

TASMANIA.

R E P O R T

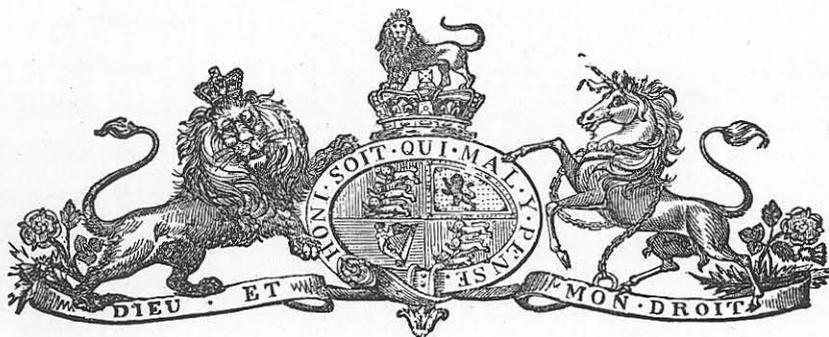
OF THE

S E C R E T A R Y O F M I N E S

FOR

1891-2,

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



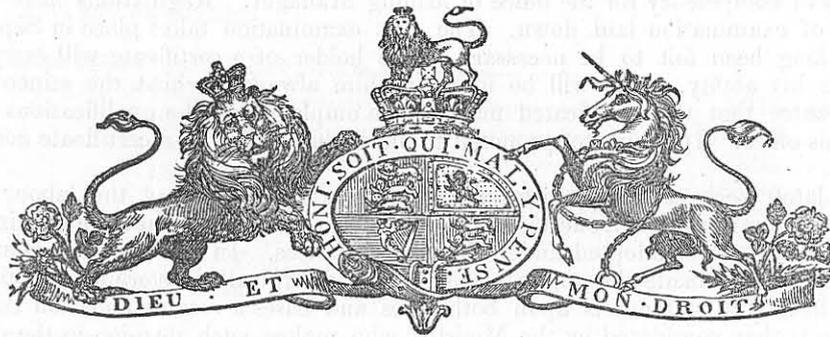
Tasmania:

WILLIAM THOMAS STRUTT, GOVERNMENT PRINTER, HOBART.

1892.

TABLE OF CONTENTS.

	Page
Annual Report of Secretary of Mines	5
„ Reports of Commissioners	8
„ „ Inspectors of Mines	11
„ Report of Geological Surveyor	13
„ „ Mount Cameron Water-race Board.....	14
Report on the Coal-fields at Oyster Bay, by the Geological Surveyor ...	15
„ Country traversed by the route of the proposed Waratah- to-Zeehan Railway, by the Geological Surveyor	22
„ Ben Lomond District, ditto	25
„ Mathinna Gold-field, ditto.....	40
„ Ore-dressing Machinery at the New Tasmanian Silver Mine at Mount Zeehan, by R. Provis, Esq., A.M., I.C.E.	58
Diamond Drills—Statement of work done by	60
Report of Strata. Ravensdale.....	60
„ Back River, Prosser's Plains	61
„ in boring for alluvial Gold at Lefroy	62
„ Macquarie Plains	62
„ Jerusalem	63
„ Langloh Park.....	64
Gold. Table—Comparative Yield.....	65
„ Quantity obtained from Quartz	66
Commissioners' Reports on Gold-fields.....	6. 8. 9. 10. 11
Table—Dividends paid	68
Silver. Ditto, ditto	68
Commissioners' Reports	6. 10. 11
Tin. Table—Quantity exported.....	66
„ Dividends paid.....	68
Commissioners' Reports	6. 9. 10. 11
Coal. Quantity and Value raised	66
Revenue: Statement of Mining	68
Miners employed, Number of.....	67
Area of Land leased.....	67



REPORT OF THE SECRETARY OF MINES.

Office of Mines, Hobart, 28th July, 1892.

SIR,

I HAVE the honor to submit my Report upon the Mines Branch of the Lands and Works Department for the year ending 30th June, 1892.

Appended will be found Reports of the various Commissioners upon the state 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; Reports by the Geological Surveyor upon the Coal-fields at Oyster Bay, County Glamorgan; the Country traversed by the proposed Waratah-to-Zeehan Railway; the Ben Lomond Mining District; the Mathinna Gold-field; a Description of the Ore-dressing Machinery in use at the Tasmanian Silver Mine, Zeehan, by Mr. Richard Provis, A.M.I.C.E.; Returns of the Operations of the Diamond Drills, together with Tables showing the Yields of Gold, Tin, Silver, and Coal; the Number of Persons engaged in Mining; the Number of Leases and Area of Land held for Mining Purposes; the Net Revenue paid to the Treasury from Mines; with the Amount of Dividend Tax paid by Mining Companies. Appendices.

Writing at this time last year, the opinion was expressed that at no previous period in the history of the Colony had the Mining industry presented a more hopeful aspect than at that time. Notwithstanding all that may be said to the contrary now, the stern logic of facts proves that that opinion was justified, and that at this date it may fitly be reiterated. The main hope of the Colony then rested upon the vast mineral resources of the West Coast Silver-fields; it does so still. True it is that owing chiefly to the financial depression which at present hangs over, not Tasmania alone, but all the colonies, the money necessary for developing those resources is not just now obtainable, and further to the fact that much money has been wasted by incompetent management, by the purchase and erection of inadequate machinery, and by the squandering of money in taking up for purely speculative purposes enormous areas of land upon which no mineral was known to exist, has caused, and is causing, an idea to prevail that the industry is decaying. It cannot be denied that gambling in shares, which some people call "mining," is, happily for the welfare of the industry, practically dead; but the fact remains, so far as these fields are concerned, that it is established beyond doubt that a large number of payable mines exist; that very extensive developments in the shape of opening the mines by means of shafts and adits, the erection of smelters, concentrators, and other machinery, the construction of railways, tramways, and roads are now in existence and in progress; that the quantity, value, and ease of treatment of the ores is proved. And is it, therefore, too much to expect that so soon as the present cloud of depression shall have rolled by, the silver lining will substantially reveal itself, and the silver mining industry will become a steady and permanent factor in the wealth of the Colony? General remarks.

Other branches of the industry, which will be separately treated of later on, are in a satisfactory condition.

Discoveries have been reported during the year of gold, both in quartz and alluvial, at Warrentinna, near Branxholm, in the North-Eastern Division; of tin at Cox's Bight, on the South Coast; asbestos, at the Savage River; wolfram, in the North-Eastern Division; and graphite, on Cape Barren Island,—none of which have so far been extensively developed.

Some of the older established gold-fields—notably Mathinna and Lefroy—are again coming into prominence.

Under the provisions of the Regulation of Mines Act, which came into force on the 1st January, 1892, a competent Board of Examiners has been appointed to conduct examinations and issue certificates of competency for the office of Mining Manager. Regulations have been framed, and a scheme of examination laid down. The first examination takes place in September next. This step has long been felt to be necessary. The holder of a certificate will carry with him a credential as to his ability, which will be useful to him always; whilst the mineowner will be afforded a guarantee that the certificated manager he employs has the qualifications necessary to his fitness for his office. It is not yet proposed to make the holding of a certificate compulsory.

Much has lately been said and written regarding the enforcement of the labour covenants of Leases. The question is a difficult one to deal with, but it is contended that the existing practice is a fair one, and the best to be adopted under the circumstances. In all cases where an application for forfeiture of a lease is made the applicant and the lessee are called before a Commissioner, who, in open Court, hears the statements upon both sides and bases a recommendation thereon. This recommendation is then considered by the Minister, who makes such decision in the matter as the circumstances justify, and if the application is upheld then the applicant has a preferential right to take up the lease. This practice gives to those who desire to acquire unworked leaseholds a fair opportunity of doing so, whilst at the same time it prevents lessees who may, temporarily perhaps, be prevented from working, being, without sufficient cause, deprived of the capital and labour which they have in the past expended upon their leaseholds. It is satisfactory to note that many lessees are tributing their ground, a practice which, in the Zeehan and Dundas Silver-fields especially, may be adopted with profit to both lessee and tributor, and will help materially towards the fulfilment of the labour covenants.

Gold. The yield for the year has been 47,906 ozs., against 20,000 ozs. for the previous year. The increase is due to the satisfactory developments at the old-established gold-field at Lefroy and the alluvial workings at the Ring River. It is anticipated that Beaconsfield will again add its quota to the gold yield of the Colony. The Tasmania mine at that place, which has in the past produced at the rate of a ton of gold per year, having now acquired a magnificent pumping plant, will shortly be in a position to resume its outputs. The Warrentinna discoveries will doubtless be developed during the coming summer, and there are indications of successful results attending operations at Mount Victoria.

Silver. During the past year a great advance has been made in silver mining, notably at Zeehan and Dundas and in the Heazlewood and Whyte River Districts. Although only yet in its infancy, the industry has made very satisfactory progress. During the year, apart from the necessary preparatory work of opening the mines, constructing roads and tramways, and erecting machinery, &c., 1938 tons of ore and 590 tons of bullion have been exported; whilst upon the two fields of Zeehan and Dundas some twelve thousand tons of ore, valued at upwards of £61,000, is awaiting transit to the smelters. From the Maestri mine at Dundas 866 tons of bullion, containing 76,844 ounces of silver, has recently left the smelters. The progress of the Heazlewood District has so far been retarded by want of roads. A small parcel of 113 tons of ore lately sent from that district yielded 9000 ounces of silver and 60 tons of lead.

Tin. The excitement of what was known as the "silver boom" drew many of the miners from this branch of the industry in the early part of the year. The yield, however, has been 4784 tons, being one ton only in excess of the output for the previous year.

The only discovery of any importance during the year has been at Cox's Bight, on the S.W. Coast. This is an alluvial deposit at present of limited extent, but as it is in hitherto unprospected country, and has already attracted a number of practical miners, further discoveries in the neighbourhood will probably result.

Lode tin-mining is attracting considerable attention in the Blue Tier District, where there is known to be several lode deposits containing a payable percentage of tin. The present difficulty, however, is to provide suitable appliances for saving the tin. Some energy is now being thrown into the matter, and no doubt a means will be found to work the deposits profitably.

Coal. The output of coal for the year has been 40,000 tons, being a decrease of 10,000 tons against the corresponding period in 1890-1.

A fair amount of prospecting is being done with encouraging results by means of the diamond drills, and a seam which was discovered by that means at Seymour is now being opened out, and promises to be a good gas coal, which, from its proximity to the sea-board, should prove a very valuable deposit.

Other metals and minerals. Excepting a discovery of asbestos at the Savage River and of graphite at Barren Island, both as yet undeveloped, but which may prove of considerable value, no important discoveries have been made during the year.

During the year ending 30th June 1118 leases for 48,763 acres of land have been issued, and 1279 applications for 60,839 acres are in process of being dealt with, besides a large number of grants of water rights and easements. Evidences of activity.

The areas leased and applied for are as follows—

For Gold.....	8915	acres		
Silver.....	105,590	"	"	"
Tin.....	26,893	"	"	"
Coal.....	18,084	"	"	"
Other Minerals.....	5179	"	"	"
Total.....	164,661	"	"	"

against 175,700 acres on 30th June, 1891. Areas leased and applied for.

The revenue for the year for rents, application fees, licences, miners' rights, &c., amounted to £34,852, against £35,942 for the previous year. This department is not credited with large sums paid into the Treasury for Stamp Duties upon the Registration of Mining Companies, Transfers of Mining Leases, Dividend Tax, and other items incidental to Mining. Revenue.

During the year 162 Companies have been registered, with an aggregate capital of £718,354. Mining Companies.

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 Mount Victoria and Waterhouse. The eastern District comprises the eastern portion of the Colony, and includes the tin-mining centres at Ben Lomond, Weldborough, and Gould's Country, with the extensive coal-bearing country around Fingal and Seymour, and the gold-fields at Mangana and Mathinna. The 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-mines at Mount Bischoff, an extensive area of tin-bearing country at Heemskirk, the silver-fields at Mount Zeehan, Mount Dundas, and Heazlewood, the gold-field at the Linda, and other more or less important mining centres. Division of the Colony.

The staff at the offices at Hobart and Launceston remains the same. An additional Inspector of Mines has been appointed: he is stationed on the West Coast, where he has done much valuable work. Departmental Staff.

The reports of these officers are annexed. It is noted with satisfaction that there has been but one fatal accident, whilst there has also been a marked diminution in the number of non-fatal accidents. I cannot but feel that the liability to accident has been greatly reduced by the careful supervision and advice of the Inspectors. The Inspectors of Mines.

Valuable reports from this officer upon the various portions of the Colony which he has visited during the year are in addition to his Annual Report, annexed hereto. The Geological Surveyor.

The record of the work done by these machines will be found elsewhere in this Report. Diamond Drills.

All sums available under these headings have been expended: it cannot be said that the results have been profitable, and it is not contemplated to ask Parliament to renew the votes. Deep Sinking: Vote in aid of mining generally.

The Report of the Board which has the control and management of this Race is annexed, and may be looked upon as of a fairly satisfactory character. Mount Cameron Water-race.

In conclusion I may say that, excepting that it suffers from the financial depression which unfortunately is just now common to all classes of business, the mining industry of the Colony is in a progressive, healthy, and hopeful condition.

I have the honor to be,
Sir,

Your very obedient Servant,

F. BELSTEAD, *Secretary of Mines.*

The Honorable the Minister of Lands and Works.

REPORTS OF COMMISSIONERS.

Northern and
Southern
Division.
Lefroy.

Mr. Commissioner Glover, in charge of this Division, reports:—

The impulse given to prospecting activity by the success attending the discovery of a payable mine on the lode known as the "Pinafore" reef, to which I alluded in my last annual report, having at intervals received a stimulus from further discoveries, has now attained a pitch of excitement unknown at Lefroy since its earliest and palmy days. The special causes of this revival have been, not only that the discovery alluded to has maintained throughout the past year its successful character, but another mine has since been established on the same reef, which, up to its present stage of development, is considered to afford equally valuable prospects, and upon which crushing operations have just been commenced. Moreover a further discovery has been made within the last six months on a lode now known as the "Volunteer" reef, which on a trial crushing gave a yield of over 7 ounces of gold to the ton, and a recent crushing of 195 tons yielded 207 ounces. The encouragement afforded by these circumstances has caused great excitement amongst the class of prospectors, and there are now 53 Prospectors' Protection Orders in force on the Lefroy gold-field alone. Amongst the various abortive mining operations undertaken at Lefroy from 1871 to 1881 which after a short time were abandoned as unproductive, there were doubtless many which under competent management would have proved valuable acquisitions to the mining resources of the country; and it is on the site of one of these, known as the "Shamrock" claim, that the promising Volunteer mine alluded to is situated. It is but reasonable to expect that further discoveries of value will result from the labours of the many prospectors now on the field. It is also a satisfactory circumstance to record that a new Association, with the assistance of Victorian capital, is about to commence deep mining operations on the Chum line of reef, on the site of the formerly productive mines, which at length failed in their yield at the comparatively superficial depth of some 350 feet, and it is the general belief of experts that under competent management—by deep sinking—these mines will again be as productive as before. Further, there is a promising enterprise which has recently been entered upon by an association to search for a deep alluvial lead supposed to exist about a mile N.W. of the Township of Lefroy. These adventurers have obtained the use of one of the Government Diamond Drills, with the intention of sinking a succession of bores across the region indicated, and this work is now actively proceeding. The yield of gold from Lefroy for the past twelve months has been 14,219 ounces, value £56,182; the yield for the previous twelve months being 1762 ounces.

Beaconsfield.

At Beaconsfield no new developments have taken place, although the yield of gold has been nearly double that of the previous year. The most noteworthy occurrence has been the acquisition and final erection of the powerful pumping machinery procured from England, by the Tasmania Gold Mining Company. The Tasmania reef worked by this Company has, until recently, been the chief source of the gold yield of the country, but the production had materially decreased some two years ago, owing to the insufficiency of the machinery to cope with the subterraneous water; and although the requisite machinery is now established and in successful operation, there has been a great amount of "dead work" to be done on obtaining free access to the lower levels, and in consequence the Tasmania reef has not yet resumed its former degree of production. Nevertheless the yield of gold from Beaconsfield for the past twelve months was 12,320 ounces; value £46,067, whilst the yield for the previous twelve months was 6578 ounces. The seven other quartz mining operations on this field are still confined to underground prospecting, which is proceeding with varying prospects. The enterprise of the Ballarat Association in proving the deep alluvial lead at the base of the Cabbage-tree range, having attained a depth of over 400 feet, is now driving to the alluvial formation, there being now only another 100 feet, or three months' work, remaining, when the value of this "lead" will be ascertained. Efforts are still pending for the acquisition of capital to work various claims under amalgamation, but nothing definite has yet been accomplished.

Lisle.

The once busy and productive gold-field of Lisle is fast subsiding into abandonment, there being now only 22 persons upon it.

Denison and
Golconda.

At the Denison and Golconda the great expectations indulged some twelve months ago have hitherto proved delusive, although several persons are still working on prospecting claims there.

Middlesex
Plains.

Middlesex Plains has hitherto yielded no satisfactory results, and at present affords but little promise of doing so.

From the foregoing circumstances, and the fact that the yield of gold from Lefroy and Beaconsfield for the past twelve months amounted to 26,539 ounces, whilst that of the previous year was only 8340 ounces, it may reasonably be considered that the prospects of the northern gold-fields are highly satisfactory.

North-Eastern
Division.

Commissioner O'Reilly reports upon the state of Mining in the North-Eastern Mining District:—

Gold.

A very material improvement has been exhibited in gold mining in this District during the past twelve months, a considerable amount of prospecting having been successfully carried on, and new finds made, which, so far, on being opened out to a moderate depth, the reefs appear to give promise of permanency and satisfactory returns.

Mount Vic-
toria.

The prospects of the Mount Victoria Gold-field have considerably improved, principally through the successful termination of the spirited enterprise of the Mount Victoria Gold Mining Company in opening out their mine at a low level by a drive, the construction of which took considerable time, costing a large

sum of money, and satisfactorily proved the existence of auriferous quartz in payable quantities in the reef thus opened out. This Company will shortly re-commence crushing with very good prospects of satisfactory yields.

There has been during the past year considerable activity shown in the Mount Horror locality in carrying on prospecting operations, which has led to a large area of land being taken up under lease, and eight mining companies being formed to mine the lands, six of which are mining and prospecting their claims, with results considered very satisfactory. On the Derby Company's claim a small battery is now being erected which will in a short time be in working order, and crushing will then be commenced. The trial crushings from this claim, as also from others in this locality, have been found very rich, and it only remains to be seen if the reefs continue to exist gold-bearing to a good depth.

Mount Horror.

The want of capital has been a considerable drawback to the more rapid development of the claims at this place, but notwithstanding this disadvantage a great deal of sound and legitimate work has been done. There are also a number of prospectors at work holding claims under Prospectors' Protection Orders.

On Mr. Gellibrand's freehold property alluvial gold has been found, and the prospects exhibited of a rich deep lead there are so encouraging and promising that a local company has been formed to mine an extensive area of land leased for that purpose.

I regret to observe that no mining has been done on the Waterhouse Gold-field during the past year, but the lessees of the "Southern Cross" claim there inform me that in a short time they will commence mining operations and the erection of a battery, &c.

Waterhouse and Lyndhurst.

Quartz crushed	26 tons.
Gold won	100 ounces.
Alluvial gold raised	25 "
Average number of men employed.....	40

Tin.

There has not been any improvement in the state of mining in these localities since my last annual report, but few miners being employed and the quantity of ore raised being small. It is apparently evident that at the Upper Cascade the richest portions of the alluvial deposits have been worked out. Although there is a considerable known extent of stanniferous ground in the Mount Maurice locality, the yield from it is generally so low that it cannot be worked profitably excepting during a period when tin holds a high price. I am informed that latterly several prospectors are at work in this locality.

Cascade, (Upper) Ringarooma, and Mount Maurice.

I am not aware of any practical steps being taken to mine the tin lodes known to exist on the "Nugget" and "Star of Peace" claims. About 13 Europeans and 20 Chinese miners are, on an average, engaged in these localities; the quantity of tin ore raised during the twelve months being about 50 tons.

There has not been any marked progress exhibited in the carrying on of mining operations in the Branhholm locality during the past year. Several of the claims have been steadily mined, and the returns are considered fairly satisfactory. No new developments have been made, but latterly a number of prospectors are at work in the back country. Fourteen claims have been mined, on which 44 Europeans and 47 Chinese have been engaged; about 160 tons of tin ore being raised.

Branholm.

There is a considerable amount of activity and enterprise exhibited in the carrying on of mining operations on all the large claims in the locality of Brothers' Home. The yields on the whole appear to be satisfactory, and there is a very marked improvement in the prosperity of the place. The Brothers' Home claim still maintains its large output, 236 tons of tin ore having been raised from it during the past year, 22 Europeans miners being employed on wages, and the mine still appears promising of future large yields.

Brothers' Home.

The "Triangle" claim, which is worked by underground mining, is progressing very satisfactorily, and so far as I can learn, promises well for the future. About 80 tons of tin ore have been raised from this mine during the past year. Fifty European miners are now employed in it on wages.

The "Briseis" Company have largely opened out their mine since my last Report, having had to contend with many difficulties in carrying on the work. Ninety tons of tin ore have been raised from this claim during the past year, and it is expected in a short time that the output will be very largely increased. On the adjoining claim, "The New Brothers' Home No. 1 Company" have resumed work about six months since, and during that period of time have raised about 86 tons of tin ore, employing on an average about 33 European miners on wages.

On the whole about 520 tons of tin ore have been raised in this locality during the past year, 116 European miners being employed on wages.

Many of the claims in the vicinity of Main Creek, Moorina, and Wyniford River are now in full work, and good progress made in the carrying out of mining operations, the yield being considered satisfactory. At Main Creek the "Black Boy" claim has yielded during the past year about 55 tons of tin ore; 4 Europeans and 14 Chinese miners being engaged on tribute.

Main Creek, Moorina, and Wyniford River.

At Bradshaw's Creek the Pioneer claim still maintains a good output, 50 tons of tin ore being raised during the past year, by 23 Chinese and 2 Europeans on tribute. At the Wyniford River the yields from the "Argus Company's" claim are but small as compared with the returns from it of former years.

The "Garibaldi" claim produced a large output for the past year, 165 tons raised by 40 Chinese on tribute. All the claims in the above localities are mined on tribute. About 30 Europeans and 169 Chinese are employed; the quantity of tin ore raised by them being 488 tons.

**Mount
Cameron.**

There has not been any advancement in the state of mining in the Mount Cameron district since my last Annual Report, matters remaining pretty stationary. Thirty-seven claims are mined, principally on tribute, by 45 European and 133 Chinese miners; the quantity of tin ore raised being about 468 tons during the past year.

**Miners'
rights.**

In the area proclaimed under the provisions of the Act 49 Vict. No. 3, available for mining purposes under Miners' Rights, between the Ringarooma and Mussel Roe rivers, I am informed that recently five men were engaged in two parties mining under the above authority, three of whom succeeded in raising twelve bags of tin ore in about six weeks.

**Mount Hor-
ror and
Mount
Stronach.**

But very little is being done beyond prospecting in the localities of Mount Horror and Mount Stronach, the tin deposits being generally poor.

A mineral, wolfram, heretofore new to this district, has lately been found, but sufficient time has not yet elapsed to ascertain if it exists in payable quantities. I understand that this mineral has a considerable market value, and is now in good demand.

Tin ore raised.

The total output of tin ore from the North-Eastern District for the year ending 30th June, 1892, amounts to 1704 tons 14 cwts., as against 1655 tons 1 cwt. for the corresponding period of 1891, there being an increase for last year of 49 tons 13 cwts. Considering the protracted drought in the late summer and early autumn months, and the consequent falling off in the supply of water to work the claims, this yield is on the whole satisfactory. I look forward to an increased output for the coming year.

**Number
of men
employed.**

During the past year there were on an average 250 European and 375 Chinese miners engaged in mining the claims.

**General
observations.**

The depression that existed during the past two years in the tin-mining industry of this District, principally through the counter attractions of the silver-fields of the West Coast to capitalists, miners, and prospectors, is gradually passing away, and many who had left during the above period have lately returned with the view of recommencing mining operations, and I have no doubt that fresh capital will also presently find its way to assist in the development of the mineral resources of this District. On the whole it appears to me that mining operations on the several claims are being carried on with much enterprise and industry in a sound and legitimate manner, and I look forward to a marked improvement in the way of larger yields during the coming year.

**Eastern
Division.
Tin.**

Commissioner Dawson reports:—

The output of tin from this division has been considerably in excess of that for last year. The lodes and dykes in the vicinity of the Blue Tier are in various stages of development, but so far I have nothing special to report.

Gold.

With the exception of the Reunion Gold Mining Company at Mangana, Mathinna is really the gold-field of this division. The leading mine, the New Golden Gate, has maintained its position during the year, and its prospects still continue first class. Prospecting is being actively carried on between Mathinna and the Upper Scamander, and I am informed that good prospects have been obtained.

Coal.

The output of coal from this district maintains its average both as to quantity and quality, and the industry appears to be now established on a firm basis. The East Coast Harbour and Coal Company are making preparations to open up a valuable seam on their property at Seymour, some 15 miles S.E. of St. Mary's, close by the sea. Harbour works to facilitate shipment of the coal are contemplated.

**North-
Western
Division.
Silver.**

Mr. Registrar O'Neill reports:—

As regards mining in this division I have little that is fresh to report. At the various mines in the Whyte River, Heazlewood, and Waratah localities work has been carried on steadily during the past year, and the prospects on the whole are very satisfactory; but for many reasons it appears to be necessary to erect concentrating machinery, and I believe the directors of some of the companies have this matter in hand. The quantities of ore sent away for tests have given very satisfactory results.

Tin.

The Mount Bischoff, the Stanhope, the West Bischoff mines, and the different alluvial claims are in full work, and with very satisfactory results. The extensive machinery at North Valley has now been completed, and no doubt will shortly be in full work.

Gold.

At the Savage River and Long Plains the alluvial miners are doing fairly well.

**Western
Division.**

Commissioner Fowell, in charge of the Western Division, writes as follows:—

The universal commercial depression has materially affected the mining industry in this district, but at the same time it is satisfactory to notice that a considerable amount of energy has been shown by the leading companies on the field towards developing their properties by obtaining machinery, constructing tramways, and getting out ore.

In comparing the actual progress made during the last twelve months with preceding years the advance made is very noticeable, and must be satisfactory to all who are interested in the future of the field.

So far the development confirms the opinion that there are true fissure lodes both at Zeehan and Dundas.

The opening for traffic of the Strahan-Zeehan and Dundas Railway will now enable companies within reasonable distance of the line to obtain machinery at much less cost for carriage, consequently the same excuse can no longer be put forward for non-fulfilment of the labour clauses. This question is a matter which I respectfully suggest will require attention in the near future. At the present time large areas are held by companies who cannot, under present circumstances, fulfil the conditions required of them by their leases, but if they confined their operations to the land their capital will warrant them in properly working, and allow the balance to be worked upon tribute, it would much encourage independent industry, and very much increase the prosperity and population of the district. Should the area which is proved to be beyond their means to properly develop be too large to let to tributors, then it would be better to dispose of the interest in it to others and improve their property with the proceeds of the sale.

The Zeehan and Dundas Smelting Company have made a satisfactory start, and in a manner which shows they mean to make their venture a success.

The Argenton Smelting Company have also for some time been turning out bullion, but on a smaller scale.

It is to be hoped that every effort will be made to keep up a supply of mineral for these companies, and I would ask your consideration upon the charges made at the present time for the carriage of ore. There is in reality but little difference between the carriage of ore and bullion. To enable the ore to be smelted upon the field coke and flux have to be carried by rail, and consequently the charge for smelting at the present railway rates is higher than that charged in the neighbouring colonies. The result is that agents are now buying up from companies ore, and can afford to give better prices than the local smelting companies. The Railway Department in these cases only obtain one freight instead of three, and the Colony lose the advantage to be obtained by the money which would be expended here and the increase in the population caused by this industry.

During the last three months there has been a revival of prospecting for tin about Mount Heemskirk, and with fairly satisfactory results. This portion of the district must ultimately become valuable, and it gives me great satisfaction to report that attention is once more directed to it.

In the neighbourhood of the Ring River a considerable amount of gold has been obtained, and it has given employment to from 300 to 400 miners, which has been a great relief during the present depression. This portion of the district is gradually opening out, and valuable results, I am satisfied, may be looked forward to.

The Mount Lyell Company have pushed forward their operations vigorously since the re-organisation of the company, and the prospects of good results are looked forward to. The connection of this portion of the district with the port, by either rail or tramway, is absolutely necessary before much improvement can be expected.

I regret that the remaining gold-mining companies in this portion of the district have ceased operations. However, should mining be permanently revived at Mount Lyell, it will necessarily follow in the neighbourhood now neglected.

ANNUAL REPORT OF THE INSPECTOR OF MINES.

Inspector of Mines Office, Launceston, 27th July, 1892.

SIR,

I HAVE the honor to forward to you my Annual Report as Inspector of Mines for the year ending 30th June, 1892.

Mining Accidents.—I am glad to be able to report a diminution in the number of mining accidents, nineteen persons having been injured, as against twenty-seven in the year ending 30th June 1891. Only one fatal accident occurred, a Chinese being killed by the fall of a tree blown up by the roots by the wind, which struck him as he was at work in his alluvial claim. Of the remaining cases eight were accidents attended with severe injury, and ten with comparatively trifling hurts: all the injured men were Europeans.

The causes of the accidents come under the following headings:—

Falls of earth and rock.—Six men were hurt by these, four rather severely, two less so. Inquiry shows that these accidents could not generally have been prevented, no carelessness being chargeable to either the miners or the managers of the mines. In one case, however, the

injured man complained that he had been ordered to do a piece of work which he had told the manager was dangerous. This accident had not been reported to the Inspector of Mines as required by law, and did not come to his knowledge till the time allowed by law for laying an information against the manager had expired, besides which he had left the colony.

Outburst of water.—Two men working in an alluvial mine were carried off their feet and sustained slight injuries from this cause.

Explosions.—Two men received injuries from explosions, one through inadvertently lighting the end of a fuse which was primed with a detonator, the other through putting a can which had contained dynamite on to a fire. No serious consequences resulted in either case. Both accidents were due to careless handling of explosives.

Fall of material down shafts.—Two men were slightly injured by falls of material down shafts: in one case the braceman was to blame, and in the other the injured man himself.

Fall of a tree.—As above mentioned, a Chinese was killed from this cause.

Falls of timber.—Two men were hurt by these, one receiving only trifling injuries, the other having his leg broken. Both cases were pure accidents.

Fall down shaft.—One miner was injured, but not severely, by falling some fifteen feet while doing work in a shaft: no blame was attachable to any one.

Truck accident.—While riding on a truck a man was thrown off by its coming in contact with an obstruction, and sustained a fracture of the thigh.

Cage accident.—A severe accident, resulting in the loss of his right hand, occurred to a man who was taking some measurements in the winding shaft at one of the plats. The cage came down unexpectedly and caught his arm. The accident was primarily due to his attempting to work in the shaft without first stopping the working of the cage.

Slipping of rope.—One man received serious internal injuries through the slipping of a rope with which he was lowering timber, he not having sufficient turns on the capstan. He admitted that it was his own fault.

The Regulation of Mines Act, 1891.—This Act came into force at the beginning of the present year. There is still a great want of familiarity with its provisions, especially with those which were not in the previous Act of 1881, on the part of many mining managers. Notices have been inserted in the *Hobart Gazette* for some months past drawing attention to the changes in the Act, and it is now being carefully attended to. The practice of raising and lowering men in shafts by means of buckets unprovided with safety appliances is still rather common, and several mining managers have been warned to put a stop to it. In some cases a mistaken and uneconomical parsimony in making the shafts too small to admit of a comfortable ladderway almost compels the men to ride in the bucket. I am afraid that it will be necessary to condemn a few of these shafts as unfit for men to travel through before owners will be brought to understand that the safety of the workmen must be considered as well as the cost of sinking.

Regulations.—Under Section 6 of "The Regulation of Mines Act, 1891," Regulations have been made by the Governor-in-Council prescribing terms and conditions for the issue of Certificates of Competency for the office of Mining Manager of a Mine, regulating the examinations for these, and appointing a Board of Examiners to conduct them; also prescribing conditions as to the manner in which the surveys of the underground workings of mines shall be effected. These appear to meet with very general approval from practical mining men; and, it is hoped, will tend towards improvement of mining.

Complaints from Miners.—A complaint was lodged with regard to the ventilation of the Mount Nicholas Colliery. On inquiry it was found that the matter had been remedied so far as there was any ground for complaint, and that the ventilation of the mine was satisfactory.

Another complaint that there were no platforms in the ladderway of the Ballarat mine, Beaconsfield, was examined into, and platforms were put in and the ladderway made as secure as possible under the circumstances.

These were the only two instances where the men working in the mines have complained as to the safety of the workings, which may be taken as evidence that the mines are in general kept in a state satisfactory to the workmen employed in them.

Mines visited.—During the year I have visited the Mount Nicholas and Dulverton Collieries, and the mines in the Whyte River, Waratah, Beaconsfield, Lefroy, Ben Lomond and Mathinna Districts. Inspector Harrison has visited those of the Mount Zeehan and Mount Dundas Districts, and sent in his Report separately.

I have, &c.

A. MONTGOMERY, M.A., *Inspector of Mines.*

The Secretary of Mines, Hobart.

REPORT OF THE INSPECTOR OF MINES AT ZEEHAN.

Zeehan, 8th July, 1892.

SIR,

I HAVE the honor to report that during the seven months that I have had charge of this District there has only been one serious accident, the sufferer being the only one to blame in the matter. I am happy to say he is now out of all danger.

There are about 24 pumping and winding plants on the field at present ; most of it is new machinery. Machinery. Many of the mines have had to shut down lately, the cause in some instances being the financial depression existing, and in others the steam pumps adopted by several of the companies not proving suitable for sinking where the water is heavy.

Boilers are especially good, and in most cases tested far above their working pressure. Boilers.

In all cases where safety cages are used I have had them submitted to a practical test before allowing them to go into work. Safety cages.

The ventilation of the mines is good ; indeed we have no underground workings of a very extensive character to make it otherwise. Ventilation.

On being appointed Inspector of Magazines I had several parcels of damaged explosives destroyed. Explosives. The magazine is now clean, and, with the assistance of the new Gunpowder Act, I hope to keep it so.

The new Mining Regulations seem to give all-round satisfaction. I find the mining managers are anxious to work in accordance with them. New Mining Act.

In conclusion, I beg to thank the managers and miners for the kindness and assistance they have rendered to me, especially in the outside portions of the district.

I have, &c.

JAMES HARRISON, *Inspector of Mines.*

The Secretary of Mines.

ANNUAL REPORT OF THE GEOLOGICAL SURVEYOR.

Geological Surveyor's Office, Launceston, 28th July, 1892.

SIR,

I HAVE the honor to submit my Annual Report for the year ending 30th June, 1892.

During this period I have forwarded to you the following Reports of the results of my examination of the districts referred to :—

- On the Coal Fields at Oyster Bay, in the County of Glamorgan.
- On some supposed occurrences of Silver Ore near Tunnack, County of Monmouth.
- On Brown Coal near Evandale Junction.
- On the Country traversed by the route of the proposed Waratah-to-Zeehan Railway.
- On the proposed boring for Coal at Langloh Park.
- On a discovery of Coal at Plenty, Derwent Valley.
- On the Ben Lomond Mining District.

I have also made a detailed examination of the Mathinna Mining District, a Report on which is now in preparation. Want of time has as yet prevented me from visiting and reporting upon the Mount Horror Gold Field and the mineral ground near Deddington, as instructed.

Beaconsfield Report—Correction.—In my Report on the Beaconsfield Goldfield, published with the Secretary of Mines' Report for 1890-91, on page 47 mention is made of a carbonaceous substance found in the Tasmania and Moonlight Mines. Further examination and analysis have shown this to be a lignite instead of nearly pure carbon as there stated. An explanation of this curious occurrence has been given in a paper by Mr. Ward, Government Analyst, and myself, read before the Australasian Association for the Advancement of Science in January, 1892, wherein the matter is fully discussed.

Coal Measures at Ravensdale and Prosser's Plains.

In the Report on these published last year, it was recommended that they should be tested by means of a Diamond Drill. As will be seen below, in the Report of the work of the Diamond Drills, this has now been done. The section of strata passed through are appended hereto. No coal was found at Ravensdale ; before the drill had gone many feet the influence of the adjacent greenstone was observable in the hard and flinty character of the sandstones passed through, and at 113 feet the bore was abandoned, the bottom being in very hard quartzite and hornstone. The nearest greenstone visible on surface was over half a mile from the site of the bore. From this test it seems unlikely that coal will be found in this locality, and there is a very great probability that if any should occur it would be spoiled by proximity to the plutonic rock.

At Prossers' Plains two bores were put down. The first of these was about a mile south-west from Brockley House and nearly due south of the junction of the Back River with the Prosser River. This bore was 414 feet 2 inches deep, and did not cut any coal, being apparently in beds of the measures below the coal horizon. The second bore was in the flat westerly from the outcrop of coal in the Back River described in my previous Report, and to the dip of the seams seen there and in Robinson's shaft and drive. It went down to 436 feet and bottomed on greenstone without cutting any coal. There must therefore be a fault between the outcrop and the site of the bore, and the coal-bearing area can only be a very small one. It seems most likely that the coal seams once existed in this locality at a level a good deal above the present surface of the ground, and that a part of these higher strata has been thrown down by a fault to where we find the coal cropping out in the River.

Diamond Drills.—In the beginning of September last the charge of the Diamond Drills was transferred from Mr. Commissioner Glover to me. Both Nos. 1 and 2 Drills have been in use during the year, No. 1 pretty constantly, while No. 2 was idle from the middle of October to the beginning of May. Since last Report the No. 1 Drill has put down one bore for coal at Ravensdale, near Little Swanport, two bores for coal at Prosser's Plains, near Buckland, and one bore for alluvial gold at Lefroy, and is now engaged in making a second at the latter place. The No. 2 Drill having completed the boring at Macquarie Plains mentioned in last Report, was moved to Jerusalem, where one bore was made for coal, and thence was taken to Langloh Park, near Hamilton, where two bores for coal have been sunk, and a third is now in progress. It is probable that both Drills will continue boring in the neighbourhood of their present positions for some time to come. Both Drills are in good order: No. 1 has been furnished with a new boiler, and No. 2 with a new derrick. Sections showing the strata passed through are appended to this Report, together with a table showing the depths and cost of the bores.

The boring operations during the year have had varying success. No. 1 Drill as above mentioned was unsuccessful in striking coal at Ravensdale and Buckland, and in its first bore at Lefroy struck the slate bottom at 175 feet 5 inches without meeting with any alluvial wash dirt. Previous bores made in 1883 have shown that it is probable that the gutter will not be much less than 300 feet below the surface. The work now being done by this Drill is of a most important character, as there is much reason to expect that the deep leads in the Lefroy District will contain payable gold, and the results of the boring may be the cause of a great expansion of the mining industry. The second bore has now reached a depth of 209 feet, but has not yet bottomed. It is probable that a good many bores will be required before the position of the deepest ground can be satisfactorily located.

The No. 2 Drill was not successful in finding coal at Macquarie Plains; at Jerusalem it pierced three seams of coal of workable size but poor quality, and one four-inch seam; and at Langloh Park it has also been very successful, cutting one small coal bed in the first bore, and five, four of them of workable thickness, in the second. There seems every probability of a very fair coal-field being opened out in this locality.

I have, &c.

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

The Secretary of Mines, Hobart.

REPORT OF THE MOUNT CAMERON WATER-RACE BOARD FOR THE YEAR ENDING 30TH JUNE, 1892.

SIR,

19th July, 1892.

This Board has the honor to report as follows.

Meetings of the Board.

The Board has held three meetings during the year, and the Race and Works have been inspected by the Chairman and by individual members on various occasions during that period.

The staff.

The staff remains unaltered, viz., a manager and four watermen and channel-keepers.

New works.

During the year a new waterman's cottage has been erected, at a cost of £44 10s. Fluming No. 38 has been entirely and substantially renewed, at a cost of £381, and the manager's house and watermen's stations have been placed in telephonic communication at a cost of £140. All these works were found to be necessary, and have added considerably to the safety and economical working of the race.

Proposed Branch Race to carry water to the western side of the Ringarooma.

The contemplated construction of a Branch Race for the purpose of supplying claims on the western side of the Ringarooma River has been abandoned for the present, for this reason, that at present all water that can be brought in by the main channel is in demand by claimholders along the line: should this demand fall off, then possibly the construction of the Branch may be fitly undertaken.

Condition of the race.

The race generally is in good order, but for several years to come considerable annual expenditure will be required in renewing flumings upon the old portion of the race purchased from the Company. In carrying out this work advantage will be taken of all opportunities to shorten the race, and to substitute earth channels for fluming, and thus reduce the cost of maintenance.

Regulations.

On the whole these are working well and satisfactorily to the customers for water. During the year new regulations have been framed, reducing the price of water to the minimum rate, viz., 10s. per head per

week of 6 days of 8 hours each, for water used for prospecting purposes only, for working turbines and hydraulic elevators, and for water used upon the area commanded by the old portion of the race. These provisions have been extensively availed of, and have been of great practical utility.

The statistics for the year are as follows:—

Average per week of claims supplied	18
Total number of heads of water supplied	3699
Tons of tin ore raised (approximate)	202
Average number of miners employed per week—	
Europeans	23
Chinese	57

Statistics.

	£	s.	d.
Total receipts for the year	2571	1	0
Cost of maintenance and management.....	1071	18	5
Paid to Public Debts Sinking Fund for the year ending 31st December, 1891	1362	3	7
Total paid to Public Debts Sinking Fund	1782	13	0
Rate (for the year) of interest upon the cost of purchase and construction	4	13	0 per cent.

Revenue.

We have the honor to be,

Sir,

Your obedient Servants,

F. BELSTEAD, *Chairman.*

C. O'REILLY,
S. HAWKES,
A. MONTGOMERY,
JOHN SIMPSON, } *Members
of the
Board.*

The Hon. the Minister of Lands and Works.

REPORT ON THE COAL FIELDS AT OYSTER BAY, IN THE COUNTY OF GLAMORGAN.

Geological Surveyor's Office, Launceston, 14th November, 1891.

SIR,

I HAVE the honor to report that, in accordance with your instructions, I went to Swansea on the 28th of October for the purpose of inspecting several localities in the vicinity of Oyster Bay which have been considered likely to contain coal and other minerals. A prospecting association has been formed in the district for the purpose of testing these places by means of a diamond drill should the indications of coal be considered sufficiently favourable. My attention was therefore specially directed to the selection of localities where prospecting by boring could be carried on with the greatest advantage.

As this was only a flying visit no attempt has been made to survey the limits of the various formations seen, and on the maps sent herewith for explanation of this report these are only very roughly laid down, being sketched in mainly from information received from local residents. Should boring operations result in finding payable coal, it would be desirable to have a detailed geological survey of the district made in order to accurately define the probable coal-bearing areas. The maps are, however, sufficiently near the truth to give a good idea of the position and approximate extent of the coal measures.

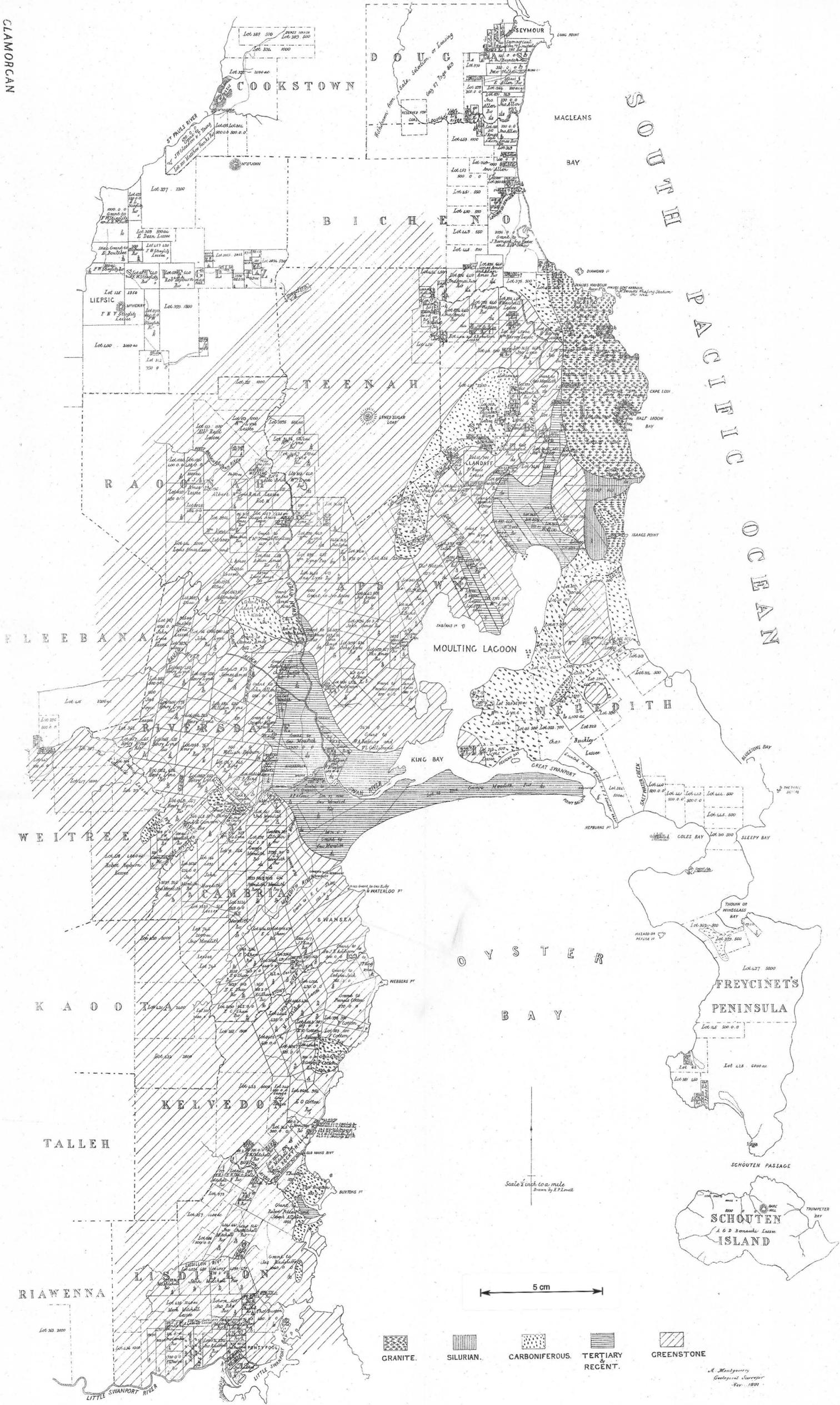
Throughout the whole district the predominant rock is diabase greenstone. This forms all the hills inland from Oyster Bay, and extends without noteworthy interruption almost to Ross and Campbell Town. One or two small ridges and hills near the coast are composed of coal-measures sandstones, but as a rule the latter are only found in low-lying ground—in the valleys and flats. Going northward from Little Swanport we find them at Lisdillon and Mayfield, and again at Kelvedon, in patches of several hundreds of acres, after which nothing but greenstone is encountered until after crossing the Meredith River, when we reach extensive alluvial flats lying at the mouth of the Swan and Wye Rivers. A ridge of greenstone divides the valley of the Swan River from the Moulting Lagoon, but the latter and the flats just mentioned must be regarded as having been at one time shallow portions of Oyster Bay, which have in course of time been more or less filled up by the detritus brought down by the Meredith, Wye, Swan, and Apsley Rivers, or, possibly, elevated above sea-level by a slight rising of the land. Throughout all these flats occasional traces of the coal measures are met with, though the covering of alluvial matter is so thick that an occasional exposure of sandstone is all that is seen. Not only is there the covering of recent alluvial debris to obscure the older formations, but also a deposit probably belonging to the early Tertiary period, which, in places, is of considerable extent. This is met with on the main road about half a mile south of the Riversdale homestead, again at the junction of the Campbell Town and Bicheno roads, and is also well seen in a cutting on the latter road about half a mile north from the junction. Traces of it are again met with in the bank of the Swan River, opposite Glen Gala homestead, and also to the north west from this, on the slopes of some low hills, composed of coal measure sandstones, which there bound the alluvial plain of the

Swan River. This deposit is made up of clays, beds of flaky impure brown iron ores, and highly ferruginous sandstones. At the junction of the roads a few fossil leaves were obtained in these last, closely resembling those found in the very similar leaf-beds of the Windmill Hill at Launceston, which are of Palæogene age. These Oyster Bay Tertiary beds have been much eroded since their formation, and are now only seen where they project as low hills through the later deposits of recent alluvial gravels. Their existence is most likely due to there having once been in the now Swan River valley a lagoon similar to the present Moulting Lagoon at the mouth of the Apsley River. This would argue that the general level of the land was in early Tertiary times much lower than at present,—a conclusion borne out by the other Tertiary deposits found at intervals all round the coast of Tasmania.

