creek we find on the flat ground just above high-water mark the shaft of the old Neptune mine. This is on private property, on a block of 600 acres, marked on the county plan (Devon No. 3) "Grant to Amos Drew." Mineral section 3596-87M was formerly held on the beach to the north-west from the shaft to take in the seaward continuations of the lodes. The shaft is now full of water. It was formerly unwatered by an 8-inch drawlift, which is variously stated to have been equal to the work and unable to cope with the water. The machinery is still on the mine, but requires repairing to put it in working order. The shaft is 10 feet by 4 feet 6 inches, and is said to be 100 feet deep, with levels from it at 50 feet and 100 feet. At the bottom level, on the last occasion when any work was done in the mine, they drove 175 feet to the N.E., and then met with an inflow of water, fresh, not salt, which was dammed off and work stopped. They also went some 75 feet to the south, met a hard bar of country, and stopped. I have not been able to get any good information as to the work done at the 50 feet level, and from there to surface. The lode is said to have been traced along the beach on a course N. 40° W., but nothing can now be seen but traces of it, the trenches along the outcrop being filled with beach-gravel. It is said to have dipped to the S.W., and the shaft was located so as to cut the reef at a vertical depth of about 400 feet. It is said that there was also a cross lode running about north and south not far from the shaft. A small piece of the ore shown to me consisted of very dense galena associated with carbonate of iron. At times it is said that there was from 9 inches to 12 inches in width of clean galena. The information was given to me that the galena averaged 75 per cent. of lead and 29 ounces of silver per ton, but sometimes had as much as 45 ounces of silver. Some quantity of ore is said to have been raised and smelted on the spot in a small hearth. Though the Cambro-Silurian strata are seen on the beach, it would seem from examination of the mullock-tips that the shaft and drives have been in the Dial Range formation in tuffs and breccias. The lode is said not to have been cut at all in the lower level, which is a pity, as this would have tested it pretty well. Having in this instance to depend entirely on somewhat conflicting hearsay reports of what was found in the mine, I cannot express any opinion as to the prospects of success if work were resumed; it would seem, however, to be a matter of no very great expense to provide more powerful pumping plant and continue the drive at 100 feet to cut the lode, when something definite would be ascertained about it. It will be

interesting to find what the lode looks like when it gets down through the breccias into the Cambro-Silurian strata, as it must before going very deep. There is a possibility of its becoming more regular and larger in the older rock.

Penguin Mine.—The shaft of this also is on the flat ground just above high-water mark, near the south boundary of Section 155-87M, now no longer held under lease. The machinery has been removed, and the shaft is full of water. It is said to have been 80 feet deep, and though so close to the shore, there was not a very great inflow of water. As at the Neptune, the outcrops of the lodes where formerly trenched upon are now full of gravel, and cannot be seen, and it is not clear what the owners had to go upon. For some three or four chains along the beach the breccia and tuff country (Dial Range formation) is much silicified and impregnated with sulphides, and is traversed by numerous veins of quartz and sulphides of iron, lead, zinc, copper, &c., and dolomite, running in a general northerly to north-easterly direction, forming rather a sort of stock-work than a lode. Native silver and rich argentiferous gray copper ore were sometimes found, some of the latter being said to have given assays of 230 ozs. silver to the ton. Near the old shaft there are still a few pieces of the ore from the mine lying about, and some of these show copper pyrites, iron pyrites, galena, blende, and arsenical gray copper ore (Tennantite, or more probably Epigenite) in quartz and dolomite. A few pieces collected by me were examined by the Government Analyst, and returned—

Gold.....	0 ozs. 1 dwt. 15 grs. per ton.
Silver.....	27 „ 15 „ 8 „
Copper.....	3·4 per cent.
Nickel.....	2·5 „
Cobalt.....	0·8 „
Lead.....	10·8 „

also traces of antimony, but no zinc. Specimens of the ore containing more of the sulphides and less of the gangue than those analysed, which were quite second-class ore, would doubtless give much higher returns. The nickel and cobalt in the ore add considerably to its value, and would be saved in smelting as a speiss in combination with the arsenic.

For the same reasons as in the case of the Neptune mine, I cannot say much as to the prospects of resuscitating this one. In one respect it appears to offer better inducement to try it again than the former, namely, that there is a considerable probability that the numerous veins scattered over a large area at surface will be found in the underlying older formation to make one or more definite lodes. I do not know how deep it would be necessary to go to get into the Cambro-Silurian strata, but do not think it would exceed 300 or 400 feet, possibly much less. It seems rather likely, from a theoretical point of view, that at the time the ground was shattered and mineral-bearing solutions began to go through it, the tufaceous formation was comparatively soft, and might well become greatly shaken and fissured by a force which would only make a clean fracture in the hard older rocks beneath. Solutions, especially hot ones charged with mineral substances, rising through such a clean fissure into a shattered pervious rock might very likely convert the latter into a sort of stockwork such as we now find, while beneath there would be an ordinary lode. Were the minerals in the scattered veins seen at surface concentrated into one lode the latter would probably be well worth working.

Hardy's Lode.—On the slope of the hill rising behind the flat on which the Penguin township is situated, some 10 chains or so W.S.W. from the Penguin mine, a small vein of galena has lately been found by Mr. Hardy in hard tufaceous country closely resembling diorite, but containing occasional rounded pebbles. The vein is small, and has been traced by a trench for some 14 feet in length. It has smooth well-defined walls, running N. 55° E., nearly straight towards the Penguin mine. The ore makes in a little chute about 3 feet long, and consists of 4 to 6 inches thickness of gossan and clayey matter, with ½ to 1½ inches of galena and cerussite, but the vein is pinched to a mere joint outside of this. It has not, however, been followed any distance along its course, or sunk upon more than a few feet. It looks like a true fissure-vein, and is worth tracing along its strike to pick up any other chutes of ore that may exist in it: these would then require to be further proved by sinking upon them. The value of the ore in silver is quite low as yet, a sample sent by me to the Government Analyst yielding 8 oz. 14 dwt. 8 grs. of silver per ton, traces of gold, and 49·3 per cent. of lead.

Some chains west of Hardy's workings, near General Wilson's house, there is an old shaft from which some clayey matter, consisting of quartz, kaolin, and yellow clayey oxide of iron, that most probably has come from some sort of lode, has been thrown out. As it might be silver-bearing, a sample was sent to the Government Analyst, but only traces of gold and silver were found by him in it. There is no means at present of seeing the size of the lode or of determining its course, and a fresh shaft would have to be sunk to further prospect it before anything could be said as to its probable value.

Sullock's Lode.—On the beach opposite Hardy's find Mr. Thos. Sullock has lately been working a large irregular lode-mass, which is somewhat similar to the occurrence at the Penguin

mine. There are several outcrops of cherty quartz, containing iron pyrites plentifully, also other sulphides, and in one part magnetite. Native copper has also been found, and in parts of the lode there is much dolomite. A piece of quartz rich in gold is said to have been once picked up on the beach in this vicinity, and a little gold is reported in assays. Some of the quartz is much brecciated, and other portions radiated crystalline. The outcrop is much covered with beach *débris*, but appears to be wide and strong, and to have more than one branch running from the main body. The general strike is about N. 55° E. Mr. Sullock had sunk a shaft 18 feet deep on the outcrop below high-water mark, but this was filled with gravel when I saw it: in the bottom he got some quartz rock containing much pyrites. Near the shore line a branch goes off to the west of the main line of outcrop and along this branch stains of green carbonate of copper and a little native copper are seen at times. On the flat shore close to the road there is an old shaft said to be 30 feet deep, from which lode-matter consisting of dense quartz, oxide of iron, and pyrites, and dolomite with pyrites, has been thrown out. As there seems to be a large mineralised zone along the line of this "lode," I took three samples from various parts for assay, and the Government Analyst has examined them with the following results:—

Sample No. 8.	*Gold*,	0 oz.	1 dwt.	15 grs.	per ton;	*Silver*,	0 oz.	8 dwts.	4 grs.	per ton.
„ 10.	„	0 „	2 „	9 „	„ ;	„	0 „	8 „	4 „	„
„ 13.	„	Traces			„	„	Traces			„

Sample No. 8 was from the shaft on the beach itself, and consisted of quartz, pyrites, pyrrhotite, magnetite, and some dolomite. No. 10 was from the old 30-ft. shaft on the shore, and was a dense mixture of quartz, oxide of iron and pyrites, with some dolomite. No. 13 was a highly silicious, somewhat cellular rock from part of the outcrop near high-water mark, and contained much magnetite, this often giving the quartz a black colour.

It seems most probable that this "lode," like the ore-bearing matter at the Penguin mine, is of the stockwork character, the tufaceous and felsitic country rock having been much silicified, altered, and impregnated with sulphides by the passage through it of hot mineral-bearing solutions. As with the Penguin deposit, it might also make into a regular lode in the underlying Cambro-Silurian country. Being gold-bearing to a small extent, there is some inducement to prospect it further at deeper levels.

Manganese.—On the beach close under Watcombe House there is a deposit of black oxide of manganese of probably Palæogene Tertiary age, from which some fairly good ore is reported to have been raised and shipped. It is so much covered over now that it can hardly be seen, and it would have to be opened out afresh to permit a judgment to be formed of its value.

Some little distance west of the Neptune mine there is a peculiar belt of earthy manganese boulders lying loose on the beach. This seems most likely to be a Tertiary deposit that has formerly been covered with basalt and so protected from erosion, but later on has been laid bare and is now in process of destruction by the waves.

Alluvial Gravels.—In a road-cutting behind the Penguin Recreation Ground we see a section of a large deposit of gravel containing some big boulders of conglomerate, lying on the top of a spur. The bedrock is not visible. This may be an old river deposit, and seems worth trying for alluvial gold. It may be one of the channels occupied by one of the streams of the neighbourhood before the outpouring of the basaltic matter filled their valleys and diverted them into new courses.

Inland Penguin District.

In the lower parts of the Penguin Creek the Cambro-Silurian slates and schists are seen for some distance up it, often containing irregular quartz veins with more or less pyrites, but none yet proved payably gold-bearing. Higher up the creek we find the Dial Range series of strata.

H. Good's Lode.—Near Mr. H. Good's house a line of ferruginous gossany matter has been found, which seems to be the outcrop of a lode. A small shaft has been sunk 20 feet deep following a vein of clayey and ferruginous lodestuff of somewhat promising appearance. Some assays from this are reported to have given encouraging results in silver. The lode is too little developed to enable an opinion to be formed of it, and would require to be trenched across at two or three places along its course, to have some prospecting shafts sunk upon it, and to be tested by a good many assays before it could be said to be likely to become of importance or not.

Devon Consols Lode.—At the head of Myrtle Creek some mining work has been done on a lode which traverses 80-acre mineral lease, 2524-87M. At the centre of this section the lode was seen in the creek, and some good copper pyrites is said to have been obtained from it. A drive was then made along the vein to the north-west (bearing 311° 45′), a distance of 170 feet. Some 40 feet in, a winze was sunk about 30 feet deep. Close to the mouth of the tunnel a shaft also has been sunk to a depth of 49 feet, but was not deep enough to cut the lode on its underlay; a small cross-cut was, however, made from the bottom of it to the lode. This shaft and the winze were full of water at the time of my visit. The lode is of the fissure type and faults

the country rock, the beds of grit and conglomerate on one side of it not corresponding with those opposite them on the other. The lode-matter is from 10 inches to 24 inches in width, and consists mostly of yellow and grey mottled clay, often showing numerous smooth friction planes through its mass parallel to the walls, which give it a streaked appearance. The walls are smooth and sometimes striated. The lode dips about 80° to the N.E., and along the hanging wall there is a vein of pyrites which appears and disappears three or four times in the length of the tunnel. It is generally small, there being only from one to two inches of clean pyrites, though there is often a good deal through the adjacent country, but it is said that at the bottom of the winze there was as much as 13 or 14 inches of it, and from the large lumps at the mouth of the tunnel it is clear that in some parts the vein must have been much larger than it shows at present in the accessible workings. A good deal of copper staining is often visible on the rock in the tunnel, and a little native copper is said to have been found in driving it, but there is very little copper visible in the ore, which is mostly crystalline iron pyrites. It was reported to me that some copper pyrites assaying 32 per cent. of copper had been got, and also that assays had returned as much as 6 ounces of gold to the ton, and in one case 7 per cent. (*sic*) of silver, which I hardly credit. The stuff now visible in the tunnel is very poor, as is shown by the following assay made by the Government Analyst of a sample taken by myself from all along the vein, a large number of chips from different parts being mixed together to obtain an average parcel:—

Gold, trace. Silver, 1 oz. 1 dwt. 5 grs. per ton. Copper, traces.

The country is mostly conglomerate (Dial Range formation), lying in flat beds, and traversed by strong more or less vertical joints. It might be worth seeing what the lode is like in the Cambro-Silurian country, which, according to an exposure in the Penguin creek in Mr. Barnes' land not far away, must lie under the conglomerate at no great depth. The prospects of the mine are not encouraging, but should any owner become satisfied that the assays of ore formerly obtained were worthy of credence, the best thing to be done to test it further would be to sink a shaft to give it a trial at a lower level. Some more driving on the course of the vein might also be done in the hope of coming upon chutes of ore.

Hematite Deposits.—On the flat top of the spur separating the Myrtle and Penguin Creeks, to the north-west of the Devon Consols mine, some work was done a few years ago by Messrs. Henry Law & Co. in search of hematite. A good deal of this ore is seen lying about the surface, some of it very pure and good, and several trenches have been made to cut it in the solid deposit. In one of these a flat layer 8 to 12 inches thick is seen, covered with a few feet of surface soil. The ore in this seems to be very good, and some has been shipped from it. At other cuttings the ore-bed is very impure, containing much silicious matter through it. There is, however, evidently a good deal of very pure dense ore about the locality, if we may judge by the loose pieces about the surface, and it could be very cheaply raised and taken to the Penguin wharf. When iron mining and smelting become established in the Australasian Colonies, this ore will probably be worth opening out. Pits and borings would be the best means of looking for it, as it is pretty clear that it forms a flat-bedded deposit in the Dial Range series of strata.

Further west, on Messrs. Brown's, Hudson's, Crawford's, and Good's properties along the Penguin Creek, the hematite ore is again found, very pure pieces being common. A few trenches have been made on Hudson's and Brown's land; in the former the quartzite bedrock (Cambro-Silurian) is exposed; in the latter there is much good ore, but also in places a great deal of objectionable silicious matter. The outcrop on Brown's land is a very large one. There was not time for a lengthy examination of this interesting occurrence of iron ore, and to get a proper idea of it a good many pits would have to be dug; but there is every reason to think that very large quantities of excellent ore could be won at small cost. A good deal of the hardest and purest stuff could probably be got by sluicing the Penguin Creek and its flats in the valley between Hudson's and Brown's outcrops. The ore seems most likely to be a bedded deposit, lying in flat layers like that worked by Messrs Law & Co., but no section of it is just now available. I do not think it has any connection with the "Iron Cliffs" deposit next to be described, though it is almost on the line where the latter might be expected to be met with. The Iron Cliffs ore is a brown hematite, quite unlike the dense red hematite now in question.

In passing over the above-named properties a few chips were taken here and there from the best-looking blocks of ore, and were tested by the Government Analyst in Hobart, the sample containing—

Peroxide of iron.....	98·0 per cent.
Silica	1·6 „
Sulphur.....	0·2 „

This is a very pure ore, suitable for making the best brands of iron and steel. Mr. Brown informed me that many years ago he sent some 30 tons of the ore to England, and got back a report that it was of the very best quality. Other tests made from time to time confirm this, Messrs. Law and others having obtained very favourable analyses. I was informed that the ore could be delivered at the Penguin Wharf at the present time for four shillings (4*s*.) a ton, and that

some had been actually taken out at that price, and if a tramway were made, which would be easy, the cost would be less. The ore is very similar to the hematite at the Blythe River, described in my Report of 5th March, 1894, and as the matter of the possibilities of iron smelting in the colonies has been fully gone into in that Report there is no need to again discuss it. It might be possible, however, to smelt a small amount of charcoal iron for special purposes locally, there being splendid supplies of wood for making charcoal. The utilisation in this way of the timber now useless and cumbersome in the district would be a great boon to the settlers, enabling them to earn something towards the cost of clearing their land. It is very doubtful if the time is quite ripe for this experiment, but it is sure to be tried some day, and these deposits of good iron ore must become very valuable in course of time.

Iron Cliffs.—About a mile and a half almost due west from Mount Montgomery to the S.W. of Mr. J. Ling's farm there is an immense outcrop of iron ore forming notable rugged outstanding rocks. The ground falls very steeply from Ling's farm down to M'Bride's Creek, a branch of the Penguin Creek, the slope being some 350 to 400 feet in vertical height in a distance of probably under ten chains. The outcrop is a wide one, probably quite 150 feet across, and runs somewhat obliquely down the slope in a more or less north and south direction. The ore is brown hematite (Limonite), often in concretionary, botryoidal, reniform, and stalactitic shapes, with occasional silicious and slaty portions. On the top of the cliffs, near Ling's fence, portion is micaceous, but gives a brown streak, unlike true micaceous iron ore (red hematite). The country rock enclosing the mass is not visible on the north side of the creek, but on the south it is seen to be the Dial Range formation. From the way in which the ore occurs in a line running down a steep hill slope presumably composed of nearly horizontal strata, from its want of any appearance of stratification, and from its structure, I am satisfied that the "Iron Cliffs" are the outcrop of a large lode. Quite similar limonite outcrops are seen in various places in the Dundas field, few, however, being so large and imposing as the huge masses here visible. Northward along the line the Tertiary basalt covers the lode outcrop, but it is seen again in one place on Ling's farm where a spring issues from under the basalt, the water running over a floor of iron ore. In Barnes' section, still further north, the iron ore contains much oxide of manganese, quartz, and heavy spar, and is plainly lode-matter. A piece taken from here by me, however, yielded only traces of gold and silver when assayed by the Government Analyst. As above remarked, the hematite iron on Good's, Hudson's, Brown's, and others' sections still further north is much on the line of the Iron Cliffs lode, but it is of quite different character, and probably a bedded deposit. It is possible, however, that some of the outcrops may prove to belong to the lode, and not all to the layer formation.

On the south side of M'Bride's Creek the iron ore is seen again in small quantity on the slopes of the gully, and some nice fibrous brown hematite was there obtained by me. It seems probable that the lode then bends a little to the west of south and gets covered by the basalt seen on Mr. Stott's farm. On the east boundary of this in the creek the felsitic and tufaceous country is much impregnated with sulphides of lead, zinc, iron, and copper, and numerous veins of dolomite and these sulphides have been observed. Some cuttings have been made into the rock, but though it is much mineralised, there is yet no sign of true lode-matter having been reached. It seems likely that a tunnel driven west here into the hill would strike the lode before long, but before doing anything to this a careful search should be made right up the bed of the creek from the Iron Cliffs to make sure that the lode has not crossed it and gone into the hill on the east bank.

The occurrence of the above metallic sulphides in the country close to the line of the lode may be regarded as indicating the probable nature of the filling of the latter, which will most likely be pyrites, carbonate of iron, quartz, and sulphides of lead, zinc, and copper. The huge size of the outcrop at the Cliffs points to the lode there being large, and it seems to me to be quite well worth trying to see what is in it below the gossan. From M'Bride's Creek tunnels could be put in along the lode both north and south, which would soon ascertain its value. Seeing that the lead ores got in the mines on the beach at the Penguin have usually been fairly valuable in silver, and that throughout the district there are traces of both this metal and gold, it appears very probable that the lode under the Cliffs may contain valuable ore. It is quite as well worth trying as most of the gossan lodes of the Dundas district, and has the great advantage over them of easy accessibility. Quite a short track would connect the tunnel on the lode with the Iron Cliffs road. It is a wonder to me that when mining was in progress in the district no one has tried to tunnel under the Iron Cliffs, as they certainly are the most promising lode outcrop in the whole district. With its splendid advantages of accessibility and ease of attack by tunnels, it most assuredly deserves a mining trial.

The brown hematite itself of the Cliffs may have some value as an iron ore in time to come, and could be very cheaply won by quarrying; it seems doubtful, however, if it would be pure enough for iron manufacture. Much of it would be excellent flux for silver-lead smelting-works.

Manganese Ore.—To the north of Mt. Montgomery, on some flat barren Crown land between Midgley's and Alexander's purchased blocks, a little rather earthy and impure black oxide of

manganese is found, apparently forming a bedded deposit which may be of the same age as the Dial Range conglomerates, or quite modern. It does not appear to be of economic value so far as now known.

DIAL RANGE DISTRICT.

Some four or five years ago several mineral leases were taken up on the east side of the Dial Range, and some little mining work was done; but before long interest in the locality died out, and the leases were all allowed to become void. The main part of the Range itself appears to be composed of conglomerates belonging to the Dial Range formation (Upper Silurian or Devonian), but the lower ground, where most of the mineral sections are, is made of Cambro-Silurian strata, the younger rocks having been denuded away more or less entirely.

Section 3472-87M, 80 *acres*.—A large creek passes through this section, and in this a lode of pyrites is seen which has had some work done upon it. An old cutting is noticeable, which is said to have been made over 30 years ago by the late Mr. C. Gould's men when he was examining this district. In this the lode was seen to be about 2 feet wide, with strike N. 20° W. and dip 72° to S.W., consisting of quartz and pyrites in laminated bands, a little oxidised in parts. Some of the quartz is very dense and carries a great deal of pyrites. About a chain further north, a tunnel was put in a few years ago to cut the lode, and a winze is said to have been sunk on this to a depth of 90 feet on the underlay, from which very solid pyrites were obtained in big lumps. The tunnel being much out of order, and the winze full of water, the lode could not be examined in these workings. A shaft 10 feet by 4 feet has also been sunk, it is said to a depth of 100 feet, but all work had to be stopped owing to the failure of the bank in which the Company's funds were deposited during the recent financial crisis. The information given to me was that the shaft was intended to be sunk 200 feet, at which depth it would reach the lode. The country is soft sandstone and slate with steep dip, striking about north and south. A good deal of very pure dense pyrites said to be from the winze was lying near the shaft, apparently put to one side for preservation. I took a number of chips from various parts and sent them to the Government Analyst, who found them to contain *Gold* at the rate of 20 grains to the ton and *Silver* 6½ dwts. to the ton, but no *Copper*. The lode is seen again on the track where it crosses the creek, and is said to be traceable for a long distance. It is a strong well-defined vein, and if further prospected may yet be proved to have chutes of valuable ore in it.

Section 2605-87M.—Towards the north boundary of this section a small shaft has been sunk, but nothing of value could be seen about it, the only stone looking at all like lode material near it being some hard quartzite with enclosed specks of pyrites. Further south, some 4 or 5 chains south of the north boundary, there is another shaft with a good deal of fair-looking gossan and a little pyrites. The hard old metamorphic sandstone country with quartz veins in it outcrops close by, but there is a lot of the Devonian conglomerate lying loose about the surface. From here there is more or less gossany material along a north and south line into section 2604-87M, and a trench has been cut through this some 12 feet deep on the top of a spur, showing the gossan going down in lode form. Probably it is the outcrop of a pyrites lode. There is a considerable thickness of lode-matter, which might turn out to be of value. It requires to be sunk and driven upon, and tested by numerous assays.

Section 2604–87M.—South-easterly from the above trench, at the centre of this section, we come to a shaft about 20 feet deep on a gossan mass, the course of which is not determinable without clearing away the scrub which has overgrown everything here. The material from this shaft having been reported to have given good assays in gold and silver, I took a few pieces and sent them to the Government Analyst, but he found only traces of gold and silver in the sample. The gossan is somewhat silicious and of rather favourable appearance.

Some 7 or 8 chains N.E. from this shaft there is an underlay shaft down 12 or 15 feet on a lode of gossan striking N. 72° E., and dipping southerly 45°, but though the stuff looked promising, the assay of my samples forwarded to the Government Analyst showed only traces of gold and 3 dwts. 6 grs. of silver to the ton. These gossan formations may perhaps improve when they are sunk upon, but present appearances are not favourable as to their being of much value. The country is a good deal broken by gullies, and if any valuable lodes are found it would probably be possible to do a good deal of work by means of adits. With present means of access it would be a hard matter to get heavy machinery on to the field.

