TASMANIA.

REPORT

OF THE

SECRETARY FOR MINES

FOR

1893-4,

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

Tasmania:
WILLIAM GRAHAME, JUN., GOVERNMENT PRINTER, HOBART.

1894.

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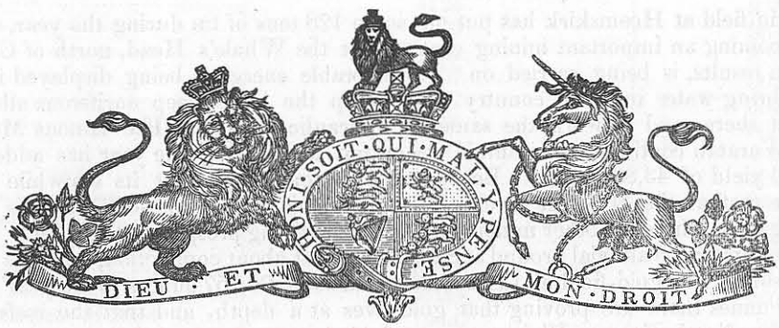


REPORT OF THE SECRETARY FOR MINES.

Office of Mines, Hobart, 23rd July, 1894.

SIR,

I HAVE the honor to submit my Report of the Mines Department for the year ending 30th June, 1894.

Appendices. Appended will be found Reports from the various Commissioners of the state of the Mining Industry in the Division under their charge; the Reports by the Inspector of Mines; the Annual Report of the Geological Surveyor; the Annual Report of the Mount Cameron Water-race Board; and Reports by the Geological Surveyor upon—

The Roy's Hill Tin Mine.
The Brookstead Estate Tin Lodes: Second Report.
The Mineral Discoveries in the neighbourhood of Bell Mount.
The Deposit of Iron Ore at the Blythe River.
Corinna Gold-field.
Lawrenny-Langloh Coal-field.
Back Creek Gold-field.
Returns of the operations of the Diamond Drills, together with Tables showing the yields of Gold, Silver, Tin, 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.

General remarks. The "substantial advance" made in the Mining industry, referred to in last year's Report, has been fully borne out during the year just closed. The value of the output of minerals and metals for the 12 months ending 1st July instant was £707,852, being £29,128 in excess of that for the corresponding period ending 1st July, 1893, and being the highest yet attained in the Colony. Steady development is being carried on in all branches of the industry, and it is satisfactory to note that *work* is taking the place of company-mongering and scrip-broking. Naturally, the absence of the hitherto prevailing speculative element, together with the low prices ruling of silver and tin, has caused a considerable decrease in the area of land held under lease for those metals, resulting in a diminished revenue. This latter element is not, however, to be much deplored, for it is far better that the money paid in rentals for large areas of unproductive country and in maintaining bogus companies should be expended in the employment of labour to win metal from the ground. The Mines receipts for the year ending 30th June, 1894, were £16,732, against £18,639 for the previous year.

No discoveries of any marked present value have been reported during the year. Work has been mainly confined to the further development of known deposits, and in this direction material

progress has been made, and with satisfactory results. The famous Mount Lyell mine has been, and now is, working a vein of silver ore from which during the past few months 473 tons of ore have been raised, containing 571,000 ounces of silver and 112¼ tons of copper. The survey of a line of railway, 21 miles in length, from this mine to the port at Strahan has been completed, and the clearing of the line commenced. At Zeehan the Western Mine has completed its railway and Luhrig concentrating plant at a large cost, all of which has been paid for out of the produce of the mine, and in addition dividends amounting to £21,000 have been paid. Concentrators have been completed at the Silver King and at Grubb's mines. The tributing system has been largely adopted on this field, and in that it has afforded profitable employment to a large number of men, and has helped struggling companies to fulfil their labour covenants and make some profit, it has been so far successful.

The old tin-field at Heemskirk has put out some 128 tons of tin during the year, and gives fair promise of becoming an important mining centre. At the Whale's Head, north of Corinna, work, with profitable results, is being carried on. Considerable energy is being displayed in the vicinity of Corinna to bring water into the country to open up the large deep auriferous alluvial deposits known to exist there, and to work the same by hydraulic sluicing. The famous Mount Bischoff Tin Mine at Waratah continues to maintain its output, and during the year has added some 2375 tons to its total yield of 43,868 tons. Beaconsfield is again resuming its erstwhile activity: the striking of the reef at the 800 feet level in the Tasmania Mine will soon put this mine on the dividend list again. There are other minor evidences of reviving prosperity at this field. A hydraulic scheme for developing the alluvial ground at Salisbury is just about completion, and bids fair to give a satisfactory result. The gold-field at Lefroy has added some 20,757 ounces to the year's output, and several of the mines there are proving that gold lives at a depth, and that the reefs are of great richness. In the North-Eastern Division the tin-fields have maintained their average, and the gold-fields at Warrentinna and Mount Victoria still continue to give small yields. In the Eastern Division the output of tin has not fallen off, and there appears to be a prospect of the enormously extensive deposits of lode tin being fairly worked at no distant period. Much progressive and remunerative work is being done at the Mathinna gold-field, whilst the coal mines at the Mount Nicholas Range maintain their output. It is satisfactory to note also that the amounts paid in mining dividends are, notwithstanding the low prices ruling, in excess of those paid in 1892-3. All these matters are dealt with more in detail in the Returns and the Reports of the various local Commissioners which follow, and are merely mentioned here as evidence that the industry is in a sound and progressive condition.

The working of the scheme for the examination of candidates for Mine Managers' Certificates continues to be successful. Two ordinary certificates upon examination and four service certificates were issued during the year. The examination papers are appended. The time is not remote when none but holders of certificates of competency will be permitted to occupy the important and responsible position of mine manager.

During the year a new Mining Act has been framed and passed into law. The new legislation has brought together the law which was distributed through some fourteen separate Acts; has assimilated and simplified proceedings, and afforded many and much-needed facilities for carrying on and liberalising the industry. Advantage was taken of the most recent legislation of other countries, and the Act, together with the regulations which have been framed under it, although not, of course, perfect, is found to be a vast improvement upon the law hitherto in force. As the mining community become better acquainted with the working of the present Act and Regulations, it will be admitted that they are as liberal, simple, and comprehensive as those of any other part of the world.

It is contemplated to hold at an early date a Conference of persons engaged in mining, at which the various wants of the industry and the disabilities under which it rests may be discussed, with the ultimate object of establishing a Mining Council or Board, who shall be charged with the duty of bringing about legislation and practice which may be considered beneficial to mining. A preliminary Conference was held at Derby in May last, but as it consisted of persons interested in one class of mining only, it was determined to submit the matters to a larger and more representative Conference to be held later on, which it is trusted will bear good fruit.

Gold. The yield for the year has been 43,391 ounces, against 37,303 ounces for the previous year, or an increase in value of £17,226. The several fields have contributed as follows:—Beaconsfield, 4065 ounces; Lefroy, 20,757 ounces; Mathinna, 8723 ounces; other localities, 9806 ounces.

Silver-ore. The output of this ore has nearly doubled that of the preceding year.

Tin. There has been a slight decrease of some 130 tons of tin for the year. This is accounted for by the low price ruling,—many owners of rich alluvial claims preferring to reduce their output rather than accept the present prices, which are barely remunerative.

Coal. The yield of coal is less by some 5000 tons than during the corresponding period of last year.

Production.

Mineral.	For the Year 1892–3.		For the Year 1893–4.		Increase.	Decrease.	Total Increase.
	Quantity.	Value.	Quantity.	Value.			
		£		£	£	£	£
Gold	37,303 ozs.	145,482	43,391 ozs.	162,708	17,226	...	
Silver	10,339 tons	103,390	18,469 tons.	184,690	80,800	...	
„ (Bullion)	23 „	500					
Tin	5006 „	400,000	4874 „	333,869	...	66,131	
Coal	39,000 „	29,250	33,192 „	26,553	...	2697	
TOTALS	...	678,622	...	707,820	98,026	68,828	29,198

TOTAL Area of Land applied for during Year ending 30th June, 1894.

Mineral.	No. of Applications.	Area.
		Acres.
Gold	207	2091
Silver	73	4030
Tin	151	5040
Coal	4	220
Other Minerals	23	1260
TOTAL	458	12,641

MINES Receipts for the Year ending 30th June, 1894.

HEAD OF REVENUE.	AMOUNT.
	£ s. d.
Rent under "The Gold Fields Regulation Act"	3611 18 6
Fees ditto	1201 13 7
Rent under "The Mineral Lands Act"	10,690 12 11
Fees ditto	1108 2 7
Rent of Diamond Drills	120 0 0
TOTAL	£16,732 7 7

DIVIDEND Tax.

Company.	For year 1892–3.		For year 1893–94.	
	Dividend.	Tax.	Dividend.	Tax.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Gold	48,235 18 9	1808 17 5	47,350 0 0	1775 12 6
Tin	72,416 19 10	2715 12 11	53,217 2 0	1995 12 9
Silver	438 8 0	16 9 3	21,355 0 0	800 16 3
Coal	...	...	605 12 4	22 14 3
Total	121,091 6 7	4540 19 7	122,527 14 4	4594 15 9

TOTAL Number and Area of Leases in force on 30th June, 1894.

MINERALS.	NUMBER.	AREA.
		ACRES.
Gold	374	3532½
Silver	372	20,860½
Tin	574	19,524¼
Coal	23	4231
Iron	6	385
Limestone	10	1327
Slate	1	200
Lithographic Stone	2	417
Mineral Paint	1	17
Shale	3	800
Ochre	4	141
Nickel	4	232
Wolfram	2	160
Marble	2	637
Cinnabar	1	20
Precious Stones	1	80
Copper	10	569
Bismuth	1	56
Asbestos	3	107
TOTAL	1394	53,296¼

AVERAGE Number of Miners employed during the Year ending 30th June, 1894.

	Europeans.	Chinese.
Northern and Southern Division	705	—
North-Eastern Division	415	332
Eastern Division	465	143
North-Western Division	393	—
Western Division	950	—
	2928	475

MINING Companies registered during the Year ending 30th June, 1894.

Number of Companies.	Capital.
42	£150,444

Division of the Colony.

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

Departmental Staff.

The growing wants of the West Coast has necessitated the appointment of a Resident Commissioner at Zeehan; in other respects the staff is unaltered.

The Reports of these officers are annexed. The work of the Chief Inspector is confined to the more settled districts. The officer stationed at the West Coast has to be ever on the move; more especially is his presence necessary now that the tributing system is so largely on the increase by unskilled miners. I much regret to have to record seven fatal accidents during the year. Four of these were undoubtedly due to carelessness, but in one case only was a conviction obtained. **The Inspectors of Mines.**

This officer (who also acts as Chief Inspector of Mines) has visited various parts of the country during the year, and done much valuable work; his principal Reports are annexed. **The Geological Surveyor.**

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

The Report of the Board which has control of this work is annexed hereto. From a financial point of view it cannot be said to be satisfactory. This result is to be attributed largely to the primitive and half-hearted manner in which the claims supplied are worked, a state of affairs which can only be remedied by the introduction of machinery and of a better skilled and more energetic class of claimholders. **Mount Cameron Water-race.**

The establishment of these much to be desired institutions in two or three of our chief mining centres, although annually urged, has not yet been accomplished. The miners at Zeehan, with much commendable energy, have started in a small but highly creditable manner, and, unaided by Government, have secured a building and commenced a course of lectures. Much interest is taken in the work by the miners themselves, and it is again strongly urged that the Government may see fit to encourage them with, at any rate, a small subsidy. **Schools of Mines.**

In conclusion, I have every confidence in expressing a most hopeful view of the progressive condition of the mining industry of the Colony.

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

F. BELSTEAD, *Secretary for Mines.*

The Honorable the Minister of Mines.

APPENDIX.

No. 1.

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

YEAR.	QUANTITY.	VALUE.
	ozs. dwts.	£
1880	52,595 0	201,297
1881	56,693 0	216,901
1882	49,122 6	187,337
1883	46,577 10	176,442
1884	42,339 19	160,404
1885	41,240 19	155,309
1886	31,014 10	117,250
1887	42,609 3	158,533
1888	39,610 19	147,154
1889	32,332 13	119,703
1890	20,510 0	75,888
1891	38,789 0	145,459
1892	42,378 0	158,917
1893	37,687 0	141,326
For the first half-year of 1894	23,040 0	86,400

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, 1892, 1893, *and the first Half-year of* 1894.

YEAR.	QUANTITY.	VALUE.
		£
1880	34,345 ounces	130,622
1881	45,776 ,,	174,956
1882	36,215 ,,	137,183
1883	36,672 ,,	138,060
1884	30,540 ,,	114,630
1885	33,266 ,,	124,234
1886	25,004 ,,	87,516
1887	33,427 ,,	123,453
1888	34,156 ,,	126,139
1889	33,069 ,,	116,517
1890	17,829 ,,	64,184
1891	33,659 ,,	126,221
1892	34,386 ,,	128,947
1893	30,163 ,,	113,111
For the first half-year of 1894	19,806 ,,	74,272

No. 3.

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

YEAR.	QUANTITY.	VALUE.
	tons.	£
1880	12,219	10,998
1881	11,163	10,047
1882	8803	7923
1883	8872	7985
1884	7194	6475
1885	6654	5989
1886	10,391	9352
1887	27,633	24,870
1888	41,577	37,420
1889	36,700	33,030
1890	50,519	45,467
1891	43,256	38,930
1892	36,008	32,407
1893	34,693	27,754
For the first half-year of 1894	15,917	12,732

No. 4.

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

YEAR.	TONS.	VALUE.
		£
1880	3954	341,736
1881	4124	375,775
1882	3670	361,046
1883	4122	376,446
1884	3707	301,423
1885	4242	357,587
1886	3776	363,364
1887	3607½	409,853
1888	3775¼	426,321
1889	3764	344,941
1890	3209¼	296,368
1891	3235	291,715
1892	3174	290,083
1893	3128½	260,219
For the first half-year of 1894	1444¼	98,475

No. 5.

RETURN showing the Number of Persons engaged in Mining during the Years 1880 *to* 1893, *inclusive, and first Half-year of* 1894.

YEAR.	NUMBER.	YEAR.	NUMBER.
1880	1653	1888	2989
1881	3156	1889	3141
1882	4098	1890	2868
1883	3818	1891	3219
1884	2972	1892	3295
1885	2783	1893	3403
1886	2681	1894 (first half-year)	3283
1887	3361		

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 1889.

Nature of Lease.	In force on 30th June, 1889.		In force on 30th June, 1890.		In force on 30th June, 1891.		In force on 30th June, 1892.		In force on 30th June, 1893.		In force on 30th June, 1894.	
	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 5*s.* an acre	1497	53,251	1303	49,463	1495	67,216	1857	89,962	1547	71,279	997	45,532¾
For coal and slate, at 2*s.* 6*d.* an acre rent	38	4499	51	7636	45	7255	47	6874	57	8963	23	4231
Under "The Gold Fields Regulation Act," at a rental of 20*s.* an acre	270	2687	325	3088a. 2r. 20p.	245	2366a. 2r. 10p.	489	4606	501	4801	374	3532½
Water Rights, Mineral and Gold	204	1005 sluice-heads.	209	950 sluice-heads.	200	998 sluice-heads.	173	812 sluice-heads.	185	890 sluice-heads.	198	866 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, 1893, issued during the Year ending 30th June, 1894, cancelled during the Year ending 30th June, 1894, and remaining in force on 30th June, 1894.

Nature of Lease.	In force on 1st July, 1893.		Issued during Year ending 30th June, 1894.		Cancelled during Year ending 30th June, 1894.		In force on 30th June, 1894.	
	NO.	AREA.	NO.	AREA.	NO.	ABEA.	NO.	AREA.
		Acres.		Acres.		Acres.		Acres.
Under "The Mineral Lands Act," for tin, &c., at a rental of 5*s.* an acre	1547	71,279	309	12,531	859	38,277¼	997	45,532¾
For coal and slate, at 2*s.* 6*d.* an acre rent	57	8963	6	839	40	5571	23	4231
Under "The Gold Fields Regulation Act," at a rental of 20*s.* an acre	501	4801	116	1065	243	2333½	374	3532½
Water Rights, Mineral and Gold	185	890 sluice-heads.	51	164 sluice-heads.	38	188 sluice-heads.	198	866 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	1887	14,611	11	5
1881	20,936	5	5	1888	23,502	8	4
1882	23,077	1	9	1889	17,254	9	0
1883	15,439	14	5	1890	26,955	4	9
1884	6981	11	10	1891	37,829	16	5
1885	11,070	5	7	1892	17,568	18	4
1886	12,523	10	4	1893	16,971	9	2

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

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	6	47,248	15	0	1771	17	6
1893	5	48,312	10	0	1811	14	5
1894, first half of	4	21,775	0	0	816	11	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.....	6	69,616 19 10	2610 12 11
1893.....	4	69,285 6 6	2598 3 11
1894, first half of ...	5	24,431 18 9	916 3 11

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	3	9023 9 0	338 7 3
1893.....	2	6300 0 0	236 5 0
1894, first half of ...	2	15,055 0 0	564 11 3

No. 12.

RETURN of Dividend Tax paid by Coal Mining Companies.

YEAR.	NO. OF COMPANIES.	AMOUNT OF DIVIDEND.	AMOUNT OF TAX.
		£ s. d.	£ s. d.
1893.....	1	605 12 4	22 14 3
1894, first half of ...	...	...	...

(No. 71.)

MINE MANAGERS' EXAMINATION.

March 5th, 6th, and 7th, 1894.

QUESTIONS SET.

Section A.—MINING.

I. Describe in detail the system usually adopted for working alluvial ground on a large scale.

II. What methods of working would you apply to ascertain whether a given district contained valuable metals, and what surface indications would you expect to see if the ground contained (*a*) Iron, (*b*) Copper, (*c*) Gold, (*d*) Coal?

III. How would you sink a shaft through "drift"? What difference would you observe in sinking through a drift of small thickness (5ft. to 6ft.) and a drift of considerable thickness (40 ft. to 50 ft.)?

IV. If in driving eastward on a lode you met with a cross-course bearing north-west, would you expect the lode to be heaved to the right hand or to the left hand? Is the size of a cross-course any guide to the extent to which it heaves a lode?

V. What is the difference in the explosive action of nitro-glycerine compounds and gunpowder? Which explosive do you prefer for hard ground, and which for soft ground, and why?

VI. What timbering would you adopt for shafts, drives, and stopes in soft ground, and what kind of timber is best for this purpose? If a lode is too wide to be taken out with ordinary timber, what system of timbering would you adopt? Illustrate both sections of this question by detailed sketches.

VII. What arrangements for winding, &c. would you employ for hauling from 1500 to 2000 trucks per eight hours from a deep perpendicular shaft?

VIII. What are the chief points of difference between vein mining, bed mining, placer mining, and mass mining?

IX. Explain the following terms:—Slide, Heave, Shoot of Ore, Horse of Ground, Pipe Vein, Carbona, Caunter Lode, Fault.

X. What is a frequent cause of dry-rot in underground timbers? and what conditions would you observe to minimise this evil?

XI. In case it were necessary to fix a Cornish pump in a shaft which had been sunk one hundred feet vertically, and then three hundred feet on the underlie of the lode, how would you change the direction of the main rod from the perpendicular to the underlie? Illustrate your answer by a sketch.

XII. If in consequence of the failure of a bucket the water in a shaft should rise above the whole of a draw-lift, how would you unwater the shaft? Why is a draw-lift preferable for use while sinking?

Section B.—ORE-DRESSING AND SAMPLING.

I. What do you consider the best known process for extracting gold from refractory ores, particularly when the gold is very fine? What machinery do you believe to be the best for fine crushing? State the reason for your answer.

II. Why is it that the slimes of galena and antimony are more difficult to collect than the slimes of tin ore? Why is it necessary to calcine some tin ores during the process of dressing?

III. How do you obtain amalgam, and how do you extract the gold from it? What do you understand by the term "the quicksilver is sickening or flouring"? How can you restore sickened quicksilver to its proper condition?

IV. Do you consider it necessary to classify ores before dressing? If so, why?

V. How would you take a fair sample of a day's tailings of a large dressing-plant?

VI. Describe in detail *one only* of the following machines:—Munday's Buddle, Rittinger's Percussion Table, Frue Vanner, Hartz Jig.

Section C.—MINING GEOLOGY.

I. Distinguish between true *lodes* and *stratified ore deposits* (ore-beds or layers). Give a short account of the mode of formation of each.

II. Describe a "*saddle-reef*."

III. Give an account of the chemical changes that commonly take place in the portions of lodes near the surface owing to oxidation.

IV. Name and give the composition of three of the principal ores of each of the following metals:—Copper, Silver, Lead, Iron, Antimony.

V. What useful minerals are most commonly found as alluvial deposits? Mention instances.

VI. In a certain district of Tasmania the lowest slopes of the hills are composed of granite carrying tin-bearing lodes: higher up the granite is overlaid by horizontal beds of sandstone and fossiliferous rocks of the Permo-Carboniferous system. Give reasons why you would or would not expect the lodes to be found in the overlying strata as well as in the granite.

VII. Discuss the question of whether lodes as a rule become richer or poorer in depth.

VIII. Name five varieties of rocks of igneous origin which form the country in which lodes of valuable minerals are found, and give instances of the occurrence of the latter in each.

Section D.—MINING SURVEYING.

I. In a survey with the magnetic needle, the following bearings and distances were noted:—

	Back-bearing.	Fore-bearing.	Distance. ft.	in.
Line 1	—	1° 36′	22	10½
,, 2	185° 27′	327° 44′	33	5½
,, 3	139° 15′	224° 53′	37	7½
,, 4	22° 57′	156° 44′	36	1½
,, 5	347° 48′	165° 03′	25	8
,, 6	346° 15′	79° 48′	48	3
,, 7	259° 34′	349° 04′	40	1

The first station is free from local magnetic attractions; what are the correct bearings of the other lines?

II. Calculate the co-ordinates (on meridian and perpendicular) of the above traverse, and plot it to a scale of not less than 20 feet to an inch.

III. An underlay shaft is sunk on a lode which for the first 50 feet (measured on the slope) underlays in it 1 in 6, for the next 30 feet 1 in 4, and then for the remaining 70 feet to the bottom of the shaft 1 in 8: what is the vertical depth of the shaft, and what is the horizontal distance between the top and the bottom of it?

IV. What are the special advantages and disadvantages in the use of the miner's dial in under-ground surveying as compared with the theodolite? Give a general description of a miner's dial.

V. In the triangle ABC the angle $A = 37° 45'$, $B = 72° 15'$, and the side $AB = 437$. Find the sides AC and BC, and the perpendicular distance from C to AB.

VI. Plot a section to any convenient scale from the following entries in a Level Book, and adopt as datum line a level 100 feet lower than Station A:—

Back Sight.	Int.	Fore Sight.	Distance.		
13·56	...	...	0	links	A
...	10·20	...	47	,,	B
...	6·35	...	83	,,	C
6·40	...	2·10	100	,,	D
3·04	...	10·00	300	,,	E
...	6·60	...	319	,,	F
..	...	12·20	400	,,	G

VII. Describe method of correction when a level is out of adjustment in collimation, *i.e.*, when axes of telescope and of bubble tube are not parallel.

Section E.—SURFACE WORK.

I. Given a 1 in 6 crossing to be laid for a turn-out from a tramway; how would you fix position for points, and how would you lay out a curve of 5 chains radius, starting directly from crossing, without a theodolite?

II. A 6-inch cast iron water main is laid on a grade of 1 in 100 for 1 mile, and the pipes are in 12 ft. lengths. What is pressure over the whole of the bottom joint, and over the whole of one bottom length when pipe is full? Will pressure be more or less when water is stationary than when flowing with its full velocity? What should be thickness of the pipes?

III. What is theoretically the best shape for a water-race, and what would be the difference in steep mountainous country compared with flat country as regards shape? Give grades generally adopted, and the reasons for differences.

IV. Give approximate breaking loads for wrought iron bars $\frac{3}{4}$-inch diameter under tensile strain.

V. What would be difference of strain on rope of a winding engine between the vertical lifting of a load and the haulage of same in a grade of 1 in 5 (excluding allowance for friction)?