So much of the surface of the flat lands at the mouth of the Swan River being covered with these recent and Tertiary formations, and natural sections of any depth being few and far between, it is not easy to form an opinion with any certainty as to whether the coal measures exist below them. Near the junction of the Campbell Town and Bicheno roads, however, sandstone has been quarried for building purposes which is evidently got from the coal measures. It is the characteristic soft greyish felspathic or argillaceous sandstone so commonly met with in our coal measures above and in the vicinity of seams of coal. The same sandstone occurs again in a detached patch near Bellbrook, on the Wye River, and in the Swan River about a mile above Glen Gala homestead, about which occurrences more will be said presently. These isolated outcrops render it very likely that the carboniferous formation underlies a great portion of the alluvial flats. It would seem, indeed, that the whole of Oyster Bay had been once a coalfield, the remnants of the coal formation at Schouten Island and the south-west corner of Freycinet's Peninsula showing that it had extended to the east side of the Bay. Whether it has happened that the soft sandstones have been worn away in course of time by the rivers and the encroachments of the sea until water now occupies the place once held by dry land, or whether, as is possible, the coal measures in the floor of Oyster Bay have never been elevated into dry land, is of no economic importance, as in either case any coal contained is quite out of reach. We must make the best of such remnants as now exist along the shores. That the coal measures once existed in the flats at the mouth of the Swan River is, to my mind, hardly disputable; but to ascertain their present condition two serious factors must be taken into account, namely, the amount of erosion they may have suffered prior to the deposition of the Tertiary and recent beds that now cover them, and the amount of disturbance and alteration they may have been subjected to by intrusive masses of igneous rock (the greenstone). Before any conclusion can be definitely come to on these points borings will have to be executed. We cannot by any means foretell the depth of the basins and possible valleys that had been scooped out of the underlying rock before the superficial deposits were laid down, neither can it be predicted how and where the intrusive greenstone has broken through it. This latter feature is the one that is most to be feared, as being the more likely to lead to serious destruction of the coalfield. The numerous outcrops of solid greenstone even in the flat land prove that disturbance from igneous intrusions must be expected. The large area of possible coal-bearing land, however, gives grounds for hoping that there may be patches of undisturbed country worth working; and testing the ground by means of a diamond drill is therefore desirable, though it cannot be said that the prospects of a return for the expenditure are very good. Even supposing that the fears above expressed as to the coal measures being cut away by erosion or destroyed by igneous intrusions should prove to be groundless, there would still be the by no means unlikely chance that workable coal would not be found in them. The enterprise of boring, though highly commendable as proving the value of the district, is therefore not one that should be entered into with sanguine hopes of profit being the result; it should rather be regarded as one of the things that should be done in the public interest to set at rest a question of great importance to the whole community.

As in most of our Tasmanian Coal-fields, the relationship of the igneous greenstone formation to the coal measures with respect to age is a subject of the greatest importance, as on it depends the possibility of coal being found to extend right under the high hills of greenstone which appear to bound the carboniferous sandstones on the westward side. This has always been a matter on which there has been much difference of opinion among Tasmanian geologists. While all are agreed that some of the greenstone is of later age than the coal measures, of which fact there is abundant proof in numerous sections where the plutonic rock is seen to traverse the sandstones, it is a matter of controversy whether all the immense hills and masses of greenstone have been erupted since the coal was laid down, or if these were not two main periods of outflow of molten rock, one antecedent and one subsequent to the formation of the coal measures. Mr. R. M. Johnston, in his *Geology of Tasmania*, comes to the conclusion that the latter theory is the correct one, and speaks of a "newer" and an "older" greenstone. In this he is supported by the high authority of Dr. Selwyn, who, in describing the district in the vicinity of the Douglas River (Report upon some of the Coal Seams of Van Diemen's Land, 1855), says:—"Inland the country rises into massive greenstone ridges, against the steep escarpments and in the hollows of which the carboniferous beds have in all probability been deposited. One is irresistably led to this conclusion from the apparently undisturbed and unaltered condition of the latter even where they are in closest proximity to the igneous mass." While very unwilling to differ from two such high authorities, my own observations in the field, coupled with the results of several borings made lately with diamond drills at Seymour, Spring Bay, Macquarie Plains, and Jerusalem, have led me to an opposite conclusion,—that the greenstone eruptions took place after the coal measures were laid down. It is impossible to prove that none of the greenstone existed before the coal era, but I would contend that if the great masses of it that exist inland from Oyster Bay can be shown to belong to the "Newer" Greenstone there is no reason for not conceding that the exactly similar greenstones of the Great Central Plateau, Mount Wellington, Ben Lomond, and other mountains, which have been assumed to be older than the coal measures, belong to the same period of immense eruptive activity. The fact that alteration of the sedimentary strata in the neighbourhood of the Douglas River was not observed by Dr. Selwyn is not of itself sufficient to prove that the greenstone there was of different age from that at Lisdillon and Mayfield, where extreme metamorphism of shales in its vicinity is very noticeable. The igneous formation is continuous from the Douglas River to Lisdillon, and if the question of an older and newer

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A. Montgomery
Geological Surveyor
1891

greenstone had not arisen no one would ever have thought of disputing the identity of the rock at the two places. The extraordinarily partial action of volcanic intrusions in disturbing and metamorphosing the strata penetrated by them has often been noticed and commented upon, rocks being found at one time penetrated by igneous dykes and yet hardly at all altered even at the contact surface, and at other times changed almost beyond recognition. So, too, the dykes appear in cases to have worked their way through the rock without greatly or even appreciably disturbing the strata, while in other cases great bending and fracturing has been caused. The evidence that has been brought forward in favour of the theory of the existence of a pre-carboniferous greenstone appears to me to be easily explainable by this well-known behaviour of igneous intrusion. Besides the want of alteration and disturbance of strata in contact with the greenstone in certain sections, it has been put forward by Mr. Johnston as proof of there being greenstones of two different ages that he has observed a dyke of greenstone clearly penetrating an older mass of the same rock. This, however, should not be held to prove any considerable difference in the age of the two bodies, as it must frequently happen in the course of eruptions that dykes are thrown up through lava flows and other sheets of igneous matter of very recent formation.

Whether the enormous quantities of greenstone found throughout the whole colony are older or younger than the coal measures, the eruptions must have been of vast extent, and partaking rather of the nature of "fissure eruptions" than of those of the ordinary crater type. If this is allowed, it seems to me that there is no difficulty in believing that the elevation of the central and eastern part of the island was due to the outflow of these great molten masses, and that they forced up with them large portions of the surface strata. It is very possible that much of the rock now exposed on the surface was originally buried, the molten matter having formed intrusive sheets and "laccolites," from which the covering sandstones have been in course of time removed by denudation. This theory of the disruption and elevation of the coal measures by a mesozoic outflow of molten rock appears to me to satisfactorily explain the very broken nature of our coal measures, the great differences in elevation of very similar beds and the constant presence of dykes of greenstone, much better than that which assumes that the coal-bearing beds were originally laid down in an archipelago of greenstone islands, and that the differences of elevation have been caused by numerous faults and the intrusion of a second outflow of igneous material. When it is possible to account for the facts by referring all the greenstone masses throughout the colony to one great period of volcanic activity, it should require very strong evidence indeed to support the belief that there had been a similar period of very much greater age in which greenstone indistinguishable from that of the second period had been poured out.

A certain amount of positive evidence that the coal measures were not laid down in hollows of the pre-existent greenstone rocks is in many places afforded by the mineral constitution of the former. A good example may be seen in the Freestone Creek, which runs into the Wye River about two miles west of the Bellbrook homestead, in the district now under consideration. Here we find a limited patch of the coal measures, consisting of beds of grits, sandstones, and shales. In the Freestone Creek there is a considerable thickness of strata laid open to view. Though surrounded for miles in every direction by massive greenstone hills, the beds in this little hollow show no sign of having been derived from the disintegration of the circumjacent rock. Several of the beds contain coarse boulders and stones, but these are not fragments of greenstone, but of granite and Archæan or Silurian schists, slates, and sandstones. The coarse white grits, too, have all the appearance of being derived from the disintegration of granite. Mica is common throughout the beds. No possible doubt can be entertained after an examination of this section that the strata were derived from granite and Archæan and older Palæozoic rocks, and not from the greenstone now surrounding them. Though the patch is a small one and surrounded by a vast mass of once molten rock, no unusual hardening or change is apparent, and the strata lie inclined at low angles, the "undisturbed and unaltered condition" noted at the Douglas River by Dr. Selewyn obtaining in this locality also. Yet it is inconceivable that the sediments deposited in this small basin should have been derived from far distant granitic and Archæan formations without containing a very much larger proportion of material from the sides of the basin, the coarse pebbles and small boulders found proving that the strata were not laid down in deep water. The effect of the heat of the igneous mass is shown in some places, however, there being a great deal of vertical jointing visible on close inspection.

On the north coast of Maria Island there is a splendid section of the lower beds of the carboniferous system (described in my report of 19th September, 1890, on the Hydraulic Limestones of Maria Island), one end of which abuts against a large mass of greenstone. The lower beds of the limestone pass into coarse conglomerates. Had these, which are plainly a littoral deposit, been laid down at the foot of a pre-existing cliff of greenstone, they would no doubt have been full of fragments of this rock; but though I made special search for such I did not find a single pebble of greenstone. Pebbles and even heavy boulders of quartz, schists, metamorphic slate and sandstone and granite, were common. It is possible, of course, that the greenstone has been brought opposite to the carboniferous beds by a fault, but the latter have certainly not been laid down against a cliff of it, and it is just as likely that the volcanic rock is a later intrusion through them as it is that a fault has taken place.

The Spring Bay coal-field also presents evidence of the intrusive character of the main greenstone masses, and of the fact that the bedding of the strata has not been greatly altered in inclination by their agency. Here the coal measures lie in a deep basin surrounded by greenstone hills, and again we should expect to find debris of the surrounding rock constituting the main portion of the sediments. The sandstones, however, show fragments of felspar and mica, which point rather to their being derived from granite or metamorphic rocks. More direct and conclusive evidence of the greenstone being intrusive is furnished by the bores made in the early part of 1891 with the diamond drill in various parts of this basin. The first bore, after passing through sandstone, struck greenstone at 117 feet. This rock was here fine-grained, but rapidly became harder and coarser in crystallisation as it was penetrated. Three and a half feet of a clayey rock lying on the greenstone appeared to be the product of alteration of its contact with the sandstones. The

appearances to my mind consist much better with the theory of the greenstone being later than the sandstone in age than the contrary supposition. In the second bore the effects of alteration of the sandstones by heat became very marked at about 46 feet, though visible almost from the start, the shales being converted into flinty stone, the sandstone to brittle quartzite, and the felspathic sandstones to a hard greenish rock with vertical joints, not unlike greenstone itself in appearance. The alteration evidently increasing with depth, the bore was not carried down to the underlying greenstone. The third bore, however, bottomed on very dense aphanitic greenstone. In this bore the strata do not appear to have suffered alteration from the contact with the igneous rock. At Ravensdale, near Little Swanport, another bore was put down. This soon struck hard sandstones and flinty shales, and was abandoned in shale which had been altered to hornstone. The main mass of the greenstone was at only a short distance from this bore, and there can be little doubt that the alteration of the sedimentary rocks was due to contact with it. All through the district from Spring Bay to Bicheno dykes penetrating the sandstones are of common occurrence. Taking these in connection with the large mass of greenstone and the alteration of the strata proved by the above bores, it seems to me impossible to come to any other conclusion than that the greenstone is entirely younger than the period of deposition of the coal measures. This theory is to some extent corroborated by a comparison of the mineral composition of the Tertiary sandstones with those of the Mesozoic age. The former are highly ferruginous and clayey, as might be expected from their being mainly derived from the greenstone, while the coal measure sandstones are very free from iron.

I have discussed the relation of the greenstones to the sandstones at some length, as it is necessary to understand this question when considering the likelihood of finding coal. If my belief is correct that the igneous rock is all younger than the sandstones, it will follow that we may expect to find the coal measures varying very much in depth, altered considerably in parts, broken exceedingly, and penetrated in a haphazard way by numerous dykes. At the same time it is quite possible that large areas of coal may be found covered by superficial cappings of greenstone. I do not, however, anticipate that this latter occurrence will be frequent, as it seems probable that long-continued denudation has removed immense quantities of former superficial deposits, leaving us now the roots, as it were, of the great lava flows. It is most likely that where beds of sandstones are seen lying at the foot of greenstone hills they will not pass under the latter, but abut up against them, and be cut off by them.

The various localities on the western side of Oyster Bay where coal measures have been found will now be described in order, going northwards.

Lisdillon and Mayfield.—South of Lisdillon homestead there is found a patch of hard white sandstone, which appears to have been hardened and metamorphosed to some extent by contact with the surrounding greenstones. This sandstone is probably only a thin capping on the igneous rock, and is of no importance as probable coal-bearing ground. Between the Lisdillon and Buxton's Rivulets, and from the latter north nearly to the Old Man's Rivulet, there is a considerable stretch of the coal measures, but these are much broken by dykes of greenstone, and in parts highly metamorphosed. At the White Hill, near Lisdillon, and also on the Mayfield Estate quarries have been opened for the purpose of obtaining flints for metalling the road. These flint-beds are altered shales which have been silicified and hardened so as to become hornstone. The nearly horizontal bedding of the strata is clearly visible in the sections, and in one of the quarries rounded pebbles were visible in the altered strata. Strong vertical jointing and sharp conchoidal fracture characterise the hornstone beds. From their proximity to large greenstone masses the conclusion must be drawn that the latter have been the cause of the alteration. An interesting instance of the greenstone overlapping the sedimentary strata was observed in a small quarry about half a mile S. 27° E. from the road-bridge across Buxton's Rivulet. The lava rock was very much fissured by numerous vertical and inclined joints, which gave it a shingly character, and made quarrying very easy; and in the floor where the upper rock had been removed fossiliferous shales were showing. Similar shingly greenstone is again seen at Barber's Point, and there, too, the shales lie close to the foot of the promontory on the beach, and very likely run partly under it. Throughout the whole area signs of the proximity of the igneous rock are often apparent in the sedimentary beds, but nevertheless there are portions of these which appear not at all affected. Up Buxton's Rivulet above the bridge felspathic sandstones are found in the bed of the stream and in its banks for perhaps half a mile, and it is possible that coal might exist in this locality in some quantity. Another comparatively undisturbed patch of sandstones lies in the paddocks to the north-east from the Mayfield homestead, and can be examined in a small creek which runs out on to the beach opposite Christmas Island. An old shaft which was sunk many years ago in this part of the ground was not successful in finding coal, and has long been filled up. At the Old Man's Rivulet a small patch of sandstone is seen, and in this are some carbonaceous shales and small seams of very impure coal. Taking the Lisdillon and Mayfield district as a whole, the probability of finding payable coal is very small, and I would not recommend boring here unless operations further to the north should reveal valuable seams, when it might be worth while to ascertain if these existed under the little disturbed area of sandstone above mentioned.

Kelvedon.—Round Mr. Edward Cotton's homestead at Kelvedon, an area of some five or six hundred acres of coal measures is found, apparently unaltered by contact with igneous outflows. The sandstone is the soft felspathic sandstone which so generally accompanies our coal seams, and may therefore be regarded as a favourable indication of their probable existence. On the beach at low-water shales are visible, and from time to time blocks of highly carbonaceous shale and fairly good-looking coal have been found cast up on the beach. From an examination of some of these pieces I am of opinion that they are not lumps lost overboard from a passing vessel, and that they are probably torn from a seam cropping out below low-water mark; even without these, however, the undisturbed appearance of the sandstone beds and their considerable extent point this locality out as one very favourable for trial with the diamond drill. A bore on the cleared low spur about due west from Mr. Cotton's house would show very shortly whether there is

any coal in the formation. It might have a very considerable extension seaward; if the drill is taken into the district this portion should not be left untested.

Bellbrook.—Opposite Bellbrook homestead the Wye River has cut through and revealed the typical felspathic sandstones and shales of the coal measures; the former containing in this instance much fossil wood, carbonised and silicified, and the latter numerous prints of grass-like leaves. The strata are dipping to the westward about one foot in ten. A short distance down the valley from the homestead a dyke of greenstone, ten to twelve feet thick, may be seen cutting through the measures and faulting them down on the eastern side, and about a chain lower the massive greenstone cuts the strata off altogether. In a small creek, known as Black Creek, running north-westerly from Bellbrook, sandstone shows for about a mile; the beds dip pretty regularly E.S.E. about one foot in seven, and in ascending the creek the lower beds of the series are exposed; no coal has been found in these. The lower beds are much more quartzose than the upper ones which show nearer the Wye River, and a good deal of silicified shale or hornstone is seen in the gravel of the creek. North and east of the creek hard sandstones are found on the top of a small ridge in close proximity to large masses of greenstone. The whole area occupied by the coal measures here is probably not more than 300 acres, and the greater part of this is not likely to be coal-bearing, as the sandstones seem to belong to the quartzose series generally found below the horizon of the coal beds. The strata are evidently much broken by dykes of greenstone, and even if coal were found, as it might well be, near the homestead, it is not at all probable that it could be worked over any extensive area or with any profit. The place is somewhat difficult of access by tramways, and several miles from the coast; it would be, in my opinion, waste of money to test this spot by means of the diamond drill.

Freestone Creek.—This place has been already referred to as showing that the strata could not have been laid down in hollows of the greenstone. The patch of coal measure rocks here found is of small extent, and so surrounded by high greenstone hills as to be practically inaccessible even if it did contain coal; this, however, I do not regard as at all probable, the strata most likely belonging to a horizon in the carboniferous system far below that of the coal. The beds dip down the creek faster than its grade and the section therefore exposed some thickness of them, but no sign of coal was observed. Coarse quartz grits, shales, and mudstones, containing coarse gravel and boulders of Silurian and Archæan slates, schists, and granites, are the principal rocks seen; strong vertical joints are seen in parts of the formation, probably due to the influence of the underlying igneous rock.

Riversdale to Glen Gala.—Mention has been already made of the extensive alluvial flats lying at the mouth of the Swan River, and of the fact that they are partly occupied by an older Tertiary formation which, with the recent alluvial gravels, renders it impossible to obtain information on the subject as to the nature of the underlying strata, and of the necessity of boring before definite conclusions can be reached as to these. The extent of the possible coal-field renders a trial of the ground by a diamond drill very desirable, although, as already pointed out, the probabilities are against the enterprise resulting in a profit. The best section is seen near Glen Gala, in the Swan River. Here the felspathic sandstone forms the bed of the stream for about a mile above Glen Gala homestead, though not plainly appearing all the way. Highly carbonaceous shale is often found washed up from the bottom of the river, and points to the likelihood of there being coal seams also. The malign influence of the greenstone dykes is well seen in the side of the river about half a mile above Glen Gala, the lower coarse quartzose sandstones being exposed dipping from 45° to 60° to the south, in close proximity to one of them, evidently having been forced up to surface by it. Both above and below this spot the felspathic sandstones in the river are lying nearly level or with only slight angles of dip, showing that the inclination of the strata alongside the dyke is abnormal. The sandstone formation extends westward from the river for nearly two miles, rising into a range of low hills. The most westerly beds are mudstones and sandstones highly charged with the characteristic carboniferous marine fossils, such as *Fenestella*, *Aviculopeecten*, *Spirifera*, and *Productus*. The dip of the beds was nowhere obtainable, but from their succession it is probably easterly, these marine mudstones being much lower in the coal measures than the felspathic sandstones found further to the east. Any coal that may exist in this part of the district would be almost certainly confined to the flat land immediately west of the outcrops of sandstone in the River Swan. The best site for a bore-hole would be near the river. Between the flats just mentioned and those lower down the river there is a large dyke of greenstone which crosses the Swan at the bridge on the road to Bicheno, and connects the main greenstone masses to the westward with the large spur of the same rock which separates the valley of the Swan from the Moulting Lagoon. Down the river below this dyke the alluvial covering is so deep that the sandstone, if existing there, is not visible. Being found at Glen Gala and near the junction of the roads from Swansea to Campbell Town and Bicheno, it is most probable that it does exist. One or two bore-holes in these flats would be required to settle the question.

Comb End, Apsley Meadows.—For about four miles from Glen Gala the road to Bicheno passes over nothing but greenstone; but very soon after passing the summit of the range which is here crossed, coal measures make their appearance, and continue down the valley through which the road passes nearly to Apslawn. In the cuttings on the side of the road leading down from the summit to Comb End occasional carbonaceous seams are noticed, and prospecting would have a very good chance of discovering coal in this neighbourhood. Round Apslawn the greenstone has again come in, but the coal measures seem to be pretty continuous from Comb End to Apsley Meadows. Towards the north-east of the Township of Llandaff they are again crossed by the road. The strata showing at this point are the quartzose sandstones, which lie as a rule below the coal horizon. North of Llandaff the sandstones extend for perhaps two miles, rising into hills which are crowned with solid greenstone. A heavy talus of loose greenstone blocks has fallen away from the tops of the hills and completely conceals the junction of the two formations. The sandstones here rise to a considerable height, and in them several seams of coal have been discovered. A section is afforded by a small stream known as Barber's Creek, which lies to the north and north-west of Mr. T. Board's farm. This creek has eroded a rather deep valley, in which are exposed the sandstones

lying under the talus of loose greenstone blocks. A little work had been done on some of the beds of coal exposed in this section, though not yet enough to prospect them at all satisfactorily. The principal working was on almost the highest part of the section exposed, at a level some 550 feet above the sea. Above this point, though a few stones of sandstone in the creek indicate that the coal measures extend still higher, the loose greenstone becomes so heavy that nothing can be seen of the rock underlying it. About 10 chains above the workings the greenstone appears to be in solid masses, and from this westward the hills are entirely composed of this rock. It is possible that the coal measures extend under, or partly under, these hills, but I am more inclined to believe that they will be cut off abruptly by the greenstone. The question could be tested by a bore some 200 feet deep from the flat at the head of the creek, or by driving into the hills in the coal seams themselves. The hardness of the greenstone would render boring an expensive matter, and there would be considerable difficulty also in getting a diamond drill up on to the flat.

The section exposed by the workings in the creek (an open cutting and two or three small pits) is as follows, taking the beds in descending order:—

		ft.	in.
Felspathic sandstone.....		40	0
Thin bands of shale and carbonaceous shale.....		12	0
		ft.	in.
A. <i>Coal Seam</i> .—Shaly coal.....		0	2
Dark stony coal.....		1	0
Hard black flinty band.....		0	6
Bright coal.....		1	0
Sandstone.....		0	1
Shaly coal.....		0	8
Hard silicious band.....		0	2
Bright coal.....		1	1
			4 8
Shale.....		0	11
Bright coal.....		0	2
Grey hard fireclay.....		2	9
B. <i>Bright Coal</i>		1	5
Dark shale bottom.....		10	and more.

Samples taken from the coal seams A. and B. from top to bottom of the beds, such bands as could be picked out in working on a large scale being omitted, were analysed by Mr. W. F. Ward, Government Analyst, with the following results:—

	A.	B.
Fixed carbon.....	44·4	49·8
Volatile at red heat.....	18·8	20·2
Mineral matter (ash).....	33·4	27·0
Moisture.....	3·4	3·0
	<u>100·0</u>	<u>100·0</u>

The proportion of ash in these coals is too great to allow of their use under present market conditions. It is possible that by using a coal-washing machine a good deal of the stony matter might be taken out, but this is out of the question so long as there is a plentiful supply of good coal in the market.

The seams strike north and south, and have a dip to the west of 7 degrees. Below the above seams the bed of the creek is obscured for some three or four chains by fallen rock, and then another outcrop of coal is met with; this is an impure coal with a few bright seams through it, and appears to be about three feet thick, but has not been cut through so as to reveal it properly; the floor is a shale or dark fireclay, strike N. and S., dip to W. $5\frac{1}{2}^{\circ}$. No assay was made of the coal from this outcrop, as it was much weathered and required to be cut into. Below this seam a thick bed of felspathic sandstone is seen in the creek bed for about four chains, when a small seam of coal 12 inches thick comes in under it; this is of poor quality. The bed of the creek below this is obscured by fallen greenstone for some distance, and at one part seems to lie in solid greenstone; but some 10 chains lower down yet another seam of coal crops out, this time about two feet in thickness, dipping slightly to the west, but not so much as the higher seams. Some of this is nice bright-looking coal, but the outcrop should be cut into before the exact thickness and quality of the seam can be determined. This seam is about 130 feet below the top workings. There are probably other seams in the measures still lower down, but owing to the creek now having a flatter grade and being much filled with debris no more are seen for a considerable distance. About 200 feet above sea level, however, yet another is exposed. On the top of this is about a foot of bad soft coal and shale, then there is 2 feet 1 inch of fair bright coal with a sandstone band half an inch thick in the middle, strike E. and W., dip to South 10° ; this dip may be only local, the outcrop being probably a little disturbed. Two chains lower down the creek the strata, soft shale and felspathic sandstone, are lying as nearly as possible horizontally, from which we may infer that the coal seam would also be horizontal. An assay sample taken from this bed yielded to Mr. Ward's analysis:—

Fixed carbon.....	43·6
Volatile at red heat.....	23·4
Mineral matter.....	26·6
Moisture.....	6·4
	<u>100·0</u>

In some of the other small creeks near Barber's Creek traces of the above coal seams, or possibly of other ones, have been noticed. The measures here evidently contain a great many beds of coal, and it is not at all likely that those exposed are the only ones. It is very probable that if the creek bed were cleared down to the bed-rock in places where it is now choked with detritus other seams would be revealed, and borings might find others again below the lowest outcrop. There is a sufficient area of coal-bearing ground in this neighbourhood to make it worth while to make preliminary borings to ascertain if payable seams exist. As it would be rather difficult and expensive to take a diamond drill up to the highest workings in Barber's Creek, I would recommend that in the upper part of this gully, where the ground is steep and the bed-rock could be easily exposed by cleaning the loose stuff out of the creek, this should be done by open trenches. A small expense would prove about 200 feet in vertical depth of strata in this way. Having done this the lower strata should then be tested with a diamond drill. The prospects of finding payable coal here seem to me quite bright enough to warrant the expense of boring. Should a good seam be discovered a tramway about seven miles in length could easily be constructed to Bicheno, where I understand there is a fairly good shipping-place.

If any boring is done near Apsley Meadows it would be well to test the strata above Comb End at the same time, as the same seams are likely to be found at both places.

Neck of Freycinet Peninsula.—In company with Messrs. James and Frederick Lyne I made a very cursory visit to the country lying to the north east of the Moulting Lagoon, which was found to present several features of interest. Granite and greenstone, Tertiary, Carboniferous and Silurian strata are all found here, and indications of mineral veins are not infrequent. A belt of white quartz gravel of considerable depth extends from the head of the Lagoon northwards for some miles, and probably indicates the position of an older channel of the Apsley River. As there is much granite in the vicinity of this it is rather probable that gutters containing tin might be found below the surface gravel.

Tin has been found on the Freycinet Peninsula, but much to the south of this portion. The Silurian system is represented by a patch of slates and sandstones, forming a high ridge just at the neck of the Peninsula. Some quartz reefs have been noticed here, and one which I saw had a not "unkindly" appearance, but so far as I could learn no gold has been yet found in any of these. The formation being favourable for gold, however, it is quite likely that careful prospecting would discover its existence. Some small ironstone veins were noticed, and samples from two of these were assayed by Mr. Ward, but without finding any metal of value: their being found at all is an argument for further search for more payable ones. The granite formation which is largely developed from Bicheno down to the south of Half Moon Bay is seen again inland from Isaac's Point and in a small patch S.S.W. from Mount Peter, but does not occur plentifully in this part of the Peninsula, though largely found to the south of it. The Carboniferous system is represented by sandstones and fossiliferous mudstones and limestones of the Lower Marine Series. Near Isaac's Point a patch of coarse grits and conglomerates is found resting on granite, which is probably part of the base of the Carboniferous system. The pebbles in this conglomerate are of Silurian and Archæan and Granitic origin. Greenstone occurs at Mount Peter and again on the point opposite King Bay, at the mouth of the Moulting Lagoon.

From information gained in the district as to the lower part of the Freycinet Peninsula, I am inclined to believe that it deserves more attention from prospectors than it has hitherto had. A considerable quantity of tin has been obtained from time to time, and probably more would be found if search were made for it.

Shipping facilities.—Should payable seams of coal be found in the Oyster Bay district, the want of a good port of shipment would be very much felt. Not having made any examination of the possible shipping-places I can only speak of them from hearsay, but I understand that Bicheno is a fairly good port for steamers, and would be capable of improvement so as to be able to deal with the produce of the Seymour, Douglas River, and Apsley Meadows fields. Any coal found in the field at the mouth of the Wye River might be shipped at Swansea so long as the output was small, but if it should become important a railway would have to be built to Cole's Bay on the east side of Oyster Bay, which is said to be a really first-rate harbour. Coal at Kelvedon, Mayfield, or Lisdillon would, I fear, have to be shipped from the beach in favourable weather, or else taken to Spring Bay.

In concluding this Report I feel bound to say that great kindness and courtesy was shown towards me by the Warden of the Municipality and by numerous other residents of the district.

I have, &c.

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

The Secretary of Mines, Hobart.

REPORT ON THE COUNTRY TRAVERSED BY THE ROUTE OF THE PROPOSED WARATAH-TO-ZEEHAN RAILWAY.

Geological Surveyor's Office, Launceston, 4th February, 1892.

SIR,

I HAVE the honor to report that, in pursuance of your instructions, I have visited the country traversed by the route of the proposed Waratah-to-Zeehan Railway, with the object of finding if it is likely to be mineral-bearing. In making this inspection, I have been very greatly assisted by the Great Northern Railway of Tasmania Company, who gave instructions to their survey parties to help me in every possible way, and provided horses and men when necessary. To Mr. John Provis, who accompanied me from Waratah to the Success Mine at North Dundas, and to Messrs. Anketell, Clarke, and Mitchell, of the Company's engineering staff, my best thanks are due for much assistance and very great courtesy. Without their help and guidance it would have been impossible for me to have seen more than a small part of the ground.

Two routes have been proposed for this railway, and partly surveyed. The first was that of the Government Survey of 1891, branching from the Emu Bay to Mount Bischoff Railway, about a mile from Waratah, and running across the Knole Plain and down the valley of the Coldstream and Huskisson Rivers, crossing the Pieman River just above its junction with the Huskisson, and then running southward through the Dundas and Zeehan Silver-Lead Fields to join the Zeehan-to-Strahan Railway. On this route very rugged country is traversed in portions of the Huskisson Valley, numerous deep gullies and high ridges having to be crossed. To find easier country a second route is now being surveyed. This leaves the Emu Bay and Mount Bischoff Railway about eight miles from Waratah near the crossing over the Hellyer River, and runs almost due south over open flat country for some 12 to 14 miles. Keeping on the watershed between the Huskisson and the Mackintosh Rivers, comparatively easy country for making a railway can be got down to the Pieman River, where this route joins the first one. The engineers have not yet, however, decided on the exact route to be followed along the watershed, surveys being now in progress to determine the best line. Having myself had some experience in railway surveying and construction, I may venture to express my opinion that a practicable route may be obtained without much difficulty. The dense bush which covers the ground is the great obstacle to the laying out of the line, entailing on the survey parties an immense amount of labour more than is required in open country.

On the present occasion, the time for my examination of the country being very limited, I devoted my attention to the portion lying between Waratah and the Pieman River, and did not visit the Dundas Silver-field further south than the Success and Owen Meredith Mines. On my former visit to this field, however, in October, 1890, enough of the country lying between the Pieman River and Mount Zeehan was seen to be sure that the whole zone traversed by this portion of the proposed railway is highly mineral-bearing. The development of the Dundas Field since then has been very great, and as far as the part of line from Zeehan to the Pieman River is concerned, there can be no doubt now as to the necessity for and success of a railway. The country north of the Pieman, on the other hand, has been as yet but very little prospected, and there is not the same assured support for a line. Until opened by the pack-track down the Huskisson Valley, and by Meredith's Cattle-track (now being marked through), it was almost inaccessible, and since the completion of these works a cessation of prospecting, owing to prevailing financial depression, has taken place, so that even at the present time very few prospectors have been at work. A fair amount of success has, however, been even now attained, several groups of sections having been taken up in the vicinity of discoveries of argentiferous galena and gossan, and it may fairly be expected that many more discoveries will yet be made.

The country traversed by both the trial railway lines for the first 14 miles from the Waratah Railway is of basaltic formation, forming a large plateau, to parts of which the names of Knole Plain, Netherby Plain, Racecourse Plain, and Hatfield Plain have been given. This basalt belongs to the series of Tertiary outflows which cover so much land in the northern districts of the Colony. It does not appear to be, as a general rule, a thick deposit, for wherever it is cut through by deep river gorges the older Palæozoic rocks are found beneath it. It is only in these gorges that any useful minerals may be expected to be discovered at first, though as time goes on it is quite probable that lines of lode, and possibly "deep leads," will be traced under the basalt. But as soon as the basaltic plateau is left the country passed over by both routes is of a highly promising nature, and will doubtless prove to be rich in minerals. From the southern side of the Netherby Plain to the Pieman River the Huskisson Valley Route passes over rocks so similar to those of the Zeehan and Dundas Silver-fields, and of the Whyte River and Heazlewood Districts, that there can be no doubt as to their all belonging to one formation. Very few fossils were noticed in the sandstones, but such as were obtained were all identical with forms common in the "fossil-cutting" on the Silver King Company's property at Mount Zeehan. The rocks observed were conglomerates, sandstones, slates, and limestones, together with serpentine rocks of intrusive character, quite indistinguishable from those met with on the now well-known silver fields of the Heazlewood and Zeehan. Sections of the strata are as yet unattainable, and the exact relationship of the different beds cannot be seen; but it is very noticeable that in going eastward from the Huskisson River over the watershed to the valley of the Mackintosh a similar succession of rocks to that met with in going eastward over the Dundas Range is encountered, crystalline schists, quartzites, and highly indurated coarse quartzite conglomerates being found in both cases as we go further inland. It may be years before the structure of the country is satisfactorily worked out, and any opinion now formed of it is necessarily of a tentative character; but I am inclined to believe that an axis of Archæan schists and quartzites runs northward from Mount Dundas in the direction of Mount Pearse, and that the Upper Silurian sandstones and slates of the silver-fields lie on the flanks of this. As to the position

of the coarse conglomerates (composed of well rounded pebbles of variously coloured quartzites), which form the top of Mount Owen, Mount Zeehan, parts of the ridge between the Huskisson and the Mackintosh, and Mount Pearce, I am in great doubt, but am disposed to believe that they are resting unconformably upon the Archæan and Silurian formations.

In the Heazlewood, Zeehan, and Dundas silver-fields large masses of serpentine rock of igneous origin have been found, which have very probably exercised a great influence on the formation of lodes in these districts. These are intrusive plutonic dykes and bosses, and vary a good deal in lithological character, from a serpentinous greenstone to pure serpentine and schiller-spar rock. In the Whyte River field and in the road-cuttings on the Magnet Range their intrusive character is plainly shown by the marked alteration of the slates in their vicinity, which are often baked and bricklike or converted into hornstone. Many of the soft clayey rocks at the Whyte River which have been taken to be decomposed diorite now appear to me to be nothing else than weathered masses of this same greenstone. Some of the richest ore in the district has been found in these. The fact that the serpentine rock occurs also at intervals throughout the Huskisson Valley increases the amount of similarity between this and the proved fields. It occurs near the head of the Que River, on the ridge between the Huskisson and the Mackintosh, about nine miles north of the crossing over the Pieman River, and again about three-quarters of a mile north of this crossing. Loose stones of it picked up in the Coldstream River show that it exists also up this stream. South-east from the Parson's Hood, on the Wilson River, another occurrence has been recorded.

We have therefore in the country lying between the basaltic plateau near Waratah and the Pieman River all the most likely conditions for the occurrence of minerals; namely—very ancient sedimentary rocks, much folded and contorted, broken through by plutonic intrusions, and exposed to view by the erosion of very numerous deep valleys. Further, these rocks, both sedimentary and plutonic, are identical with those in fields lying both to the north and to the south of them, which have proved highly fertile in minerals. As already remarked, but little prospecting has been done in this area, yet several discoveries have been made, which are an earnest of many more to come when the country is better opened up. A description of some of these finds will serve to show that the prospects of future mining here are very good.

Just-in-time Claim.—On the eastern side of the Huskisson, and close to the river, a discovery of galena has been made which goes by this name. It is about a mile south of the crossing of the Que River by the pack-track from Waratah to the Pieman River. Several sections have been taken up in this vicinity. The discovery is quite undeveloped at present, the lode not even having been cut through. The outcrop shows a mixture of quartz, baryte, galena, and a little calcite, and the lode is evidently a strong one, over two feet wide at the least, and probably quite five or six feet wide. Its course is not altogether clear, but appears to be nearly north and south. No first-class ore is yet exposed, though a good deal of the stuff would probably be worth concentrating. The country rock is limestone and sandstone. Working facilities are good, as it will be easy to drive on the course of the lode right into a considerable hill. This is a discovery of some importance, and is well worth following up to see if richer ore may be obtained.

Lynch's Silver Falls.—Another discovery of galena has been made some two or three miles from the last named, in a small tributary of the Huskisson, known as Ross Creek. A waterfall 110 feet in height occurs in this stream, and on breaking into the face of the rock it was found to be a lode. The face of the fall is, in fact, the exposed "hanging wall" of the lode. The country rock is a somewhat angular quartz conglomerate or grit. The lode is a wide one, not less than 30 feet through, and strikes, as far as at present ascertainable, N. 10° E., dipping to the westward. It is largely composed of quartz, and a good deal of altered country-rock, and contains much greenish serpentinous matter and some baryte and calcite. Towards the hanging wall there appears to be a good deal of lode-slate and some limestone. There appear to be a good many slickensides in the lode-stuff, and from these and its often brecciated appearance it is probable that a good deal of motion of the country has taken place while the lode was being formed. Galena is scattered through the mass of the lode everywhere, but not to my mind in payable proportion so far as yet exposed. No work of any consequence has yet been done to open up the discovery, however, and it is quite likely that mining operations will reveal good shoots of ore. It would be advisable to cross-cut the lode from the foot of the falls, and then drive along its course, making frequent cuts into it as work progresses. This mine is admirably situated for cheap working, being easily opened by adits into the hills on each side of the creek, and having excellent water-power. It certainly deserves to be tested further.

Carroll's Reward Application.—About nine miles north of the Pieman River, on the track to Waratah, application has been made for a reward claim on a soft lode in serpentine country. A small hole has been sunk about seven feet, showing a wall of clayey decomposed serpentine, and about six to eight feet in width of lode-stuff composed of clay, oxide of iron, oxide of manganese, and quartz. The lode has not been cut through. It seems to run a little to the west of north, and a quantity of loose gossan in the vicinity probably belongs to it. I did not ascertain if any silver had been found in the lode-stuff, but from its close resemblance to the clayey and ferruginous outcrops of some of the Dundas lodes in similar serpentine I should judge it worth while to sink a little further on the lode to ascertain its value.

Sale's Application.—A section has been applied for on an outcrop of gossan in serpentine country about two miles north of the Pieman crossing. No work whatever has been done on this, and as it lies in a wet shallowish depression in the ground it is quite possible that it may prove to be nothing but a deposit of bog iron ore; still it is rather more probable that there is a lode in this vicinity, as the ironstone is found over a considerable distance.

Several sections have also been taken up on outcrops of gossan between the Huskisson and the Wilson Rivers, but I could not find time to visit these.

Farrell's Discovery.—An important discovery of galena is reported from the junction of the Fury and Brougham Rivers, which unfortunately I could not on this occasion spare time to visit, as it would have taken two more days. The specimens shown to me by the prospector were very pure galena. Mr. Farrell describes the country as limestone, and reports the existence of some large caves in it. This find is of consequence as showing that the silver-lead bearing country exists to the east of the railway route as well as westward from it.

Silver Cliffs Mine, Waratah.—This mine is also an evidence of the northerly extension of the argentiferous area. It is situated within two miles of the Town of Waratah, in one of the deep gullies lying north of Mount Bischoff. The country rocks are metamorphic sandstone or quartzite, sandstone, and slate. Two lodes have been discovered, and are being worked. The main one, from which the mine derives its name, was found cropping out in a high cliff, the face of which was covered with galena. Subsequent work has shown that the lode is a fault fissure traversing the strata obliquely, and that the hard quartzite which forms the cliff has resisted denudation, while the softer slates on the hanging-wall side of the lode have been removed. The face of the quartzite is very distinctly marked with strong horizontal striations, a very unusual feature, which shows that the displacement of the country along the fault fissure took place almost horizontally, instead of in a more or less vertical direction as is usual. The lode-stuff on the outcrop consists of quartz with galena, blende, and some pyrites, and is from two to four feet in thickness: slickensides are found through parts of it. Two adits have been driven to cut this lode, the lower one of which has not yet reached it. The upper one was continued some little distance through the lode without meeting with any further lode-stuff, and then a drive was put in from it along the course of the lode. This has so far proved very poor, but little galena being found. In the end of the drive at the time of my visit, however, a little more ore was coming in, and it is possible that the patch of ore met with on surface is just ahead. In this drive the footwall of the lode preserves the same hard, polished, and horizontally striated appearance which is seen in the wall laid bare on surface. Several small veins of galena have been found in another part of the face of the cliff, which seem to be running towards the lode, and are probably "feeders" to it. The results obtained so far underground have been very disappointing after the high expectations raised by the really good prospects on the surface, but it seems to me that there is no reason to despair yet of the future of the mine, and very probably as work proceeds further ore-bodies will be met with. There can be no doubt as to the permanence both in strike and dip of so well-marked a fissure. The second lode on this property runs almost at right angles to the strata and should cross the first-named—or more probably be faulted by it—on the hill behind the mining manager's house. A shaft had been sunk fifty feet on this, showing a lode up to two feet wide of galena, antimonial galena, Jamesonite (feather-ore), carbonate of iron, blende, and quartz. Some of the ore was very regularly banded. The lode has been traced some chains on surface, and appears to be a good and permanent one. Much of the ore from the shaft is of very good quality, and fit to be sent directly to the furnaces.

Mount Bischoff Silver-Lead Mines.—The existence of argentiferous lead ores in the vicinity of Mount Bischoff has long been known, and a company was long ago formed to work one of the veins containing them, but without success. These earlier workings, however, taken in connection with the Silver Cliffs mine, show that such ores may be looked for in this formation.

Timber.—Both railway routes, after leaving the plateau, pass through forest country. Much of the timber is of small value, but there is also a fair proportion of "stringy-bark" and "celery-top pine" trees that would afford valuable timber for mining and building purposes, while the smaller trees, such as the "leather-wood," "tea-tree," sassafras, and "horizontal scrub" are good fuel either for engines or for household use.