Section 3468–87M.—In this section, close to the S.W. angle, there is an outcrop in a creek of a lode of pyrites and quartz much like that above-mentioned in Section 3472–87M. Strike N. 15° W., dip easterly 72°. It has not been cut into to show its thickness, and requires further opening before any opinion can be expressed as to its value.

Further south than these sections I was informed that there was a fairly long tunnel on a section which I had not time to visit, but from the information given to me it did not seem worth while to spend another day in again going up to the Dial Range to look at it. As will be seen

from the above, very little work has been done in the District, and not much encouragement received to go on further with it. It seems clear, however, that there are lodes and indications of minerals, and further prospecting may yet result in good discoveries. The ground is very thickly covered with scrub, and progress in exploring it is consequently very slow.

SULPHUR CREEK.

West of the Penguin Creek the older Cambro-Silurian strata are well seen along the beach, often very full of strings of quartz which often carry pyrites, and have sometimes been taken to be true lodes. On the side of the Sulphur Creek road, on the steep grade where it rises up from the flat ground along the shore, a piece of very rich gold-bearing stone, showing gold and pyrites freely, is said to have been recently found, but after examining it and seeing the place where it was said to have come from, the conclusion was forced upon me that the discovery was not genuine. The specimen had plainly come from some depth underground, and was most probably from one of the Lefroy mines. Some work had been done by Mr. M'Phail to find the reef from which the rich stone was supposed to have come, but as yet he has found nothing but small quartz veins such as are seen very commonly in the country rock where it is exposed on the beach.

West of the Sulphur Creek on the beach there is a band of ferruginous slate containing pyrites. When concentrated the pyrites is said to have yielded 8 dwts. gold to the ton on assay, but as there is only a small percentage of sulphides in the rock it would not pay to attempt to work them at this value.

MOUNT HOUSETOP DISTRICT.

From Mount Housetop northwards along the course of the Blythe River there is a considerable area of granite country, and in the southern portion of this several mineral leases have from time to time been taken up for tin ore, mostly between the Emu and Blythe Rivers from 3 to 4 miles N.W. from Mount Housetop on the heads of the Falls and Trial Creeks. A section, 238-91M, has also, however, been taken up N.N.E. of Mount Housetop, near the head of the Laurel Creek, on the east side of the Blythe River. My examination only included the principal discoveries at the Falls and Trial Creek. These lie from three to four miles E.N.E. from the Hampshire Hills station on the Emu Bay to Bischoff Railway, and less than a mile east of the eastern boundary of the V.D.L. Company's Hampshire Hills block. At the time of my visit no regular work was in progress on the field, only a little prospecting from time to time, and most of the mineral leases have been thrown up.

Going eastward from the Hampshire Hills station the country passed over for about three miles is all basaltic, even in the deep gullies of the Emu River and its tributary creeks. On the railway line a little above the station the granite rock is seen cropping out in a cutting, rather fine grained, and not unlike some of the stanniferous quartz porphyries of the Blue Tier tin-field in general appearance. A short distance east of the Hampshire Hills block boundary the granite again emerges from under the basalt, though runs of this cover it in places. It is worth noticing that as the granite is found high up on the west side of the valley of the Emu River on the railway line, and again equally high on the east side at the tin-field, but is not seen in the much lower ground between, there must have been an old valley in it before the coming of the basalt in much the same position as the one now existing. This fact may have importance in future if search for deep leads under the basalt is undertaken, as it will be seen further on there is some reason for expecting. The basaltic country followed by the railway line up from Burnie, flanked by older rocks along the Cam and Blythe Rivers on each side, may perhaps represent an old valley filled up with basaltic matter.

Most of the tin workings have been in the creeks for alluvial tin ore and in shallow ground, but there are also some deep alluvial gravels covered with basalt that have been a little prospected, and a little work has been done on some lodes. On section 1202-91M (formerly held by E. Spinks) a shaft was sunk some 19 feet on a soft lode of talcose matter and quartz running more or less north and south, said to be 4½ feet wide in the bottom of the shaft. This was fallen in and inaccessible, and the lode could not be seen at all when I visited the spot. Some of the soft lodestuff that had been thrown out of the shaft gave me a little tin ore when washed, but was poor. Some good ore is reported to have been raised, and a creek running up to the shaft is said to have been fairly good in alluvial tin, probably derived from the lode. It would seem therefore that there is some inducement to open the vein more thoroughly so as to ascertain if it is worth mining upon.

In the adjoining section 1277-91M (formerly J. Revel's) there is another soft lode also running about N. and S., on which a shaft has been sunk to a depth of 40 feet (full of water when I saw it). This is rather an interesting occurrence ; the lode-matter, about 18 inches in thickness, consists principally of kaolin carrying tin ore and tourmaline impregnated through it. Some very fair prospects are obtainable, and some of the stuff is quite rich. I was told that a good deal of it was so full of tin that it was carried over a hill by the prospectors some considerable distance to a small wooden "dolly" (or rough stamper) which they erected beside a suitable creek, and was there

crushed and sluiced. A small creek heading from the vicinity of the lode is said to have yielded a good deal of alluvial ore. This lode seems to me to be well worth looking into, as it promises to be valuable. Being in low ground it could not well be prospected by a tunnel, but a few windlass shafts sunk along its course would soon give information about it enough to show if its development would be worth persevering with.

A little west of these workings the track crosses another little creek which has been worked for alluvial tin on a somewhat fine-grained soft granite bottom. Here there is a great deal of angular and water-worn glassy quartz with tourmaline and occasional sapphires.

To the north west of section 2813-87M two branches of Falls Creek have been worked. Johnston's workings were in very shallow ground on a red granite bottom, in which numerous veins of quartz with tourmaline are exposed. Much crystalline quartz and schorl occur here in the wash. The ore was much contaminated with titaniferous iron ore difficult to separate, which lowered its value. Below the workings in the tail-race basalt comes in, showing spheroidal weathering, probably a dyke bursting through the granite. In Dale's workings on a neighbouring small creek the tin ore was very well water-worn and free from impurities, and had much well rounded water-worn quartz gravel associated with it. At the head of this creek there is a short tunnel, now fallen in, driven on a bed of waterworn "wash," which is found running into the spur. A shaft has also been sunk in the top of this spur, and gravel obtained from it, but I could not learn if bottom had been reached. It is evident that there exists here a considerable quantity of older water-worn gravel covered by surface soil which is partly of basaltic origin. Just at this point the gravel is not covered with solid basalt; but this appears close by, and I have little doubt but that it covers the bulk of the deposit. The place is worth prospecting further, and it will probably be found that the "wash" dips away under the basaltic country, and that this will cover "gutters" or old water-courses containing a good deal of ore. Practically nothing has been done to test this promising deposit. The occurrence of waterworn tin ore, fairly coarse in size, along with thoroughly rounded gravel, shows that it was not sluiced from the bedrock by the present short creeks, but by some older ones in which there was much more powerful attrition of the material carried along, and taking this in conjunction with other finds further south, there can be little doubt that the principal alluvial deposits of the district are to be looked for in an older system of water-channels now buried under the basalt to the westward of the granite area.

Close to the track from the Hampshire Hills to the tinfield, on Section 2813-87M, there are some holes sunk on outcrops of rather vitreous-looking quartz, which has not been found to carry any mineral of value. One of these gives further evidence of the existence of buried gravels to the westward, the granite bottom dipping rapidly in that direction under brown basaltic soil. In the west end of the trench well waterworn quartz "wash" came in under the brown soil, and with it came water, which led to the abandonment of further work. The granite crops out both north and south of this place, so this lead seems to be a small branch running to join a main gutter lying further westward under the principal basalt area. The gravel might be traced to the westward by shafts and bores with advantage.

Waterworn tin-ore, probably derived from a deep lead, is found also along the west side of the flats near the head of Trial Creek, at two places known as "The Big Tin" Creek and "The Knoll." At the first of these places very coarse well-waterworn tin-ore is found in very shallow soil consisting of weathered granite bedrock almost without gravel. Probably, we have here a case where the heavy tin-ore is all that remains of a portion of the lead which has been denuded away right down to the granite, all the lighter material being removed and only a little of the heaviest ore left on the bedrock. The basalt country is close at hand to the west, and search should be made along its edge for deep ground dipping under the lava rock. At "The Knoll" the same sort of thing is again noticed, coarse waterworn tin-ore with a very little rounded quartz gravel being found on the surface of some low rounded granite knolls. Here too the deep lead has probably been entirely washed away, leaving only a little of the heaviest tin-ore upon the bedrock, which has been cut to new shapes by the modern watercourses. At all the above places the tin-ore obtained is very pure and not associated with titaniferous iron-ore or other deleterious substances.

In what are called the Trial Flats, however, which are extensive, swampy flats covering some 100 acres to the south of Section 2813-87M, the tin ore is unsaleable, or nearly so, through being associated with a great deal of foreign matter, ilmenite, zircon, sapphire, garnet, and some heavy rare minerals, not removable by streaming. Much of the tin ore is well waterworn, much more so than the associated ilmenite, and may be derived from the deep lead. Holes sunk in various places throughout the flats have shown the alluvial ground to be from 7 to 9 feet deep as a rule, with an average depth of about 2½ feet of gravel under the surface soil. The Trial Creek carries a good supply of water, but the ground being very flat is not easily worked. A good deal of cutting of races and tailraces has been done and some paddocks of ground taken out, but owing to the impurities in the tin ore saved the work has not been payable. The best method of working these flats would be by hydraulic elevators, but there would be some difficulty in getting a sufficiently large supply of water for them at a high enough elevation to be useful, without making a long water-race.

In Section 2813-87M there have been a few trenches and holes made on a lode of ferruginous granitic lode-stuff, which often shows impressions of large cubes of pyrites, which would no doubt be found unoxidised on sinking a little deeper. Some of this stuff being said to have given returns on assay of both gold and silver, I collected a few fragments of the more gossany material from one of the shafts and sent it to the Government Analyst, who found, however, only a minute trace of gold and no silver. The lode runs about north and south, and is seen again as about 8 feet wide of granitic-looking lode-stuff in the Trial Creek arranged in somewhat parallel ribs or layers of quartz with talc, chlorite, and pyrites; here it is not well defined and does not look at all promising. Ferruginous material is again seen on the same line to the east of the workings on Trial Flat, and again near the place where the "big tin" was found. At this last spot there is a large outcrop of crystalline quartz, and some silver is said to have been obtained in assays. At no part of the course did this lode seem to me to be worth spending much money upon in testing it.

Near "The Knoll," a flattish ferruginous vein of quartz and magnetite, with talc and a little pyrites was noticed, on which a trench had been cut, and not far from this some very solid hematite was picked up on surface.

In the gravel in the creeks and about the surface numerous stones of quartz, quartz and tourmaline, and other vein materials are commonly met with, so it seems likely that veins are frequent in the granite country. The district is clearly a mineral-bearing one, and therefore worth prospecting, and no doubt in time discoveries of greater value than anything now known will be made. At present the most promising ventures would appear to be the development of the tin-bearing kaolin lode in 1277–91M and of the deep lead on the west side of the field. The district is easily accessible, and is worth more attention from prospectors than it has received.

TABLE CAPE AND CAM RIVER DISTRICT.

The district between the Cam River and the Dip Range and Rocky Cape Hills is traversed by a number of rivers and creeks flowing to the northward, which have cut it into a series of roughly parallel ridges and gullies. Going due west from the mouth of the Cam River we should cross in succession the Seabrook Creek, Camp Creek, Big Creek, Blackfish Creek, the Inglis River, the Flowerdale River, and the Sisters Creek, besides numerous small tributaries of these. Camp Creek runs into the mouth of the estuary of the Inglis River, and Big Creek into the head of it; the Blackfish and Flowerdale join the Inglis a little higher up; and the Calder River comes in some 12 miles from the mouth of the Inglis. The country slopes gently seaward from the Campbell Range, the ridges between the gullies of the main creeks being approximately equal in altitude at corresponding distances from the Coast. There is generally a somewhat steep rise from a flat strip of low land of varying width along the coast on to the spurs, and these then are found to afford good grades for roads. Most of the main spurs have roads along them, but the deep gullies intervening prevent easy communication between points on adjoining ridges. The tops of the spurs are all formed of basalt and basaltic tuffs, probably thrown out from a large number of vents throughout the district, of which Mt. Hicks is the most prominent. Going down into the valleys, however, we soon get off the basalt and come on older formations. Immediately under the basalt there is nearly always a layer of white well-rounded quartz gravel, often containing gold, at an elevation of from 300 to 500 feet above the sea-level. The gravel is generally lower towards the coast than further inland, and as it is found more or less all over the district under the basalt at the same elevation approximately on each side of each spur and on opposite sides of each valley, it is clear that previous to the basaltic eruptions there was an extensive area of country sloping gently seawards covered more or less with gravel. No doubt the main cause of the formation of this sheet of gravel was the general subsidence of the North Coast in Palæogene Tertiary times above referred to. It is not clear if the area was under water at the time of the basaltic eruptions, or if it was more or less a land surface: possibly portion was under the sea and other parts formed low shelving shores. We find evidence of occasional lacustrine or estuarine formations in beds of carbonaceous gravel and shale with much lignite through them, but I neither saw any distinctively marine or freshwater fossils, nor heard of any having ever been found. It is a matter of great consequence from a gold-seeker's point of view whether the gravels were laid in position by wave-action along a beach or by running water on land, for beach-gravels, when auriferous at all, are not often payably so, while in river-gravels there is much more chance of finding payable gutters. From the uniform way in which the sheet of gravel is spread it seems most likely that it was laid down upon a beach. As, however, it was deposited during a period of subsidence when the sea was constantly encroaching on the shore, it is possible that the channels of streams carrying the gravel seaward became filled up and covered over in some instances without being destroyed by beach erosion, and consequently there may exist gutters in the deposits in which larger amounts of gold may be expected. It may be well here to repeat the remark made above, that we have also in the district several deposits of later gravels of probably younger age than the basalts lying at lower levels than the older sub-basaltic sheet: these are well seen on the Calder Road, where it rises off the flats (themselves composed of recent gravels), and where a branch runs off from it to the Inglis River, in the S.W. angle of the Parish of Quiggin. These and the flats near the shore are probably relics of beaches left behind by the gradual rising of the coast in Neogene and Recent times. They contain occasional

traces of gold, but are not regarded as payable, though there does not seem to have been much effort made to prove them by sinking holes to the bedrock. It seems likely that they may be payably auriferous in parts, especially in any gutters that may exist in the bottom.

The presence of the sub-basaltic gravels is constantly indicated throughout the district by springs, which issue from the gravel layer. Most of the small branch gullies are found to start from such springs, and the basalt has often been undermined and eroded away around them so as to form somewhat circular or semi-circular hollows with steep sides, like old quarries. It is noticeable, however, that the white gravel is not often seen in much quantity down the creeks springing from these terraces, the explanation being that the light small rounded stones composing it are rapidly swept entirely away out of the steep beds of the watercourses. As the springs indicate the position of depressions or channels in the bedrock underlying the gravel in which the water soaking through the surface can collect, they also show the most promising places for attacking the terraces by tunnelling in the hope of finding the old gutters. They are not necessarily themselves, however, the outlet of old gutters, for these may be stopped by hard basalt or clayey material, and the springs may only indicate the lower places in the edges of underground reservoirs filled with gravel and water, over which the water makes its escape.

In the lower parts of the valleys we come on Cambro-Silurian or, possibly, Archæan schists, &c. in the beds of the Inglis River, Cam River, and part of the Seabrook Creek, but more usually on the nearly horizontally stratified soft sandstones, shales, and mudstone conglomerates of the Wynyard formation. The conglomerates easily yield up the boulders of the older rocks, granite, schist, quartzite, &c. contained in them to the creeks which cut through them, the soft mudstone matrix rapidly wearing away and setting the hard enclosed stones free. The greater part of the drift material in the beds of the streams is therefore usually made up of the older gravel once enclosed in the conglomerates. It has been noticed in several of the creeks that when the bedrock is conglomerate the wash contains more and coarser gold than elsewhere, and it seems by no means impossible that these rocks are the source of much of the gold found in the streams. The forces that could move heavy boulders about could also move fairly large pieces of gold, and there is no reason why there should not be a little gold through the mass of the conglomerates. Should it be found eventually that these have been partly deposited by ice action, there would be no difficulty in supposing that at times auriferous drifts had been transported to sea by this agency. The boulders themselves are derived from formations favourable for the occurrence of gold-bearing lodes, and it is quite probable that these existed and that there was alluvial gold from their disintegration in the streams which formed and swept to sea the gravels we now find embedded in the conglomerates. The occurrence of much of the gold seems at times to favour the theory that it comes from the bedrock and not from the Tertiary gravels. So far as I know, however, no gold has ever been found *in situ* in the conglomerate. Close observation by the men working the creeks would probably throw much light on this matter. It may be urged with much force that as the Tertiary gravel layer once without doubt extended right over the places now cut out into valleys, immense quantities of material from these must have been sluiced by natural processes, and it is possible that the heavy gold has remained in the beds of the creeks as they were cut lower and lower, long after all the gravel in which it was once enveloped has been swept away. Both sources of the gold are possible and likely, and in either case the result is the same in one practical aspect, namely, that the alluvial gold is not derived directly from lodes, but indirectly from older alluvial accumulations, which may themselves have travelled a long way from the parent rocks before coming to rest. The Wynyard formation, as far as I saw it, seems quite destitute of quartz veins, and from its little indurated character is very unlikely to ever prove to be their matrix. The Cambro-Silurian strata are much more likely to be the real source of the gold, and where they crop out they often contain numerous quartz veins; but I did not hear of any gold with quartz attached to it having ever been picked up in the streams, or of any proved auriferous veins having been found. From want of recognition of the fact that most of the gold is derived from older detrital deposits, undue importance has often been attached to the occurrence of small quartz veins in the bedrock near where good gold has been sluiced out, these having been assumed to be the only possible source of the gold. It seems very likely that the gold has really come from some considerable distance inland.

A good deal of gold has been at one time and another obtained from this district, and a few men constantly make a living by sluicing even yet. The ground is nearly always shallow, and worked in a rough way by ground-sluicing. It appeared to me that more gold would be got if the work were carried out in a more systematic manner, the creek beds being thoroughly cleaned out instead of being only scratched along the actual watercourses, as is usually done. Most of the gullies known to be gold-bearing have, however, been worked more than once, and are now hardly likely to be worth going over again. In the Cam, Calder, and Inglis Rivers, however, there are larger gravel banks, which seem worth testing to ascertain their fitness for hydraulic sluicing. Also, there are all the sub-basaltic gravels to be worked yet if found payable.

A short description of each of the localities visited will now be given, with notes of whatever of interest was found in them.

Inglis River.—On the western fall of the ridge between the Flowerdale and Inglis Rivers, at two places on Messrs. Fenton's and Margetts' properties, I was shown outcrops of very impure lignite, little better than carbonaceous clay, lying immediately under the basalt at heights of about 265 and 320 feet respectively above sea level. In Margetts' ground there were layers containing much white quartz gravel. As these outcrops represent former swamps or peaty deposits, it is likely that they were formed in flat low-lying ground. As swampy flats along the courses of streams often have a deep channel traversing them, it seems possible that there may be deep gutters under these lignitic deposits which might contain gold. The carbonaceous layer is said to crop out also on the east side of the ridge on the fall to the Inglis. A little further south, some of the creeks running into the Inglis were found to issue from a white gravel layer lying immediately under the basalt, but were not auriferous, and the gravel here, though of likely appearance, does not give good prospects when washed. To the east of Mr. Margetts' property (264a. 2r. 17pls. near S.E. angle of Parish of Flowerdale), several small creeks have been worked with some success on each side of the Inglis River. On examining these it was found that they had not been worked higher than some old terraces of gravel left by the river when it ran at a higher level than at present. The highest of these terraces was noted to be 75 feet above the river, another was about 50 feet, and others lower. Where the branch creeks cut through these, and the material composing them had been sluiced by natural processes, the water-channels were payable for working. Some of the terraces are of considerable size, and would be worth prospecting to find if they are valuable enough to be worked by hydraulic sluicing, though I am not at all sanguine as to this being the case. The bottom rock is micaceous schist, striking about N. 80° E. On the east side of the river, in a branch creek which has been worked up for some distance, veins of quartz are not uncommon in the bedrock, and one larger one consisting of dolomite, quartz, and pyrites has been thought to be a lode, but is not clearly seen, and requires cutting into to be properly exposed to view. A few pieces of it were sent by me for analysis to the Government Analyst, but they were found to contain only traces of gold and silver. The gold along the Inglis is clearly derived from the older gravels formerly brought down by the river, and the source of these must be looked for before we shall find the source of the gold.

Calder River.—Some gold has been obtained at the junction of the Calder and Inglis Rivers, and from here for some distance up the Calder there are very considerable flats formed of river gravels, which give promise of being workable by hydraulic sluicing on a larger scale than any work hitherto carried out in the district. The bedrock here is the Wynyard formation, conglomerate low down, and shale and sandstone higher up in the sides of the valley. The white Tertiary gravel is seen at about 265 feet above the river or 435 feet above sea level on the old track down to the junction of the rivers, and above it there is basalt to the top of the spur, some 670 feet above the sea. A good many prospecting holes have been sunk in the flats alongside the river in days gone by, but the ground does not appear to have been found rich enough for ground-sluicing. More than half a mile above the junction the Calder makes an S-shaped bend through a large flat, and near the head of this a section is shown in the bank from surface down to bedrock, exposing about 5 feet of brown clayey soil on top with about 4 feet of rather coarse river wash beneath. The wash consists of boulders and gravel of the older rocks from the mudstone conglomerate strata. There is a little gold obtainable, enough to make the flats worth testing with a view to hydraulic working. A splendid supply of water at any desired pressure could be got from the Calder if the ground should prove worth working by this method. By cutting a straight channel for the river a good deal of the flat could be worked by ground-sluicing, but it would be far better to get water under high pressure to do the work, especially as there might be some difficulty in getting rid of water and tailings out of the lower parts of the flat and the present bed of the river. Hydraulic elevators would at once overcome any trouble in this respect. It would also be desirable to use these machines so as to stack the tailings out of the way and prevent them from going into the Inglis and being carried down by it to do possible damage to properties in the low land. My examination was far too hurried to enable me to give a positive opinion as to the value of these flats, but they seemed quite worth the trouble and expense of prospecting thoroughly with a view to hydraulic sluicing.

On the east side of the Calder a branch creek has been worked below Game's farm right up to the white gravels under the basalt, here 545 feet above sea level. Good heavy gold is said to have been got in this creek.

Moore's Plains.—These are composed of basalt, and lie at an elevation of about 850 feet above sea level, between the heads of the Blackfish and Big Creeks. Several gold-bearing creeks run into both these streams. From Moore's Plains I went eastward into Big Creek, on basalt country all the way ; then over a ridge into some gullies which feed Camp Creek, which have been worked for gold. Here again the Wynyard formation, at this place shales and sandstone, was found to be the bedrock, and the creeks took their rise from beds of white gravel issuing from under the basalt.

Big Creek.—Some workings were also visited lower down Big Creek, not far from Wynyard, on the Timber Reserve to the west of Messrs. Moroney's and Bauld's selections. The same.

feature as above described was seen repeated, the creeks being gold-bearing on a bottom of mudstone conglomerate, sandstone, and shale, and heading from springs in beds of white gravel lying under the basalt capping. The white gravel layer was noted to be 380 feet and 335 feet above sea level at the heads of two small creeks. In one spot it was strongly cemented together by some silicious cement to a very hard conglomerate, probably due to hot silicious solutions emanating from the basalt flows when first poured out. In one of the larger creeks some fairly heavy gold has been found on conglomerate bedrock containing large boulders of granite, quartzite, fossiliferous sandstone, &c.