VI. An inflow of water is coming into a mine at the rate of 9 inches in 4 hours. The mine pump is set to work at the rate of 75 gallons per minute. After 3 hours' pumping the water has lowered 2¼ inches. What is the quantity of water (in c. ft.) coming into the mine?

VII. The total pressure upon the upper surface (diameter) of a mine pump bucket is 15 tons; the head of water 200 feet. What is the diameter of the bucket, and the pressure per square inch?

VIII. In a mine 1654 feet deep, a winding drum 22½ feet diameter is used for winding, the diameter of rope 1½ inch. What length must the drum be between the flanges to prevent the rope coiling upon itself?

IX. What will be the period of time occupied in winding from a depth of 650 feet,—the engine piston to travel 360 feet per miuute, stroke of piston 3 feet, diameter of drum 6 feet, rope 1·1 inch diameter ?

X. What retarding force can an engine-driver effect through a pressure of 150 pounds applied to the brake lever of a winding drum having an effective leverage of 35 to 1, taking the coefficient of friction one-half?

XI. What is the least size (square rods of pitch pine) required for working a plunger pole pump 14 inches diameter, discharging water at a maximum height of 50 fathoms above the bottom clack ; taking the crushing force of the timber at 2 tons per square inch, allowing a factor of 32 for contingencies and safety ?

XII. The diameter of a pump bucket is 16¼ inches. The discharge launder is 150 feet above the level of water in sump. What is the tension on the pump-rods in the up-stroke (omitting friction) ?

Section F.—BOOK-KEEPING AND MINE ACCOUNTS.

I. A certain fairly large mine, worked with the aid of winding and pumping engines, has its concentrating mill, two miles distant, under the same management, and connected with the mine by a horse-tramway ; under what headings would you classify the expenses of the mine, and what books should be kept at the mine manager's office in order that he may readily be able to give detailed costs of each separate class of work ? Give specimen pages of these books.

Section G.—MINING LAW.

I. What are the provisions of "The Regulation of Mines Act, 1891," as to the storage and use of explosives in mines ?

II. What are the provisions of the same Act with regard to signalling in mines ?

III. What precautions are required to be observed in driving underground towards old workings full of water ?

IV. What are the duties of a mining manager with respect to inspecting and recording the state of safety of the mine workings and appliances ?

V. What steps must be taken by the lessee of a mineral section to secure the timber upon it, and how much of this can he have reserved to his own use ?

VI. A section is held under lease under "The Mineral Lands Act": what are the provisions of the law as to marking its boundaries and maintaining these marks ?

VII. What course of procedure is to be followed in order to obtain a ning Easement ?

VIII. Under what circumstances is a mineral lease liable to be forfeited

REPORTS OF COMMISSIONERS.

Commissioner Glover reports :—

Northern and Southern Division.

Whilst, during the past 12 months, the Northern Gold-fields have presented nothing very remarkable to be recorded, the general development has, nevertheless, been steadily progressive and highly satisfactory. The principal, though most recent event, as being one of the greatest importance to the gold yield of the country, has been the resumption of operations on the lodes, and consequent gold production of the Tasmania Mine at Beaconsfield. The other circumstances which may be mentioned are certain enterprises commenced during the year, viz., the introduction of the system of hydraulic sluicing to be applied to a large tract of country at Salisbury, the necessary water being brought from Supply Creek, about eight or nine miles from Beaconsfield, at considerable expense ; and the project of treating the mud and detritus at the mouth of Middle Arm Creek, which discharges into that arm of the Tamar, to recover the pyrites and fine gold which has escaped from the works of the Tasmania Company. The work of the former of these projects is now near completion ; but the latter is at present suspended, as alleged, for the establishment of more extensive appliances than those at first employed. The Ballarat enterprise for proving the deep ground at Cabbage Tree Hill has recommenced mining operations after a long suspension caused by the influx of water. There are several new mining undertakings in progress, and much energy has been awakened by the important revelations in the lowest depth of the Tasmania mine. The yield of gold from Beaconsfield for the 12 months was 4065 ounces, value £14,909.

Beaconsfield.

Salisbury.

Middle Arm Creek.

Lefroy.

At Lefroy the two regular dividend-paying mines on the reefs, known respectively as the "Pinafore" and "Volunteer," continue their yields, the latter having given over three ounces to the ton of stone treated. Two other mines on each of these reefs are being actively worked, with fair prospects of success. The resumption of operations on five or six of the mines, which some twelve or fifteen years ago were commenced and abandoned, is at present engaging the efforts of promoters. There are also new undertakings in the neighbourhood, said to be valuable, but at present there is no development upon which to found a definite opinion. The gold produced at Lefroy for the past 12 months amounted to 20,757 ounces, value £81,848 ; that of the previous year being 15,548 ounces, value £60,200.

Lisle.

Denison.

At Lisle some 50 men still continue to gain a living by reworking the formerly worked-out ground on extended claims, and two prospecting associations are doing *bonâ fide* work in the hope of adopting the hydraulic sluicing method of treating the ground, if a right of water from St. Patrick's River can be obtained. During the past 12 months Lisle has contributed 1442 ounces of gold, value £5691. The region comprising the Denison, Golconda, &c. is almost deserted by prospectors, nor are the efforts of isolated prospectors likely to be of much effect, capital being required for the description of work now necessary in that neighbourhood. But very recently a strong association has been formed in Hobart for the purpose of exploring a special prospecting area of 320 acres on Panama Creek, Golconda, and operations in trenching have been commenced.

Bell Mount.

At the gold-field of Bell Mount, near Sheffield, no new discoveries of any great value have been made during the year. The field is occupied by some 25 men. The quantity of gold obtained for the 12 months was 1415 ounces, value £5467.

Mr. Commissioner O'Reilly reports as follows :—

North-Eastern Division. Gold.

There has not been any material advancement in the state of gold-mining in this district during the past twelve months, a great deal of the work done in the claims being of a preliminary or prospecting character. At Mount Victoria two claims have been mined, and there appears some likelihood of the prospects of this locality being improved during the coming year.

The yields of gold from one of the above claims (Mr. F. Krushka's), on which during the past year mining operations were commenced, are considered very satisfactory, and warrant an expenditure in more largely developing the mine. The Mount Victoria Company are about to recommence crushing in a brief period with, it is said, good prospects of success.

At Warrentinna the prospects of the gold-field have been somewhat clouded for a time during the past year through the Derby Gold Mining Company having suspended active mining operations for a few months, during which only a few men were employed in further prospecting the claim, which has led to further discoveries; and I am informed that, in a short time, crushing of quartz will be again carried on.

Several of the other claims have been mined on tribute, in some instances very profitably ; but in a few others I fear that the returns or yields have not as yet paid the tributors for their labour.

A new battery is being erected to meet the growing requirements of the locality, and will tend much towards promoting the development of this gold-field.

The track from Branxholm to this locality (Warrentinna) is almost in an impassable state, and it is with very great difficulty that foot-travellers or horse-traffic can pass over it, thus rendering the cost of provisions and stores for miners much higher than if the state of the track were otherwise. A short distance from Warrentinna a new claim, known as "Kerrison's," has been very thoroughly prospected by a party of working miners, and the prospects are considered so encouraging that a small crushing-plant is being erected.

Although the yields of gold from the Warrentinna locality have not been large, there is a good deal of confidence placed in the future advancement of this gold-field by experienced miners, and I look forward to increased yields during the coming year.

Notwithstanding a few reverses experienced by some persons engaged in gold-mining in the above localities during the past year, on the whole the returns show a satisfactory improvement over the previous year,—there being an increase of 943 tons of quartz crushed, as also of 926 ozs. 11 dwts. of gold won.

Quartz crushed	3851 tons.
Gold won	2467 ozs. 11 dwts.
Average number of men employed	85

Tin.

Having reported very fully in my last annual report upon the state of tin-mining in this district, but little change in the state of things has arisen since then to refer to at the present time. Notwithstanding the low prices ruling for tin ore during the greater part of the past year, a steady and persevering industry and enterprise has been exhibited by many of the claimholders in carrying on mining operations on their mineral-bearing lands with, on the whole, satisfactory results as regards the yields.

The shortness in the supply of water during the autumn months and early winter time has considerably retarded the progress of mining operations; and the low price of tin has caused a considerable extent of the lands that contain but a poor deposit of tin ore to remain unworked. There are a good many claims held under Miners' Rights, and, so far as I can learn, the holders of such are doing fairly well in carrying on mining operations.

The total output of tin ore from this district for the year ending 30th June, 1894, amounts to 1595 tons, which, on the whole, appears to be satisfactory, considering the drawbacks before referred to. During the above period the average numbers of men employed were—Europeans, 295; Chinese, 325.

Eastern Division. Tin.

Commissioner Dawson reports:—

The output of tin has kept up fairly well during the year. From the 1st January to the 30th of June 76 Miners' Rights have been issued to tin-miners. I cannot yet venture an opinion what effect the issue of these Miners' Rights will have upon the output of tin.

The yield of tin by stampers is still confined to the Anchor Company.

Mr. J. M'Queen, a gentleman from New Zealand, has erected a foundry near St. Helen's, where he intends to manufacture his "patent machinery," which will be placed on the "Puzzle Claim," where large developments of tin stuff have been made. If his patent succeeds he may reasonably expect orders from other companies for the same.

I am credibly informed that the show at "Rix Hill," Ben Lomond, for tin is improving.

Gold from quartz.

This industry is progressing very steadily at Mathinna and surrounding districts. The Golden Gate Company is giving a good yield of gold that should be satisfactory to shareholders.

The City of Melbourne claim will again make a start under a new company, which has just been floated. The Twilight and other companies are actively engaged in further prospecting their properties.

Holders of Miners' Rights are actively prospecting in the vicinity of Mathinna and on the Upper Scamander River.

Gold from the alluvial is a thing of the past.

Coal.

The Mount Nicholas and Cornwall mines are going steadily on with their operations. The output of coal is steady, and the coal of excellent quality. This industry is a settled one.

I have nothing special to report as to the mining industry of this district. Without being over-sanguine, I am of opinion that, considering the low price of tin, together with the general depression that still exists throughout the Colony, the mining interest in this district is in a healthy condition.

North-Western Division. Tin.

Mr. Registrar Tegg reports:—

The Mount Bischoff Tin Mining Company's mine continues its regular output, and from all appearances is likely to do so for years to come.

The West Bischoff has been idle for a short time, but work is to be started again, almost immediately, on tribute.

The Stanhope mine is being worked with excellent results. Stanhope Alluvial and Waratah Alluvial with fair results.

Silver.

Mining in the Whyte River and Heazlewood Districts has been rather dead: for though, in mining parlance, there are some really good shows, still it requires large capital to test them.

The Godkin mine is in full work, but not ore-raising.

The Washington Extended has passed into new hands, and is now known as the Confidence Mine. Work is being carried on, but no ore raised.

The property formerly known as the Whyte River S. M. Company is now being worked by Messrs. Jupp and Eastman, who are sanguine as to its ultimate success. Assays of ore from this property have given excellent results. Lately two tons of ore were sent to the smelter, but the result has not yet been received.

The Magnet Silver Mining Company's property is being energetically worked; and if what report says be true, is likely to prove a good property. Ten tons of ore have been sent away, but the yield is not yet to hand.

The Silver Cliff has passed into the hands of Mr. Richard Bailey, but at present is idle.

Gold.

In alluvial gold-mining payable results have been obtained at Rocky River, Long Plains, Whyte River, and the Hellyer. At Whyte River, a short time ago, one man in 15 days obtained £40 worth of gold; and quite recently, at Rocky River, one man, quite a new hand at the work, in three weeks obtained £20 worth, including a two-ounce nugget.

At the Hellyer the great drawback is the want of pack-tracks, nearly half the working time of the men being spent in carrying in supplies.

Commissioner Fowell writes :—

Western Division, Southern portion.

Mount Lyell.—The Mount Lyell Mining and Railway Company, Limited, have continued developing their valuable property during the past year, and, so far, with great success.

Dr. Peters' report is being borne out in every particular, and the rich vein of mineral has been steadily followed down with an excellent result.

The mine now requires the railway to Macquarie Harbour most urgently, and it is to be hoped the company will not relax their efforts to obtain it as soon as possible.

West Mount Lyell.—This company has done a considerable amount of work during the year, and as the Mount Lyell and South Mount Lyell companies have proved their properties to be beyond question of great value, West Mount Lyell should have a fair chance of striking the same deposit.

The South Mount Lyell Mining Association have done a large amount of prospecting, and have been well rewarded for their labour. This mine is in somewhat a similar position to the Mount Lyell companies,—further progress is at a standstill awaiting a railway or tramway connecting it with the Coast.

A Reef has been discovered near the Guilfoyle Creek, to the east of the King River Company's sections. It has been driven for some distance; it promises well, and improves both in quality of the stone and quantity as the drive is extended.

The Madam Howard Gold Mine has been worked for a time, and has sent down two or three parcels of gold.

The Woody Hill Mine.—A considerable amount of work has been done on this mine, and the prospects are very favourable. A tunnel is being driven to prove the mine at a depth of over 200 feet. The country has been very hard but is now getting softer, and the mine manager hopes to strike the reef in about three weeks. This is the first gold mine on the West Coast that has endeavoured to prove what exists at a depth, and it is to be hoped they will be well rewarded for their enterprise.

The Princess and *Princess Extended* are now held by another company, who have done a large amount of work during the year. At present an effort is being made to float a larger company, and obtain machinery to get below the disturbed country. There is quite sufficient encouragement, from what has been done already, to warrant extending operations with good prospect of success.

During the year a considerable amount of *alluvial mining* has been carried on, and, as a rule, the men employed have obtained fair results.

There is an evident inclination to extend prospecting towards the south end of the district and in the direction of Mount Darwin. The track which is now being opened up along the Garfield River will greatly assist, as miners will be able to get supplies of stores with much greater ease from Strahan to Flanaghan's Flat, and avoid passing over Mount Sorell.

The experience of the past six years has fully confirmed my faith in the permanency and value of the mineral deposits on the West Coast, and it is simply a question of time and opening up the country by tramways and railways to ensure a safe return for capital invested.

Commissioner Hall reports :—

Western Division, Northern portion.

Gold is not being produced in such large quantities as formerly. This seems to be owing to the fact that the best of the known gold-bearing areas have been picked over, and the surface gold having been obtained the ground has then been abandoned. But notwithstanding this a fair number of men are still profitably engaged on prospecting areas, and will probably be able to continue so for some time longer.

During the past year a marked change has come over the mining industry as regards the silver-lead mines. In that period we have entered upon the *bonâ fide* dividend-paying age. Certainly only one mine has so far distributed its profits (amounting to from £2000 to £3000 monthly) at regular intervals, but there is very little doubt but that other mines will in a short time follow that lead. The principal mines have got well forward in the systematic development of their resources, and are daily proving that there is a large amount of wealth to be won from their various areas. One feature in the progress of the field has been the increase in the tribute or royalty system. Many leaseholders who from want of capital or other reasons have not been able to develop their properties, have obtained much benefit by letting the working of their lodes to tribute parties, and by these means, besides obtaining capital for future working, have hastened the development and proved the value of their areas. Two new concentrating plants have been erected during the year, making a total of six now in active work. It is probable that the smelting plant will be at work either at Zeehan or at Strahan before very long. It is much to be regretted that Dundas mines have not so far proved as valuable as it was thought they were when first discovered. For the pre sent, with three or four exceptions, the mines there have ceased work. This does not mean that they are valueless,—far from it. No one can say what the expenditure of a little capital in honest work would prove, and there are many properties there that are well worth further testing.

Tin mining has received a sudden impetus, and a great deal of productive work as well as prospecting is going on in several parts of the district, notably Mount Heemskirk, Stanley River, and North Dundas. The quantity of this mineral that is being won is increasing rapidly, and it seems certain that it is going to form a large item in the list of exports.

A large deposit of nickeliferous ore is being worked in the vicinity of North Dundas, and a quantity has been exported, with the result that the working of the deposit has been proved to be profitable.

Although a number of miners have been attracted to other fields, particularly those of Western Australia, still others seem to have arrived in equal numbers to take their places ; and, as far as they can be counted, there seems to be quite as many men engaged in mining now as there were a year ago.

REPORT OF THE CHIEF INSPECTOR OF MINES.

DURING the year I have taken every opportunity of inspecting as many mines as possible, but my duties as Geological Surveyor have taken up so much time that no systematic rounds of inspection could be made, and several mining districts could not be visited at all during the year. In consequence of the infrequency of the visits of the Inspector a considerable amount of laxity in the observance of the provisions of the Mining Act, 1893, is often noticeable, though I am glad to say usually only in matters of minor importance. It has been my endeavour to insist on strict compliance with the law wherever instances of its non-observance have been met with, but unless more frequent inspections can be made I am afraid that a good many mines will still continue to be worked without due regard to it.

Mining Accidents.—The number of accidents recorded in the mines of the Colony is much the same this year as in 1892-3, the total number being 27, as against 29 last year, 19 in the year before last, and 27 in the year ending 30th June, 1891. The number of accidents resulting fatally is unfortunately above the average, 7 men having been killed—five Europeans, and two Chinese ; of the other cases, 8 were attended with rather serious injury, though none very severe, and 12 were comparatively trifling.

The causes of accidents were as follows :—

Falls of Earth and Rock.—By these 1 European and 2 Chinese were killed, 1 European and 1 Chinese seriously injured, and 2 Europeans hurt in a lesser degree : total, 7.

Falls of Material in Shafts.—Three Europeans were killed while sinking shafts by falls of material from surface. In one case a piece of timber slipped from the rope by which it was being lowered and killed a man below; in the other the sinking bucket full of water broke away from the rope through the splice drawing out, and instantaneously killed two men in the bottom of the shaft. In the latter instance the mining manager was fined at the Police Court for neglecting to test the rope as required by the Act. One serious and three trifling accidents also occurred from falls of material in shafts, all the injured men being Europeans : total, 7.

Machinery in motion.—Two Europeans were seriously and three less severly injured by accidents with machinery : total, 5.

Explosions.—Four men were hurt by explosions of detonators, 2 seriously and 2 less severely; all four cases seem to have been due to careless or ignorant handling of the detonators. Another man was slightly injured by an explosion of a little loose blasting powder ; all were European miners : total, 5.

Fall from battery stage.—One European received rather severe cuts and bruises by this means.

Fall of a tree.—One European while working by himself in an alluvial claim was killed by a tree falling upon him.

Fall down shaft.—A European miner received somewhat severe injuries by falling down a shaft a distance of thirty feet.

Several of the accidents were mishaps such as the miner's calling can never be entirely free from, but there can be no doubt that a large proportion could have been avoided by the exercise of greater care and vigilance by the workmen. Except in two of the cases above mentioned, however, it has not been thought necessary to take proceedings against any person concerned in these accidents.

Complaints as to safety of Mines.—Two complaints have been made to me as to the state of mine workings with regard to safety, but on investigation both were found to be unwarranted.

Inspector Harrison reports :—

I am very sorry to say the accident list is again very heavy, namely, 11, 4 of which proved fatal ; none of the others were of a very serious nature. Accidents.

Although a few mines have closed down for the present, we have 32 shafts at work, in which either pumping or winding machinery is erected, being an increase of 7 since my last Report. Machinery.

Cages and ropes have been tested on all mines using same ; in one instance a rope broke during the operation, and was condemned. Safety appliances and ropes.

Proceedings were taken against a manager for neglecting to have his winding-rope tested before putting it into use, and a fine of £5 imposed. Proceedings were also taken against two men employed at the Montana Mine for negligently allowing a piece of timber to fall down one of the shafts, by which a miner named Harry Clark was killed. This case was dismissed, as there was not sufficient evidence to prove negligence on their part. Prosecutions.

Both magazines are in clean condition. 83 cases of damaged explosives were destroyed by me in May last. Magazines. Remarks.

Although the heavy fall in the price of silver has been keenly felt on this field, I am pleased to say the output of ore is being well maintained, and will, I feel sure, be considerably increased in the near future, especially when the smelting-works go into blast again, allowing the low-grade carbonate ores to be treated to advantage. At Mount Heemskirk tin mining is assuming a far more permanent character ; lodes are being opened up and worked to advantage. Good lode tin has been found on the Stanley ; while the Commonwealth Company are preparing to open up their large pyrites deposit at Mount Dundas on an extensive scale. General Remarks.

In the Mount Lyell District mining is in a most healthy condition, and giving employment to a large number of men. Several new gold-bearing lodes are now being opened up in this locality.

Western District.

List of Accidents for the Year ending 30th June, 1894.

1893.

20th July.—James Donohoo was hurt on the forehead on the British Zeehan Mine through putting the wrong end of fuse in charge, and holding the candle under the cap until it exploded.

20th August.—John Mannix lost two fingers of the right hand through a stone falling from the face while in the act of lifting a cap-piece into position on the Western Mine.

12th September.—Joseph Ward got the small bone of his ankle broken in the Silver King Mine by a fall of ore from the face while in the act of working out the effects of a shot.

18th September.—David Ward, married, age 45, native of Limerick, Ireland, was killed at the Silver Queen Mine through the bursting of a mullock-pass that he was endeavouring to run.

31st October.—Harry Clark died from the effects of injuries he received the day previous in a shaft of the Montana Company, his mates allowing a piece of timber they were in the act of sending down to fall away. Clark was a married man, aged 30, a resident of the N.W. Coast.

1st November.—William Rodgers, single, age about 30, native of Hobart, and George Smith, single, age about 30, native of Ballarat, were both killed at the Fahl Ore Mine, through the eyesplice in iron rope drawing and allowing a large bucket full of water to fall a distance of over 60 feet down the shaft in which the unfortunate men were sinking ; both were killed instantly.

1894.

4th January.—Alick Patterson, engine-driver, lost one of his toes. He was cleaning the crank of the pumping-engine whilst in motion.

30th January.—John Wade was injured internally at the Silver King Mine by going into the winding-shaft at surface while the cage was in motion.

3rd February.—D. Sullivan lost a finger at the Silver Queen No. 2 shaft through the pump-rods falling away.

4th June.—Henry Lee lost a thumb and finger of the left hand at the British Zeehan No. 2 shaft. While in the act of screwing a dynamite cap into a piece of fuse it exploded.

ANNUAL REPORT OF THE GEOLOGICAL SURVEYOR.

DURING the year I have forwarded to the Department the following Reports:—

On the Roy's Hill Tin Mine.
On the Brookstead Estate Tin Lodes. (Second Report.)
On the Mineral Discoveries in the neighbourhood of Bell Mount.
On a Deposit of Iron Ore at the Blythe River.
On the Corinna Gold-field.
On the Lawrenny-Langloh Coal-field.
On the Mount Huxley Gold Mine. (Three Reports,—the second one being written by Mr. Jas. Harrison, Inspector of Mines at Zeehan, conjointly with myself.)
On the Queen River and Mount Lyell Mining Districts.
On the Back Creek Gold-field.

In the months of January and February, 1894, I made a detailed survey of the Back Creek Gold-field. The Lefroy field was also looked at cursorily, as a preliminary to a detailed survey which is to be made as soon as there is an opportunity. Short visits have also been made to the Rix Hill Tin Mine, the Whyte River mine, the Warrentinna Gold-field, and the mines at Branxholm, Derby, and Bradshaw's Creek, by which information has been gained that will be useful in future more extended examinations of these localities.

In December, 1893, in order to make the position of Tasmania as a mineral producer more widely known, a Paper on "The Mineral Industry of Tasmania" was contributed to "The Engineering and Mining Journal" of New York, U.S.A., and was published in its issues of the 21st and 28th April, 1894. As this Journal now publishes an Annual Supplement, the "Mineral Industry," giving full statistics of production of all mineral products the world over, it is important that the figures relating to our Colony's wealth should be regularly supplied to it.

The Report on the Iron Ore Deposit at the Blythe River has attracted some attention outside the Colony; and several inquiries have been made as to it by people interested in the iron trade. As shown therein, there is a great likelihood that the time is drawing very near, if not now come, when the large deposits of iron ore which Tasmania possesses will be profitably worked.