Transport from Mines to Railway.—An important question for consideration in fixing the route of this railway is that of the possibility of bringing in feeders to it in the shape of tram-lines, roads, and aerial tramways. It is clear that the business done by the railway must depend greatly on the possibility of gaining access to it. Between the Pieman River and Zeehan I do not think that there is much to be feared on this score, the route following low-lying ground and being easily reached from most of the mines which lie near to it. In the choice of a route between the Pieman and Waratah it seems to me, however, that careful consideration of this question will be necessary, for parts of the country are so rough that it might often be necessary to make a very long detour in order to reach the railway. It has been pointed out that the Archæan schists and quartzites seem to lie in a line between Mount Dundas and Mount Pearse, and that the country most similar to that of the proved silver-fields lies to the westward of this line—that is, up the basin of the Huskisson. While it is extremely likely that the old schists will be fertile in minerals, gold being perhaps the most likely one to be found, yet the fact remains that such discoveries as have been made are in the Silurian formation and on the Huskisson basin. Farrell's discovery at the Fury and Brougham junction probably indicates, however, that the silver-bearing formation recurs on the eastern side of the axis of older rocks. The line of railway, if run from the Pieman Crossing up the valley of the Mackintosh and thence round the head waters of the Que River, would keep along the ridge of schists and quartzites; and should these unfortunately prove to be barren in minerals, this part of the line would have to be fed by tramways running over the ridge into the Huskisson valley or across the valley of the Mackintosh. Ore would then have uphill haulage to the railway in nearly every instance. If, therefore, a practicable line can be got down the Huskisson valley, it seems to me that it would be better policy to make it there than to sacrifice all considerations of feeding it to a perhaps lower prime cost of construction. Owing to the rugged nature of much of the ground there will necessarily be a good deal of difficulty in getting branch lines to mines at any distance whichever route is selected. As the country is explored, however, it is likely that many as yet unsuspected routes for tramways will be found, and it is quite possible that much of the anticipated difficulty will disappear. The luxuriant growth of tangled scrub and forest which now covers everything prevents good views of the country being obtained, and makes it perhaps seem more difficult to traverse than it really is.

Older Discoveries of Minerals.—In estimating the mineral-producing capabilities of this District it must not be forgotten that from time to time in years past the exploring parties who have penetrated it have reported the discovery of other minerals besides lead and silver. Gold has been found on the Wilson River, near the eastern base of the Parson's Hood; a very highly spoken-of discovery of bismuth has been long known to exist at Mount Ramsay; and tin ore has also been obtained. The last-named mineral has now been found in almost every place where granite occurs in the Colony, and as the country from Mount Livingstone to the Magnet Range is nearly all granite it is nearly certain that tin-fields will be opened up there. Particular attention should be given by prospectors to discovering further occurrences of the erinite and topaz-porphry dykes which have undoubtedly caused the immense deposits of tin ore at Mount Bischoff, as it is very probable that this was not the only outbreak of the sort.

Prospects of the Railway.—In conclusion, I have to say that in my opinion the prospects of success of this railway are very good. It passes through a very large portion of the Zeehan and Dundas Silver-field in close proximity to a number of mines which now are putting out ore of excellent quality, and to a great many promising prospects not yet developed; it taps the north-western slopes of Mount Read and Mount Murchison, which have lately been proved to be promising gold-fields; north of the Pieman it goes through a district as yet practically unproved, but still an evident extension of the Dundas Silver-field, and already affording undoubted evidences of carrying minerals; and at Waratah it connects with the road to the Whyte River and Heazlewood fields—a very important feeder. There can be little doubt that the whole of the country between Waratah and Zeehan is destined before long to carry a large population, whose requirements will ensure good business to this line.

I have, &c.

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

The Secretary of Mines, Hobart.

REPORT ON THE BEN LOMOND DISTRICT.

Geological Surveyor's Office, Launceston, 5th May, 1892.

SIR,

I HAVE the honor to report having visited the Ben Lomond District, and made a general examination of the mineral areas taken up there for tin and silver mining purposes. My first visit to the district was from the 8th to the 15th of December, 1891; but as the Great Republic mine, the principal one in the place, was at that time full of water, due to repairs to the winding machinery being in progress, I again went to it on the 8th, 9th, and 10th of March, 1892. While sufficient time was taken to get a good general idea of the geology of the district and to fairly well examine the principal mineral-bearing ground, no attempt was made to lay down with accuracy the boundaries of the formations met with or to make any survey of the various lodes. A detailed examination such as would be required to do these things would consume a great deal of time, and does not seem to me to be at all necessary as yet, the amount of development done up to the present being very small. The general map forwarded with this report is therefore only a sketch one, to indicate broadly the general position of the various formations.

The mines are all at the north end of Ben Lomond, lying on the slope extending from below the towering cliffs known as "The Butts," which form the highest point of the mountain, to the South Esk River at Avoca. From the valley of the Esk the ground rises rapidly to about 2200 feet above the sea level, at which height we come on a very noticeable terrace (*see* section herewith) of fairly flat ground of very considerable extent, reaching from the head waters of Gipps' Creek on the west to Story's Creek on the east, and averaging probably two miles in width. From the north side of this terrace the ground rapidly rises, getting steeper as we ascend, till on the talus of broken rock lying immediately at the foot of "The Butts" it is inclined at the angle of 30° to the horizontal. Finally, vertical cliffs up to 250 feet in height are met with, forming the northern edge of the table-land which lies on the top of the mountain at a height of slightly over 5000 feet above sea level.

A fairly good cart road has been made from Avoca to the Great Republic mine, and access from it to the other mining properties is pretty easy. It goes up the valley of the Castle Carey Rivulet, coming up on the terrace above mentioned on section 3520-87M. Here it crosses an old unformed road leading from the Rix Hill mines to those of Story's Creek. This old road connects near the Rix Hill mine with another track leaving the main road about four miles from Avoca and leading to the Ben Lomond, Great Republic, and Gipps' Creek mines, and to the Town Reserve lying at the foot of "The Butts." Between Avoca and the junction of the main road with this old track the ground is pretty flat, the valley of the Castle Carey Creek widening out and running flatter as it comes out on the flat valley of the South Esk.

The township of Avoca is situated on a patch of basalt of probably Tertiary age and of limited extent. It is similar to the other Tertiary basalts found in this Colony and in Victoria. For about a mile along the Ben Lomond Road after crossing the Esk we pass over clayey and sandy beds, which I have not examined closely, but which are probably part of the Tertiary deposits which extend up the valley of the South Esk for a long distance. Next diabase greenstone is met with. This is portion of a very extensive mass which bounds the mineral-bearing area on its western side, and connects with the great cap or boss of the same rock which forms the table-land on the top of the mountain. The old road to Ben Lomond above spoken of runs along the contact of this greenstone with the granite and carboniferous formations next to be mentioned. About a mile and a half from Avoca sandstones belonging to the lower beds of the coal

Topography.

Access.

Geological Formations.
Basalt.

Tertiary.
Greenstone.

Carboniferous.

Granite.

Carbon-
iferous, &c.

measures (permo-carboniferous) are come upon, and the road passes over these up to its junction with the old track, where granite comes in. This is a porphyritic granite composed of felspar, quartz, and mica, all well developed, but with the felspar (orthoclase) in much larger crystals than the other constituents. It, however, varies a good deal in different places both in composition and texture. In some parts of the district, as near the Great Republic mine, and again on the main road near where it crosses the Buffalo Creek, masses of quartz porphyry are seen in which the felspar is not in recognizable crystals, but forms the groundmass in which the crystals of quartz are studded. Mica in these rocks is in small quantity, absent, or micro-crystalline. In the Great Republic mine the granite country, which as a rule is coarse-grained and of the usual ternary type, is in parts hard, dark-coloured, and fine-grained, with occasional very large crystals of orthoclase up to two inches in diameter. The colour of the ordinary country granite of the district varies from grey to reddish-grey, and in general it is very similar to the granites of Mount Cameron, Mount Stronach, the Blue Tier, and the Freycinet Peninsula, with which it is probably contemporaneous. It forms the main mass of the country rock between Gipps' Creek and Story's Creek, and goes northwards close to the greenstone capping of the mountain, and probably extends underneath it. It is overlaid in parts by strata belonging to the coal measure formation, slightly inclined shales, mudstones, sandstones, and conglomerates, often highly charged with typical fossils of the permo-carboniferous system. These are met with in various parts of the district: on the main road from Avoca at about 1400 feet above sea-level, and thence to the top of the terrace at 2200 feet, in patches over various parts of the terrace, and at intervals along the course of Gipps' Creek. At the foot of the greenstone talus below "The Butts," sandstones and conglomerates of this system are found pretty regularly, and for some 300 or 400 feet up on the talus, occasional, though rather rare, blocks of sandstone are met with, showing that there is probably a considerable thickness of these beds lying up against or running under the greenstone of Ben Lomond. In this instance it seems highly probable that the greenstone had overflowed the sandstone beds to some extent rather than cut them abruptly off, for the curious step-like terrace seen in the section was certainly till quite a recent period covered by permo-carboniferous strata, and the high greenstone escarpment of "The Butts" is most likely due to the rapid erosion of these soft beds from beneath an overlying sheet of greenstone.

From a scientific point of view the coal measure strata of this district are worth a much more detailed examination than I have yet been able to make of them, as it is probable that they afford a very complete section from the marine beds of the permo-carboniferous formation to the mesozoic plant beds of the upper coal measures of this Colony. Highly fossiliferous limestones are found in Gipps' Creek; the mudstones of the head of the Castle Carey Creek are also rich in fossils (marine); in the sandstones just north of Section 703-91m fragments of vegetable remains, too broken for recognition, were observed; in the mudstone conglomerate near the Story's Creek Company's small dam coaly fragments of plant stems were pretty plentiful, and higher up Story's Creek inflammable shale has been obtained; and, finally, at a height of about 4000 feet some seams of coal, with the characteristic mesozoic fern fossils accompanying them, have been discovered. Mr. R. M. Johnston also informs me that shales containing the characteristic glossopteris and gangamopteris of the lower coal measures have been collected near the head of Gipps' Creek. It would seem, therefore, that the section here revealed ought to give a fairly complete sequence of the beds from the base of the lower coal measures to at least the coal horizon of the upper coal measures. The interesting problem of the age of the Ben Lomond greenstone would probably be solved by a detailed examination of these occurrences. While there is a certain amount of evidence that the greenstone is younger than the permo-carboniferous formation, it is not so certain that it is also younger than the mesozoic or upper coal measures; and, as has been frequently pointed out, the relations of the diabase greenstones to the coal measures of this Colony have a most important practical bearing on the extent and value of our coal deposits.

The greatest thickness of carboniferous strata in this district is exposed in the patch at the head of the valley of the Castle Carey Creek. Here there are probably not less than 600 feet of them in vertical thickness. On the terrace, however, they appear to form only a very thin coating, through which the underlying granite has been exposed in many places. In the vicinity of the old Tasmania mine, for example, nothing but granite is seen, the coating of sedimentary strata having been entirely removed by denudation. Traces of the former presence of these beds at no distant time are, nevertheless, to be seen in many parts of the flat ground, even where no part of them is seen *in situ*, the surface being strewn with waterworn rounded pebbles of metamorphic slate, quartzite, schist, quartz, and granite, which at first sight lead one to suspect that deposits of alluvial drift exist. They are, however, in reality derived from beds of soft mudstone conglomerate, small patches of which may be seen still undisturbed in various places on a ridge to the west of the old "Clunes" mine, near the Eastern Marsh, on the flat between Nesbitt's and Story's Creeks, and elsewhere. A very good specimen of them is to be seen in a shallow shaft sunk not far from the Story's Creek Company's small dam, just at the foot of the greenstone talus. Here the conglomerate appears as a hardly at all indurated mudstone, full of thoroughly waterworn pebbles of quartz, metamorphic sandstone, and granite, exactly similar to the rounded stones found scattered over other parts of the terrace. It may be here remarked that, though immediately under the talus of greenstone from the high cliffs of the top of the mountain, I could find no pebbles of greenstone in the conglomerate, which goes far to prove that the greenstone is of later age. In none of the other places where conglomerate was found could I find any pebbles of greenstone in it either, though, in most instances, close to existing large masses of that rock.

The elevation of the sedimentary beds to such heights as where we now find them has probably been performed by means of a series of faults. The sandstones found at the foot of the mountain are probably of the same horizon as those at the foot of the talus of greenstone below "The Butts," some 1700 to 1800 feet higher. Whether this dislocation was produced by one or by more than one fault no evidence has yet been collected to show, but, most probably, more than one would be required. A small fault is visible in an

angle of the road leading up the valley of the Castle Carey Creek, near the bottom of the large patch of coal measures beds there existing: the sedimentary beds are seen to be cut short off by a nearly vertical granite wall. It is possible that the faults may have some connection with the mineral-bearing lodes of the district, and, even if not, they deserve study from a mining point of view, as being likely to cut off any lodes they may encounter in their course.

Another formation has yet to be mentioned before passing on to a consideration of the mineral deposits, namely, ancient metamorphic sandstones and slates, highly inclined as to bedding, and much seamed with quartz veins, found in the vicinity of the upper part of Story's Creek. No fossils were observed in these, but it is most probable that they belong to the same series as those further eastward at Mangana and Mathinna, and are of Silurian age. Silurian slates are also said to occur near the head of 'Gipps' Creek, a locality which I did not visit. Fragments of this formation are very abundant in the permo-carboniferous conglomerates above mentioned. Silurian.

SILVER MINING AREAS.

A large number of mineral sections have been taken up for silver mining purposes between the head waters of the Castle Carey and Buffalo Creeks and near Rix's Hill. They fall naturally into two groups, those in granite and those in the permo-carboniferous sandstones. The latter are nearly all together in a group, at the head of the Castle Carey Creek, and are shown in the smaller plan accompanying this report, which is taken from one kindly furnished to me by Mr. Frank Reed from his own surveys. As shown thereon, several lines of lode run through the sections, and all are very similar in character. They are well defined, and readily traceable on surface for long distances, the outcrops frequently forming distinct outstanding lines of rock. By describing them in some detail their characteristics and probable value may be explained.

Section 3520-87M.—This and the adjacent Section 3521-87M are held by the Avoca Silver Proprietary Syndicate, of Melbourne. Two lines of lode seem to unite in the former section, and near their junction a shaft has been sunk to a depth of 88 feet in hardish mudstones and sandstones full of the characteristic fossils of the marine beds of the carboniferous system (*Fenestella*, *Protoretzpora*, *Spirifera*, *Stenopora*, &c.). At the bottom of the shaft a drive was put in to the south-east a distance of some 16 feet, cutting the lode about 8 feet from the shaft. It consists mostly of rather spongy silicious oxide of iron (brown hematite) with a good deal of fragmentary country rock enclosed in it. A sample taken by picking a large number of small pieces of the lode-stuff from the heap on surface, was sent for assay to Mr. W. F. Ward, Government Analyst, in Hobart, but did not contain any metal of value. On surface the main lode is easily followed along the line laid down on the plan: it generally is very full of fragments of country rock, but in places is fairly free from these, and consists then almost entirely of siliceous brown oxide of iron. The outcrop varies in width up to 10 or 12 feet, and the lode, if opened, would probably be found to average 6 or 8 feet in width, or perhaps more. The trend of the lode is on the whole about N.N.W., and its underlay is only slight, and towards the N.E.

Sections 695-91M and 694-91M.—A little to the east of the shaft the second lode, shown on the plan as joining the first near it, crops out very plainly and may be traced E.S.E. through Section 695-91M into 694-91M. It consists of a breccia of fragments of the country fossiliferous mudstones cemented together by brown oxide of iron and some quartz, and often contains small crystals of quartz.

Sections 886-91M and 885-91M.—In these a change of country is met with, granite coming in. The junction of this with the fossiliferous mudstones is rather obscured by surface detritus through which the lodes are not clearly traceable; still two lodes which are well seen in the granite appear to be identical with ferruginous outcrops in the mudstone country in Section 887-91M, from which it would appear that they penetrate both sorts of rock, a fact which may prove to have an important bearing on the prospects of these lodes. Two small prospecting holes have been sunk in Section 886-91M, one about six chains south of the centre of the section, and the other near the south boundary about three chains from the S.W. corner. The former is said to be about 30 feet deep, but was full of water when I saw it. A lode about 14 inches wide, striking N. 55° W., underlying a little to N.E., consisting of a mixture of brown oxide of iron, quartz fragments, and siliceous cementing material, is seen here, and may be traced to the south-east to the top of the ridge on which the section is situated, and even further.

Tin is reported to have been found in this lode where picked up again farther to the south-east, but this I cannot vouch for. Samples for assay taken by me from the stuff at the shaft yielded no metal of value when tried by Mr. Ward. The second prospecting hole on this section is only a few feet deep; it reveals a large lode of quartz over six feet in width and of banded character, consisting of two bands of solid quartz one foot and two feet in thickness, with one foot of rubbly quartz between, and rubbly quartz again on the hanging wall. Dip S.W. about 76°. The quartz did not appear "kindly," and as far as I could learn neither gold, silver, nor tin has yet been found in it. About 20 feet south of this quartz there is a large strong outcrop of siliceous oxide of iron carrying some spots of white quartz. Loose stones from this and the quartz reef strew the slope down to the creek. Probably both belong to one large lode. Being in granite country the lodes in this section are to my mind better worth testing than those in the sedimentary strata. As the ground rises rapidly on the east side of the Castle Carey Creek, it would be easy to prove both of them by driving on their course from the creek level.

Section 887-91M.—It is possible that the lode being sunk on (February, 1892,) by the Castle Carey Company on this section, is connected with the last-mentioned lode. A shaft has been sunk on it to a depth of about 40 feet in vein-stuff, consisting of fragmentary country rock, brown oxide of iron, and quartz. Water coming in too strongly when the level of the adjacent creek was reached, the work had to be abandoned.

The outcrop is very well defined, and strikes N. 25° W. In the shaft the underlay was found to be 1 in 15 to the north-east, and the width of the lode over four feet. The veinstuff was all oxidised right down to the bottom of the shaft. This lode being strong and well defined would be a good one to trace into the granite, which is not far distant from it, in order to see if it would be richer in metal in the more favourable country. In the shaft it has been worthless.

Sections 694-91M and 934-91M.—The two lodes shown on the plan passing through the S.W. corner of Section 694-91M are traceable as lines of loose stones of ferruginous brecciated material. The more northerly one is seen crossing the road as a line of ferruginous fractured country rock rather than distinct lode stuff, about one to two feet wide. Both seem rather small, and require to be trenced upon so as to be cut in solid country, and then prospected by sinking on them or driving in from the creek.

Section 699-91M.—Following the lode in 3520-87M northwards along its course, it is found crossing the road to the Great Republic mine as a band of ferruginous stained country rock, and is there traceable by loose surface stones into Section 699-91M, as shown on the plan. In going over this line I found it rather difficult to follow the outcrops, and it seemed probable that there was more than one line of lode, perhaps two or three close to one another and nearly parallel. The line on the plan indicates the general position of the outcrops.

Section 703-91M.—On the north boundary of Section 703-92M a very distinct outcrop of ferruginous lode-matter of similar character to those before described is met with, very probably belonging to the same line of lode or fracture as the foregoing, corresponding fairly well both in position and direction. The outcrop is traceable northwards for about 20 chains, and stands out boldly in several places. As a rule it is more ferruginous and contains less country rock than those hitherto spoken of. A large number of fragments from different outcrops were sent to Mr. Ward for assay, but did not contain any metal of value. The lode has not been worked upon at all, but appears to be from three to eight feet wide. The country is mostly hard mudstone and sandstone, with some conglomerate containing rounded pebbles of quartz and Silurian slates. A few indistinct impressions of plant stems were observed in the mudstones. I do not think that the permo-carboniferous strata are here more than 100 feet thick at the very most, as the granite appears quite close by. Here, too, it is most likely that the only hope of finding payable ore in the lodes is to follow it down into the granite country.

Section 705-91M.—On Section 699-91M a north-westerly lode has been discovered, and traced as on plan, into 705-91M. A tongue of granite here shows through the sedimentary strata, and a small shaft has been sunk almost at the junction of the two formations. The outcrops show the lode to be from 1 to 4 feet in thickness, but it may, of course, prove much larger when properly laid bare. The shaft was full of water, preventing examination. The lodestuff thrown out was mostly siliceous brown oxide of iron, containing no metal of value according to Mr. Ward's assay of the samples taken by me.

As will be seen from the above description, there is a great similarity in all these lodes traversing the permo-carboniferous mudstones and sandstones. They consist mainly of angular fragments of the country rock, cemented together by brown oxide of iron, clayey matter, and silica. The lodestuff is usually loose and spongy, and gives one the impression of having been formed at a comparatively recent date. There is no doubt that the lodes represent definite lines of fracture in the country rocks, and very probably, if opened up, it would be found that there is a certain amount of displacement in the beds traversed, those on one side being faulted down a greater or less distance. The lines of fracture having been loosely filled with broken country rock have been channels through which water carrying iron and silica in solution has percolated, depositing the present cementing material. Possibly, in the first instance, the iron was deposited as pyrites. Near the Great Republic mine, close to the track to Gipps' Creek, and on the Ben Lomond Company's property, pyrites and quartz lodes are found traversing granite, and these in their oxidised outcrops rather closely resemble the foregoing lodes.

In the prospectus of the Avoca Silver Mining Company, five assays of gossan from the lodes on the Company's properties are quoted, two of which gave good returns, 48 oz. 3 dwt. 16 grs. and 64 oz. 10 dwts. 8 grs. of silver respectively. The first was described as "quartz and iron gossan, with a little carbonate of lead," the second as "iron ore." During all my examination of these lodes I did not see one particle of carbonate of lead, nor did any of the assays of samples taken by myself, and analysed by the Government Analyst in Hobart, yield either lead or silver.

In the present unopened condition of the lodes it is hazardous to offer an opinion as to whether any metal of value will ever be found in them or not. The country rock in which they lie has not yet been proved to carry payable lodes anywhere in this Colony. Silver-lead lodes have been found in various parts of the world in strata much younger than our permo-carboniferous system, and there is no reason for anyone to say that it is impossible for these also to contain ore; still all the silver-lead lodes of this Colony have hitherto been found in the Silurian and Plutonic rocks, and very strong indications of the existence of the metals would have to be present before we should expect them in so much younger a formation. The most favourable feature, to my mind, in these lodes, is the almost certainty that they pass downwards into the granite. This has been proved to carry silver, lead, and tin in this same district, and it is quite possible, and not unlikely, that in it the lodes will carry these metals. The fact that the lodes above described also are on the whole parallel to the known metalliferous veins of the district leads us to have a certain amount of hope for their future, though it must be remembered against this that there is yet no evidence, except the similarity of strike of the sets of veins being contemporaneous.

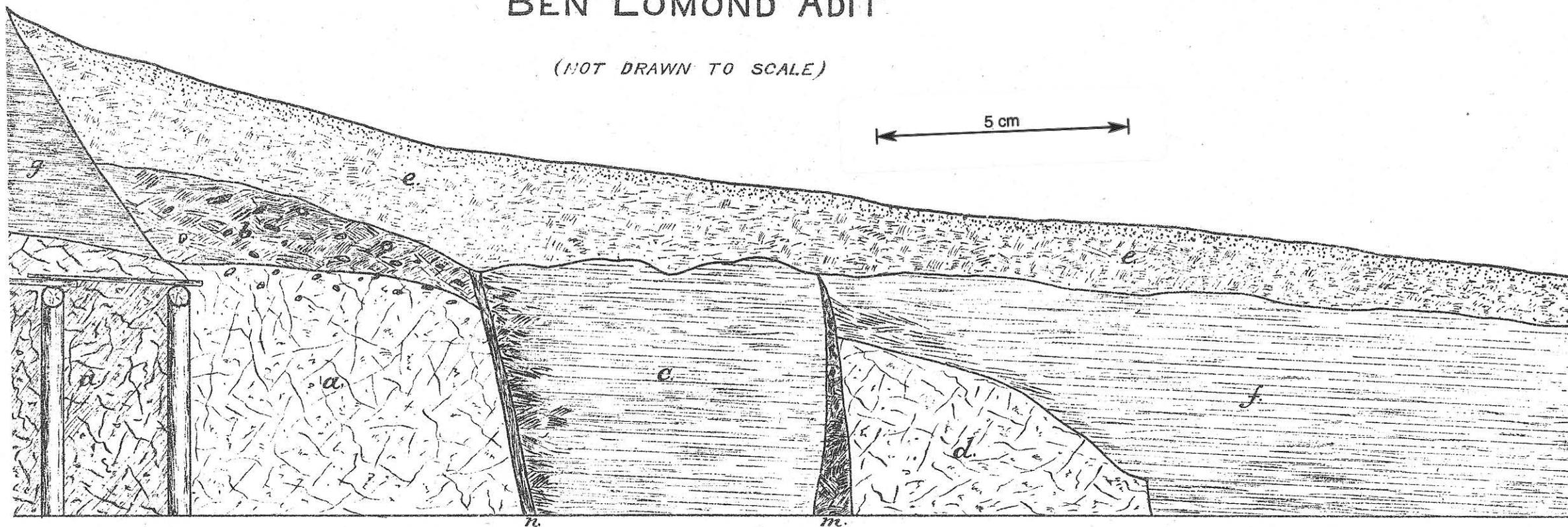
Efforts have been made to form large companies in Melbourne to work these lodes, and a ridiculously high value has been placed upon them. If the money already spent in trying to float these companies and

SECTION

SEEN IN SOUTH SIDE OF APPROACH TO THE

BEN LOMOND ADIT

(NOT DRAWN TO SCALE)

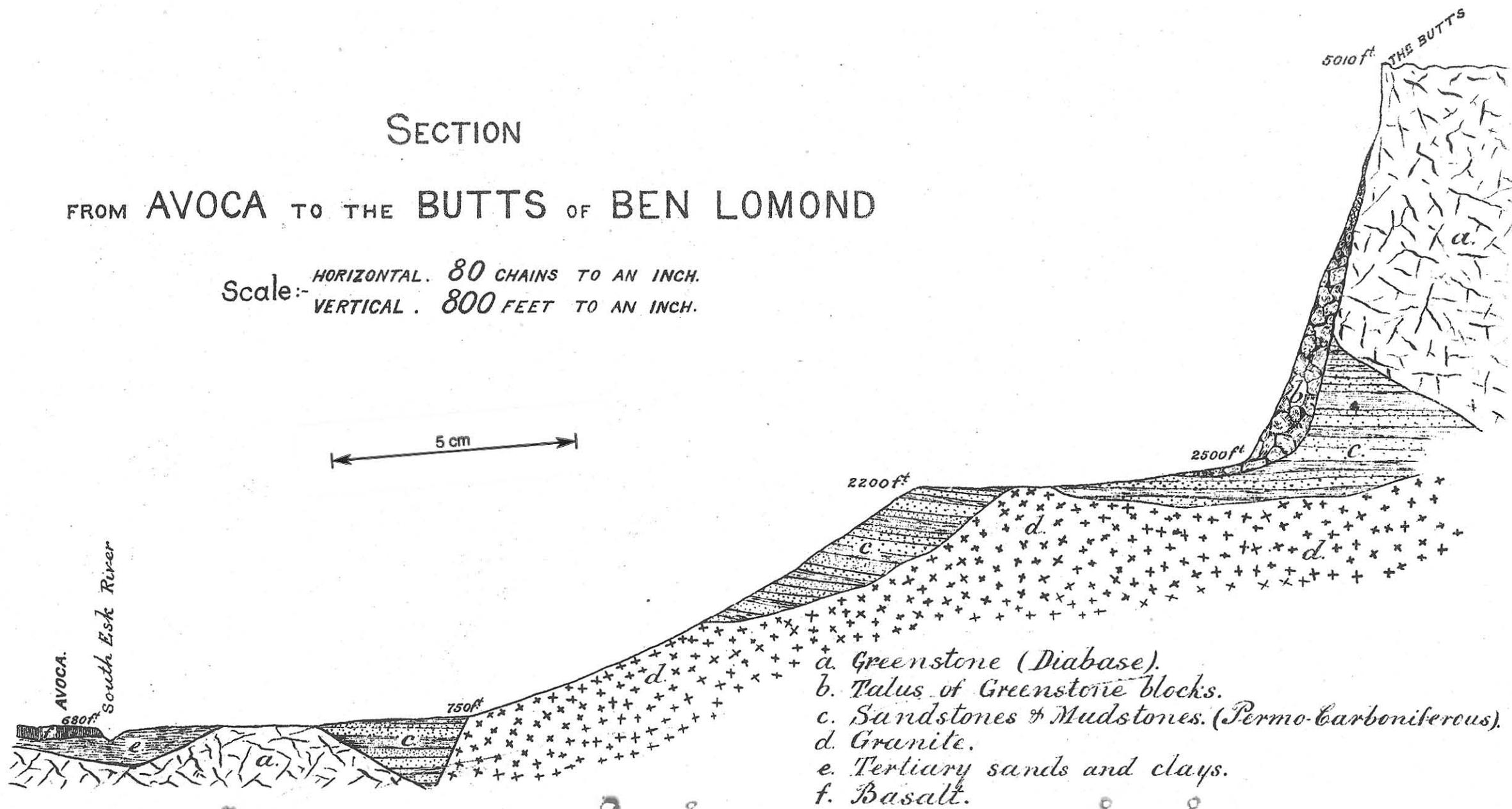


- a. Granite, containing rounded pebbles of quartz and quartzite near contact with b, also broken shale.
b. Broken Shale, with rounded pebbles.
c. Shale, broken near contact with n.
d. Granite.
e. Surface soil, clay and gravel.
f. Shale, a little broken near contact with d.
g. Shale, seen over top of tunnel, same as c. and f.
m. Clayey contact mass, fragments of shale and blue clay.
n. Clayey vein at contact of a and c.

SECTION

FROM AVOCA TO THE BUTTS OF BEN LOMOND

Scale:- HORIZONTAL. 80 CHAINS TO AN INCH.
VERTICAL. 800 FEET TO AN INCH.



printing glowing prospectuses had been put into work on the ground instead, it would long ago have been proved if there was anything to mine for, a question at present extremely doubtful. I might sum up the prospects thus:—There are lodes, of fair width, definite and persistent over very considerable distances; it is very doubtful if any silver or lead has yet been found in them; they are in country rock which has hitherto never been found to contain silver ores in this Colony; they almost certainly go down into granite country, which has been proved to contain lead, silver, and tin in this very district; there is a certain amount of probability that in the granite they will contain these metals; they require to be prospected to find them; and the possibilities of finding ore seem to me sufficient to warrant a small expense in so prospecting.

Coming now to the ground taken up for silver-mining purposes in granite country, we find that the prospects are much more hopeful. Several of the sections once taken up have, however, been forfeited, and are not now held by anyone. Sections 935-91M and 695-91M comprise part of an old section 1637-87M, which has been given up. At the time of my visit a notice of application to lease 40 acres, due east and adjoining Sections 935-91M and 695-91M, was posted near an old working on this forfeited section. This hole was partly full of water and could not be entered, and the direction of the lode laid bare in it could not be ascertained with any approach to certainty. It is a large one, consisting of quartz impregnated with galena, blende, copper pyrites, talc, and fluorspar. The vein stuff is very hard, and, though some of it contains a good deal of galena, is, as far as seen, too poor to work. It much resembles some of the hard stuff in the Rix Hill lode. Though poor where it has been struck, it seems to me that this lode is well worth tracing and proving by trenches along its line of strike. It is highly probable that in places it will be found to contain more metal, and particularly tin ore. From the size of the lode as exposed in the cutting, it is probably not less than eight feet thick. A strong lode formation of this size may well be expected to prove permanent and, in parts at least, payable.

Abandoned Sections, 1971-87M, 1972-87M, 2062-87M.—On one or more of these forfeited sections a very interesting occurrence of galena is to be noted, namely, as an impregnation through granite. The rock is here almost altogether composed of felspar, quartz and mica being hardly at all distinguishable. The felspar is of whitish, pink, and greenish colour, with large porphyritic whitish crystals standing out from the mass, and the weathered portions are much blackened by dioxide of manganese. A hole about 20 feet deep has been sunk in the rock, proving it to be very hard, and likely to be expensive both to mine and to crush. Impregnated through the stuff is a good deal of galena with generally a large admixture of blende. This occurrence is of interest as showing the existence of lead in the country rock, though I do not think that any of the stuff so far exposed is nearly rich enough to pay for treatment. I could not detect that there was any dyke or intrusive mass of this very felspathic rock penetrating the ordinary granite of the district; it rather appeared to become more quartzose and gradually merge into the regular type. A little to the east of the shaft some softer rock has been cut in a shallow trench, and it might be possible to sink here more easily; but I am rather inclined to believe that the softness is only due to superficial and atmospheric influences, and will not extend to more than a few feet in depth.

Scott's Find.—Some 14 or 15 chains N. 15° W. from these workings the same galena-bearing felspar porphyry is seen again, though ordinary granite intervenes between the two places. Here, too, the rock seemed rather a felspathic segregation than an intrusive mass. A trench about five feet deep has been sunk on a soft portion of this by Mr. Scott, prospector, of Ben Lomond. The soft material excavated contains much talc or chlorite, partly decomposed felspar, oxide of iron, kaolin, and some quartz, and may perhaps prove to be part of a lode traversing the porphyry. On the joints crystals of cerussite (carbonate of lead) are pretty plentiful, and a good deal of galena is seen on breaking the more solid lumps. The appearance of the stuff is, however, deceptive, as it yields on concentration a much smaller percentage of galena than would be expected from looking at it. Some of the best-looking pieces collected by me were sent to Mr. Ward, Government Analyst, in Hobart, with a request that he would determine what percentage of concentrates could be obtained by washing, and their value. He reports:—"Sample B, after concentration by washing, yields galena and blende, &c., equal to 2.1 per cent., containing 23.8 per cent. of metallic lead, and silver at the rate of 11 oz. 8 dwt. 16 gr. per ton of concentrates. No gold is present in this sample." From this it appears that not only is the percentage of galena in the stuff small, but it is also poor in silver when obtained. The amount both of lead and silver is nevertheless very noteworthy for a country rock, and gives good hope of finding rich deposits in any lodes that may in time be found to traverse it. The attention of prospectors should be directed towards tracing any veins that may appear in the country round about into this proved metalliferous rock, which would be very likely indeed to enrich them greatly. It is also worth while finding out if the felspathic mass is or is not an intrusive dyke. Should it prove to be one, there would be considerable probability of finding contact lodes along its edges.

Rix's Hill Mine.—The most important discovery of silver ore yet made in the Ben Lomond District is on Section 1191-87M. Here blocks of galena weighing several hundredweights and of high assay value have been obtained. There has been much controversy as to the prospects of this mine and the direction in which the lode is running, and there is here a problem which requires well directed work for its satisfactory solution. A shaft and irregular open working have been made two chains south-east from the centre of the section, the open working forming an irregularly circular hole 8 or 9 feet deep and about 15 feet in diameter, at one side of which the shaft has been sunk to a depth of 33 feet from surface. From the bottom of the shaft some 15 feet altogether of driving had been done in different directions. The open working used to be drained by a deep trench, but this is filled up with rubbish and could not be examined, which is unfortunate, as it was likely to have thrown light on the course of the lode. The rock showing on all sides of the open working is lodestuff consisting of rather hard quartzose granular veinstone impregnated with talc or a hydromica, and some kaolin. Much cassiterite (tin ore) occurs through the stuff, and in the stone thrown out of the excavation I very soon picked out a large number of pieces that would be highly

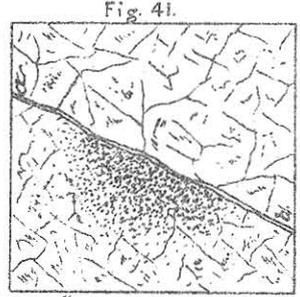
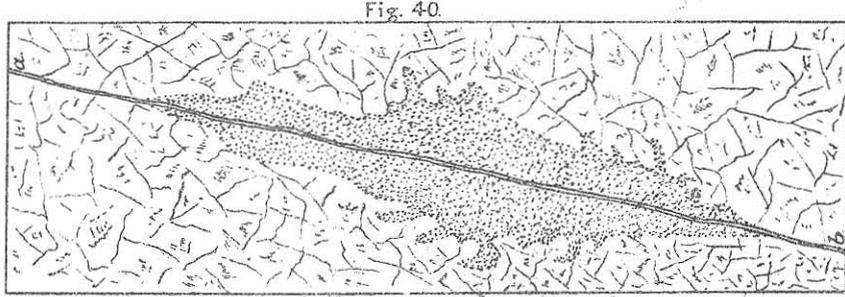
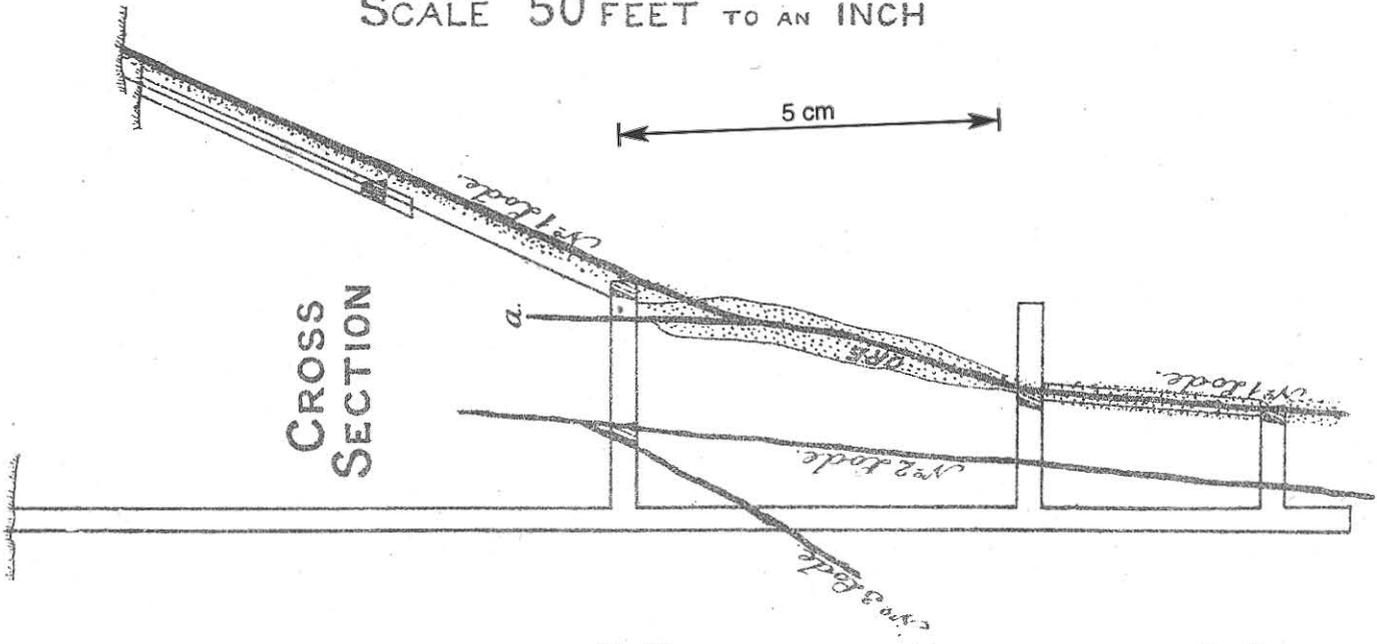
payable if obtainable in quantity. The tin ore is in fine grains, and generally appears to be richest where there is much green talc in the stone, specimens of which may be said to consist almost wholly of these two minerals. A little galena, blende, and copper-pyrites are occasionally visible in the vein-stuff, but not enough to be of themselves worth more than passing notice. Running through this lode-matter, however, in flattish irregular masses are numerous strings and veins of hard glassy-looking quartz, often in very large crystals, and in this quartz, and more especially immediately round it, galena, copper pyrites, and black blende (marmatite) occur freely, and several tons of highly payable ore are reported to have been won from the workings, small as they are. Much of the copper pyrites is altered to and coated with indigo copper. A careful examination of the workings, and conversation with Mr. Briggs, who was at the taking out of the ore, led me to the conclusion that the veins of quartz and associated sulphides had no regular course, but lay in irregular patches of very variable thickness and extent through the rest of the lode-stuff. They are evidently of later formation than the bulk of the lode, bunches of talcose tin ore being often seen to be clearly cut through by the veins of glassy quartz. It seems evident that after the filling of the lode with quartz-carrying talc and tinstone it has been shattered and fissured, and the crevices have been filled with clear quartz and sulphides of lead, zinc, copper, and iron. The evidence of this later origin of the quartz and sulphide bunches seemed to me very conclusive. In the small drive eastward from the bottom of the shaft the country granite is struck, forming a well-defined almost vertical wall, separated from the lode-stuff by a clay selvage or flucan. The wall has a very slight underlay to the eastward, and strikes north and south, but has only been laid bare for about 4 feet in length. It is so well defined, however, that I have no doubt as to its being a true lode wall.

In order to cut the lode at a lower level, an adit has been driven 180 feet N. 21° E. through granite country to a point almost immediately under the shaft. The Mining Manager, Mr. Savage, told me that the adit was 65 feet below the top of the shaft, but according to my aneroid the difference is only 50 feet. The last 25½ feet of the drive are through lode-stuff similar to that seen in the open working. The western wall of the lode is struck at an acute angle, and, as the drive has been continued straight on, it passes diagonally across the lode, and not at right angles through it. The western wall is not quite so well defined as the eastern one seen in the shaft, the selvage not being so distinct. By observing the marked difference between the lode-stuff (which has, however, a somewhat granitic appearance) and the country granite the division is easily found. It strikes N. 10° W., and has a very slight underlay to the westward. The mean strike of the eastern and western walls as observable in the workings is, therefore, N. 5° W., and the lode can have little, if any, underlay. In this connection it is important to notice that lode-stuff of very similar character has been got in a trench seven chains north from the shaft, the line connecting it with the latter bearing N. 5° W. The surface of the ground being much covered with superficial granite debris, it is impossible to actually trace the lode from the shaft to the trench, but the bearing of the connecting line agreeing with the mean bearing of the walls of the lode, it is most probable that the latter continues right along it. The idea has been generally held that the course of the lode is about W.N.W. and E.S.E., but from the facts stated it appears certain that its course is only a few degrees to the west of north. The lode stuff on the western wall consists of granular quartz with talc and kaolin, carrying a little disseminated galena, marmatite, and pyrites, and very little tin ore. On getting further into the lode, however, much better tin ore was obtained, and the last 10 feet of the drive passed through some very rich stuff. Three or four tons of good ore were won here in making the drive. In the face, which has not gone far enough to cut the eastern wall of the lode, more marmatite and copper pyrites were showing at the time of my visit than had been met with previously, and it seems likely that on the eastern wall, which would be reached in a few feet further driving, more sulphide ore would be obtained. The owners, however, for some reason or other ceased working without penetrating to the eastern side of the lode. Measured at right angles to its course this must be some 16 or 17 feet wide. It is a very great pity that work was stopped without going a little farther. The quantity of tin ore in the stone is quite sufficient to justify going on with the driving; in fact, if the stone continued of the same richness it seemed to me, from such judgment as could be formed by the eye alone, without actually crushing and washing off large quantities of the stuff, that it was highly payable. With a wide lode like this, in solid country, working should be cheap; and though the adit commands only some 50 feet of "backs" at the shaft, going northward on the course of the lode the ground rises, and at the crown of the ridge—say six chains north of the shaft—there would be between 110 and 120 feet of "backs," and going over the ridge a deeper adit could be driven along the lode from the deep valley in Warner's section, 3365-87M. The stone in the trench before mentioned, seven chains north of the shaft, appears to be worthless; but the lode has not been cut through, and it may be as in the adit poor on one wall and good on the other. The quantity of tin ore seen in the adit and the open working makes me have no hesitation in saying that this lode well deserves a thorough trial, there being every reason to hope for a payable mine being the result. This, too, is having regard only for the tin, quite outside of any argentiferous lead ore that might be obtained as well.