Camp Creek.—Some six miles up the Mount Hicks Road we come to a part of the district where a good deal of gold has been got in gullies running into Camp Creek and Seabrook Creek. The top of the spur on which the road lies is, as usual, basalt, but going down the road which leads through Messrs. Hyland's and Harris's properties we get below this, and come upon, first, white gravel, and then sandstones and shales of the Wynyard formation. In Hyland's ground, on what is called Pine Hill, there is a large area of gravel not covered with basalt, and several holes have been sunk to prospect it. Some of these went into soft sandy material which may be Tertiary or possibly only a soft bed of the Wynyard formation. A small creek known as Whitewash Creek, cutting through the gravels, has been worked with some success. Another, known as the Cornishman's Creek, has also been gold-bearing, and along this there seems to be considerably more depth of gravel in the terrace drifts than near Whitewash Creek. The gravels lie pretty high, 500 to 550 feet above sea level, and some 85 feet above Camp Creek, consequently to bring water on to the ground for sluicing it would probably be necessary to make a water-race of some length. It would take a good deal of time and labour to prospect this ground enough to enable me to say whether it would pay if water for sluicing were brought on to it, but it seems to me that the chance of success is good enough to warrant a systematic test being made to ascertain the quantity and quality of the gravel available, and the possibility and cost of bringing in an adequate supply of water.

In Mr. Harris's property, on the west side of Camp Creek, a tunnel has been driven some 70 or 80 feet into a spur, following a bed of somewhat coarse white wash which lies nearly horizontal. In parts of this fair prospects of gold are obtainable by panning, but not good enough to pay for blocking out the ground, and there does not seem to be enough depth of wash to warrant expense in bringing in a water-supply to work by the hydraulic method. As gravel is seen on the hillside above the tunnel some distance, however, it might be advisable to sink a shaft just under the edge of the basalt capping to try if the higher lying drift contains gold that would pay for removal of the stripping from above the layer of better wash on the bed-rock. On the west side of the same spur the gravel is again seen emerging from under the basalt, some 10 chains or so away, and there can be no doubt as to its forming a more or less continuous sheet right through. The bottom is a soft sandstone. The practical question is whether there is or is not a gutter under the spur in which the gold will be more concentrated. The best way to test this would be to put in a tunnel lower than the present one, so as to allow for a possible dip of the wash towards the centre of the spur. From time to time rises could be made up to the wash to ascertain its thickness and value. Should the gravel gradually dip below this tunnel, the presence of some sort of a gutter would be proved, and there would be a strong presumption that it would turn out to be worth working. The drive would then have to be continued on through the drift, and winzes and bores be put down in the floor to find out the deepest parts of the old channel. The depth of the gutter being known, another tunnel would have to be driven low enough to get below it, so as to admit of proper working of it. As the sandstone bottom rock is very soft, the prospecting by means of tunnels would be much more satisfactory than diamond-drill borings through the basalt capping. It is of great importance to the district to find out if gutters really do exist under some of the basalt spurs, and as there is much reason for hoping that this is the case, and as the finding of them would result in considerable mining development, an effort should be made to test the question at a few of the most promising localities, for example, at this tunnel, at the tunnel on Mr. Gilmour's land on the west side of Seabrook Creek, and at some old workings to the east of the Mt. Hicks road, not far from Mr. Hyland's place, to be described presently. The work would not be very expensive if systematically carried out, but is too heavy for the resources of ordinary prospectors. Seeing the benefit that would result to the district from the discovery of sub-basaltic leads, it seems to me that the local landowners might well subscribe to test the matter. Nearly all the likely ground is now private property, and the owners are therefore directly interested, and would benefit largely if good leads were found.

In a branch of Camp Creek in Mr. C. R. Mackenzie's block to the north of Pine Hill it is again seen that the wash runs under the basalt hills on each side of the gully. The bed of the creek has been worked more than once, and some small tunnels have been driven into the spurs following the gravel beds, but not much could be seen owing to these workings being very much collapsed.

On the east side of the Mount Hicks Road on the fall to a deep branch of Seabrook Creek we find some old shafts and tunnels on Mr. Cooper's land (formerly C. R. Mackenzie's), now much

fallen in. These show gravel again under the basalt at much the same level as on the Camp Creek side. One of the shafts is said to have been 20 feet deep. As far as can be seen there is a good deal of wash about here, and as gold has been got in it, and the creeks running from it have been auriferous, there is some inducement to give it a more thorough trial than it yet has been afforded.

Seabrook Creek.—East of the last described discoveries auriferous gravels are found quite similarly situated on the fall to Seabrook Creek on Messrs. Gilmour's and Hülls' land, and again at much the same elevation on the east side of the valley of Seabrook Creek. The bottom is usually here shales and pebbly mudstones of the Wynyard formation. The gravel layer is a good deal lower than that above described, being at an elevation of about 350 feet above the sea, corresponding with that on the timber reserve in Big Creek rather than with those of Pine Hill, which lie at an elevation of from 500 to 550 feet. More mining work has been done on the gravel on Mr. Gilmour's land than anywhere else in the district, a good deal of ground having been blocked out and sluiced. This was done a good many years ago, and the workings are now only partly accessible. In the tunnel there are prospects obtainable that show that the wash would pay handsomely if it could be sluiced directly, but from the fact that work was abandoned by the former miners it is pretty clear that it is not rich enough for blocking out. There is a very fair area of gravel without much basaltic covering, and it seems desirable to test it by a number of shafts to obtain a reliable estimate of the quantity of wash easily accessible and its average value, also of how much stripping would have to be removed from the top. The gravel in the tunnel lies in a flat layer, and does not appear to be dipping into the spur under the main basalt capping, but may do so further in. Part of it is seen to be strongly cemented together, forming a conglomerate, but probably this would only be in patches, and might not interfere much with working. Should exploration prove that there is a sufficient quantity of payable wash here to warrant hydraulic working, it seems probable that water could be got on to it by a race from the upper parts of Camp Creek and Big Creek. As previously said, this would be a good place to make a trial by tunnelling to see if the wash forms gutters under the basalt spurs.

On Mr. Hülls' land, again, there is a small tunnel into the bed of wash under the basalt at the head of a creek which has been worked, and nice-looking gravel is seen which contains a little gold. Here also a test might be made by tunnelling to look for a buried channel.

On the east side of Seabrook Creek, opposite Hülls' place, the largest gold nugget, some 3½ oz. in weight, ever reported to be found in this district was found some years ago in a branch creek heading from the sub-basaltic gravels. Most of the creeks hereabouts have had some gold in them.

A cut has lately been made through an elbow in the Seabrook Creek itself by Mr. Gilmour to try to lay bare part of the bed of the stream, so that it may be cleaned up for any gold that may be in it. The cut shows shaly black mudstone with small pebbles (Wynyard formation). At the time of my visit the creek was running in its old channel, but in summer it will be easy to divert it and try the part of the bed laid bare. The Seabrook Creek must contain more or less gold in its bed, because the creeks draining into it have many of them proved to be auriferous; but I do not anticipate very great success from this venture.

Lower down the Seabrook Creek alluvial gravel containing gold is seen at the head of a small branch creek near Mr. Cooper's house, which has been worked more than once by diggers. As usual, the creek heads from springs in a layer of wash lying under basalt. In one place a rather nice prospect was obtained during my visit from some coarse wash belonging to this layer. This gravel is not far from the coast, and is only about 150 feet above sea-level, being thus considerably lower than that at Gilmour's and Hülls' tunnels.

In Hodgetts' property, a mile or two higher up the creek, gravels are again met with cropping out from under the basalt about 220 feet above sea-level. The wash is of a favourable character, and seems to form a fairly thick layer, so would be worth cutting into enough to drain it and allow it to be tested. The creek issuing from the gravel has yielded some gold.

On the west side of Mr. Hodgetts' ground the old Cambro-Silurian or Archæan mica schist country with quartz veins in it crops out, and there is often much rubbly quartz in the surface soil. The first gold got in this part of the district was found close by here in the side of the Seabrook Creek, and fair prospects of gold are still to be had in the vicinity in a little of the creek wash that has been left unworked. I did not, however, see any likelihood of there being enough of this gravel to warrant expense in bringing in a water-race for sluicing. In a small branch creek Mr. Hodgetts has found a sort of quartz reef in blue soft schist country, but it had become so covered up that I could not see it. The quartz from it does not look at all likely to be gold-bearing. It is very unlikely that these quartz veins have had anything to do with shedding the gold found in the neighbourhood, which probably all comes from the sub-basaltic gravels, or possibly partly also from the conglomerates of the Wynyard formation.

Cam River.—A mile or two above the junction of the Guide and Cam Rivers there are some extensive alluvial flats along the banks of the latter, consisting of river gravel brought down by the stream. The river being in flood on the day of my visit, the natural sections of the gravel deposit usually seen on the banks were not accessible, and no shafts were available for getting prospects from the wash. Mr. J. H. Ware, who accompanied me, informed me that he had obtained very fair prospects in the lower gravels. There are two terraces of gravel visible in some places, the lower and larger one being only a little above the level of the river, and from 8 to 10 feet in depth. The wash seems of very likely character from what was seen of it. Should these flats be found to contain gold enough to pay for working, there is a very large quantity of material available for sluicing. In dry weather, in summer, a number of shafts should be sunk to thoroughly test the ground. A splendid supply of water for sluicing is at all times of the year obtainable from the Cam River, and very short water-races would be required to bring it in, but, as in the cases of the Calder and Inglis River flats, it would be preferable to go to some trouble to get high-pressure water. This would enable the deep holes in the flats to be cleaned out by hydraulic elevators. By cutting a straight channel through the flats also it would become possible to divert and work the existing river bed.

The country rock is Cambro-Silurian or Archæan schists, slates, and sandstones. In one part there is a very hard silicious jaspery belt through it that may be a large lode, but it requires some cutting into to determine its true nature. At another part there is a good deal of gossan, which may come from a lode, but it is not known to contain any metal of value.

At the first bridge up the Cam road after leaving the Cam township, a creek is seen running over a sheet of hard conglomerate, which proves to be only a very strongly cemented bed of the tertiary gravel. It seems likely to be auriferous, and as there are very likely to be layers of soft uncemented wash under the conglomerate, it would be worth taking some trouble to find where this lies upon the bedrock, and to ascertain the position of the old gutter which very possibly exists under the cemented sheet. The bottom stuff might well be payably gold-bearing.

Sisters Hills.—No discoveries of any value have been reported from the Sisters Hills, but as they are composed of older Palæozoic schists, sandstones, quartzites, &c., of favourable appearance, this piece of country seems worthy of more attention from prospectors than it has hitherto obtained. Veins of quartz are common, and sometimes they contain pyrites. One piece sent by me for assay to the Government Analyst gave, however, only traces of gold and silver.

Zircon deposit.—Near Jacobs' Boat Harbour, on Mr. R. L. Skinner's land, there is a small creek notable for yielding large numbers of zircons and occasional sapphires. Much of the alluvial drift in this creek is really very rich in these gems. The sides of the gully are basalt, but the stones in the wash are mostly hard sandstone and quartzite, probably from the older Palæozoic hills to the north. The gems are little waterworn as a rule, and have probably not travelled far. There is a good deal of flat gravelly ground along the course of the creek which could very easily be worked, and if a market could be got for the stones they could be raised in quantities here very cheaply. With the great extension of incandescent gas-lighting on the Welsbach and similar systems that will probably take place before long, it is not at all unlikely that this deposit may become of commercial value. Some of the larger zircons are of very fine colour, and can be cut satisfactorily. The sapphires seem mostly to be of poor colour and very much fractured.

ARTHUR RIVER DISTRICT.

Only a very short visit was made to the Arthur River District, to Kay's old diggings, and to the Campbell Hydraulic Company's property. The road from Table Cape to Mt. Bischoff was followed to the south of the Henrietta Plains, then Sprent's track to Kay's diggings on the Arthur, some little distance below the junction of the Hellyer River. The track keeps on basalt country for the most part, and rises to an altitude of about 1800 feet on the Campbell Range on the top of the divide between the Inglis and the Arthur Rivers. Near the Inglis a considerable outcrop of diabase greenstone is seen. Going down into the Arthur Valley the north side appears to be mostly composed of mudstone conglomerate of the Wynyard formation; on the south side it is hard schist and slate and metamorphic sandstone (Cambro-Silurian). It would almost seem as if the Arthur River at Kay's crossing ran along the junction of the two formations, quite possibly along a line of fault. Going from Kay's Crossing to Gray's Creek, and from this across Campbell's Creek and over the range on to the Arthur again at the Campbell Hydraulic Company's workings, the Wynyard formation is met with nearly all the way, and in one place is seen also on the south side of the river, but the usual bedrock there is the Cambro-Silurian rocks. On the north side I was informed by Mr. R. Quiggin that there are large outcrops of limestone not far from the track; these would probably be Cambro-Silurian also. On both sides of the river there are occasional gravel terraces met with, in one instance as much as 200 feet above the river, no doubt left behind by the stream as it has cut its way downwards into the country.

Kay's diggings are on the south side of the Arthur, which is crossed by a cage and wire rope. Here there is a lot of alluvial gravel of very varying depth, from 50 to 70 feet above the river level, and about 550 feet above the sea. Work has been confined to cleaning out the creeks by rough ground-sluicing. Some deep ground has been proved to exist, and there may be a considerable amount of this: it would take some time and labour to determine now how much of it is available and what is its value, as the old workings are too much covered up to give assistance. No one has been working on the field recently, except an occasional fossicker. Several small creeks have been worked, some said to have been very good. It seems probable that they obtained their gold by natural sluicing of older river terraces. The bedrock is schist and slate, sometimes with a good deal of calcareous matter and veins of calcite, striking N. 45° to 55° E., much twisted, and often seamed with quartz veins. There does not appear to be much prospect of this old field coming into notice again unless the run of deep ground turns out to be larger than seems likely. There may, however, be patches of ground worth working on the slopes left untouched by the diggers, and if wholesale stripping of the soil by sluicing were resorted to there would probably be gold found in very unlikely looking places. I did not hear of any gold being got on the north side of the river except in the edge of the river bed itself, though several terraces of gravel are seen.

Gray's Creek.—A little work has been done about two miles below Kay's diggings on the north bank of the Arthur, where this small creek cuts through some rather considerable gravel-banks lying 70 to 100 feet above the Arthur River. These gravels contain large rounded boulders of a great variety of rocks brought down by the stream when formerly running at a higher level than at present. The creek has been worked, but no thorough trial has been made to ascertain the extent and average value of the gravel terraces to show if they would pay for hydraulic sluicing.

Campbell's Creek.—This is a considerable stream, and runs into the Arthur some little distance below the last-mentioned one. Some work is said to have been done along its course in the lower portions where the old river terraces have presumably been sluiced in it.

Campbell Hydraulic Gold Mining Company.—This Company is prospecting, and preparing to work by hydraulic sluicing, some very extensive terraces of river-gravel some two or three miles below the mouth of Campbell's Creek, and a short distance above the point where a rather large river, not named on the maps, but called by the Company the Keith River, joins the Arthur on the south side. The gravel deposits are on the south side of the Arthur, and to reach them from Wynyard it is necessary to cross on a punt or wire-rope and cage which have been laid down by the Company. They form several terraces, at heights from 20 to 100 feet above the river, and cover a large area. Some 14 or 15 shafts from 10 feet to 20 feet in depth have been sunk in the various terraces, and one was put down 50 feet before reaching the bedrock. The "wash" is river-gravel, somewhat coarse and not cemented. The bottom is usually Cambro-Silurian slates, but in one shaft the flat-lying Wynyard formation is seen. The terraces are much broken by small watercourses, which however do not seem to have been worked, partly it is said on account of want of a good water supply. The prospects that were washed in my presence from the various shafts were not at all encouraging, the bulk of the gravel being evidently poor. On the bedrock they were better, but it must be remembered that in hydraulic sluicing the whole of the gravel must be sent through the races, and we are concerned with the average value of the stuff from surface to bedrock, and not only with the richer layer at the bottom. Mr. A. Pyke, who was in charge of the work, however, stated that he had washed several large samples of the gravel from some of the shafts as it was brought up, and was satisfied that it was rich enough on the average to pay for hydraulic treatment. Six dishes, about 150 lbs. weight in all, of the gravel thrown out from various shafts, taken from several different places in each heap, were washed when I was going over the ground, and yielded 0·046 grains of gold, equal to $\frac{7}{10}$ of a grain to the ton, or about 1 grain to the yard. One dish, about 25 lbs. weight, of bottom dirt gave 0·413 grains of gold, equal to 1 dwt. 13 grs. to the ton. One grain to the yard might be made to pay, especially if there should prove to be considerably better wash on the bottom as well, if there was a good supply of high-pressure water for sluicing, and also a good escape for tailings, but the workings would have to be on a large scale, and economically conducted. I did not go to see the Keith River, from which it is proposed to bring in a water supply, but was given to understand by men who knew it that there was always a copious flow of water in it, able to furnish 50 heads of water at all times of the year. As the highest gravels are about 100 feet above the Arthur, it will be necessary to bring in the water-race at a still higher level, and I should recommend that as much pressure as is obtainable without too great expense should be got from the first. The Keith River is said to have falls and rapids along its course which give it a very steep average grade: if so, a high-level race would not be much longer than a less efficient low-level one. The higher race would also cross the gullies higher up than the lower one, and would consequently have easier country for construction. As the ground to be worked is not rich, every advantage must be taken to secure efficient and economical working, and high-pressure water is of the greatest importance. Some of the flats near the river may prove difficult of drainage and clearance of tailings, and here the high-level water would permit the use of hydraulic elevators. At the time of my visit a start had been made with cutting a water-race to

carry about 18 heads of water, which would come in on the level of the second highest terrace; but it seems to me that it would be much better to construct the high race from the first. The work that has been done to prove the ground has been good so far as it goes, but it would have been much more satisfactory if the stuff from each test-shaft had been, no matter at what trouble, carried to a spot where it could be sluiced in a box, so that the gold in it from grass down to bed-rock could be weighed and the average value of the ground estimated with some precision. A great many more shafts also are required for a thorough test. Much money would be saved in hydraulic ventures if the mines were properly proved by preliminary work before the expense of bringing in a water supply is undertaken. The gravels are very favourably situated for working, and with a good supply of water at high pressure I see no reason why even less than a grain of gold to the yard should not be made to pay.

Should hydraulic sluicing result profitably in this vicinity, it is probable that gravel terraces fit for working would soon be found lower down the Arthur River as well. Bearing in mind the high terraces of the Corinna and Table Cape fields, it is likely that the lower Arthur district will also have high gravel deposits, and search should be made for these on the tops of high spurs as well as for more modern drifts in the creeks.

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

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

The Secretary for Mines, Hobart.

REPORT ON THE ZEEHAN-DUNDAS MINERAL FIELDS IN FEBRUARY, 1896.

Mines Office, Launceston, 8th May, 1896.

SIR,

I HAVE the honour to forward to you some observations on the progress of the Zeehan and Dundas fields, as noted during a short visit in February last. Owing to my illness during the greater part of March, and press of accumulated office work consequent on my absence, I regret to have been unable to send in a Report sooner.

Having described these fields pretty fully during 1895 and previously—(see "Report on the progress of the Mineral Fields in the neighbourhood of Zeehan," &c., dated 15th May, 1895, and former Reports therein mentioned)—it will only be necessary now to supplement the information previously given so as to bring it up to date. On this occasion I visited most of the mines actively at work in the vicinity of Zeehan, then went out to those near the Town of Dundas, and later on to the North-East Dundas and Mount Read Districts; but owing to illness I had then reluctantly to abandon my intention of visiting some new ground that has been taken up in the vicinity of Mount Tyndall and the head of the Henty River, and of going thence across country to Mount Lyell.

Geological Notes.—Since last Report a good deal of information has been gained as to some of the geological features of the district which is worth putting on record. The most important is that relating to the so-called "White Rock" of the Zeehan district, about the nature of which there has been a good deal of doubt. It occurs in the Western, Montana, Junction, Oonah, Silver Queen, Silver Queen Extended, Mount Zeehan (British), and elsewhere along a belt of country running north-westerly to north north-westerly across the field, conformably with the general strike of the associated Silurian strata. This belt has as yet proved the most productive portion of the district, and the galena in it is as a rule richer in silver than that from the parts where the white rock is not found, giving rise to an apparently well founded belief that this is the most favourable "country" for the existence of valuable lodes. In my last Report it was considered to be of rhyolitic nature, but had not been analysed or examined with the microscope. It has now been subjected to petrographical examination by Messrs. W. F. A. Thomae, late of Zeehan, and W. H. Twelvetrees, of Launceston, who have determined it to be a melaphyre. Mr. Thomae, in a paper on "The Zeehan and Dundas Silver Field, Tasmania," read before the Institute of Mining and Metallurgy, London, on 20th November, 1895, describes it as follows :—"This volcanic rock is a grey greenish, in some places dark green, hard rock, weathering to a soft red or yellow earth, amygdaloidal, the cavities being filled with delessite, siderite, calcite, and rarely with quartz. It gets very hard at a depth of a few hundred feet, where it is less decomposed. Here it apparently consists chiefly of altered plagioclase felspar and augite with its characteristic decomposition products, and both physical and chemical characteristics point to its being a melaphyre." Mr. Twelvetrees is describing the rock at some length in a paper to the Royal Society of Tasmania this year, and has been so good as to let me have his notes, from which the following abbreviated description has been prepared :—"Hard grey rock dotted with black spots from the size of a pin's head upwards, obtained from the Silver Queen mine : specific gravity, 2·80 ; microscope slides show glassy groundmass devitrified to some extent by globulites and felspar microliths ; the felspar is labradorite, or closely akin thereto ; the sections show numerous pores and cavities, often more or less filled with chloritic substance, probably delessite, sometimes with calcite, siderite, or more rarely, quartz ; the rock is an originally vesicular basalt, much altered by decomposition and re-arrangement of its mineral constituents, and falls thus among the melaphyres."

In various parts of the field we find stratified beds of fragmentary volcanic material regularly interbedded with ordinary sedimentary material, a feature well seen in the southern tunnel on the Oonah lode, and these are without doubt the tuffs belonging to the lavas above described. It is clear that both lavas and tuffs were laid down during the period of deposition of the Silurian strata associated with them, and from the regularity of the bedding of some of the tuffs it is probable that the eruptions were submarine. The tufaceous beds would probably be widespread over a large area in the neighbourhood of the points of eruption, while the lavas would be massed more or less closely round these. As beds of slate of considerable thickness are found separating the lava sheets, we must conclude that, as usual, the eruptions were intermittent and extended over considerable periods of time. These considerations will help to explain the distribution of the melaphyre lavas and tuffs

in the district. The whole series has after deposition been subjected to very severe contortion, which has twisted the strata into very irregular folds. No doubt dykes of basalt or melaphyre must accompany the lava flows and tuffs, but few, if any, of these have been certainly recognized, and we may now regard it as pretty well established that the bulk of the Zeehan "White Country" consists of melaphyre lavas and tuffs intercalated conformably among the Silurian strata and belonging to the same period.

The extension of the Western Company's tramway to the northward has laid bare, in a cutting close to the Western Extended mine, a bed of mudstone full of rounded pebbles of sandstone, granite, and other older rocks of the district, lying unconformably on the Silurian strata. This is probably of Tertiary age and marine origin, but as yet no fossils have been found in it. Apparently there is only a small patch of this mudstone formation at this point, but it is liable to occur elsewhere in the district, and would have to be sunk through in searching for lodes. Like the high gravels on the track from Zeehan to the Pieman crossing at the junction of the Stanley River found a little further north, and those of the Eureka tin mine, North Dundas mine, and Eden railway ballast-pits, this deposit bears testimony to the fact that in comparatively late geological times the whole of the lower-lying parts of the Zeehan field were submerged below sea-level. It even seems probable that some of the existing topographical features are due to marine erosion, the flat valley in which the most of the town of Zeehan lies and the Argent flats evidently owing their shape to some other agency than the erosion of running streams. The valleys have wide flat bottoms, not filled with alluvial matter, but having the bed-rock planed down to a nearly level surface, and the enclosing hills rise very abruptly from them with steep slopes. The likelihood of the Silurian formation having suffered very little erosion since perhaps the middle of the Tertiary Period must be taken into account in any speculations as to possible chemical changes that may have taken place in the superficial portions of the lodes. It is believed by a good many persons, as a result of very general experience of this field, that the superficial portions of a great many lodes have been enriched by a chemical concentration in them of silver and lead, and the long period of time which the above considerations show to have been available for such chemical action to have gone on gives some support to their view.