Diamond Drills.—Only the No. 2 Diamond Drill has been at work during the year,—having been engaged in boring for coal at Southport, and afterwards been taken to Zeehan to bore horizontally in the western drive of the Tasmania Crown mine, where the ground had become very hard and expensive to drive through in the usual way. Particulars of these bores are given in the tables appended hereto. Only a three-inch seam of coal was cut in the Southport bore, and below it the drill went through marine sedimentary deposits. As the No. 2 Drill is only intended to work to 600 feet, and began to run very heavily at the last, the bore was discontinued at 612 feet, without having reached the formation underlying the coal measures. It is a pity that a complete section of the strata could not be obtained, as up to the present very little information is available as to the lower coal measures of the Colony, to which the Southport and Port Cygnet coal seams belong.

At the Tasmania Crown mine the drill has been greatly delayed by a succession of mishaps,—the worst of which was the breakage of the air cylinder. The rock is brittle also, and does not core well, causing progress to be slow, and leading to considerable loss of diamonds by fracture.

During the year there have been several proposals to employ the drills, but none of these came to anything. A great deal of good can be done by diamond drill boring, and they could be very usefully employed in several mining ventures now in progress.

REPORT OF THE MOUNT CAMERON WATER-RACE BOARD FOR THE YEAR ENDING JUNE 30, 1894.

17*th July*, 1894.

SIR,

This Board has the honor to report as follows :—

The Board has met as frequently as occasion required. Meetings of the Board.

The Staff now consists of a manager, three watermen and channel-keepers, the services of one waterman having been dispensed with during the year, and the work distributed between the remaining three. The Staff.

No new works have been undertaken during the year, but several of the flumings upon the old portion of the race are becoming very unsafe, and a considerable loss from leakage is taking place. They are almost beyond repair, and it is probable that in the very near future much renewal work will have to be done. Apart from this, the race is in good order and condition. The outlay of last year in the construction of conserving dams enabled the work of cleaning the race to be performed at a very much less cost than heretofore, and with no loss of revenue whilst the work was in progress. Condition of race.

Owing to the reduced demand for water, and the consequent large quantity which was unused and running to waste, the conviction was forced upon the Board that the price demanded by Act of Parliament was greater than customers could pay. Upon the recommendation of the Board an amended Bill, empowering the Board to make more liberal Regulations, was submitted to and passed by Parliament in November last. This has enabled the Board to frame regulations upon a more equitable scale, under which the users of water pay for it by a royalty upon the value, according to the market price of the tin raised. These regulations came into force on the 8th December last, and are satisfactory in that more claims are worked and no water is wasted ; but they have so far resulted in a considerable loss of revenue ; this loss is attributable, however, to the low price of tin which has ruled throughout the year. Should the market improve, the Revenue of the Board will correspondingly improve ; of this, however, the Board are certain that had the old scale of charges continued the Race would have worked at a loss, and an enormous quantity of water would have been wasted, for, with the average poorness of the ground and the prevailing low price of tin, it would have been impossible for miners to have continued using the water. Regulations.

The Statistics for the year as follows :— Statistics.

Average per week of claims supplied	17		
Greatest number supplied in any one week	25		
Present number supplied	16		
Total number of heads of water supplied	3415		
Tons of tin ore raised	136		
Average number of miners employed—37 Europeans ; 25 Chinese	62		
	£	*s.*	*d.*
Total receipts for the year	1133	16	6
Cost of maintenance and management	946	8	3
Paid to Public Debts Sinking Fund for the year 1893	853	9	1
Total cost of purchase and construction	32,928	0	0
Rate (for the year 1893) of interest upon the cost of purchase and construction	2·59 per cent.		

Revenue.

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

No. 2 DIAMOND DRILL.

Report of Strata passed through in boring for Coal at Southport for the Southport Coal Prospecting Association, No Liability.

BORE No. 1.

Boring commenced, 15th July, 1893; finished, 10th October, 1893.

Strata.	Thickness.	Total Depth.
	ft. in.	ft. in.
Surface shaft	18 0	18 0
Blue shale with small sandstone bands	6 6	24 6
Grey argillaceous sandstone	9 0	33 6
Grey quartzose sandstone, with mica	24 0	57 6
Ditto ditto, with little coal	0 3	57 9
Blue shale	7 9	65 6
Grey sandstone and blue shale	28 8	94 2
Black shale	0 10	95 0
Grey sandstone and black shale	5 1	100 1
Black shale, with plant impressions	10 6	110 7
Black shale and dark sandstone	5 0	115 7
Grey sandstone and fossiliferous black shale	19 1	134 8
Coal	0 3	134 11
Hard black shale with plant impressions	5 11	140 10
Hard blue shale and grey sandstone	41 0	181 10
Hard grey sandstone and grit	38 11	220 9
Hard dark grey fine-grained sandstone	212 0	432 9
Coarse rubbly sandstone	0 6	443 3
Hard grey fine-grained sandstone	64 0	497 3
Hard conglomerate	10 1	507 4
Hard grey fine-grained sandstone, with pebbles, marine shells, and blue shale bands	104 10	612 2

From the Foreman's weekly reports. Position of bore 70 chains north of the mouth "The Narrows," and one chain west of beach, about 30 feet above sea-level.

No. 2 DIAMOND DRILL.

Horizontal Bore at the Tasmania Crown Mine, Zeehan.

Boring commenced 5th March, 1894; discontinued on account of breakage of air-cylinder on 6th March; boring recommenced 24th April, 1894: still in progress.

Up to 30th June a distance of 160 feet 7 inches had been bored through hard and brittle dolomitic limestone with occasional slate bands in it. Detailed section of strata passed through deferred till completion of boring.

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

DIAMOND DRILLS.

Statement of Work done to 30th June, 1894.

Year.	*Locality.*	*Direction of Bore.*	*No. of Bores.*	*Total Distance bored.*	*Average Cost per foot, inclusive of Labour & Fuel.*
	No. 1 DRILL. (Table remains same as in last year's report.)				
	No. 2 DRILL. (Table as in last year's report, with the following additions:—				£ s. d.
1893...	Southport—For Coal	Vertical	1	612	0 5 3
1894...	Tasmania Crown Mine, Zeehan—For Silver	Horizontal, underground	1	161	In progress.
	TOTAL	...	40	11,471	

Aggregate number of bores 76
Total distance bored ..... 24,815 feet

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

Launceston, 26th July, 1894.

REPORT ON THE ROY'S HILL TIN MINE.

Geological Surveyor's Office, 5th October, 1893.

SIR,

ON the 26th and 27th of last month I visited the Roy's Hill Mine, and have now the honour to report upon it.

The mine is situated on freehold property near the south-west corner of a block of 2560 acres formerly held by Robert Hepburn, on the south side of the St. Paul's River, eight to nine miles by road from Avoca. Access to it is very easy, as a good road from Avoca to the East Coast runs through the block, and from this a practicable cart track, about half a mile long, leads to the workings; this track could, with little expense, be improved so as to become an excellent road, as the country over which it passes is nearly level and of gravelly nature. The mine lies just at the foot of the range of hills which form the south side of the St. Paul's River Valley, on a low flat spur running north-north-westerly into the river flats.

The lower spurs of the range are mainly composed of granite, similar to that of Ben Lomond, the Blue Tier, and Mount Cameron; this is well seen to the south-east from the mine. Lying upon the granite in horizontal strata we often find conglomerates, grits, sandstones, and fossiliferous mudstones belonging to the marine beds of our coal measures (Permo-Carboniferous). The spur on which the mine workings lie is capped with these younger strata, which, towards the south, cover and conceal the outcrop of the lode. West of the workings still another formation is represented, as we here come upon a patch of the old Silurian, or perhaps Archæan, metamorphic rocks, quartzites, sandstones, and slates; these probably are part of the same series of old rocks as are seen on the south side of St. Paul's Dome, at the neck of the Freycinet Peninsula, at Storey's Creek on Ben Lomond, and on the Mangana and Mathinna gold-fields; the granite is younger than these, and has been intruded through them. The lode which is now being worked lies along the contact of the granite and quartzite formations, and is probably due to alteration of the granite by hydro-thermal action along the margin of its mass. To the northward from the mine the older rocks soon disappear beneath the more recent alluvial deposits of the St. Paul's River Valley, but are again found north of the river on the foot-hills at the base of St. Paul's Dome. The alluvial deposits are mostly of early Tertiary (Palæogene) age, and on the Benham Plains are overlaid with vesicular basalt; they belong to the same period as the older fluviatile and lacustrine deposits of the Launceston Tertiary Basin, which are also in places overlaid by similar basaltic flows.

The old rocks carrying the lode are generally covered by these newer formations, or obscured by detritus derived from them, in the vicinity of the mine, and the discovery of the latter must be regarded as a lucky one, considering that a very small patch only of the bedrock was exposed.

The map sent herewith will be useful in showing the relative positions of the various mining workings to be described. It is not from accurate survey, but simply from a rough traverse with hand compass and tape, but will be sufficiently correct to show the general shape of the lode. The section is not to scale, but is a diagram to represent the relations to one another of the Tertiary, Silurian, Granitic, and Permo-Carboniferous formations.

As already remarked, the lode is a contact mass lying between the granite and quartzite formations. In all the holes and trenches, except that south of No. 4 shaft, the sedimentary rock is seen on the western margin of the granitic mass. The dip of the contact plane is generally rather flat to the westward, as if the body of granite were rapidly getting larger going downwards, but in No. 2 shaft it is to the eastward, and all through it is very variable. The main granite mass is not seen close to the workings, and I was in some little doubt as to its presence, but Mr. Pilbeam, the manager of the mine, was good enough to sink a hole on the eastern side of the spur to determine what the country rock there really was, and after passing through six feet of superficial matter the ordinary porphyritic granite was met with. The stone exposed on the eastern side of the line of contact is nowhere cut through to the main mass of regular granite, and is itself somewhat difficult to describe, varying a good deal both in composition and appearance. Generally it is mainly composed of granular quartz, with silvery white micaceous flakes rather sparingly distributed through it; but at times there is much mica, and sometimes there is a good deal of talc. In parts there is much kaolin, derived, no doubt, from decomposition of felspar. The softer parts of the lode containing mica, talc, and kaolin seem on the whole to be the richest in tin ore, but good tin is also found sometimes in even the hardest and densest of the stone. There is a great deal of black and brown tourmaline through the lodestuff, some of which is very difficult to distinguish from tin ore

without crushing it: the tourmaline is distributed in patches, some parts of the lode containing large quantities of it, others but little. Irregular small veins of white quartz are often found in the softer parts of the lode, and some of the richest patches of tin ore have been found close to these. As far as yet seen I have been unable to detect any appearance of banded structure in the lode-matter, the arrangement of the materials in it being seemingly quite irregular, patches of soft stone, hard stone, micaceous stuff, stone full of tourmaline, and so on, coming in and going out quite suddenly. The tin ore seems to partake of the same irregularity of distribution, not being in recognisable veins, but in patches. On the whole, the lodestuff right on the contact with the metamorphic sandstones appears to be softest and most full of tin ore, a lot of it being exceedingly rich, but going eastward the lodestuff seems to become more like greisen (a granite composed of quartz and mica without felspar), gets hard, and does not generally appear to carry much tin ore. In many respects this lode corresponds pretty closely to the dyke or contact mass in the Fly-by-Night Claim at Gladstone, which has been better laid bare by sluicing than the Roy's Hill one. The stone is very similar, and both bodies are, in parts, rich in tin. The Fly-by-Night stone is found on the contact of the granites of Mount Cameron with the Silurian or older slates and sandstones of Gladstone township, just as the Roy's Hill lode is on the contact of a similar granite with a like sedimentary formation. It is probable that the latter lode will be like the former—a large wide mass of very variable composition and uneven distribution of tin ore, necessitating rather extensive and well-directed prospecting before there can be any assurance of profitable mining resulting.

The mining works that have been carried out are shown on the plan, consisting of several shafts and trenches. No. 1 shaft, the most southerly of all, is 50 feet deep, and from the bottom of it a drive has been made to the westward 30 feet. For 30 feet down the shaft followed the contact of the quartzite and granitic formations, dipping westerly about 78°, but the wall then dipped very flat away to the westward, and was not cut in the drive from the bottom of the shaft for 30 feet, when it was again met with, still dipping westerly about 11°. In the top part of the shaft there was a little tin in the softer stuff, but nothing very rich, and there was some tin found in the surface soil to the eastward of it, but in the lowest 20 feet the rock was very hard and poor or barren. The drive passed through the same hard micaceous stone for two or three yards, and then got into soft felspathic and greenish talcose stuff, which, however, only carried occasional specks of tin ore. At 30 feet there was a small good patch of ore in the shaft, really very rich, the tin ore being disseminated in fine grains right through solid dense micaceous quartz, but this was soon cut through. On the whole, therefore, the lode in this shaft is very poor.

No. 2 shaft is 119 feet N.N.W. from No. 1, and is about 25 feet deep: it is sunk along the quartzite wall. For the first 12 feet the wall dipped slightly westward, then turned over to the east, and the average underlay of the shaft has thus become 1 in 10 to the eastward. The lower part of the wall is well defined and like a regular lode-wall, and strikes N. 15° W. For about 12 feet down there was very rich ore in this shaft, the tin lying mostly in a vein dipping at a flat angle to the westward, but lower down hard micaceous granular rock was met with, and very little tin was found. Here the quartzite wall and lode were both much seamed with thin red veins of oxide of iron, probably oxidised pyrites, lying generally very flat; in some of these the manager told me he had got tin. A drive has been extended eastward eight feet from the bottom of this shaft in the same hard rock as in the bottom of No. 1 shaft, but no tin of consequence was found in it. On surface a trench has been carried along the lode from this shaft for about a chain in length, and from 8 to 10 feet deep. Some very rich ore has been got from this, and is still visible in the bottom. About 3½ tons of this were lying bagged for sending away at the time of my visit, and several tons had already gone to Sydney for treatment. About 2½ or 3 tons of the same rich ore (probably containing about 20 per cent. of black tin) were at surface ready to put in bags, and there was also a heap of about 40 tons of second-class stuff raised, which should be highly payable if crushed on the mine.

No. 3 shaft is 119 feet N.15° W. from No. 2, and is about 32 feet deep. It underlays a little to the westward, following the quartzite wall. On its north side a small stope has been taken out from a depth of 22 feet to surface, and about 15 feet in length. Excellent ore was got in this and in the top part of the shaft. In the bottom the hard quartzose micaceous rock again is found, and is not rich, though occasional good patches of rich ore are distributed through it. A good deal of ore has been raised from this place, and there were on the ground about 17 tons that had been bagged for removal, 10 tons being stuff that the Manager estimates would yield 10 per cent. of black tin and 7 tons that should give 30 per cent. Nearly 15 tons have already been sent away, and have yielded 30 per cent. of black tin. On the ground there is still a little of the best ore not bagged, and about 30 tons of the estimated 10 per cent. stuff, with probably 20 tons more of poorer dirt that would pay well for local treatment. Not having actually had the heaps measured and sampled myself, the above figures are those of the Mining Manager, but from inspection I should judge them to be fairly correct.

Sixty feet north of No. 3 shaft a hole about 6 feet deep and 5 feet wide has been sunk on the lode, exposing the quartzite wall dipping westerly (underlay about 1 in 5), and showing very good ore. The tin is here in very hard and solid stone as well as in the softer stuff, and looks better for permanence than in the other workings. About 3 tons of good ore have been raised from this place.

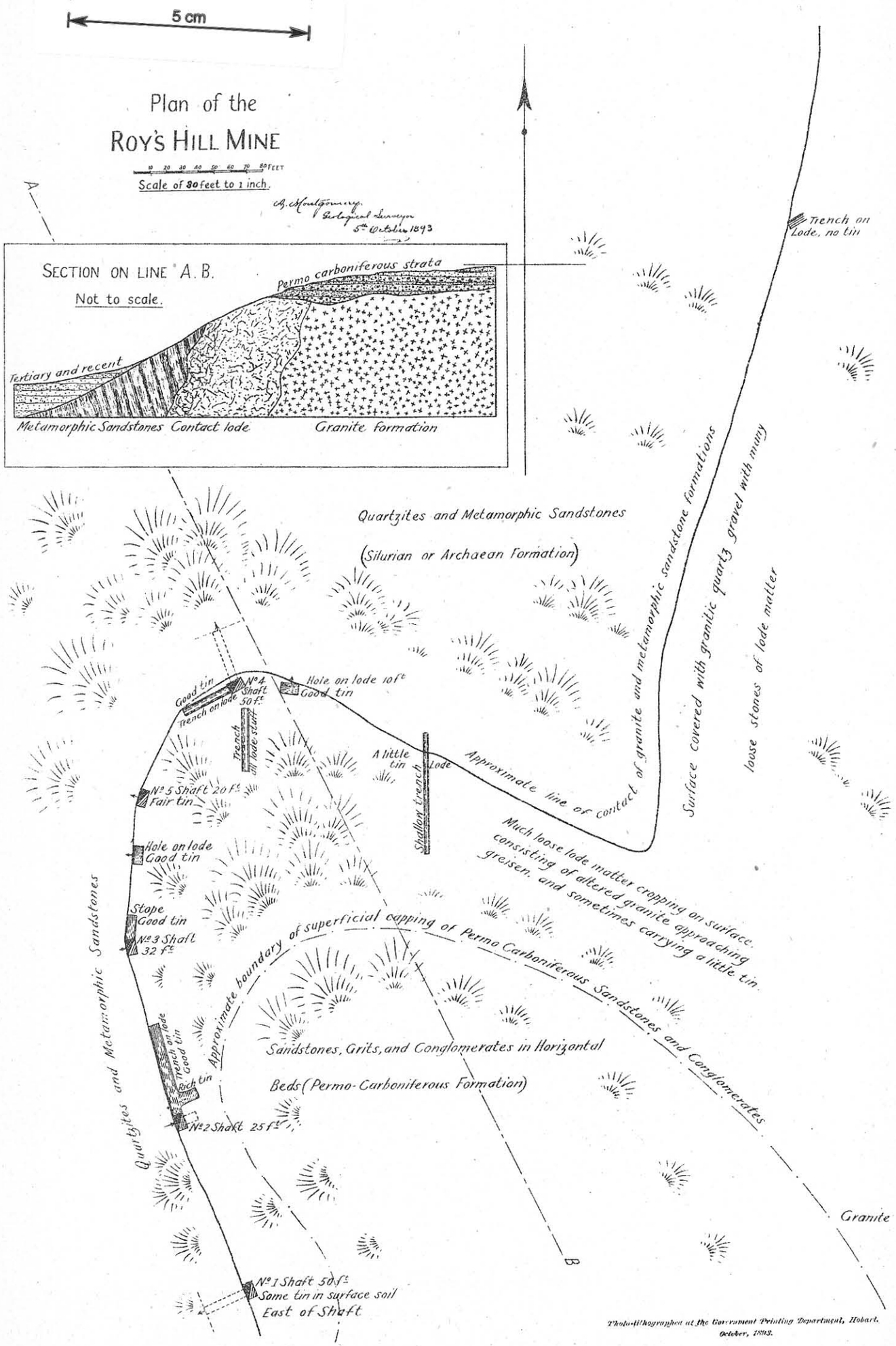


Photo-lithographed at the Government Printing Department, Hobart.
October, 1893.

No. 5 shaft is 97 feet N. 5° E. from No. 3, and likewise underlays to the westward. It was 20 feet deep the day I saw it, and was being sunk deeper. There has been fair tin from top to bottom of it in a soft layer lying on the quartzite wall, and varying from 5 feet to 18 inches in thickness. The hard rock on the eastern side of the shaft seems to be generally poor. About 9 tons of fair ore, that would probably yield 4 or 5 per cent. of black tin, have been raised from this shaft.

About 63 feet N. 27° E. from this the lode begins to turn rapidly round to the eastward, still following the contact of the granitic and metamorphic sandstone formations. A trench 5 or 6 feet deep has been dug along the outcrop for 38 feet N. 63° E. to No. 4 shaft, and from this a good deal of fair ore has been raised, mostly from soft rock. No. 4 shaft is vertical, and 50 feet deep, and from the bottom of it a drive has gone 34 feet to N. 20° W. In the face of this drive the Silurian rock is met with, the wall dipping flat to N. 35° W., at an angle of 15° to 17°. The bottom of the shaft and first part of the drive are in soft quartz porphyry, with the felspathic matter much decomposed, but towards the face the rock, though still pretty soft, is more micaceous. With the exception of one or two places, the rock passed through in both shaft and drive has been quite poor in tin. To the south of the shaft a trench about 40 feet long has been cut down into the bed-rock, showing some good tin ore in hard stone towards the northern end. The stuff towards the south end is poor or barren. This trench is useful as showing the width of the lode, and also that good tin exists in portions of the hard rock quite a distance away from the softer stuff on the quartzite wall that generally appears to carry the most tin.

East of No. 4 shaft 35 feet another hole about 10 feet deep has been sunk in the lode alongside the sandstone wall, showing payable ore in soft rubbly micaceous lodestuff. About 80 feet further east a long shallow trench has been cut north and south, but not deep enough to expose the bed-rock thoroughly. At its north end we find loose angular pieces of quartzite and metamorphic sandstone for about 12 feet, then micaceous granular quartzose lodestuff for the rest of the distance to the south. At the contact of the two sorts of rock a little tin has been obtained. This is the last trench but one upon the lode, but to the eastward from it there is much outcropping micaceous granular quartzose rock, similar to that found to the east of No. 1 and No. 2 shafts, and in the south end of the north and south trench at No. 4. This often carries tourmaline, and sometimes a little tin ore is seen. The contact of the granitic and sedimentary formations can be traced as shown on the plan by the difference in the surface stones, hard angular sandstones being common to the west of the line drawn, and fine angular quartz gravel, micaceous quartz, quartz, and tourmaline, and other granitic detritus to the east of it. A trench shown in the north-east corner of the plan again shows lode-matter full of tourmaline lying alongside the solid Silurian rock, and makes it likely that the lode will be found to follow the contact line right round all its sinuosities. This peculiarity of contact lodes, as distinguished from ordinary fissure veins, will require to be borne in mind in working and further prospecting this mine. It is likely to be variable and irregular both in strike and dip, its shape depending on that of the original granitic intrusion.

From the above detailed account of the workings it may be gathered that rich tin ore, mostly in soft talcose, clayey, and micaceous rock, has been found in the lode for a distance of about 350 feet, but that all the deeper shafts have been as yet unsuccessful in getting ore of good quality at quite a short distance below the surface. Must we therefore jump to the conclusion that the occurrence is simply a "surface patch," and that the tin will cut out when sunk upon? I think not, for this would imply as a consequence that proximity to the surface in some way affects the deposition of tin ore in lodes, which is a proposition opposed to the most generally accepted views on the subject. According to these it is most probable that tin lodes were originally formed at great depths below the surface of the ground, and that they have in course of time been revealed by the removal of immense masses of superincumbent strata by long continued denudation. If so, the original distribution of the ore in the lodes could in no way have anything to do with the present surface line. In the cases of some lodes, especially those of copper and lead, we know, however, that there is often a superficial enrichment of the higher-lying parts of the lodes through the action of the atmosphere and rain in decomposing and dissolving the metals in the outcrops, and causing the formation of solutions which find their way down into the lode mass, and enrich the ore there by being again deposited. But we have no evidence of any such chemical enrichment in the case of tin lodes, and the talc, mica, and tourmaline found in the present instance with the tin ore are not minerals commonly found as products of superficial alteration, but rather such as appear to be formed under conditions of considerable heat and pressure; so it is very improbable that the deposition of the ore has been in any way dependent upon the accident of its position near the present surface. It is of interest to note, however, with regard to this point, that it is clear that on the particular spot where the mine is situated the present surface of the granite is almost the same as that which existed at the time of the deposition of the Permo-Carboniferous sandstones. The rounded water-worn surface of the hard rock in the south end of the trench south of No. 4 shaft was even very probably worn to shape as we now see it by the waters of that distant period. Since then the granite has been covered with a great accumulation of later deposits, which have not been completely removed again till quite recent times. The outcrop of the lode is therefore substantially the same as when it was washed by the Permo-Carboniferous sea. During the ages while it was buried deep

under the thick strata of the coal measures and great flows of the Mesozoic lavas, it is possible that chemical changes may have gone on in the lode, leading to its enrichment in tin ore at its contact with the overlying rock. This far-fetched hypothesis seems to me the most plausible explanation that could be offered in this case of the existence of a rich "surface patch" with no good ore below it, and is only introduced to show how difficult it is to account for such rich pockets having any necessary connection with the accident of their being found at surface. It is true that rich bunches of ore have often been found cropping out at grass and have soon given out when sunk upon, but it is also true that in many instances further exploration has developed numerous other such ore-bodies at greater depths. When a surface patch is worked out it too often happens that the lode is thereupon abandoned as worthless, and in the multitude of such experiences it is often lost sight of that there are very many cases where perseverance has been well rewarded.