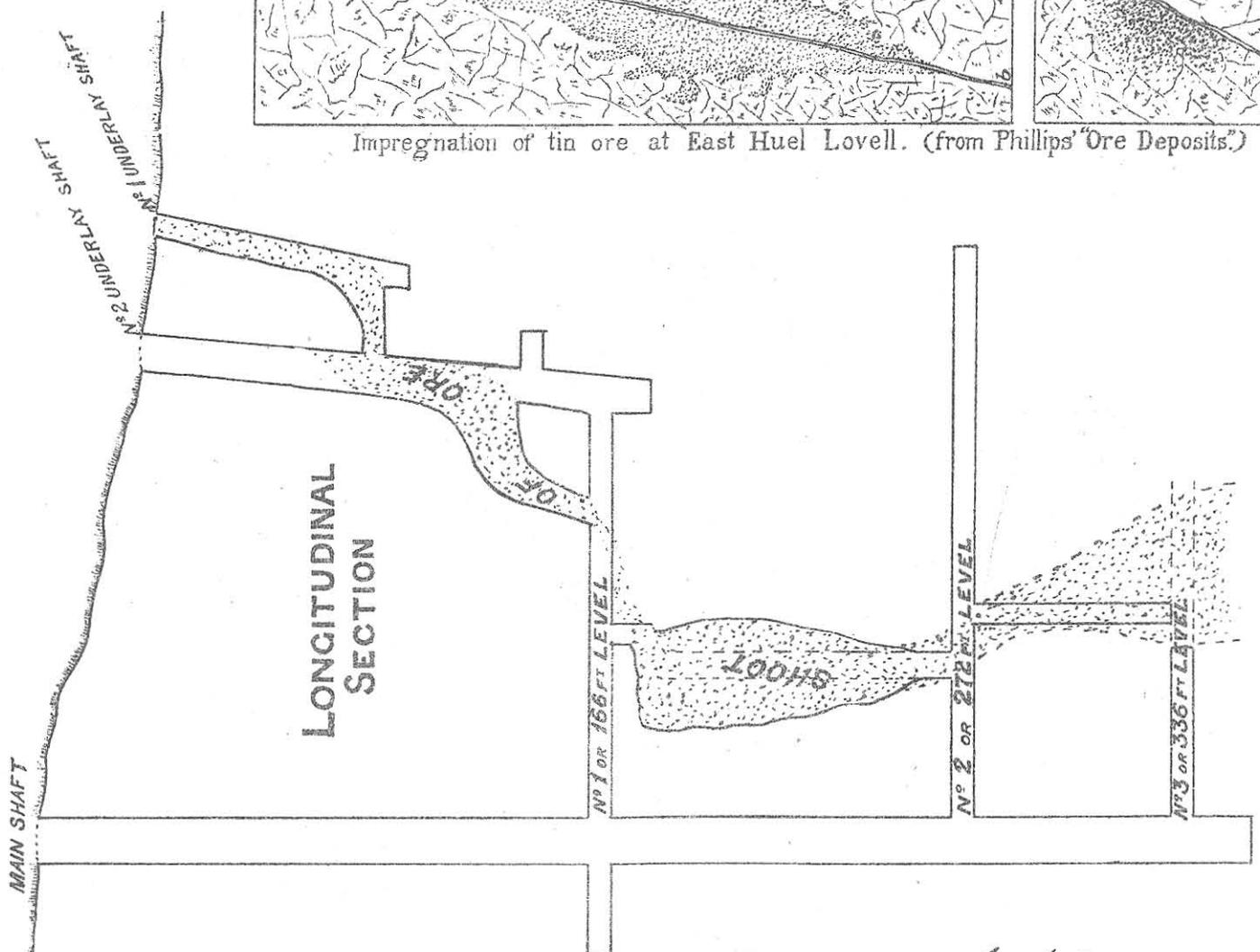
About 50 feet N. 75° W. from the shaft another lode has been struck in a trench, a fact which has had much to do with the belief that the main lode ran W.N.W. and E.S.E. The strike of this is, as well as I could ascertain it from the short and rather poor wall exposed, N. 75° W., and it must, therefore, run against or pass through the main lode almost at the shaft. It appears to dip about 65° to the S.W., and consists of quartz and talc—very like the vein-stuff of the main lode—containing impregnated specks of galena and copper pyrites, but no tin ore as far as I could see or learn. The hanging wall is not seen, and the thickness of the lode is not, therefore, ascertainable, but it cannot be less than three feet nor probably more than eight feet. This lode may have some connection with another one found in section 1520-87M, towards the south-east corner of which some very good specimens of tin ore, composed of small crystals of cassiterite, studded through somewhat cellular and granular talcose quartz, have been picked up along a line running N. 65° W. The vein-stone is very similar to that in the workings of the shaft and adit, but is more weathered. Most of the stones, though often very large, appear to be loose, and the lode, of which they are fragments, has not yet been cut in the solid ground; but there can be no doubt as to its existence in the near neighbourhood of the line of loose blocks. Hardly any work has been done in the way of trenching for

GREAT REPUBLIC MINE

SCALE 50 FEET TO AN INCH



Impregnation of tin ore at East Huel Lovell. (from Phillips' "Ore Deposits")



A. Montgomery
 Geological Surveyor

GREAT REPUBLIC MINE

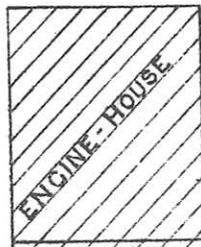
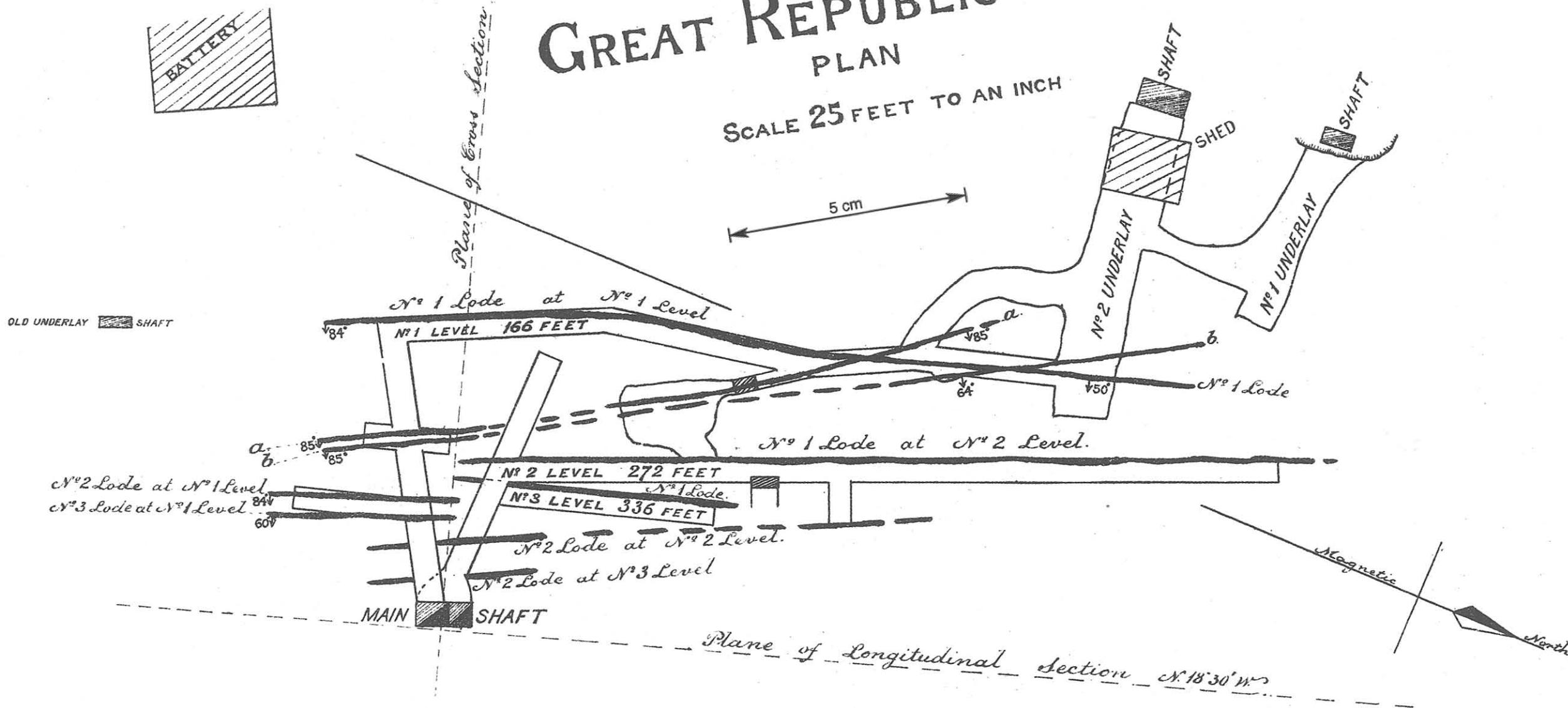
PLAN

SCALE 25 FEET TO AN INCH

5 cm



OLD UNDERLAY SHAFT



A. Montgomery
 Topical Surveyor

this lode, which is surprising, as many of the specimens are rich enough to make it well worth searching for. The position of this lode is considerably to the south of where it should be expected, if it were the same as the foregoing cross-lode at the shaft; but there is, nevertheless, a good deal of likelihood of their being identical. If not, they must be approximately parallel.

A good deal more work will yet require to be done before it is clear to which of the lodes that run into one another at the shaft the silver-lead ores and other sulphides belong. As above remarked, the quartz veins carrying these sulphides in them and on their margins are very flat-lying, irregular, and variable. They seem to me, however, rather to run across the main lode than with it, and they may be connected with the cross-lode described, or it is even possible that there may be a third lode crossing and shattering both this and the main one. Efforts should be made to ascertain the relation; and with the mine in its present state, with the dead-work of driving an adit through the hard granite country all over, the action of the owners in abandoning work without seeing what was in the lode they had struck with so much pains can only be described as pusillanimous. Very little work is now required to definitely settle the question of the course of the lodes and the mode of occurrence of the silver-bearing sulphides. It would be advisable to continue the adit to strike the eastern wall of the main lode and then drive along it for some distance. A cross-cut should be put in to where the cross-lode strikes the main one, so as to ascertain if the two form a junction, or if one cuts through or is faulted by the other. Two or three months' work ought to be quite sufficient now to show if the mine is worth going on with, as there is every reason to believe it is.

C. R. Foster's Section, 3505-87m.—A lode of considerable interest is seen in this section, a few chains west of the Rix's Hill Mine. It is mainly composed of breccia, of country rock, sandstone, and slate, with occasional rounded pebbles probably derived from conglomerate beds, all cemented together by siliceous brown oxide of iron and kaolin. The fragments of country rock at this point are mostly derived from the permo-carboniferous strata, though I noticed also an occasional fragment of granite. The same lode is also seen again close to the old road at the head of what is known as the "Black Pinch," in section 1842-87m, where it contains a larger proportion of fragments of granite, as well as slate, sandstone, quartz, kaolin, and oxide of iron. I took samples for assay from Foster's section, but they proved valueless when tested by Mr. Ward. The bearing of the outcrop here is N. 15° W., but the lode appears on the whole to have a N.N.W. course, as it is said to be traceable for about ten miles along the contact between the diabase greenstones and the granite formation. The ferruginous outcrops are often 10 to 12 feet wide. What is probably part of the same lode is seen on the hill west of the old "Clunes" mine workings, but is there mainly made up of mudstones hardened by infiltration of silica. There can be little hesitation in classing this as a "contact lode" formed by the breaking of the diabase greenstone through the older formations. The presence of fragments of the sandstones of the coal measures in the lode-stuff in Foster's section and at the "Black Pinch" where these do not occur *in situ*, the country being all either greenstone or granite, goes to prove that they at one time overlaid the granite, and have been removed by denudation. If the lode owes its origin to the eruption of the greenstone, as is most probable, the presence of these sandstone fragments in such quantities in the vein-stuff of this contact fissure goes far to prove that the diabase is younger than the coal-measure rocks. This lode is in its main characteristics similar to those in the sections at the head of the Castle Carey Creek previously described, and is fairly parallel to the main line of lode there. It is worthy of remark, too, that most of the lodes of the entire Ben Lomond District have a northerly to north-westerly bearing, whether carrying tin ore or otherwise.

Besides the occurrences of silver or supposed silver lodes above mentioned, there are reported to be several other ferruginous veins discovered in various parts of the district, some in granite, some in the coal measures, on which next to nothing has been done, and which I did not examine.

Tin Mining Areas.—We now pass on to a consideration of the ground taken up for tin-mining purposes, all of which is in the granite formation except the Sections in the neighbourhood of Story's Creek, many of which are on Silurian slates and sandstones.

The Rix's Hill Mine, which is much more a tin mine than a silver one, has been already described.

The principal mine now working in the district is that known as "The Great Republic," and is the most important as being the one which has yielded the largest quantity of ore and been sunk to the greatest depth. A plan and two sections (cross and longitudinal) of the workings are attached for the purpose of illustrating the remarks to be made on this mine. These, though approximately correct, are not altogether from actual survey, being taken as far as it went from a survey by Mr. G. T. Eddie in January, 1890, and brought up to date by means of rough measurements only, with hand compass and tape, which cannot pretend to accuracy. They are, however, sufficiently correct for the purposes of this report.

The Great Republic.

The ore cropping at surface was first of all worked by means of an underlay shaft, marked No. 1 underlay shaft on the plan. As this went down it was found that the ore was in the form of a pipe-vein and dipping southerly, and when a depth of about 67 feet had been reached No. 2 underlay shaft was sunk to work it further. In this again it was found that the ore continued to pitch to the southward, and it was recognized that a main winding and engine shaft was required. This was accordingly sunk ("main shaft" on plan), and at 166 feet a crosscut was driven towards the lode. In this drive four veins were cut before reaching the main lode, all running more or less parallel to it. The first was met with about 16 feet from the shaft, and is known now as No. 3 lode. It dips 60° towards the shaft, and passes through it about 40 feet below this level. It is a small vein, and carries little (if any) tin ore where cut. At 21 feet from the shaft another small quartz vein, now known as No. 2 lode, carrying a little tin ore, was passed through. At 33 and 36 feet a pair of small veins were cut, and in the soft ground between them there was a little tin. These are marked *b* and *a* on the plan, and appear to be branches of the main lode. None of the veins above mentioned were of any magnitude, being practically only planes of division in the country rock coated with a little quartz, and often having the granite softened and decomposed along the sides of the

fissure. The soft ground between the veins *a* and *b* is rather altered country than true lode-stuff. The main lode was met with in the crosscut at 58 feet from the shaft, and was driven along till connection was made with the underlay shafts. The ore in the bottom of the No. 2 underlay shaft still pitching southward, was met with about 105 feet from the crosscut and followed up by a stope to where it left the side of the shaft. The lode is a mere fissure in the granite, rarely more than an inch wide, filled with quartz, clay, and fluorspar. The walls are smooth, and often distinctly striated, showing the vein to be a true fissure on which motion of the country rock has taken place. Though the vein proper is itself so small, the wall rock is often much decomposed, the felspar and mica of the granite being changed to kaolin and talcose material, and this soft rock often contains tin. For mining purposes it really is the lode, being the part from which the ore is extracted. The main shoot of ore from which all the tin taken from the mine has come is all altered wall-rock highly charged with tin ores. At the bottoms of the underlay shaft and the stope southward from it the lode is crossed by two veins (seen on the plan), which are probably those marked *a* and *b* seen in the crosscut. These dip steeper than the main vein at this part of the mine, and must drop into it before reaching No. 2 level, as they are not met with there. The shoot of ore coming down through the underlay shafts and stope continued again below No. 1 level, dropping nearly vertically to No. 2 level. The best ore in this part of it began at the point where a winze sunk on vein *a* proved it to fall into and join the main lode. The veins *a* and *b* seem to be branches of the main lode only, and probably join it again, going both north and south.

At 272 feet a second level has been opened, a crosscut being driven 27 feet to the lode, and then a level extended along it 163 feet. No. 2 lode was cut in the crosscut 15 feet from the shaft, but was a mere fissure, and so was not followed. It has been cut again in a small cross-drive from the drive along the main lode, showing that going northwards it is getting nearer to it, and rendering it very probable that both lodes will junction if followed to the north. In this level, as in the top one, the main lode was very small, being nothing but a mere fissure filled with quartz, clay, and fluorspar. The ore shoot between Nos. 1 and 2 levels is very large and fine, but will be described at length presently.

A third level has been opened at 336 feet. In this No. 2 lode was cut 6 feet from the shaft, consisting of from 6 to 12 inches of soft granitic matter and quartz, but with no tin, and the main lode at 27 feet from the shaft. Where first struck this was again merely a fissure plane between hard walls, but going northwards soft rock containing ore came in on the sides of the vein, and the available tinstuff opened out to two feet wide at 19 feet from the crosscut. At the time of my visit a winze was being sunk from the level above in the ore-shoot, and the drive was nearly up to the bottom of this winze. In the face the lode-channel had opened out to 10 or 12 inches, but there was also good tin in the soft granite of the hanging wall. The winze went down all the way in good ore, and I have since been informed that the drive was continued on for over 40 feet, all in good tin ground. At this level the lode certainly looks better and shows more tin than in the upper ones.

The shoot of ore has been the feature of this mine from the very first. Mr. Moyle, the manager at the time of my examination of the mine, was not in it at the time when the two underlay shafts were sunk, and could not give me much information about them, but between Nos. 1 and 2 levels the ground was worked out under his directions, and was examined by me in company with him. The ore body followed down through the underlay shafts and stope became small where passed through by No. 1 level, but made strong again some eight or ten feet lower, where the vein *a* dropped into the main lode. From this downwards nearly to No. 2 level there was a splendid mass of ore which has been taken out, leaving a great cavity over 30 feet deep, about 30 feet long, and from 10 to 17 feet in width. The fissure vein in the upper part of this was wider than usual, being from 2 to 3 inches wide, and consists mostly of green and purple fluorspar and some quartz. Very fine specimens of fluorspar are here obtainable. The tinstuff itself is granite wall-rock softened and altered and impregnated with tin oxide. The granitic matter is talcose and contains much kaolinised felspar. At one part of the south end of the shoot it contained a great deal of black tourmaline in radiated spherical bundles, and where these came in the tin went out. In some places the soft tin-bearing granite was separated from the hard country by joints or walls, but in others no line of demarcation could be drawn, the ore-bearing rock gradually merging into barren stuff. About 30 feet above No. 2 level the shoot became narrow again, and was small where driven through, but the winze sunk to No. 3 level was in good ore all the time, and according to report it would seem that the shoot has widened out at the bottom level so as to be longer than it has ever been seen in the mine before. It is most probable that the origin of the shoot is as follows:—After the fracture of the country which formed the lode channel, the solutions carrying the tin found their way more easily along certain comparatively open parts of the fissure than along such as had been almost entirely closed by the falling together of the severed walls. These solutions caused decomposition of the granite and deposited the tin in this altered and softened rock. The shoot would then represent the course of the main flow of water through the lode fissure. The thick vein of fluorspar (thick as compared with the usual width of the vein proper) must have been deposited in an open fissure, and this wide part of the fissure would naturally be the main channel for the circulation of the water carrying the mineralising solutions.

The mode of occurrence of tin ore in the Great Republic Mine is very similar to one described by Mr. J. A. Phillips in his treatise on Ore Deposits, as will be seen from the following quotation and the copies of his figures annexed:—

“An impregnation of granite by tinstone which occurs at East Huel Lovell, in the Parish of Wendron, Cornwall, has been very clearly described by Mr. C. Le Neve Foster. Figure 40 represents a horizontal section of this deposit as seen at the 100-fathom level, in which *a b* is the *leader* or *divider*, a small vein composed of quartz and ferruginous clay, varying from $\frac{1}{4}$ to $\frac{1}{2}$ inch in thickness. The dotted portion is the tinstuff, outside which is the ordinary granite of the district. This granite is well marked and encloses large crystals of orthoclase, while the stanniferous portion consists of a mixture of quartz, mica, gilbertite, and cassiterite, with a little fluorspar, iron pyrites, copper pyrites, erubescite, copper glance, and chalybitis. Gilbertite, a crystalline alteration product of felspar, is frequently abundant. There is no wall or selvage between the tin-bearing mass and the surrounding granite, the two gradually merging in to one another, and, following the leader along its strike, the tin-bearing rock decreases in width until at last both walls of the vein are composed entirely of granite. The shoot of tin at the 100-fathom level was about seven

fathoms in length, the richest part having a length of three fathoms and a width of nearly nine feet. In some cases the oxide of tin lay entirely on one wall, as shown in figure 41, but the prevailing characteristics, namely, the leader of quartz, the absence of any wall between the tin and the granite, and the general composition of the tin ground, always remained the same. The main shoot of tin ore at East Huel Lovell has been followed from the 40-fathom level down to the 110 as one continuous pipe, and is in the shape of a long irregular cylindroid with an elliptic base generally about fourteen feet long by seven wide."

The ore in the Great Republic shoot has proved very rich, and if obtainable in larger quantity would make the mine a very profitable one. The ore is, however, unfortunately confined to this one shoot, as far as yet ascertained, the lode being outside of this too small and poor to be worked. As the shoot, though a strong and remarkable one, is of very small length horizontally, it has been necessary to do a great deal of dead-work for opening up a comparatively small piece of ground. Every successive level requires the main shaft to be sunk deeper, and crosscuts and drives to be made for a very considerable distance before the ore is reached. This large amount of dead-work is a severe burden on the mine, and unless other shoots are discovered, or the present one enlarges in depth, will probably lead to its eventual abandonment, even though good ore should continue to be found. That other shoots will be found by driving on the course of the lode is most probable, and exploration work to discover them should certainly be pushed forward. As there appears to be a tendency for the veins to come together towards the north, prospecting in this direction by extending the drives along the lodes is highly advisable. To the southward of the present workings it is not unlikely that the veins *a* and *b* will rejoin the main lode, and the junction may perhaps again form an ore-shoot. Should two or three more ore bodies similar to the one in the present workings be found, the mine would have a very promising future, but as long as all work is confined to the one shoot now in hand it can hardly be expected that much profit can result. The extension of this shoot in length at the No. 3 level is a favourable feature, and may be the beginning of a change for the better in the character of the lode generally. There is always a large amount of likelihood that a fissure vein, which is very narrow where first cut, will expand when worked on both in strike and dip, and as the regularity of the lodes in this mine, and the smoothed and striated appearance of the walls, point to their being strong lines of fissure, it is probable that wider portions will be found if looked for. It is not unlikely that both No. 1 and No. 2 lodes are branches from one lode, into which they will unite in depth.

Taking the proved richness of the known ore-shoot into account, as well as the probabilities of other shoots being found and of the veins coming together, and of the lode itself making wider when sunk and driven on, it is my opinion that this mine is a very genuine mining venture, and likely to prove a successful one. In its present position, however, it should not attempt to pay dividends out of any surplus realised from the good ore. So much has yet to be done to open up the mine, that if the ore pays for the dead-work the owners should be well satisfied for the present, and trust to get their profit from future developments.

The value of the ore in the shoot, which, it must be remembered, is the only part of the lode furnishing crushing-stuff, may be seen from the following figures:—

Between 11th December, 1890, and 1st December, 1891, 912 tons of ore were stamped for a return of 63 tons 18 cwt. of black tin, or 7 per cent.

In January and February, 1892, 90 tons of ore were crushed for 175 bags, or about 9 tons, of black tin, equal to 10 per cent.

Since the commencement of operations the product from the mine has amounted to 131½ tons of black tin, for which in all about 1560 tons of ore have been crushed, the average yield therefore being about 8.4 per cent. of black tin, or very nearly 6 per cent. of metallic tin, the yield of the black tin averaging from 70 to 72 per cent. of metallic tin. The value of this is about £8420.

As showing how much dead-work has to be done in proportion to the ore won, it may be stated that during 1891 out of an average of 26 men employed only 4 were at work getting ore.

The mine has a 10-head stamp battery for crushing the stone, and two Frue vanners for concentrating it. The gratings have 82 holes to the square inch, and the battery crushes about 30 tons of ore a week, working eight hours daily, or at the rate of 1½ tons per head in 24 hours. The crushed material does not go directly on to the vanners, but first passes through three, straight narrow buddles, each about 10 feet long, in which the heaviest ore is saved. This is dressed by hand by washing in another straight buddle or tie, the tailings from which go on to the Frue vanners together with the overflow from the first three buddles. This arrangement, by taking out a large portion of the heaviest tin ore, lightens the work of the two vanners, which would otherwise be overburdened if set to treat the stuff from 10 heads of stamps, containing 7 to 10 per cent. of concentrates. The vanners are driven by a belt from the cam shaft, a bad arrangement that ought to be altered, as the tables cannot be driven with the required regularity from the cam shaft. No assays are made of the tailings, a defect that ought also to be remedied, as it is most important to control the working of the dressing machinery by regularly testing the tailings to see that an abnormal per-centage is not being lost. The battery is driven by a 20 h.p. portable high-pressure double-expansion engine, by Marshall. A sister engine is used for winding. The battery and dressing appliances cannot be said to represent a good type of dressing machinery, but under the circumstances of the mine are probably as good or better than a more elaborate plant. More room is badly required in the battery, working being very much cramped, but it serves very well to test the mine. Should the Great Republic become a large concern, a better style of dressing machinery and a larger plant would require to be erected. Classification of the crushed material, the first requisite for successful concentration, is at present ignored altogether.

Ben Lomond Mine.—No work is being done now on this property, and the expensive mining and ore-dressing plant erected is suffering much from disuse, woodwork being rotted, split, and warped, and iron-work eaten with rust. I was unable to examine the underground workings owing to the shafts being full of water, and the long adit partly fallen in and half-full of water also. It is not possible, therefore, for me to say very much about the prospects of the property. Some four or more lodes are known to exist in it. No. 1 is near the main shaft, which has been sunk to work it to a depth of 100 feet. The lode strikes N. 37° W., has an easterly dip, and is said to have averaged about 3½ feet in thickness. About 1½ chains N.W. from the main shaft a small shaft has been sunk on the lode to a depth of 80 feet, and about 50 feet

N.W. from this there is another 80-foot shaft. These two shafts are in my opinion unnecessarily close to each other, the exploration work done by the second being more easily and cheaply done by driving from the first one. The lode-stuff lying about these shafts is a rather hard, talcose, quartz, micaceous in parts, also white quartz with pyrites. Fluorspar is pretty common, and some tourmaline also is found. Not much tin ore is visible, but presumably any good stone extracted has been sent to the battery.

No. 2 lode lies to the west of No. 1, and strikes N. 22° W., dipping easterly. On this there is a surface excavation, 40 feet long, 15 feet wide, and 12 feet deep, from which I was told that 38 tons of tin ore had been extracted. In the bottom of the cutting the lode appears as a small vein of quartz and quartzose granitic matter, showing little or no tin, and enclosed in hard country. The rich pocket was in soft granite, and when the hard country came in the ore died out. The vein is very well defined in the bottom of the excavation, and from its former richness ought to be worth sinking on in the hope of finding other similar rich bunches. The ore-bearing stuff is now of course all gone, but from the description of it given to me it seems very probable that it was softened and altered granite impregnated with cassiterite, similar to what is found in the ore-shoot of the Great Republic mine, and the experience of this would lead us to expect it to be found to continue downwards. Practically no search has been made for it below where the ore cut out, a winze sunk a few feet on the vein being hardly worth mentioning. It very often happens in ore-shoots that there are blank spaces beneath which the good ore again makes.

A few feet westward of the excavation are some thin quartz veins, striking N. 22° W.

Between the lines of No. 1 and No. 2 lodes, and about 1½ chains from the line of No. 2, is a lode carrying a great deal of tourmaline, striking N. 25° W., and dipping vertically, or with perhaps a very slight underlay to the westward. The vein where cut shows 12 inches of almost solid tourmaline rock, with the tourmaline in interlacing radiating needles, and 12 inches of quartz mottled with bunches of tourmaline.

No. 3 lode is about 1½ chains west of No. 2, and is cut in a drainage race from the excavation at No. 2. It consists mostly of felspathic matter, with some tourmaline.

No. 4 lode is perhaps one chain further west, and consists of micaceous quartz carrying a little visible tin ore.

Westward again from this is a lode of iron pyrites and quartz about two feet thick, running N. 25° W., and dipping easterly at a high angle.

It will thus be seen that a series of parallel veins have been cut on surface, and to cut them underground an adit about 750 feet long has been driven on a course N. 57° E. A fall of the roof had dammed the water back in this, and prevented me from going into it more than about 100 feet. The adit is some 105 feet below the outcrop of No. 1 lode. As far as I could learn, very little driving has been done on the lodes either from the shafts or from the adit. I could not ascertain how much stone has been crushed, but was given to understand that the quantity was quite small, the surface excavation on No. 2 lode furnishing the greater part of it.

At the mouth of the adit a 10-head battery has been erected, furnished with classifiers, jiggers, and ties as tin-saving appliances. The whole building is now in very bad order, the woodwork being very much warped and shrunk, so much so that the dressing appliances would have to be entirely renewed before doing any work. They could not have been very efficient in the first instance, for, though fairly good so far as they went, there seems to have been no adequate provision for the treatment of the fine sands and slimes.

This mine is a standing example of a mistake which is far too common, and which ruins many promising ventures. The capital of the company has been spent on building a battery and doing dead-work of one sort and another before proving the mine itself. If I have been correctly informed, the main shaft was sunk before the adit was driven, and it would have been an easy matter to prospect Nos. 1 and 2 lodes from the shaft to the same depth as is commanded by the adit. It would have been better to do this prospecting work from the shaft before driving the adit. If it had proved satisfactory the construction of the tunnel would have been very desirable, as it cuts through the whole system of veins, provides a way to the battery, and drains the mine to a depth of over 100 feet. If the adit had been made before the main shaft was sunk and provided with winding engine and pumps, the mine would have been proved to the same depth as now without any necessity for these. Hence, so far as testing the mine to a depth of 100 feet is concerned, either the main shaft and its machinery or the adit is altogether superfluous. Had the mine proved a good one both would have been doubtless required, the shaft to work the ground below the adit level. But all the available money was spent in building the battery, erecting winding and pumping machinery, sinking shafts, and driving the main tunnel, and at the end of all this nothing was left to look for the tin with. Had the money used for the battery and driving the adit been expended in driving on the lodes from the main shaft a great deal of exploratory work could have been done, and it is very probable that the mine would have been in operation to this day. The lodes are strong and well defined on surface; some of them have been in parts very rich in tin, and there is very reasonable hope that payable shoots of ore would be found in them if they were explored. The amount of work done underground is so small that their value cannot be at all regarded as disproved, and it is likely enough that it may yet be a very profitable investment. As the lodes can now be driven on from the adit at small expense, it seems to me that prospecting them would be a very legitimate risk. The experience of the Great Republic mine in finding the ore concentrated in rich shoots is very likely to be repeated in this and other mines throughout the district, especially as there is reason to believe, from the parallelism of the Ben Lomond, Great Republic, and Gipps' Creek lodes, and from their similarity in easterly dip and mineral contents, that they all belong to one system of contemporaneous fissures, and are therefore likely, according to the experience of mining districts all the world over, to have many features in common and be very similar in their behaviour.

In the approach cutting to the Ben Lomond Company's adit shales belonging to the coal measure series of rocks are exposed, and the section is of peculiar interest as showing features that lead to a suspicion that the granite itself has been intruded into the sedimentary strata. As this point has considerable geological importance, a sketch section of the occurrence is attached. On the south side of the approach, just at the mouth of the adit, the granite, *a*, which is of the usual type common throughout the whole district, contains imbedded in it rounded pebbles of quartz and quartzite. Immediately above the

granite the shale is very much broken and displaced, and contains similar pebbles to those enclosed in the granite. The surface of the latter at the contact is full of broken shale and rounded pebbles. It is also clear from the section that either the portion *c* of the shale has been faulted down between the masses of granite *a* and *d*, or that the latter have been pushed up through the shales. The shale above *d* is a little broken, though not so much as over *a*. In the shale, the beds of which lie very flat, I found carbonaceous markings but no distinct fossils, and a good many pebbles of quartz and quartzite. Though the surface of the granite is much decomposed and softened, it seems hardly possible that pebbles could have been actually sunk into it for a distance of two or three feet, and the explanation that seems to fit the case best is that the granite masses were intrusive, and in pushing their way up through the shales absorbed portions of the latter, but could not absorb the pebbles of nearly pure silica contained in them. Against this theory has to be placed the fact of the crystals of quartz and felspar in the granite being as large and well defined at the contact with the shales as anywhere else, and that the shales, though broken at the contact, are not hardened and metamorphosed, as they would probably have been by a plutonic intrusion. The presence of fragments of granite in some of the mudstones of the permo-carboniferous series proves conclusively that some at least of the granite was in existence as a hardened rock before the shales were laid down; for, from their lithological character, the carbonaceous workings found in them, and their horizontal bedding, there can be little question of the latter belonging to the permo-carboniferous formation. Until further evidence is available a satisfactory explanation of the section will probably be wanting.

Gipps' Creek.—An interesting system of lodes is seen in the valley of Gipps' Creek in a small branch stream running through Sections 3116-87M (R. Bennell), 3118-87M (Gaunt), and 2650-87M (Gaunt and Foster), and also in Sections 2338-97M, 2309-87M and 2308-87M (all in the name of A. Mayne), known as the Long Tunnel Company's Property. Near the junction of the branch creek with the main one in 2650 87M, a good deal of ground sluicing has been done and very fair tin obtained. A number of fairly parallel veins bearing between N. and S. and N.W. and S.E. have been exposed in the bed rock by this work, all dipping easterly. They consist of quartz with a great deal of tourmaline and some wolfram, and occasionally tin ore. Splendid specimens of tin ore in quartz, but little waterworn, have been found in sluicing, and pretty plentifully, but no lode of corresponding richness has yet been struck. As the veins are seen in parts to contain tin it may be that the rich specimens are from patches in these, but I think it is more likely that they are derived from lodes higher up the little creek. A few chains above the alluvial workings a trench has been sunk on a lode of quartz and tourmaline running north-westerly. A few stones of white quartz containing wolfram were lying about the hole, but I saw no wolfram in the lode, which is hereabout 4½ feet in thickness but not well exposed. About half a chain north-west from this a number of narrow veins of quartz running close to and parallel to each other and bearing N. 20° W. have been laid bare, dipping about 45° to the eastward. The quartz is highly charged with tourmaline, but I also got some specimens with nice tin ore in them as well. These veins are probably part of the 4½ foot lode or else are parallel and close to it. A short tunnel across them into the hill at this point would give valuable information. The tourmaline in these veins is very similar in occurrence to that in the tourmaline lode in the Ben Lomond property previously mentioned.

The sluicing work shows that the small creek is running almost upon the bed rock and for prospecting purposes it would be very easy to carry a trench right up to its bed across the line of the whole lode system. In winter when water is plentiful this work could be very cheaply done by its aid: any lodes crossing the creek would then be laid bare. The specimens obtained in sluicing are so tempting that more work should certainly be done to try and find the lode from which they have come, and as it is clear that there are a number of parallel veins running across the creek there is no easier way of prospecting them than by stripping its bed right up. Should valuable lodes be found the ground is sufficiently steep to allow of their being well tested by means of adits without winding and drainage expenses. The owners cannot be congratulated on their enterprise in working those promising sections, which have been held for four or five years and practically nothing done on them.

In the *Long Tunnel* mine work was at a standstill at the time of my visit, and had been so for a long time. A good deal of mining work has been done, and at least three distinct lodes have been cut. From their position and course these probably belong to the same system of veins as those described in Gaunt, Bennell, and Foster's Sections. On the north boundary of Section 2858-87M an underlay shaft has been sunk on a lode 2 feet 3 inches thick, striking N. 10° W. and dipping easterly 50°. This is a very well defined lode with distinct walls. The veinstuff is mostly quartz, somewhat granular, and containing hydromicas and tale, and shows a somewhat banded structure in parts. A very fair amount of tin ore is visible in it, and in the stuff extracted and lying at surface the tin seems to be in payable quantity. A vein of copper pyrites about two inches thick with rich tin ore in close proximity is seen in the sides of the shaft. This, after following the lode down for some 20 or 30 feet on the underlay, was sunk vertically through the footwall to connect with a tunnel that has been driven for the purpose of cutting the lode. This tunnel, however, before reaching the tin lode, struck another one composed of barren quartz, which was driven along presumably in the belief that it was the lode sought for, until it was proved to be a different one by the sinking of the aforesaid vertical winze from the underlay shaft. This quartz lode runs N. 10° W. and dips easterly about 1 in 1, and must therefore be almost exactly parallel to the tin-bearing one both in strike and dip. The tunnel would probably have to be extended some 50 feet past the quartz lode before striking the one seen in the shaft. Another shaft has been sunk on the tin lode to the south of the line of the tunnel, but being full of water could not be examined. The material thrown out of it shows a very fair quantity of tin ore. This lode seems well worth giving a practical trial, and by extending the adit to cut it this could easily be done.

In the south part of Section 2358 a long tunnel, from which the mine takes its name, has been driven from the side of Gipps' Creek to a total distance of 560 feet. The roof having fallen in at about 300 feet from the mouth, I could not examine more than half of it. The first 200 feet are through country rock, on a course N. 10° W., then it veers round to about N. 12° E. for about 80 feet, when a small lode running N. 10° W. and dipping easterly 50° to 60° was met with, and the drive continued northwards along its

course. This is probably a parallel lode to the one cut in the north of the section. As the adit is driven exactly on the course of the system of lodes, it has nothing like the same prospecting value as a crosscut would have had. It would have been far better after driving into solid and settled country to have driven crosscuts east and west across the strike of the lodes, and then driven on these as they were picked up. The lode found at about 280 feet from the entrance was probably never more than from 30 to 40 feet to the east of the tunnel all the way, and it was only through changing the course that it was struck. I certainly think that crosscuts should be driven from this tunnel if value is to be expected from the expense of making it.

Near the western boundary of Section 2358-87M a lode has been struck in two or three trenches and a shaft (now fallen in). Some pretty good tin is seen in the stone. The vein is said to have been from 18 inches to 3 feet wide in the shaft. Course N. 10° W., dip easterly. An adit has been commenced to cut this lode, but was discontinued after going 75 feet without reaching it. As this adit, if continued, would have cut all the lodes pretty well at right angles, it is a pity that it was not driven instead of the long adit. Both are on much the same level.

It will be seen from the above account that a great deal of work has been done without result. Of the three tunnels driven, aggregating about 1000 feet in length, none have reached the lodes proved on surface to contain tin. Both the tin-bearing lodes are well worth trial, and could be easily tested without much further expense. Their easterly dip is rather troublesome, as it makes the adits required to reach them much longer than if they had been vertical or dipping westward. The non-success of the former company should not be allowed to prejudice this mine in public estimation, for the prospects are neither better nor worse than before they started operations, all their trouble and expense having done nothing to prove the lodes, though they have made it easier for some one else to step in now and do so.

The Long Tunnel adit is about 400 feet below the plateau, on the western edge of which the Great Republic and Ben Lomond mines are situated. It would therefore be possible to do a very large amount of prospecting by driving eastward at right angles to the average course of the lodes. At least two groups of lodes are known to exist between Gipps' Creek and the eastern boundary of the Great Republic Company's ground,—viz., those of the Long Tunnel Company's and Bennell, Gaunt, and Foster's sections, and those of the Ben Lomond and Great Republic Companies' ground. Between these two groups there may be, and very likely are, others parallel to them. The strong lode of the Rix's Hill mine further south shows that the north-north-westerly to northerly system of veins is persistent over a long distance in strike. It is therefore possible that if a real "long tunnel," say 8000 feet long, were driven in from Gipps' Creek a large number of lodes would be cut by it at depths up to 400 feet. By coming lower down the creek to a point west of Section 1651-87M an adit could be got from 700 to 750 feet below the plateau. This would probably, however, begin too far to the east to cut the Long Tunnel Company's group of lodes. Water-power for driving machinery for compressing air and haulage could be easily and cheaply obtained from Gipps' Creek. In the present undeveloped state of all the mines it would be premature to undertake any such extensive scheme of work as this, but should the district turn out well it would be practicable, and indeed necessary. It is not at all outside the domain of practical mining to contemplate the possibility of driving right through to Story's Creek, a distance at the most of five and a half miles. At their nearest points the streams are only four miles from each other.

Story's Creek.—A large number of sections have been at one time taken up near the head of Story's Creek, but at present next to no work is going on, and many of the leases have been forfeited. On the Story's Creek Tin Mining Company's property (Sections 2141-87M, 1089, and 1077, held in the names of J. C. Genders and R. Bennell), one, and sometimes two, men are kept employed. Far more work has been done on this Company's ground than on any of the adjacent holdings, and it will be alone described now. The country is different from that in which the previously described tin lodes are situated, being in highly inclined metamorphic sandstones of probably Silurian age instead of in granite. The latter, however, is not far distant, being found in Nesbitt's Creek on the west, and on the east on the ridge between Story's Creek and the head of the Aberfoyle Rivulet, and probably the Silurian formation is also underlaid by it at no great depth.

A great deal of surface-work has been done on these Sections, the soil, though very shallow, having often contained large quantities of tin ore. So good are the prospects of loose tin that there seems at first sight every reason for the high estimation that has been held of this property by the owners and many others who have visited it. It is very reasonable to believe that where there is so much loose tin on surface, evidently from its angular and little abraded nature not carried far from the parent veins, there are good lodes beneath, and this belief, though not yet borne out by the results of the underground work performed, can by no means be regarded as overthrown, as it may well be that the rich veins have not yet been discovered. An examination of the numerous veins laid bare, however, is apt to modify the good opinion formed by looking at the loose tin alone, as it shows that there are numbers of quartz veins, mostly too small for profitable working, carrying bunches of very rich ore. The wearing away of these under atmospheric influences would have the effect of releasing large quantities of tin ore, and it might well turn out that, instead of there being one or more good lodes in the country that have supplied the tin, there are a large number of small and poor ones, unpayable as a rule, but bearing rich little pockets of ore. Going over the veins that have been exposed it would be very easy to pick out large numbers of most excellent specimens, but to take the general lodestuff as it comes to hand, it would not be payable. The tin ore is generally in large coarse crystals or aggregations of crystals, forming bunches in hard white quartz. Many miners look upon such occurrences with disfavour, regarding stone with the tin ore finely impregnated through it as much more permanent, while the coarsely crystalline ore in rich patches is considered likely to exist in only small quantity.

Without making a regular survey, it is hard to say how many separate lodes are exposed in this property. The surface-workings are on flattish ground, forming part of the terrace which extends to Gipps' Creek, though cut off from the main part of it by the valley of Nesbitt's Creek, a small tributary of Story's Creek. The underground workings are from the deep gully of the latter creek, and I am not certain as to the connection of the three or four lodes seen there with those exposed on the flat ground higher up. Where there are so many similar lodes or veins, careful tracing and pretty accurate surveying

would be required to establish the identity of a lode seen in two or more places at considerable distances from each other. In the northern portion of the surface-workings several leaders of white quartz from 3 inches to 6 or 8 inches wide are seen, all running between N. 30° W. and N. 40° W., and dipping westerly about one in one. These appear to belong to a system of parallel veins lying close together rather than to definite lodes. They often contain rich patches of coarsely crystalline tin ore, especially on the edges of the quartz veins: wolfram is also very frequently seen. The quartz, as a rule, adheres fast to the metamorphic sandstone or slate country, and is not divided from it by a flucan or selvage. These veins have very nearly the same strike as the beds of the country rock, but appear to cross them in dip. About two chains to the east of these veins, on the brow of the slope leading down to Story's Creek, an open cutting has been made into a place where several veins of quartz have been cut close together. The main vein runs about N. 50° W., and dips westerly 60°: it is about 12 inches thick, and contains a good deal of wolfram. Several flat-lying veins, dipping westerly about 30°, and from 8 to 12 inches thick, are seen making into the main vein: some of them carry patches of tin ore, much of it resin-coloured, and generally adhering to the outside of the quartz veins.

Going a short distance to the south of this cutting along the brow of the gully an undeveloped quartz lode running north and south is met with, and following it southward two others parallel or nearly so to it are also seen, all three lying close together. The north-westerly and northerly veins must form a sort of network in some portions of this ground. The quartz veins are all similar to those above described, hard white quartz with occasional bunches of coarse tin ore. Belonging to the north and south series of veins mention must now, however, be made of another occurrence which is of a more promising character, found towards the south end of the surface workings. This is a very flat-lying vein of soft clayey matter, much stained and mixed with oxide of iron, and containing a good deal of tin ore, being in streaks very rich. The strike as far as now ascertainable is N. 5° E., dip westerly about 15°. From quite a small hole sunk on the outcrop 16½ bags of tin ore were obtained by sluicing the soft lode-stuff, the tin ore being crystalline, and not in any way waterworn. About a chain to the south of this, where the flat vein appears to junction with one or more of the other lodes, another small hole yielded 10 bags of tin. (A bag of tin ore weighs about one hundredweight). This occurrence being all in the somewhat broken surface rock, and not in solid settled country, is not quite clear as to its nature, but it is probably a very flat lode, two or three feet thick. The amount of tin seen in it makes it well worth further prospecting, especially as its character is more favourable for tin than the hard quartz lodes. I regard this as the most promising feature of the property, and one that ought certainly to be worked on so that more definite knowledge of it may be obtained.

The underground workings consist of levels driven from the valley of Story's Creek about 100 feet above the level of the stream. The main level is driven along the course of a lode of white quartz, 2 to 4 feet in thickness, carrying a few patches of tin ore and a good deal of wolfram. It has well-marked walls with clayey selvages, and varies in strike from N. 17° W. to N. 32° W., dipping westerly about one in one. The level has been driven some 300 feet along the lode, the latter being a good deal split up in the face where work has been left off. About 120 feet from the mouth of the tunnel a crosscut has been put in to the eastward, and at about 60 feet another lode of quartz is cut, after passing through which the crosscut has been extended to about 300 feet without further discoveries being made. This second lode is from one to two feet wide, strike N. 17° W. to N. 20° W., and dips westerly 35°. It has been driven on to the northward, and one or two stopes have been taken out on it. The walls are well defined, the quartz being separated from the country by a clayey selvage. A little tin and a good deal of wolfram are visible in the stone. At the mouth of the tunnel about 15 feet west of the main lode another small parallel quartz lode has been cut, but not further worked on. Throughout these workings the quartz is hard and white, and the tin ore when it does occur is concentrated into coarsely crystalline bunches. The wolfram is also in patches, and a great deal more abundant than the tin ore. As far as can now be seen the lode-stuff extracted must have been very poor.

The same mistake made by the Ben Lomond Company has been repeated here, a battery having been put up before the ore was in sight to keep it going. It has been well built, but is now falling into serious disrepair. There are ten stamps, a pair of spitzbitten, one 3-sieve jigger, one shaking-table, and several ties. The motive power is derived from a 32 ft. overshot water-wheel, the water for which is brought down by a pipe from a race which comes over the terrace, and is supplied from a dam higher up Story's Creek. A turbine or Pelton water-wheel, under the circumstances, would have been a much more efficient motor, as well as cheaper and simpler. The ore from the tunnels can be run directly on to the feeding-floor of the battery, and this being built on the slope of the hill very little handling of material is required. The mill being well placed for working the ore from the present levels, it is perhaps rather unfair to criticise its location, but it may be pointed out that a lower adit could be put in to cut the lodes from the level of Story's Creek 50 or 60 feet below the battery, and if the mine went ahead this would have to be made. The mill would then have to be moved, or the ore lifted to it. It seems to me that it would have been better to have put the dressing-floors lower down the creek; the stone from the present levels could then have been sent down to it by a shoot, the ground being steep enough for this to work well, and at the same time the ore from the low-level adit could have been brought along a level grade. Probably quite 60 or 70 feet more head or pressure could then have been obtained from the race to work a water-wheel or turbine, with consequent large increase of motive power.

Leaving out of consideration the further prospecting of the soft flat lode above-mentioned, which ought to be done in any case, and dealing only with the quartz veins, it seems to me that before giving them up as hopeless it would be worth while ascertaining if they passed into the granite country at a reasonably accessible depth. The granite may be regarded as the source of the tin in the overlying Silurian formation, and should the lodes, as is likely, pass down into it at no great depth, there is a very considerable probability of their being much richer in the more favourable country. A large quantity of tin, taking it altogether, certainly exists in the upper parts of the lodes, but so much scattered as not to be payable, and, as this is almost certainly derived from the lower granite, the presumption that the lodes will improve going downwards has a good deal in its favour. It would be interesting to find out if any of these lodes can be traced into the granite along their strike, and if any dislocation takes place at the contact of this and the Silurian formation. The lodes dipping westward at a flat angle towards the granite which appears in

Nesbitt's Creek only a short distance to the westward, it is possible that valuable knowledge could be gained by boring with a diamond drill at a point where the lodes might be expected to be struck at a depth of 600 or 700 feet, there being a likelihood of their then having passed into the granite.

Tasmanian Tin Mining Company.—In going to Story's Creek from Avoca we pass through the sections formerly held by this company and a number of others. The ground has been abandoned for years, and the scrub is beginning to cover the old trenches and workings. The Tasmanian Company had a main shaft, winding and pumping machinery, and a tin-dressing plant, but after a very little underground work the flat tin-bearing vein which had been the basis of expectations failed, and the mine stopped. The machinery was sold off, and much of it is now lying rusting on the hill above the Story's Creek battery. A great many old trenches and small shafts are to be seen all over this ground, but from the stone visible now the prospects do not seem to have been very good. In a trench about six chains north-east of the old main shaft a lode formation is seen, three or four feet wide, striking N. 57° E., and carrying a little tin with a good deal of tourmaline. The lode-stuff is talcose soft granitic matter, some of it hardened by infiltration of silica, with a little clean quartz. I have been informed that very good prospects of tin can be obtained on parts of Egan's Freehold, Lot 882, but as this is private property no mining can be done. The granite country in all this neighbourhood is favourable for the occurrence of tin lodes, and this part of the district may come to the front again at any time with new discoveries.