Two other interesting instances of parts of the present land surface being nearly identical with very much older surfaces are seen on the top of Mount Read. Near the South Mount Reid mine, and on the crown of the ridge almost opposite the Mount Reid workings, are seen two or three small patches of a soft conglomerate made up of coarse gravel and small boulders set in a mudstone matrix. I have not been able to find any organic remains which would show indisputably the age of these conglomerates, but from their position and composition they seem most likely to be portion of the Permo-Carboniferous beds seen further east on the Eldon Range and Mount Pelion. The formation has on Mount Read been all swept away except these few remaining patches, but they are sufficient to show that the present surface of the top of Mount Read is nearly the same as existed when the Permo-Carboniferous beds were laid down. The other instance above referred to occurs on the western spur of Mount Read two or three miles to the north of the Mount Reid workings. Here yet another conglomerate, quite unlike the last, is found resting unconformably on the older schists. This is portion of the widespread formation of Upper Silurian or possibly Devonian age seen on some foothills of Mount Murchison to the eastward of Mount Read, on the Pimple, on Mounts Pearse, Farrell, and Claude, and on Mounts Lyell and Owen. On North Mount Read it has almost entirely been removed, but a few patches are left to show that the present surface must be very nearly the same as that upon which these ancient gravels were laid down. Of course enormous erosion has gone on in comparatively modern times in the valleys of the Ring River and other streams heading from Mount Read, and it is not contended by any means that the shape of the existing surface of the old schists is anything like the same as that of the ancient one upon which the conglomerates were laid down, but it does seem probable that the portion of the old schists containing the deposits of sulphide ores now being mined has been for an enormous length of time comparatively near to the upper surface of the schist formation, and that though it may have been once and again buried deep under an accumulation of later strata, it has been more than once denuded of these, and brought within reach of the chemical action of the atmosphere and superficial waters. If these have any effect in forming or altering such deposits it would appear, therefore, that there has been ample time and opportunity for them to exercise their influence.

Railways and Tramways.—During last session of Parliament an Act was passed to enable the Van Diemen's Land Company to make a railway from Waratah to Zeehan, but as yet no active steps appear to have been taken to begin its construction. The making of a light railway from Zeehan to North East Dundas was also authorised as a Government work, and good progress has been made with this, construction following close on surveys. A few miles at the Zeehan end are said now to be finished, and before long the line will be very useful in taking out supplies and machinery and bringing back firewood and timber, even if very little ore is carried just at first till the more developed mines of the Upper Ring River Valley are reached. At the time of my visit it was proposed to have the terminus somewhere in the Ring River Valley at the foot of Mount Read, where the ores from the Hercules and adjacent mines could be readily run down to it, but the survey was expected to be continued over the deep lead saddle towards the Rosebery district. Owing to the broken nature of the country the line is very full of curves and bends, but a

practicable route has been obtained without much difficulty to the foot of Mount Read in the Ring River Valley. This line will be of immense benefit to the district, and should have plenty of traffic to make it pay for its cost.

Concentration Losses.—In my last Report considerable attention was given to the losses of silver during concentration which occur in the dressing mills. I regret to say that in one matter there was a rather serious inaccuracy which has been pointed out to me by Mr. Luke Williams, formerly manager of the Grubb's mine. This was in some experiments attributed to Mr. Johnson, then assayer at Grubb's mine, but which were really designed and carried out by Mr. Williams. The results of the experiments quoted by me, and the description of the method of carrying them out, were given to me in conversation by Mr. Johnson without reference to his books, and the information turns out to be inaccurate. Mr. Williams has kindly supplied the exact figures, which are as follow:—

	Lead.	*Silver.*		
	Per cent.	ozs.	dwts.	grs.
No. 1 Sample—Galena: Before washing	76·75	124	15	17
„ „ After washing	75·00	105	16	19
No. 2 Sample—Antimonial Galena: Before washing	71·75	215	18	12
„ „ „ After washing	63·00	172	3	1
No. 3 Sample—Antimonial Galena: Before washing	70·00	172	9	14
„ „ „ After washing	66·00	163	6	16

The experiments were conducted by putting a number of small pieces of ore of ascertained assay value into a small pocket of wire netting hung near the side of the jig some six inches above the sieve, where water passed in and out of the pocket at every stroke of the jig plunger, leaving them there for some time, and then assaying them. The loss shown is very much less than the figures quoted in my previous Report, though still very serious. The whole subject of the efficiency of the concentration treatment of the galena ores of the Zeehan district requires rigid investigation, to find out the exact causes of loss and the means of preventing it. An increased saving of even 5 per cent. of the silver passing through the mills would mean thousands of pounds annually added to the production of the district.

Mines visited.—A brief account will now be given of the state of development of the various mines visited.

Zeehan-Montana mine.—Two levels have been opened from the main shaft, at 112 feet and 192 feet, and at each of these a large amount of driving has been done. The lower level was full of water at the time of my visit, and could not be examined; it is said to have been hitherto very barren. At the upper level driving and stoping have been steadily carried on upon the four lodes in the vicinity of the shaft, and a long cross-cut has been run out westward to intersect what is known as No. 6 lode. A tunnel from surface has also been driven on this lode, which has been a very good one. At the 112 feet level it has been driven along both north and south, and, though not so good as in the tunnel, still promises fairly well. At the time of my visit there were seven parties of men at work stoping on five different lodes, four drives were being extended on lodes, and the main western cross-cut was being pushed forward. A peculiarity of this mine is that ground apparently barren where passed through in the levels has turned out payable in many instances when it has been stoped, the ore lying in small patches and bunches all through it. The policy of the mine has come to be to stope the lode even where little or no ore is showing, and in the main it has proved successful, the working having resulted very profitably. The output of ore since the present company took possession of the mine has been:—

In	1893.....	182 tons 12 cwts.
„	1894.....	1364 „ 9 „
„	1895.....	1688 „ 11 „
	TOTAL.....	3235 tons 12 cwts. to Dec. 31st. 1895.

The assay of this ore averages 68 per cent. of lead and 109 oz. silver per ton: it is shipped to Europe and sold there instead of locally, as in the case of most of the Zeehan mines.

The main shaft is only 120 feet from the eastern boundary of the property, and the lodes have an easterly underlay, besides which the effect of the slides met with in the mine is to heave them to the eastward. It has therefore become evident that there is not much use in sinking the present main shaft deeper, except for No. 3 lode, unless the company can acquire a portion of the adjoining Silver Queen section 1636M. It is now proposed to sink a new main shaft nearer the centre of the section to work No. 6 lode and another one seen on surface about 200 feet west of it, and to cross-cut from this east and west. The cross-cut from the 112 feet level is therefore being pushed on westward in order to cut any lodes that may be in that direction and to give information as to the best position for a new shaft. The property has been a good one so far, and there is little doubt that, if well developed as proposed, it will continue to give good profits in the future.

Mount Zeehan (Tasmania) Silver-Lead Mines.—The work done by this company during 1895 has been confined to what is known as No. 8 lode, on which workings are being carried on at the 60 ft. and 110 ft. levels. There is a large lode of pyrites to the east of the shaft, the outcrop of which is seen at surface, and with this appear to be associated two or more somewhat irregular veins of galena and blende. At the upper level the galena lode is to the west of the pyrites, but at the lower one it seems to have come in to the wall of the large lode, which here has ore on both sides of it. A great many smooth walls are encountered in the workings, which render the tracing out of the various branches of the veins very difficult and tedious, a lot of cross-cutting being still required to prove how many separate veins are here present and what are their relations to each other. Some good ore has been obtained from these workings, but on the whole they are rather poor. In a winze to the north of the shaft, at the bottom level, a nice vein of galena was seen going down, and this, I understand, has since improved.

A large number of tributors have been mining on this company's property, eight parties being at work at the time of my visit. Flaherty and party were getting out some very rich gossany ore and fair galena; Keddie and party had had a very profitable tribute, and at Bayley's tribute I saw some of the purest galena ever met with on the field, while other parties had worked with varying success. The plan of the sections in the manager's office shows some 24 or more apparently separate lodes which have now been worked, mostly by tributors, and it is evident that the argentiferous veins are very numerous. New ones are continually being found. The shallow workings made on the outcrops by tributors are useful in showing the strike and dip of the lodes, and so indicating the best position for shafts to be sunk to work them on a large scale, and it is now evident that three or more main shafts are required. The property is, in my estimation, a valuable one, but is too large to be done justice to by the present company, and would be best divided amongst several proprietaries, each with capital enough to sink a main shaft and make the necessary cross-cuts and other exploratory work.

The New Mount Zeehan Mine.—Preparation was here in progress for resumption of work, and it is to be hoped that the numerous lodes known to exist on the ground will now receive a fair trial.

Oonah Mine.—Steady and successful work has been carried on in this mine during the past year. The deepest level, No. 4, is 260 feet below the mouth of the shaft, or 205 feet below the adit. Two nice shoots of ore have been cut in it, one apparently the downward continuation of the ore worked above by the Junction Company on the boundary, the other being that seen in the winze from the level above. There seems a strong likelihood that another shoot will be struck on extending the drive still further south. In the stopes above this level some very fine ore was seen, massive galena of fibrous appearance, quite similar to the richest ore got near surface. As the lode here is a good depth below surface, and in hard solid country, this ore is not at all likely to be of secondary origin, and I look upon its occurrence as showing that the rich bunches of galena found near surface in so many of the Zeehan mines were also not of secondary origin, but were primary portions of the lodes, and, consequently, that other such bunches will be found to occur also in depth. The good galena in the bottom of the Oonah mine has often a somewhat banded structure, bands of fibrous and cubical galena alternating. The country is melaphyre lavas, often very scoriaceous, and tuffs.

In the adit level connection has now been made right through to surface on the south side of the hill. On this side the lode was found in doing some surface work, and was followed northwards, yielding excellent ore. When the tributors stopped driving the main No. 1 level (adit level) south they had lost the ore, but were within 20 feet of the bunch which has since been found.

The mine is now well opened up, and should put out a good deal of ore in 1896. Nos. 3 and 4 levels should be pushed on southwards, and either the present shaft sunk deeper or a new and more central one started: the developments shown by the south end of No. 4 level will probably decide which course would be the best. Some cross-cutting for other lodes parallel to the main one might also be done with advantage.

The concentration of the second-class ore from this mine has now become a matter of consequence, and at the time of my visit it had not been certainly decided what was to be done. The proposal which seemed to me the best was one to make a tramway round by the Junction mine to the Western mill, and have the concentration done there.

Junction Mine.—Work was confined to sinking the main shaft when I visited this mine, but a small shaft had also been lately sunk in the south of the section near the Oonah boundary, from which it was intended to crosscut for the Oonah lode. The main shaft was to be sunk to No. 4 level, 182 feet deep, the other levels being at 122, 92, and 50 feet. No stoping has been done south of the shaft over the 122 feet level. Some fair ground, showing really good ore in places, has been opened, and will probably yield a considerable quantity of ore when stoped. The lode has been all along rather poor, but is a promising one, and may come to the front as a producer any day. On surface a tramway is being made to take the second-class ore to the Western Mill for concentration.

Western Mine.—The main shaft is now down to No. 7 level, 430 feet, and a great deal of work has been done in extending the drives on the lodes. In the No. 6 and 7 levels the lodes

have been barren, but had not been driven along very far; better ground is expected to be met with in them both north and south. At No. 2 level the lode has been followed north into the recently bought section formerly held by the Silver Beauty Company, and in the end there was a little galena at the time of my visit. The lower levels throughout the mine do not look so well as the upper ones, the lodes being generally much poorer, but there is still a great deal of ground to be opened up, and better ore may make again at any time. Stoping is going on above Nos. 5, 4, and 3 levels, but between this last and No. 2 the greater part has now been taken out. Good ore was seen in many places in the stopes, but for some time past there has been more and more difficulty in getting first-class ore, and the grade of the stuff sent to the mill has fallen very low. The mine is, however, still more than paying its way, and there is every hope that the extensive exploration work that is being done will soon again develope richer ore bodies. The Western Company have lately bought the North-Western Mine also, and have decided to buy second-class ores from neighbouring mines for concentration at the mill, and everything possible is being done to make the best of the situation. In the south end of the mine it seems to me that it might be advantageous to cross-cut east to the lode known in the adjacent Junction Mine as No. 2, supposed to be the Oonah lode. Search should also be made for the Zeehan-Montana No. 6 lode, which may be connected with the ore found just inside the mouth of the Western No. 2 adit.

Western Extended Mine.—This is situated towards the N.E. angle of Section 1062-87M. A shaft has been sunk 90 feet, and levels opened from it at 27 feet and 86 feet, but as yet the workings are of small extent. At surface to the south of the shaft two small veins from 2 to 6 inches wide, containing pretty pure galena, have been cut by trenches, and a small tunnel has been run in to the southward on the course of one of these. Both run a little east of north. The vein in the tunnel was also seen in the 27-feet level. The main lode, however, is running north-westerly with rather a flat underlay to the north-east, and in the levels is seen to be a mass of clayey mullock and lodeslate intermixed with quartz and carbonate of iron, five to six feet in width, with smooth walls. The lode was valueless when I saw it, but may improve as it is followed. Some few tons of clean galena, mostly from the small vein in the 27 feet level, have been sold from the mine, but the value in silver was not very high. The sections belonging to the Western Extended Company lie in a good position with respect to the known lodes worked further south by the Western and other mines, and are worth prospecting in consequence. The country is mainly slate and sandstone, the ground lying to the north of the melaphyre belt. It is by no means unlikely that this may be found in depth, and if so the chances of getting payable ore in the lodes would be greatly increased. The machinery at present on the mine is quite inadequate for sinking the shaft deeper and opening out the lodes as extensively as is required.

Tasmania Crown Mine.—The adits from the east and west sides of the hill in Section 736-87M have been connected by a drive along the third lode met with in the former, and a little stoping has been done on this vein. A tribute party has also been at work on a lode near the N.W. angle of the same section, and has stoped it out pretty completely for a length of 130 feet down to the 100 feet level. The same vein is worked by the Western Company across the boundary from Simson's shaft. It seems probable that this lode is the same as that driven along between the two adits, but if so it must take a sudden bend or be heaved considerably by a fault. Seeing that there are several considerable heaves in the adjacent Zeehan-Montana mine due to faults, it seems most probable that there has been a dislocation.

Silver Queen Mine.—Operations for the last year have been almost entirely confined to the vicinity of No. 4 main shaft, on the lode formerly worked on tribute by Messrs. Aird and Lamb. The company having bought out the tributors, have now entire control of the lode, and have worked it with splendid success, the Silver Queen mine having again become the largest producer of ore in the district. A tunnel has been put in from the flat ground round the main shaft following the lode southerly nearly to the boundary of the adjacent Silver Queen Extended section, and 44 feet below it is another level from the prospecting shaft known as Mace's, which also goes nearly to the boundary. The tributors' bottom level is a little lower, 60 feet from the top of their shaft, and a level has also been opened out from the main shaft at 110 feet. In the stopes over the 44 feet level at the time of my visit there was a splendid body of very pure ore, and a winze being sunk to connect with the bottom level showed this good galena continuing downwards. The bottom level had however been poor, but there was some doubt as to its being on the same lode as carries the ore, as the latter in the winze appears to be likely to lie to the eastward of the 110 feet level. The plans of the workings show in the north end a change in the strike of the lode from south-easterly to south-westerly, and it seems very probable that there are really two sets of lodes intersecting one another. A similar feature was seen in the upper levels of the Western mine, where it proved eventually that two lodes intersected one another in the form of an X. Cross-cutting on each side of the angle in the Silver Queen lode would therefore be advisable. At present the mine looks very like the Western in its earlier stages, and there is much reason to look for similar successful results. During the half-year ending 31st December, 1895, it yielded 1850 tons of first-class ore, which realised £20,991 when sold; the second-class ore has mostly been stacked for future treatment.

The concentrating plant belonging to this mine is being taken from its old site at No. 1 main shaft and re-erected near No. 4, and the mill is to be greatly improved by the addition of vanners

and other appliances to deal with the sands and slimes which cannot be treated by the jigs. In its new position the mill can easily be connected with Nos. 2, 3, and 4 main shafts, all of which are in its vicinity. The Zeehan tramway is being extended up to the new mill, which will be a great advantage.

Silver Queen Extended Mine.—This property has for two or three years past been chiefly worked on the tribute system, several parties having been employed on the numerous lodes and veins contained in it. It is regrettable that the owners cannot see their way to developing it more energetically. The Silver Queen lode worked from No. 4 shaft has been traced into the adjacent Section 187-87M, and a tunnel has been put in which cuts it on the boundary. The lode is here very small, and in two branches 12 to 18 feet apart. A winze has been sunk 30 feet, and the lode driven on about 30 feet each way, to N.E. and S.W., but as yet with very little success. The tunnel is extended eastward some 200 feet past the lode, keeping just inside the boundary of the section; near the end it cut through about 40 feet thickness of black clayey matter with a little gossan and quartz in it, which may be either a cross-course or a mullocky portion of a lode. A little driving might well be done on this to ascertain its nature.

The north portion of Section 187-87M has been divided into six roughly rectangular blocks of about 10 acres each, for the purpose of letting tributes, and these are numbered from 1 to 6 in succession from east to west. The tunnel just mentioned is in Tanner and party's tribute on block 1. On block 3 there is a shaft 30 feet deep, close to a small creek from which Messrs. Fahey and Hill took about 5 tons of galena. The lode is said to have shown about six inches of galena, but after following it some 25 feet to the N.E. the party had to abandon the work on account of inability to cope with the water. A cross-cut is proposed to be put in to this lode from the tunnel next to be described. This is on block 4 on Fahey's tribute, and has been driven southerly along a lode which was first found close to the creek. Here there was a little ore in it, but on trenching south along it the vein was found to consist of about 15 inches in thickness of gossan and carbonate of iron with but little galena, and valueless to tributors. The ground rising, the tunnel was then commenced and was put in 170 feet, the lode being iron oxide and blende, of small size, and valueless. Having got off the lode a cross-cut had to be made to the westward to pick it up again: it was then followed due south for 190 feet. The last 90 feet were in ore, from 6 inches to 15 inches wide, and in some stopes above the level I saw beautiful clean galena 12 to 15 inches wide. Some good gossan ore was also obtained. The country is melaphyre lavas and tuffs, much decomposed, but black slate comes in the end of the tunnel, without however cutting off the ore up to the time I saw it. The lode runs north and south and dips to the east. In this soft kindly country it would be advisable to cross-cut as often as possible in search of parallel veins of ore. This ore-body is not very large, but is promising, and a shaft should be sunk to work it below the tunnel level.

Near the centre of the north boundary of Section 188-87M a vein of galena 2 to 6 inches wide has been cut, and in another tribute block just north of this, in Section 187-87M, there is a 6-inch vein of very good ore. Both are in hard country and small, but may improve when followed. Near the centre of the eastern boundary of Section 188-87M two parallel lodes lying close together have been driven along for a distance of 200 feet by a tunnel. Near the mouth of this a shaft was sunk 35 feet in depth, but the lode, though strong, was poor, and work on it has been abandoned.

Grubb's Mine.—This is unfortunately now shut down, the company having got into financial difficulties. When it is re-opened it will be advisable to do a great deal more exploration work along the course of the lode than has hitherto been attempted; and there is much reason for believing that the mine will then again be successful. Its record of production is a fairly good one considering the amount of ground open.

New Tasmania Mine.—This also is shut down. After the company ceased working a party of tributors shifted the machinery from No. 1 to No. 2 shaft, and worked from the latter for some little time with considerable success, but eventually had to abandon the mine. Much, if not all, of the machinery has since been sold.

Colonel North Mine.—This property consists of two 80-acre sections, 1584-91M and 1585-91M, formerly held by the Queen and Balstrup Junction Company. There is a very large outcrop of good-looking gossan, (chiefly oxides of iron and manganese) near the centre of Section 1585, running north-westerly. A shaft has heen sunk to a depth of 100 feet, when water was met with, and machinery had to be procured, which is now in course of erection. At surface the shaft is in the lode, but at 50 feet it passed into the country, showing that the lode has a northerly underlay. When this shaft has been sunk deeper, so as to be well below the oxidised portion of the lode, it will be possible to test the latter thoroughly. About three chains south of the shaft a tunnel has been driven 413 feet into the hill on which the gossan outcrops, on a course N. 40° E. The whole of the ground passed through in this is much weathered and stained with iron oxide, and it is evident that considerably greater depth must be attained in order to get below the zone of oxidation. Three large bodies of gossan were cut in the tunnel; one near the mouth, which is taken to be a lode, parallel to the main one and some 120 feet south of it, is a large likely-looking mass; the second or main lode is 55 feet wide; and the third, near the end of the tunnel, also seems a large body. There is much quartz in the face, and it is doubtful if the lode has been yet cut right

through. On the main lode a winze was sunk 60 feet, at which depth water was struck. The bottom of the winze is much on the same level as the bottom of the main shaft, and a drive about 150 feet long along the lode would connect them. This mine seems as likely as any to solve the problem of the behaviour of the big gossan lodes of the Zeehan and Dundas districts in depth. Neither in the Comet, Mount Dundas, Adelaide, nor Balstrup's lodes has the necessary depth yet been reached to get quite below the gossan, and in the case under notice it would therefore be advisable to sink right away to at least 300 feet before cross-cutting. The lodes are large and likely to be oxidised to some depth, and to avoid disappointment it would be best not to open out too soon. There is here a very good chance of success, and the venture is a highly commendable one.

Section 2111-91M.—This was formerly held by the Balstrup's Central Company, whose main shaft has been referred to in previous reports. Very little has been done on this section since the former owners held it, but from all appearances it should be worth energetic prospecting. In the S. E. angle of the section at the junction of a small creek running southerly with the Manganese Creek there is a very large outcrop of iron and manganese oxides, with a little carbonate of iron and galena. One piece of galena is stated to have assayed 60 per cent. lead and 40 ozs. silver per ton. The enclosing country is sandstone, and the south wall of the gossan mass, which is fairly distinct, runs about N.W. and S.E. The lode here seems to be quite two chains wide, but a good deal of work would be required to prove it properly, and as the ground is wet a good shaft and set of pumps are necessary.

O'Rourke's Mine (Section 249-93M).—This is close to the old South Balstrup's shaft, and affords an excellent illustration of the folly exhibited by several companies which a few years ago in a moment of scare abandoned operations after going to the expense of sinking shafts and putting machinery upon them without doing any exploration work. In this instance galena had actually been cut when orders came to cease working. O'Rourke's shaft and main workings are a little to the east of the South Balstrup shaft. A tunnel has been driven to cut a large lode running N. 35° to 45° W., the thickness of which has not been ascertained. Three parallel veins of ore have been worked in it down to a level 21 feet below the tunnel. An underlay shaft has been sunk on the footwall (sandstone) to a depth of 30 feet below the tunnel, and at the time of my visit preparations were being made to sink it deeper. When worked on a large scale it will be best to cross-cut to the lode from the South Balstrup's shaft. When I visited this mine some 200 tons of first class galena had been raised and had been sold for about £2000. When furnished with good machinery it should probably develope into a very fair mine.

Section 260-93M.—This lies to the S.E. of O'Rourke's, and on the line of his lode two small shafts have been sunk in wet ground, with the result of getting some galena and carbonate of iron. Nothing can be done, however, without machinery to master the water.

Badenach's Mine (Section 288-93M).—This also is on the line of O'Rourke's lode, and some ore has been taken out from a shallow tunnel and shaft. There appears to be a chute of ore here well worth going after. At present there is much difficulty with water, and steam machinery is required.