In a case like the Roy's Hill mine, where good tin has been found for a length of 350 feet, and where the large size of the lode bears witness to the strong mineral-forming action that has gone on, I do not think there is much reason for gloomy forebodings because the deeper shafts have not yet found much good ore. It may take some time and patience to develope further ore-bodies, but, in my judgment, there is every reason to go on working hopefully. The distribution of the tin will probably be found to be irregular and patchy, but a few good bunches would pay for a lot of dead ground. I should recommend that a main shaft be sunk near the middle of the known ore to a depth of, say 100 feet, and that the lode be then thoroughly prospected by driving along it and making numerous crosscuts. It should be remembered that the eastern wall has not yet been anywhere seen; and, though present appearances seem to show the ore to be best on the western one, it might not be so always. The good ore in hard rock in the trench south of No. 4 shaft shows that the tin is by no means confined to the contact with the sandstones. While sinking the shaft it would also be well, at the same time, to follow the outcrop of the lode still further by surface trenches, and to cut several to the eastward across the mass to the eastern wall, so as to determine whether there was not more tin-bearing rock not yet uncovered. The way the tin occurs in the similar Fly-by-night contact mass renders it likely that ore will thus be found. The formation is evidently a large one, and should be explored from the contact with the quartzites on the west side to the unaltered granite on the east, which has not yet been laid bare.

Mr. Henry Simpson, Manager of "The Roy's Hill Freehold Proprietary Company, Limited," the owners of the mine, has been good enough to give me the following statement of the ore sent away from it for reduction up to date :—

"A. 12 tons 10 cwt. treated at the Parke and Lacy Company's Works, Sydney, yielded 1 ton 17 cwt. 0 qrs. 13 lbs. concentrates, assaying 67·6 per cent. metallic tin, and 7 cwt. 1 qr. 22 lbs. assaying 69·0 per cent.

"B. 9 tons 16 cwt. 2 qrs. treated at the Clyde Smelting and Concentration Works, Sydney, yielded 3 tons 10 cwt. of concentrates, assaying 62 per cent. metallic tin.

"C. 4 tons 18 cwt. treated by T. Bateman, Launceston, with a 'Mudie' Crusher, yielded 1 ton 9 cwt. 3 qrs. concentrates, assaying 73·3 per cent. metallic tin.

"A. and B. were crushed by Huntingdon mills, and then passed over Frue Vanners. C. was crushed by 'Mudie' Crusher, and streamed in the ordinary way."

Parcel A. therefore gave a mean return of 17·8 per cent. of black tin, assaying 68 per cent. metal; that is, it contained 12·1 per cent. of metallic tin. Mr. Pilbeam, Manager of the mine, told me that there were two lots of ore, of about 8 tons and 4 tons weight respectively, treated by the Parke and Lacy Company, the first returning 23 per cent., and the second 9 per cent. of black tin. These agree fairly with the more exact figures of the Company's manager. The 8-ton parcel came from No. 2 shaft and trench, and the 4-ton one from No. 4 shaft and trenches.

Parcels B. and C. came from the same heap, from No. 3 shaft and stope. The yield from B. is equivalent to 35·6 per cent., which, at 62 per cent. metal, is equal to 22·1 per cent. of metallic tin. That from C. was 30·4 per cent. of black tin of 73·3 per cent. assay, equal to 22·2 per cent. of metal. The two tests gave, therefore, practically identical results.

On the mine there are about 15 tons of stuff raised that should yield over 20 per cent. of black tin, about 40 tons that might give 10 per cent., and over 100 tons that would probably yield 3 or 4 per cent. of black tin. Counting the unbroken ground shown in the plan, it would probably be fair to say that not less than 1000 tons of payable ore are "in sight." As there is no mill nearer than the Brookstead Company's one, which is on the other side of the St. Paul's River, it would be advisable for the owners of Roy's Hill to procure a small crushing-plant to enable this ore to be turned into money. Till more work has been done underground it would be as well not to put up a large or expensive mill.

A good supply of water for dressing purposes can be got from the Snow Creek. This is said to be a permanent stream all through the summer, and has every appearance of being so. When I saw it all the watercourses were in flood, and there were over 20 heads of water in the Creek. In the height of summer Mr. Pilbeam estimates that it carries 7 heads. From three to three-and-a-half

miles of race through easy country would bring water in from it twenty to thirty feet above the No. 2 shaft. In the flat at the foot of the spur on which the mine is situated this would give a pressure of 80 to 90 feet. By constructing dams in the Snow Creek it is probable that water enough could be stored for a pretty large dressing-mill, and in the wet season for power to drive it as well. In summer the aid of steam might have to be sought. As there are several considerable creeks in the neighbourhood, not to speak of the St. Paul's River itself, there should, however, be no great difficulty in getting water-power for all purposes, even for a fairly large mill, by going to the expense of some longish races and good-sized dams.

On the Roy's Hill Freehold there are some other places that might be prospected with advantage. On the east side of the valley of the Snow Creek, and about a quarter of a mile south of the main road, there is a large outcrop of micaceous granular quartzose lodestuff, often carrying tourmaline and containing some tin. This is a very large mass, the loose stone from it covering the ground for a length of about five chains and a width of quite three chains. It seems to run N. 70° to 80° W., but, as no walls are seen, this may not be its true course. I saw some nice specimens of tinstone in parts of this, though on the whole the stone seemed poor. It would be worth while trenching across it, however, to see if there were not richer and workable portions in it.

About a quarter of a mile from the eastern boundary of the estate, on the low hills to the west of the Roy's Lea Creek, there is another pretty large outcrop of stone very similar to the last, but containing more tourmaline. This is also tin-bearing, and should be further tested. Still another large lode of similar character is found on the top of the spur, just east of the eastern boundary of the estate in Crown land. A little work has been done here by a prospecting party, and some of the stone shows good tin. The lode is a very large one apparently, and runs N. 40° W. A tunnel could be driven into it along its course at a depth of over 100 feet below the top of the ridge. The stone seems poor on the whole, but may well contain payable portions which are worth looking for. This lode is a little N.N.W. from the workings of the old St. Paul's Tin Mining Company.

There does not seem to be much chance of finding payable alluvial tin on the Roy's Hill estate, as the valleys are nearly all filled with either the old Tertiary sediments or with more recent detritus from the formations on the range to the south, diabase greenstone, and coal measures rocks. There probably are deposits of alluvial tin in the St. Paul's River valley, deep below the surface drifts, but it is questionable whether these could be discovered and worked without very great expense.

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

The Secretary of Mines, Hobart.

SECOND REPORT ON THE BROOKSTEAD ESTATE TIN LODES.

Geological Surveyor's Office, Launceston, 26th October, 1893.

Sir,

I have the honour to report having again visited the discoveries of tin on the Brookstead Estate, St. Paul's River, on the 27th, 28th, and 29th of last month, and now forward some particulars of the progress made since my former Report of 18th November, 1892.

The development of the property during the past year has not been so rapid as might be expected from its excellent prospects, the delay being due, however, to circumstances connected with the management of the company owning it, and not to any fault of the mine. The Brookstead Proprietary Tin Mining Company, No Liability, who had secured mining leases over the estate from the proprietors of the freehold, after doing some mining work to be hereafter described, and obtaining a battery for crushing, fell into financial difficulties, and failed to comply with the terms of their agreement, whereupon their leases became forfeited, and their machinery and tools were sold by the Sheriff. A new company, "The New Brookstead Tin Mining Company, No Liability," has since been formed, and has acquired similar mining leases to those held by the first one, and bought the battery and tools, and it is expected that work will now proceed with vigour.

The battery of 15 stamps formerly at the Cream Creek mine has been placed in the valley of the Main Creek, some ten chains or so below the entrance to the drive on the main lode. It was in course of erection at the time of my visit, and nearly completed, and was expected to be in running order towards the end of November. The dressing machinery consists of jigs, buddles, and convex slime-tables of the same pattern as those in use in the Mount Bischoff mine. A tramway from the mine brings the ore to the battery. To provide water for the concentrators a dam is in course of construction in the Main Creek, from which a race 132 chains in length is to lead the water to the mill. The dam was half built when I saw it, and the building of the race fluming had just been commenced. The race comes in on the hillside 170 feet above the feeding floor of the battery, and about 200 feet above the Main Creek; at 152 feet below it a Pelton wheel is to be placed, which will drive all or part of the machinery, according to the water available. In wet weather it will probably supply all the power required, but when there is little water it will have to be supplemented by a steam-engine which just now is employed driving a small saw-mill cutting boards for the water-race flumings. The Pelton wheel is placed above the battery, so that the whole of the water may be available for the concentrators. By enlarging the dam and going to some expense in bringing in other creeks by races to discharge into it, it would be possible at all times to have a full supply of water for the present battery for both power and dressing purposes, and this will, no doubt, eventually be done if the mine proves successful. In the meantime, while it is being tested, the existing arrangement will suffice very well. It is expected that the battery will be able to start crushing by the 1st of December.

The principal mining work done has been the making of a drive along the main lode, which is now in 271 feet from the opening set. The approach is about 50 feet long. The face of the drive is about 130 feet vertically below the surface, as the hillside rises rapidly, and the lode strikes fairly into it. The drive has been made unnecessarily wide, namely, eight feet, which has resulted in the extraction of a large amount of barren wall-rock. An ordinary mining tunnel would have been quite sufficient for all immediate requirements. The lode has varied a good deal in size in the distance driven, from about six feet in width down to eighteen inches, and may be put down as averaging three feet. It has been tin-bearing all the way, and, judging from inspection of the heap of 500 tons or so at the mouth of the tunnel, it should be highly payable. The battery test will, however, soon decide whether this is so or not. At 187 feet from the mouth of the drive a winze has been sunk from surface to connect with it, its depth being 85 feet. The stone raised from this winze is about the same quality as that from the drive, so it is probable that the whole block from the tunnel to surface will be worth putting through the battery. This would mean about 4000 tons of ore if the lode averages three feet in width.

Like most of the Brookstead lodes the main lode appears to have a central vein, which is richest in tin ore, splendid bunches being often obtainable from it. On each side of this lies a mass of greyish lodestuff, probably the result of chemical alteration of the wall-rock, from which, however, it breaks away very clean. It consists mainly of granular quartz, much resembling the quartz of the country rock, through which is disseminated a good deal of mica, and often much talc and tourmaline. Tin ore is the principal metallic mineral carried by it, but at times iron, arsenical, and copper pyrites are found, also a little galena, and more blende. These do not, however, appear to be

in such quantities as to be very detrimental to the dressing of the tin ore, and I do not anticipate that any roasting will be required in order to get rid of them. A little fluor-spar ~~of tin~~ often occurs in the joints in the lodestuff, and tourmaline is very common, both these minerals being very usual associates of tin ore here as elsewhere.

Very little has been done since my previous visit on the Christoe lode, which is one lying 94 feet N.E. of the main lode and parallel to it. Some 75 or 80 feet above the main tunnel level another cutting into it has laid bare some extremely rich stuff, even better than that formerly described from lower down the hill. Though this lode is not large, this very rich vein in it will make it well worth stoping out, and when the battery gets to work it will, no doubt, be opened up.

Both these lodes can be traced for long distances along the surface, crossing hills and valleys with great regularity on a course N. 70° W., and generally showing more or less tin in their outcrops. On the east side of the Main Creek they do not seem to be so rich as to where driven upon, and all somewhat split up into veins, but further east again some considerable distance they once more are seen as well-defined bodies of stone.

As described in my former Report, there are a large number of lodes in the Brookstead property running more or less parallel to the main lode. With the exception of a few trenches on the outcrops of these they are still quite unopened, and it will only be necessary to speak of them generally. It is said that there are now about thirty known tin-bearing veins, some very small, others of a fair size, from two up to six feet in width. Without survey I cannot say if this statement is correct, but it seems very credible and likely. Besides those running W.N.W., there are also several lodes with courses between N.W. and N.N.W. which must run into or cut the first and more numerous set; the junctions of the two lines should be worth exploration, as such points are often richest in tin lodes elsewhere. The veinstone is generally quite similar to that of the main lode above described, but some almost pure blocks of tourmaline rock are also found, the mineral being in bundles of interlaced acicular crystals. Most of all the lodes show a central vein or "fissure," which often contains tin and tourmaline. Many of these are merely partings without any included quartz or other deposited matter. It seems probable that there has been a circulation of thermal waters along the fissures, which has caused an alteration in the wall-rock for some little distance, the felspar and mica being largely removed and replaced by talc, tourmaline, and tin ore. In parts where the best tin is found there seems to be very generally much talc, but in the poorer portions the veinstone is mostly hard granular quartz. It is yet premature, however, to attempt to formulate any general rule as to what parts of the lodes are likely to be the best in tin ore, though we may possibly be able to do so when more mining work has been done.

Of the many outcrops of lodes on which shallow trenches have been dug, most contain some tin ore, only in a few cases, however, rich enough to be worth working. In some I saw no tin ore at all though the lodestuff looked promising. The trenches having simply been put down at random where the lodes cropped out most strongly, it would be too much to expect that they should all be found containing rich tin. If they were traced along their courses it is probable that many rich shoots of ore would be discovered. In a district containing so many lodes in close proximity to each other, it is only to be expected that a large proportion will not pay to work. The almost universal presence of some tin in the outcrop is, to my mind, a very favourable feature, indicating the probability of richer parts being found when closely searched after. Outside of the main workings the best shows of ore are on the line of the Main and Christoe lodes, on a hill towards the eastern part of the estate, near the "No. 1" alluvial workings, and on the "western lode" on the spur between the Panel Marsh and Williams's Creek. A lode, about a chain south of the main one, on the first-mentioned hill, also shows a strong body of good tin-bearing stone about three feet wide. Some very rich specimens of tinstone have been found adhering to quartzite on a spur just east of the Panel Marsh Creek, but the lode from which they come has not yet been trenched for. This spur separates the Panel Marsh Creek from Bayley's Marsh Creek, but is divided into two branches on its southern side by a blind gully. The top of the spur is capped with Permo-carboniferous conglomerates and sandstones in horizontal layers; on the eastern branch of the spur these rest upon granite, but on the western one they overlie metamorphic sandstones and slates (Silurian, or even older). It is near the contact of the granite with the sandstone formation that the rich specimens have been picked up, and as a quite similar contact on the other side of the St. Paul's River Valley at Roy's Hill has proved rich in tin, this one also should be well prospected.

Alluvial Workings.—Not very much has been done in the matter of working the alluvial ground on the property since my last report. In the Main Creek three holes were sunk near the battery, reaching bottom at 16 feet, 30 feet, and 18 feet respectively, but very little tin was obtained. The material passed through proved to be nearly all diabase greenstone from the range to the north, and there was but little granite. This shows that the main part of the alluvial filling of this creek has come from a distance and from the non-stanniferous rocks, and makes it probable that the tin derived from the erosion of the granite formation will have to be looked for much lower down the stream, and most likely it is mainly buried deep in the bottom of the St. Paul's River valley. The terraces along the north side of the valley have not yet been tried on a working scale, though some

REPORT ON THE MINERAL DISCOVERIES IN THE NEIGHBOURHOOD OF BELL MOUNT.

Geological Surveyor's Office, Launceston, 6th November, 1893.

Sir,

On the 12th October I left Sheffield for the purpose of examining and reporting upon the recent discoveries of gold, tin, and bismuth near Bell Mount. In order to see as much of the country as possible I went out to the field by way of Mount Claude and the Middlesex, or Five-mile Rise Gold-field, noting the mining work in progress on the way, and I also made a short excursion to some gold-bearing ground in the vicinity of Stormont.

The Bell Mount is a small peak, probably 2700 feet or thereabouts in height, on the divide between the Forth and Wilmot Rivers, about W.S.W. from the west end of Mount Claude, and is about 21 miles by road from Sheffield. From the township westward to the Forth Bridge the road is mostly metalled and very good, then going southward through the Parish of Narrawa it is not good, being only formed in places, while other portions have been simply cleared. After passing the furthest out agricultural selections the road becomes a simple bush pack-track which in wet weather becomes almost impracticable. This track continues on through the mineral sections and joins the road from Liena to Middlesex, near the Great Caledonian mine. This road, which is an unformed one and unfit for wheeled traffic, crosses the Forth at the Lorinna Bridge, and on the top of Gad's Hill connects with a track which leads over Mount Claude on to the main road from the Mount Claude mine to Sheffield. It is therefore possible to reach the Bell Mount Field either by way of the upper Forth Bridge or the lower one. For foot traffic there was a cage and wire rope as well across the river between the Mount Claude sections and Bell Mount, but I was informed that it was out of order and not much used.

The route followed by me was that over Mount Claude and Gad's Hill to the Five-mile Rise gold-field and thence back to Sheffield by Bell Mount. Round Sheffield the country is mostly composed of basalt of Tertiary age, which weathers to a rich chocolate-coloured soil: in one place I saw signs that this overlies deposits of sand and clay full of ferruginous bands similar to those usual throughout the Launceston Tertiary Basin. On the road to Railton the old Silurian rocks also are seen, at intervals slates, sandstones, and limestones, but I did not see anything of the Coal Measures, though they are close by at the Dulverton Colliery. Basalt is again found on Gad's Hill and on the watershed between the Wilmot and Forth Rivers, as will be more particularly described later on. As it everywhere covers older formations likely to carry minerals, and often shows indications of having filled up and obliterated old watercourses, it is quite likely that numbers of "deep leads" worth prospecting are concealed under the basaltic covering, even down in the farming districts where mining is not at present thought of. In the Bell Mount Field there is great hope of the finding of payable "wash" below the lava flows.

The older mineral-bearing rocks are well seen in the rugged masses of Mount Roland and Mount Claude, the peaks of Bell Mount and Stormont, and along the slopes of the deep valley of the Forth River. The evidence as to the age of the principal formation is not yet satisfactory, though a few fossils have been found at the Middlesex and Bell Mount gold-fields, but it seems probable that it belongs to the same period as the rocks of the Zeehan and Heazlewood silver-fields, which are doubtfully classed as Upper Silurian. On the tops of Mount Roland, Mount Claude, Bell Mount, and Stormont we find large beds of coarse conglomerate, consisting of pebbles of quartz and quartzite very similar to the conglomerates of Mount Owen and Mount Zeehan. These are interstratified with more or less indurated sandstones, quartzites, grits, slates, and limestones, the whole series lying in much contorted folds. The conglomerates are the highest members of the series, the rocks seen in the deep gullies, though conformable with them, being generally sandstones and slates. On the whole, though each layer is much crumpled into wavelike shape, the general stratification appears to be fairly horizontal, thus explaining the occurrence of the conglomerates on the detached peaks. Nothing was seen of the ancient schist and quartzite formation which forms the country rock in the head of the Forth Valley near Mount Pelion, and it probably lies deep below the one just mentioned. In the Dolcoath T. M. Company's sections and in the bottom of the valley of the Forth opposite them, a granite formation is seen, which appears to be intrusive through the Silurian strata, and to have caused considerable metamorphism of them near the contact. It consists of quartz, reddish felspar, and dark mica, closely resembling the granite found in the Mersey River near Liena and on the top of Gad's Hill, with which it is in all likelihood directly connected. Near the Great Caledonian mine at Middlesex a decomposed granitic rock is seen which probably is also connected with it, and on the Iris T. M. Company's ground there is

another much weathered rock which may prove to be a quartz-porphyry or else a fine-grained marginal portion or dyke of the granite. Near this latter, in the Iris Company's tailrace, a hard blue-black dense rock is found, which weathers to a greenish clay: on the weathered surfaces it is clearly seen to be a conglomerate composed of well-rounded pebbles, but on breaking it across it resembles a crystalline rock. It is clearly a conglomerate which has originally contained much felspathic or argillaeceous matter, and has been intensely hardened and rendered sub-crystalline by metamorphism, an effect probably due to the instrusion of granite close by. The principal discoveries of tin ore in the district are not far from the granite, though mostly in the Silurian strata, and it is therefore likely that the occurrence of tin is, as usual, the result of the presence of this rock.

The useful minerals found in the district comprise gold, tin ore, carbonate and sulphide of bismuth, and argentiferous galena. Wolfram is rather plentiful, accompanying the tin ore in the Iris claim in troublesome quantities, and topazes, often fine clear crystals, are pretty abundant, but it does not seem likely that either of these minerals will be of commercial importance. The tin and bismuth occur, as far as yet seen, only within short distances from the granite, but the gold and galena are more widely distributed, and seem to belong to the Silurian strata. The largest nuggets of gold have come from the new Bell Mount field, and for its extent this has probably proved the richest area of auriferous ground in the district, but the most gold has been taken from the Five-mile Rise or Middlesex portion of it. No reefs of any importance have yet been found from which the gold might have been derived, and I am inclined to think that much of it comes from small veins in the Silurian rock, and possibly also from the direct disintegration of this. The conglomerates often show pebbles of reef quartz in their mass, and as it is therefore evident that the rock from which they were derived contained quartz veins, there is no unlikelihood that gold also was present, and might thus exist in the later rocks formed of the gravel and sand resulting from their erosion. From this aspect we might then regard the conglomerates as simply very ancient alluvial "wash," only that they were marine gravels and not river drift.

The Middlesex and Bell Mount fields are at a considerable altitude, the Great Caledonian mine being some 2600 feet, and the Bell Mount Gold Camp about 1800 feet above sea level. There is a considerable rainfall, and in consequence the vegetation is luxuriant, in the sheltered gullies especially. It is of much the same type as on the West Coast silver-fields, though not quite so dense—myrtle, sassafras, tree ferns, celery pine, and tea-tree being among the commonest forms of vegetable life. The horizontal scrub, so much dreaded by the prospectors of the West Coast, exists, but not to any very troublesome extent, but on some of the higher and more exposed ground a tangled mass of tea-tree, bauera, and cutting-grass is often met with, and is very hard to penetrate. On the plains we find stringy bark, peppermint, and other large timber of the eucalpytus tribe, and this forest is generally very open. The dense vegetation in the valleys, however, is a great bar to prospecting, and it will be only after the bush has been much burnt off that the country can be thoroughly searched for minerals. The discovery of the Bell Mount gold-field is said to have been due to a fire last year, which cleared off the dense bauera scrub and laid the surface open for examination.

The country is much broken by deep ravines, the principal ones being the gorges of the Forth and Wilmot Rivers. The valley of the Forth is very deep, the Lorinna Bridge being only about 700 feet above sea level, and from the river to the mining sections at Middlesex and Bell Mount there is a rise of between 2000 and 1000 feet. Deep gullies run down from the high ground, cutting the slopes into rugged furrows. From Middlesex to the Iris Company's ground there is a flat basaltic plateau on the top of the ridge separating the Iris and Forth Valleys, but this terminates about two miles south of the peak of Bell Mount, and the tin sections are mainly on the broken ground falling away to the valleys on the Forth and Wilmot. Going westward to Stormont there are several deep ravines to cross, and then the ground again falls away into the deep gully of the Falls River. This stream and the Iris River, when united, form the River Wilmot.

While the rugged nature of the country will no doubt make it somewhat difficult to transport machinery and material to the new Bell Mount tin and gold-fields, it has nevertheless the advantage of affording very great facilities for mining operations and for obtaining copious supplies of water for mining purposes. The benefit of these facilities is not at present felt, as the alluvial deposits happen to be almost on the top of the ridge separating the Forth waters from those of the Wilmot, but later on, when lode mining begins, they will be greatly appreciated.

In the following description of the localities visited they are taken in the order in which they came on my route, as it would be inconvenient to deal with the discoveries of the different metals separately, more than one being often found on the same Section.