Summary.—To sum up as to lode-mining in the Ben Lomond District it must be first of all said that the amount of development done is not at all commensurate with the large amount of money that has been spent on the mines. With the exception of the Great Republic and Story's Creek mines hardly any work has been done on the lodes; there has been a great deal of fossicking about and scratching the surface, a great deal of work begun and not finished, much premature erection of machinery, great expense in all sorts of ways, and consequently the investing public have lost faith in a field which absorbed so much money without yielding results. Nevertheless there are numbers of genuinely good opportunities in the district for legitimate mining work, and if this is carried on in a well directed and economical manner, having regard only to getting returns out of the ground and not out of the share-market, I have little doubt that in course of time there will be steady and productive mines opened up. It cannot be gainsaid that this field stands very ill in the public estimation at present, but it has been condemned without a fair trial, mainly on account of useless and extravagant expenditure on everything except the lodes themselves.

Alluvial Tin Deposits.—Throughout the Ben Lomond District there has been but little alluvial tin obtained. Such gravel drifts as have been found are of comparatively small extent and shallow, and are confined to the valleys of the existing watercourses. Those of Gipps' Creek have been the most important. As this absence of alluvial tin is often regarded as an indication of poverty of the lodes beneath, it is of consequence to point out that there are reasons for it, both geological and topographical. On the terrace where gravels are often expected to be found the patches of the coal-measure formation abundantly seen widely spread all over it show that till quite recently the granite, the matrix of the tin, was covered by younger non-stanniferous deposits, and has not been subjected to any appreciable amount of aqueous erosion, which alone could set free and concentrate its contained tin ore. The only places where there has been any considerable erosion of the granite are in the deep gullies of the creeks running down from the terrace. Even in these, in the Castle Carey and Gipps' Creeks more particularly, there is proof that great portions of the valleys have been scooped out of the permo-carboniferous strata before reaching the granite, so that the amount of this that has been sluiced by the operations of nature is smaller than might be at first thought. But the principal reason of these creeks not carrying more tin is the steepness of their beds, on account of which the ore has no doubt been swept down into the South Esk Valley, and should be looked for in the deep flat ground where the streams debouch into it. A certain small amount of tin is found in all the creeks, and in Gipps' Creek, where, through the bed being in places flatter than is usual, accumulations of gravel have been deposited at more than one part of the valley, the workings have assumed considerable importance.

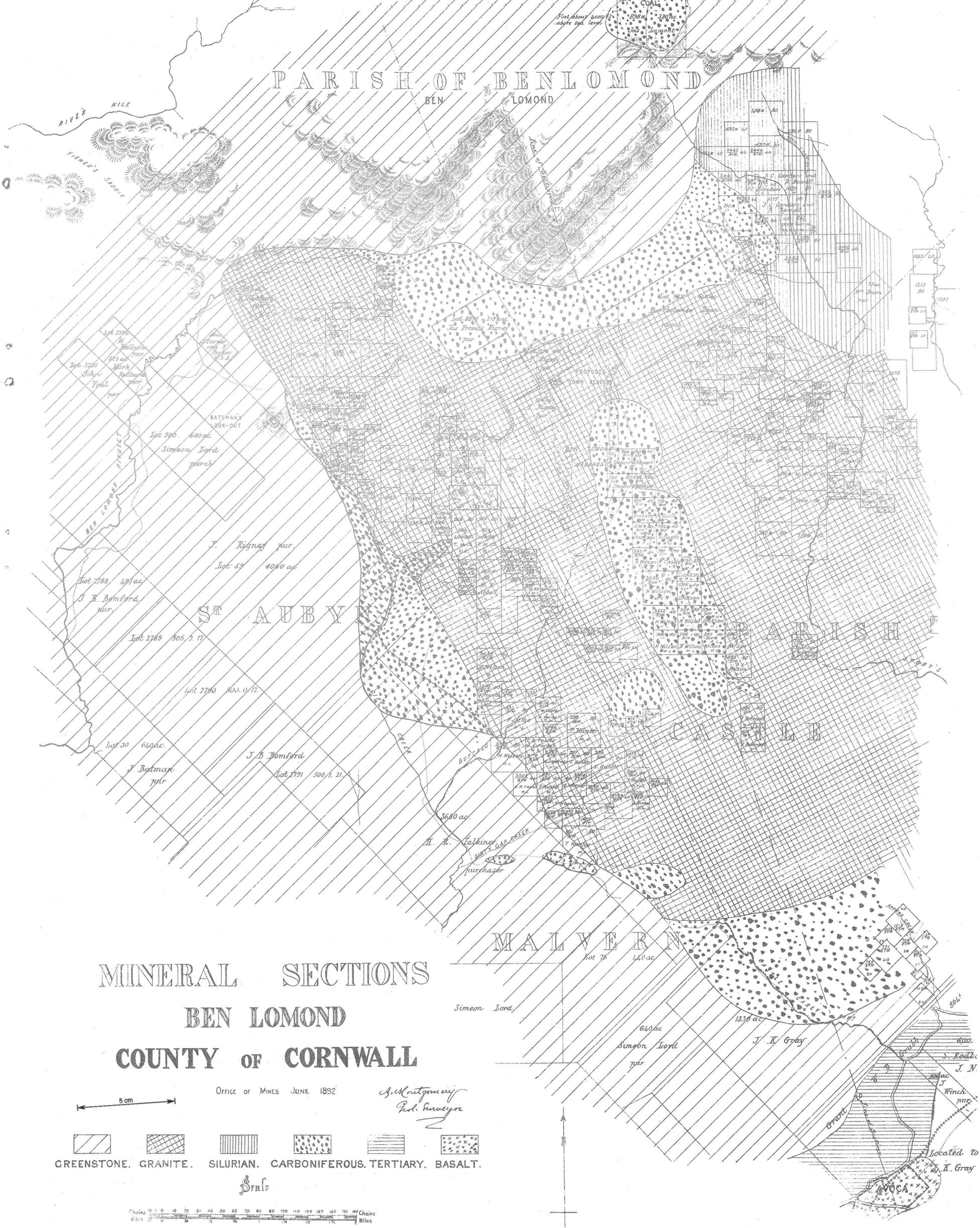
Clunes Workings.—To the west of the Long Tunnel Company's ground, on Sections 2267-87M. and 2265-87M., a considerable amount of alluvial tin has been obtained from a branch creek running into Gipps' Creek. The ground is not deep, rarely more than 4 and 5 feet, and though understood to have been highly payable at first is now believed to be practically worked out. The richness of this gravel argues well for the value of the lodes known to exist along the eastern slope of the valley.

Rigney's Freehold.—About a mile and a half below the Clunes workings we come upon an alluvial flat of considerable extent, being about 35 chains in length along the creek and averaging perhaps six chains in width, an area of from 15 to 20 acres. The creek on which the Great Republic Company's battery is situated joins Gipps' Creek towards the head of this flat. A piece of land comprising this flat, and in all containing 107½ acres, has been leased from the owner, Mr. J. F. Rigney, by J. Powell and others, and is known as the Rigney's Freehold No. 1 Company's Block. About 30 chains lower down, and at and below the junction of the small creek that runs past the Ben Lomond Tin Mining Company's battery with Gipps' Creek, there is another smaller flat comprising about 10 acres in all, which is contained in a block of 124 acres leased by Mr. Rigney to Hudson and Murrell, and known as Rigney's Freehold No. 2. Still further down Gipps' Creek other similar flats are seen which will doubtless be worked if the above-mentioned two claims prove payable. The geological features of the valley are noteworthy and supply an explanation of the formation of the alluvial deposits. The eastern side is composed of steep slopes and cliffs of, in the upper part of Block No. 1, granite, and, in the lower part of No. 1 and the whole of No. 2, coal measures, sandstones, shales, and limestones. The western side appears at first sight to be all greenstone, but here and there we find traces of carboniferous shales showing under this rock, and in reality it would seem that the coating of greenstone on the slopes is only a superficial one. Further examination shows that the greenstone is all in loose blocks, and frequently the shape of the ground reveals that numerous landslips have taken place. The high ridge west of the creek seems to be composed of green-

PARISH OF BENLOMOND

BEN LOMOND

Flat about 4000 ft. above sea level.



MINERAL SECTIONS

BEN LOMOND

COUNTY OF CORNWALL

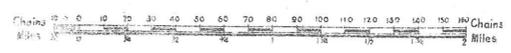
Office of Mines June 1892

S. K. Montgomery
Pub. Surveyor

5 cm

- 
 GREENSTONE.
- 
 GRANITE.
- 
 SILURIAN.
- 
 CARBONIFEROUS.
- 
 TERTIARY.
- 
 BASALT.

Drain



stone, and may be either a dyke or a flow which has run over the carboniferous rocks, and has no doubt supplied the blocks that now cover all the western slopes of the valley.

At a point in No. 1 Block west of the head of the alluvial flat, and at an elevation of 220 feet above it, alluvial gravel consisting of waterworn quartz, granite, and granitic lodes-stuff, and containing some fair prospects of tin ore, has been discovered on the slope of the hill. This appears to form a terrace some three or four chains in length, but had not been cut into at the time of my visit (27th May, 1892) sufficiently to show its width. The finding of river gravel at such an elevation above the present stream is very instructive, and opens up a large field for prospecting, for there may be many other such terraces along the slopes of the valley on both sides. The gravel must have been laid down when the stream ran at a much higher level and had not eroded its valley to anything like the present depth. As time went on it has cut its way lower and lower, and there is therefore a probability of finding other terraces left behind on the slopes of the valley at various elevations. At the lower end of the flat on No. 1 Block, on the western side of the valley and 40 feet above the flat, alluvial gravel left in this way has already been found. It contains some tin ore also. These two older deposits on the slopes of the valley are not likely to be the only terrace drifts left behind by the creek while cutting its way downward, and it will therefore be advisable to prospect both sides of the valley for others. The presence of tin ore in both terraces in appreciable quantities is also a strong argument for the existence of rich gravels in the present river flats, as much of the gravel of the older terraces must naturally from time to time have been washed down into the creek. In prospecting for terrace gravels regard must be given to the possibility of their being covered by superficial slips of greenstone from the higher parts of the ridge. So much of this appears to have gone on that there is a strong probability that most of the gravel deposits will be covered. The readiness with which the surface soil of these slopes slips is easily explainable when we consider that the valley has been in great measure eroded out of a mass of soft shales which readily become clayey on exposure to atmospheric influences. Rain-water descending through the porous surface stuff is stopped by the shales below and runs along their clayey surface, thus causing slips of the overlying material. The rather common occurrence of springs of water on the western slopes of the valley is due also to the drainage waters being unable to sink into the shales, but finding a passage between them and the surface stuff.

The formation of flats of alluvial gravel in the creek is now easily explained: from time to time large landslips have slid down into the valley and blocked the stream. In the dams so formed gravels have accumulated until the barrier has been cut through again by the running water. In the case of the two properties mentioned, it is probable that the present outlets from the flats are not yet so low as the original creek bed, as the gravel deposits appear to be deeper than them. The stream has been forced over to the eastern side of its valley by the slips and has cut down there to solid rock, which has then prevented it from scouring down to the old level. In both flats it has been found necessary to blast tail-races through the solid rock bars at the outlets in order to be able to work the drift behind them. In the No. 2 Company's tail-race the bar is fossiliferous limestone and calcareous shale belonging to the permo-carboniferous system, and very rich in organic remains. The bar at the outlet of the No. 1 Company's flat is a dark shale, divided by strong joints into polygonal prismatic blocks resembling basaltic columns when seen at a little distance. This polygonal vertical jointing is probably due to the presence in the near vicinity of a greenstone dyke, which has strongly heated the shales. The joints are clean-cut plane faces, and the blocks show sharp angles between adjacent faces.

In both flats a number of test pits have been sunk to prove the ground, with very encouraging results. This work was still in progress when I visited the claims. The holes are from 8 to 16 or 20 feet deep. One which was free from water when I saw it was 12 feet deep. There were 6 feet of black surface soil on the top; then 6 feet of heavy gravel, composed mostly of granitic debris, and containing more or less tin all through it; then limestone bottom, which had a slight pitch westerly away from the present stream. Mr. Macdonald, who was in charge of the work, informed me that this feature was very noticeable in most of the pits he sunk, indicating that the old original creek-bed lay to the westward, under the covering of slipped greenstone blocks which has driven the stream out of its old channel. As might be expected, considerable difficulty is experienced in sinking these pits on account of water, but enough has been done to show that there are large quantities of tin-bearing gravel, and that the deepest ground lies along the foot of the western slope of the valley, or even under it. I do not think, however, that as a rule there will be any large extent of gravel found buried under the slips, though the main gutter must in places be so covered. Between the two flats the gully in which the creek runs is narrow and with steep sides, but one or two holes have been sunk, and proved that there is gravel to a considerable depth below the bed of the stream, and that it carries tin. Wash is to be seen in one place in the side, covered with surface detritus. On the whole I am quite satisfied that this creek amply warrants a working trial, and that present appearances are all in favour of its being payable when worked by hydraulic sluicing. The wash might be treated by ground-sluicing without much trouble after deep tail-races had been blasted through the rocky bars at the outlets, but the advantages of the hydraulic method in cheapness and expedition are so great that there can be no question that it is the proper one to adopt. It might be advisable, in order to thoroughly test the ground before going to the expense of bringing high-pressure water on to it, to do a certain amount of ground-sluicing, but when the real work begins, hydraulicking must be resorted to. As an example of the cheapness of hydraulic work, I may quote the cost of it at the Blue Spur Company's claim in Otago as given in the Reports on the Mining Industries of New Zealand, 1891. Here the material is not only broken down and sluiced by the hydraulic method, but also elevated to an average height of 60 feet by means of hydraulic elevators. During the year ending 31st December, 1890, 410,000 cubic yards of stuff were elevated and sluiced, yielding only $1\frac{3}{4}$ grains of gold, or a value of $3\frac{1}{2}d.$ a yard. The expenditure on wages was only about $1\frac{1}{2}d.$ per yard. It will therefore be evident that under favourable circumstances tin drifts yielding only from a quarter to half a pound of tin ore to the cubic yard could be profitably dealt with by hydraulic sluicing.

The facilities for hydraulic work in the present case are unusually good. The outlet of the upper flat is about 300 feet below the Clunes workings and 750 feet below the Great Republic mine; the second flat is about 60 feet lower. Gipps' Creek affords a never-failing supply of water, and smaller supplies, but of greater head, can be obtained from the Great Republic and Ben Lomond Creeks. Only comparatively

short pipe-lines would be required. Water can also be got during the winter from the top of the ridge on the western side of Gipps' Creek, and this supply will enable the terraces to be worked. Experience in hydraulic working has shown that money is well spent when used to secure possession of copious supplies of high-pressure water, and that it is false economy to be niggardly in the matter of races and pipes. Having a good high-pressure supply will also remove any difficulty that may be encountered in getting fall for tailings as the workings are advanced into the flats, and also will do away with the need for cutting deep tail-races at their outlets, for it may be utilised to raise the stuff by hydraulic elevators. In order that the debris from the upper workings shall not be deposited on the flats lower down the stream to the detriment of their working, it will be best to avoid sending the tailings down the creek as much as possible, and the employment of elevators to stack the tailings on the worked-out ground would on that account alone be highly beneficial. There can be no doubt that if these upper flats are payable several others lower down the creek will also be worth working, and the prevention of the tailings from going down on to them from the top workings is therefore a matter of great moment. Deposition of sludge is often a source of much litigation in creek workings of this sort, and everything possible should be done to avoid it. (Some notes on hydraulic elevators were attached to my Report of last year on the Gladstone District, published with the Report of the Secretary of Mines for 1890-91).

I have not examined Gipps' Creek below its junction with the Buffalo Creek, but if there is payable tin in the upper parts there is a likelihood of there being a good deal also in favourable situations right down its course. The workings of the two companies that have been formed will therefore be of much general interest, as they will very probably be the means of opening up a considerable sluicing industry.

I have, &c.

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

The Secretary of Mines, Hobart.

REPORT ON THE MATHINNA GOLD-FIELD.

Geological Surveyor's Office, Launceston, 12th September, 1892.

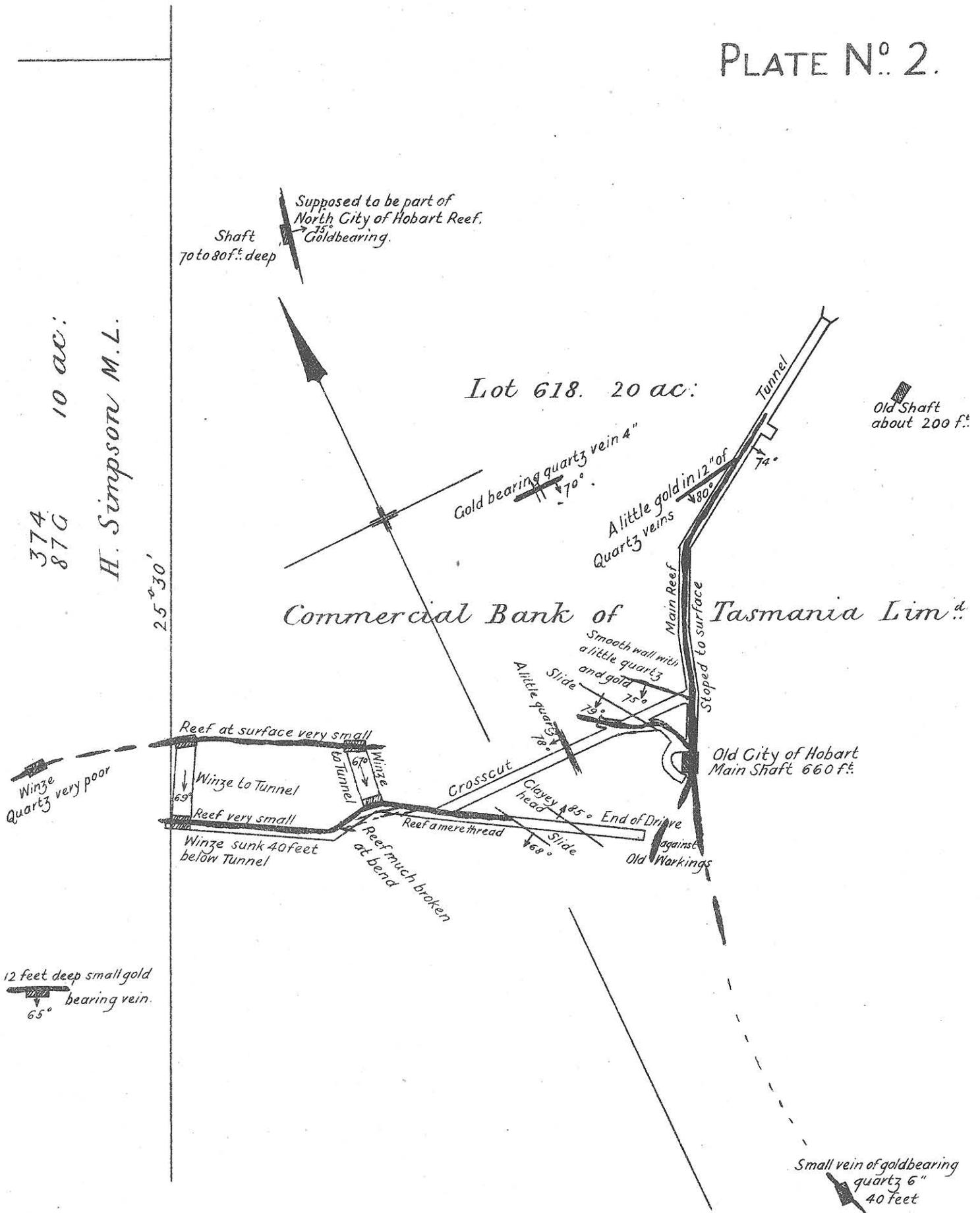
SIR,

I HAVE the honor to forward to you my Report on the Mathinna Gold-field. A month in all was spent in my examination of the district, from 30th May to 11th June, 1892, and again from 4th July to 15th July, inclusive. Owing to it being necessary to do a great deal of actual survey work in the mines and on surface in order to locate the various reefs correctly on the map and render intelligible their relations to each other, I was not able to extend my observations to the outlying parts of the district, and the present Report, therefore, deals only with the mines in the immediate vicinity of the Township of Mathinna.

This gold-field is situated about half-way between Tower Hill and Mount Blackboy, and distant 17 miles by road from Fingal Railway Station. The road from Fingal to it runs alongside the South Esk River all the way, skirting wide alluvial flats formed by the stream. Opposite the Township of Mathinna, at the bridge crossing the South Esk, the elevation above sea-level is between 900 and 1000 feet according to aneroid barometer. The principal mines are on three spurs running down to the Esk from the foothills of Tower Hill, and separated by two valleys known as Black Horse Gully and the Long Gully. The township lies in the former gully. In the lower portions of these valleys, where they debouch upon the alluvial plains formed by the South Esk, there are considerable accumulations of alluvial gravels, some of which have been payably auriferous.

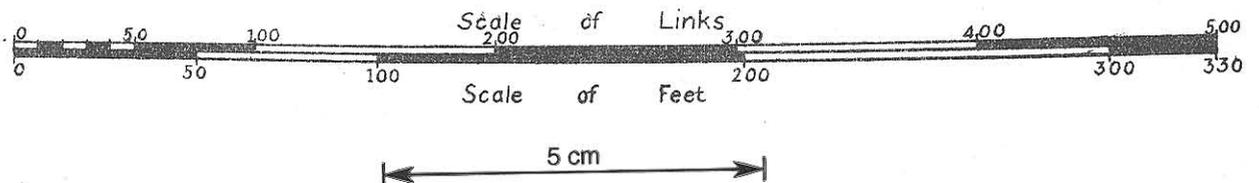
All the hills in this district are formed of slates, schists, and sandstones of Lower Palæozoic age, part of the extensive formation which is found all the way east from the Ben Lomond range to the mouth of the Scamander River, and which extends northward to past Mount Victoria. It is almost certainly the same formation that is found again at the Lefroy, Denison, Mount Horror, Gladstone, and Mount Victoria gold-fields, and has therefore proved auriferous over a large area. Fossils being almost if not entirely unknown in it, the geological age is uncertain, though probably not younger than the Lower Silurian. The general geological features of the country lying eastward of Ben Lomond are well seen in Mr. Chas. Gould's Map of the Fingal Gold-field and Mount Nicholas Coal-fields (House of Assembly Journals, 1869, No. 20), which shows plainly that the rocks of the auriferous series have been formerly covered by those of the coal measures, remains of which are now found in rings round all the high mountains; Ben Lomond, Mounts Victoria and Albert, Mount Young, Mount Blackboy, Tower Hill, Mount Nicholas, and the north slope of the Fingal Tier all showing the same fringes of Upper Palæozoic strata. It follows from this that the present surface of the older formation is in the neighbourhood of Mathinna, probably never more than 900 or 1000 feet at the most lower than that which existed before the coal measures were laid down, and consequently the upper parts of it have been subjected from time immemorial to the various atmospheric and other influences which produce disturbance and chemical alteration in the superficial layers of the earth's crust. This may have much to do with the unsettled character of the reefs at higher levels in the Mathinna field, and the large quantities of veins and bunches of quartz in the surface strata.

The strike of the beds of country has not been determined very satisfactorily, though I took its bearing wherever a good observation could be obtained. The slates and schists show a foliation or slaty cleavage running across the strike at an acute angle, which is often impossible to distinguish from true bedding, especially on the weathered outcrops of the rock. In the adits of the North Eldorado, Telegraph, and East Golden Gate mines, however, the true bedding planes can be clearly followed, and are found to run about



Plan of Workings
of the
MATHINNA MINE

*Abstract out of mine
Geological observations*



MATHINNA GOLDFIELD

General Plan showing position of Mines and Reefs.

5 cm

Ch. Montgomery
Geological Survey

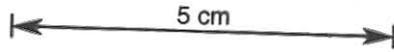
Scales of Chains: 10 20 30



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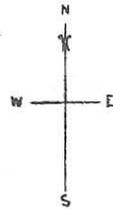
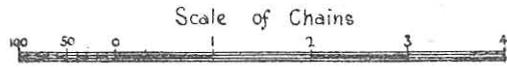
- A. Golden Stairs Shaft
- B. Golden Spur Shaft
- C. Star of Mathinna Shaft
- D. Golden Gate Extended Shaft
- E. Golden Ladder Shaft
- F. Central Golden Gate Shaft
- G. North Golden Gate Shaft
- H. New Golden Gate Shaft
- K. South Golden Gate Shaft
- L. Pride of Mathinna Shaft
- M. (Old) Derby Shaft
- N. New Eldorado Shaft
- O. (Old) City of Hobart Shaft
- P. St Patrick Shaft
- Q. (Old) Black Boy Shaft
- R. Old Boys Shaft
- a. (Old) Welcome Stranger Shaft
- b. Golden Spur Shaft
- c. (Old) Glencoe workings
- d. East Golden Gate Adit
- e. (Old) Caledonian Adit
- f. (Old) Caledonian workings
- g. City P. A. Tunnel
- h. Jubilee Tunnel
- k. Telegraph Tunnel
- l. Telegraph Shaft
- m. (Old) Gladstone workings
- ru. New Eldorado Whip Shaft
- o. New Eldorado Tunnel
- p. North Eldorado Tunnel
- r. North Eldorado workings
- s. New Golden Gate Adit
- t. City of Hobart Extended Shaft
- u. (Old) North City of Hobart workings
- v. (Old) Champion workings
- w. Old Boys Prospecting Shaft
- x. (Old) Yellow Boys Shaft and works
- Figures in circle denote height above Bridge across the South Esk taken with Aneroid

PLATE 3.



PLAN

SHOWING POSITION OF LODES AND WORKINGS OF THE NEW ELDORADO MINE



By Montgomery Geological Survey

396.87G 10ac. J. J. Martin & L.

295 87G. South Golden Gate

437 87G South Golden Gate

201 83

F. M. Clerke

524 87G

H. Simpson

183 83

Commercial Bank of Tasmania Ltd

10ac

MAIN SHAFT 171 ft.

530 87G

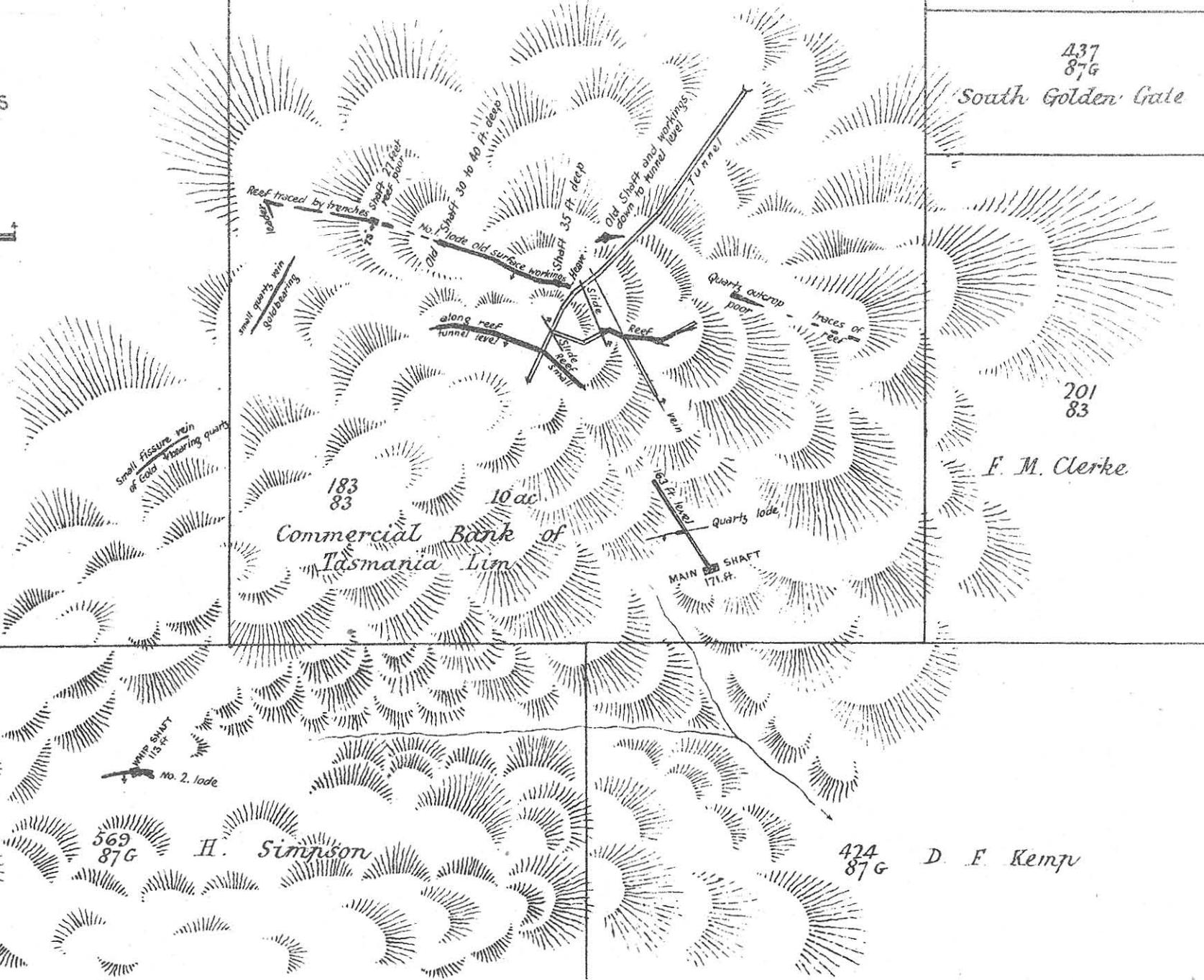
H. Simpson

569 87G

H. Simpson

424 87G

D. F. Kemp



north west and south east, and to dip north-easterly at angles from 25° to vertical. These three tunnels, being at considerable distances from each other and giving concordant results, we may consider the above to be the normal strike of the country beds. The foliation planes run about N.N.W. and S.S.E. and dip pretty vertically. Several sets of joints cross the beds, but I was not able to find any degree of regularity in their direction: in the New Eldorado mine the main joints have a strike about N. 60° E., but elsewhere they varied very much. These points are noticed because a connection is sometimes traceable between shoots of gold in reefs and the beds and joints of the country enclosing them. The flat dip of some of the strata should accordingly be borne in mind: in the East Golden Gate adit it is only 28°, and in the North Eldorado adit from 25° to 60°. They are doubtless bent into a succession of synclinal and anticlinal folds, and it will be worth noting, as sections are exposed in the mines, whether these recur at short intervals, showing the beds to lie on the whole fairly horizontally, or whether there is a general dip of the whole mass of strata to the north east or south west. This will be of importance in enabling the position of belts of hard country and of strata favourable and unfavourable for gold, should such be found to exist, to be foretold as likely to be encountered in the mines. Present appearances incline me to think that on the whole the strata have a dip to the north east.

It may be here noted that the occurrence of cleavage planes more or less directly across the planes of sedimentation of slaty rocks is essential for the production of good roofing-slate; and as this character is seen to obtain in the Mathinna district, there are grounds for hoping that some of the harder belts of the country rock may be found to yield this valuable product. This possibility is commended to the attention of prospectors.

Though this gold-field was one of the first worked in the Colony, surprisingly little mining worthy of the name has been done in it till quite lately. The old City of Hobart mine, it is true, went down to a depth of 660 feet, but, with this exception, almost nothing had been done at greater depths than 100 feet, and very little even below 50 feet, until the recent success of the New Golden Gate mine led to a revival of speculation and the sinking of several deeper shafts. Numbers of bunches and veins of good stone have been found and worked downwards from surface as long as they were payable in the earlier days of the field, but no systematic work was done, and as soon as the stone became poor, or broken up, or faulted, the mines were promptly abandoned, and the district has in consequence got the name of being "patchy" and unreliable. Later developments have shown that a principal cause of the uncertainty of the veins at surface is, in all probability, the disturbed nature of the superficial country rock, it being necessary to sink some distance before really solid and settled country is reached. A possible explanation of the unusual amount of superficial disturbance has already been suggested. The following description of the various mines will enable me to show what has been done in each case, and allow conclusions to be drawn as to whether this field has been fairly tried and found wanting, as its detractors aver, or if it is a very promising and practically untouched one, as is my own opinion.

Mathinna Mine.—Under this name are now included the old City of Hobart, North City of Hobart, and Champion mines, situated in 20-acre Section, No. 618. The relative position of these is seen on the General Plan, Plate No. 1, sent herewith, and the principal workings on a larger scale in Plate No. 2. The old City of Hobart lower workings are now not accessible, the ground having fallen in. The following particulars have, however, been very obligingly supplied to me by Mr. Peter Irvine, who was manager of the mine in its last days. He writes:—"My remarks will be from memory, but will be approximately correct. In 1877 I took charge of the mine, and was in charge until it was abandoned in 1881-2. When I took charge a shaft 9' x 3' was sunk to a depth of 460 feet from surface. The reef is what is called a 'North-and-South reef'; the true course is about 15 degrees east of north, with an underlay of 1½ in 6 to the west, and with a slight strike or pitch to the north. The quartz from the surface down to about 300 feet was of a white, rather loose nature, averaging about 3 feet wide and very good, being considerably over an ounce to the ton; stone being easily got, the walls or country being a nice soft slate. The quartz below that down to 660 feet, the depth to which I sunk it, was of a beautiful laminated character, the seams greatly charged with arsenical pyrites carrying a good percentage of fine gold; the stone in size about 16 inches; the country here a hard blue slate. At 580 feet deep a slide was met with which threw the reef over 8 feet to the west and also carried the shoot of gold away to the north at an angle of 45 degrees, and I may say that shoot of gold is still there. I tried to induce the company to drive for it, and also the men to tribute for it, but it is left there for a future generation to take out. Now I come to what I believe to be the cause of the stoppage of the works at that mine. There were several reasons: the principal one was the short shoot of stone, only 50 feet in length, and too small to take out without breaking into the hard walls; also want of prospecting, that is, crosscutting and driving on the line of reef, which had splendid walls as far as it was driven on; also the hard country to sink. The last contract for sinking was £9 per foot, good men, and they did not do very well out of it. We sunk for 60-foot levels, so you will see that it took more gold than came out of the one 60-foot stopes to sink for another 60 feet and so on, and we had nothing to spare to do any other dead-work. We had a very nice winding and pumping engine on that shaft with a 7-inch plunger and draw-lift, but not a great deal of water to contend with; but the machinery was too light for the depth—the one engine had to do both winding and pumping." Mr Irvine concludes his letter by saying, "But I have not the slightest doubt that the mine is a good one, and the time will come that, with proper machinery and systematic working, it will prove to be one of the regular dividend-paying mines of the Colony." I may remark that Mr. Irvine's account of this mine agrees entirely with what was told to me by other old residents of Mathinna familiar with the workings. The "eyes were picked out" of the reef, as miners say, and no driving was done on the course of it to find other bunches and shoots of good stone. Where the quartz became too narrow to work profitably it was left standing, and sinking was resorted to until the increasing cost of working and need for more powerful machinery made the mine unremunerative. The machinery was forthwith sold off, the battery dismantled, and the mine allowed to fall in.

It is to be noticed that in the lower workings described by Mr. Irvine the underlay was to the westward: in the adit shown on my plan it is to the eastward. I have not been able to ascertain exactly the depth at which the turn took place, but all accounts agree that there was a change of underlay. The shaft, 200 feet deep, seen on the plan just east of the entrance to the adit was sunk to cut the reef, but failed to do so on account of the change. The main shaft is said to be sunk in solid slate of the footwall country for about 400 feet in the bottom, which, if correct, would show that the turn took place somewhere about the 200-foot level.

The workings now accessible consist of the adit and drives from it shown on the plan. Two attempts have been made to get round the broken ground at the shaft in order to drive southward on the line of reef, but in both cases the old workings were encountered, and the drives were not persevered with. In the western drive from the adit a small reef has been followed, and the same has been traced on surface by trenching, and followed down to the adit level in two winzes. It is gold-bearing, but very small. In the winze at the boundary of the Section it averaged from two to three inches only; and did not improve in size, but rather got smaller in a continuation of the same winze sunk 40 feet below the level of the adit. The quartz is stated by Mr. Clerke, the manager of the mine, to have yielded 13 dwts. of gold to the ton. In this winze the stone was on the hanging-wall; in the one further east it was the same also, averaging perhaps four inches in size, and yielding 12 to 13 dwts. to the ton, but in this case at the tunnel level there appears to be a good deal of quartz running into the footwall as well, and a little cross-cutting might be done with advantage. This reef has in parts very well-defined smooth walls, but in other parts is very much split up and hard to follow. In the drive on it from the cross-cut towards the old main shaft the smooth footwall is cut off short by a slide which doubtless heaves it to the southward, but no attempt has been made to recover it. There are several of these clayey heads and slides running about N.W. and S.E. in the angle between the two reefs, but none of them appear to be faults of any magnitude. Some of them have a little quartz in them, and one at the east end of the cross-cut carries a little gold. It is possible that they may have some connection with what is known as the North City of Hobart lode, which is due to join the City lode somewhere about this place, though possibly the latter lode is itself identical with the former, in which case the vein of stone followed in from near the mouth of the adit would only be a branch. The North City lode is supposed, however, to have been struck in the old shaft, seen in the top left-hand corner of the plan (Plate 2). About 10 inches in thickness of quartz is here visible, and a good deal of stone is said to have been taken out and crushed, but I have no information as to the yield of gold. It thus seems probable that there are either two or three lines of lode joining or intersecting one another near the old City of Hobart shaft; but there appear to be so many small auriferous veins in the surrounding country that definite conclusions as to lines of lode cannot yet be come to.

The main lode is supposed to have been picked up again to the south of the main shaft, in a prospecting shaft about 40 feet deep, shown on the plan. The reef in this is small, about six inches wide, but carries some gold. Further south, on the adjoining Section 885-87G, held by M. Murray and Davidson, a shaft, known as the City of Hobart Extended shaft, has lately (in 1891) been sunk in search of this lode to a depth of some 130 feet. It is only six feet by 3 feet in size—an example of false economy, as such a small shaft can never be used for working purposes. The workings were shut down when I saw them, and much water was in the shaft, so that I could not go below, but gold-bearing stone is reported to have been obtained.

In the south-east corner of Section 618 there are some old workings formerly known as the Champion mine. The reef in these has two branches running between N.W. and W.N.W. A considerable amount of stoping has been done, but the workings are now inaccessible. The quartz is stated to have returned about 7 dwts. to the ton. This lode also should run into or through the main lode.

The workings on the old North City of Hobart lode are in the north-western portion of the same section. For about 130 feet along the boundary a surface trench or underhand stope on the reef still remains open, the channel being from 18 to 30 inches wide, which is said to have been the width of the quartz. The lode dips eastward 75°. A little further to the north-east, in flat ground, are several old pits and trenches in which quartz was obtained. Two shafts were sunk about here, both now fallen in, one 60 feet or thereabouts, from which gold-bearing quartz carrying 6 dwts. to the ton was taken, and the other over 100 feet deep, which was being sunk as a whim-shaft, but never reached the reef. The quartz from the whole of this lode is said to have been of low value, only about 2 dwts. of gold to the ton as a rule.

It will be seen from the above that gold-bearing stone has been obtained throughout the whole length of Section 618, and that there are probably three or four distinct lines of lode in it. The veins as a rule have been small, and difficulty has been experienced in tracing them owing to the quartz running very thin and breaking up into strings. All the lines of lode appear to be converging to a point a little south of the old City of Hobart shaft. The prospects of mining are not very bright, but still in my opinion warrant a trial. It would not, I am afraid, be possible to re-open the old City of Hobart shaft without as much expense as would sink a new one of larger and more convenient size. Further prospecting would be best done from a shaft, and at such a depth as to be in solid settled country. In the old workings the friable white quartz was replaced by laminated stone carrying pyrites at about 300 feet, which indicates this depth as a proper one for opening out at. Exploratory work should then be done by cross-cutting and driving upon the various lines of lodes.

The Mathinna Company possess a fairly good 10-head battery of the usual type, which would be much improved by the addition of a pan to grind blanket sand, and some concentrating appliances such as Fruevanners, for saving pyrites. There is a large quantity of old tailings on the flat ground near this battery which would probably be worth grinding over again.

New Eldorado Mine.—The lodes and workings of this mine are shown on plan, Plate No. 3. The main workings are in 10-acre Section 183-83; they consist of an adit and drives therefrom, some small shafts and trenches on surface, and a new main shaft 3 ft. 8 ins. by 9 ft. 8 ins., 171 in depth. From the latter a cross-cut is being driven at the 163-foot level towards the reef, which was in 100 feet when I visited the mine and has since been extended. This will cut the lode 220 feet below its outcrop, and a little over 100 feet below the adit. The country driven through in it is a hardish slate, the rate of progress of driving

being about 12 feet a week with three shifts. At 58 feet from the shaft a vein of lode slate and quartz about four feet wide was passed through, running N. 80° E. and dipping southerly 47½°. On its footwall there is a good deal of quartz, much stained with brown oxide of iron, and yielding a little gold. It has been called No. 3 lode; since my visit I am informed that it has been driven on both east and west, and that two walls crossing it have been encountered, the distance between them being some 25 feet; the western one runs N. 20° W., carries quartz, and is again met with in the cross-cut at 51 feet past the No. 3 lode; the eastern one runs N. 30° W., and shows three feet of lode-matter. These very probably are two of the cross-courses shown on the plan which cut through the main lode at the adit level, but as they were found since my visit I have not seen them.

The workings on surface on the main reef are seen on the plan. The lode varies from two feet in width down to six inches. In its western part in the trenches where it has been exposed it is from 18 inches to two feet wide, but is poor in gold; coming eastward from these we find a shaft about 27 feet deep sunk on the reef, and showing it to be still poor, but between this shaft and the next one east of it the reef, though narrowed to six inches, is fairly rich, and from here onwards it has been stoped out to depths of from eight to 60 feet. A slide is next met with which heaves the stone to the north, but the faulted portion has been recovered and worked down to the tunnel level with very good results. Some of the quartz from the surface workings on the west side of the slide is stated to have yielded 3 oz. 18 dwts. of gold to the ton, and a crushing of 200 tons gave from 18 dwts. to an ounce. Going still further eastward the reef has not been certainly traced, it being doubtful whether some barren outcrops of quartz on about the same line belong to it or not.

The adit driven to intersect the reef at a lower level was unfortunate enough to strike it where broken by two or more slides, which seem to have puzzled and disheartened the operators. At 228½ feet from the entrance a cross-course was passed through, consisting of a vein 2 inches wide of white pulverulent quartz between well-defined plane walls, striking N. 30° W. and dipping N.E. 49°. This vein is seen again in the eastern drive on the course of the reef, and has been driven on for 62 feet. In this drive its course is much the same as before, but its dip is steeper, being 66° to the N.E., and the quartz in it, though generally soft and pulverulent, is in places hard and glassy. This vein does not appear to fault the lode at all, appearing rather to be slightly heaved itself by the latter. At 245 feet from the mouth of the adit a slide, which we shall call No. 1 slide, parallel to this cross-course is met with, which does fault the lode. This slide strikes N. 30° W. and dips N.E. 50° where cut in the adit, and N. 37° W., dip N.E. 65°, where it passes through the lode in the eastern drive. It generally shows two plain smooth walls separated by ½ to 2 inches of clay. At 299 feet another slide, No. 2, nearly parallel to the last, is met with, striking N. 32° W., and dipping N.E. from 59½° to 65°. There are from 18 to 20 inches of clayey broken slate in this, where it goes into the east side of the adit, and from 6 to 10 inches on the west side. The tunnel has struck exactly the intersection of this slide and what has been supposed to be the main lode channel, along which a drive has been made to the eastward. At 313½ feet from the entrance the adit struck the reef, which was then driven on 102 feet to the westward and 48 feet eastward. In the western drive both hanging and foot walls of the lode are generally distinctly defined and smooth, and the channel between them is from 4 to 6 feet wide. Most of the filling is broken and slipped masses of the country rock, full of strings of quartz, but there is also a distinct quartz vein from 18 inches to 3½ feet thick in the wider portions, and dwindling down at times to only 2 or 3 inches. A rise has been put up 18 feet on the foot-wall, but no stoping has been done, the stone having been too poor to take out. The dip of the walls is from 56° to 64° southerly. In the drive east from the tunnel on this part of the lode the quartz vein is a mere string, increasing, however, to 6 inches in width in the face. The hanging-wall is smooth and well defined, and dips 56° to the southward. A few feet in from the adit a mass of veins of quartz, mixed through with broken country rock, is seen running off to the north-east through the footwall, which may be part of a north-easterly lode. This drive is not yet far enough to the eastward to be intersected by No. 2 slide, which, however, must be close at hand. The drive eastward from the intersection of No. 2 slide by the adit follows a smooth footwall running N. 58° to 60° W., and dipping to the southward 62°, but no quartz was got for the first 30 feet, when the wall made a sudden bend to the north-east, and broken quartz mixed with country rock made its appearance. This, however, appears to cross the drive on a course about S. 35° W., and is probably, therefore, the north-easterly lode seen in the inner eastern drive above described. The quartz is of the same broken character. On the bend in the wall there is from 8 to 18 inches of quartz, but no gold. About 49 feet from the side of the adit the No. 1 slide was struck, and a change in the reef-stuff was at once apparent. The broken quartz of the north-easterly lode is at once cut short off, and gold-bearing stone takes its place. This was followed up, and found to connect with the old surface workings. In the stopes from the tunnel upwards the slide may be clearly traced, forming their western end, and cutting off the quartz. A length of about 50 feet has been stoped on the reef above the level. At 95 feet from the adit a winze has been sunk on the lode to a depth of about 60 feet, but at 38 feet the slide was met with, and of course cut off the stone. This was of very good quality right down to the slide. Another winze has since been sunk 31 feet nearer the adit. Ten feet below the level the slide was struck, and the winze was then continued down in good stone on the intersection of the lode and slide until the first winze was broken into. There is now about 18 inches thick of quartz showing in the side of this later winze in the first 10 feet below the level, but lower down it is very thin, though a good body of stone was found all along the intersection. East of the main winze some 12 inches or so of quartz is seen going off into the hanging-wall. The drive, however, was turned more to the north-east, and soon passed through the lode altogether, the stone leaving it on the southern side 30 feet past the winze. It seems to me, therefore, that the stone going into the hanging-wall just past the winze should have been followed. A block of good quartz has been left unstoped above the winze to protect it, but this appears to be the eastern end of the shoot of gold, for no stoping has been done further in.