There is a wooden tramway from the South Balstrup shaft past the above workings (O'Rourke's, Dunnes, and Badenach's), which goes on past the old Austral and North Austral mines and connects with the Government wooden tramway. This has been very useful to the parties now working, and with a little repairing would continue to be so.

Zeehan-Bell Mine (formerly Silver Bell.)—Very little work has been done here since last Report, the company having been in course of reconstruction. The tribute party who have the mine in their hands, in conjunction with the party on the neighbouring Silver King lease, have sunk a winze on the common boundary to a depth of 50 feet below the 115 feet level, and are preparing to open out from this. A new deeper level from the main shaft is urgently required, and also either a dressing mill or tramway connection with some neighbouring one. If the dressing ore known to exist in the mine were worked there would be a considerable addition to the output, but under present circumstances it does not pay the tributors to take it out.

Silver King Mine.—The work of the tribute party on the Zeehan-Bell boundary has for the last year been chiefly confined to making connection with the Bell workings, and sinking a winze on the boundary in conjunction with the Bell tribute party as above mentioned. A small pumping plant has been provided to unwater the workings below the Bell 115 feet level, but if they become at all extensive this plant will be insufficient. A lower level from the main Zeehan-Bell shaft would be the best solution of the difficulty.

At the Silver King main shaft a good deal of work has been done, levels being open at 106 feet, 176 feet, and 246 feet; a considerable amount of stoping has been done over the two upper levels. Some very fair bodies of galena were visible in the workings at the time of my visit, and the lode is strong and well defined. The galena is rather poor in silver compared with the average of the Zeehan field, carrying only about 36 ounces to the ton. To make the best of the mine it should be opened up more extensively at several levels, and frequent cross-cutting in search of parallel ore-bodies should not be neglected.

The mill has lately done a good deal of work both for the mine and for the public, but could be greatly improved in several respects. The Silver King property has for some time past been entirely worked on the tribute system, but deserves more vigorous and systematic opening up than tributors are likely to be able or willing to give it.

Section 345-93M. (formerly known as the Talune southern block.)—Hearing that some work was being done on this lease I went out to it, but found no one on the ground. A prospecting shaft had lately been sunk near the creek, close to where a vein of coarse-grained cubical galena was found in 1890 (see my Report on the Progress of the Mount Zeehan and Mount Dundas Silver-Lead Fields of 25th November, 1890), but this was full of water, and nothing could be seen.

Comet Mine (including *Maestrie's Broken Hill Mine*, which has been taken on tribute by the Comet Company.)—Steady and profitable progress has been made in this mine since my last Report, and it is still looking well. A good deal of known ore-bearing ground yet remains to be stoped above the 260 feet level, and should be quite sufficient to keep the output up until the next level is ready. The shaft has been sunk another 75 feet, total depth 350 feet, and a cross-cut at 335 feet towards the lode is now being driven. As the galena is going strongly underfoot at the 260 feet level there should be a good block of ground above this lower one. The galena is not all in one vein, but in two or more parallel ones separated by bands of dolomite and gossan, and a good deal of cross-cutting is necessary in order to make sure of keeping all the veins in sight. The new bottom level, being only 75 feet below the present workings, will probably find still a great deal of gossan in the western part of the large lode, which has to be cut through before the galena veins are reached. No time should be lost in again sinking the main shaft as soon as the new level is in to the ore body and the work can proceed conveniently.

The dressing-mill is still a very crude one, but is expected soon to be improved, so as to be fit to dress properly the second-class ore, and the accumulated heaps of seconds which have been roughly treated by the existing plant. There is a good deal of second-class ore fit for dressing still in the stopes, which will be taken out when the mill is ready. There is also a lot of very good gossan ore carrying carbonate of lead, which will not concentrate well, but would be excellent fluxing material for smelting. The galena in this mine is rather below the average in silver, the selling value being from £5 to £6 a ton.

A long flume has been constructed to carry the creek well over the outcrop of the big lode, and thus keep its water as much as possible out of the mine. The water discharged from the pumps, however, runs north through the Comet adit to the mill, and as it runs over the upturned edges of the strata, and these are somewhat porous, it seems rather probable that a good deal gets back again into the ground in this portion of its course. To detect if this is so the stream should be gauged close to the shaft and also at the outlet of the tunnel, and if it should prove that there is appreciable loss it would be advisable to put in boxes to carry the water instead of letting it run over the bare rock.

West Comet, (formerly *Central Dundas*) and *Mount Dundas Mines*.—The West Comet Silver Mining Company, No Liability, now hold the ground formerly belonging to the Central Dundas Company, and have also taken the adjacent Mount Dundas Mine on tribute for five years. At the time of my visit preparations were being made to resume working from the Central Dundas main shaft, which is down 60 feet below the West Comet adit. For this purpose a 12-inch lift has been put in the shaft, and is proposed to be worked by flat rods through the adit from a water-wheel 20 feet in diameter, with 4 feet breast, driven from the Comet Creek. I am very doubtful as to whether this arrangement will answer, and would much prefer to see a good engine on the shaft so that the mine might be opened out in depth in a way to do justice to it. It is at present proposed to unwater the main shaft and connect the bottom level from it with Creer's shaft, which is to be deepened.

These two mines will always be best worked in conjunction, and it is a pity that the attempt to re-open them is not being made in a more efficient fashion, but the capital of the owners is not enough to do as much as could be desired. The lode has always given excellent promise of being payable if properly developed, and it is to be regretted that it has not been taken in hand by a strong company able to put suitable machinery upon it, and to open it at several levels from a deep main shaft.

Section 2357-87M (formerly Dundas Extended Company's.—Not having previously seen this mine, I made a visit to it on this occasion, though no work has been done on it for some time. An adit has been driven some 200 feet or so to cut the lode, and a shaft has been sunk to a little below the adit level. The lode is a large mass of gossan containing a vein of chromate of lead, which probably corresponds to a vein of galena lower down. The strike of the chromate vein appears to be a little west of north, similarly to the galena veins in the Comet and West Dundas mines. There is a strong flow of water from the shaft, and to work the lode it is clear that fairly powerful pumping plant would have to be provided. The prospects are favourable, and the lode worthy of a good mining trial. The country seen in the adit is much weathered serpentine.

Adelaide and Anderson's Mines.—These have lately been worked in conjunction, the Adelaide Company having taken the Anderson's ground on tribute. Working has only lately been resumed,

the mines being shut down during 1894 and 1895. The machinery at the Adelaide main shaft not being able to raise the water satisfactorily from the bottom level, the lift has been hauled up to No. 2 level, and work has been going on at this. There are several veins of galena, mostly small, and in hard dolomite country. Some of them have very smooth regular walls, and seem likely to be permanent, but the hardness of the country is a great drawback. Work has also been proceeding in Anderson's section from a prospecting shaft to the east of the main one. Lately, however, the mines have again shut down owing to want of capital. A larger and better pumping outfit is much required so that the mines could be thoroughly opened to some depth, and a good deal of money must be laid out in driving and cross-cutting in order to open up stoping-ground. On surface the creek has been flumed for some distance to prevent the water getting down into the workings through the outcrops of the lodes, but the fluming ought to have been carried a little further down in order to get quite clear of them. There appears to be good inducement to give these mines a further trial, and much reason to think that energetic working will give profitable results.

Sections 305-93M *and* 306-93M.—These are held by the M'Kimmie Silver Mining Company, and lie in low wet ground in which prospecting is difficult on account of water. In Section 305-93M, near the centre of it, two lodes of galena have been cut in trenches. One of these runs N. 12° E., and has been trenched along the outcrop to a depth of about 6 feet and for a length of 126 feet, the cutting yielding 56 tons of ore, which sold for £10 15*s.* a ton. A main shaft has been started to work this lode, but cannot be gone on with until a pumping-engine has been procured. The second lode is visible three or four chains to the north of this in a long trench originally intended for drainage. In this it is seen to consist of carbonate of iron and galena, and seems to be running about N. 20° W., but is not bared enough to allow of the course being well seen. The galena was not found to be so rich in silver in this as in the first lode. The country is mostly slate. The two lodes being close together and apparently likely to intersect, could be worked from one main shaft. The prospects are good enough to warrant getting machinery and opening up the mine in a systematic way.

On Section 306-93M towards the N.E. corner a valuable discovery has been made of niccolite (arsenide of nickel), but unfortunately so little has been done to open it that we cannot know much about its size and general character. A little shaft has been sunk on it to a depth of 10 feet, but was full of water at the time I saw it, and the ore vein was invisible. The lode is said to be about 2 feet wide and to have about 10 inches of niccolite and a little galena. Strike about N. 40° E. Some beautiful pure ore was lying at surface, and it was intended to ship two tons of this to Europe to find out its value. Assays are said to have returned 37 to 45 per cent. of nickel, so the ore should be very valuable. I could not see what was the nature of the country enclosing the lode, but most probably it is slate; the serpentine however is seen close by to the eastward. The close connection of serpentine with nickel deposits was alluded to in my last Report, and the finding of this lode emphasises the advice then given to search for nickel along the contact of this rock with the stratified formation. Close to the little shaft there is a great deal of gossan running in a line towards the lodes on Section 305. The country is so low and wet that no sinking can be done without machinery. It would be advisable to try to drain the flat in the vicinity of the lodes by deep trenches which would carry off the surface water, and this work would also do some good prospecting. The new Zeehan-Mount Read tramway will pass quite close to this mine, so it will soon be an easy matter to get machinery out to it, and from the prospects afforded it is likely that it will contribute a considerable amount of ore for the tramway to carry to Zeehan.

Nickel P.A., Section 1956-91M.—No work has been done on this since my last Report, but at the time of this visit preparations were being made to open the mine again. The Zeehan to Mount Read tramway will afford very easy access to this promising property.

Success and Owen Meredith Mine.—The wooden tramway to this from the North Dundas road has been completed, and the mine working again during the past year. Unfortunately it shut down while I was at Zeehan, and I could not get out to see it before the water rose. Some very good ore was got, but it was found that the mine required to be opened at greater depth and furnished with more powerful pumping appliances, and the tribute party were unable to do so much dead-work, especially after their long and plucky struggle to make their tramway. Here, again, capital is required to put a very promising mine on a good working footing and give it a chance of being remunerative.

North Dundas and Commonwealth Mines.—These I did not visit, hearing that they were practically in the same condition as when last seen. They both are worth vigorous development.

Gormanston Mine.—This also was not visited, as no advance worth mentioning had been made during the year. Prospecting has been carried on from time to time and stones rich in tin have been picked up, but the parent lode has not yet been found. The bush is very dense and also green and hard to burn, so prospecting goes on very slowly. If a good fire could be got through it so as to clear the surface there would probably be little difficulty in discovering the lode, and, judging from the floating fragments of it, it should be a good one.

South Curtin and Davis Mine.—(Section 293-93M.)—Notwithstanding its name, this property is not due south of the Curtin-Davis lease, but south-west of the Curtin-Davis Extended one. On it is one of the numerous lodes which were discovered during the time when the Dundas Field was first taken up in mineral leases. This was then known as J. Fitzgerald's lode. Nothing, however, was done to it in the way of opening it up, and the ground was forfeited, and not taken up again until the discovery of the value of the Curtin-Davis lode again attracted attention to this part of the district. About the centre of the section a tunnel has been begun, going in on the course of the lode, which here runs N. 25° W. and dips to N. E. 82°. The tunnel was in only about 10 feet on the day I saw it, and the lode was about five feet thick, consisting of rather good-looking gossan, in some parts of which chloride of silver and native silver were freely visible. The country rock is coarse grit or conglomerate. The visible silver in the gossan speaks very well for the value of the lode in its unoxidised portions, and these should soon be reached by the tunnel. Probably the ore carried will be found to be fahlore similar to that in the Curtin-Davis mine. This, however, cannot well be the same lode as that in the Curtin-Davis, but is a parallel one lying very considerably to the westward of it. It is a very good prospect, and before long should be an ore-producer.

About 5 chains down the little creek which passes the tunnel mouth some work has been done on a vein of galena associated with blende and copper pyrites. The lode appears to be here very soft and mullocky, and the ore vein is not at all well defined. It is of very doubtful consequence, but may be worth prospecting when deeper tunnels are being driven on the main lode.

The ground falls rapidly towards the Ring River, and excellent facilities are afforded for tunnelling. In this part of the district the lodes do not appear to have been oxidised so deep as those near Dundas town, and shafts will not be required in most instances for a long time. Though at present difficult of access, the construction of the Zeehan-Mount Read tramway will make this property quite easy to reach, as it skirts along the slope of the hills quite a short distance down north from the workings.

Section 307-93M.—This is known as the *Curtin-Davis Consols* property. When I saw it work was only commencing, and not very much could be seen. There are two lode outcrops running about W.N.W., the northern one being a large quartzose mass with a good deal of pyrites. The other lode is smaller and contains more pyrites. Some of this is reported to have yielded at the rate of 40 ounces of silver to the ton when assayed. A tunnel is being put in to cut both these lodes. In cutting the approach for this a vein of very solid pyrites and blende was met with. The northern lode has been trenched on in two places close to the northern boundary, and also in the adjoining No. 1 Curtin & Davis block. In these trenches it is seen to be a strong lode containing much pyrites and gossan, the latter often carrying a good deal of arseniate of iron. The strike here is seen to be north-westerly. Though nothing of much value has been found on this section as yet, it appears well worth prospecting.

No. 1 *Curtin and Davis* (Section 317-93M).—This lease lies immediately south of the Curtin-Davis Extended block, on the south side of the Bellinger Hill. About seven chains south from the north boundary a big lode outcrop has been found, striking N.N.W. and dipping easterly. The lode matter contains a great deal of slate with pyrites blende and galena, and is enclosed between smooth slickensided walls. On the footwall there is a lot of solid pyrites, but the galena and blende seem to be in strings and small veins. A tunnel is being commenced to cut this lode, but will only strike it some 27 feet below the prospecting cutting on the outcrop. It will enable a shallow drive to be made for prospecting purposes along the lode, but will be of little use as a working adit. This discovery is said to be on about the line of the Curtin-Davis lode, but I am doubtful as to their being one and the same. The Curtin-Davis Consols lode has also, as above stated, been cut in this property near the south boundary.

Sections 291-93M (" Orr's Section") and 343-93M (belonging to the Central Curtin and Davis Mining Company, No Liability).—A lode has been found in these sections about six chains to the east of the N.W. angle of the Central C. & D. block, and has been traced northward from the boundary into Orr's section by a trench on the outcrop for a distance of about three chains, and to the southward in the Central block by cross trenches for about four chains. Its strike is N. 35 W. The lode is small but well defined, and shows some very good fahlore, with copper and iron pyrites. The veinstone is mostly siderite. In the Central section a tunnel could be driven along the course of the lode, but in Orr's block it does not appear to be an easy matter to get one in, as the outcrop is in low ground. The lode contains some good-looking ore, and is well worth testing.

Curtin-Davis (Section 242-93M*) and Curtin-Davis Extended (Section* 292-93M*) Mines.*—These are under one management and working on the same lode, so may conveniently be dealt with together. They have been vigorously developed, having had the good fortune to fall into the hands of owners able and willing to spend money freely upon them. A good pack-track has been made from the Government track at the Grey Ore Camp to the top of the Bellinger Hill, a lot of clearing has been done, good huts have been built, and the lode has been opened at different levels by a series of tunnels. The lode crops out on the steep north face of the Bellinger Hill, a bold bluff which is one of the most striking features in the topography of the district. The top of this hill is 1586 feet above the bridge across the Ring River at the Grey Ore Camp, or 2253 feet above

sea level. The horizontal distance between these points is about a mile, so that the average slope from top to bottom is about 1 in 3½. Near the main Curtin-Davis workings it is actually 1 in 1 or 45° for a long distance, and in parts quite precipitous. The outcrop of the lode runs right up this steep face, thus affording most excellent facilities for testing and working it by adits driven along its course at different levels. Though generally spoken of as a new discovery, the lode has been worked on formerly by the Montezuma and John Godkin Companies, the latter very narrowly missing a good chute of ore found by the present owners. The strike of the lode averages about N. 9° W., and it underlays eastward. Between No. 4 tunnel and the summit of the hill, according to a fine plan of the property made by Mr. C. W. James, C.E., the average underlay of the lode would be about 1 in 2. Owing to the steepness of the slope, and the considerable underlay of the lode, the course of the outcrop on the face of the hill is N. 13° E., differing from the true strike by 22°.

On the top of the hill the lode has been traced by trenches southward in the Curtin-Davis Extended block to about 4 chains from the north boundary. It is seen as a fairly strong body of gossan, 2 to 4 feet wide, in this portion. The gossan can be easily followed down the steep rocky face to the highest of the tunnels, known as No. 1 of the Curtin-Davis Extended Mine, 105 feet below the summit. At the time of my visit only the approach to this had been cut, and the lode was still much changed to gossan, nevertheless 3 or 4 tons of oxidised ore had been considered worth saving and stacking for treatment. No. 2 Entended tunnel is 72 feet below No. 1, and was originally begun by the John Godkin Company. It is not on the lode the whole way, the first 93 feet being a cross-cut through country rock. Then a drive was made south on the lode, and before going far a fine chute of fahlore was found, forty feet in length, and reported to have been in one part as much as 3½ feet wide. The face of this drive was 74 feet in from the cross-cut at the time of my visit, and was then poor and slaty. Lower down the hill we find another tunnel driven by the John Godkin Company, in a distance of 81 feet, on a lode which appears to be parallel to the main one and lying to the east of it. This vein was oxidised all the way, but has not been followed further, as the tunnel is only 28 feet lower than the last one, and it is proposed to make this and the next lower one the working levels.

No. 1 Curtin-Davis tunnel is 242 feet below No. 2 C.D. Extended, and has been driven on the lode a distance of 104 feet. Ore was found all the way in for 55 feet, and was got also in the approach for about 30 feet. In the steep rocky cliff below the approach good gossan is also seen, so the chute is in all probability quite 100 feet long. In the face of the tunnel the lode was poor when I saw it.

Going down 137 feet more we come to No. 2 C.D. tunnel, which was in only 30 feet the day I visited it. The lode here is well defined but small, only 6 to 10 inches wide, and mostly gossan.

No. 3 C.D. tunnel, 121 feet below No. 2, is in 105 feet, and carried good ore nearly up to the face, where the lode became disordered and a great deal of pyrites came in, but fahlore again made its appearance the day I left the mine.

No. 4 tunnel is only a small one, 168 feet below No. 3, driven 19 feet, and the lode in it is very small and valueless. Above it there is a big mass of ironstained slaty matter, so it seems probable that here we have the lode channel filled with broken country. Cross-cutting would be advisable in this case if the lode does not improve as it is driven along, for the vein followed might not be the only one representing the lode, but merely one of a number of small branches.

No. 5 tunnel is 166 feet below No. 4, and is a short one, only 34 feet in length, and was the upper of two tunnels formerly put in by the Montezuma Company. In the mouth of it there is a gossan vein about 8 inches wide containing oxide of bismuth, and reported to assay very well for both silver and bismuth. When driven upon the vein thinned down quickly to a mere streak, but the walls remained distinctly visible, and probably if the drive were continued the lode would make bigger again. There are some surface cuttings just below the approach to this tunnel, and a vein about 10 inches thick of gossan carrying oxide of bismuth and arseniate of iron is visible. It is possible that the veins at this tunnel may not be the Curtin-Davis lode, and that this lies to one side of them, but from their position it is likely that they are all that it is represented by at this part.

The No. 6 tunnel, know as Brumby's, is a cross-cut 122½ feet long made by the Montezuma Company. It is 146 feet below No. 5, or 1157 feet below the outcrop on the top of the hill. The lode was not met with in it, though it is right across the course as shown by the workings higher up. The country is here rather a coarse conglomerate. According to Mr. James' map it would seem rather more probable that the lode lies altogether east of this tunnel than that it is still to the west of it.

The ore from all the tunnels which have yielded any has been very similar, consisting of fahlore with copper and iron pyrites, and sometimes a little stibnite in a veinstone of quartz, carbonate of iron, and lodeslate. The oxide of bismuth at the No. 5 tunnel doubtless indicates the presence in the unweathered lode-matter of native bismuth or its sulphide, and this may prove a valuable constituent.

Another lode, known as the Eastern lode, has been found about 500 feet east of No. 3 tunnel. A cutting has been made on it, which shows it to consist of 3 to 9 inches of gossan, copper pyrites, fahlore, and iron pyrites, with a good deal of quartz. Course about N.N.W. Though apparently of next to no consequence of itself on account of its small size, it is important as showing that parallel lodes to the main one are in existence, rendering cross-cutting from time to time very advisable. Indeed, it seems rather likely that the main lode itself is made up of a series of parallel

veins lying close to one another and often overlapping, rather than a continuous single vein. Frequent cross-cutting is all the more necessary if this view is correct.

Taking the work described above it will be seen that valuable ore has been found at No. 5, No. 3, and No. 1 Curtin-Davis tunnels, and at Nos. 2 and 1 of the Curtin-Davis Extended, the lode being proved ore-bearing for a length of 1300 feet and vertical depth of 1000 feet. The ore seems to be in chutes. Some very high assay returns have been obtained from small parcels of the ore which have been tried, but up to the time of my visit there had been no bulk sampling of the heaps of ore that had been raised. A sampling of the largest heap, at No. 1 C.D. tunnel, was then proposed to be made before long. Until bulk samples have been assayed there is no certainty as to the average value of the ore, but, judging from its appearance, it should give very good returns. The treatment of the second class ore from which the richer stuff has been picked out will demand serious consideration, as wet concentration in the ordinary way is almost certain to be attended with very serious loss through sliming of the friable fahlore. The extraction possible by concentration should be the subject of very careful experiments before a dressing-mill is erected.

A very fine waterfall, known as the Montezuma Fall, is seen in the eastern part of section 242-93M of the Curtin-Davis holding. Its height is said to be between 470 and 500 feet, the top portion being a clear leap of 200 feet. In wet weather a large stream passes over the fall, which is then a magnificent spectacle, and even in dry weather there is a considerable flow. Higher up the creek there are said to be several smaller falls. In all probability it will be possible to make dams for conservation of water at various points along the course of the stream, so as to ensure a steady supply all the year round, and if so a magnificent water-power will be available at small expense for generation of electricity, compression of air for rock-drills, and driving dressing machinery, furnace-blowers, &c. There are said to be two other considerable waterfalls in the district on other creeks further westward, and with attention to conservation of the winter's abundance, so as to have a supply during the short dry season, there should be very little difficulty in getting all the water-power required for the purposes of the mines, and the works for the treatment of their produce.

The Zeehan-Mount Read tramway has been surveyed so as to pass only a very short distance below the Montezuma Falls, and the ore from the Curtin-Davis mines will very easily be sent down to it. The prospects of success seem therefore in the main very favourable, the lode promising well for a good yield of ore, and everything being most advantageous for dealing with the minerals after they are extracted.

Fahl Ore Mine, Section 3212-87M.—This has been shut down for some time, but will probably be re-opened before long. The lode belongs to the same series of fahlore-bearing veins as those above described of the Curtin-Davis and Central Curtin and Davis Companies, there being apparently a group of such in this part of the Dundas district. No doubt as time goes on numerous others will be found as well as those now known.

North Colebrook, Section 236-93M.—Only a little prospecting has yet been done on this, but it has revealed that there are two large bodies of lode material in it similar to that in the adjacent Colebrook holding. On the supposed line of the Colebrook main lode a trench has cut a mass of rather good-looking gossan, and a short distance further north-east a little work has been done on a large outcrop of axinite containing copper pyrites, pyrrhotite, arsenopyrite, and a little chrysotile disseminated through it. The enclosing country rock is not here visible, and there is nothing to show the course of the lode, if lode it is. The material here is very poor in copper, and as yet does not appear to be of any value. The other lode is near the western boundary of the section, and is a similar large mass of gossan and axinite with the above sulphides in small quantities. It had been barely stripped when I saw it, but was evidently a very large outcrop.