Mount Claude.—The only work now going on in this District is being done by The Kentish Proprietary Silver Mining Company, No Liability, on Section 90-87M, who are continuing the adit begun in 1883 by The Mount Claude Silver-Lead Mining Company; the latter drove it 593 feet and then abandoned it in 1884, after which year it remained untouched till 1891, when The Southern Cross Proprietary Silver Mining Company, No Liability, again took

it in hand and extendad it some 60 feet further. This Company then got into difficulties, and the mine fell into the hands of the present owners, who have now extended the adit to 800 feet and are still driving. The tunnel runs S. 22° 16′ W. from the Claude Creek, and passes through a series of beds of sandstone and limestone. The strata are much crumpled, the dip changing several times in the course of the driving from northerly to southerly. The first 500 feet were mostly through hard metamorphic sandstone or dark quartzite, after which a great deal of hard blue crystalline limestone has been met with. At 682 feet what may prove to be a slide was cut through, striking N. 70° W. and dipping northward at an angle of about 30°. A strong stream of water comes from this. Near the mouth of the drive several small veins of galena were passed through, generally less than an inch in thickness, and too small to be of any importance, except as showing that the country rock carries ore. Across the creek from the mouth of the adit a little work has been done on Section 2990-87M, on another small and rather irregular vein of galena, and the old Mount Claude Company also drove some short tunnels a short distance further up the creek on some rather similar veins. There appear to be a good many small galena veins in the country rock, giving hope that if a larger lode were found it might contain payable quantities of ore. The main adit has been put in for the purpose of cutting what was believed to be a large lode, which crops out as a mass of gossan on the hillside some 210 feet above the tunnel. Some trenches cut into this outcrop have shown it to contain veins of galena of very fair silver value. The width of the ferruginous outcrop is 105 feet, and it may be traced for some chains in length. Unfortunately it is not easy now to see what has been found, for the ground is very wet, and the trenches have become partially filled up and very much iron-stained. The principal one is about ten or twelve feet deep, and is cut into the northern side of the lode-mass. Along this a shallow drive has been made some 10 feet to the east and 30 feet to the west. As far as can be now seen, the lode-matter consists of broken country rock and quartz, with much oxide of iron in the crevices, but Mr. Hartrick, the manager of the mine, informed me that a vein of galena was worked out here and was left underfoot, dipping to the south at a very flat angle. In a small creek some two chains further west there is much broken country rock, with veins of oxide of iron and occasionally carbonate of iron, and a little galena, blende, and pyrites have been found here. Fair concentrating ore, consisting of galena in a gangue of carbonate of iron and broken country, has been obtained from another hole a short distance east of the first-mentioned trench also. Four bags of picked ore from the flat vein are reported to have been assayed in Melbourne with the result of returning 79 ounces of silver to the ton and 59 per cent. of lead. In Section 644-91M a very similar outcrop of ironstone is found on about the line of strike of the above one, and a shallow tunnel some 85 to 90 feet in length has been driven across it. About half way in this tunnel there is some broken stuff interspersed with veins of carbonate of iron carrying a little blende and galena, and a nice bunch of good ore is said to have been taken out. The country rock is quartzite and limestone, lying in rather flat strata. Further east still on the line of these outcrops it is said that there are more ferruginous masses. Going westward along the course of the supposed lode there is a sort of depression or break in the ground, which is always very wet and swampy, and this break continues to the Forth River, where gossan is again reported to be found upon the line of it. It seems rather probable that this depression in the ground may be the result of a break or fault in the rock below. The appearance of the stuff where the outcrop has been cut into indicates rather a broken line of country than a true lode fissure, and though it is clear, from the galena and other lode minerals found, that a certain amount of deposition of lode-matter has gone on, it seems to me very doubtful if this will be found of sufficient quantity and regularity to be worth working; I should rather expect to find a somewhat wide mass of broken country rock, with veins and bunches of ore scattered irregularly through it. It is quite possible, however, that there may be considerable and well defined ore-bodies. It is very unfortunate that the tunnel was begun when so little had been done to ascertain the nature of the occurrence, not even the direction of underlay of the lode being then known. Even now, all that is known on this head is that there is an apparent underlay to the southward of the wall that has been cut, and that the tunnel has further proved that if the lode exists down to that level it must underlay to the south, otherwise it would have been already met with. It would have been advisable to have driven a shallow tunnel right across the formation before going down to the deep level, so that it could be seen what really was the nature of the lode and how it was lying. Were it not that such a shallow tunnel would be of no use in working the lode, and that the deep one is 800 feet into the hill, it would seem to me desirable even now to explore the surface; but, as things are, it is probably best to continue the main tunnel. The face of this is now 330 feet past the point where the wall of the lode would have been met with had it been vertical, so its underlay must be greater than 1½ in 1, and even supposing that the southern edge of the iron-stained matter at surface indicates the hanging-wall of the lode, and that we take this instead of the footwall, the underlay to the south must still exceed 1 in 1. The probabilities therefore are that if the lode exists at all at the tunnel-level it will be met with inside another 100 feet, else it will be most unusually flat, and it would be better to spend money on driving this distance at the level, where, if successful, it would afterwards be useful in developing the mine, rather than the same length in a shallow drive that would be useless for working purposes.

Should payable ore be found the facilities for economical working are very good. The Claude Creek would supply water for dressing purposes and motive power with little expense, and for a long time there would be no need to mine below the adit-level, so that winding and drainage

machinery would not be required. The tramway laid by the old Mount Claude Company to the end of the Claude Range has been taken up, but could easily be relaid, and from the end of it into Sheffield and Railton the road is fairly good, and could easily be made an excellent one: the ore could therefore be readily and cheaply sent to market. While the prospects of the mine are not very bright, and a great deal of money has been spent without value being received for it, there is still a chance of success, and a little perseverance now will finally decide whether or not the lode lives downwards.

On the road over the top of Mount Claude, right at the saddle, there is an outcrop of hematite speckled with spots of white kaolin, which has from time to time attracted the attention of prospectors. It appears to be a bedded deposit, lying conformably between the conglomerate strata both in strike and dip, and has probably been originally a bed of brown iron ore deposited at the same time as the conglomerates. It is said to be traceable for miles, and a little gold is reported to have been got in it. The hematite is much like the massive hematite on the outcrop of the Mount Lyell pyrites mass, and it is possible that in depth this also may change to pyrites. The bed is, however, quite small, only 2½ to 3 feet in thickness, and would no doubt be contorted in accordance with the crumpling of the enclosing strata, which are at this place seen to be much thrown into wavelike folds, so that it is not likely to be worth mining upon.

Middlesex Goldfield.—A good deal of gold has been got from this field in past years, and a few men are still working. The country rock is mostly sandstones and slates, much like those of the Zeehan field. The gold obtained has been mostly got from shallow alluvial workings along the beds of the small watercourses which have cut into the hill slopes, the "wash" being mostly subangular fragments of the country rock. Some of these little creeks have yielded a good deal of gold, mostly angular and associated with quartz. Though reefs from which the gold has been shed have been persistently looked for for many years, only a few small gold-bearing veins have been found, and it seems more probable that the metal is coming from minute veins in the country rock itself than from definite reefs. A little work has been done on some of the veins that have been found, but nothing of consequence was got. The Thistle Company drove a cross-cut about 45 feet to cut a small lode, and then followed this N. 50° W. for 90 feet. It was, as far as can now be seen, only from one to six inches in thickness, and consisted of iron-stained rubbly quartz and sandstone in which there was some gold. A vein of galena is also reported to have been obtained, but I did not see this. The vein has a fairly well-defined wall, but is too small to do anything with. The Union Company sank a small shaft on some gold-bearing veins, and then drove a tunnel about 145 feet to cut them, but do not appear to have been successful in reaching them. The most extensive mine, however, was the Great Caledonian, which has considerable underground workings and a nice 15-head battery. The workings being full of water I could not examine them. On surface the lode appears as a small, rather irregular, vein of ferruginous rubbly quartz and sandstone, not unlike the Thistle one. The stuff raised from the deeper levels also does not appear to have been well defined quartz, but only ironstained, partly silicified, country rock. After one or two disappointing crushings the mine was abandoned. From what I could see of the surface portions of the lode I wonder that it was ever considered worth opening a mine upon it.

Some 15 chains or so south of the Great Caledonian mine there are two small shafts sunk on what is known as Johnson's Reef, which is a vein 4 to 12 inches in width of iron pyrites, said to be gold-bearing. The outcrop is largely composed of dense hematite. The vein seems somewhat irregular, and very little has been done beyond cutting it in the two small shafts. It might be worth following a little way to see if it becomes any more promising. This lode must be near the contact of the granite and sandstone formations, the country rock enclosing it being a somewhat decomposed greenish granite. This is said to have been met with also at the deepest level of the Great Caledonian mine.

Another mine in this district, but close to the Forth River, on which a good deal of work has been done—namely, the Campbell's Reward mine—was not visited on this occasion by me, as it was out of the way, and said also to be now inaccessible on account of fallen rock and timber. As seen from the above, I only examined this field cursorily in passing, there being no work of consequence now in progress. From the amount of gold which has been taken from it, it will no doubt continue to be prospected, and likely enough good reefs will yet be discovered.

Stormont Goldfield.—A short visit was made to some sections held under Prospectors' Protection Orders, situated about half a mile north of Stormont, on the divide between the head of the Stormont Creek (a tributary of the Iris) and the Falls River. A little work has been done in the Stormont Creek lower down, but was not payable as far as I could learn. No one was at work on the field at the time I saw it, and I was only able to get information at first hand about one claim, that held by Messrs. Moon and Cates. In this there is a considerable area, over an acre probably, of gravel, forming a terrace between the main branch of the Stormont Creek and a small watercourse which joins it. A tailrace has been opened up the latter, and a little sluicing has been done. The wash in the small face that has been worked is from 4 to 6 feet deep, and is mainly subangular quartz and quartzite, together with well-rounded gravel from the disintegration of the old

conglomerates. The gold is fine and not much waterworn, but is very hard to save in ground-sluicing, as the bedrock is a hard hackly-jointed quartzite or hard sandstone, very full of joints and fractures, which retain the gold, and cannot be satisfactorily cleaned out. About 3 ounces of gold have been got from the small amount of gravel as yet sluiced, which is a fairly good return. In the tailrace there is a false bottom of dark clay, with angular pieces of quartz and quartzite in it; what is below this is not yet known. A small race brings in a little water from the Stormont Creek, and in winter a fair supply could generally be got, but in dry weather there would be but little obtainable. This promises to be a fairly payable claim for a party of men who would work it themselves, after getting all the available water into a race and providing themselves with a short line of pipes for hydraulic working. By opening the terrace at the junction of the two creeks and working upwards the whole of the wash could be systematically sluiced. The terrace requires further testing by means of a few holes before much labour is spent on it, but, judging by present appearances, the ground is quite worth the attention of a working party. I do not think that a company employing men on wages would be likely to make any profit from it.

On the hill above the terrace several veins of quartz have been found, but as yet no defined reefs; the locality is well worth further trial.

On the slope to the Falls River, across the divide from Moon and Cates's claim, there is another claim (Aylett's) which has somewhat similar angular wash and a little gold, but, as the owners were not on the ground, I could not learn what success had attended their working.

The country rock in these claims is very similar to that at the Middlesex Field, only that there is much conglomerate on the higher ground, the peak of Stormont being all conglomerate. Between this field and the Bell Mount one the country is very much covered with basalt, and it is only at intervals that the older rocks are visible. At the Iris crossing there is a good deal of limestone and quartzite, and it is said that a garnet rock also exists, but I was unable to find it. There is also limestone further to the east, and a small creek disappears entirely into a cavern in this formation. In the deep creeks the basalt is often cut through, and in one or two places "wash" has been found under it, and it is likely that careful and intelligent search round the margins of the basaltic cappings would be rewarded by the discovery of buried gravel deposits or "deep leads" emerging from under them. As these would belong to a time previous to the outflow of the basalts, and when the whole of the surface of the country exposed to the wearing down action of rains and streams was composed of the auriferous formation, they are much more likely to contain gold than the recent watercourses which have cut their valleys through the non-auriferous basalt. The largest flows of basalt seem to be between the Iris River and the Bell Mount tin-field, the western-most sections of which are largely covered with it. At the time of the volcanic outbursts it seems pretty evident that the main ridges and valleys of the district were much the same as at the present day, and that the lava flows poured over the slopes therefore ran somewhat parallel to the now existing surface, but nevertheless the smaller gullies and watercourses were not in quite the same positions as those in which the streams now run. The scoriæ and ashes and the flows of liquid lava would naturally accumulate most in the gullies and fill them up, forming an entirely fresh surface, which has since been cut into its present shape by the action of running water. Where the basalt flows are largest it is probable that there was formerly low ground. It is a very common feature in leads covered with this rock to find the old gutters right under the crowns of high ridges of it, the explanation being that the main streams of molten matter ran down into the lowest ground and formed the thickest masses of hard rock right in the bottoms of the gullies over the gravels; then, when the running waters again began to cut into the surface they had little effect on the hard volcanic rock, and cut into the softer stuff on each side of it, wearing it down until the basalt remained as a ridge. Consequently in prospecting it is advisable to trace the course and find the terminations of the lava ridges, and then search for deep ground round the ends of each old flow. Where practicable, shafts may also be sunk in the ridges through the rock capping. The main hope of the district seems to me to depend on the discovery of alluvial gutters beneath the basalt, as they are much more likely to be important than the comparatively small quantities of "wash" in the modern watercourses.

Bell Mount Tin and Gold Field.—The sections taken up for tin-mining in the vicinity of Bell Mount are situated a little more than two miles south of the peak, and the gold sections just at the foot of it on its south-western slope. A discovery of silver-lead ore has also been made to the north of the auriferous ground on the west side of the Mount.

Iris Tin Mining Company, No Liability.—This Company hold seven sections, comprising 551 acres (Nos. 1405-91M, 1406-91M, 1421-91M, 1403-91M, 1404-91M, 1420-91M, and 1407-91M), situated on high-lying flattish ground, right on the watershed between the Forth and Iris Rivers. The basaltic plateau lying on the watershed and extending from Middlesex terminates about the south side of the property, but there is still a considerable amount of basalt to the north west of the end of the plateau covering the slopes of the hills. The greater part of section 1403-91M is covered by it, as are also the south-west corners of 1404 and 1405. The main workings are in section 1404, where at the time of my visit a party of tributors were ground-sluicing along the

course of a small creek running into the River Forth. In the tailrace the bedrock seemed to be all the hard blue conglomerate above described, weathering to greenish clay. Further to the north-west, however, a decomposed granitic-looking rock is seen, which may prove to be a quartz-porphyry, but which I cannot name with certainty till I have seen it in its undecomposed condition. This contains occasional veins of quartz and mica, very small, but likely to yield tin, and I am disposed to regard it as the rock from which the ore is derived. The tin ore is crystalline, and hardly at all waterworn, and sometimes has a little quartz adhering to it. The wash is distributed over a considerable area, but is, as a rule, shallow and rather poor, and, as the ground is covered with thick forest, there is considerable expense in clearing it. The water-supply also is poor, being dependent on rains, the creeks being small and soon dried up so high on the divide. A dam has been made to impound as much water as possible, but it has not much capacity, and a large part of the tin-bearing ground is not commanded by it. Along the north boundary of sections 1403 and 1404 a number of prospecting holes have been sunk, bottoming at depths of from three to six feet, in which more or less tin ore has been found, but I doubt very much if there is enough to make the ground pay. It might give wages to a working party, but unless something better than has yet been seen is found, there seems to me to be no chance of profit for a non-resident owner or company. The low price of tin, owing to the large amount of wolfram contained in the ore, is to be reckoned with, as well as the expense of working the ground. The principal inducement for the present company to continue working is the possibility of finding lodes from which the alluvial tin has been derived. In the middle of the holding, where the granitic rock above-mentioned (the doubtful quartz-porphyry) crops out, there is greater probability of finding ore than elsewhere, though the experience of the adjoining Shepherd and Murphy's claim shows that the tin veins also exist in the Silurian formation. The surest way of discovering the lodes is by working the alluvial covering off the bed-rock, and as this progresses it is likely that tin-bearing veins will be laid bare. The alluvial working will be necessarily slow and intermittent, depending on rains for water for washing, but it is very doubtful if it would be of any use for the owners to go to the expense of bringing in a water supply from a distance to allow of regular work. If several of the owners of sections were to band together to bring in a water supply for the whole field, it might, perhaps, be made successful commercially, but I fear such concerted action is very far in the future.

Section 1403-91M has the best water supply of any of the Iris Company's sections, the so-called Seven-mile Creek running through it, but is mostly covered with basalt. Some prospecting might be done in this for a deep lead. In the north-west angle of section 1405 some work has been done on a lode containing topaz, sulphide of bismuth, and carbonate of bismuth, which seems to be an extension of the bismuth lode worked in Shepherd's section 1437 adjoining, but it is very small, much broken up into strings, and in hard quartzite country, so it does not seem possible that it could be worked with profit. A little metallic bismuth has been found in the gravels of the creek below where this lode crosses it.

Dolcoath Company (not registered).—This Company holds Sections 1333-91M, 1334-91M, 1336-91M, 1337-91M, and 1366-91M, comprising 365 acres. Mining operations are confined to Section 1333, where a tin-bearing rock has been discovered on the west side of the Forth River Valley on steeply sloping ground some 600 feet lower than the Iris Company's workings, and probably 1000 feet above the Forth River. The south-eastern half of Section 1333 and the greater part of Sections 1334 and 1336 are on granite country, but in the north-west portion of 1333 and in 1366 the bedrock is quartzite and conglomerate. The stanniferous rock must be nearly on the contact between the two formations, and is probably a marginal portion of the granite which has been altered and impregnated with tin by hydrothermal action along the contact. It is rather of the character of a stockwork than a contact lode, being composed of numerous varieties of granite more or less impregnated with tin ore. We find in it portions consisting mostly of glassy quartz and large weathered crystals of felspar, others in which the rock is mainly granular quartz with a little mica through it, others again carrying much green talc and soft kaolin, while at times bunches of topaz crystals and stone composed of quartz and topaz make their appearance. The most common rock contains a good deal of kaolinised felspar cementing together quartz granules, and often carries much iron arsenical and copper pyrites. A little molybdenite also is found. In many respects the stanniferous rock resembles the stuff in the stockworks of the Blue Tier district, but contains a great deal more topaz than is usual in these, being in parts quite a topaz rock. The tin ore is in bunches through the stuff, appearing to accompany the topaz-bearing parts most of all, and is generally in somewhat large crystals, though also at times found finely impregnated. The whole occurrence is similar to the Roy's Hill deposit in the St. Paul's River Valley, except that the latter does not show topaz rock, both being marginal masses of granite at the contact of granitic intrusions with quartzites, which have undergone chemical alteration and rearrangement of the constituent minerals. The stanniferous mass in the Dolcoath property has been proved to be over 100 feet in width by surface trenching, and a tunnel is now being driven through it at a depth of 50 feet below the highest part of the outcrop to test it more thoroughly. This tunnel has an approach of about 24 feet in length cut through the stockwork rock, and has been driven 15 or 16 feet into it. Both in the surface trenches and in the tunnel a good many bunches of tin ore have been found, and excellent specimens can be obtained, but on the whole the stuff yet met with is poor. After crushing and washing off several samples carefully taken so as to

fairly represent the bulk of the rock, I could come to no other conclusion than that it was far too poor to pay for working. Since my visit I believe that some better stuff has been cut, but whether this is the beginning of a general improvement or only a patch of ore remains to be seen. As the unaltered granite is seen in a small creek passing the mouth of the tunnel only a short way to the east, it is evident that the tunnel has been begun towards the eastern side of the stockwork, and as the likelihood is that the mineralising solutions found passage most freely along its western side on the actual contact with the quartzite formation there is reason for hoping that better ore will be obtained as the tunnel is extended westward. In the Roy's Hill deposit the best ore has been found right on the contact, and in the case now under consideration it would be advisable to push the tunnel through to the quartzite wall. The formation is so large and carries so much tin that, even though not payable at present, it deserves thorough prospecting. Should payable ore be found in quantity the ground is very suitable for working either by open quarrying or by tunnelling, and is so steep that the stone could be easily and cheaply sent down by a self-acting tramway to the Forth River, where an unlimited supply of water for driving machinery and dressing ore is always available. From the machinery site there would probably be no great difficulty in crossing the river and connecting with the road from Sheffield to Mount Claude, so that transport of machinery and ore would be fairly cheap. With these facilities, a very small percentage of tin, one per cent. or even less, could be profitably worked if a very large bulk of rock were available without picking. Very large quantities of stuff would have to be crushed and dressed, the problem being just the same as in the case of the large low-grade stockworks of the Blue Tier.—(See Report on the Tin Mines at the Blue Tier, County of Dorset, 19th January, 1893.) In the Dolcoath mine it may turn out that it will pay to pick out the rich ore, but I do not think that this will be so, and believe that reduction of the ore in bulk as it is mined will be the only chance of success. Lest I should be misunderstood, I would again repeat that at present the rock found is not in my judgment payable under any circumstances, but there is great hope that further exploration will yet lay bare richer rock, and it is only when such richer rock is obtained that the above remarks as to working will apply. The formation requires to be penetrated by the tunnel to its western side; and while this work is in progress surface trenching across the lode should also be carried on, cuts being made from side to side of the stanniferous rock at frequent intervals along its course. Similar stuff has been picked up a long distance away from the workings, and it is rather likely that the whole length of the contact between the granite and silurian formations will be found to be at intervals tin-bearing, so a great deal of prospecting has yet to be done. The presence of tin ore in the surface soil will probably here, as at the Blue Tier, afford an indication of the quality of the bedrock below. The property of the Dolcoath Company cannot yet be said to be a valuable one, but is one on which valuable discoveries are very likely to be made, so its exploration can be recommended as a genuine and promising prospecting enterprise.

The Shepherd and Murphy Tin Mining Company, No Liability—(Sections 1437-91M *and* 1456-91M, 158 *acres in all).*—This Company's ground has been more thoroughly prospected and better opened up than any other in the district, and can now show alluvial tin ore and gold and lodes containing tin oxide and carbonate and sulphide of bismuth. The work is practically confined to Section 1437, next to nothing having been yet done on 1456, which is mainly covered with basalt. This rock also comes in strongly on the western side of Section 1437, but the eastern portion is pretty free of it, and is composed of slate and sandstone country. The principal workings are on a small creek running a little west of north through the section, and joining the Seven-mile Creek near the northern boundary. Another small creek runs pretty parallel to the last near the eastern boundary, and on the spur separating the two very fair prospects of tin can be obtained in various places. The tin ore is crystalline and angular, and is probably derived from a set of lodes which have been found running east and west through the holding; one of these has been stripped and cut into along the outcrop in the slope to the eastern small creek above mentioned: it is small, being only from six to ten inches in thickness, and consists of quartz and carbonate of bismuth with a little tin ore and some wolfram. A good deal of tin was got by stripping the surface here, very much mixed with carbonate of bismuth, which, owing to its high specific gravity, cannot be separated from the tin by washing. The specific gravity of tinstone, according to Dana, is from 6·4 to 7·1, and of bismutite (carbonate of bismuth) is from 6·86 to 6·909, so that the two substances are as nearly as possible the same weight. Parts of the lode are very rich in bismuth, and if equally good ore continues downwards the vein might be profitably worked; it is seen again further to the west, still containing a little bismuth, but is small and much broken, and, as already said, it has been traced into the Iris Company's section. The lode being small and not very rich, except in one part, I am not sanguine as to its being successfully worked, especially as the enclosing country is pretty hard at the spot where the best ore is seen, but it deserves to have some work done upon it to test it lower down. In depth the carbonate will no doubt be replaced by sulphide of bismuth and metallic bismuth. The value of bismuth ore is rather hard to arrive at, the price depending very much on the stock in the market. The world's consumption of the metal is quite small, and a shipment of 50 tons of it would probably have difficulty in being disposed of. The retail value of the pure metal is high, the latest quotation I have seen (*Engineering and Mining Journal*, September 16, 1893) being $6·25 per kilogramme, or at the rate of, say, £1270 per ton. The price got by the producer is, however, much less, and would probably not exceed £700 a ton.

Bismuth and bismuth ores frequently contain both gold and silver, but as far as I can learn no tests have yet been made of the ore from this claim to ascertain if it contains the precious metals. As both gold and silver are found in the vicinity, there is much likelihood of their being associated with the bismuth, and assays should be made for them.