Not having been able to examine the old surface workings, I cannot say positively if slides Nos. 1 and 2 reappear in them. According to the ends of the workings seen on surface it would appear as if there was yet another slide running north-easterly, but I have seen no sign of such at the adit level, and it is possible that the old workings at the break extended further west underground than is seen on surface, in which case No. 1 slide would quite account for the heave. No. 2 slide does not appear to have dislocated

the surface workings, and I do not think it will prove to be a fault of any importance. The smooth wall followed from the adit between this and No. 1 slide seems to me probably not to be the lode channel at all, but a parallel wall on its footwall side. It might carry quartz if followed in strike and depth.

Looking at the gold-bearing stone it is seen that the shoot is pitching eastward. The poor stone met with on surface in the western part of the lode corresponds with that portion got at the adit level past No. 2 slide. The rich stone has been cut through by the slide and heaved to the north, but in the adit is still to the east of its position on surface. The eastern pitch is also seen at the east end of the stopes from surface down to the adit. This being the case, it appears to me that the drive now being put in from the main shaft is running towards the poor ground, and that it would have been better to have driven a more northerly course to try to intercept the known shoot of gold. There would also have been a better chance of striking the lode away from the slides, but at present the cross-cut is going fair for the disturbed region.

Before stopping all work at the adit level I think it would be well to extend the drive further east along the lode channel in the workings south of No. 2 slide. This would very soon be met with, and it would be seen if it heaved the reef any distance, which I do not think it will, a piece of information valuable when searching for the lode at lower levels. This alone, however, would not be worth extending the level for, but there is a considerable chance that between it and No. 1 slide gold-bearing stone might be met with. The shoot is much longer at surface than at the tunnel level, and has been cut through by the slide subsequent to its formation. There may be a portion of the shoot still on the western side of the fault which would be worth looking for. The eastern being the most probable down-throw side of the fault, the corresponding cut-off portion of a patch of good stone found on its western side is, however, to be expected at a lower level on the eastern, and *vice versa*.

In Section 569-87G, also belonging to the New Eldorado Company, some work has been done on another lode, known as No. 2 lode. A prospecting shaft has been sunk on the underlay 113 feet, and short drives have been put in at 19 feet, 30 feet, and 83 feet from surface. No work was being done at the time of my visit, and the bottom of the shaft was full of water. Mr. Clerke, the Manager of the mine, informed me that the quartz was a good deal broken up in the bottom, that there was a well defined foot-wall, but the hanging-wall was not seen, and that a good deal of gold was visible in the stone, which he estimated to be worth 14 or 15 dwts. to the ton. The 83-foot level (or 90 feet measured on the underlay) was, however, free of water, and was examined by me. A drive from the side of the shaft has been made 19 feet in direction S. 67° E., the last 10 feet along a well-defined footwall. This comes into the drive with a somewhat sudden bend, emerging from the country north of the shaft on a course S. 42° E. In the face there is about 12 inches of quartz carrying good gold, and a stope has been taken up above the level for 25 or 30 feet. The dip of the footwall in the stope is 75° to the southward and in the level 81°, so that the reef appears to here turn a little steeper. Below the level the dip continues about 81°. Round the shaft itself there is quite a large number of small veins of quartz running across the lode-channel towards the footwall and carrying gold, but so much mixed with country rock as hardly to be worth taking out. Very little has been done at the 30-foot level. At the 19-foot level a drive runs N. 85° E. for 8 feet and S. 80° W. for 27 feet from the shaft. The stone varies from eight to eighteen inches in width, and at this level carried very payable quantities of gold; much country rock would, however, require to be taken out and crushed along with the quartz. In sinking the shaft the hanging-wall of the lode was followed in the upper part, but it is badly defined and not always easy to trace. At the 90-foot level the footwall came in as already mentioned; in the upper levels it is not seen, the lode-channel being therefore of a considerable width between the walls. In all 77 tons of stuff were crushed from this shaft for the very good return of 105 ounces of gold. The lode is therefore well worth further exploration.

In Section 538-87G another reef has been exposed by trenches crossing the crown of a ridge. There is a great deal of loose quartz about the surface here, and a little gold has been obtained; no mining work has yet been done. The No. 2 lode should run into this one, and the junction of the two, being a likely place for gold, should be sought for. Three other small veins shown on the plan have been discovered, all carrying a little gold. The one in Section 524-87G occupies a very distinct fissure in the schist rock, and is said to have yielded several small rich specimens; it is, however, only $\frac{1}{2}$ to 2 inches in width.

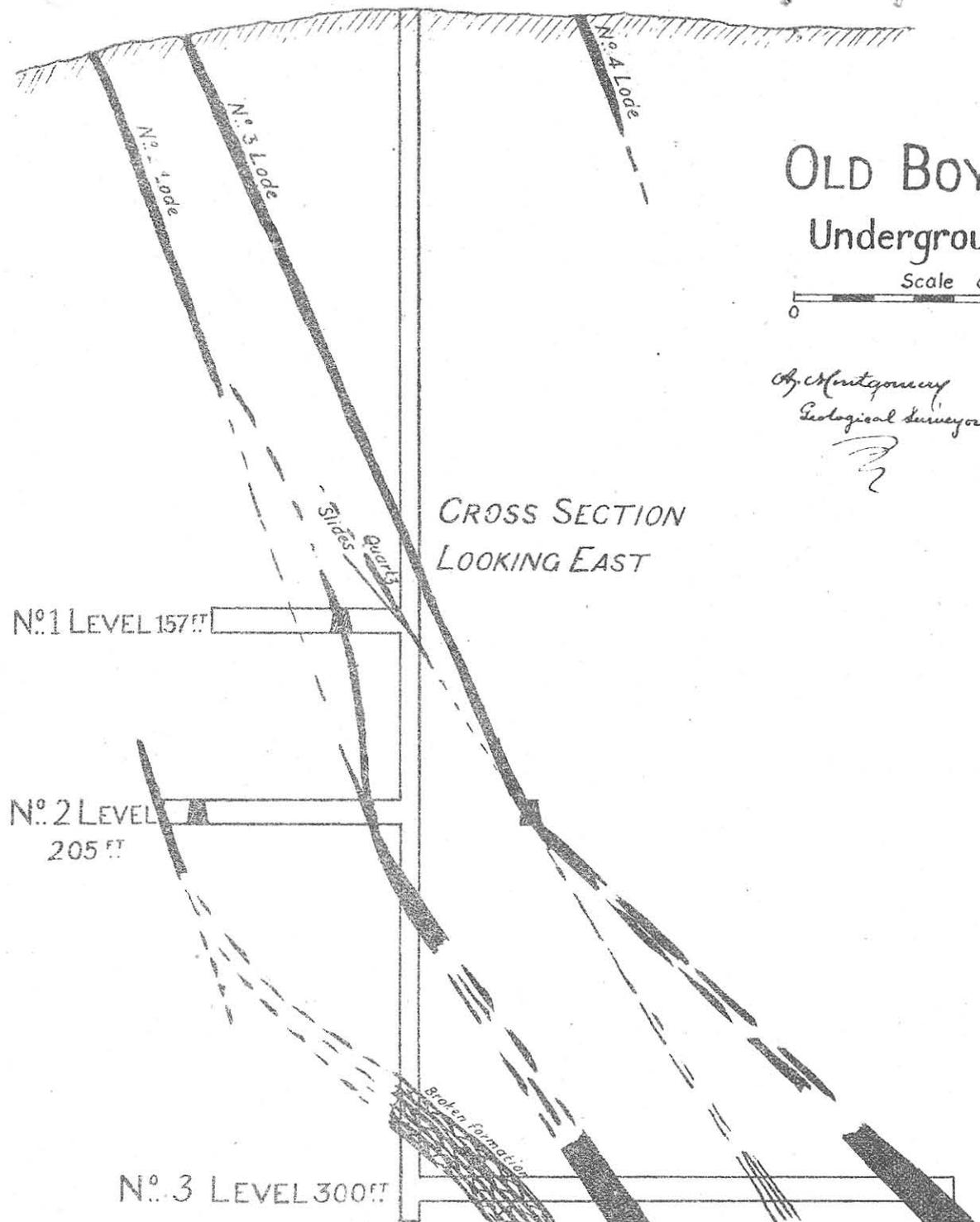
Mr. Henry Simpson, manager of the New Eldorado Company, has kindly supplied me with the following list of crushings from the mine for the last six years:—

1886	31st December	40 tons quartz gave	28 ozs. gold
1887	30th January	45	100 "
"	12th March	38	58 $\frac{1}{4}$ "
"	30th April	90	191 "
"	30th June	135	229 "
"	15th August	90	94 "
1891	14th November	30	64 "
1892	19th February	45	40 $\frac{1}{2}$ "
"	8th August	22	5 $\frac{1}{4}$ "
TOTAL		535	810 "

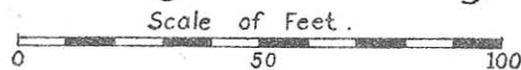
Mr. Clerke, mining manager, informs me that besides these crushings there were some others of older date, one of which yielded 100 ounces of gold from 29 $\frac{1}{4}$ tons of quartz. He estimates that quite 500 tons more have been crushed.

It will be seen that the value of the crushing-dirt has been exceedingly good, giving an average return of over an ounce and a half of gold to the ton. This should encourage the owners to go on with their main shaft and prospect the lode thoroughly. Other shoots of gold are very likely to be found, and as the reef appears to be a strong well-defined one there is every inducement to give it a fair test. The No. 2 lode is also well worth working on.

North Eldorado Mine.—Section 396-87G.—The reef worked in this section is nearly parallel to the Eldorado main reef, and is shown on the general plan, Plate 1: it has been traced on surface by trenches

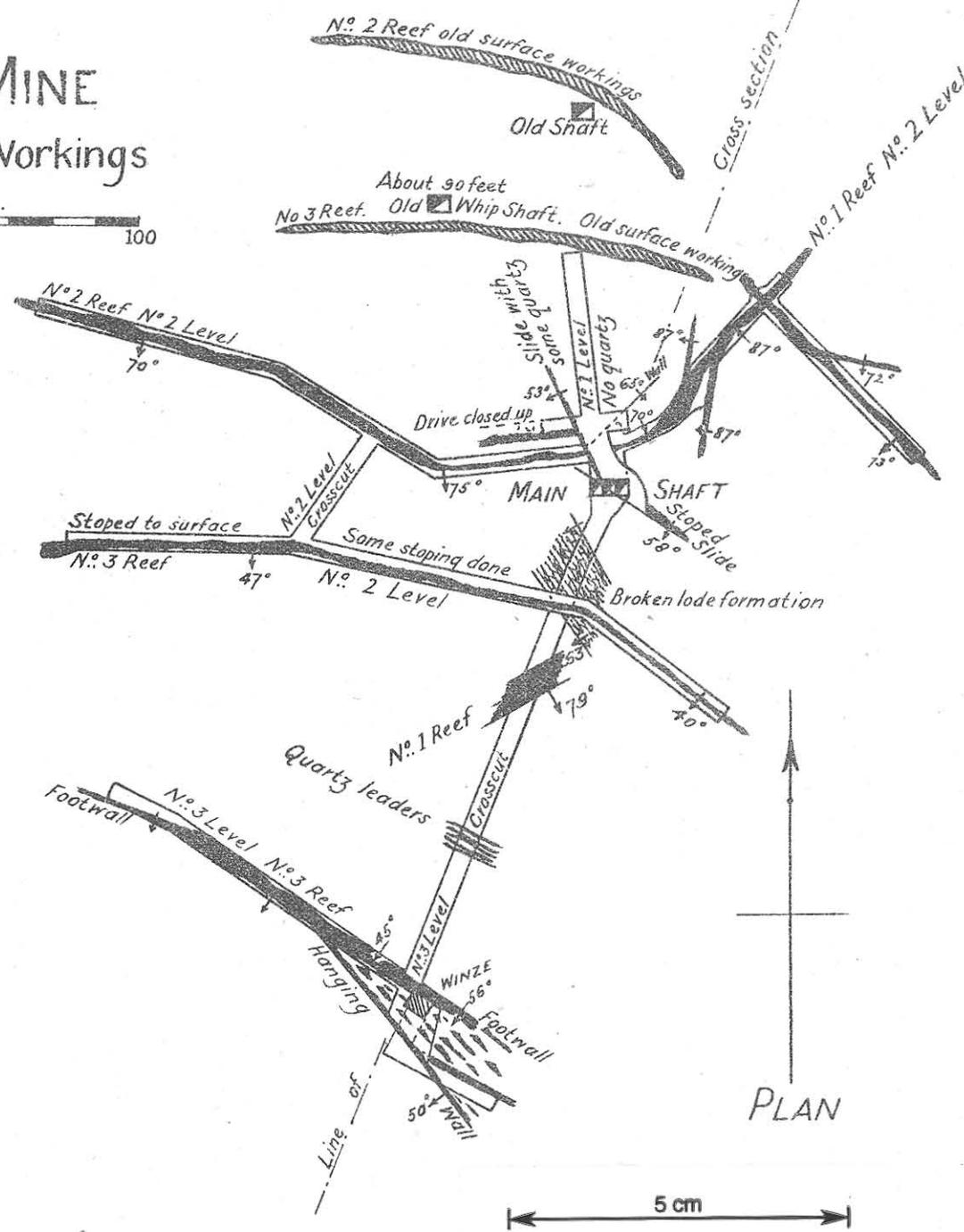


OLD BOYS MINE Underground Workings



*By Montgomery
Geological Surveyor*

PLATE N^o. 4.



for over three chains. A small shaft has been sunk on the underlay to a depth, it is said, of over 110 feet, but the only recent workings are at about 60 feet. At the time of my visit a party of tributors had just finished taking out a small trial crushing of six tons of quartz, but as they had removed the top ladders and windlas-rope I did not get down into the workings. They report the stone to average about 18 inches in thickness. The reef underlays to the south about one in eight. As far as I could learn locally, the quartz from this mine has not been rich, and the workings are of very small extent. In order to cut the lode a tunnel has been driven at a level about 90 feet below the outcrop for a distance of 261 feet, but without finding it, though considerably past the point where it might have been expected to be met with. About 180 feet from the mouth of this adit a break in the country rock and a few strings of quartz may perhaps indicate the passage of the reef, being near the spot where it ought to have been cut. This break might be driven on with advantage towards the shaft to prove if it really is the lode.

Old Gladstone Mine.—Section 470-87G.—These workings are on a reef also running nearly parallel to the Eldorado reef: they have been abandoned for some time, and the shafts being full of water little is now visible. The reef appears to have been from two to three feet wide, the walls, as far as seen, showing themselves smooth and well defined. About 60 tons of quartz are said to have been crushed from here, yielding from 9 to 11 dwts. of gold to the ton. The underlay is about 18 inches in six feet to the southward. The workings seem to be of very small extent. This lode, from its position, might be identical with the one traced across the crown of the ridge on Section 530-87G of the New Eldorado ground.

Old Boys Mine.—The sections held by the Old Boys Gold Mining Company, No Liability, are 390-87G, comprising the old Black Boy mine, 394-87G, the old White Boy, and 393-87G, the old Yellow Boy. The position of the lodes is shown on Plate 1, and the more modern workings in plan and section on Plate 4. It is difficult now to get any accurate information as to the workings of the old mines, every statement concerning them having to be accepted with reservation. The Yellow Boy main shaft is a small one, about 5 feet by 3 feet, and is said to be over 100 feet deep. The stopes now open at surface appear to have had a reef from 18 inches to 3 feet wide in them, from which good quartz is stated to have been obtained: this lode runs north-easterly. The Black Boy workings were on two large reefs which crop out on the spur, towards the northern end of which the Boys shaft is situated. Several shafts have been sunk on these, and a good deal of stoping and surface trenching has been done, but the workings are not now accessible. The two reefs junction near the south boundary of 390-87G, and here a shaft was sunk to a depth of over 120 feet, the first 40 feet vertical, the remainder on the reef, which has an underlay of 1 in 2 to the westward. Mr. S. Richards, the manager of the Old Boys Mine, some time ago rigged a windlass over this shaft, and with great difficulty and risk got down into the old workings, and found that at the 120-foot level 80 feet had been driven on the lode south and 30 feet to the north. In the south end the lode had pinched; in the north it was 12 feet wide: the stone carried a little gold, but not enough to pay. In the surface trenches parts of the lode are still exposed, and the two reefs average each from two to six feet in thickness. A good deal of quartz is reported to have been crushed when the mine was at work for returns of from 4 to 10 dwts. of gold to the ton, but on the whole the reefs were not payable under then existing conditions. In Sections 435-87G and 434-87G the reef has been traced southward by several trenches and old shafts and much surface quartz, and would appear to be turning more to the south-east, but no workings of importance have been executed. The immense quantities of loose quartz on the surface testify to the strength of the reef.

It will be seen from Plate 1 that the western branch of the Black Boy reef is running directly for the new main shaft of the present company. It has not, however, been traced right through to it. The Old Boys' main shaft is the old White Boy shaft, which has been repaired and sunk deeper by the present owners. It was put down to cut two reefs which had been worked by small shafts from the surface downwards. These, now known as Nos. 2 and 3 reefs, are reported to have yielded quartz of value over an ounce to the ton from the old surface workings, some of which were 90 feet deep. They run between west and west-north-west, and underlay to the south. Another reef, parallel to these and now known as No. 4, lies under the engine-house, south of the main shaft, but the old workings have been filled up and can hardly now be seen at all. The lode known as No. 1 reef was not seen at surface; it runs north-easterly, and appears to junction with No. 2. Three levels have been opened out from the main shaft, at 157, 205, and 300 feet. At No. 1 level little can now be seen, the drive west on the lode having been filled with mullock. Two clayey slides are here seen close to the shaft, as shown on Plate 4, both dipping south-west. Though they apparently cut off the reef at No. 1 level, they are not met with at No. 2, which shows them to be of no consequence as faults. A little quartz is found on each of them, and a small stope has been taken out on the east side of the shaft on one. At No. 2 level a considerable amount of driving has been done. Nos. 1 and 2 lodes appear to join one another just north of the shaft. No. 1 has been followed 58 feet to the north-east. There is but little quartz in it, and this is in veins from 3 inches and less up to as much as one foot in thickness in different parts of the lode-channel, which is mainly filled with squeezed and much contorted lode-slate. Several smooth clean walls are seen along the course of the drive, and it seems to me that the lode-channel is a fairly wide one, probably not narrower than 6 or 8 feet, and filled with fallen-in country rock through the interstices of which veins of quartz have formed, but likely to be filled with solid quartz in other portions of its extent. The several smooth walls and strings of quartz, the clayey selvages on these walls, and the constant occurrence of lode-slate wonderfully contorted by pressure, show the lode to be of the fissure-vein type, and argue well for its permanency. As we shall see later on, the New Golden Gate reefs in parts show exactly similar features. 7 feet from the end of the drive on this reef another line of lode running N.W. and S.E. is met with. This appears to pass through the No. 1 reef without dislocating it to any extent, which may, perhaps, be due to the almost vertical dip of the latter. A drive has been made to the south-east along this new reef a distance of 50 feet. It winds about a good deal, but on the whole preserves an even course. At first it contained from 6 to 18 inches in thickness of quartz, but at 19 feet 6 inches of quartz run off on a more easterly course along a smooth wall, and from this point to the end of the drive there is hardly any quartz.

In the face the lode-stuff is 2 feet 9 inches wide, with only a little quartz on the hanging and foot walls. This reef has well-defined smooth walls dipping south-westerly 73°, but, like No. 1, is mostly filled with lode-slate at this level.

Westward of the shaft the drive has been carried 140 feet along No. 2 reef. There are only strings and bunches of quartz in a channel filled with broken and squeezed lode-slate along this drive. The channel is from 8 inches to over 6 feet in width, and has smooth walls with clayey selvages. As shown on the plan, a cross-cut has been driven at this level to cut No. 3 reef, and drives east and west have been made along this. The drive west is 53 feet in length, and above it the ground has been stoped up to or nearly to the surface, the shoot of stone having apparently a pitch to the south-west. In the face the lode is much broken, but appears to be a large mass of quartz, and to be making into a strong body of stone in the south-west corner. In the drive east, which is 109 feet long, there is little more than a mere string of quartz, the channel being from 6 to 8 inches only in width, and mostly filled with crumpled lode-slate. One or two small stopes have been taken out where patches of quartz have occurred.

At No. 3 level a cross-cut has been driven in a south-south-westerly direction a distance of 134 feet. From 13 to 30 feet from the shaft a lode, consisting of broken twisted lumps of country rock with a good deal of quartz through it carrying a little gold, was passed through. The walls were not at all distinct, and the course is consequently not well ascertainable, but it appears to be N.W. and S.E. The same lode was passed through in the shaft a short distance above the plat, and from its course and dip it is therefore very probably identical with the reef in the east end of the drive on No. 1 lode at No. 2 level. Between 44 and 54 feet from the shaft No. 1 reef is met with in the cross-cut. It was also cut in the shaft from 15 to 24 feet below No. 2 level, and though lying rather irregularly had at times as much as 3 feet of gold-bearing stone, which was saved for crushing. In the bottom level a little gold can be obtained all through the lode formation, but there is only a little quartz, and that much mixed with broken country rock. Towards the footwall some bluish quartz seems identical with a band of stone passed through in the shaft in which the best gold was got. At 89 feet the cross-cut went through several small veins carrying a few "colours" of gold. These have been taken to be No. 2 reef, but I think they are more likely droppers from No. 3, as shown on the section, and that No. 2 is not seen on account of its junctioning with No. 1 as in No. 2 level above, on the west side of the cross-cut. At 122 feet the footwall of No. 3 lode is struck, dipping here much flatter than in the level above; indeed all the reefs appear to run flatter below No. 2 level. From the cross-cut a drive has been extended west 80 feet, the footwall being followed for 33 feet, after which it veered round more to the south, and in the face is in the south-west angle of the drive. At 33 feet the hanging-wall came in on the south side, and in the face the two walls are close together, with 12 inches of lode-matter between them. The contents of the reef in this drive are lode-slate, with but little quartz and very poor in gold. Seeing that the shoot of stone in No. 2 level pitched westward, however, and that this drive is not yet far enough west to be under where it might be expected, I think it would be advisable to continue driving another 50 feet in the hope of getting the same run of gold-bearing stone. It is to be noted that so far as this drive has been extended no sign has been yet seen of No. 1 reef running into it, though from its course both at No. 2 level and in the cross-cut it ought to have been met with, which leads me to think that it must turn round in the same way as in No. 2 level to join No. 2 reef. Possibly, we should not call Nos. 1 and 2 reefs separate lodes, but regard them as one and the same, though much bent. The cross-cut has been continued on to 134 feet from the shaft, and terminates against the smooth hard hanging-wall of No. 3 reef, dipping S.W. 50°. In the floor on the footwall a body of gold-bearing stone was cut, pitching west so as almost at once to disappear beneath the drive west on the reef. Had the cross-cut struck the latter four feet further west the stone would have been missed unless a drive had been put in to the eastward. Going east the stone is rising, but at the time of my visit it was not possible to estimate at what angle. A winze had been sunk on the underlay 24 feet, and a drive put in along the footwall 26 feet east from the winze, when I saw the mine. At the winze there were 18 inches of solid gold-bearing quartz, and in the face from 12 to 15 inches. The quartz contained a good many specks of arsenical pyrites and galena, which in this district, are generally associated with gold. This body of quartz was separated from the lode-slate in the reef channel on its west end by a distinct selvage and similarly from the broken lode-slate forming its hanging-wall: the true hanging-wall of the formation is seen in the chamber for the winze to lie twelve or more feet south of the footwall carrying the quartz. The lode formation seems to be getting wider at this point. It may be remarked that the occurrence of the gold-bearing quartz here in a body separated from the main lode-slate filling of the reef channel by selvages is exactly similar to the way in which several of the gold-bearing bodies of stone in the New Golden Gate mine have been found. A crushing of 67 tons of quartz from this place, including however, a few tons of stone from the No. 1 reef, were passed through in the shaft, yielded 43½ ounces of gold. Since my visit I understand that work has been continued on this stone, which has narrowed and widened again more than once, but continued to yield payable quartz. This shoot lies to the eastward of all the upper workings, and might perhaps be met with by extending them. The pitch of the ore to the westward recalls that the shoot on the same reef worked above No. 2 level was also pitching westward, and gives hope that this mine will show the feature so common in many others of several parallel shoots of ore. It is encouraging also to find good quartz in the east end of the lode, for it is in that direction to my mind that prospecting should be most vigorously carried on in the hope of reaching the intersection of these reefs and the main reef of the old Black Boy workings. This is more likely to come on the east side of the shaft than on the west, and the very frequent richness of junctions of lodes makes them always worth exploration.

This mine seems to me a very promising property. The lodes are of a considerable size, and have been proved persistent to a depth of 300 feet, and show stronger and better defined in the bottom than in the upper levels: though much filled with worthless lode-slate they have in two places shown shoots of payable stone; they doubtless join or intersect within a short distance the strong Black Boy line, which though poor where worked was nevertheless gold-bearing and consequently in other parts of its extent may be rich, and the country rock appears to be more settled at the lower levels. To predict success to a mining venture in the present state of this one would not be justifiable, and would be the assertion of a hope or

probability as a certainty, but there are undoubtedly good grounds for entertaining expectations of success and consequently for spending money freely in the vigorous development of the mine by sinking and driving,—sinking I regard as of the first importance.

In Section 394-87G, 184 feet from the south-east corner, a prospecting shaft has been sunk on a small gold-bearing lode which from its course and position may be part of the old Yellow Boy reef. The stone was followed down to 18 feet, when a slide came in dipping easterly and cut it off. The shaft was then carried down to 80 feet and cross-cutting commenced; when I visited this work a drive had been put in 11 feet on a course S. 45° E. Some quartz about 12 inches wide with a good deal of intermixed slate was cut 9 feet from the side of the shaft; course S. 77°, W., dip S.E. 71°. Should the Yellow Boy reef be found in this shaft it would be worth driving on to its junction with the Black Boy reef.

St. Patrick's Mine.—A small reef, which is very likely an offshoot from the main Black Boy line, but may be connected with the east and west reef of the Mathinna Company's holding, is found in Section 437-87G, and has been traced by trenches eastward into 465-87G. A prospecting shaft, six feet by three feet, has been sunk on the underlay to a depth of about 60 feet, and about 40 feet further east another small shaft, now fallen in, has been put down. No work had been done for some time in the mine, and the ladder way seemed very insecure, so I did not go down into the workings. Very little quartz was in the paddock, though none is said to have been taken away, and as far as I could see the vein is very small both in the shafts and the trenches.

The New Golden Gate Mine.—This mine has been the cause of a revival of mining in the district, and is by far the most important in it. It presents several very noteworthy features, and throws much light on the nature of the reefs of this locality and must therefore be described in considerable detail. The principal workings are in Section 13-87G; the shaft and surface workings are marked on Plate No. 1, and all the underground workings are shown in plan and sections in Plates Nos. 5, 6, 7, and 8. The ground has been held by three or more successive owners, the predecessors of the present company having been unfortunate enough to pass over the main auriferous bodies without finding them. Their operations were on what is now known as the western reef; this was worked down from surface at first, and then a long adit was put in to cut it about 50 feet below the surface. In the first half of this two lode-channels were passed through, now recognised to be those of what are termed the Main and Loane's reefs. At the time they were cut they were not thought anything of, as was indeed only natural, as there is very little in them to distinguish the lode-stuff from the country rock. From end to end of this adit the latter is much weathered and broken, and contains a great many veins and bunches of quartz, and the two lode-channels appear very little different from the rest of the country, being filled almost entirely with broken slate and clayey matter with but little quartz. About 210 feet in the adit passed through a mass 10 feet thick of quartz veins lying in irregular fashion in the country rock without defined walls, and 15 feet further in another lode was struck. This contains a good deal of quartz and much country rock, with strings of quartz running through it. The walls are not clearly defined, the most distinct being one which has a north-westerly course and north-easterly dip. This agrees fairly well with the position of the reef at the No. 2 cross-cut 146 feet lower. A little driving has been done on this lode as shown on the plan, almost entirely in lode-matter containing much quartz; these drives are utilised as a powder magazine. The name of the Central reef has been given to this lode. Between this and the Western reef at the adit level the country rock contains many bunches and veins of quartz, and though this feature is not seen at the lower level, I am disposed to believe that the Central and Western reefs are branches of one and the same lode, and that they will be found to unite going north and perhaps also to the south. The Western reef was reached in the adit 310 feet from the entrance, and has been driven on at this level as shown in plan. In the drives several smooth hard walls are seen, but these do not appear to be main walls in every case, there being several walls in the lode-channel, a feature also often exhibited by Loane's and the Main reefs. Some of these are marked on the plan. In the old workings the reef had a slight underlay westward, but the general dip of the walls and of the stone in a winze sunk on the footwall is to the east, and in the lower level the reef lies to the east of its position in the adit, so that on the whole it has an easterly underlay. The reef in the workings has varied very much in width, from only a few inches of quartz up to eight or nine feet. In the southern drive the lode is much broken, and a stope has been taken out underfoot to a depth of about 35 feet on a vein of stone that runs almost at right angles across the general course of the reef. The present owners have done very little in this part of this mine at the adit level, and it is difficult to get accurate information as to the old workings. Mr. James M'Murray, who was the last to work it (about 1881) on any considerable scale, states that his first crushing of 23 tons yielded 9 dwts. 12 grs. of gold per ton; his next of 124 tons gave 13 dwts. 12 grs. to the ton; and then a still larger crushing of between 200 and 300 tons only returned from 3 to 4 dwts. to the ton. Two parties had previously worked the reef and taken out more or less gold. It will be observed on the plan that both at adit and No. 2 levels the footwall runs off into the country on an almost southerly course, corresponding with that of the longest body of old workings, and it may therefore be possible that going south this reef branches, one part going south-east to join the Main and Loane's reefs, and the other keeping a southerly course. Against this may be urged that the reef must turn to the west of north going northwards or it would have been cut sooner in the western cross-cut of the North Golden Gate mine, unless perchance its underlay changed. At No. 2 level both Central and Western reefs have again been cut, as marked on plan. The Central reef is still badly defined, but a little gold has been got in it in a winze sunk about 18 feet. The Western reef, where first struck, is composed of from 3 to 4 feet of solid quartz containing a little gold, but 30 feet from the cross-cut it gets small and in the face there is only a little quartz, the lode-channel being 4 feet 6 inches wide, filled with lode-slate. As this reef has been payably gold-bearing in parts it should not be neglected altogether, but a certain amount of prospecting should be steadily carried on upon it. It will be easier to do this from the shaft at the 600 or 700 feet levels, however, than higher up, as there will not be so far to drive to reach the reef. (See cross-section, Plate No. 6.)

The discovery of gold which has given the New Golden Gate mine its present prominence was first made in the adit level, a little gold-bearing quartz having been found by A. Loane while picking into the

floor of the drive where the lode-channel of the reef which now bears his name had been passed through. This led to his sinking a winze in which more gold-bearing stone was got, the quartz yielding 1 oz. 8 dwts. to the ton. About 40 feet below the adit the weathered yellowish slate country changed to blue slate, this depth being apparently the limit of superficial oxidation by the atmospheric influences, and the reef almost at once became a solid body of quartz from 2 to 4 feet in thickness; down to this level it had been rubbly and broken. The main shaft was then sunk, and about 100 feet down struck a till then unknown reef carrying gold, now known as the Main reef. Since then the development of the mine has been vigorously and skilfully prosecuted, with highly remunerative results. The shaft is now 510 feet deep, and the No. 6 or 500 feet level is being opened out, while there are large reserves of crushing stuff still in the upper levels to be stoped.

The Main reef and Loane's reef both alter their course pretty frequently, but on the whole are fairly parallel in the northern portion of the mine. South of the shaft they junction, as shown on plan, the junction getting further and further south at each successive lower level. Towards the north end the reefs must either diverge pretty widely or else Loane's reef splits into two branches, the western one of which diverges rapidly from the eastern, otherwise the Main reef could not be missed by the cross-cut from the North Golden Gate shaft, which appears, however, only to have cut Loane's reef or a western branch from it. In the fact of the workings being at the junction of the Main and Loane's reefs with one another, and also not far from that with the Central, and perhaps, Western reefs, lies the explanation of a number of the unusual features presented by this mine, and a possible key to the question, of much interest to the district, as to where to look for the extensions of the New Golden Gate lines of reef.

On the plan the portions of the reefs carrying payable gold-bearing quartz have been dotted, the parts left white being "dead ground" generally filled with broken and twisted lode-slate carrying but little quartz, and not payable to take out. There is very often a distinct selvage between the body of auriferous quartz and the "dead ground." The dotted portions on the sections, plates 7 and 8, also indicate the auriferous quartz. The size of the reefs, as might be expected, varies very much, from quite small to as much as 30 feet. At No. 4 level Loane's reef was 22 feet wide, all payable stone. On the Main reef above No. 4 level one of the stopes was 18 feet wide, the quartz being a solid white mass from side to side. Widths of from 6 to 8 feet of stone have been common in various parts of the mine, and probably to say that the quartz averages 4 feet in width throughout the ore-bodies would be a conservative estimate. Some of the quartz is remarkably white and like loaf-sugar in appearance; some laminated, the layers of quartz being separated by thin seams of greasy black polished slate; in other parts it frequently contains angular fragments of the wall-rock, and shows brecciated structure; and not uncommonly it exhibits smooth highly polished slickensides or friction surfaces. In both reefs the number of smooth planes or "walls" coated with clay, often exhibiting striæ and other evidences of motion of the walls one upon another is very noteworthy. These may often be taken for the true walls of the reef, when they are in fact a very considerable distance from it. In some instances in breaking into these apparent walls, other bodies of quartz, or "splices," as they are often called by the miners, are found behind them, and there may be several such splices separated by smooth plane surfaces between the walls of the lode-channel. This feature makes it necessary to frequently cross-cut in order to be sure of not missing bodies of stone. Even after cutting through all the quartz bodies, however, it would not seem that the true walls of the lode-channel are always reached, for the country rock seems to be much broken and often full of strings of quartz,—has, in fact, the character of the "horses" of slate met with in lodes. Between Loane's and the main reef this is particularly noticeable, and while it is evidently to be expected in the country lying between two contiguous reefs, it also points to the possible explanation that these two are really one reef separated by a large "horse," the lode-channel extending from the hanging-wall of the Main reef to the footwall of Loane's. Both these walls appear to be better defined and more persistent than any of the numerous others met with between them, and the water traversing the rock appears to drain along them in preference to other channels. The "main hanging-wall," as it is called, is a particularly well-defined fissure. It was first struck at 70 feet from the surface in the main shaft. It is again met with in a small cross-cut to the east of the shaft at No. 1 level, also along the northern part of the drive on the main reef at No. 1 level, and again in the cross-cut east from the junction of Loane's and the Main reef at the same level. It has therefore on the whole a north-north-westerly course. It is again well seen in No. 3 level in the north drive on the Main reef, and is perhaps also seen in No. 5 level, but had not been bared enough to make certain when I saw it. It is generally very hard and smooth, and affords passage to a good deal of water, which deposits brown oxide of iron as it oozes out. The main footwall of Loane's reef is not so well-defined as this hanging-wall, but shows distinctly in several parts of the mine as marked on the plan. It is significant that the main hanging-wall has not been met with in the drive at No. 4 level east from the junction of the two reefs, and probably it lies still further east.

At No. 1 level there are some features of the mine to be noted. On the plan a drive is seen running to the westward in continuation of the cross-cut from the shaft to Loane's reef. This reef was met with sooner than was expected when being driven for, and the cross-cut was therefore extended through it to make sure that it was really the one looked for. A reef-channel was followed, from six inches to two feet wide filled with clayey lode-slate containing a little quartz. At about the distance where Loane's reef was expected a clayey head was cut through, which appears to be really the footwall of the reef. The cross-course followed runs right through this to the quartz portion of the reef, between which and the shaft it was no longer seen. After passing through the footwall the cross-cut still followed along the cross-course, the footwall of which makes a decided bend round to the north-west in the end of the drive. Nothing corresponding to it has been found in the cross-cut at No. 2 level below. It seems to me most likely to be simply a fracture of the country, extending probably from the Central to Loane's reef and formed at the same time as the main set of lode-channels. In the drive north on Loane's at this level the reef suddenly took a bend to the north-west, and while on this course carried neither quartz nor gold, but was filled with lode-slate. On bending to the east of north again the quartz was once more found. The break was at first taken to be a slide, but as no similar fault occurs in the Main reef nor in this one at the next level below, this cannot be so. The reef has a large "horse" in it at this point between the quartz and the footwall

met with in driving westward, and the blank ground lies along the north side of this mass, which has wedged out by the time No. 2 level is reached. A very similar piece of dead ground is seen at the south junction of Loane's and the Main reef at No. 1 level, the channel of the former breaking suddenly across to join the latter, and being filled with lode-slate instead of quartz. The drive from this junction eastward to the main hanging-wall is worth noticing: it has followed a smooth wall carrying a little quartz and dipping to the southward. The country is pretty solid, but yet does not seem altogether undistributed, and in parts close to the smooth wall it is much contorted or puckered in minute folds of the thin layers of slate. The wall has every appearance of being a slide, but the Main reef passes through it without being heaved. What is clearly the same wall is met with again in No. 4 level, where, however, it is Loane's reef that goes on through it without dislocation. If the break had been a slide it might have been possible for it, under some circumstances, to have faulted the one lode and not the other, but it could not fault the one lode at one level and the other at a lower one: hence we see that it is not a slide at all, but only a break through the block of country lying between the reef-channels and the main hanging-wall. It is therefore probable that south of this break there is a large "horse" of country lying between the reef-channel and the hanging-wall, and there is a considerable likelihood of quartz being found in some parts along the latter if followed. To test this a cross-cut is being put in at the No. 4 level. The country in it, so far as had been driven at the time of my visit, was hard solid slate, apparently undisturbed. Should the hanging-wall be found as anticipated, but not carrying quartz, it will be advisable after following the reef-channel further south some considerable distance to again cross-cut for it, unless the reef turns more to the south-east and runs back towards the wall. The present workings may be merely the south end of a similar large "horse" which widens going northwards, and it is possible therefore that the south point of this new wedge of country may also be rich.

The southern extension of No. 1 level from the junction and that of the No. 4 are both in dead ground, the reef-channel being filled with lode-slate carrying but little quartz. The general parallelism of these two levels in their southern portions is very marked, as seen on the plan. The No. 1 level, however, does not show a feature which is well seen in Nos. 3 and 4 levels—namely, the junction of the lode-channel with another one coming in from the north-west. This is likely to be the Central reef coming in to join the Main line, and so probably connecting it with the Western reef. When this lode was struck at No. 3 level the winze on the Central reef at No. 2 level, which was standing full of water, was almost immediately drained.

In the north end of the mine the drives on Loane's reef have been generally short, not having been pushed any distance into the dead ground. The forking of this reef at No. 4 level is to be remarked. One branch runs about due north and underlays eastwards, the other runs nearly straight towards the workings of the North Golden Gate mine on what is nearly certainly a continuation of it. This western branch has a slight westerly underlay, as has also the North Golden Gate reef. (It is to be borne in mind that the No. 4 level of the New Golden Gate mine is nearly 100 feet above the level of the North Golden Gate cross-cut.) It does not seem that the east branch of Loane's reef continues its northerly course very far, as it would have been cut if so in the northern extension of the drive on the Main reef at the same (No. 4 level), which, as seen on the plan, runs considerably west of north. And if it turns west of north to any extent it is hard to see how it could fail to have been cut in the eastern North Golden Gate cross-cut, even allowing for the easting due to the underlay and difference of level of the two drives. Two possibilities therefore present themselves,—either the eastern branch of Loane's reef bends round to the north-west rapidly and rejoins the Western one before reaching the boundary between the New Golden Gate and North Golden Gate mines, or else it has only swerved a little to the westward, enough to make it still lie ahead of the drive on the Main reef. The former supposition implies an entire change of underlay of the northern part of Loane's reef, and I therefore think it much more likely that the latter is the true one, and that the eastern North Gate cross-cut would have to be extended still more to the east before it would reach the east branch. With regard to the western bend of the north part of the drive on the Main reef at No. 4 level, it is to be noticed that a footwall runs off to the east at the beginning of the bend (at the winze from No. 3 to No. 5 level), and that the quartz almost immediately gives out and is succeeded by lode-slate when the lode begins to turn, so that I incline to believe that the drive has left the main reef at the winze and followed a break in the country between the two lodes which connects their two channels, and consequently that if the drive were extended a very little further it would strike Loane's reef. The wall at the winze, if followed, might then lead on to a continuation of the Main reef stone.

The longitudinal sections, Plates 7 and 8, show that the body of auriferous quartz has been fairly continuous in both reefs from about 70 feet below surface downwards, and that it has a certain amount of pitch towards the south. In the Main reef, below No. 4 level, there was blank ground, as shown on the section down to No. 5, but at this level a new body of auriferous stone was encountered, which appears likely to be of great importance. In the way in which it was divided from the lode-slate filling of the dead ground by a clayey selvage, this quartz body closely resembled the one met with in the Old Boys mine at No. 3 level in No. 3 reef previously described. In the north end, at the time of my visit, two horses of country were causing this stone to branch, the best gold-bearing quartz being on the foot-wall. This "new make" of stone, as it is called, is a fine strong body of quartz, and will probably continue good in depth. It will be soon tested by the works from the 500-foot level now in progress.

It has been noticed by the mining manager, Mr. Thomas Andrews, as a general rule throughout the mine, that when the lodes bear towards the east of north they carry gold-bearing quartz, and when they veer round to the west of north to any considerable extent the quartz is replaced by barren lode-slate. There are a few minor exceptions to this rule, the most notable being the north part of the Main reef at No. 5 level, but on the whole, as may be seen by an examination of the plan, it holds good substantially all through the mine. In the Western reef, too, the gold-bearing stone was mostly obtained where it had a course a little east of north. While not disposed to agree that a rule may be founded upon this fact that the portions of the reef still unexplored running east of north are likely to be the gold-bearing ones, while such as bear west of north will be poor, still there are certainly grounds for such an opinion, and it will be of much interest to observe if the future workings prove the rule to hold good. Extension of the drive north at No. 4 level on the Main reef would be a convenient and rapid way of testing it practically. If this lode continued on its north-westerly course it must have been cut ere now in the North Gate cross-cut,

but as it has not been so cut it must turn again to the north or north east, and, consequently, by following it, it should soon be got again on the strike favourable for gold. As already mentioned, however, I am inclined to regard the apparent turn of the reef to the north-west as a break through the country to join Loane's reef, and to suspect that the Main reef has been left in the eastern wall of the drive; in which case the test of the hypothesis would be unsatisfactory.

In the New Golden Gate Company's section, 32-87G, and in the south-east part of 13-87G, a number of trenches and pits have been from time to time sunk on leaders and strings of quartz, more or less gold-bearing, marked on Plate No. 1, which appear to indicate a large lode channel or run of lodes going in a south-easterly direction from the main workings. Almost on the south boundary of Section 32-87G yet another reef has been got in some old workings from what is known as the Snake shaft, also running a south-easterly course. None of these have been worked at all recently. They seem to agree with the workings at the No. 4 level south in the mine itself, and with the course of the main hanging-wall, that the reef runs south-south-easterly from the main shaft. The main lode-channel appears therefore to be that of the Western reef, the north and south reefs (Loane's and the Main) being branches from it. It is not impossible, however, that these are faulted at the junction, and some cross-cutting might well be done south of it to try if this is the case, but there do not appear to be any signs on surface to indicate that it is so.