West Colebrook, Section 239-93M.—The workings on this lease are also as yet confined to surface cuttings, and are on the western slope of the Colebrook hill. Veins of axinite with copper pyrites, pyrrhotite, and arsenopyrite have been laid bare, and close to surface native copper and sulphide, red oxide, and carbonates of copper have been found in small quantities, no doubt resulting from superficial chemical action upon the copper pyrites. In places the vein matter appears to replace the country rock metasomatically, and the whole occurrence is rather that of a sort of stock-work than of a true lode.

Colebrook, Section 216-93M.—On this a tunnel has been driven a distance of 110 feet, the last 83 feet being through an almost solid mass of sulphides, chiefly arsenopyrite and pyrrhotite, with a little copper pyrites. The sulphide body has not been cut through, the face of the drive still being solid pyritic matter. There is a good deal of axinite with the sulphides, also some chrysotile and chlorite. Unfortunately, though there is such a huge mass of mineral matter, it is all but valueless, the small quantities of copper, silver, gold, nickel, and cobalt which have been found in it being insufficient to allow of profitable extraction.

Down the steep slope below the mouth of the tunnel there is quite a cliff of axinite and sulphides, but this is separated as far as can be seen on the surface from the body seen in the tunnel by a mass of country rock. On top of the ridge again, near the West Colebrook boundary there is yet another large outcrop, and the ground between this and the tunnel appears to be more or less all seamed with veins of the same minerals as above mentioned. Going south along the ridge there

is yet another large outcrop. All these occurrences, both on this section and on the North and West Colebrooks, seem very irregular, the bodies of sulphides and axinite apparently neither being of definite shape nor running in regular lines; they rather seem to be huge bunches and ramifying veins. The country in which they occur is a black fine-grained rock, weathering whitish externally, easily fusible, with white streak and splintery fracture, which I take to be of igneous origin. It is now shortly to be examined microscopically, when its proper appellation will be determined. Throughout this rock spots and little veins of pyrrhotite are often plentifully scattered, and also veins of chrysotile, besides larger veins of axinite and sulphides. The occurence of axinite in the huge masses in which we find it here is quite unusual. A good deal of copper is sometimes seen in the sulphide masses, especially near surface where chemical concentration has gone on, and some of the richer bunches of black copper sulphide are said to have given good assays for silver. The large masses of sulphides are very alluring to the miner, and probably sooner or later portions of them will be found rich enough for metallurgical treatment. A deep tunnel into the hill from below the cliff under the Colebrook tunnel would probably give valuable information as to these deposits, and prove if they contain useful metals in workable quantity.

South Rosebery.—Very little has been done on this lease since my last visit. The shaft has been sunk about 34 feet and a start made to drive west, but it was found that the sulphide body had been passed through and the drive was apparently going into the footwall, which proved to be schist with layers of pyrites and baryte: the dip here is 55° to the eastward. The sulphide body is a large solid one, but hardly so big as would be expected from the adjacent trench on surface. The whole of it seems to carry a large percentage of zinc. It is possible that the schist met with in the bottom of the shaft is not the true footwall, but only a layer of rock lying between the hanging-wall portion of the lode and another on the footwall still to be cut: it is a pity the cross-cut from the bottom of the shaft was not carried further.

Some three chains to the S.E. of the shaft down a small gully a tunnel has been begun some 45 feet below the mouth of the shaft, and has been driven about 70 feet to S. 70° W. The country passed through is whitish argillitic schist (pyrophyllite schist), containing much pyrites, and dips to the eastward. In the end the schist has become more than ever impregnated with pyrites, copper pyrites, and blende, at times being very heavily charged with sulphides, but I hardly think it is far enough in yet to cut the mass seen in the shaft. A deep tunnel from the other side of the hill would, however, be of much more real service in developing the mine than any extension of a shallow one like this.

This is a valuable property, though of small acreage (ten acres), and deserves to be vigorously opened out. The gold-bearing vein at the west end of the surface trench should have especial attention paid to it.

Rosebery.—A certain amount of work has been done on this extensive property during the past year, but not nearly the progress has been made that might fairly have been expected in the time, and there is but little to add to my last year's Report.

A number of shafts have been sunk along the line of the lode, but all were full of water and could not be examined. The furthest south of these is situated between the South Rosebery workings and the big trench described in my last Report, and is said to be 25 feet deep, and to have bottomed on a solid sulphide body. A good deal of very solid sulphide ore, principally blende and pyrites, with but little copper or lead, was seen lying about the surface. Going north the next shaft is that formerly described beside the big trench, in the hanging-wall of the sulphide lode. This shaft is said to be 53 feet deep. According to the stuff thrown out it has gone through a large body of very solid dense blende and pyrites, the ore being very similar to that found as boulders in the big face of the alluvial workings. Fifty-six (56) feet W.S.W. from this shaft another has been sunk about 15 feet in the footwall portion of the lode, and the stuff from it is mostly schist very heavily impregnated with granular iron pyrites and some copper pyrites and blende. Between these shafts must be almost all lode-matter, more or less metalliferous. About 10 chains further north two shafts have been sunk 27 feet and 20 feet respectively, and very solid heavy lumps of mixed pyrites, blende, and galena have been obtained. There seems to be more lead ore at this point than heretofore, also more barite. The surface material passed through here consisted of heavy alluvial drift containing large heavy boulders, and as the shafts were full of water I was not able to satisfy myself as to whether the ore at surface was from the true bedrock, or from large boulders such as were got pretty plentifully in the alluvial workings. Still following the line of the lode, which has been taken as N. 30° W. for another 10 chains or so northerly, we find three shallow pits sunk close together on clayey gossan which may be portion of the lode. They will have to be sunk deeper to get through the gossan and prove what lies underneath. Some 4 chains further north a tunnel has been driven across the layers of schist country (here striking N. 20° W. dipping N.N.E. 65°), a distance, when I saw it, of about 90 feet—course N. 55° E. A small vein of quartz with crystalline stibnite was cut in this tunnel, and is said to have given a good assay for silver. On surface above the tunnel a trench shows schist highly charged with pyrites, but further to the north-east deep alluvial matter comes in and surface prospecting becomes difficult. The tunnel is intended to go under the alluvial gravel and prove this part of the ground. It is very shallow, however, and to my mind was not worth putting in, as the labour could have been much more profitably employed in making a deep tunnel at a much lower level, which would be

available for working the lode. I understand that lately a deep tunnel has been begun, but it ought to have been taken in hand long ago.

The year's work on this mine appears thus to have consisted of sinking some 8 shallow windlass shafts a total distance of about 160 feet, and driving through soft country about 100 feet, besides building a few huts and cutting a trifling matter of tracks. This is the sort of development that sickens investors by its slowness, and ruins many a good property. The Rosebery Company have a very promising mine, but so far there is little or nothing payable in it in quantity worth working, and to make anything of it energetic and intelligent management and systematic work are required.

Sheppard's Section, 504-93M.—In the bed of the Koonya River, a short distance above the bridge on the pack-track, a small lode about two feet wide is visible running N. 55° W. No work has been done to open this, and where seen it is of no value, consisting of quartzose lode slate and carbonate of iron with a little pyrites. On the S.E. side of the river the ground rises, and some prospecting might easily be done on the course of the lode. Lower down the river, close to the crossing of the old track, a little vein ¼ inch thick of galena was pointed out to me in a small creek, but there does not appear to be any regular lode just here. The vicinity would, however, be worth prospecting.

Allom and Morley's Sections, 409-93M *and* 410-93M.—These are close to the Deep Lead saddle, on some spurs forming foothills of Mount Read. On one of the sections some prospecting cuts have been made into a steep spur of argillitic schist rock, exactly similar to that found enclosing the Mount Read and Mount Black sulphide bodies. In these cuts the schist is seen to contain a great deal of iron and copper pyrites, and as the trenches got deeper a great improvement was noticed in the mineral contents, bunches and strings of pretty pure copper pyrites making their appearance. It seems likely that a body of ore is not far distant. The shape of the ground allows it to be easily prospected by tunnels, and there is much reason to think that a little diligent work will soon result in finding bodies of ore. The strata here run about N. 30° W. and dip 70° to the N.N.E. The line of the Zeehan-Mount Read tramway if continued to the Mount Black district must pass very near these sections.

Ring River P.A. (Sections 252-93M *and* 253-93M.*)*—A good deal of prospecting has been done on this property, and some very promising veins have been found. The country is the same pyrophyllite schist as in the last case, with a good deal of pyrites and other sulphides disseminated through it. In one trench I noticed a band about 3 feet in width very heavily impregnated with iron and copper pyrites and some blende, which would be worth sinking upon. Further west from this another trench has cut about two feet in thickness of solid pyrites, apparently highly cupriferous, and about one foot of heavily mineralised schist, the lode being capped on surface with gossan. Work had been begun to cut this with a tunnel at a lower level. This property seems a very likely one, and certainly is worth vigorous prospecting.

Barlen's Section, 30-92G.—This has attracted a great deal of attention of late on account of a vein of good ore having been found in a prospecting drive from a shaft near the south boundary. It also deserves notice on account of the plucky way it has been opened up by a small party of men working for themselves, who have made a very much better show of development than many of the neighbouring companies. The rich lode struck in the Hercules mine being not far from the south boundary of Barlen's section, a shaft 26 feet deep was sunk on the latter on the supposed line of it, and a drive from the bottom of this has been put in to the eastward a distance of 150 feet, where it cut a lode of pyrites and mixed sulphides, the latter from 6 inches to 2 feet in thickness, and assaying well for silver. The ore did not rise any distance above the drive, but seems to be making strongly underfoot. A good deal of flinty lodeslate is associated with the sulphides. At the time of my visit it was intended to cut a chamber and sink on the ore vein, but for permanent work a tunnel will be required. The shaft is about 4 chains from the west boundary, and the surface slopes steeply westward. An adit from the west boundary would cut the lode at a much lower level than the existing workings, and would prospect a lot of ground as well, probably cutting the big lode of the Hercules. For prospecting purposes it would be well to carry the tunnel right across the section to its eastern boundary. No ore has yet been sold from this mine, but it was reported to me that a bulk assay of the stuff raised had been made and had given a highly payable result. It does not seem at all certain that Barlen's lode is the same as the rich vein of the Hercules, but no surveys appear to have been made to exactly determine their relative positions. The big lode of the Hercules has not yet been found in Barlen's section, though according to its strike it should go into this. The property is a valuable one, and well worth the outlay of capital for thorough development.

Hercules.—The progress made on this holding during the past year has been in one way rather disappointing, not nearly the amount of development work having been done that might reasonably have been expected in the time. The large ore body mentioned in my last Report has been proved to be 45 feet in width and underlays to the eastward. On the hanging-wall side there is a good deal of fairly pure blende, copper pyrites, and galena, in veins pretty distinct from each other and

associated with some quartz. Close to the trench across this big lode a short distance to the south-east a shaft has been sunk some 20 feet on the underlay of a gossan vein striking N. 35° W., from which fair prospects of gold may be washed. The rich vein mentioned in my last Report widened out rapidly when sunk upon, and has been of great service to the company. It has been worked from a shallow adit for a length of 47 feet. Below the adit a winze has been sunk on the underlay 20 feet, the ore body here being four feet wide of sulphides of iron, copper, lead, and zinc, carrying gold and silver. Near surface the sulphides were oxidised, and the resulting gossan was very rich in gold. The following figures show the quantity and value of the ore raised from this vein from 29th May, 1895, to 14th April, 1896, according to a return kindly furnished to me by Mr. E. Gaunt, manager of the company :—

	tons.	cwts.	qrs.	lbs.			ozs.	dwts.	grs.			ozs.	dwts.	grs.
Gossan.....	9	13	1	13	containing	Gold	102	18	22	and	Silver	2051	10	0
Sulphides...	62	1	2	27	„	„	142	19	0		„	4227	17	19
	71	15	0	12			245	17	22			6279	7	19

The weights of ore and figures of gold and silver values are those upon which sales were made in the Zeehan ore market after making the usual deductions and allowances; the actual values would be somewhat greater. The great cost of packing out the ore has persuaded the company not to send away any more at present, but to wait for the completion of the Zeehan-Mount Read tramway. The high value in gold and silver of the sulphide ore is very encouraging, as there seems no reason why it should not be maintained in depth, or why similarly rich veins should not be discovered.

To cut the big lode and the rich vein at some depth a tunnel has been driven S. 75° E. a distance of 192 feet, but at the time of my visit it had not yet reached the lodes. Lately it has been reported in the newspapers that ore has been cut. The tunnel is over 100 feet below the outcrops, and the lodes are underlaying eastward, so a considerable distance has to be driven to cut them. It would be well to carry the tunnel on through the known lodes and as far as possible into the hill, so as to intersect any parallel ore bodies, which are very likely to occur in such a formation as this.

To the south from the main workings a small tunnel has been made from the side of the pack-track through a body of gossan 22 feet wide containing fair prospects of gold, and a little further south along the track I was shown a new find that had lately been made, viz., a vein about 18 inches wide of sulphide ore (containing much blende), said to assay at the rate of 19 dwts. of gold and 85 oz. of silver to the ton.

There is every reason to believe that the country here is full of veins of sulphides, all more or less auriferous and argentiferous, and much trenching and tunnelling across the strike of the schist country requires to be done in order to discover these and prepare them for working.

South Hercules (Sections 15-95 and 23-95).—Prospecting on this property had practically only begun at the time of my visit, and there was not much to be seen. About two chains from the northern and four chains from the eastern boundary of Section 15-95 a vein six inches thick of sulphide ore (intimately mixed pyrites, copper pyrites, blende, and galena) had been cut in a lode of broken schist and quartz veins four feet wide. The ore was reported to be of low value, carrying only 3 dwt. 22 grs. of gold and 8 ounces of silver per ton. The vein runs N. 20° W., and seems to be getting a little bigger as it is followed downwards. Near this place in another cutting veins of copper pyrites were noticed in the schist country, here running N. 30° W. Doubtless, numerous sulphide veins will be found by continuance of prospecting, and some of them may well turn out to be of workable size and value.

On the south boundary of the holding a shaft has been sunk right at the south-east corner of Section 15-95 (or S.W. angle of 23-95) on a dense lode of solid sulphide ore. The shaft is down 16½ feet, and the lode is 6½ feet wide. The walls are well defined, and strike N. 17° W., dipping easterly 60° to 70°. The ore is mostly pyrites and blende with a little copper pyrites and galena, and is said to assay much the same as the average sulphide ore from the Hercules' big lode and the Mount Reid Company's lodes, as quoted in last year's Report. The lode appears to be portion of the same one as is worked by the Mount Reid Company.

Mount Reid Mine, Section 3302-87M.—The progress on this mine during the past year has not been very great, only a few men having been employed, pending negotiations for the sale of the property in London. The work done has been directed to proving the lode as thoroughly as possible. Seven shafts have been sunk at intervals along it, and the material brought out has been daily assayed. The main prospecting shaft is down a depth of 50 feet, and the lode has been proved by cross-cuts to be 25 feet thick, and has been driven on south a distance of 40 feet. No. 1 shaft south is 12 feet deep, and crosscuts from it have proved the lode-matter to be 40 feet wide. No. 2 shaft south is 14 feet deep, but the lode has not been cut across. No. 3 and 4 shafts south are each 20 feet deep, and cross-cutting was beginning at the time of my visit. In No. 4 the hanging-wall was cut 6 feet east of the shaft. The lode-matter comprised a great deal of solid sulphide ore with thin layers of schist through it at times, and on the west side of the shaft was really a schist

very heavily charged with pyrites rather than ordinary lodestuff. The strike here was noted as N. 70° W., dip eastward, 60°. In No. 3 shaft there was much quartzite, which is also seen plentifully about the surface in the vicinity of both the southern shafts, but also some solid sulphide ore, and a vein of fairly good galena. North of the main shaft there are two shafts in gossan; "No. 1 north," 12 feet deep, got sulphide ore in the bottom; and "No. 2 north" cut the footwall at 4 feet, and sulphides at the bottom, 13 feet. This last shaft is about 4 chains from the north boundary of the section, where, as above stated, the South Hercules Company have again cut the lode. From the main shaft to the No. 4 south is a distance of about 8 chains.

Mr. G. P. Sinclair, the Manager of the mine, was good enough at my request to furnish a synopsis of the assay results obtained during the progress of the above workings, which I now give in his own words:—"The following are the average results of assays made from the different prospecting shafts sunk by me on the above property. The assays from main prospecting shaft are from 24 feet deep to 50 feet, and about 60 feet of drives. There are 261 different samples:—

No. of Shaft.	Gold.			Silver.			Lead.	Copper.	Zinc.
	oz.	dwt.	grs.	oz.	dwt.	grs.	per cent.	per cent.	per cent.
Main prospecting shaft	0	3	9	6	6	22	9·0	0·7	30
No. 1 South „ „	0	5	15	28	7	22	12·7	2·35	20
No. 2 „ „ „	0	9	9	25	19	8	6·6	traces	15
No. 3 „ „ „	0	11	22	13	5	13	5·7	½	10
No. 4 „ „ „	0	9	4	6	18	21	3·7	½	10

The two shafts north in gossan bulked 18 dwts. gold and 20 oz. silver per ton each."

The above figures being averages of daily assays may be fairly considered representative of the bulk of the ore in the mine. The quantity of such ore in sight is very large, and the mining costs should be very low, inasmuch as for a long time the stuff could be raised by an open cut along the outcrop of the lode, a method of working which would probably result also in the finding of numerous veins of ore which would escape notice in ordinary mining. The average value, however, is so low that it is at once seen that the general run of the ore will not pay for export, but will have to be treated on the spot.

Evenden Mine, Section 299-93M.—About two chains from the eastern and 8 chains from the northern boundary of this section a tunnel has been begun on a course of S. 35° W. to cut a lode seen higher up the slope of the steep hillside on which the lease is situated. At the time of my visit the tunnel was in a distance of 42 feet, but had not reached the lode. This is seen, however, some 60 feet higher up the hill, where it has been cut into and followed by a drive to the southward for a distance of about 50 feet. The lode here was much oxidised and rather small, but a little galena and pyromorphite were obtained, and some native silver. In the end of the drive a mass of carbonate of iron and pyrites appears to be associated with the lode. A winze has been sunk 10 feet where the vein was first cut, and in this the lode-matter was three feet wide between the walls. Course of lode N. 15° W., underlay to westward. 25 feet above these workings the outcrop of the lode is seen in another little cutting, consisting of about 5 feet in width of gossan, quartz, and carbonate of iron, with pyrites and a little galena, the latter being said to assay close on 100 ounces silver to the ton. A great deal of a green serpentinous mineral is here associated with the lode. The course of the latter was here noted as N. 12° W.

Near the centre of the same section a large outcrop of gossan, 82 feet wide in one place, has been exposed by trenches, and traced for a distance of 10 or 12 chains to the north and 5 or 6 to the south. Course N. 10° W., underlay not yet known. The ground is very steep, and it is proposed to test this lode by a tunnel which, according to the mining manager, Mr. Evenden, in 195 feet of driving would come in 250 feet vertically below the outcrop. This lode seems well worth testing, though so far as I could learn nothing of any value has yet been found in it. Another small gossan lode associated with some jaspery quartz is seen in a trench down the hill below the main one some little distance.

On the road from Dundas to Mount Read, which passes through this property, a mass of dense quartz impregnated with a good deal of iron and copper pyrites is seen at the junction of the slate country with the conglomerates which form the Pimple Peak. The latter seem undoubtedly to lie unconformably upon the schist and slate country seen in the Evenden workings, and it seems possible that this quartz mass is a lode formed in a fault which has thrown down the conglomerate against the slate country seen to the westward.

Treatment of the Mount Read and Mount Black Sulphide Ores.—As very great interest is now being taken in the Mount Read district, numerous new companies being floated to work mines along the sulphide belt, it is timely to give some consideration to the question of what is to be done with the ore when it is raised in order to give profits to investors. So far as work has gone the ore obtained may be divided into the following three classes:—

(1.) *Gossan Ore.*—Found as yet principally in the Hercules and Mount Reid mines. Some of this has been very rich in gold and silver, and would pay handsomely if sold in Zeehan to the ore-

buyers. The great bulk of it, however, would leave little if any profit to the mine-owner if it had to be exported for treatment. Under present circumstances it would probably be best treated by pan-amalgamation; but if local smelting works became available, it would be most desirable fluxing ore. It is not proved yet that it exists in quantity sufficient to keep a pan-plant of economical size running for a reasonable length of time.

(2.) *Rich Sulphide Ore.*—The rich vein in the Hercules, and a little of the best ore in the Mount Reid, Barlen's, and Rosebery mines are valuable enough to pay export charges. The quantity of this class of ore yet known to exist is, however, very limited.

(3.) *Ordinary Sulphide Ore.*—The great bulk of the deposits in question yields a mixture of pyrites and blende, with more or less galena and copper pyrites, carrying a little gold and silver. In some cases the galena and copper pyrites may be to a small extent separated mechanically from the other minerals, and a merchantable product thus procured, but the great bulk of the stuff has the minerals too intimately mixed together to allow of mechanical separation. This principal bulk of the ore of the district is too poor to be profitably exported, and will require local treatment. To get at some idea of the general value of this ore we may collect the following figures from last Report and the Mount Reid results given above :—

		Gold per ton.			Silver per ton.			Lead.	Copper.	Zinc.
		ozs.	dwts.	grs.	ozs.	dwts.	grs.	per cent.	per cent.	per cent.
From 1895 Report.	South Rosebery	0	4	21	22	4	6	12·5	0·64	28·0
	Mount Reid	0	4	21	17	14	10	12·8	0·72	26·4
	Hercules	0	4	21	5	1	16	13·5	0·90	28·8
See above	Mount Reid, main shaft	0	3	9	6	6	22	9·0	0·7	30·0
	Mount Reid, No. 1, 2, 3, 4 shafts	0	9	0	18	12	22	7·2	0·84	13·8
Average		0	5	10	14	0	0	11·0	0·76	25·4

The value of such a mixture may be taken as, at the most, £3 per ton unless the zinc is utilised. In ordinary smelting it is not only lost altogether, but is besides an intolerable nuisance; indeed, with such a percentage of zinc as shown smelting would be impracticable. Numerous processes have been devised for the treatment of ores carrying a large percentage of zinc, and it is claimed that some of these are a commercial success, though I do not know of any instance where one has proved to be so on a working scale under Colonial conditions. The Smelting Company of Australia, Limited, are now putting up works for the purpose of dealing with such zinciferous ores at Illawarra, in New South Wales. They propose to roast the ore to a condition in which the zinc contents can be leached out by water and dilute sulphuric acid, the residue being then smelted in the ordinary way. The zinc is to be recovered from the solution either in the metallic state by the electrolytic process of Messrs. Siemens Bros. & Co., Limited, or as oxide by the Marsh and Storer process. The principle of the latter is precipitation of zinc by magnesium oxide, an operation which creates a demand for the mineral magnesite. It will shortly be seen if this Company is successful in treating the sulphide ores of Broken Hill; if so the same process would do for the Mount Read ores, and works would probably have to be erected in the Ring River Valley. For roasting purposes wood is an excellent fuel, and is plentiful and cheaply obtainable there, while water-power for the generation of electricity for the electrolytic process is available within reasonable distance. The Hercules Company have, I understand, secured the water-rights from a small lake on the north-west side of Mount Read, and should the water power available from this and the various branches of the Ring River be insufficient it seems quite possible to bring in electrical power from stations near Lakes Westwood, Selina, and Julia, from the head of the Henty river, or from the Pieman River. Coke for smelting the roasted ore after extraction of the zinc would of course have to be brought from Strahan by rail and tram. Should the methods of using pyrites as fuel in smelting operations, which nowadays appear to promise great success, become thoroughly practicable, the huge masses of pyrrhotite and arsenopyrite in the Colebrook mines might be made available, as well as the less zinciferous portions of the sulphide ore from the Mount Read mines.