Near the lodes the alluvial tin is mixed with a good deal of carbonate of bismuth, and there will be some difficulty in smelting to avoid making an alloy of the two metals. By careful firing at a temperature sufficient to reduce the bismuth to the metallic state, but not high enough to smelt the tin ore, it will be possible to eliquate a good deal of the former, but I doubt very much if it can be completely separated. The mixed ore will therefore probably require to be sent to Europe for sale, instead of being sold and smelted locally as usual.

In the creek which runs through the middle of the section a lot of clearing and sluicing have been done, and there appears to be a very considerable quantity of alluvial stuff worth sluicing. Towards the north side of the section the creek runs over a bottom mainly composed of basaltic *débris*, and at the junction with the Seven-mile Creek there is evidently a considerable thickness of this, for though deeply cut into it is not cut through. The true bottom, or bedrock, is therefore not yet reached in this part of the ground. To the west of the creek a long trench has been cut in loose surface stuff, largely derived from the basalt formation, which, nevertheless, gives good prospects of tin and a little fine gold. Ironstone containing tin ore was also found here, and it is possible that there is another lode to be laid bare. A little higher up the hill than these workings a shaft has been sunk on a spur in alluvial ground to a depth of 15 or 18 feet without reaching the bedrock. The wash in this is mostly sandstone, quartz, and quartzite, a good deal waterworn, and gives prospects of gold and a little tin. This wash probably belongs to one of the old buried channels, and a strong effort should be made to find the old gutter by sinking a number of shafts to bedrock across the spur. In the alluvial workings in the creek the gravel, which is largely of basaltic origin, often lies in beds which are plainly dipping to the west and even south-west, showing that when they were laid down the ground sloped towards what is now the spur west of the creek. In the face which was at work at the time of my visit the wash was getting deeper and the bottom dipping downwards going westward, so that everything points to deep ground in that direction, and probably as work proceeds the wash will be followed right under the basalt.

The highest face in the little creek when I saw the claim was just on the outcrop of a small tin-bearing lode, four to eight inches wide, consisting of quartz carrying tin ore, often in rich bunches, and a little carbonate of bismuth. All along the outcrop of this little lode good prospects of tin are obtainable. Parts of it are seen to be very rich, and though it is probably too small to be worked, it will be well to prospect it by laying it bare still further. This is an east-and-west vein, parallel to the above described bismuth lode, which is itself found again about 2½ chains further down the creek, and has been bared by sluicing. Two small quartz veins are here seen carrying tin and a little bismuth ore, and lying parallel to each other a few yards apart. Very fair tin was got here from the surface, and nice specimens may be picked out of the veins. About four chains further down the creek there is another parallel lode, better looking and larger than any of the above. It consists of two quartz veins six to ten inches thick, with a "horse" of sandstone about two feet thick between them. There is a soft clayey "dig" on one side of the main vein, and, counting the quartz and this, the lode-matter is probably from 2 feet to 2½ feet in thickness. Very good tin was got in the surface soil, and rich specimens are to be seen sticking in the lode still unbroken. This lode might pay to work, and is certainly worth trying.

Between the north and south boundaries of the section there is a fall of over 380 feet, so there is a good opportunity for sluicing to advantage. A small race brings water from the Seven-mile Creek to the north side of Section 1456; this should be enlarged, and a line of pipes laid from it so as to get the assistance of the pressure of the water in sluicing the lower ground. There is a good deal of water in winter in the Seven-mile Creek, and, with attention to conservation, it could be made to furnish a very fair supply for the greater part of the year.

Close to the south boundary of Section 1437 a little work has been done, which again goes to show that there is deeper ground under the basalt to the westward: some gold is got in the wash here obtained.

The tin ore in this claim when cleaned up seems generally to contain a little gold, and when the work goes further west it is probable that the gold will be worth separating. The easiest method of doing this appears to be to stream the dressed tin over blankets laid on the floor of an inclined sluice-box. Grading of the tin ore into sizes by means of sieves would probably make the operation somewhat easier. It will be noted that in this property the principal minerals are tin ore and bismuth, and that gold is of subordinate value; but I am not at all sure that this relation will continue, and have considerable hope that in the deep ground the gold will be the most valuable constituent.

Gold Claims.—Between the Seven-mile Creek and the gold workings the country is mostly covered with basalt, but sandstone and conglomerate make their appearance as we approach the claims

from the south. The workings are on the head of a small creek running into the Wilmot River, and taking its rise on the southern slopes of Bell Mount. On the south side of the creek Sykes and party are working some ground which appears to run away from the present creek as it is followed. The wash contains large, heavy, well waterworn boulders of conglomerate, which may be traced south up the slopes of the hill, and probably indicate the course of an old stream previous to the basaltic outbursts. The wash varies much in depth, the bottom being very uneven. The bedrock is slate and sandstone, containing quartz veins: it is rather ragged and difficult to clean up. The gold is not greatly waterworn, and is accompanied by a little tin ore. This claim, as work proceeds, will probably yield much useful information as to the older system of watercourses which carried the large boulders. These themselves are likely to be a good indication of the best wash-dirt, and though difficult to handle, should be persistently followed. In the creek itself north of Sykes' claim another party was at work, having cut away a rocky bar that had previously formed a sort of dam. This bar is just below the junction of two small creeks on which the principal claims are situated: these ran through somewhat flat-lying swampy ground, and do not carry very much water. Between them there is a small hill, but going northwards this is found not to be connected by a ridge with the main peak of Bell Mount, but to be cut off from it by swampy flat land. It would seem that the waters from this swampy flat may have at various times drained away through either branch of the creek. The whole of the flats have been taken up by diggers, some 80 men being at work on the field at the time of my visit. The drift consists of pretty well waterworn gravel, and would average from three to eight feet in depth in the lower parts of the leads, but gets deeper towards the north. The only part of it found to be worth saving is about six inches on the bottom, the top drift being of no value. The bottom is not true bottom but a false one, consisting of black clayey matter, in which in parts the remains of vegetation that has grown in it are at times plainly seen: it is evidently, therefore, an old surface soil. It seems to be an earthy swamp deposit, and is likely to be some little thickness. Two holes have been sunk in it by Betts and party in the eastern branch of the lead, one of which did not reach bedrock at about 16 feet, but had to be abandoned, while the other, at about the same depth, struck blue limestone bottom, dipping westward. No wash was found in these holes under the black pug, but it does not seem likely that the gutter was reached. More work should be done to find if there is any wash and gold on the true bedrock: there is a considerable probability of their existence, but no certainty. In the flat at the head of the lead the amount of stripping to be taken off is so considerable that the work becomes very expensive, and in some of the claims it is already contemplated to begin driving out the bottom wash without removing the overburden. Water is very scarce except in wet weather, and the want of this essential, together with the heavy stripping, are much against successful working. It seems to me rather doubtful if a good water supply could be obtained from any of the available creeks without an expense which the prospects of the claims would not justify, and probably therefore the whole of the field will have to be worked with storm-water as available. In the flat at the head of the leads there is still a good deal of ground to be worked, but the lower parts where the valleys are narrow and the gold might be expected to be most concentrated, are getting pretty well worked out, and another wet season or two would see them exhausted unless fresh wash is found under the pug bottom. The value of the flats higher up is as yet but little known.

The quantity of gold obtained from these diggings is not accurately known, but some 500 ounces can be accounted for. Several fairly large nuggets have been obtained, the heaviest being a trifle under 16 ounces in weight. Some of the parties have been fairly successful, others very indifferently so, but on the whole the field seems to have been as yet a fairly payable one.

It should be mentioned that the fall of the black pug false bottom is much the same as that of the existing creeks, so that it would seem that these have deposited the auriferous gravels. The source of the gold is as yet quite a mystery, but light will probably be thrown on it as work progresses. It would seem to come from the slopes of Bell Mount, but it may also possibly be derived from the re-washing of older gravels belonging to the river system obliterated by the basaltic flows. Much work will be required to solve the problem. On Section 990-87G there is an outcrop of ferruginous gossan which requires prospecting. It can be traced some distance on a line running N. 30° W. or thereabouts, and crosses the head of the leads, and has been suspected of being the lode from which the gold is derived. While I do not think this is the case, I should nevertheless advise that some shafts be sunk along this outcrop to ascertain what sort of a lode it is. As the scrub gets burnt off other lodes may be found, and in the dry weather when alluvial work is stopped the search for these might be more systematically carried on. The amount of gold obtained from the small area worked quite warrants strenuous efforts being made to discover the source from which it has come.

Silver-Lead Discovery.—On the west side of the peak of Bell Mount, which here slopes precipitously down the Wilmot River, some veins of argentiferous galena have been found. The principal one is probably quite 400 feet above the river, on a very steep rocky sideling. The lode lies very flat, underlaying about 2½ in 1, and strikes about N.W. and S.E. A small tunnel driven some 15 feet into the hill shows it to be from 2 to 2½ feet in thickness, consisting mostly of quartz with some broken country rock, and carrying spots and small veins of galena and pyrites. The

vein appears to be rather irregular, and as it shows at present is quite too poor to work. The clean galena from it is of fair quality, some pieces taken by me and assayed by the Government Analyst yielding 73 per cent. of lead, traces of gold, and 57 ounces 3 dwts. 8 grains of silver to the ton. The other veins found lower down the hill and further to the south are very small and poor. The country rock is blue slate and sandstone.

While the silver-bearing lodes yet found are not of much consequence themselves, they show that the country rock is favourable for the existence of galena veins, and indicate that prospecting for them may be carried on with reasonable hopes of success.

Reviewing the whole district examined on this occasion, it will be seen that gold has been found almost everywhere where the Silurian slates and sandstones occur, at Middlesex, Stormont, and Bell Mount; that argentiferous galena occurs in the same formation at Mount Claude, in small quantities at the Five-mile Rise, and at Bell Mount; and that tin ore and bismuth are associated with the intrusive mass of granite of the Bell Mount Tin-field. Taking into account the large area of ground over which the covering of basalt conceals the mineral-bearing formations, and the dense bush which also hinders prospecting, the number of discoveries already made should indicate that the district must be more than ordinarily rich in minerals, and therefore well worth attention from prospectors and mining adventurers.

I have the honor to be,

Sir,

Your obedient Servant,

A. MONTGOMERY, *M.A.*,

The Secretary of Mines, Hobart. *Geological Surveyor.*

REPORT ON A DEPOSIT OF IRON ORE AT THE BLYTHE RIVER.

Geological Surveyor's Office, Launceston, 5th March, 1894.

SIR,

I HAVE the honor to report upon a deposit of hematite iron ore on land held under mineral lease from the Crown by Mr. R. Quiggin on the Blythe River, some seven miles from its mouth. On the 16th of January last I made a superficial examination of the deposit, but, as it is still quite in a state of nature, and in no way opened up by cuttings or mining works of any sort, I was not able to make such a minute study of it as its importance undoubtedly deserves. Before it can be properly examined, and its extent and value accurately estimated, a considerable amount of time, money, and labour will require to be expended in clearing, trenching, and sinking upon it. From what is even now visible, however, it is quite clear that the ore is present in enormous quantity, and in a position affording splendid facilities for cheap mining, and there is every inducement to open quarries upon it and try it in a practical manner, provided it can be shown that there is any reasonable probability that iron-smelting can be made to pay in the Australian Colonies under existing conditions of the labour market, prices of fuel, and demand for the metal. As to this I shall have something to say later on, but first it is necessary to describe the mining property itself. The accompanying map, copied with slight alterations from one by Mr. Peart, authorised surveyor, kindly lent to me by Mr. Norton-Smith, of Burnie, will illustrate the description.

The iron deposit may be reached by either of two routes from the main road connecting Ulverstone and Burnie, the easier one being along the road through the Parish of Stowport, lying between the Blythe River and the Heybridge Rivulet to Ellis's, O'Keefe's, and Etchell's selections. The ore is met with on O'Keefe's western section, and on the adjacent Crown land, on which Mr. R. Quiggin holds under mineral lease the following sections:—1061-91M, of 40 acres; 1009-91M, of 73 acres; 851-91M, of 78 acres; and 856-91M, of 80 acres. As shown on the map, the outcrop of the deposit traverses the first three of these sections and the western part of O'Keefe's purchased block. The second route to the mine is along a track which runs up the eastern side of the Blythe River to it, but this is now in bad order, and not practicable for horses. Going over these two routes, the structure of the country is fairly visible, the sections afforded by the deep gorge of the Blythe River, and along the coast line, showing it very plainly. The main country rock is of sedimentary origin, consisting of sandstones, slates, and occasionally limestones of probably Silurian age, or even older. No fossils were seen during my visit, and I could not hear of any having ever been got in this vicinity, so there were no data for determining the age of the formation. The strata dip at high angles, and are very much metamorphosed, at times approaching schists and quartzites. Their general strike is north-east and south-west, conforming closely in this to the strike of the iron ore deposit. These older strata are seen all the way up the Blythe River gorge to the mine. The valley of this stream is a deep one, the bottom being 500 feet below the agricultural selections on each side of it at the place where the hematite crosses. This farming land is fairly flat on the whole, though a good deal undulating, and is composed of basalt of Tertiary age which covers the older rocks first mentioned. It is found on both sides of the Blythe River valley, and decomposes to a fertile agricultural soil.

The deposit of iron ore has been cut through by the Blythe River, and is found on each side of its valley rising up the slopes until it disappears under the basaltic capping. The outcrop is about five chains in width, and even allowing for loose stones from it gravitating down hill and making it appear wider than it really is, I do not think that there can be less than about 200 feet in width of ore on an average; along its length it has been traced and is easily visible for 74 chains, or close on a mile. The ore crops out in large lumps and the surface soil is full of it, and at several points, some of which are marked on the map, it stands up in large rocks and cliffs; these afford the best sections of the ore-body yet available, and a careful inspection of them shows it to be a massive hematite with a large proportion of very pure high-grade ore. In some parts there is a good deal of quartz mixed with the hematite, sometimes in strings and veins and sometimes in angular fragments; I also noticed a good many pieces of jasper and of siliceous hematite. The north end of the ore mass seemed rather more siliceous and impure than the parts close to the river. The whole deposit is therefore by no means a pure high-grade hematite, but there can be no doubt that very large quantities of very pure ore with little silica could be obtained without much picking. Till the mass, however, is actually cut into and tried there are no data for estimating what proportion the pure ore bears to the entire mass, or how much lean ore would have to be quarried and rejected

in obtaining each ton of first-class stuff. This is a factor of the greatest importance in calculating the cost of mining the hematite, and will require to be attentively studied during the progress of preliminary exploratory work. In the bed of the Blythe River there is a large amount of very good ore, representing no doubt the hardest portions of the stuff which has fallen into it, the softer and more friable matter being washed away by the water. Waterworn ore is found in the bed of the stream for some distance down, and nearly a mile below the mine I noticed rounded boulders of it in an alluvial terrace, probably quite 20 feet above the water's level. It would probably be worth while ascertaining if the bed of the stream could not be worked profitably for the fine hard ore which has been concentrated in it by natural sluicing operations. As it was quite impossible for me, in the undeveloped state of the mine, to obtain a sample of the ore which would at all fairly represent its average bulk value, and as such a sample would indeed be of no particular use, inasmuch as in actual working a lot of lean ore would be necessarily rejected, I only took a few samples of the best looking boulders in the river for analysis. They may be looked upon as fairly representing the best ore, but from inspection I should judge that many thousands of tons of equally good stuff could be readily obtained. What the average yield of such first-class ore from the bulk of the deposit would be is, as already remarked, only to be ascertained after it has been opened out by trenches and cuttings. The samples taken were forwarded to Mr. W. F. Ward, Government Analyst in Hobart, with instructions to have them carefully examined for all impurities likely to interfere with the quality of the iron to be made from the ore. He reports the analysis as follows:—

"Iron peroxide (= iron 66·4)	95·2 per cent.
Silica	4·8 ,,
Phosphoric Acid.....	Traces.

This ore is of excellent quality, being practically free from all impurities with the exception of the silica. It resembles the well-known Cumberland Red Hematite, so long used for the production of steel by the Bessemer process."

According to this analysis, the Blythe River hematite is one of the finest and purest in the world, ranking with the famous Spanish, Algerian, and Cuban ores, which are now exported in very large quantities to the United Kingdom, United States, France, and Germany, for the manufacture of Bessemer steel. The deposit must be one of the largest also, containing many millions of tons. The data for calculating its size are very insufficient, but, taking them such as they are, a rough calculation may be made which will serve to give some idea of it. On the south side of the river the ore is seen for a horizontal distance of about 8½ chains, and rises to a height of 280 feet above the stream: on the north side it rises to 500 feet above the river, in about 50 chains horizontal distance, and then falls a little, say, to 400 feet, for another 16 chains. Taking the width of the ore-body at 66 yards, these measurements give the cubic contents of the deposit under the visible outcrop down to the level of the Blythe River as slightly over 10,000,000 cubic yards, or, at 3 tons to the cubic yard, 30,000,000 tons. It is not to be supposed that the ore terminates where the outcrop disappears under the superficial basalt, or that it only goes down to the level of the Blythe River, while the width also is probably underestimated, so that the deposit is clearly of enormous extent.

It is, too, most favourably situated for economical working, the steep sides of the river gorge giving exceptional opportunities for mining by open quarrying. Working faces could be opened at different levels on both sides of the river, so that an army of men could be at work at one time quarrying the ore in steps, and it could be lowered to the river by self-acting tramways, and in some places even by shoots, by gravitation, at very small expense. The cost of mining ought to be very low.

The Blythe River is at all times a considerable stream, and would be able to supply power for working air-compressors, electric-lighting appliances, and concentrating machinery. The latter would sooner or later be required as the best way of getting rid of the piles of second-class ore that would rapidly accumulate in working. The possession of this good water-power would be a large factor in the economical working of the mine.

The gorge of the Blythe is pretty steep and rough, but I do not think any serious difficulty would be found in making a railway down it from the mine, a distance of between six and seven miles. The present track on the eastern side of the river is six and a half miles from the mine to the main road and to the surveyed line of the Ulverstone-to-Burnie Railway. It seems highly probable, however, that the western side of the river would be the better one for the line to the mine. It has also been proposed to take a railway direct to Emu Bay, but I understand there are serious difficulties in the way of doing so. Going down the Blythe River and then along the Ulverstone-Burnie Railway the ore would have to be carried about twelve miles to reach the Emu Bay Breakwater for shipment, and the grades would be easy ones, so the item of carriage of ore to port of shipment ought to cost but little.

This iron mine, therefore, possesses the advantages of enormous quantities of ore easily mined, of great purity of the mineral, and of proximity to a deep-water port, also of ample water-power; and if any mine of iron will pay in the Australian Colonies this one should.

I have not been able satisfactorily to convince myself whether this deposit is a true lode or an ore-bed, but incline to the latter opinion. The strike of the ore-body coincides as nearly as possible with that of the enclosing country rocks, and in one or two places I thought traces of stratification in the ore itself could be detected. The purity of the mineral, too, rather favours the ore-bed explanation. On the other hand, the occasional strings, veins, and angular enclosures of quartz rather point to its being a lode. Similar strings and veins, however, occur in the surrounding country rock, and it seems possible enough that those in the ore are similarly formed by infiltration of silica into cracks and crevices of its mass long after it was formed. It seems most probable that the ore-bed was originally a mass of brown iron ore deposited along with the sandstone and slate strata when the latter were laid down as horizontal layers; in the course of time the strata have become tilted on edge, and the brown iron ore has become changed to the red hematite. From a mining point of view it matters little whether the ore is in a lode or in a nearly vertically-dipping bed, as the method of working is the same in either case; but if it could be proved to be a bed or sedimentary deposit greater confidence would be felt as to its remaining of fairly uniform quality over long distances in length and depth. When some mining work has been done it will probably be easy to definitely settle the question of the classification of this deposit.

It is not the only one in this part of the country, for not many miles away, near the Penguin River, there is another large iron ore deposit, which is described as quite similar to the Blythe River one, but which I have not myself seen, and possibly many others lie concealed beneath the superficial basaltic covering.

There can be little doubt when the time comes for making iron in the Australian colonies these iron mines will be of immense value to their owners and to the country. The important question now to be considered is, can they be profitably worked at the present time? It should be the work of a specialist in the manufacture of iron, thoroughly conversant with the European and Colonial iron markets, and with the conditions under which the metal is made elsewhere and would have to be made here, to give an answer to this; and only such a one can speak with authority on the subject. Having only a general knowledge of the problem I cannot claim any such authority, and any opinion now expressed by me would require to be verified by a specialist before being acted upon; but I have endeavoured to gather together some reliable facts and figures which may serve to throw light upon the question. By the kind assistance of the Government Statistician I have been able to obtain returns from all the Australian colonies except Queensland and Western Australia and from New Zealand, of the value of iron and iron goods imported into them, which will give some idea of the demand for iron that already exists. As the classification adopted by the various Colonies is not uniform, I have not found it possible to combine all the returns in one table, and therefore present them as revised for the five years ending with 1892.

IMPORTS OF IRON AND STEEL INTO TASMANIA.

	1888.	1889.	1890.	1891.	1892.	TOTAL.
	£	£	£	£	£	£
* Manufactured goods of Iron and Steel	164,621	171,240	190,537	220,624	163,016	910,038
Galvanised Iron	...	2855	4400	4879	3932	16,066
Galvanised and Corrugated Iron.....	...	...	...	...	1437	1437
Iron—Rod, Bar, Hoop, &c.	21,935	17,966	19,482	19,074	14,015	92,472
Iron pipes	...	7258	11,488	4741	12,865	36,352
Railway Material	25,142	22,051	59,038	35,537	6211	147,979
Steel, unmanufactured	...	1335	1964	2581	1902	7782
Tin-plates, unmanufactured	...	3745	4215	5651	4435	18,046
TOTAL.....£	211,698	226,450	291,124	293,087	207,813	1,230,172

* Including cutlery, hardware, and goods of all sorts mainly composed of iron and steel.

IMPORTS OF IRON AND STEEL INTO SOUTH AUSTRALIA.

	1888.	1889.	1890.	1891.	1892.	TOTAL.
	£	£	£	£	£	£
Steel and Iron Rails	814	615	4459	36,725	35,381	77,994
Rod and Bar Iron	32,178	23,948	55,607	43,421	42,179	197,333
Pig Iron	14,548	23,378	22,246	18,482	14,436	93,090
Manufactured Iron Goods*	41,691	56,950	95,448	88,661	76,241	358,991
TOTAL .....£	89,231	104,891	177,760	187,289	168,237	727,408

* Including drain pipes, columns and girders, pipes and tubes, fencing, plate and sheet, hoop, fencing wire.

IMPORTS OF IRON AND STEEL INTO NEW ZEALAND.

	1888.	1889.	1890.	1891.	1892.	TOTAL.
	£	£	£	£	£	£
Steel and Iron Rails*	22,844	35,367	50,319	24,810	17,072	150,412
Rod and Bar Iron	33,390	39,225	36,066	41,195	62,694	212,570
Pig Iron	9556	13,684	16,728	15,531	13,177	68,676
Manufactured Iron Goods, Pipes, &c. †	215,315	346,723	319,303	302,996	389,635	1,573,972
TOTAL £	281,105	434,999	422,416	384,532	482,578	2,005,630

* Rails only, exclusive of railway bolts and fastenings.
† Exclusive of cutlery, hardware, hollowware, and ironmongery, nails, railway plant, implements, tools, and machinery.

IMPORTS OF IRON AND STEEL INTO NEW SOUTH WALES.

	1888.	1889.	1890.	1891.	1892.	TOTAL.
	£	£	£	£	£	£
Railway Material*	87,033	98,257	297,666	826,256	346,755	1,655,967
Rod and Bar Iron (including plate and sheet)	125,393	141,297	181,576	214,009	150,872	813,147
Pig Iron	30,690	29,454	25,124	35,214	25,772	146,254
Manufactured Iron Goods (including Drain Pipes)	1,794,771	2,155,227	2,363,998	2,924,982	2,259,516	11,498,494
TOTAL £	2,037,887	2,424,235	2,868,364	4,000,461	2,782,915	14,113,862

* The value of rails only cannot be stated.