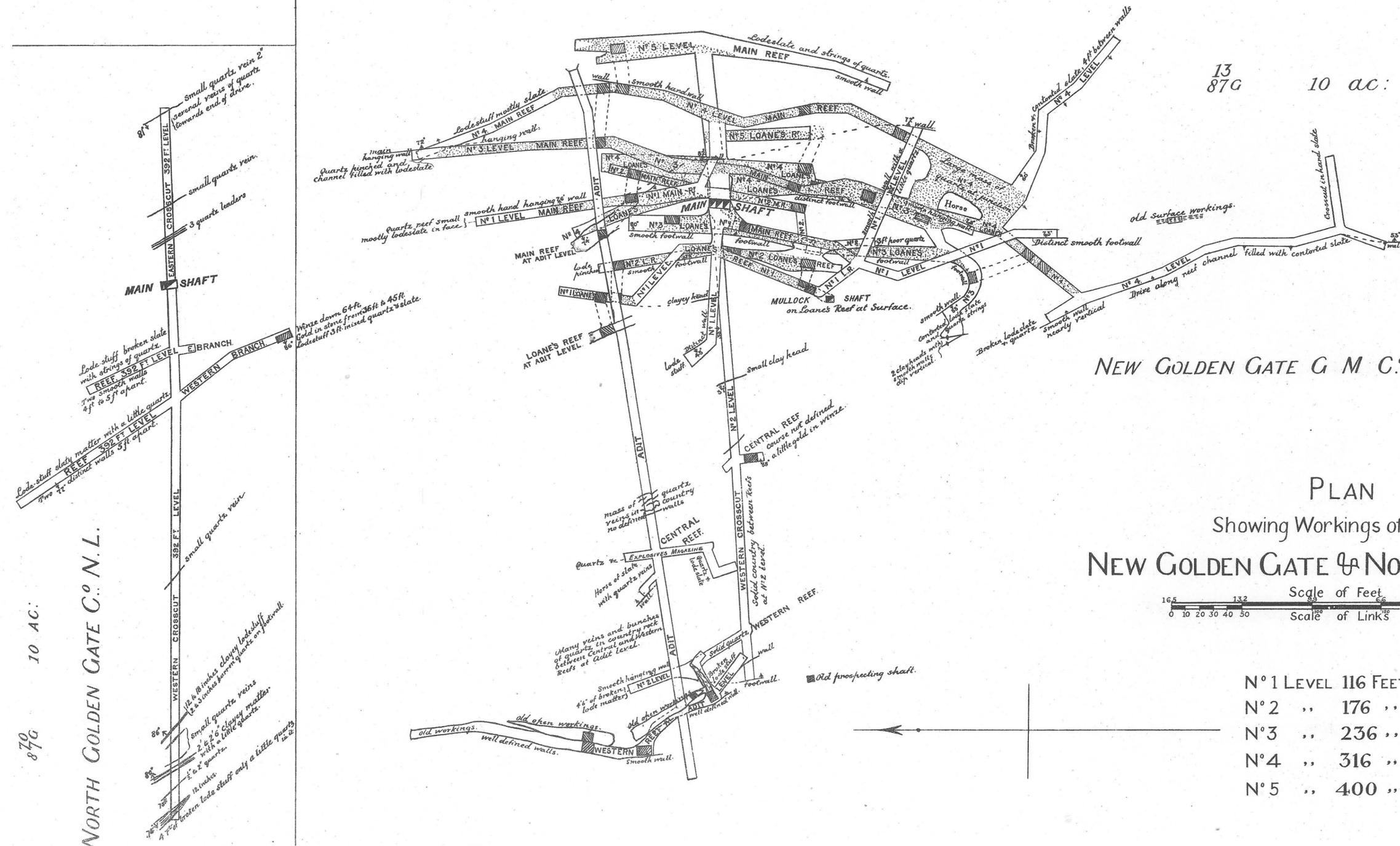
The exploratory work in this mine has been kept well ahead of the stoping, and there are large reserves of good stone above No. 4 level, while between Nos. 4 and 5 the ground is practically untouched, though proved by the levels and winzes to contain good ore. The stone in the bottom level is strong and good, and winzes are showing it to be continuing downwards equally well. In sinking from No. 5 level to No. 6 a gold-bearing leader was passed through in the shaft, two feet thick in the bottom, which may be the top part of a new make of stone on the footwall of Loane's reef, or, more probably, a dropper to the Central reef, in which case the latter is likely to be gold-bearing where it comes in. There is, therefore, an unusual amount of certainty that the mine will be remunerative for many years to come. I understand that it is intended to keep on sinking the shaft as fast as levels can be opened out, a policy which will prove the mine well in advance of the exploitation, and do much to render its shares a calculably safe investment. I do not think, however, that the exploratory work should be limited to sinking and opening up the present known ore-bodies, for driving through the dead ground on the course of the lodes ought also to be persistently carried on. The Company owns likely ground both north and south of the present workings, and there is every probability that, by driving along the reefs new ore-bodies will be struck. Driving north on the Main and Loane's reefs is specially to be recommended as most likely to be quickly followed by the discovery of payable stone. Both the Central and Western reefs also are worth further exploration, and while the mine is in a prosperous condition is the proper time to prospect them. Besides driving, a great deal of cross-cutting should be done from side to side of the reef-channels, and occasionally through from Main reef to the Western reef, for the experience of the mine has been that there are very numerous parallel lode-channels, and that these ramify so that it is only by constant cross-cutting that they can all be kept sight of.

The New Golden Gate Company possess what is certainly the most complete gold-saving plant in the Colony, having, in addition to the ordinary stamper battery, two Watson & Denny pans for crushing blanket sand and coarse tailings, and an installation of Frue vanners for saving pyrites. Moreover, in order to get the best results from the vanners these are not required to deal with the tailings just as they come from the battery, but have them classified into coarse and fine sands and slimes by a series of spitz-buttens. Excellent work is thus secured in concentration of the pyrites. The battery is lighted with electric light.

From June, 1888, up to 31st July, 1892, 24,175 tons of quartz have been raised and crushed, yielding 27,009 ounces of gold, or an average yield of 1 oz. 2 dwts. 8 grs. to the ton, which realised £102,220 8s. 3d. For the six months ending 31st July, 1892, 96 tons of pyrites were saved by the Frue vanners from 7210 tons of quartz, or equal to $1\frac{1}{3}$ per cent. The net profit resulting from the saving of pyrites amounted to £555 15s. 2d. The cost for the last half year of working the mine, including raising and crushing quartz, progressive and surface works, and all other expenses incidental to working the mine and managing the Company, is equivalent to £1 9s. $1\frac{1}{2}$ d. or 7 dwts. 17 grains of gold per ton of quartz crushed. The preceding half year the cost was £1 11s. 9d. per ton. The total amount paid in dividends now amounts to £36,000 and in dividend tax £1350.

North Golden Gate Mine.—Section 70-87G.—The workings of this mine are shown in plan and cross-section in plates 5 and 6. The main shaft is 7ft. 10in. by 3ft 10in., an awkward size for working, not permitting of two cages and a ladder-way as it should, and is 405 feet deep. Levels have been opened out at 150 feet and 392 feet. The upper one is almost on the same level as the No. 2 of the New Golden Gate, and the lower is a little below the No. 5 of the latter mine. A broken mullocky reef formation is said to have been got in the upper part of the shaft, and about 55 feet down some leaders were got carrying a little gold. At the 150-foot level a cross-cut has been driven east and west from the shaft. In the eastern cross-cut, which is 47 feet long; the end is in a broken mass of slate and quartz, the footwall of which is seen at 40 feet from the shaft striking N. 21° W. and underlaying to the east; this wall has been driven on north and south about 10 feet each way; it carries about 2½ feet in width of mixed slate and quartz, but no gold. The western cross-cut is driven 31 feet, and at 20 feet from the shaft passed through a body of quartz 3½ feet wide, carrying traces of gold. An almost vertical wall is exposed 12 feet from the shaft, with 8 feet of slate between it and the quartz vein. At the 392-foot level the eastern cross-cut is driven 82 feet from the shaft, cutting a few quartz veins, as seen in plan, but nothing of any consequence. The western cross-cut is 253 feet in length, and has cut near its west end a number of veins of quartz and clayey lodestuff, shown on the plan, which probably indicates that the Central and Western reefs of the New Golden Gate mine are close at hand. At 30 and 53 feet from the shaft two lode-channels have been passed through, and driven on as shown in the plan. These have smooth well-defined walls with clay selvages, but are filled with lode-slate and contain very little quartz so far as followed. Towards the south they probably soon join one another. Close to the New Golden Gate boundary a winze has been sunk to a depth of 64 feet, and in this some gold-bearing quartz was obtained. It was not in a well-formed body, but in lumps and veins,

Old Prospecting Shaft



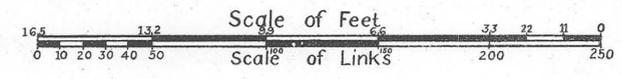
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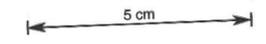
NORTH GOLDEN GATE CO. N.L.

NEW GOLDEN GATE G M CO. NO 'LIA'

PLAN
Showing Workings of the
NEW GOLDEN GATE & NORTH GOLDEN GATE



- No 1 LEVEL 116 FEET
- No 2 " 176 "
- No 3 " 236 "
- No 4 " 316 "
- No 5 " 400 "

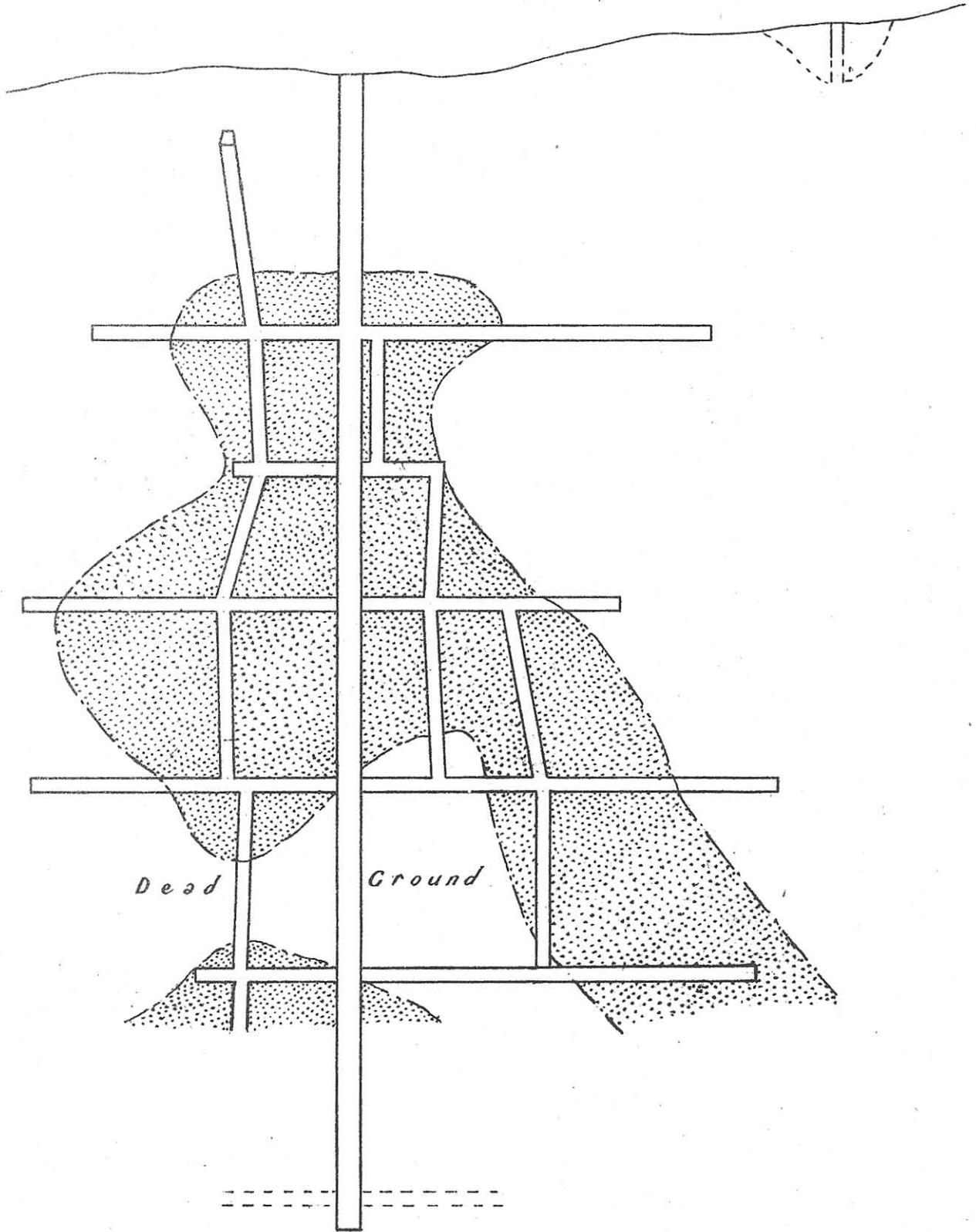


G. J. Montgomery
Geological Engineer

NEW GOLDEN GATE MINE
(LONGITUDINAL SECTION LOOKING EAST.)

MAIN REEF.

Dotted portion shows auriferous quartz body.



66 33 0 66 132 198 ft.

Scale 66 Feet to one inch

5 cm

A. Montgomery
Geological Surveyor

NEW GOLDEN GATE MINE

LONGITUDINAL SECTION

LOANES REEF.

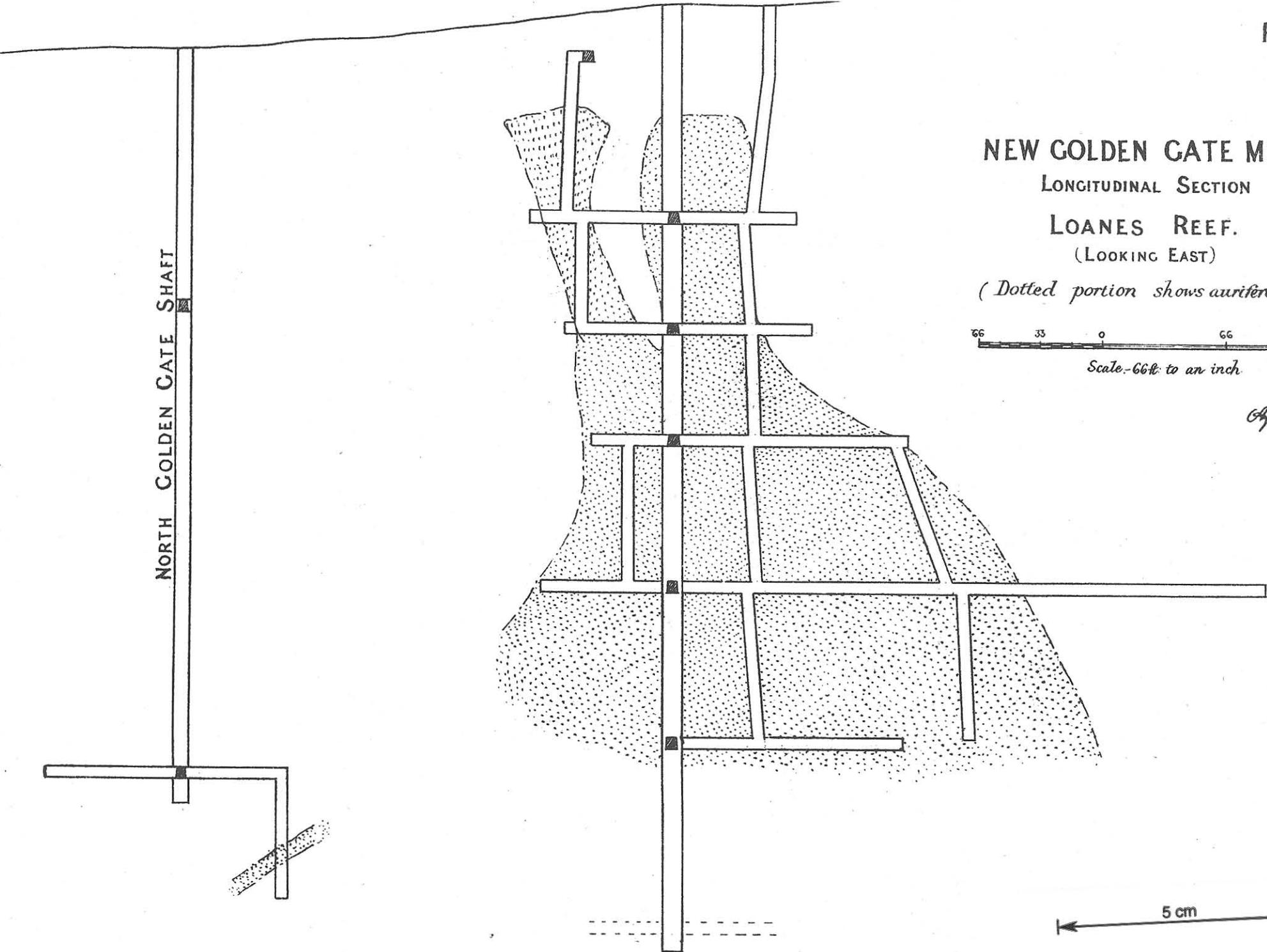
(LOOKING EAST)

(Dotted portion shows auriferous quartz)



Scale - 66 ft. to an inch.

A. J. Montgomery
Geological Surveyor



NORTH GOLDEN GATE SHAFT

5 cm

through much polished and twisted lode-slate of the same character as much of the dead ground in the New Golden Gate reef.

On looking at the plan, and remembering that the 392-foot level of the North Gate corresponds pretty nearly to the No. 5 level of the adjacent mine, it will be seen that if the New Golden Gate Main reef keeps its course it will run a little east of the eastern boundary of the North Gate section, and if it turns a little to the west of north, as the north ends of No. 3 and No. 5 levels render likely enough, it might come into the section. The end of the eastern cross-cut at the 392-foot level is 30 feet from the boundary, and the possibility of getting either Loane's reef or even the Main reef within this 30 feet seems to me to warrant the extension of the cross-cut to it. Should gold-bearing stone be struck even on or outside the boundary the reef above the level would underlay back into the North Golden Gate property, and a considerable block of valuable ground might be secured. The possibility of the reefs turning more to the west of north should also be contemplated, as this would bring them back into the section.

I have already discussed, when dealing with the New Golden Gate mine, the probability of the branches of Loane's reef seen at No. 4 level diverging further from one another or again reuniting. I have therefore only to say now that it appears to me that the following explanation of the various reef channels cut in the North Gate mine seems most in accordance with the facts we have knowledge of. The mullocky formation in the upper part of the shaft was Loane's reef, which is seen in a similar condition in the open workings on surface round the mullock shaft of the New Golden Gate. Going downwards this divides into two branches, one underlaying a little to the west, the other to the east. The latter was passed through in the eastern cross-cut at the 150-foot level, which, however, was not extended far enough to cut the parallel Main reef; the former was also seen at the 150-foot level in the Western cross-cut, and is no doubt that passed through in the Western cross-cut at the bottom level, where it has again divided into two branches, which very probably will be found to reunite when followed.

Though the prospecting operations of this mine have so far been unsuccessful in finding payable quartz, it appears to me that there is very good inducement to continue the search for some time yet. The eastern crosscut at the 150-foot level should be extended to the boundary to try if possible to cut the Main reef, and that at the bottom level also to cut the eastern branch of Loane's reef. The cross-cut west should go still further to intersect the Western reef, and this should be followed by driving. The best hope of getting returns however, lies, I think, in following the western branch of Loane's reef seen in the bottom level, as the barren filling may at any moment give place to gold-bearing quartz. It would also be advisable to sink the shaft deeper, say another 200 feet, and again cross-cut to this reef. The gold found on the winze at the boundary may very possibly be a string from the ore-body in the New Golden Gate mine leading to another one at a greater depth in this mine. There is very good reason to hope for ultimate success if working is perseveringly carried on.

South Golden Gate Mine.—Two shafts known as the South Golden Gate and Pride of Mathinna shafts have been sunk in the Sections held by the South Golden Gate Gold Mining Company, the former on Section 295-87G and the latter on Section 361-87G. Both have been laid out to the south-south-east of the New Golden Gate mine in consequence of the various veins of quartz found on surface from time to time indicating a general trend of the reef in that direction, as above remarked in dealing with the latter. When I visited the field these shafts were not in work and had water in them, consequently I have not been able to get below, and the following particulars of the work done have been supplied to me by the mining manager, Mr. S. Richards. The South Golden Gate shaft is 10 feet by 4 feet in the clear, and has been sunk 205 feet. A level has been opened out at 200 feet, and driven about N. 65° E. a distance of 242 feet. At 153 feet in the shaft a reef was struck, and passed through at 166 feet, dipping easterly: it consisted of from six to eight feet of lode-slate with some quartz on the foot and hanging-walls, and is supposed to be the same reef as is seen close by on surface in the Snake shaft of the New Golden Gate Company's Section 32-87G. In the level this reef was struck again at 18 feet from the shaft, about 6 feet wide, and was driven on 32 feet 6 inches on course N. 25° W. It consisted of quartz and polished squeezed lode-slate, but contained no gold. At about 138 feet a slide was passed through, underlaying towards the shaft about seven feet in three. At 178 feet a large lode formation 25 feet wide was met with, underlaying westward about three feet in five; this was succeeded by 10 feet of country rock, and then another lode formation 13 feet wide and underlaying the same as the first was cut through. These lodes were filled with black greasy slickensided slate with occasional bunches of quartz, similar to that obtained in the North Golden Gate Company's winze and also in the Star of Mathinna Company's Mine.

The Pride of Mathinna shaft is 70 feet deep, and a drive has been made from the bottom in direction N. 73° E. for over a hundred feet. About 50 feet from the shaft a small reef 12 inches wide was cut, running north-north-westerly. This is also seen on surface in two trenches, in the southern of which it appears to have formed two branches 16 feet apart. The reef is underlaying eastward.

It is not possible, in the present state of our knowledge of the field, to form an opinion of much value as to whether these shafts are on or near the line of the New Golden Gate reef. As already stated, the surface indications would lead us to believe that this takes a south-south-easterly course from the junction in the New Golden Gate mine. If so, these two shafts would not be far from the line, and their getting load-stuff in about the position where it might be expected according to this theory is strong evidence of its truth. On the contrary, however, it may be urged that the underlay of the slaty lodes in the South Gate mine is to the westward, while the New Golden Gate reef has an eastern underlay. More work will have to be done before there will be any certainty as to their identity. The South Gate cross-cut has only been driven some 242 feet, and the ground has therefore not yet been at all adequately prospected. From the position of the Sections held by this company the New Golden Gate reef can hardly fail to pass through either 295-87G or 360-87G, and extension of the cross-cut both east and west is accordingly to be recommended. The possibility of the north and south reefs of the New Golden Gate passing through or being faulted by the north-westerly ones is not altogether remote, though not, to my mind, very probable.

The stone from the old workings on the Snake Shaft reef in the New Golden Gate ground is reported to have yielded some 10 dwts. of gold to the ton, and as this reef continues strong in the South Gate workings it may at any time again become gold-bearing, and should therefore be driven on. The mullocky

reefs ought also to be followed, far enough at any rate to give a good idea of their general strike. It is possible that they may be cross-courses and have nothing to do with the New Golden Gate reef. I should have preferred to have seen the shaft 200 feet deeper before any cross-cutting was done, and think that when the mine goes to work again it would be best to sink to 400 feet before opening out. The prospects of the mine seem to me good enough to put it in the category of legitimate mining ventures, in which it is often necessary to risk considerable capital for a problematical reward. Without such ventures mining would be at a standstill. This company has made a good beginning with its prospecting work, and it is to be hoped in the interests of the district that the shareholders will not lose heart on account of the want of immediate success, but determine not to abandon their undertaking without giving the ground a thorough trial.

New Golden Gate Extended, Golden Ladder, East Golden Gate, and Star of Mathinna Mines. (See Plate 9.)—It is most convenient to deal with this group of properties together, as their lodes are more or less related to one another. They are all on the slopes of the most easterly of the three main spurs on which the mines of this gold-field are situated. On the general plan (Plate 1) several shafts will be seen lying more or less in a line north from the New Golden Gate and North Gate shafts. The one in the southwest corner of 204-83 is a small prospecting shaft sunk to a depth of 60 feet in search of the New Golden Gate lode, but without any success. In the north-west corner of the same section is an old shaft, now full of water, said to be 120 feet deep. Quartz is reported to have been in former years obtained from this yielding (18 dwts. to the ton), and the lode is stated to have run about north and south. Near the eastern boundary of 209-87G is the new main shaft of the New Golden Gate Extended Gold Mining Company, 11 feet by 4½ feet in the clear, and 159 feet deep. This was shut down, and could not be got into for water at the time of my visit. The last 8 feet in the bottom was stated by the Mining Manager (Mr. W. M. Glass) to be mullocky lode-stuff. Two and a-half chains north from this shaft is a small old shaft sunk by the old Glencoe Company on a north-and-south reef, which may be the same as that worked in the old shaft in 204-83, but is more probably identical with a vein of quartz cut in the excavation for the New Golden Gate Extended Company's engine-house. A small adit, now used as a powder magazine, has been driven to cut this lode, and a little driving has been done along its course in the old shaft. The reef shows 3 feet or more of rubbly quartz, and has a slight underlay westward. A crushing taken out many years ago is said to have yielded 10 dwts. to the ton. The Star of Mathinna shaft is in Section 469-87G; its dimensions are 11 feet by 4 feet, and depth 157 feet. At 50 and 60 feet two gold-bearing leaders were passed through dipping westerly. A cross-cut has been opened out at 150 feet and driven S. 78° W. 63 feet. At 21 feet from the shaft a reef was cut 3 feet wide and driven on 21 feet S. 30° E., underlaying to eastward about 4 in 6. This consisted of fairly solid quartz with well-marked clayey walls. It contained no gold, and became small in the end of the drive and split up into leaders. At 44 feet from the shaft a lode two feet wide underlying west was cut, from which there was a considerable flow of water: no driving was done on this, as it contained no gold, and the formation was much broken. These particulars were given to me by Mr. S. Richards, the manager of the mine, as work had ceased for some time, and this shaft also was full of water. On the surface a reef of quartz is seen in three trenches, as shown on Plate 9, and an old shaft 30 feet deep has been sunk upon it. In the bottom of this the quartz divides into two branches, going downwards, one underlying east, the other west, something after the fashion of a saddle-reef. The quartz saved and lying at the main shaft is much mixed with polished black sliken-sided slate, and several pieces of the white quartz are themselves rubbed quite smooth and bright by pressure and friction of one piece on another. The lode-matter was exceedingly like that from the winze on the North Golden Gate Reef.

It would appear, therefore, that there are veins of quartz running a more or less north-and south course, between the Star of Mathinna shaft and the New Golden Gate shaft. Taking this fact together with the evidence in the New Golden Gate and North Gate mines, it seems pretty clear that the Main reef of the former, if not Loane's reef as well, continues on a more or less north-and-south course. The various veins are probably similar to those met with in the surface strata of the New Golden Gate ground, which, it will be remembered, became solid reef at a lower level. Cross-cuts ought most certainly to be driven from the Gate Extended and Star shafts right across the line of these surface veins. It would be safer not to open out however above, say, the 200-foot level. It would be advisable also to cross-cut north-east from the Gate Extended shaft to cut the lodes seen in the old Caledonian adit to be mentioned presently.

A great many quartz veins have been found on the spur shown in Plate 9, and it is evident that it will be necessary to do a lot of work before it can be seen whether there are two or more main lines of reef, or simply numerous disconnected veins. The largest masses of quartz are those formerly worked by the old Caledonian Company on Sections 204-83 and 11-87G, now held by the New Golden Gate Extended and Golden Ladder Companies respectively. The adit put in by the old Caledonian Company and extended more recently is shown in Plate 9, and deserves considerable attention. What appear to be three closely parallel reefs have been exposed on surface by trenches, composed of from 18 inches to 5 feet wide of quartz. Old stopes 18 inches to 5 feet wide are still to be seen from which the quartz was extracted and crushed. The most distinct of these gives a course N. 75° W., and dip northerly of 73° for the reef, but, as shown on the plan, stone runs rather irregularly, though on the whole about N.W. and S.E. The quartz is said to have yielded payable returns for a time. In the adit country slate is passed through for 89½ feet, when we come to a wall crossing the drive on a N. and S. course, and dipping westerly 70°. Six feet further on there is another striking S. 30° E., and dipping westerly 68°. At 135 feet another wall is met with striking S. 20° E., and dipping the opposite way to the others, namely to the N.E. at an angle of 64°. In the roof of the drive the lode-stuff, broken clayey matter, and quartz, is pretty continuous between the first and last of these walls, but in the floor between them there is a mass of pretty solid-looking country rock. The lode-matter seems to form a sort of saddle reef over this piece of country. I take it all to be one formation from 89½ to 135 feet. This reef does not appear to have come to surface at all, and I am therefore inclined to regard it as portion of the flat reef seen further in. At 143 feet a large reef is met with consisting mostly of broken clayey country rock on the footwall side, but nearly all quartz towards the hanging-wall. The footwall strikes N. 20° W., dipping N.E. 70°, and the hanging-wall has strike N. 18° W., dip N.E. 72°: the

latter was cut at 169 feet from the entrance to the adit. A shaft had been sunk from the surface workings on this lode, but is now walled up, and I cannot therefore say if it went deeper than the adit, or if there were any workings from it. At 191 feet in another reef is cut, striking N. 45° W., and dipping S.W. 78°. It consists of from 12 to 18 inches of quartz, and appears to be one of the reefs seen in the trenches on surface: from its underlay it should join the shaft reef at no great depth. Between the latter and it, and apparently cut short off by both of them, there may be followed along the sides of the drive a flat vein of quartz from two feet to four feet in thickness, which sends off numerous stringers into the country. This flat vein waves about very much, being now in the roof and again in the floor. The saddle-shaped reef first met with in the adit is probably a part of it where it makes a more sudden bend than usual. Between the reef cut at 191 feet and another at 203 feet the flat vein is not seen, being most probably either above the roof or below the floor of the drive, but it is seen again past the latter in the end of the adit. Between these two reefs the country rock appears but little disturbed, and the beds of slate are well marked and strike N. 30° W. dipping N.E. 86°, thus conforming to the general strike and dip noticed in other parts of the district. The lode at 203 feet strikes N. 55° W. and dips N.E. 70°, or in the opposite direction to the one preceding it: it has been driven on six feet to the north-west and 14 feet to the S.E. The lode-channel is from three to four feet wide, and is mostly filled with mullock containing strings of quartz: on the east side of the drive, however, there is about four feet of quartz on the hanging-wall. The footwall portion consists of two smooth greasy black walls from eight to sixteen inches apart, with soft clayey mullock between them. Both this and the preceding lode if they keep their course must shortly run into the main lode, and the turn of the surface workings towards the west very likely indicates the point of junction.

Leaving the adit at the hanging-wall of the shaft reef, a drive has been extended a little south of east into the Golden Ladder Company's Section. This has followed the flat vein, which is very much crumpled and irregular along its course. It appears in places to be sending a more or less vertical offshoot up into the roof, and is generally from a foot to 18 inches in thickness. At 76½ feet from the adit a quartz vein two to six inches in thickness runs north-easterly across the drive: it dips S.E. about 83°, and at 94 feet a winze has been sunk 60 feet on it by the Golden Ladder Company. At 82 feet a clayey head running N. 25° W. and dipping N.E. 83°, apparently a bedding plane of the slate country, cuts off the flat vein, but traces of it reappear further along the drive. If this were extended a little further it would cut the two lode formations met with at 191 and 203 feet in the adit. The flat vein, or blanket vein as such are often called, is a feature in these workings not very commonly met with. It must be older than the more vertical lodes as these cut distinctly through it and fault it. It has been a very troublesome vein to follow, and appears to have diverted attention from the more promising true lodes. A somewhat similar flat vein has been found in the Jubilee mine, as will be described further on.

The shaft reef is a strong body of quartz, and was auriferous in the upper portions; the other two lodes further north-east in the adit also appear to be well defined fissure veins; there seems to me, therefore, every reason for following them downwards. Their appearance is quite as promising as is that of Loane's reef or the Main reef of the New Golden Gate mine at much about the same level in the surface adit. Cross-cutting to the north-east from the New Golden Gate Extended shaft would probably cut the line of reef in not more than 360 feet, but I think it would also be well to sink a deep winze on the stone itself from the adit. With a good shaft already in existence not more than 600 feet away in a direct line from the old workings, it would not be worth while to sink a fresh one near the mouth of the adit to prospect these reefs, as the work could be better done by cross-cutting them from the main shaft and then driving along the lode-channel at not much greater cost. This appears to me to be work which has a very fair chance of a successful issue, for all over this spur veins of auriferous quartz have been obtained from time to time, and there cannot be the least doubt therefore that the country is favourable for gold.

In the Golden Ladder Company's Section 11-87G some quartz veins have been cut on surface very much on the line of the outcrop of the above reefs, but no work except very shallow trenching has yet been done on them. It may be remarked that there is a considerable likelihood that there is a junction of a north-north-westerly lode, with one or more running north-westerly at the old working, as a short drive S.W. from the drive on the flat vein, shown on plan, has proved that the main reef on which the shaft is sunk, has not turned back to a south-easterly course inside of 40 feet from the adit, at any rate, and is therefore likely to continue on much the same bearing, S. 18° to 20° E., as where passed through by the adit. The veins of quartz in the S.W. corner of 11-87G are not unlikely to be leaders from this main reef. The old shaft and workings shown here on the plan were also made by the old Caledonian Company, and are said to have yielded some very fair quartz, but are not now accessible. The workings were about 40 feet deep near the old shaft, but got shallower going towards the little creek. Where the line of reef crosses the latter there is a great deal of barren quartz exposed for a width of about 18 feet. A shaft has been sunk on the line of this reef, known as the Central Golden Gate shaft (not working at the time of my visit), but no quartz appears to have been yet got in it. Lower down the hill, however, in an old trench can be seen a lode about 5 feet wide of broken slate and rubbly quartz underlaying to the north-east, which is probably a branch from the same line of lode. A small prospecting shaft has been lately sunk by the Golden Ladder Company, and a short tunnel driven as shown on plan, but work on these had been abandoned without any discoveries of value having been made so far as could be seen. The tunnel is probably to the north of the line of reef worked in former times, and therefore will not cut it at all.

On the top of the spur, about the middle of the south boundary of Section 419-87G a lode has been cut in a shallow pit, which contains some gold, and has a very kindly appearance. As far as can be judged from the very poor exposure presented, it runs about W.N.W., and may, therefore, be connected with the north-western line of reef seen in the Old Caledonian adit. Some work will have to be done, however, before its course can be even approximately made sure of.

Along the crown of the ridge running through the centre of Section 383-87G, several gold-bearing veins of quartz have been discovered, and a little desultory work has been done. The Golden Ladder Company have sunk a shaft (full of water when I saw it), and made several trenches on some quartz veins shown on the plan. These do not appear to form a well-defined reef at the present elevation, but may come together when solid unaltered country is met with at a depth. In the shaft from 2½ to 3 feet in

width of rubbly quartz may be seen, running nearly E. and W., and dipping northerly. Very good prospects of gold are reported to have been obtained while sinking. The direction of the veins on surface is a little to the north of west, but they have not been cut in a long trench run from the N.W. corner of 11-87G to the crown of the ridge, except in one spot, which would give north-west as their general direction if the stone cut in it were the same as that in the shaft. In this long trench the country rock has been thoroughly laid bare, and there is very little chance of any veins of quartz worth mentioning having escaped notice.

Section 383-87G is one of several held by the East Golden Gate Gold Mining Company. Two small shafts have been sunk in it right on the top of the ridge, on gold-bearing veins; but the course and underlay of these is not at all well defined as yet. There appears to be a line of reef running along the spur, nearly N.W. and S.E., for a great deal of loose quartz is strewn all along this line, and veins of quartz have been cut in several trenches all running more or less along it. It is probable enough that the Golden Ladder veins last mentioned also belong to this lode system. Remembering that the outcrop of Loane's Reef is a very similar mass of irregular leaders interspersed through country rock, there is a considerable chance of there being a strong reef below here also. To test this an adit has been begun by the East Gate Company, but will have to be carried 200 or 300 feet further before it will reach the probable line of lode. It is very doubtful if this adit will be of any use when put in, as it appears necessary in this district to attain depth before the lodes can be found solid and undisturbed, and instead of continuing it I think it would be better to sink a shaft and cross-cut to the reef channel. A deep cross-cut, from side to side of the hill, from such a new shaft to the New Golden Gate Extended shaft, would not be a very heavy undertaking for the two companies concerned, the distance being very little over 1000 feet, and would be a most valuable prospecting work. By arranging to begin driving from the East Gate shaft to cut the supposed lode under the ridge, and from the Golden Gate Extended shaft to cut the reefs seen in the Caledonian adit, at the same level in both cases and along the line connecting the shafts, each company would perform a piece of prospecting very necessary to be done in its own ground in any case in such a way that the unknown piece of country lying between the two lines of reef could be rapidly and easily prospected afterwards by extending the drives.

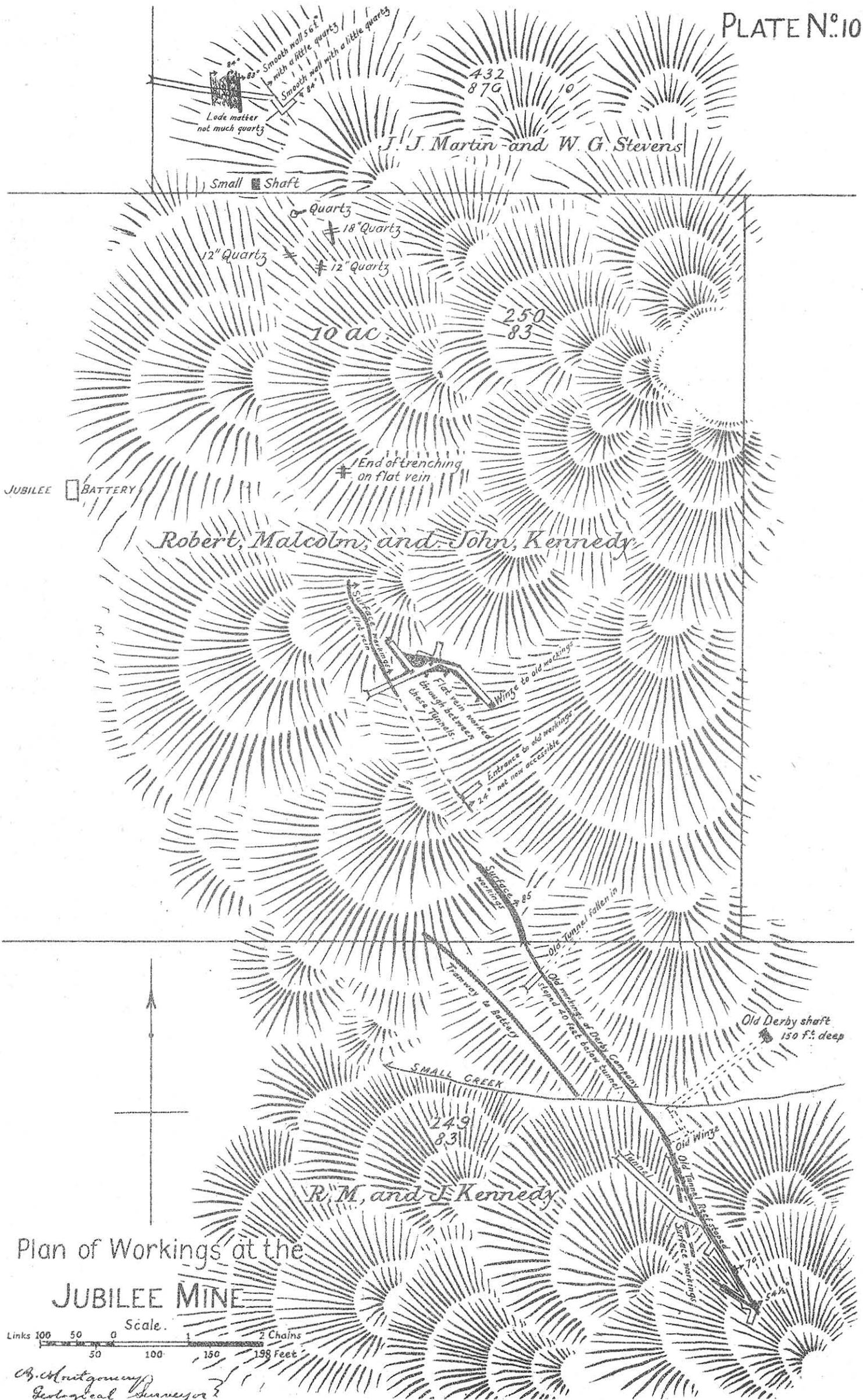
Near the north boundary of Section 369-87G a small cross-lode running N.E. and S.W. was formerly worked by the old Glencoe Company, but I have not been able to learn with what success. The old underlay shaft appears to be over 60 feet in depth, and the stone seems to have been from 18 inches to 3 feet in thickness, according to the width of the old stopes. If this lode continues it should join the Star of Mathinna reef near the main shaft.

Golden Stairs Mine.—This is another of the old mines formerly worked in small way near the surface which has been lately reopened. The reefs are found in Sections 253-87G and 386-87G as shown on the General Plan, Plate 1. A main shaft has been sunk to work the reef on which the old Royal Standard Company formerly operated. The old workings consisted of two shafts, 53 and 30 feet deep respectively, sunk on the reef, and between these the ground was stoped to surface, it is said with very good results. Another old shaft $2\frac{1}{2}$ chains further north appears to be a shallow one, and to have had no stoping done from it. To the northward from this the reef has been traced by trenches for several chains, till the covering of superficial alluvial matter became so deep as to interfere with its being traced further. The outcrop is generally rubbly and rusty quartz with much clayey matter. South of the old workings $1\frac{1}{2}$ chains the reef has been traced to a point where it junctions with another smaller one running more to the north-west, which has been found again in a trench 5 or 6 chains away; south of this junction it does not appear that any sign of the reef has been seen. It is said that £1500 worth of gold was got in the shallow alluvial workings north of the shaft, much of which was little water-worn, and may have come from these reefs. While the alluvial work was in progress, another reef running east and west was discovered, and worked for over a chain along the surface, yielding good gold in the capping. This was known as the Welcome Stranger reef. Specks of gold are even now to be seen in occasional pieces of the rubbly outcrop. A small shaft was sunk some 45 or 50 feet, and a drive put in to cut the reef, but was unsuccessful in finding gold, whereupon further search was promptly abandoned and the shaft allowed to fall together.

The main shaft of the Golden Stairs mine is east of the old workings, and has been sunk 165 feet; it is 11 feet by 4 feet in the clear. At 150 feet a cross-cut has been driven S. 72° W. to cut the reef; this had only been advanced 58 feet at the time I saw it. The shaft was sunk in slate country, but the cross-cut at 28 feet struck sandstone, and from there onwards the rock was alternate bands of slate and sandstone underlaying 1 in 4 towards the shaft or north-easterly, and striking N. 35° W., thus having the general strike and dip of the district. Since my visit the reef has been struck, and the manager, Mr. W. G. Stevens, has kindly sent me the following particulars:—"Since your visit here we have extended the cross-cut west a distance of 40 feet, the last eight feet of which passed through a formation 8 feet wide, gold-bearing from wall to wall. Where passed through in cross-cut the formation was composed of one foot of stone on footwall, 4 feet of sandstone and quartz leaders in centre, and two feet of quartz and one foot of flucan on hanging wall. We have driven 40 feet north on lode, and the footwall portion of lode has varied from 1 foot to over 4 feet in thickness. The mixture of sandstone and quartz, and the hanging wall quartz have cut out. The lode seems to be composed of makes or splices of stone. The lode so far has proved far wider and richer near bottom of drive than elsewhere, which leads me to think we are near the cap of a large payable body of stone, consequently I have recommended the sinking of shaft another 100 feet, which ought to test it.....I may state the lode is trending nearly north and south, and has an underlay of $2\frac{1}{2}$ feet in 6 feet west."

It may be worth noting that this lode is on much the same course, underlay, and line as the western branch of Loane's reef passing through the North Golden Gate mine, and that this line, if continued southward, passes a little east of the South Gate shaft near where the mullocky lodes were cut, and still further south comes fairly upon the line of the Jubilee main reef. These need not necessarily be connected, but all the same this line should be well prospected in case the reef is continuous right along it. Even if not altogether continuous it is probable that lodes will be found off and on along this line.

5 cm



Plan of Workings at the
JUBILEE MINE

Scale.
 Links 100 50 0 50 100 150
 2 Chains 198 Feet

B. Montgomery
 Geological Surveyor

Golden Spur Mine.—This had been shut down for some time when I visited the District, and I could not examine the workings in consequence of their being full of water. Very little is to be seen on the surface. The main shaft, over 100 feet deep, $10\frac{1}{2}$ feet by 4 feet in the clear, is situated in Section 333-87g. It was sunk on a vein of gold-bearing stone from which fair prospects were obtained. The same vein has been traced to the south-east into Section 404-87g, where, however, it is very small, only $\frac{1}{2}$ to 2 inches wide. The walls are pretty well defined nevertheless, and dip S.W. 64° . It seems very possible that this is a leader from a main reef further east. On Section 356-87g a prospecting shaft has been sunk close to the cemetery, about 100 feet, to further test the reef seen in an old shaft known as Moore's, which is close beside it. This old shaft was some 60 feet deep, and some stoping was done from it, the quartz being said to have been payable. The strike of the reef, as far as ascertainable from the old stopes, is S. 30° to 35° E., and it has a very slight underlay eastward. The old stopes are about 2 feet wide, and the walls are well defined. I am not aware if any driving was done from the new prospecting shaft to cut this reef below the old workings; if not, it seems worth doing. If the reef continues on its course it will run into the New Golden Gate ground at the western reef, and it is therefore not unlikely that these two are identical. The line joining them is worth a trial.

Jubilee Mine.—The lodes and workings of this mine are shown on Plate 10 as far as I was able to enter them, several old drives being now fallen in. The workings are on Sections 249-83 and 250-83. The ground was formerly worked by the old Derby Co., who were successful in obtaining some very rich quartz in their main reef in the north part of 249-83. They worked from the surface downwards and drove south into the high hill in the southern Section, and later on sunk a main shaft to a depth of 150 feet, and drove from it to the reef and along the latter to connect with a winze sunk from the workings above. The reef was, however, poor and much broken at this part, and work was soon abandoned. The timber was unfortunately drawn from the upper part of the old shaft, and it would probably now be rather difficult to repair for the purpose of further exploring the reef as ought to be done, the former trial having been a very insufficient one. The old stopes went about 40 feet below the tunnel shown on the plan; the stone was small, about 7 or 8 inches wide only, but often very rich, but got too small and too much broken to work, and was therefore abandoned. In the end of the tunnel a vein of quartz comes in from the north-west 12 to 15 inches wide, but very poor in gold, dipping 82° to the south-west. At its junction with the main reef a winze has been sunk in which a large and strong body of quartz 5 feet wide is visible. In another winze further back along the drive the main reef is from 8 to 12 inches wide; in both it is very poor. Seeing that this reef has been a rich gold-bearing one in parts, and appears to be making into a strong mass of quartz in the south end, it deserves further prospecting. This would now be best done at some depth, from a main shaft. The possibility of this reef being part of a line of reef running through the South Golden Gate, New Golden Gate, and North Golden Gate mines and on to the Golden Stairs has already been referred to above.

A party of tributors have lately traced this reef a little further north by means of a deep trench and shallow drive along its course, but it is both narrow and poor in gold. These appear to be the last workings north on the true Derby reef, which, I take it, has nothing to do with the flat reef found a little further to the northward. As will be seen from the Plan, the main reef probably lies to the west of the two tunnels put in on the flat reef, and therefore has not been intersected by them. The outcrop of the flat reef happens to be almost on the same line as that of the Main reef, but I do not think there is any other connection between them. The flat reef has been a good deal worked; it is very much like that found in the old Caledonian tunnel previously described, dipping and rising into very irregular hollows and hills, and sending off strings of quartz into the country in much the same way. It has been gold-bearing, but not rich, and a good deal of quartz has been crushed from it. The difficulty of extracting the stone from so undulating and flat-lying a body, and of knowing where to look for it if lost sight of for an instant, are greatly against much mining being done upon it. In my opinion the best work for this property to take in hand is to try to trace the main lode north and south, and sink a main shaft to test it at lower levels.

There is a small battery on this mine, the crusher used being a Huntingdon mill. The tributors had been burning the quartz to render it more friable, a fact which confirms the local opinion that this mill is not altogether successful in dealing with hard quartz. The plant is sufficient for testing purposes, which is all that is required in the present position of the mine.