The future of these mines depends on the successful treatment of their large deposits of comparatively low-grade ore, and this treatment must be a local one. The establishment of metallurgical works at the foot of Mount Read or near the Pieman River seems to be a necessity for their successful working. Such works would also treat the ore from the Curtin-Davis group of mines, and would be of great benefit to the whole Dundas district. If the development of the district has to depend only on the rich ore that can be profitably exported, it does not seem likely that there will be any rapid progress, and the mining will be on a small scale. No doubt the rich veins already found are not the only ones in the district, and more like them will be discovered; nevertheless, the greatest value lies in the large low-grade bodies, and the sooner the metallurgical treatment of these is successfully taken in hand, the more quickly will the field pass from the stage of small and intermittent production to that of a permanent mining centre.

Though the above-quoted average value of the Mount Read and Mount Black sulphides is nearly the same as that of the average Broken Hill ore proposed to be treated at Illawarra, I am by no means sanguine that ore of such grade can be profitably handled locally for some time to come, and it would probably be necessary to select the stuff so as to send to the furnaces only the best portions. Assays show that the ore varies greatly in value, and I do not think that there would be much difficulty in getting large supplies of material considerably richer than the quoted bulk average. The Mount Reid Company, for example, could supply from their southern shafts ore carrying over £4 a ton in precious metals. Unfortunately data for calculating what is possible to be done are not yet available, none of the mines except the Mount Reid having yet undertaken systematic assaying of the ore-bodies. A few desultory assays are made from time to time, usually of picked specimens, but no attempt has in most instances been made to ascertain definitely and exactly the values of different portions of the ore bodies and the quantities of each grade available. It is now imperatively necessary that the mines shall prove that they can furnish a constant and regular output of ore of value to pay for metallurgical treatment, for until this is done it would be absurd to erect reduction works. There is every reason to believe that the mines will be able to supply ore of the requisite quality, but accurate figures of quantity and value are required in place of vague opinions of this sort. Systematic laying open of the ore-deposits and daily assaying of the sulphides are the only method by which the necessary knowledge can be gained.

Concluding Remarks.—The Zeehan-Dundas field has on the whole made very satisfactory progress during the past year. The output of ore is fairly constant, and shows no likelihood of falling off, but may rather be expected to increase. Capital is finding its way back to these fields as they prove their permanency, and better development may be looked for in consequence. The opening of the N.E. Dundas district by the light railway is a great step in advance, and promises to make a large increase almost at once in the output of minerals. It should be made at once to a spot where it can be reached by tramways from the Mount Read mines, and extended as soon as possible to the Mount Black district.

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

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

The Secretary for Mines, Hobart.

GEOLOGICAL SURVEY OF THE LEFROY GOLDFIELD.

PROGRESS REPORT.

Mines Office, 1*st July*, 1896.

SIR,

I HAVE the honour to report as to the progress made with the geological survey of the Lefroy Gold Field during the year ending 30th June, 1896. Owing to other calls upon my time it has not been possible for me to go on with this work continuously, and it has had to be put to one side for months at a time. Six weeks have been spent on the ground, however, and quite two months have been devoted to plotting the fieldwork and preparing plans and sections of the various mines in the Office.

The object of the survey is to get together for publication all information that will assist the further development of the field, and so add to the Colony's production of gold.

It is intended to prepare a general topographical plan of the district, showing the shape of the surface, the position of the various lines of lodes, and the location of the various mining leases and the workings upon them. About one-fourth of this map, showing the south-western quarter of the field, is all but completed, and the remainder is partly plotted. There will also be plans and sections of the workings on the various lodes to as large a scale as is conveniently practicable. Those of the mines on the Chums, Pinafore, Morning Star, Land o' Cakes, and Volunteer lines of reef are partly drawn, and could be completed without much further work. The plans of the mines furnished annually to the office of the Inspector of Mines have been used as much as possible in compiling these maps, but a good deal of actual surveying has in some cases to be done to connect them and to supply deficiencies. It is considered that the publication of fairly complete plans of the workings of the mines would be of great service to all investors interested in the field, and especially to those outside the Colony who might wish for full information.

Special attention will be given to mapping the system of "deep leads" which traverse the field, and to getting together such facts as will be useful in determining whether there is any likelihood of it being possible to work them profitably for alluvial gold. At this stage it may be said that so far as the examination of the field has gone, there seems considerable probability that some of the sub-basaltic "leads" will be payable, but that there will be a serious difficulty to contend with at the outset in the water in these old channels, as some of them lie below sea-level. Once the water accumulated in the "leads" is pumped out, it is not likely that the ordinary influx will be at all formidable.

As soon as circumstances will permit, it is now my intention to complete the topographical survey and examination of the underground workings, next to complete the maps, then, finally, to revisit the field for the purpose of getting any fresh information brought to light in the interim, and to finish the Report. This will require about three months' undivided attention.

Though the examination of the district is yet very incomplete, it may be of service to make known one or two of the conclusions already come to especially bearing upon the question of the lodes carrying gold in depth. In every instance hitherto the gold-bearing stone found near the surface has, sooner or later, been lost at depths from 300 to 500 feet, and the lowest levels on the reefs have been unprofitable, from which has arisen a belief, strongly held by many investors, that it is no use expecting to get gold below a comparatively shallow depth. This pernicious notion has retarded the progress of the district very considerably, destroying confidence in the minds of investors, and preventing them from going into the deep-sinking operations, which would otherwise have been boldly and energetically entered upon. The sections of the workings that have been prepared show very strikingly the very small foundation upon which the belief rests, for in all cases where the shafts have been sunk into the supposed barren parts of the lodes it is seen that the amount of exploration work that has been done has been so little as to be quite inadequate to allow of the proper testing of them. Granting that in these lower levels the lodes have been poor, there is, nevertheless, so little done that a wholesale condemnation of them is very premature. And even if it should become established that there is a barren zone in the reefs, say below 400 feet, experience elsewhere, in Victoria for example, gives us support in believing that at some lower depth they will again carry gold. In the case of the Lefroy reefs there are certain considerations now to be mentioned which supply somewhat probable reasons for an alternation of auriferous and barren zones in them.

The reefs, with a few exceptions, belong to a group of nearly parallel lode-fissures running about N. 75° E., and usually underlaying to the southward; there are also a number which run more or less north and south, but these have hitherto been barren, and it seems probable that they belong to quite a different system of fractures from those which have formed the auriferous group; the latter were originally fault-fissures, dislocating the strata traversed, so that at any given point we usually find that the country on the hanging wall does not correspond exactly with that on the

footwall. In most of the mines we find proof that after the lode channels had been filled or partly filled with more or less auriferous quartz, which would no doubt present the usual phenomena of richer chutes and poorer intermediate portions, further motions of the wall rocks have taken place, striating and smoothing the surfaces of the quartz sheets already formed, crushing them at times to rubble, and in places tearing them altogether asunder. The large slickensides seen in the Volunteer reef show this action particularly well, and in the mullocky portions fragments of slickensided auriferous quartz have at times been found, showing that the original main sheet of quartz had been torn asunder. The occurrence of "splices" of barren quartz lying alongside rich stone, which have often been noticed, would probably be due to the same cause, the barren stone being formed at a later date, subsequent to the movement which had smoothed and striated the surface of the auriferous portion. The wide mullocky portions of the lodes, so common throughout the field, would also probably be due to the repeated faulting movements along the planes of weakness afforded by the reefs.

The effect of faulting movements along the planes of the reefs must necessarily be frequently complete disruption of the previously formed sheets of quartz, and the distance to which parts of the sheets formerly in contact would be separated would depend on the amount of downthrow of the faults. We should therefore expect to find blank spaces in the reefs where the auriferous quartz sheet has been more or less torn apart, leaving only mullock in its place or possibly non-auriferous quartz of a later period of formation. Below these spaces we should again come upon the stone that has been torn away from them. This explanation is rather strikingly supported by the experience of the Volunteer mine. In this there was good quartz above No. 1 level, and again below No. 3, but comparatively little between, though there were some very curious detached patches. No. 2 level showed hardly any payable stone from end to end, but was mostly in mullock. If we fold the longitudinal section of the mine showing the stoping done so that No. 3 level is superimposed upon No. 1, it will be seen that the shoot of gold worked becomes practically continuous, and it seems probable that really the good stone below No. 3. level was once continuous with that above No. 1. Below No. 5 level there has been another blank in the lode, which may be due to another rupture of the original continuous auriferous sheet, which would then be found at some lower level.

It has sometimes been supposed that the loss of the gold in the Lefroy reefs in going downwards might be due to their passing out of a group of favourable strata into underlying unfavourable beds, as it has often been noticed on many fields that the character of the enclosing country appears to influence the value of lodes. In support of this theory, it has been pointed out that the strata in Lefroy lie at flat angles. In making the geological survey, special attention has been given to this question, with the result that there does not appear to be any connection between the shoots of gold and the country enclosing them. The strata are not lying at very flat angles after all, but dip at about 15° to 20° on the average, and the planes at which the gold appears to have died out in the reefs do not correspond with the bedding-planes of the country. Furthermore it appears likely that certain strata which have enclosed gold-bearing portions of one reef in one mine have not carried auriferous quartz in an adjoining reef in the next mine.

The conclusion arrived at after studying the Lefroy reefs is that there is no reason to think that gold will not be found in them to any depth to which they may be followed, though probably in more or less detached patches owing to disruption of the auriferous sheets by faulting. There is certainly no sufficient evidence of the gold dying out in depth to warrant the idea that sinking is useless; on the contrary, there is much inducement to put down deep shafts in the confident belief that they will be remunerative.

Seeing that a large number of parallel reefs, some fifteen or more, have been discovered in the district, and that much of the surface is so covered with alluvial matter as to make prospecting a matter of difficulty, systematic cross-cutting on lines running north and south is much to be recommended. When deep-sinking operations are commenced it will be desirable to amalgamate as many adjacent properties as can be conveniently worked from each main shaft, so as to save expense, and it will be necessary to do a good deal of cross-cutting to connect the workings on adjacent lines of reef. Should three or four deep main shafts be sunk it would not be a very heavy work to connect them right across the field by a system of cross-cuts, and in opening out from each it would be well to preserve as much as possible corresponding levels in adjacent mines to permit of connections being made. Probably systematic cross-cutting in this way would result in the discovery of reefs yet unknown. Ventilation and drainage would also be much facilitated.

The production of gold from the Lefroy reefs compares favourably with that from other known fields, having regard to the amount of ground laid open on the lodes by mining works, and I have much confidence that future exploitation will result quite as well on the average as that in the past. The field presents very good opportunities for the investment of capital in legitimate mining ventures.

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

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

DESCRIPTION OF A SMALL COLLECTION OF TASMANIAN SILURIAN FOSSILS PRESENTED TO THE AUSTRALIAN MUSEUM BY MR. A. MONTGOMERY, M.A., GOVERNMENT GEOLOGIST, TASMANIA,

BY

R. ETHERIDGE, JUN^R.,

Curator, Australian Museum, Sydney.

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1.—INTRODUCTION.

Some time ago, Mr. A. Montgomery, M.A., Government Geologist of Tasmania, presented to the Australian Museum a small collection of Silurian fossils from Zeehan and Heazlewood.

As so little is at present known of the organic remains occurring in the sedimentary rocks of these important mineral fields, a few notes on their affinities may not be out of place, notwithstanding the very poor state of preservation of the fossils. However, any facts that may be evolved from their elaboration will perhaps be of use to future investigators who may have the good fortune to take up the subject hereafter.

The occurrence of organic remains at the above localities does not appear to have come under the notice of Mr. R. M. Johnston at the time he wrote his valuable work, "The Systematic Account of the Geology of Tasmania;"[1] perhaps even they had not been discovered, and all that I know on the subject is gleaned from the official Reports of Messrs. Thureau and Montgomery.

2.—GEOLOGY.

Mr. G. Thureau informs[2] us that the rocks containing the silver-lead ores at Zeehan belong to the Silurian series, and consist of very much contorted dark blue shales and grey sandstones. The fossils he noticed were "Trilobites, Polyzoa, Corallites, Crinoids, and Brachiopoda." Of the Zeehan deposits, Mr. Montgomery says[3] the country rock consists of Silurian grits, sandstones, and slates, in many places much bent, contorted, and twisted. The central portion of the Heazlewood District, he remarks,[4] is composed of Silurian sandstones and limestones, &c.

Mount Zeehan is situated in the County of Montagu, on the west coast of Tasmania, to the east of Trial Bay, some distance north of Macquarie Harbour, and between the Badger River and the coast. Heazlewood is still further north, north-east of the town of Corinna, in County of Russell, as shown on "Sketch Map—General Geological Features of Tasmania," in Johnston's work.

3.—LIST OF THE FOSSILS BY LOCALITIES.

Heazlewood.—
- Favosites grandipora, *Eth. fil.*
- Hausmannia meridianus, *Eth. fil.* and *Mit.*

Zeehan.—(Despatch Limestone.)
- Asaphus, *sp. ind.*
- Hausmannia meridianus, *Eth. fil.* and *Mit.*
- Hausmannia, *sp. ind.*
- Illænus Johnstoni, *Eth. fil.*
- Amphion? brevispinus, *Eth. fil.*
- Leptodomus? nuciformis, *Eth. fil.*
- Eunema Montgomerii, *Eth. fil.*
- Orthoceras, *sp. ind.*

Heazlewood.—(Blue-grey schistose rock.)
- Cornulites tasmanicus, *Eth. fil.*
- Cromus Murchisoni, *De Kon.*
- Rhynchonella decimplicata, *J. de C. Sby.*
- Rhynchonella capax, *Conrad.*
- Tentaculites, *sp. ind.*

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[1] Quarto, Hobart, 1888. (By Authority).
[2] Mount Zeehan Silver-Lead Lodes and other Deposits, 1888, p. 1.
[3] Report on the State of the Mining Industry on the West Coast, 1890, p. 7.
[4] *Ibid*, p. 15.

ZEEHAN.—(Blue-grey schistose rock.)
Cornulites tasmanicus, *Eth. fil.*
Cromus Murchisoni, *De Kon.?*
Rhynchonella borealis, *Schlotheim?*
Rhynchonella cuneata, *Dalman.*
Strophodonta, *sp. ind.*
Tentaculites, *sp. ind.*
ZEEHAN.—(White quartzite.)
Lophospira? *sp. ind.*
Murchisonia, *sp. ind.*
Raphistoma, *sp. ind.*

The Collection also contains other forms too indefinite for determination.

4.—NOTES ON THE SPECIES.

Corals.

Favosites grandipora, *Eth. fil.?*

F. grandipora, Eth. fil.—Records Australian Museum, 1890, I., No. 3, p. 61, t. 8, f. 6-9.

Obs.—Certain specimens of a Favosite in highly decomposed limestone recall the typical features of this species, the corallites highly thickened internally, and the walls copiously perforated by very large uniserial pores close together. The whole of the tabulæ have been dissolved, leaving no trace of their presence. Beyond an extra amount of thickening of the corallite walls, the present specimens do not add to our knowledge of the structure of *F. grandipora.* It is naturally somewhat difficult to speak with certainty of the species when dealing with such highly decomposed species, but I believe this to be identical with the coral I described under the above name from the Lilydale Limestone of Victoria.

Loc.—Heazlewood, in limestone.

Genus PLEURODICTYUM, *Goldfuss.*

(Petref. Germaniæ, 1829, I., p. 113.)

Pl. , Fig. 1.

Obs.—The impression of ten or more corallites is, I believe, referable to this genus. The outline of each individual corallite is polygonal, the spaces formerly occupied by the walls being represented by partial grooves; here and there small connecting processes represent the mural pores. The size of the corallites would favour the view here advanced, rather than a reference to *Favosites.*

Loc.—Zeehan, in a light coloured schistose rock.

Trilobites.

Genus HAUSMANNIA, *Hall & Clarke.*

(Pal. New York, 1888, VII., pp. XXIX. and XXXI.)

Hausmannia meridianus, *Eth. fil. & Mitchell.*

Pl. , Figs. 4 & 6.

H. meridianus, Eth. fil. & Mitchell, Proc. Linn. Soc. N.S.W., 1895, X(2), p. 504.

Obs.—A fragmentary pygidium of a large *Hausmannia* occurs amongst the Heazlewood specimens. It corresponds in all particulars,—large size, wide and very long axis, and the greatly increased number of segments in the latter,—to the N. S. Wales examples that Mr. John Mitchell and the writer have distinguished by the name of *meridianus.* The tail apex is not preserved, so that the peculiarities of this portion visible in Bowning specimens need not be referred to.

The size of the specimen is one and a quarter inches long by one and three-quarters broad, and there are eleven or twelve pleural segments more or less exposed to view. The increase in the number of axial segments in the pygidium over and above the normal of the typical *Hausmannia caudatus*, Brün., is not peculiar to the present form. According to Salter[1] the pygidium axis of *H. caudatus* should possess 11-12 segments, but the late M. Barrande mentions[2] as many as 18-19 in *H. Hausmanni.* Numerous instances of more than twelve could be cited; for example, the American Devonian *H. okioensis* has seventeen axial segments and a terminal appendage.

Loc.—Heazlewood; and Zeehan, in the Despatch Limestone.

Hausmannia, *sp. ind.*

Pl. , Fig. 5.

Obs.—Several specimens of a possible second form exist as portions of pygidia, having the same general characters as the preceding species. In the best preserved example, however, there are but nine axial segments visible, all of which show traces of a tuberculation that has never been seen on any of the N.S. Wales or Victorian specimens of *Hausmannia.* The limb in decorticated individuals is exceedingly wide and slightly concave. The pleural segments also bore tubercles, and, from the presence of this form of ornament, I am led to expect that the present examples are distinct from those before referred to under the name of *H. meridianus.*

[1] Mon. Brit. Trilobites, 1864, Pt. 1, p. 49.
[2] Syst. Sil. Bohême, 1852, I., p. 538.

A similar tuberculated pygidium, as well as cephalic-shield exists in *H. verrucosus*, Hall,[1] of the Niagara Group of Indiana, U.S.A.

Loc.—Zeehan, in the Despatch Limestone.

Genus ASAPHUS, *Brongniart.*

(Crust. Foss., 1822, p. 17.)

Asaphus, *sp. ind.*

Pl. , Fig 2.

Obs.—A single small pygidium, seen from the concave interior, is, I think, referable to *Asaphus*. It is three-quarters of an inch long, by nearly the same wide. The pygidium appears to have been gently arched, with a flattened border, a narrrow long axis extending to the limb at the apex, and very faint traces of short coalesced pleural segments. The specimen is sufficiently preserved to show the presence of the genus in these rocks, and no more. As compared with the pygidia in the Caroline Creek beds, it is in the first place longer (*i.e.*, from before backwards) than *Asaphus*, sp. *a.*[2], but shorter than in sp. *b.*, but is less oval, and more angular in the centre of the posterior border than either of them. Of the two, it is more nearly allied to sp. *a.*, but I do not think identical with either.

Loc.—Zeehan, in the Despatch Limestone.

Genus ILLÆNUS, *Dalman.*

(Kongl. Vet. Acad. Handl., 1826, p. 248.)

Illænus Johnstoni, *sp. nov.*

Pl. , Fig. 3.

Obs.—Two specimens are in the collection, both slightly pressed out of shape; one is unquestionably a glabella, the other is more indefinite, and it is difficult to say whether it is a glabella or pygidium. The glabella measures one inch long, the transverse measurement being the greater—viz., one and a quarter inches. There is every reason to believe that this glabella was fairly convex or gibbous, particularly about the centre. The axial grooves are wide and deep (in the decorticated state), and wide apart, curving slightly outwards, but not sufficiently to form a lobe as is sometimes the case in this genus, such, for instance, as in *I. tauricornis*, Kut.[3]; these grooves are also rather short, extending but little beyond what would be the position of the eyes were the latter preserved. The glabella narrows towards the front, which is steep or highly inclined; posteriorly it slopes off gradually to the neck-furrow, and does not overhang the latter as in some forms. The precise course of the facial suture cannot be followed, from the amount of lateral pressure the specimen has undergone, and the same fact will no doubt to some extent affect the degree of convexity of the glabella. On the side least affected in this way, the facial suture seems to be fairly straight and but little curved.

The neck furrow, from glimpses of it that can be obtained seems to have been very fine and narrow, and the neck-lobe similarly so. In a few species of *Illænus*, such for instance as *I. revalensis*, Holm,[4] the glabella possesses three oval depressions on each side, representing the glabella furrows, but these have left no trace on our specimen. The surface (*i.e.* decorticated) is devoid of sculpture, except along the anterior margin, where a few parallel and semi-anastomosing grooves are visible.

I have never before had the good fortune to see an *Illænus* either from Australian or Tasmanian rocks, nor, so far as I am aware, has the genus been described from those of the latter Colony; but De Koninck has recorded[5] the presence of *I. Wahlenbergii* from the Upper Silurian of New South Wales, but without giving a figure. At the same time there is a strong resemblance, in *I. Johnstoni*, to this species, notwithstanding that the cephalic shield of our fossil is imperfect, showing neither the eyes nor the free cheeks. Under these circumstances the measurements previously given can only be accepted provisionally. On the other hand, the axial grooves of *I. Wahlenbergii*, Barr.,[6] are considerably longer than those of our form, and more or less circumscribe the glabella, and with these facts before me, I think it better to distinguish the latter by a separate name.

Loc.—Zeehan, in the Despatch Limestone.

Genus CROMUS, *Barrande.*

(Syst. Sil. Bohême, 1852, I., p. 821.)

Cromus Murchisoni, *De Koninck.*

Pl. , Figs. 7 & 8.

C. Murchisoni, De Koninck, Foss. Pal. Nouv.-Galles du Sud, 1876, Pt. 1, p. 54, t. 1, f. 8.

Obs. The larger portion of a cephalic shield and four pygidia, all with the test removed.

De Koninck has complicated the discrimination of this and allied species by erroneous references to his figures. For instance, he describes the head and tail of *Encrinurus Barrandei*,

[1] Indiana Geol. Survey Report, 1881 [1882], XI., p. 345, t. 35, f. 7, 14-17.
[2] Etheridge, Junr., Proc. R. Soc. Tas. for 1881 [1882], t. 1, f. 6.
[3] Holm, Mém. Acad. Imp. Sci. St. Pétersbourg, 1886, XXXIII., No. 8, t. 6, f. 10, & 11*a*.
[4] *Loc. cit.* t. 2, f. 4 *a* & *b*, 5 *a* & *b*.
[5] Foss. Pal. Nouv.-Galles du Sud, 1876, Pt. 1, p. 46.
[6] Syst. Sil. Bohême, 1852, I., p. 684.

De Kon., but refers to the figure (his Fig. 8, Pl. 1) only. He likewise describes the cephalic shield of *Cromus Murchisoni*, and refers to the figures of both cephalic shield and pygidium (his Figs. 9–9*b*, Pl. 1), at the same time stating that both the thorax and pygidium were unknown to him. In other words, Prof. De Koninck reversed the numbers of the figures on his first plate. Fig. 8 should be *Cromus Murchisoni*, and Figs. 9–9*b* should be referred to *Encrinurus Barrandei*. That such is the case is evident by bearing in mind the generic differences of the cephalic shield of the two forms in question.

In the Tasmanian specimens the larger portion of the glabella, the neck segment and portions of the fixed cheeks, are preserved. The positions of the glabella furrows are distinctly marked by the large five primary tubercles on each side, the furrows in the cast being short and somewhat wide. Between each of these points the surface is occupied by four or five secondary tubercles ranged in a line, whilst on the anterior part of the glabella smaller tubercles of a tertiary order become numerous. The neck segment is strong and wide. Neither of the pygidiums are wholly preserved. There are twenty-six coalesced segments at least in the axis, which tapers to a very fine apex. The central line is devoid of segmentation, and there appear to be only four strong tubercles along it. The coalesced pleuræ are very much less in number.

Another Australian Trilobite of this group has been described[1] by Mr. A. F. Foerste as *Encrinurus Mitchelli*, but whether I am correct or not in my determination of the Tasmanian forms, I think Foerste's species is identical with them.

Loc.—Heazlewood, in a blue-grey schistose rock; ? Zeehan, in the same matrix.

Genus Amphion, *Pander*.

(Beiträge Geog. Russich. Reiches, 1830, p. 139.)

Amphion? brevispinus, *sp. nov.*

Pl. , Fig. 9.