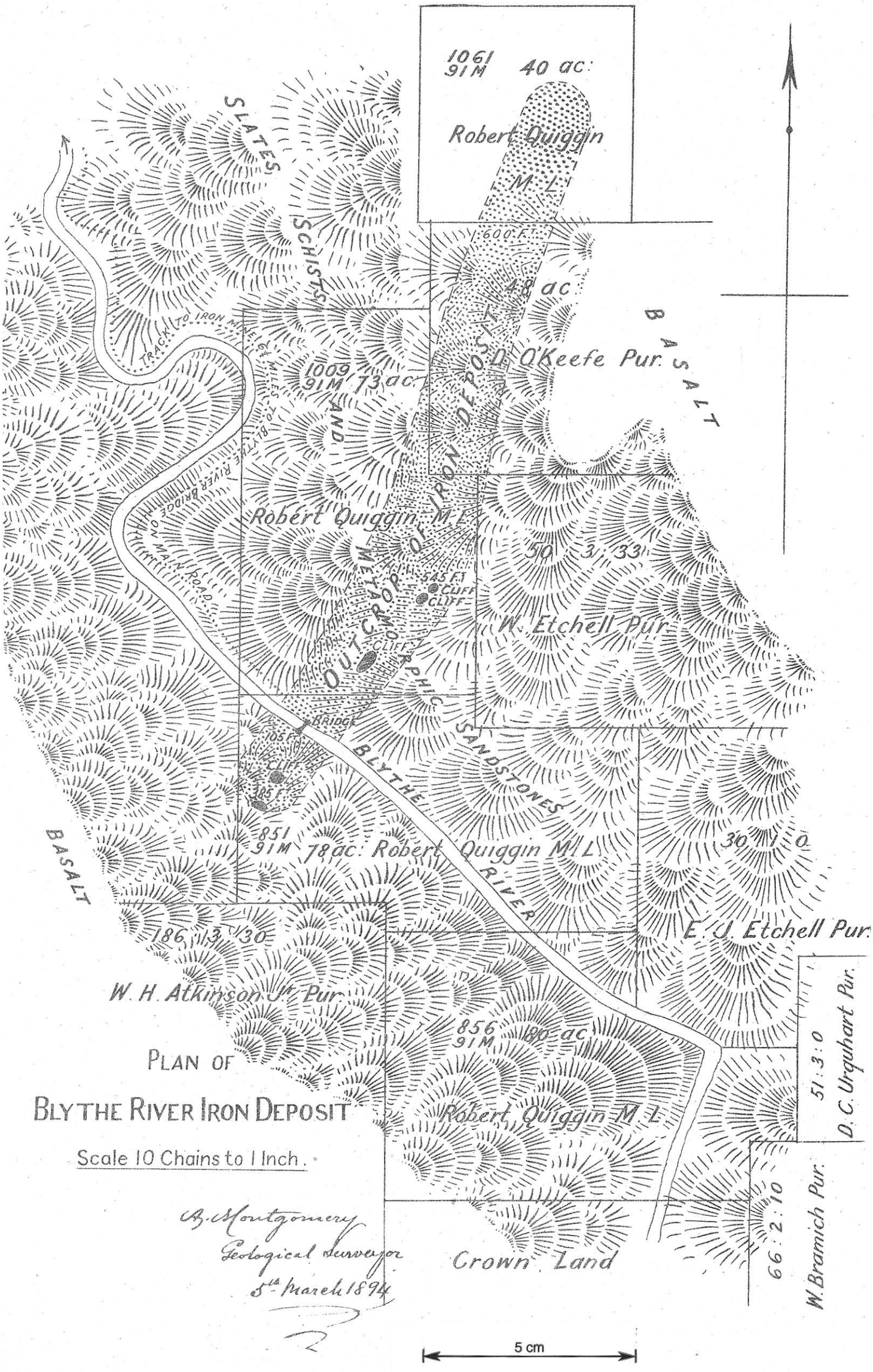
IMPORTS OF IRON AND STEEL INTO VICTORIA.

	1888.	1889.	1890.	1891.	1892.	TOTAL.
	£	£	£	£	£	£
Steel and Iron Rails	237,334	436,184	162,548	10,589	4192	850,847
Rod and Bar Iron	122,548	197,870	159,572	105,135	64,415	649,540
Pig Iron	89,174	99,895	83,950	73,532	31,015	377,566
Steel	43,854	53,179	53,740	35,446	25,433	214,652
Manufactured Iron Goods, Pipes, &c.*	1,558,170	1,747,073	1,572,217	1,514,088	1,000,887	7,392,435
TOTAL £	2,051,080	2,534,201	2,032,027	1,738,790	1,125,942	9,482,040

* Including Steel Cordage.

As will be seen, the item "Manufactured Iron Goods" in the above tables includes a great deal more in the Returns of some of the Colonies than in those of others. Taking the grand totals for the five years as they stand, however, their sum amounts to £27,559,112, and if we include Queensland und Western Australia, whose Returns I have not been able to get in time for this Report, we may safely estimate the grand total for all the Colonies at £30,000,000, or at the rate of £6,000,000 worth of iron goods per annum. To get greater accuracy it would be necessary to deduct the exports of iron from each Colony to ascertain the amount used; but against this we may place the large value of iron goods of all sorts not shown in the tables, and probably this would quite compensate for the exports. It is therefore clear that a very considerable market exists, which would be able to absorb the produce of a fairly large smelting-works.

Should iron-smelting be begun in Australia it is probable that for some years the production would be confined to pig iron, iron and steel rails, iron and steel rods, bars, girders, columns, and other simple shapes, and foundry material, though in course of time no doubt it would be found possible to compete with Europe in manufactured goods of all sorts. Turning again to the tables, it is seen that the imports of pig iron, rod and bar iron, unmanufactured steel, and steel and iron rails and railway material amount to a grand total of £5,753,281, which may, however, include locomotive engines in the cases of New South Wales and Tasmania. However, counting in Queensland and Western Australia, it should not be far from correct to assume the colonial consumption of the above sorts of iron as averaging about £1,000,000 in value annually for the period quoted. It is not to be supposed that one smelting establishment would be able to supply all the different brands of iron required for manufacturing purposes, or could beat all foreign competitors so thoroughly out of the field as to be able to hold a monopoly of it; still the figures show a market large enough to encourage us to believe that our own iron smelters would not have any surplus metal requiring to be exported for sale. It is not probable that for many years to come Australia will be able to compete with Europe and America in the open markets of the world, but if we can hold our own within our own domain, and consume all the iron we can produce, the iron manufacturing industry would soon need no special fostering.


1061
91M
40 ac:
Robert Quiggin
M.L.
600 FT.
SLATES
SCHISTS
TRACK TO IRON MINE
BLYTHE RIVER BRIDGE ON MAIN ROAD
1009
91M
73 ac:
Robert Quiggin M.L.
OUTCROP OF IRON DEPOSIT
MYARMORPHIC
545 FT
CLIFF
CLIFF
CLIFF
BRIDGE
105 FT
CLIFF
385 FT
BASALT
D. O'Keefe Pur.
BASALT
50
3
33
W. Etchell Pur.
SANDSTONES
BLYTHE RIVER
851
91M
78 ac: Robert Quiggin M.L.
30
1
0
E. J. Etchell Pur.
186
1
3
30
W. H. Atkinson Jr. Pur.
856
91M
80 ac
Robert Quiggin M.L.
51:3:0
D. C. Urquhart Pur.
66:2:10
W. Bramich Pur.
Crown Land
PLAN OF
BLYTHE RIVER IRON DEPOSIT
Scale 10 Chains to 1 Inch.
A. Montgomery
Geological Surveyor
5th March 1894
5 cm

Now let us try to arrive at some estimate of what it would cost to make iron locally. To get at this we must first see what it costs elsewhere. I am indebted to "The Mineral Industry, 1892," by Mr. R. P. Rothwell, for most of the facts and figures on this head now to be quoted.

From tables prepared by the U.S. Labour Bureau, under the Hon. Carroll D. Wright, Commissioner, covering the period between 1887 and 1890, it appears that the total cost of one ton of run-of-furnace pig iron, as reported by 26 establishments in the Northern District of the United States, averaged $13·94 (=£2 18*s.* 1*d.*), and in 24 establishments in the Southern District, $10·75 (=£2 4*s.* 9½*d.*): one establishment on the Continent of Europe gave the average cost per ton as $11·03 (=£2 5*s.* 11½*d.*). The details of cost at the above 50 U.S. establishments are of interest as showing the main items of expense and their relative importance, and are therefore quoted, the average costs being taken :—

	Northern.	Southern.
Ore	$6·96	$3·47
Cinder, scrap, &c.	·58	·01
Limestone	·50	·47
Coke	3·33	4·46
Coal	·37	·00
Total minerals	$11·74	8·41
Labour	1·47	1·53
Officials and clerks	·18	·16
Supplies and repairs	·51	·61
Taxes	·04	·04
Grand Total	$13·94	$10·75

In the same tables the cost of charcoal iron is given from seven establishments in the Northern States, and from one in the Southern, ranging in the former from $14·45 to $25·24 (average $19·45) per ton, and in the latter being given as $10·27. The writer of the article on Iron in "The Mineral Industry," however, says :—"It is not at all likely that the average cost of hot-blast charcoal iron anywhere in the country is below $14."

The average cost per ton of Gray forge iron in the Northern District of the United States is given as $13·50, in Great Britain as $8·03, and on the Continent of Europe as $9·06. No. 1 foundry iron in the Northern United States is given as costing on an average $13·86 a ton, and on the Continent of Europe $7·74, excluding taxes. Spiegeleisen on the Continent cost $15·07, only one establishment's figures being quoted however. Basic or Thomas iron on the Continent cost $9·63, and in Great Britain $10·89 a ton. The average cost of Bessemer iron in the Northern United States was $15·37, in Great Britain, $10·33, and on the Continent of Europe, $11·74.

The average figures for Bessemer iron and Gray forge iron respectively made in Great Britain, quoted in Mr. Wright's Report, are in detail made up as follows :—

	Bessemer iron.	Gray forge iron.
Cost of Ore per ton, of pig	$6·09	$3·63
„ Cinder and Scrap	0·23	0·10
„ Limestone	0·20	0·32
„ Coke	2·64	2·74
„ Coal*	·0075	·02
„ Labour	·6625	·67
„ Officials, clerks, &c.	·055	·04
„ Supplied repairs	·43	·33
„ Taxes	·015	·02
„ Items not detailed	...	·06
Total cost of Pig	$10·33	$7·93
Number of establishments reporting	4	3
Number of furnaces	4	6
Average output per day per furnace	76 tons	78 tons
Tons of Ore used per ton of pig	1·8	2·45
„ Cinder and Scrap	·07	·22
„ Limestone	·345	·45
„ Coke	1·175	1·08
„ Coal	·0025	·007
Average cost of ore per ton	$3·39	$1·48
„ „ Cinder and Scrap per ton	0·32	0·45
„ „ Limestone per ton	0·58	0·71
„ „ Coke per ton	2·25	2·53
„ „ Coal per ton	3·00	3·00

* In one Bessemer and two Gray forge establishments about one ton of coal is used along with every hundred tons of coke.

It is not explained why the coal should cost more than the coke per ton, but it is probably not the same as that from which the coke is made, and may perhaps be anthracite brought from some distance. The smelting, however, is substantially all done with coke.

It is seen from the above that the most important items of cost of making Bessemer iron, which is what we have at present to consider, as the Blythe River iron mine yields an excellent Bessemer ore, are the cost of the ore and the cost of the coke used for smelting it, these two amounting to 84½ per cent. of the total cost of production. Most of the Bessemer ore used in Great Britain is now imported from Spain, the deposits of West Cumberland and North-west Lancashire only supplying about 2,500,000 tons a year, as against about 4,000,000 tons imported. According to the contributor of the article on the Mineral Industries of the United Kingdom in Rothwell's "Mineral Industry," 1892,—"About 20 per cent. of the total make of pig-iron in the United Kingdom is now and has for some years past been produced from imported ore, a large part of which is delivered to the furnaces at 11*s.* per ton, the average content of iron being 50 per cent." The proportion quoted is stated to have risen to 25·2 per cent. in 1892. (Engineering and Mining Journal, 1893, page 494.) From the above tabular statement it appears that during the period of Mr. Wright's investigation, the average Bessemer ore used at four British Establishments cost per ton $3·39 = (14*s.* 1½*d.*) and yielded 55⅓ per cent. of pig iron, which we may take as equal to say 53½ per cent. of pure iron. Allowing for losses in smelting we may estimate that the ore would assay about 57 per cent. iron. According to the return of imports into the United Kingdom during the same period (1887 to 1890), the average value of the imported ore (which is mostly Bessemer ore) was 15*s.* a ton. It is probable that the recent heavy fall in the value of silver will have lowered the price of Spanish ore, as Spain is monetarily a silver standard country. In estimating the relative prices at which the British and Australian smelters respectively would purchase their Bessemer ore, I do not think, therefore, that we should put down the cost to the former at more than 11*s.* a ton, the price quoted by "The Mineral Industry's Contributor."

At what price, now, could we deliver the Blythe River ore to a smelting establishment? Taking into consideration that coke is a bulky, and therefore expensive cargo to carry, and that, as shown above, nearly as much weight of coke as of ore is used in the first smelting, without counting the coal and coke used afterwards in converting the pig iron into merchantable rails, rods, sheets, and so on, it is pretty clear that it would be cheaper to send the ore to Newcastle to be smelted than to try to reduce it in Tasmania. This would have the further advantage that the metal made would be at once available for distribution throughout New South Wales and Queensland, without the expense of freight from Tasmania. Smelting at Newcastle seems to me the only hope of success with the Blythe River and Penguin ore.

The mine being admirably situated for mining the ore cheaply, it seems a quite safe estimate, even after allowing that a good deal of second class ore unfit for smelting had to be moved and rejected while picking out the pure mineral, if we put the cost of winning it at 3*s.* a ton. The distance to Burnie Breakwater being 12 miles, another shilling should cover the freight to the port. The freight from Burnie to Newcastle will be a very important factor in the calculation, and I have been at some pains to get reliable figures on this head. Seeing that vessels taking coal and coke from Newcastle to Melbourne, Adelaide, and Port Pirie can call at Burnie on their return trip and load with iron ore, it is pretty certain that if shipments of 800 or 1000 tons of ore a week (enough to keep one large furnace in work) or over could be guaranteed to the shipping companies, contracts could be made to carry it at 5*s.* a ton. Allowing 2*s.* a ton for contingencies and profit, the ore could then be delivered at Newcastle for about 11*s.* a ton, or about the same price as the British smelter pays for his Spanish hematite.

As regards the price of coke, however, the position is much less satisfactory. While the British smelter pays, as shown above, from 9*s.* 4*d.* to 10*s.* 6*d.* a ton for his coke, the best coke delivered in Newcastle costs 25*s.* a ton. As the best coal is now sold in Newcastle in the trucks at 7*s.* 9*d.*, and small coal at 4*s.*, it seems likely that coke could be supplied considerably cheaper, probably at not more than 20*s.* a ton at the outside, if a local furnace were in a position to make large contracts for it. The quality of the New South Wales coke is not perhaps quite as good as the English, but is susceptible of improvement with the use of coal-washing appliances and greater care in manufacture. In a report, dated 22nd December, 1892, by the Government Geologist of New South Wales, Mr. E. F. Pittman, it is pointed out that there is not so much difference between the English and German cokes and the best New South Wales makes as is generally supposed. After comparing the analyses of nine samples of foreign coke supplied to the Broken Hill and Port Pirie smelting works with those of fourteen samples made in different parts of New South Wales, he says:—"It will be observed that some of the Welsh coke used at Broken Hill contains a higher percentage of ash than the colonial coke made by either the Purified Coal and Coke Company, Wallsend, or the Singleton Colliery Companies; also that the *average percentage* of ash, calulated from the nine samples of foreign cokes in use at or in transport to Broken Hill amounts to 7·26, which is only 0·6 per cent. lower than is contained by the coke made at the Purified Coal and Coke Company's ovens, Wallsend." Mr. Pittman summarises his conclusions as to the relative quality of the New South Wales and foreign cokes as follows:—"Some of the cokes at present manufactured in New South Wales are nearly equal, as regards ash, to the

average of the imported cokes in use at the Broken Hill smelting works. Several of the cokes at present manufactured in New South Wales are superior, as regards per-centage of ash, to some of the imported cokes in use at Broken Hill. That in regard to strength, or capacity for resisting pressure, the cokes manufactured in New South Wales are superior to some of the imported cokes at present in use at Broken Hill."

The ash of the New South Wales cokes is admitted to be somewhat more siliceous, and consequently more refractory to smelt than that of the average English ones, but as a set-off to this it contains less sulphur and phosphorus. In the Records of the Geological Survey of New South Wales, Vol. II., Part III., 1891, page 110, it is stated in a paper by Mr. J. C. H. Mingaye, F.C.S., Government Analyst, that "as regards the presence of sulphur, the coals of New South Wales are exceptionally free from that element, and I think will, without doubt, compare in this respect with coal in any part of the world." At page 114 of the same paper Mr. Mingaye again says—"The ashes of the coals of New South Wales yields much less phosphoric acid than the English, which is greatly in their favour when the coals or cokes are required to be used for iron-smelting purposes," and he quotes the mean percentage of phosphoric acid in five samples from the Northern District of New South Wales as ·726 per cent., and in six from Great Britain as 1·843 per cent. The purity of the coke from sulphur and phosphorus will allow of the production of very fine iron from the pure Tasmanian ore, and is an advantage which few but iron-smelters will adequately realise.

As a set-off against the siliceous ash of the Colonial coke the great purity of the ore might be urged, but it would be premature to do so until actual shipments have been sampled. If the ore can be kept of the same average grade as the Spanish ore, say from 50 per cent. to 65 per cent. iron, it is as good as we have any right at present to expect it to be, though there is much reason to hope that a higher average value could be maintained.

Taking the English figures above given for Bessemer pig iron as a basis, we may now attempt a rough estimate of the cost of producing a ton of pig at Newcastle :—

	£	*s.*	*d.*
1·8 tons ore, at 11*s.*	0	19	9½
·07 tons cinders, &c., at say 2*s.*	0	0	1½
·345 tons limestone, at 4*s.*	0	1	4½
1·2 tons coke, at 20*s.*	1	4	0
Total materials	£2	5	3½
Labour, officials, supplies, &c., say	0	10	0
Total cost of pig	£2	15	3½

As against $10·33 or £2 3*s.* 0½*d.* in England, the extra cost being about 12*s.* 3*d.*

The handicap which the colonial smelter would have as against his English competitor is the freight on the latter's goods out from England. This is very variable, according to the exigencies of the shipping trade, ranging from occasionally a nominal sum up to as much as 25*s.* a ton. After a good many inquiries it seems to me to be pretty safe to take 12*s.* 6*d.* a ton as about the lowest average freight on iron from London to these Colonies. As regards New South Wales and part of Queensland the local smelter would have the whole of this in his favour ; but when he had to ship from Newcastle to Melbourne, Adelaide, New Zealand, and Tasmania, it is doubtful whether the freight on his goods, owing to the high intercolonial rates prevailing, would not be almost as much as if they were sent from London. The Newcastle manufacturer would then have a slight advantage in New South Wales and Queensland, but could hardly meet English competition elsewhere in the Colonies. It must be remembered that the case of pig iron is the one most favourable to the Colonial smelter, as the higher rates of wages and coal here will make the further working up of the metal into merchantable shapes relatively more costly than in Great Britain.

It is possible that a powerful company acquiring the iron mines, and also coal mines of its own and making its own coke, might be able to reduce the cost of producing iron to a figure approaching the British cost, the facilities for bringing the ore and coke together at Newcastle, and for distributing the product afterwards, being really unusually good. The case in favour of a trial at making iron in these Colonies seems good enough to warrant its being investigated in all its details by a skilled specialist in the manufacture. The attempts hitherto made at iron-smelting have been failures, or very partial successes, but it seems to me that the proposal to reduce sea-borne ore at Newcastle has points in its favour which were wanting in other instances.

As showing the value of a deposit of high-grade Bessemer ore, the following notes on the iron deposits of Cuba, taken from "Rothwell's Mineral Industry, 1892," will be of interest :—"The Cuban iron-ore deposits, one of the most important groups of Bessemer iron mines in the world, are found on the range of mountains called the Sierra Maestra, which skirts the southern coast of the Province of Santiago de Cuba. The ore can be mined with great facility by means of side-hill

cuts. The average analyses of the cargoes have been between 58 per cent. and 65 per cent. of metallic iron, and about 0·02 per cent. of phosphorus." A syndicate of Pennsylvania capitalists obtained a concession to build a narrow-gauge railroad from the mines to the port of Santiago de Cuba, a distance of 17 miles. "The line was laid through a very mountainous country, and the first car-load of ore was shipped late in 1884. Since then the output has been increasing year by year, and in 1891 it amounted to 330,000 tons. To haul the ore from the mines to the port there are at present in use about 20 locomotives and over 2000 cars, while the total number of men employed averages about 1500. The company has built an iron pier at the harbour of Santiago de Cuba high enough to allow the railroad cars to dump directly into the steamers. There are no ore-docks, so the company must have sufficient cars to allow the loaded ones to be side-tracked until the arrival of the steamers, every two or three days. The company controls a regular line of iron steamers plying between their pier at Santiago de Cuba and Philadelphia or Baltimore. Most of the ore is consumed by the Pennsylvania Steel Company and the Bethlehem Iron Company. It is estimated that over $3,000,000 has been spent in this enterprise, with gratifying financial results. In 1890 the Sigua Iron Company, composed of Philadelphia capitalists, was organized, and purchased another group of mines in the same mountain range, about 30 miles from Santiago de Cuba. It has constructed eight miles of standard-gauge railroad. An ore-dock of 5000 tons capacity was built in the open sea, and will be protected from the prevailing south-east winds by a breakwater now in process of construction. The first shipment of ore from this group of mines arrived in Philadelphia a few weeks ago in the American whale-back steamship '*Joseph L. Colby*.' A portion of the cargo went to the Midvale Steel Company, whose analysis gave:—Metallic iron, 67·576 per cent.; phosphorus, 0·014 per cent.; sulphur, 0·026 per cent.; silica, 1·400 per cent."

The importance to all the Australian colonies of the establishment of an iron-smelting industry in their midst can hardly be over-estimated, seeing that there is, perhaps, no other that gives a greater stimulus to national progress. If it can be successfully established it will go far before long to render us less dependent upon the outside world for markets for our foodstuffs and raw materials and for manufactured goods, by encouraging a manufacturing population who will consume the former and supply the latter, for the development of coal and iron industries always carries with it progress in other branches as well. The question of fostering it by the removal of restrictions on intercolonial trade and by other means is therefore well worth the consideration of colonial statesmen.

In conclusion, I would urge the owners of the Blythe River mine to have the deposit opened out by mining works far enough to allow accurate estimates to be formed of the quantity and value of the ore available, and to make sure that neither the quantity, quality, nor cost of winning it has been miscalculated, and to have the whole question of smelting it and disposing of the iron thoroughly looked into by an experienced iron manufacturer. In my opinion the time has come for such a thorough investigation of both mine and market, and the magnitude of the issues at stake demands that care and expense should not be spared in these most necessary preliminaries. I have to thank Mr. Wm. Jones, of Burnie, Mr. J. W. Norton-Smith, Mr. J. T. M'Donald, of Salisbury's Foundry Company, Launceston, and Messrs. Huddart Parker & Co.'s and the Union S.S. Co.'s, of New Zealand, Managers, for much information as to freights, &c.; the Government Statistician, Mr. R. M. Johnston, for tables of iron imports into the Colonies, and the Under Secretary of Mines, Sydney, for information as to prices of coal and coke at Newcastle, and for Reports on the Coals and Cokes of New South Wales.

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

A. MONTGOMERY, *Geological Surveyor.*

The Secretary for Mines, Hobart.

REPORT ON THE CORINNA GOLDFIELD.

Mines Office, Launceston, 9th April, 1894.