Section 432-87g.—The work done on this section is also shown on Plate 10. A good many veins of quartz are seen about the surface, and a small shaft has been sunk a few feet where shown on plan, but the only work of any consequence that has been done has been the driving of an adit, known as the City P.A. tunnel, from the western boundary of the section. At $53\frac{1}{2}$ feet from the entrance a soft mullocky lode was met with and driven through for 26 feet. Two distinct smooth walls, one of them the hanging-wall, are seen, which agree in giving the strike of the lode as N. 5° W., and its dip as 83° or 84° to the eastward. There is a good deal of quartz mixed with the mullock and pug, but no gold was found in it, though it contained a good deal of pyrites of favourable appearance. I think it would be worth while doing some more work on this lode to see what it would lead to, for it is not unlike some of the softer portions of the New Golden Gate reefs, and also answers the description of the mullocky lodes passed through in the South Golden Gate cross-cut, and its position is very nearly on the line connecting the Golden Stairs reef with the Jubilee main reef, so that it may prove to be a part of a main line of lode. It would be interesting to trace it southwards and see if it had any connection with the Jubilee reef.

In the end of the tunnel two smooth hard walls, carrying a little quartz and flucan upon them, were encountered, cutting each other nearly at right angles, but apparently not faulting one another. One dips north-westerly $56\frac{1}{2}^{\circ}$, the other south-easterly 84° . It is very possible that either or both of these may fault the mullocky lode or be thrown by it. The north-easterly one in the face shows about four feet of broken curly slate and soft mullock, and water depositing iron oxide oozes out along the footwall. It therefore closely resembles portions of the Boys and New Golden Gate reefs that are filled with lode-slate. Further developments in this tunnel are likely to be interesting.

Telegraph Mine.—Almost due west from the City P.A. tunnel, on the other side of Long Gully, is an adit known by this name: it has been put in to cut some gold-bearing veins found on the top of the ridge along the boundary between Sections 418-87G and 417-87G, and has been driven 161 feet through hard slate and schist country. No lodes have been cut in it, though several irregular veins and bunches of quartz have been seen, and it will have to go another 260 or 270 feet before reaching the shaft for which it has been driven. This is 55 feet deep, and has been sunk on a vein of rubbly quartz 12 to 18 inches thick, which is stated to have yielded fair prospects when sinking. The vein appears to run N.W. and S.E., and has been traced S.E. some little distance by trenches. All along the spur for some distance north of this there is a great deal of loose surface quartz, and it is rather probable that a considerable northerly reef is yet to be found. No work was being done in this mine at the time of my visit, the failure of the Bank of Van Diemen's Land having been the cause of stopping operations in it, as in several other cases in the district.

Lady Mary Mine.—Sections 411-87G and 408-87G. This mine is situated north-west from Mathinna township and on the opposite side of the South Esk, being in what is called the Dan's Rivulet Gold-field. By road it is about four miles distant from Mathinna. The mine was worked some years ago and abandoned after a very short trial, and is now being again re-opened. A new shaft has been sunk 105 feet, and is to be put down still further before driving for the reef. The workings are near the eastern boundary of Section 408-87G, and about half way from the north and south boundaries. The reef runs N. 53° E. and dips S.E., but there also appears to be a branch dipping away to the north. The old workings consist of an underlay shaft 45 feet deep, from which stoping has been done N.E. and S.W. for a total distance of about 150 feet. At the N.E. end, 57 feet from the old underlay shaft, there is a small shaft about 20 feet deep, in which the reef appears to be bending round to an east and west course, and a little south of east from this, at a distance of 78 feet, a reef has been cut in a prospecting shaft 25 feet deep recently sunk. In this there are about 18 inches of quartz carrying a little gold, but I do not think it is more than a branch of the main reef. In the south-west end of the old workings the stone appears to have got very small. On the north-west side of the workings opposite the old underlay shaft, some quartz running parallel to the main reef at a distance of some 20 or 30 feet has been worked and a few tons of quartz extracted: this shows that the entire lode formation is probably considerably wider than the veins of stone worked, and points to the necessity of frequently cross-cutting from wall to wall. In the underlay shaft the reef is about three feet wide in the south-east end, and underlaying S.E. 1 in 3; in the opposite end there is also quartz underlaying the opposite way which has not been followed. According to the information I received the stone obtained by the former owners from the underlay shaft yielded about eight dwts. of gold to the ton; and in the stopes S.W. from it better quartz was found, some of it yielding over two ounces to the ton when crushed. A good deal of black oxide of manganese is contained in the stone, which interfered considerably with the amalgamation. The amount of work done by the old company was quite inadequate to give a fair trial to the reef, and the results obtained, if correctly reported, are in my opinion quite sufficient encouragement to justify the present owners in re-opening the mine. The country rock in the new main shaft is a soft yellowish sandstone, the solid unaltered country not yet having been reached.

South of the workings there is found over a large area of the surface a great deal of oxide of iron carrying angular pieces, and occasionally distinct veins of quartz which appears to be of a lode character. Owing to very wet weather setting in I was not able to trace this out satisfactorily. It appears to have a trend N.W. and S.E., and will cross the line of lode a short distance S.W. from the end of the old workings. No gold has been found in it. In the main shaft occasional veins of ferruginous matter similar to this have been passed through, which confirm my idea that it is of lode character. When intersected by the new workings it will probably be more clearly visible, and it will better appear if it is worth doing any work on it.

On Section 151-87G a soft lode 4 feet wide of rubbly quartz containing a little gold has been cut to the south west of, and very much on the line of, the Lady Mary reef. A few feet north of this hard quartz with much contained oxides of iron and manganese is seen, but does not appear to be gold-bearing.

On the road from the old Lady Mary battery (removed long ago), to the mine we pass over some alluvial ground which must be an old terrace of gravel deposited when the South Esk had not cut its bed down to the present level. There is a good deal of this alluvial matter about the lower slopes of the spurs, and it is very probable that in parts there will be more or less gold in it.

Very wet weather coming on I was obliged to defer further examination of this portion of the gold-field. A good deal of prospecting is going on, and there are several old claims which in former days gave more or less gold, so there is a probability of good reefs being discovered any day. As in the Mathinna field proper, however, I think that it will be necessary to sink well below the oxidised superficial strata before the lodes will be found to be well defined and permanent.

Some general conclusions may now be drawn as a result of this examination of the Mathinna gold-field. The country rock is highly auriferous, gold having been found in it in every direction, not only in defined reefs but also very commonly in innumerable small veins. The number of well defined reefs is very considerable, and though no line has been traced with certainty over any very long distance, there is reason to believe that this will yet be done in more than one instance. The New Golden Gate, Black Boy, and City of Hobart lines all appear to be fairly persistent in strike. The very commonly heard statement that there are two sets of reefs at Mathinna, one north and south, the other east and west, is seen by a glance at the plan to be very far from accurate, most of the reefs diverging so considerably from the cardinal points as to make it quite misleading. The strike of the reefs does not appear sensibly to affect their gold value, good stone having been found in the New Golden Gate, New Eldorado, Old Boys, Jubilee, City of Hobart, and Lady Mary mines on widely divergent courses, showing that the direction of a reef is no criterion of its gold-bearing capacity. (I may remark here that the belief once very commonly held that reefs running north and south were likely to be richer than those on other courses has long been exploded by facts, though it lingers in existence still along with such curiosities as the notion that all good reefs live on the sunny side of hills.) The observed fact that in the New Golden Gate mine the gold is found almost invariably on a

course east of north, and hardly ever when the reef turns to the west of north, may prove to be a reliable rule in that particular mine, but I do not think is likely to be a general one throughout the district. No one class of country rock, as, for example, sandstone, hard or soft slate, or schist, has yet been proved to be more favourable for gold than any other in this district. In the auriferous quartz, iron, and arsenical pyrites and galena, also sometimes blende, are commonly associated with the gold, and these sulphides appear themselves to be auriferous and well worth saving by concentration. Sufficient development has not been done to establish any rule as to whether the junctions of reefs are here richer than other parts, but there is considerable evidence that such is the case, and as this feature is one very commonly found in lodes elsewhere, it seems advisable to find and well prospect all junctions. The New Golden Gate rich stone is at the junction of the Main and Loane's reefs and not far from the junction of both with the Central reef. The Black Boy mine gave its best gold at the junction of its two reefs, and the gold now being got in the Old Boys' mine is probably not far from the junction with the Black Boy line. The City of Hobart rich stone was also at the junction of two reefs. The New Eldorado and Jubilee rich quartz does not, however, appear to have been near any junction, and the above instances may be only coincidences. The workings of all the mines have shown that in the higher levels the reefs are very generally considerably disturbed, the quartz being of a rubbly nature and liable to be very patchy in gold. It is seen at the same time that the country rock has been subjected to atmospheric influences which have effected a good deal of chemical change, oxidising iron compounds, removing soluble constituents, and softening and changing to clayey matter rocks which at greater depths appear as hard blue slates and schists. There can be little doubt that this chemical change is accompanied by more or less change of volume leading to swelling or contraction of the ground, and resulting in the disturbance of the superficial strata which is sought to be explained. In the New Golden Gate mine the change from the yellowish country to the blue unaltered rock takes place at about 70 feet from the surface in the shaft, and it was not till this level was reached that the reefs became solid masses of quartz. The connection between the superficial alteration of the country and the fragmentary and unreliable nature of the reef in this instance is so marked that it seems justifiable to consider that the same change will take place in other cases also. For this reason I take it that prospecting to be of much value must in this district be at a depth well below the level of atmospheric influence. The success of the New Golden Gate mine in finding solid rich quartz at a depth below a reef formation, which on the surface consists merely of leaders and strings of quartz mixed with clay and country rock, should encourage the owners of such properties as the East Golden Gate, Telegraph, and others, which show large quantities of loose rubbly quartz on surface, to sink deep upon them. A fortunate fact which makes mining from shafts very much easier at Mathinna than in many other districts is that so far as experience has gone there is but little water in the country rock. Neither the old City of Hobart, New Golden Gate, North Golden Gate, or Old Boys' mines have had any trouble with it, and it seems generally easily kept down by baling without requiring special pumps.

The Mathinna gold-field until lately had only been tested in a desultory way by picking out the good stone from the outcrops to a shallow depth. Later experience shows this to have been a very poor trial, as it has shown the outcrops not to be a fair sample of the reefs underneath. With the exception of the old City of Hobart mine, which was worked simply to extract a patch of gold without any exploratory work being done along the line of reef, and so courted disaster, no mine on the field had been tested in a practical way to a depth sufficient to found an opinion upon as to the permanency or otherwise of the gold-bearing stone until the New Golden Gate mine was opened. The work of the Golden Stairs and Old Boys' mines is tending to confirm the favourable opinion of the field given by the New Golden Gate's operations, and I do not doubt that if other mines on the field were opened in a miner-like fashion, the district would become a steady gold-producer. What is most required is that a good working capital should be subscribed to be spent in underground work in each mine, and that the shareholders in the companies should realise their responsibilities as mining adventurers and be prepared to go through with the enterprises they undertake.

Alluvial Mining.—In the lower part of Black Horse Gully and in parts of Long Gully a great deal of alluvial mining was done in the earlier days of the field. I have not been able to get any estimate of the amount of gold raised, or the average earnings per man. The amount of ground turned over is, however, very considerable, and must have occupied a large number of men for more than a short period. Local report says that the gravels were on the whole poor, barely giving average wages to the men engaged. The alluvial stuff is not deep as a rule, few of the shafts being over 25 feet in depth, and most of them much less. The gravel was mined out and washed mostly in cradles, no sluicing having been done. As hydraulic sluicing, if water were brought in, could probably be done for not more than one-tenth of the cost of mining and cradling, it seems possible that the ground, which was too poor to work by the old process, could be profitably dealt with if attacked on a larger scale. This has been done over and over again on old goldfields, so that it may be almost said to be a rule that gravels that have been worked over in a primitive way may generally be treated profitably afterwards by hydraulic sluicing. The question appears to me to be well worth serious consideration, taking into account the cost of bringing in water at high pressure, the disposal of tailings, the area and depth of the ground to be sluiced, the average value of the stuff from surface down to bed-rock, and the cost of working. The quantity of available gravel seems to me to warrant the expense of making the preliminary tests which ought to precede setting to work on a large scale. It would be necessary to sink series of shafts all over the ground to be worked in order to find the quantity and value of the stuff that could be obtained, everything raised from each shaft being carefully measured and washed. It could then be readily calculated whether it could be made to pay for hydraulic working.

On the private land (Talbot's estate) between the Mathinna township and the South Esk, I understand that no mining was allowed, and from the boundary line northward is therefore virgin ground. There is every reason to think that the gravel in this portion of the valley of the Esk, at the mouth of the two auriferous gullies of the Black Horse and Long Gully creeks, would contain a good deal of gold, and perhaps enough to pay for hydraulic sluicing. There must be a good deal of gold in the valley of the South Esk also brought down by that river and Dan's Rivulet, as both of these streams run through proved auriferous country,

but it is very doubtful if there would be enough to pay for working, the gravel not having been yet sufficiently concentrated by natural causes. There is, nevertheless, a considerable possibility of payable ground being discovered if looked for, and the matter seems to me worth attention. The large amount of water to be encountered in working the river flats would make them difficult to prospect by sinking shafts, and boring with a water-auger or light diamond drill would probably have to be resorted to.

Some years ago, I am told, a survey was made for a water-race to the River Tyne, a branch of the Esk, and it was found that a plentiful supply of water could be brought on to the Mathinna field at a height of over 100 feet above the Esk. The country traversed was reported to be easy, and the estimated cost for a race, from 8 to 10 miles long, was some £3000. I have not been able to get particulars of this scheme, and the above figures may be, and probably are, very inaccurate; but I believe the main fact, that it is possible to bring in a good supply of water from the Tyne at an elevation sufficient for the hydraulic working of the alluvial ground by means of a race about 10 miles long, through fairly easy country, is correct. The reported estimated cost seems to me much too low. Should any such race be seriously contemplated, the great advantage of a considerably higher-level scheme should be also taken into account, one which should give say 120 feet of pressure at the Golden Gate and Mathinna batteries, so as to enable them to be worked by water-power. The saving of cost by using water-power instead of steam for the battery at the New Golden Gate would be so considerable as to make this matter worth consideration by that company in their own interests alone, without any regard to the alluvial workings.

A strong argument in favour of treating the flats by hydraulic sluicing is that there is a very great probability that by doing so payable reefs would be exposed. Those at present known do not sufficiently account for the gold found in the Black Horse Gully, and there may very well be a reef or several reefs still undiscovered in it.

In concluding this Report, I have to say that the managers of the various mines all took very great trouble to afford me all help in their power, and were personally most kind to me. I have also to thank Messrs. Peter Irvine and James M. Murray for valuable information freely contributed by them, and Messrs. H. J. Wise, Henry Simpson, and William Cundy, for reports and plans.

I have, &c.

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

The Secretary of Mines, Hobart.

THE ORE-DRESSING MACHINERY AT THE NEW TASMANIAN SILVER-MINE, ZEEHAN.

This machinery, being the first of its kind used in Tasmania for treating silver-ores, has attracted unusual attention from engineers and others connected with the Tasmanian silver industry, and the following short and necessarily superficial description of it will probably meet the requirements of those who desire a general idea of the system adopted, and will form a basis for those who contemplate erecting similar machinery.

The ore is first fed into an ordinary stone-breaker (A., Plate 1), which breaks it into pieces varying in size from one cubic inch downward. It then falls upon an inclined shaking-table (B., Plate 1), the upper end of which is perforated for the purpose of allowing all the ore which may already be reduced sufficiently in size to pass through the perforations, and from thence into the jiggers.

The coarser pieces of ore are delivered by the shaking-table into a pair of crushing-rolls (C., Plate 1). These complete the crushing and reduce the ore to the size suitable for treatment in the jiggers.

In practice it is found that a small proportion of the ore gets through the rolls before being reduced to the required size. This is prevented from going to the jiggers by means of a revolving cylindrical iron sieve known as a sizing-trommel (D., Plate 1), which receives all the ore discharged from the crushing-rolls, that which passes through the trommel being fine enough for subsequent treatment in the jiggers, and is carried automatically to the jigger-house, while that which passes *over* the trommel is taken back to the rolls by a self-acting elevator and is recrushed. The ore is now ready for treatment in the jiggers. There are five of these, each divided into six compartments. A sheet of perforated iron is fixed in compartments 1, 2, and 3, and upon this is laid a bedding of clean galena about one inch thick and made up of fragments just too large to pass through the perforations.

A stream of water constantly flows in at one end of the jigger and out at the other, thus keeping up a continuous horizontal movement, and a jiggling (rising and falling) motion is imparted to the water by means of plungers placed in compartments 1A, 2A, and 3A.

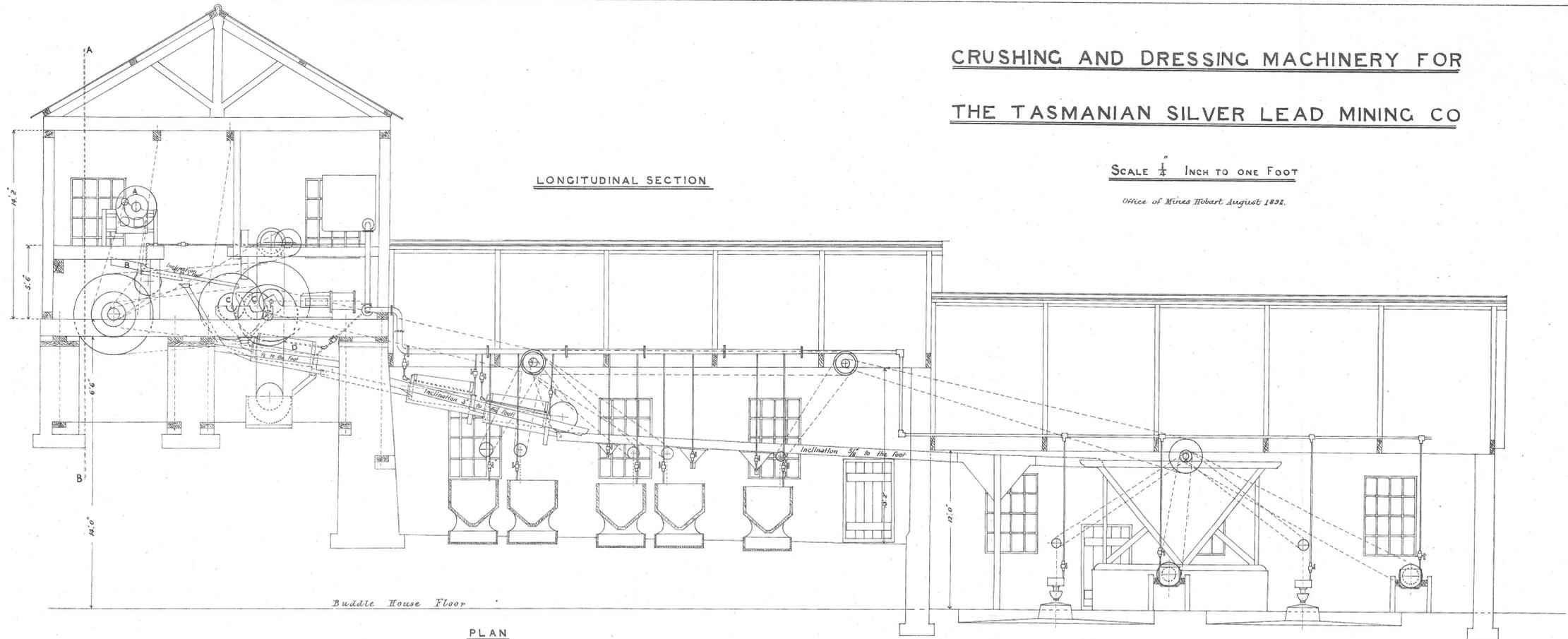
The ore, which has previously been sized in a trommel or a classifier, is now fed in at compartment 1 and drops into the agitated water. The best of the ore being heaviest falls to the bedding, intermingles with it, and finally passes through the perforated iron plate and is discharged as clean ore through the bottom of the jigger. The lighter part, consisting of easily separated gangue, is carried by the current of water to the tailing-box; while the medium weight stuff, which consists of a mixture of galena, zinc blende, and iron pyrites, is arrested in compartment No. 2, in which the jiggling motion of the water is more gentle and the bedding a little thicker. Here the galena is separated from the blende and pyrites, the former passing through the bedding and the perforated iron, whilst the foreign matter is carried to compartment No. 3, where it is similarly treated and deprived of any galena which may still be mixed with it.

It is lastly washed off as tailings, and by the time it has passed through the three compartments it carries only a minute proportion of galena.

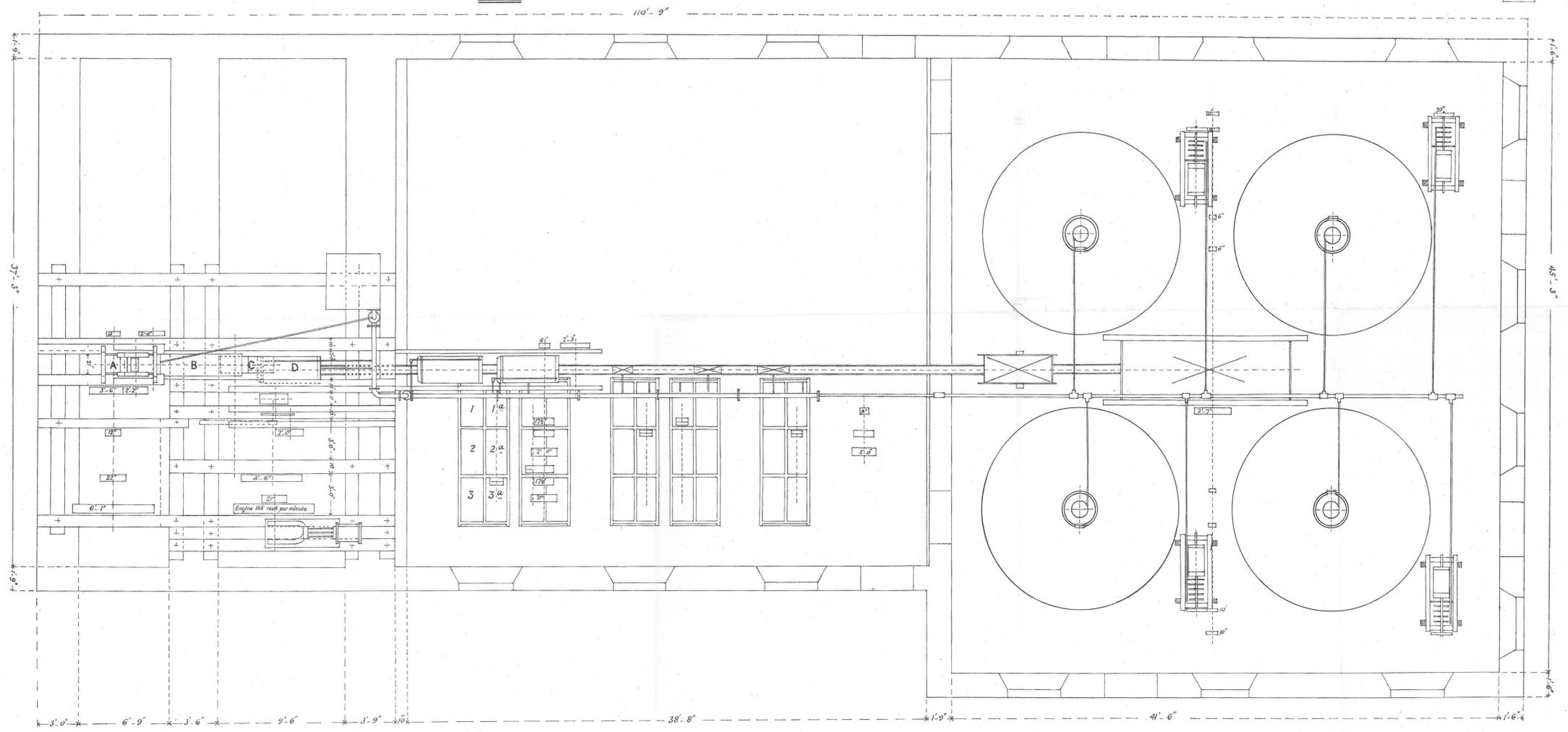
CRUSHING AND DRESSING MACHINERY FOR
THE TASMANIAN SILVER LEAD MINING CO

SCALE $\frac{1}{4}$ " INCH TO ONE FOOT

Office of Mines Hobart August 1892.



PLAN



5 cm

If it is desired to save the blende and pyrites as by-products, the stroke of the plungers can be so arranged as to save clean galena in compartment No. 1, a mixture of galena, blende, and pyrites in No. 2, and blende and pyrites in No. 3; but the writer does not advocate this style of machinery for effecting a clean separation of blende from pyrites. Each jigger completes its own work, and acts independently of the others. The operations carried on in each are similar, the coarsest stuff being treated in the first jigger, and each one in succession being fed with finer stuff than the one before.

To get a maximum amount of work out of the jiggers it is essential to feed them regularly and with as near an uniform size as possible. To effect this the coarser stuff is sized by trommels, and the finer by conical classifiers.

A trommel is simply a cylindrical sieve and requires no description. A classifier is a vessel like a large funnel; an upward jet of clean water is introduced at the bottom of the classifier, whilst water containing fine ore in suspension flows in at the top. The heavier part of the ore resists the upward current and falls near the bottom of the classifier, where there is a place for its exit, while the lighter and finer stuff passes forward to the next classifier, which is larger, and in which the upward current is less strong.

Three of such classifiers separate all the fine ore from the slimes; the former is treated in the jiggers, and the slime is dressed in the ordinary well-known cradle.

The capacity of this plant varies with the class of ore under treatment. The ore from one part of the New Tasmanian Silver Mine, in which the gangue is silica, can be treated at the rate of 20 tons in eight hours, while that from another part of the mine, in which the gangue is composed mainly of blende and pyrites, requires nearly double the time.

The power for driving the machinery is furnished by a 10-inch horizontal engine, and the steam-pressure used is 60 lbs. per square inch.

The whole of the machinery was made and supplied by Mr. Geo. Green, of Aberystwith, North Wales, who makes a speciality of ore-dressing machinery, and who has for many years enjoyed a high reputation for his success in this important branch of engineering work.

RICHARD PROVIS, A.M.I.C.E.

DIAMOND DRILLS.

Statement of Work done to June 30th, 1892.

Year.	Locality.	Direction of Bore.	No. of Bores.	Total Distance bored.	Average Cost per foot, inclusive of Labour & Fuel.
No. 1 DRILL.					
1882-3	Back Creek—For Gold	Vertical	7	feet. 1330	£ s. d. 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 }	Beaconsfield (Phœnix G. M. Co.)—For				
1890 }	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...	Lefroy—For Gold.....	Ditto	2	249	In progress.
TOTAL.....			33	12,297	
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, 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—Mt. Bischoff Alluvial T.M. Co.— For Tin	Ditto	7	1548	0 6 11½
1887...	Waratah—Mt. Bischoff T.M. Co.—For Tin	Ditto	7	841	0 11 8
1887...	Ditto—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	2	462	In progress.
TOTAL.....			36	9911	

Aggregate number of bores 69
 Total distance bored..... feet 22,208

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

Launceston, 4th August, 1892.

No. 1 DIAMOND DRILL.

Report of Strata passed through in boring for Coal at Ravensdale.

Bore commenced 7th August, 1891; finished 27th August, 1891.

Strata.	Thickness.	Total Depth.
Surface soil.....	ft. in. 6 0	ft. in. 6 0
Brown and bluish quartzose sandstones.....	31 0	37 0
Hard brittle grey, green, and brown quartzose sandstones, lower parts showing vertical fractures and very hard; bad boring.....	50 0	87 0
Hard altered shales (hornstone), extremely dense and hard at the bottom of the bore.....	26 9	113 9

No. 1 DIAMOND DRILL.

Report of Strata passed through in boring for Coal at the Back River, Prosser's Plains.

No. 1 BORE.

Commenced 15th September, 1891; finished 7th November, 1891.

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Surface soil	6	0	6	0
Soft brown sandstone	35	6	41	6
Firm white and grey quartzose sandstone	48	6	90	0
Blue shale	1	0	91	0
White quartzose sandstone, with micaceous layers	84	3	175	3
Light grey sandy shale	19	9	195	0
Greenish grey and white quartzose sandstone	51	0	246	0
Arenaceous shale	18	0	264	0
Greenish grey quartzose sandstone	67	10	331	10
Hard quartzose sandstone	20	8	352	6
Mud shale with minute marine fossils	29	0	381	6
Hard greenish shale with veins of calcite and vertical fracture	24	6	406	0
Hard dark arenaceous shale	8	2	414	2

No. 2 BORE.

Commenced 30th November, 1891; finished 2nd February, 1892.

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Reddish sand } Surface shaft	18	0	18	0
Greenstone gravel }	13	0	31	0
White and brownish quartzose sandstones	4	6	35	6
Grey shale	0	8	36	2
Brown quartzose sandstones	1	7	37	9
Greyish and dark shales	15	6	53	3
Grey quartzose sandstone	0	6	53	9
Dark and grey shale	10	0	63	9
Hard grey quartzose sandstone	14	10	78	7
Dark and grey shales	14	5	93	0
Greenish grey arenaceous shale	5	6	98	6
Bluish and reddish shale	13	11	112	5
Grey quartzose sandstone	1	0	113	5
Grey and red shales with sandy bands	30	4	143	9
Grey quartzose sandstone	5	0	148	9
Grey shale with a few carbonaceous markings	1	10	150	7
Grey arenaceous shale	30	8	181	3
White quartzose sandstone	37	2	218	5
Grey shale	1	6	219	11
White quartzose sandstone	1	6	221	5
Grey arenaceous shale	16	8	238	1
White and grey quartzose sandstones with occasional mud pebbles	97	11	336	0
Dark shale	0	6	336	6
White quartzose sandstones with a few mud pebbles	8	7	345	1
Grey shale	2	6	347	7
Grey quartzose sandstone with vertical fracture; bad boring	21	6	369	1
White mudstone with vertical fractures	4	7	373	8
Grey, green, and brown quartzose sandstones with vertical fracture, brittle; bad boring	63	1	436	9
Dense fine grained greenstone (diabase) with veins of calcite	3	0	439	9

No. 1 DIAMOND DRILL.

Report of Strata passed through in boring for Alluvial Gold at Lefroy.

BORE No. 1.

Bore commenced 23rd April, 1892 ; finished 6th June, 1892.

Strata.	Thickness.		Total Depth.	
	t.	in.	ft.	in.
Surface shaft	11	4	11	4
Scoriaceous vesicular basalt.....	24	10	36	2
Basalt, more solid.....	16	6	52	8
Vesicular basalt.....	36	7	89	3
Hardened brown fine sand	4	0	93	3
Hard vesicular basalt	11	2	104	5
Dark brown compacted fine sand	4	6	108	11
Whitish grey compacted fine sand	2	8	111	7
Soft scoriaceous basalt	6	2	117	9
Brown sandy clay	2	11	120	8
Grey sandy clay	1	0	121	8
Compacted coarse and fine sand and fine gravel with peaty markings	2	3	123	11
Greyish sandy clay with peaty markings	8	0	131	11
Brown compacted fine sand and mud with carbonaceous markings	12	5	144	4
Basalt, partly vesicular	28	4	172	8
Brown compacted fine sand and mud.....	2	9	175	5
Light-coloured bluish slate (bottom)	15	1	190	6

BORE No. 2.

Bore commenced 16th June, 1892. Still in progress. Depth 58 feet 8 inches, through scoriaceous basalt on 30th June.

No. 2 DIAMOND DRILL.

Report of Strata passed through in boring for Coal at Macquarie Plains.

BORE No. 2.

Commenced 15th June, 1891 ; finished 15th July, 1891.

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Strata previously reported, section appended to Secretary of Mines' Annual Report for 1890-1891		306	9
Grey sandstone	39	4	346	1

No. 2 DIAMOND DRILL.

Report of Strata passed through in boring for Coal at Jerusalem.

Bore commenced, 18th August, 1891; finished, 30th September, 1891.

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Surface shaft, hard cemented gravel.....	37	6	37	6
Coarse grey felspathic or tufaceous sandstone, with carbonaceous markings.....	22	11	60	5
Light grey shale.....	3	9	64	2
Grey tufaceous sandstone with mud pebbles and carbonaceous markings.....	13	8	77	10
Grey clod showing fossil plants.....	3	0	80	10
Grey tufaceous sandstone with coaly markings.....	14	11	95	9
COAL, No. 1 Seam.....	3	0	98	9
Grey tufaceous sandstone.....	16	10	115	7
Grey shale with fossil plants.....	4	6	120	1
Grey tufaceous sandstone with carbonaceous markings.....	21	1	141	2
Hard grey sandstone, with calcite veins and carbonaceous markings.....	5	2	146	4
Dark clod with carbonaceous streaks.....	0	8	147	0
COAL.....	0	1	147	1
Dark clod.....	0	5½	147	6½
COAL.....	0	0½	147	7
Dark clod with coaly streaks.....	1	9½	149	4½
COAL.....	0	10½	150	3
Band.....	0	0½	150	3½
COAL.....	1	8	151	11½
Grey clod and tufaceous sandstone.....	8	2	160	1½
COAL.....	1	8	161	9½
Band.....	0	9	162	6½
COAL.....	0	5	162	11½
Fine grey tufaceous sandstone.....	2	6	165	5½
Grey clod.....	2	10	168	3½
Coarse grey tufaceous sandstone with a few veins of calcite, and carbonaceous markings.....	58	8	226	11½
COAL, No. 4 seam.....	0	4	227	3½
Grey clod with fossil plants and calcite veins.....	7	8	229	11½
Fine-grained sandstone, hard and splintery, with calcite veins.....	6	8	241	7½
Coarse felspathic sandstone with specks of carbonaceous matter.....	25	6	267	1½
Black shale with cubical iron pyrites.....	0	4	267	5½
Grey tufaceous sandstone with specks of carbonaceous matter.....	22	5	289	10½
Dark shale, hard boring.....	7	6	297	4½
Black siliceous fine-grained sandstone.....	3	0	300	4½
Black clod showing fossil plants.....	4	0	304	4½
Grey tufaceous sandstone with carbonaceous markings.....	25	8	330	0½
White calcareous shale, hard and brittle, with plant impressions.....	7	0	337	0½
Hard greenstone, fine-grained at top, a little coarser in grain at bottom.....	6	10	343	10½

Analysis of Coal from Jerusalem Bore, made by W. F. WARD, Esq., Government Analyst, 25th September, 1891.

	NO. 1 SEAM.	NO. 2 SEAM.	NO. 3 SEAM.
Fixed carbon.....	42·3 per cent.	50·7 per cent.	33·9 per cent.
Loss at red heat.....	26·9 "	28·3 "	29·1 "
Mineral matter (ash).....	22·4 "	16·4 "	34·4 "
Moisture.....	8·4 "	4·6 "	2·6 "

In No. 1 Seam the Foreman reported that the greater part of the best coal broke up and would not form a core. The quality of the seam as a whole is probably better, therefore, than is shown by the above analysis.

No. 2 DIAMOND DRILL.

REPORT of Strata passed through in boring for Coal at Langloh Park.

BORE No. 1.

Commenced, 26th April, 1892; finished, 16th May, 1892.

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Surface soil and clay.....	16	0	16	0
Brown tufaceous sandstone, hard, brittle, and full of fractures	34	8	50	8
Grey tufaceous sandstone.....	2	0	52	8
Very black clod.....	0	10	53	6
Coal, with $\frac{1}{2}$ inch band of clod at 54' 6"	1	1	54	7
Dark fireclay	2	6	57	1
Grey tufaceous sandstone, with occasional coal markings, getting harder with depth, very hard at 98 feet and downwards	58	5	115	6
Diabase greenstone	5	2	120	8

BORE No. 2.

Commenced, 23rd May, 1892; finished, 2nd July, 1892.

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Surface soil	4	0	4	0
Hard brown tufaceous sandstone	22	0	26	0
Grey tufaceous sandstone with occasional hard bars.....	39	5	65	5
Greenish-coloured shale	4	7	70	0
Mixed shale and tufaceous sandstone	26	0	96	0
Clean tufaceous sandstone	12	6	108	6
Fireclay.....	0	5 $\frac{1}{2}$	108	11 $\frac{1}{2}$
Coal	0	1 $\frac{1}{2}$	109	1
Fireclay	0	3 $\frac{1}{2}$	109	4 $\frac{1}{2}$
Coal	2	8	112	0 $\frac{1}{2}$
Band } No. 1 Seam.....	0	2	112	2 $\frac{1}{2}$
Coal	1	3	113	5 $\frac{1}{2}$
Fireclay band	0	6 $\frac{1}{2}$	114	0
Coal	3	1	117	1
Fireclay.....	3	10 $\frac{1}{2}$	120	11 $\frac{1}{2}$
Coal	1	3	122	2 $\frac{1}{2}$
Band	0	1 $\frac{1}{4}$	122	3 $\frac{3}{4}$
Coal	0	5	122	8 $\frac{3}{4}$
Band } No. 2 Seam	0	0 $\frac{1}{2}$	122	9 $\frac{1}{4}$
Coal	1	7 $\frac{1}{2}$	124	4 $\frac{3}{4}$
Band, black clod	0	4 $\frac{1}{2}$	124	9 $\frac{1}{4}$
Coal	0	10	125	7 $\frac{1}{4}$
Fireclay.....	5	11 $\frac{1}{4}$	131	6 $\frac{3}{4}$
Coal	0	6 $\frac{1}{2}$	132	1
Band } No. 3 Seam	0	0 $\frac{1}{2}$	132	1 $\frac{1}{2}$
Coal	1	7	133	8 $\frac{1}{2}$
Dark shale, with plant impressions.....	1	3	134	11 $\frac{1}{2}$
Fine grained tufaceous sandstone	5	0 $\frac{1}{2}$	140	0
Blue shale, with fern impressions	5	6	145	6
Grey tufaceous sandstone, with occasional coal markings	36	2	181	8
Tufaceous sandstone, with streaks of coal	1	4	183	0
Mixed shale and tufaceous sandstone	0	11	183	11
Dark shale	0	2 $\frac{1}{2}$	184	1 $\frac{1}{2}$
Coal—No. 4 Seam	1	3 $\frac{1}{2}$	185	5
Light and dark shales	1	6	186	11
Grey tufaceous sandstone	21	7	208	6
Sandstone, full of coaly matter	2	0	210	6
Dark tufaceous sandstone	3	0	213	6
Grey tufaceous sandstone, with hard bars at 250 and 258 feet	54	0	267	6
Mixed shale and tufaceous sandstone, with streaks of coal.....	1	0	268	6
Clod, with streaks of coal	0	10	269	4
Coal	1	5	270	9
Dark band } No. 5 Seam	0	8 $\frac{1}{2}$	271	5 $\frac{1}{2}$
Coal	1	11	273	4 $\frac{1}{2}$
Hard clod	0	2 $\frac{1}{2}$	273	7

BORE No. 2—continued.

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Hard dark fireclay	6	6	280	1
Dark tuffaceous sandstone, with coal streaks	17	11	298	0
Black clod, with fern impressions	9	0	307	0
Coal	0	1½	307	1½
Black clod.....	1	10½	309	0
Mixed shale and tuffaceous sandstone	9	3	318	3
Coal	0	5	318	8
Hard black shale, with fern impressions	4	9	323	5
Dark sandstone, with white veins	14	7	338	0
Hard altered sandstone	1	5	339	5
Hard diabase greenstone	2	0	341	5

Analysis of Coal from No. 2 bore, Langloh Park, by W. F. Ward, Esq., Government Analyst.

	No. 1 Seam.	No. 2 Seam.	No. 3 Seam.	No. 5 Seam.
Fixed carbon	55·9	62·4	42·5	52·6
Matter volatile at red heat	18·0	20·5	21·2	9·9
Mineral matter (ash)	21·4	13·0	31·0	34·0
Moisture lost at 212° Fah.	4·7	4·1	5·3	3·5
	100·0	100·0	100·0	100·0

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

No. 1.

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

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
For the first half-year of 1892.....	22,240	0	83,400

No. 2.

RETURN showing the Quantity of Gold obtained from Quartz during the Years 1880, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, 1891, and the first Half-year of 1892.

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
For first half-year of 1892	17,590 "	65,962

No. 3.

COMPARATIVE Statement of Tin exported from Tasmania during the Years 1880, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, 1891, and for the first Half-year of 1892, 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	3607 $\frac{1}{2}$	409,853
1888	3775 $\frac{1}{4}$	426,321
1889	3764	344,941
1890	3209 $\frac{1}{4}$	296,368
1891	3235	291,715
For first half-year of 1892	1486 $\frac{1}{2}$	135,128

No. 4.

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

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
For first half-year of 1892	18,658	16,792

No. 5.

RETURN showing the Number of Persons engaged in Mining during the Years 1880, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, 1891, and first Half-year of 1892.

YEAR.	NUMBER.
1880.....	1653
1881.....	3156
1882.....	4098
1883.....	3818
1884.....	2972
1885.....	2783
1886.....	2681
1887.....	3361
1888.....	2989
1889.....	3141
1890.....	2868
1891.....	3219
For first half-year of 1892.....	3139

No. 6.

RETURN showing the Number and Area of Leases held under "The Mineral Lands Act" and "The Gold Fields Regulation Act," in force on 30th June of each Year since 1887.

Nature of Lease.	In force on 30th June, 1887.		In force on 30th June, 1888.		In force on 30th June, 1889.		In force on 30th June, 1890.		In force on 30th June, 1891.		In force on 30th June, 1892.	
	NO.	AREA.	NO.	AREA.	NO.	AREA.	NO.	AREA.	NO.	AREA.	NO.	AREA.
		Acres.		Acres.		Acres.		Acres.		Acres.		Acres.
Under "The Mineral Lands Act," for tin, &c., at a rental of 5s. an acre	656	22,892	957	32,231	1497	53,251	1303	49,463	1495	67,216	1857	89,962
For coal and slate, at 2s. 6d. an acre rent	62	10,665	41	6045	38	4499	51	7636	45	7255	47	6874
Under "The Gold Fields Regulation Act," at a rental of 20s. an acre	149	1474	285	2812	270	2687	325	3088a.	245	2366a.	489	4606
Water Rights and Mining Easements	107	773 sluice-heads.	140	852 sluice-heads.	204	1005 sluice-heads.	209	2r. 20p. 950 sluice-heads.	200	2r. 10p. 998 sluice-heads.	173	812 sluice-heads.

No. 7.

RETURN of the Number and Area of Leases under "The Mineral Lands Act" and "The Gold Fields Regulation Act," in force on the 1st July, 1891, issued during the Year ending 30th June, 1892, cancelled during the Year ending 30th June, 1892, and remaining in force on 30th June, 1892.

Nature of Lease.	In force on 1st July, 1891.			Issued during Year ending 30th June, 1892.			Cancelled during Year ending 30th June, 1892.			In force on 30th June, 1892.						
	NO.	AREA.		NO.	AREA.		NO.	AREA.		NO.	AREA.					
		A.	R.	P.		A.	R.	P.		A.	R.	P.				
Under "The Mineral Lands Act," for tin, &c., at a rental of 5s. an acre.....	1495	67,216	0	0	724	36,599	0	0	372	13,763	0	0	1857	89,962	0	0
For coal and slate, at 2s. 6d. an acre rent.....	45	7255	0	0	14	1879	0	0	12	2360	0	0	47	6874	0	0
Under "The Gold Fields Regulation Act," at a rental of 20s. an acre	245	2336	2	10	286	2696	0	0	42	424	2	10	489	4606	0	0
Water Rights and Mining Easements	200	998	sluice-heads		16	17	sluice-heads		33	193	sluice-heads		173	812	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	1886.....	12,523 10 4
1881.....	20,936 5 5	1887.....	14,611 11 5
1882.....	23,077 1 9	1888.....	23,502 8 4
1883.....	15,439 14 5	1889.....	17,254 9 0
1884.....	6981 11 10	1890.....	26,955 4 9
1885.....	11,070 5 7	1891.....	37,829 16 5

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.

No. 9.

RETURN of Dividend Tax paid by Gold Mining Companies.

YEAR.	NO. OF COMPANIES.	AMOUNT OF DIVIDEND.	AMOUNT OF TAX.
		£ s. d.	£ s. d.
1880.....	5	65,852 17 2	2467 16 0
1881.....	4	99,250 0 0	3721 17 6
1882.....	5	55,825 0 0	2093 8 9
1883.....	5	63,168 10 0	2368 16 4
1884.....	4	39,400 0 0	1477 10 0
1885.....	2	61,250 0 0	2296 17 6
1886.....	3	41,125 0 0	1542 3 9
1887.....	2	66,750 0 0	2503 2 6
1888.....	2	65,375 0 0	2451 11 3
1889.....	4	28,000 0 0	1050 0 0
1890.....	3	13,609 0 0	510 6 9
1891.....	3	35,200 0 0	1320 0 0
1892, first half of ...	5	21,750 0 0	815 13 3

No. 10.

RETURN of Dividend Tax paid by Tin Mining Companies.

YEAR.	NO. OF COMPANIES.	AMOUNT OF DIVIDEND.	AMOUNT OF TAX.
		£ s. d.	£ s. d.
1880.....	11	64,755 0 0	2428 6 3
1881.....	13	102,418 0 0	3840 13 6
1882.....	12	108,935 0 0	4085 1 3
1883.....	9	98,837 2 6	3706 7 9
1884.....	4	60,169 0 0	2256 6 9
1885.....	4	92,644 0 0	3474 3 0
1886.....	5	108,849 10 0	4081 17 1
1887.....	6	128,753 0 0	4828 4 8
1888.....	10	148,638 17 2	5573 19 10
1889.....	6	100,850 0 0	3781 17 6
1890.....	10	87,187 10 1	3269 11 1
1891.....	8	83,598 1 6	3134 0 0
1892, first half of	5	37,700 3 3	1413 15 1

No. 11.

RETURN of Dividend Tax paid by Silver-Lead Mining Companies.

YEAR.	NO. OF COMPANIES.	AMOUNT OF DIVIDEND.	AMOUNT OF TAX.
		£ s. d.	£ s. d.
1891.....	4	10,360 0 0	388 10 0
1892, first half of.....	3	8584 14 0	321 18 0