Obs.—Two small pygidiums, disassociated from other parts, are referred to under this name. In the number of the coalesced segments, backward direction of the pleuræ, embracing as they do the termination of the axis, and spinose free ends, these fossils seem to agree with the pygidium characters of the genus *Amphion*.

There are five axial segments, and a terminal appendage, and five pleuræ, the whole of the component parts being rather widely separated from one another by deep grooves, whilst the outward terminations of the axial segments are slightly nodular. The pleuræ are a good deal arched downward, and the two last on each side quite posteriorly directed. The terminal appendages are large relatively to the size of the pygidiums, but this is not uncommon in the genus. The free ends of the pleuræ do not project far beyond the margins, and are more perceptible in a portion of one of the specimens, as a bluntly-toothed edge.

The brevity of the pleural spines causes a resemblance to the pygidium of *Amphion Fischeri*, Eichwald, as figured by Hoffmann,[2] but not only is the terminal appendage in *A.? brevispinus* longer, and generally larger, but the whole pygidium of the latter is shorter and wider than that of the European tail.

A.? brevispinus is probably nearest to *A. pseudoarticulatus*, Portlock,[3] resembling this British species both in the number of its segments and shortness of its spines.

Loc.—Zeehan, in the Despatch Limestone.

Annelida.

Genus Cornulites, *Schlotheim*.

(Petrefaktenkunde, 1820, p. 378.)

Cornulites tasmanicus, *sp. nov.*

Pl. , Fig. 10 & 11.

Obs.—Several decorticated casts of this interesting supposed Tubicolar Annelid occur at both localities. The longest example is one and a half inches, and in that space portions of at least thirteen or fourteen rings or annulations are visible. In a small fragment preserved in the round, the greatest diameter is three-eighths of an inch. The inverted conical annulations are broad, measuring fully one-eighth of an inch in the direction of their growth, and with the semi-imbricating appearance common to the genus.

As the specimens are but casts of the interior, it cannot be expected that any trace of the fine longitudinal microscopic striæ that ornament the exterior of these organisms would be preserved, but one impression, apparently of an outer surface, exhibits a concentric wrinkling that may possibly represent the irregular outer surface of a *Cornulites*. A similar irregularity of surface is excellently shown in Prof. Hall's figure of *C. proprius*[4] from the Niagara Group of Indiana State. The internal annulated casts are very like those of the characteristic *C. serpularius* of the European Wenlock beds, but the annulations are longer (*i.e.*, longitudinally). The sharp and distinctly

[1] Bull. Sci. Lat. Denison Univ., 1888, III., t. 13, f. 2, 3, 20.
[2] Verhandl. Russ-K. Min. Gesellsch. St. Petersb., Jahr. 1857-58 [1858], p. 34, t. 3, f. 4.
[3] Report Geol. Londonderry, &c., 1843, t. 3, f. 5 c.
[4] Indiana Geol. Survey Report, 1881 [1882], XI., p. 327, t. 32, f. 4; 28th Ann. Report N. York State Mus. Nat. Hist., 1879, t. 31.

annulated form of the segments in these tubes also finds a counterpart in *C. armoricanus*, Œhlert,[1] from the French Devonian rocks. Again, a striking resemblance exists in the strongly imbricate and subindibuliform condition of the segments in our casts to Prof. Hall's figures of *C. chrysalis*,[2] a species of the Lower Helderberg Group of N. America. Many other comparisons might be made, but these are sufficient to indicate the relations of our form.

Loc.—Heazlewood, in a blue-grey schistose rock ; Zeehan, in a white to grey schistose rock.

Brachiopoda.

Genus Rhynchonella, *Fischer.*

(Notice Foss. Gouv. Moscou, 1809, p. 35).

Rhynchonella decimplicata, *J. de C. Sby.*

Rhynchonella decimplicata (J. de C. Sby.), Davidson, Mon. Brit. Sil. Brachiopoda, 1869, III., Pt. 7, No. 3, p. 177, t. 23, f. 20-24.

Rhynchonella decimplicata, M'Coy, Prod. Pal. Vict., Dec. V., 1877, p. 26, t. 47, f. 3-6.

Obs.—A number of crushed examples of this species are associated with the remains of *Cromus Murchisoni*, but are sufficiently well preserved to exhibit the distinctive features of the species. *R. decimplicata* has already been met with in the Upper Silurian of Victoria by M'Coy, and although figured by Mr. R. M. Johnston in his "Geology of Tasmania," is not, I think, from Tasmanian rocks.

Loc.—Heazlewood, in a grey-blue schistoze rock.

Rhynchonella cuneata, *Dalman.*

Pl. , Fig. 16.

Rhynchonella cuneata (Dalman), Davidson, Mon. Brit. Sil. Brachiopoda, 1867, Pt. 7, No. 2, p. 164, t. 21, f. 7-11.
Rhynchonella cuneata, Johnston, Syst. Acc. Geol. Tas., 1888, t. 7, f. 9.

Obs.—An impression of a single ventral valve possessing the general characters of this species tends to confirm Mr. Johnston's recognition of it as a Tasmanian fossil, but the number of costæ seem to separate it as a variety. In *R. cuneata*, Dalm., the costæ are from ten to fourteen, of which four or five occur on the fold of the dorsal valve, and three or four in the sinus of the ventral. On the impression from Zeehan there are ten costæ, but only one of these occurs in the sinus. The shell evidently possessed the same cuneate form and elevated umbo. There is, however, no trace on this cast of a punctate surface similar to that of the American shell. Prof. James Hall has referred to this species, and erected it into a separate genus under the name of *Rhynchotreta ;*[3] neither did Dr. T. Davidson recognise this structure in European examples of *R. cuneata*.

Johnston's figure, from the shading, I take to be a dorsal valve, with three costæ on the fold.

Loc.—Zeehan, in a blue-grey schistose rock.

Rhynchonella capax, *Conrad*, sp.

Pl. , Fig. 17 & 18.

Rhynchonella capax (Conrad, sp.), Meek, Report Geol. Survey Ohio, 1873, I., Pt. 2, p. 123, t. 11, f. 6*a-f*.

Obs.—A number of very beautiful external impressions, often of the united valves, seem to me to be referable to this species. They represent a rounded sub-globose form, with close rather inrolled beaks, a well-marked fold and sinus, and numerous sub-angular costæ, sometimes very fine, crossed by innumerable decussating laminæ. The costæ do not exceed twenty in number, but vary from sixteen to twenty, seven to eight on the flanks, one to three on the dorsal fold, seldom three, however, and only one or two in the ventral sinus. The convexity of the valves is about equal, and the fold relatively wider than the sinus. The zigzag laminæ increase rapidly in width and prominence towards the front.

In general habit, casts taken from these impressions are very like *Rhynchonella capax*, of the Hudson River Group of North America, and equally so of *R. Lewisii*, Davidson,[4] from the Wenlock Limestone of England, for indeed the latter shells differ but little from one another.

In *R. capax* the lateral costæ are from four or five to seven, on the dorsal fold four, and in the ventral sinus three. In *R. Lewisii* there are from two to five costæ in the fold, and one to four in the sinus.

The Tasmanian impressions are certainly after the type of these closely allied species, but apparently closer to *R. capax*, in fact separated chiefly by the relative number of costæ. I therefore propose for our shell the varietal name of *meridionalis*, and would write it in full as *R. capax*, var. *meridionalis*, Eth. fil.

Rhynchonella anticostiensis, Billings[5], is also a close ally, in fact Meek regards it as a synonym of *R. capax*. It possesses four ribs on the fold and three in the sinus.

In addition to the number of costæ, the Tasmanian shells differ only in being relatively smaller and less globose than the American.

Loc.—Heazlewood, in a blue-grey schistose rock.

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[1] Bull. Soc. Études Sci. Angers, 1887, t. 10, f. 5, 5 *a* & *b*.
[2] Pal. N. York, 1888, VII. t. 116, f. 26-28.
[3] 28th Ann. Report N. York State Cab. Nat. Hist., 1879, p. 166.
[4] Mon. Sil. Brachiopoda, 1869, Pt. 7, No. 3. p. 180, t. 23, f. 25-28.
[5] Pal. Foss. Canada, 1862, I., Pt. 3, p. 142, f. 119*a-c*.

Rhynchonella borealis, *Schlotheim?*

Pl. , Fig. 19 & 20.

Rhynchonella borealis (Schl.), Davidson, Mon. Brit. Sil. Brachiopoda, 1869, Pt. 7, No. 3, p. 174, t. 21, f. 14-20.

Obs.—Numerous examples of a crushed *Rhynchonella* have yielded characters that place it very near to the above species, particularly one variety figured by Davidson (*see* his. t. 21, f. 18, 18*a*.)

I believe the fossils are the remains of a subtrigonal shell, with the fold of the dorsal valve abruptly raised, with wide smooth sides, and the crown of the fold longitudinally and narrowly sulcate, the single rib or costa thus formed on each side being sharp and well defined. The flanking costæ, from three to four in number, are also prominent and sharp. The sinus of the ventral valve is wide and deep, with two insignificant costæ at the bottom close together. There are four costæ on each flank, and the intercostal spaces or valleys on both valves are deep. The whole surface of the valves is crossed by very strong concentric frills.

Our fossils are not only closely allied to the form of *R. borealis*, already indicated, but also to its variety *diodonta*, Dalman, and they have some characters in common with *R. bidentata*, Hisinger,[1] and *R. altiplicata*, Hall,[2] of the Lower Helderberg Group of North America, but, as regards the former of these, not possessing so high a dorsal fold, and more costæ.

Loc.—Zeehan, in a greyish-white schist.

Genus Strophomena, *Rafinesque.*

Strophomena? *sp. ind.*

Pl. , Fig. 12.

Obs.—An impression of a very peculiar Strophomenoid shell that is worth figuring to draw attention to it, although of doubtful generic identity. There is evidence of a large sinus, thereby indicating a ventral valve. The sinus is too pronounced for the specimen to be a species of *Orthis*, except such species as *O. biforata*, Schlotheim, of the Middle and Upper Silurian, but it is unlike the latter in outline. So far as mere shape is concerned it approaches *Tropidoleptus*, Hall, or *Enteletes*, Fisher.

Loc.—Zeehan.

Genus Strophodonta, *Hall.*

(Pal. New York, 1852, II., p. 63).

Strophodonta, *sp. ind.*

Pl. , Figs. 13–15.

Obs.—Crushed and fragmentary examples of a Strophomenoid shell are numerous in the rock from the Silver King Mine, bearing many delicate, curved, radiating costæ. The chief point of interest is the presence of a crenulated hinge-line, the impressions of numerous transverse denticles. This character indicates the genus *Strophodonta* rather than *Strophomena*. The crenulations extend from one end of the hinge-line to the other, on each side the fissure. The shell was semi-oval, and provided with a large number of fine costæ, simply radiating on the centre of the valves, but gradually curving outwards on the flanks.

Loc.—Zeehan, in a greyish-white schistose rock.

Pelecypoda.

Genus Leptodomus, *M'Coy.*

(Brit. Pal. Foss., 1852, Fascic. 2, p. 277.)

Leptodomus? nuciformis, *sp. nov.*

Pl. , Fig. 28.

Obs.—A small shell that it is difficult to refer positively to any genus, but having the general appearance of *Leptodomus*, M'Coy. It has an oblong-oval convex valve, with a straight posterior hinge-line, a rather high umbo, a faint indication of a cincture, and numerous well-marked fine concentric rugæ that unite towards the ventral margin into groups or bundles representing growth stages. The anterior margin is obliquely rounded, whilst the posterior margin is, although generally rounded, somewhat semi-truncate also.

Although no absolute proof exists that this is a true *Leptodomus*, still, from its general resemblance to that genus, I have provisionally placed it therein, with the trivial name *nuciformis*, from its rounded and compact nut-shaped outline. It is quite sufficiently distinct for future recognition.

Loc.—Zeehan, in the Despatch Limestone.

Gastercpoda.

Genus Lophospira, *Whitfield.*

(Bull. Am. Mus. Nat. Hist., 1886, I., No. 8, p. 312.)

Pl. , Fig. 24.

Obs.—It is with some hesitation that I refer the impression of a fragmentary univalve to this genus, characteristic of the Trenton Limestone of North America, and the Wenlock Limestone of the Island of Gotland. By taking a cast of the impression we see the remains of a turreted shell,

[1] Davidson, *loc. cit.*, 1883, V., Pt. 2, p. 150, t. 10, f. 3, *a* & *b*.
[2] Pal. N. York, 1852, II., p. 231, Atlas, t. 33, f. 2 *a-k*.

with sharply carinated whorls, and generally presenting a bold and somewhat rugged appearance. There are portions of four whorls, each divided almost in the centre by a strong and sharp carina, the surface of each whorl above it being more or less concave, and below nearly straight walled. Our cast corresponds better with Lindström's figure of *L. bicincta*, Hall, sp.[1], than it does with Whitfield's types. Whatever may be the ultimate resting-place of the former, I think the Tasmanian cast will be found congeneric, although sufficient of the body whorl is not preserved to show the second or lower keel. All trace of sculpture has been removed.

There is no more evidence in our specimen than there is in Lindström's figure of the ultimate uncoiling of the whorls described by Whitfield as typical of his genus, and it is just possible therefore that the Gotland shells called *L. bicincta*, Hall, sp., by Lindström, may not be that species.

Loc.—Zeehan, in a white quartzite.

Genus MURCHISONIA, *D'Archiac* and *De Verneuil.*

(Bull. Soc. Géol. France, 1841, XII., p. 154.)

Pl. , Fig. 23.

Obs.—This genus is represented by the elongated cast of a turreted-pyramidal shell, slowly increasing in size. There are five whorls (as preserved), almost straight sided, and swollen near the sutures, caused by a slight projection of the wide and apparently flat band, which on the upper whorls is situated at that point, but on the body whorl forms its periphery.

Although only a fragment, this is a well marked shell. It belongs to that group of Murchisoniæ to some extent represented by *M. cingulata*, His., but differs in possessing straight-walled whorls and a more rapidly attenuating spire. The sculpture is unpreserved.

Loc.—Zeehan, in a white quartzite.

Genus EUNEMA, *Salter.*

(Canadian Organic Remains, 1859, Dec., I., p. 24.)

Eunema Montgomerii, *sp. nov.*

Pl. , Fig. 21 & 22.

Sp. char.—Shell conical, turreted, of four non-oblique whorls, and a nucleus, encircled by prominent sharp carinæ, the first three whorls each bearing two, one immediately around the suture, the other near the middle; below this the sides of each whorl are straight-walled; body whorl with four keels, the three upper as already described, whilst the fourth is much more anterior in position—practically quite anterior—and somewhat oblique; the sides of each whorl between the first and second carinæ are concave, whilst the second carina is always the more prominent; the sutures are flat or very slightly concave; surface ornamented with microscopic thread-like lines of growth, varying slightly in direction between the encircling carinæ. Height of the largest specimen three-quarters of an inch.

Obs.—A very well marked shell, allied to *E. strigillatum*, Salter,[2] of the Trenton Epoch of North America, but broader in relation to its height, and differently directed carinæ. It affords me much pleasure to associate with this the name of Mr. A. Montgomery, Government Geologist of Tasmania. Johnston's *Trochonema Etheridgei*[3] is perhaps an allied, although distinct shell.

Loc.—Zeehan, in the Despatch Limestone.

Genus RAPHISTOMA, *Hall.*

(Pal. N. York, 1847, I., p. 28.)

Raphistoma? *sp. ind.*

Pl. , Figs. 25 and 26.

Obs.—In the white sandstone from Zeehan several very poor casts of a low-crowned shell occur, difficult of determination, but having the appearance of this genus, and in some respects resembling the form I have lately described as *R. Brownii*,[4] but lower in the spire, and therefore probably distinct. It is very desirable that additional examples of this fossil should be obtained, with the view of determining its systematic position with greater accuracy.

Loc.—Zeehan, in a white quartzite.

Pteropoda.

Genus TENTACULITES, *Schlotheim.*

(Petrefactenkunde, 1820, p. 377.)

Tentaculites, *sp. ind.*

Pl. , Fig. 27.

Obs.—This elegant genus is represented by a very large number of external impressions. Casts taken from the latter display a remarkably elongate and delicate form, extending to a fine needle-point, but without any trace of the bulbiform embryonic shell. The characteristic annula-

[1] *Pleurotomaria*, Sil. Gastropoda and Pteropoda of Gotland, 1884, p. 104, t. 8, f. 15-25.
[2] Canadian Organic Remains, Dec., I., 1859, p. 29, t. 6, f. 4.
[3] Syst. Acc. Geol. Tas., 1888, t. 5, f. 13 and 14.
[4] S. Australian Parl. Papers, 1891, No. 158, p. 9, Pl., f. 1-3.

tions are about one-fourth or one-fifth millimetre apart, or four to five in number in the space of one millimetre. The interannular spaces are delicately transversely striated as usual in the genus. The annulations were very sharp, and apparently came to a fine edge.

Specific identification from the condition of the specimens is impossible, but it is a smaller form than that figured [1] by myself from the Siluro-Devonian rocks of the neighbourhood of Wellington, N. S. Wales.

Loc.—Heazlewood and Zeehan, in a blue-grey schistose rock.

5.—AGE.

The species detailed in the foregoing pages present both a Lower and an Upper Silurian facies, but with a preponderating tendency towards the latter. I think it not impossible that they represent a series of beds homotaxially equivalent to the lower portion of the Upper Silurian.

DESCRIPTION OF THE FIGURES.

Fig. 1. *Pleurodictyum?* sp. ind.—The impression of portions of ten corallites. The walls have entirely disappeared, leaving traces of the mural pores as small connecting shafts between the corallites. Zeehan.

2. *Asaphus*, sp. ind.—Small pygidium consisting of the test seen from the inside. Zeehan.
3. *Illænus Johnstoni*, Eth. fil. The cephalon or cephalic shield, with well marked axial grooves. Zeehan.
4. *Hausmannia meridianus*, Eth. fil. and Mitchell.—Pygidium showing the largely increased number of segments: cast from an impression. Heazlewood.
5. *Hausmannia*, sp. ind.—A smaller pygidium, probably of a distinct species, with the axis tuberculate. Zeehan.
6. *Hausmannia meridianus*, Eth. fil. and Mitchell.—The right coalesced pleuræ showing the wide limb. Zeehan.
7. *Cromus Murchisoni*, De Koninck.—The glabella and portion of the fixed cheeks—×2. Heazlewood.
8. The same.—Pygidium, with the apex wanting—×2. Heazlewood.
9. *Amphion? brevispinus*, Eth. fil.—Small pygidium, decorticated at the apex, but showing traces of the pleural spines—×2. Zeehan.
10. *Cornulites tasmanicus*, Eth. fil.—Internal cast of the tube. Heazlewood.
11. The same.—A smaller tube in the same condition. Heazlewood.
12. *Strophomena.*—Impression of a ventral valve? Zeehan.
13. *Strophodonta*, sp. ind.—Imperfect cast. Zeehan.
14. The same.—Hinge-line of Fig. 15 to show denticulations—×3. Zeehan.
15. The same.—Partially preserved cast. Zeehan.
16. *Rhynchonella cuneata*, Dalman.—Impression of the ventral (?) valve. Zeehan.
17. *Rhynchonella capax*, Conrad.—Cast taken from the impression of two valves in juxtaposition—×2. Heazlewood.
18. The same.—A ventral valve—×2. Heazlewood.
19. *Rhynchonella borealis*, Schlotheim?—Cast of the ventral valve taken from an impression—×1½. Zeehan.
20. The same.—Zeehan.
21. *Eunema Montgomerii*, Eth. fil.—Showing general characters. Zeehan.
22. The same.—A smaller example. Zeehan.
23. *Murchisonia*, sp. ind.—Cast taken from an impression. Zeehan.
24. *Lophospira?* sp. ind.—Cast taken from an impression. Zeehan.
25. *Raphistoma?* sp. ind.—Internal cast, apical view. Zeehan.
26. The same.—Side view showing the keeled whorls. Zeehan.
27. *Tentaculites*, sp. ind.—Cast taken from an impression—×6 (about). Heazlewood.
28. *Leptodomus? nuciformis*, Eth. fil.—Left valve—×3. Zeehan.

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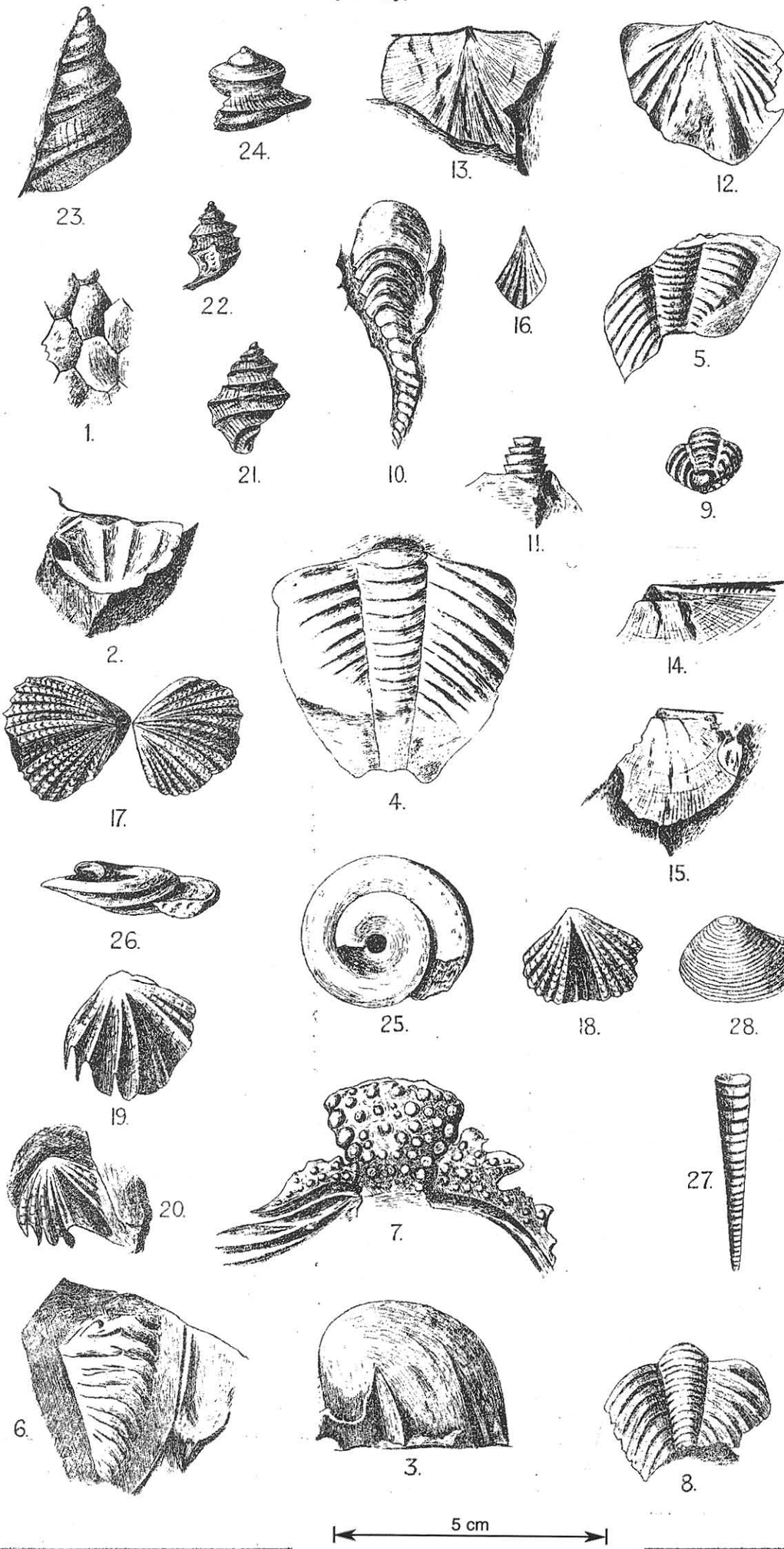
[1] Journ. R. Soc. N. S. Wales, 1880, XIV., p. 253, pl., f. 10.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