SIR,

I HAVE the honor to report to you upon the Corinna Goldfield, of which I have recently made a general examination. Leaving Launceston on the 12th March I reached Corinna on the evening of the 14th by way of the road from Waratah through the Heazlewood silverfield, and remained in the district till the 22nd. During my visit I examined pretty closely the areas of 1000 and 500 acres respectively at the heads of Middleton's Creek and the Lucy River which have been for the time being withdrawn from the operation of the leasing clauses of "The Mining Act, 1893," and are being prospected by syndicates with a view to working by the method of hydraulic sluicing.

The road from Heazlewood to Corinna keeps along the divide between the valleys of the Savage and the Whyte rivers, both of which, with their branches, have yielded a great deal of gold. It passes over the Long Plain and Brown's Plain, both of which are considerable stretches of somewhat flat country lying right on the divide between the two valleys, and have yielded a good deal of gold. On part of the Long Plain and over nearly the whole of Brown's Plain there is a superficial covering of water-worn gravel, of considerable depth in many parts of the latter. In places the gravel has been strongly cemented together so as to form a hard conglomerate, often closely resembling the conglomerates found in formations of very much greater geological age. Between Brown's Plain and Corinna the divide is usually covered with similar gravel, and occasionally conglomerate, though the bed-rock is visible in a few places. At Corinna, on both sides of the river, there are a succession of gravel terraces well seen while going along the track from Waratah to Trial Harbour, and on the spurs running into the Pieman, Whyte, and Savage River Valleys we find every here and there corresponding terraces, which have been without doubt deposited in succession as the streams cut their valleys down to lower and lower levels.

The bed-rock on which the gravels rest is most likely of Silurian age, though palæontological proof of this is as yet wanting or very scanty, and consists in different localities of various species of rocks,—conglomerates, schists, quartzites, slates, metamorphic sandstones, and crystalline limestones being all represented. The strata are very much contorted, sometimes being on edge or inclined at high angles, and again quite short distances away being seen almost horizontal. This is well seen in the section at "Hell's Gates" where the Pieman River cuts through the Donaldson Range: in a high cliff strata of slate, sandstone, and conglomerate are seen dipping 58° to the N.W. and striking about N.E. and S.W., while a short distance further down the river the layers are horizontally bedded, and again higher up the river at the Falls Creek they also lie nearly flat. In the Rocky and White River beds also the strata are seen to be greatly tilted and contorted. Veins of quartz are common in the bedrock, and larger ones, or reefs, are not unusual, but very little attention has yet been given to these, though there can be little doubt that auriferous lodes must be present among them. Some of the known reefs look well enough to deserve being prospected.

With the exception of a small patch of basalt, most likely of Tertiary age, which is seen on the road about six miles north of Corinna, the superficial gravels and the Silurian bedrock are the only formations met with in the district. At 22 miles from Corinna, however, we find a large mass of serpentine, which is there the principal country rock throughout the northern portion of the Heazlewood silver-field and extends to the Magnet Range. The goldfield on its eastern side lies against the granite of the Meredith Range: I am not aware that any gold has been found in this formation. The alluvial gravels often contain stones evidently derived from the granite range, especially a hard quartz and tourmaline rock, and the traces of tin ore through them are most likely also derived from it. The occurrence of stones, which have come in all likelihood from the Meredith Range on the west side of the valley of the Whyte River and further west still in the gravels of Middleton's Creek on the Savage fall, is of great interest, as tending to show that they were laid down prior to the excavation of the Whyte River Valley. Had the features of the country at the time of the laying down of the gravels been the same as at present, it is clearly impossible that stones from the Meredith Range on the east side of the Whyte could have crossed its deep gorge and been laid down on the divide between it and the Savage River. Of course it is possible that there may be a yet undiscovered outcrop of the granite on the west side of the Whyte River, but as the country has been well looked over by gold-diggers and prospectors without seeing anything of the kind, it is not likely that it exists. The most likely explanation of the distribution of the granitic stones is also the one that best explains

the occurrence of gravels on the top of the ridge between the Savage and Whyte rivers and on the tops of the Lucy spur, Frenchman's spur, Conroy's spur, and others. The highest of these that I noticed lay at an elevation of 1100 feet above sea level on the Long Plain; on Brown's Plain they are from 850 to 950 feet high; and on the Lucy and adjoining spurs from 650 to 750 feet. Except in the Pieman Valley and portions of those of the Whyte River and Middleton's Creek close to it, where the terraces of gravel descend from the divide down to sea level, the gravel usually disappears when we go down a short distance from the tops of the ridges into the adjacent valleys, and in these latter the solid bedrock is seen. Every here and there, however, there are terraces of gravel at varying elevations in these valleys also. The main deposits of gravel may therefore be said to lie at a considerable and fairly uniform elevation, varying a little above and below an average of about 800 feet. From the top of Mount Donaldson (1460 feet) a view is obtained of the country which goes far to explain the history of the deposition of the alluvial matter. It is seen that the whole country forms a plain rising gently from the coast towards the Meredith and West Coast ranges, the Donaldson and Norfolk ranges being isolated hills standing on this plain like islands rising from the sea. Exactly the same appearance is noticeable looking towards the sea from Mount Lyell. The gentle uniform slope seaward from the foot of the ranges points to the plain being one of marine erosion, and I have little doubt that this is really the case. During some past period there has been a depression of the western portion of our island, or more probably of the whole of it, during which the sea encroached further and further inland, levelling the inequalities of the surface as it proceeded, until it reached the flanks of the Meredith Range, Mount Dundas, and the West Coast Range; the Norfolk, Donaldson, and Heemskirk ranges then forming islands. During this period the gravels resulting from the disintegration of the shore rocks and those brought down from the ranges by streams were laid down in more or less regular strata on the bedrock. Doubtless a good deal of gold was distributed through these.

After a time the land began to rise again, and the shore-line to recede further and further westward. The marine deposits would then be attacked by streams running over them, and the gravels frequently sluiced over and re-arranged. As the elevation proceeded the streams would cut deeper and deeper into the bed-rock, ultimately forming the deep gorges and valleys in which we now find them running. From time to time terraces of gravel would be left behind at various elevations as we now find them. According to this theory the deposits on the tops of the ridges would be the oldest, and the terraces at lower elevations successively more recent going downwards. It is confirmatory of this view that the highest gravels show the thoroughly water-worn, highly rounded pebbles characteristic of marine gravels rather than the more flattened shapes prevalent in river gravels. The fact that the "wash" is often cemented to a hard conglomerate in the deposits at the highest elevations also goes to show that these are the oldest.

The evidence as to movements of elevation and subsidence of the land having been the main cause of the present distribution of the West Coast gravels is by itself fairly strong, but when we remember that in the North-Eastern District, from George's Bay to Lefroy, there is even better proof that there has been a prolonged and extensive subsidence of the country during the Paleogene portion of the Tertiary Period, followed by a gradual elevation during Neogene and Recent times, it seems clear that we must accept the explanation above given as the correct one. It may be here mentioned that the alluvial terrace deposits at North Dundas and the Ring River would be explained by the above theory as well as those of Brown's Plains and the Lucy spur.

The gravels near Corinna township, in Middleton's, Jansen's, and other creeks falling into the Whyte and Savage rivers, and at low levels along the Pieman River, have probably been largely derived from the older and higher deposits, which have been broken down and redistributed by the streams during the excavation of their valleys. The large accumulations in the neighbourhood of Corinna may very possibly be due to the slowness with which the Pieman River could only excavate its gorge through the Donaldson Range, it being very conceivable that the gravels brought down by the main stream and by the Whyte and Savage rivers would have a tendency to accumulate behind this bar faster than they could be carried away. The formation of this deep gorge through a high range is corroborative of the theory above explained, for it must have been cut from the top downwards, and therefore the outlet for the Pieman River waters must have been much higher than at present, as far as the Donaldson Range is concerned, though perhaps not with respect to sea level.

I have dwelt on the geological history of the gravels at some length in order that some conclusions may be deduced from it that may be of assistance in working them for gold:—

(1.) The highest gravels on Brown's Plains, the Lucy and neighbouring spurs, and at the ridge at the head of Middleton's Creek, may frequently cover deep leads, or buried watercourses, which had nothing whatever to do with the existing surface configuration of the ground. In these a deep gutter is just as likely to be found under what is now a ridge on surface as under present low ground. Existing water-channels which have been worn through the gravel deposits may be expected to contain concentrated in them the gold originally distributed through the stuff that has been removed.

(2.) The lower gravels on the slopes of the valleys may be expected, when opened up, to reveal their terrace character more plainly than at present, and the runs and leads of gold in them are likely to be more or less parallel to the main valleys. It will probably often happen that the bottom of a terrace will dip in towards the hill upon which it rests for a greater or less distance, forming terrace gutters which should sometimes be rich. The terraces originally parallel with the main gullies may be expected to be cut across by the later water-courses running down the slopes of the latter. These will contain a lot of gold concentrated from the older deposits cut through by them. Owing to the action of these small streams crossing them, the terrace shape of the older deposits will often be difficult to recognise.

(3.) As many now bare slopes of bed-rock have been at one time covered with gravel which has since been removed, it is possible that heavy water-worn gold may often be found upon these, and occasional stripping of the surface soil from areas where no gravel is visible may therefore lead to rich finds. All little patches of gravel found on bed-rock slopes should be tried, as they may often prove to be remnants of much more extensive beds.

The gravels themselves vary a good deal in composition: the higher ones are mostly composed of well water-worn quartz and quartzite pebbles intermixed with coarse and fine quartz sand; but in the lower deposits there is often much clay and ferruginous cemented sand. In Fogarty's workings on Middleton's Creek there is much concretionary limonite (brown oxide of iron) in nodules, and the clayey wash is strongly cemented together with the same material. In some of the lower workings in Middleton's and Jansen's Creeks there is a great deal of chalcedony, often not much water-worn; this may be derived from the underlying bed-rock, which about the place where most of the chalcedony occurs is often an impure limestone. When washing the gravel for prospecting purposes a little black sand nearly always is found remaining behind to the last along with the gold; this is mostly chromic iron, doubtless derived from the serpentine country towards the Heazlewood. I have also been able to recognize in it tourmaline, rutile, and zircon; and probably other heavyish minerals exist in it also. A little tin ore is said to occur in it; and as tin is known to exist in the Rocky River and other streams coming from the Meredith Range, it is probable that it will be found widely distributed through the drifts; but in the few tests I have made of the black sand it is either absent or only in very small quantity. Gold is almost universally present in the gravels, though often only in very small "colours," and at times a little osmiridium is also found. In the Whyte and Savage Rivers, both of which pass through serpentine country, the usual matrix of this metal, there are said to be often found considerable quantities of it.

All over the goldfield, from the head of the Savage River southward to the Pieman, diggers have been at work for the last thirteen or fourteen years, and a great deal of gold has been obtained. For some years past there have not been many men at work, but every winter, nevertheless, sees some engaged in working the creeks and more easily accessible terraces. Most of the work done has been of a primitive description, often simply with cradle and tin dish, and hydraulicking has only been resorted to in a few instances, and then with poor supplies of water and inefficient apparatus. The highest ground, where water for sluicing has not been obtainable, has only been fossicked over by digging small holes in the watercourses and little gullies, and washing the material with pans and cradles. The work done has proved that the auriferous area is very extensive, but it may be said to be practically worked out so far as primitive means are concerned. For hydraulic sluicing, however, there is a very wide field, and great prospects of success.

I shall now describe in some detail the various localities visited.

Corinna Township.—On both sides of the river at the Corinna ferry there are extensive terraces of alluvial gravels likely to contain gold. On the south side they are passed over by the road to Trial Harbour for about 2½ miles, where a heavy sand drift is met with at an elevation of about 640 feet above the river. A little further south the slate bedrock crops out at surface, and the gravels disappear. The slate bedrock is also seen at a small creek about one mile from the ferry, and is seen in the banks of the Pieman River at short distances above and below the ferry. It is therefore probable that the terrace gravels are of no very great depth anywhere, though sometimes they may be 50 or 60 feet deep; there is evidently a large quantity of gravel in several places. Next to no prospecting has been done on this side of the Pieman, and the higher gravels, though containing "colours" of gold, are so poor, according to a few tests made by me, that there does not seem much inducement to try them further; but when we consider that the best gold is sure to be in the bottom gravels, a few random dish prospects taken on surface ought not to be accepted as conclusive. In my opinion it would be quite worth while to spend a few hundred pounds on properly testing these terraces by shafts and drives. There appears, however, to be considerable difficulty in getting water for sluicing on this south side of the river, and anyone undertaking to work these gravels would do well to satisfy himself of the possibility of getting an adequate supply before going to much expense.

On the north side of the river at Corinna the road to Waratah rises over a succession of likely looking terraces for about 5 miles. The bedrock is seen in the banks of the Pieman River, a few

chains below the ferry, a high hill, part of the Elizabeth Range, of solid rock there terminating the gravels on the westward side. For over a mile from the ferry the terraces do not appear to have been worked at all, though a little gold is found in the surface gravel, and much of the wash is of a fairly promising nature. As the gravels of the Whyte River must have met those of the Pieman in this vicinity, when both rivers were at a higher level, it is likely that good runs of gold will yet be found, and persistent and thorough prospecting by shafts sunk to bedrock is to be recommended.

About two miles from the river, after passing over a high terrace, on which there is a great deal of very hard conglomerate, formed by the gravel becoming cemented strongly together by some very silicious cementing matter, the ground falls for about sixty feet towards a saddle on the divide between Middleton's Creek and the Whyte River, the elevation of the saddle being about 190 feet above the Pieman River. From this point onwards for over a mile to the north a great deal of work has been done in the creeks falling on each side of the divide towards the Whyte River on the east and the Savage River on the west.

Middleton's Creek.—On the western fall the main creek is that known as Middleton's, which runs a southerly course about parallel to the road (which here lies on the top of the ridge between this valley and that of the Whyte River) and to the Elizabeth Range for about a mile, then turns suddenly to the westward, cutting a gorge through the range, and runs into the Savage River, about a quarter of a mile above its junction with the Pieman. Several small branch creeks run into Middleton's, and most of these have been worked, and have yielded a lot of gold. The true bedrock is seen near the big bend in the creek, again in a small creek on the west side, known as Fogarty's, and along all the western side of the valley above this on the slope of the Elizabeth Range. It is here generally a soft arenaceous slate. Towards the head of the valley the creek has three branches, known as the Left (or western), Middle, and Right (or eastern) branches. These come together at the head of a stretch of flat ground, some 12 or 15 chains in length. A short distance up the western branch from the junction the true bedrock is seen, and a quartz reef crosses the creek. Between the western and middle branches there is a very peculiar gully, which has no outlet, falling towards a hole at the foot of a steep rocky face. As the rock is an impure limestone, it is certain that the water escapes by an underground channel. On the other side of the divide a stream of water issues from a cave in a similar limestone in the lower part of Sailor Jack's Creek; and two circular depressions, without visible outlets for the water that gathers in them, one near Jansen's Old Camp, about three miles from Corinna, and another larger one on the top of the divide, about two chains west of the road at two miles, also point to there being underground channels through the limestone. There is nothing unusual in this, as caverns and underground channels are common wherever limestone is found. The two "sinks" just mentioned are nearly on the top of the main ridge, and their sides are entirely composed of gravel, but there can be little doubt but that the bedrock lies close beneath them. This deduction is of importance, for the bedrock is not generally seen in the ridge, and to look at it one would be very apt to form the opinion that it was entirely formed of gravel for a great depth; but it seems likely that there is a corresponding ridge of hard rock close beneath. This opinion is strengthened when we examine the bottom exposed in the creek workings on each side of the ridge; it is almost always a black, somewhat cemented mixture of sand and earth, often containing rounded gravel, but frequently also angular and subangular quartz and chalcedony fragments. It is plainly not the true bedrock, but a "false bottom," but though it may here and there cover deposits of gravel containing gold, I think it will be generally found to lie upon the true bedrock. It seems to be, in fact, simply the old surface soil formed on the bedrock, when the latter was first laid bare by the streams, and at a later period it has been covered again with gravel. It often contains gold, and in working will probably be found worth removing down to the solid rock, and in some cases it is likely that rich gold will be found by so doing. In the middle branch of Middleton's Creek, five or six chains above its junction with the western branch, two shafts have been sunk, sixteen feet in the black false bottom, without reaching bedrock. A little gold was obtained all the way down, and much pyrites and lignite. The black bottom is evidently of alluvial origin, though older than the gravels resting upon it, and therefore requires prospecting. From the angular appearance of much of the stone contained in it, however, I do not think that it can be far from the bedrock. All the workings on both sides of the divide are on this false bottom, and it is seen to slope with the existing creeks and conform closely to the present configuration of the ground. A very similar black sandy layer lies between the gravels and the schist bedrock at some workings on Blackguard Hill at Brown's Plains and at the Lucy Spur workings.

The only party working in Middleton's Creek at the time of my visit was that of Fitzpatrick and partner, who have a claim in the main creek just below the flat above mentioned. Want of water—the season having been very dry—was preventing them from doing much sluicing, and the ground was getting very deep. The claim is a good one, however, and should give good returns to the owners when they have more water. The black false bottom is here soft, and contains a lot of gold, giving payable returns. The gold is flattened and water-worn, but fairly heavy. This claim is at the foot of a face worked some time ago by M'Lean and party by hydraulicking, and though they were unable to get down to the good ground that Fitzpatrick is now working they are said to have had payable returns.

Lower down the creek are several other old workings—Crotty's and Strong's, Middleton's, Conroy's, and others. Middleton's old face is on the western side of the creek; the wash is seen to be 14 or 15 feet deep, but is clayey, and gives poor prospects. It is said, however, to have yielded a good deal of heavy gold when worked on the large scale. Somewhat similar wash, but more cemented by oxide of iron, is seen at Fogarty's workings, in a small creek on the west slope of the valley. These are said to have yielded payable returns of coarse heavy gold, but rarely show gold in dish prospects. When ground contains coarse gold it is often impossible to get any fair idea of its value by dish prospecting, for the chances are greatly against any particular sample containing the gold. Ten cubic yards of dirt might contain an ounce of gold in three or four pieces, which might all be lying close together, and there would be little chance of getting one of these in a casual trial of the ground with a tin dish. A good deal of work has been done in Fogarty's Creek, and there are evidently large terraces of wash still left to be sluiced away. Much of the stuff, however, is so strongly cemented together that explosives would be required for shattering it before it could be sluiced. In one of the terraces some shafts have been sunk a depth of 20 or 30 feet without reaching bottom. The stuff thrown out from these often yields fair prospects. With a constant supply of water at high pressure it seems very likely that a good sluicing claim could be established at this place.

The flat above Fitzpatrick's workings is so deep and wet that it has not hitherto been possible to work it except by sinking holes in dry weather and cradling the stuff taken out; practically it is yet untouched, and from its position and surroundings it ought to be good; to work it by ground sluicing a deep tail-race would have to be brought in up the creek, and as the grade of this is rather flat the tail-race would need to be a long one; with an adequate supply of high-pressure water there would, however, be no difficulty in working it by means of hydraulic elevators. To work Middleton's Creek from top to bottom in a systematic manner the tail-race would be necessary, and any strong company securing the ground would find it to their interest to put it in at once. According to my aneroid levels Fitzpatrick's workings are about 145 feet above the Savage River, and Conroy's face about 60 feet, and the former are not more than 100 chains distant from it: the tail-race would therefore be much flatter than is desirable, as a fall of from 4 feet to 4 feet 6 inches to the chain is wanted for a good tail-race. With attention to flushing and the assistance of the winter rains, however, the race could be kept pretty clear. To work out the bottom of the flat, however, hydraulic elevators would almost certainly be required. An accurate survey should be made to determine the length of tail-race that would be required, and to ascertain definitely if it could be got with a workable grade.

On the west side of the creek at the head of the flat Mr. Fitzpatrick has sluiced out an excavation 30 feet long, 16 feet wide, and 12 feet deep, obtaining 6 ounces of gold in doing so, which was very payable. This return is at the rate of 13½ grains to the cubic yard. This cut is made into the side of a terrace, and should be a fair sample of its average value. The gold was flattened and fairly coarse in size, and was richest on the black sandy bottom previously described. The present supply of water to this face is very scanty, work being only possible after wet weather, but if there was a constant supply the ground should pay well.

Up the various branches of Middleton's Creek large quantities of gravel are seen, and gold is nearly always obtainable in the dish when washing is resorted to. The creeks have given a living to men working with cradles and long-toms in wet weather, and therefore there is a strong presumption that hydraulic sluicing of the terraces themselves will be payable. As the gravel is concentrated in the gullies of the creeks by natural sluicing it is not fair to take tests from the stuff exposed in the sides of these as representing the average value of the terraces, and in order to prospect these properly shafts should be sunk in them, and all the stuff thrown out should be carefully washed: by this process some accurate data could be got for estimating what gold could be won by hydraulicking.

The highest workings in the middle branch of Middleton's Creek are at an elevation of about 380 feet above sea level; but there are still higher terraces, and in bringing in a water supply to command the ground it would be very desirable to have it at not less than 500 feet. With a constant and copious supply of such high-pressure water I have little doubt that the whole of the old workings in Middleton's Creek and its branches could be profitably re-sluiced, and very probably the terraces would also prove payable in many cases. There is a large extent of wash available, and except in the lower parts of the creek, where as above said it is doubtful that a satisfactory tail-race can be got, there are generally very good facilities for getting rid of tailings.

While examining Middleton's Creek a great many prospects were washed, and the gold from a proportion of them was saved and weighed. These tests cannot be taken as thoroughly representative of the average quality of the gravel, as some were from surface stuff, others from near the bottom, and nearly all from the banks of creeks, where, as above pointed out, there must have been a good deal of concentration of the stuff. On the other hand, they do not contain a fair proportion of the richest part of alluvial deposits—the bottom layer—which was not generally accessible, and very frequently in hydraulic sluicing even though the upper drift is not payable the richer bottom

stuff makes up for all deficiencies. Taking this into account, the tests must be looked upon as, on the whole, very satisfactory. In the present condition of the ground it would be necessary to expend considerable time and labour before a thoroughly reliable estimate of the average value of the gravels could be made, for a large number of shafts would have to be sunk in the terraces. The actual sluicing that has been done at various points by Messrs. Middleton, Fogarty, M'Lean, Fitzpatrick, Conroy, and others, with poor supplies of water, low pressure, and many other disadvantages, has, however, done a great deal to prove that the ground will pay well when worked under more favourable conditions. The following were the results of some of my tests; the dishes used containing 400 cubic inches, equal to 26 lbs. of gravel—(estimating that 100 yards of sand and gravel in the solid swell when broken down to 107 yards, the proportion given by Molesworth, 1 cubic yard of undisturbed stuff would contain 125 dishes, or 1·45 tons):—

7 dishes from Middleton's old workings in the main creek, mostly light clayey stuff, gave 8 "colours" of gold, weighing ·02 grains, equal to 0·25 grains per ton, or 0·36 grains per cubic yard. (It is interesting to note from this example that the average weight of the eight "colours" of gold was only 0·0025 grains apiece.)

3 dishes from Fogarty's terrace workings at point of spur, between two branches of small creek and shafts on S.W. side of creek, gave 0·2 grains of gold, equal to 5·73 grains to the ton, or 8⅓ grains to the cubic yard.

4 dishes from Conroy's workings near the big bend in Middleton's Creek, two being the upper light drift and two the lower gravel, gave 0·245 grains of gold, equal to 5·27 grains per ton, or 7⅔ grains per cubic yard.

12 dishes from the western and middle branches of Middleton's Creek at differents points gave 1 grain of gold, equal to 7·2 grains per ton, or 10·4 grains per cubic yard.

Summing these up, we get that 26 dishes yielded 1·465 grains of gold, or at the rate of 0·05635 grains per dish, equal to 4·85 grains per ton, or 7 grains to the cubic yard. Even this low result, however, is quite payable for hydraulic sluicing, there being many instances where ground containing as little as 1 grain to the yard has been profitably dealt with by this method.

Brooks' and Lincoln's claim.—About 2½ miles from the head of Middleton's Creek, on a small watercourse running into the Savage River, Messrs. Brooks and Lincoln have for some time past been working a large face of wash-dirt, part of a large terrace. This is one of the low-lying terraces above mentioned, which have been doubtless formed when the Savage River ran at a higher level and been left behind as it cut its way downwards. The track from Middleton's Creek to this claim passes over country in which the bare bedrock is visible for the most part, but some of the spurs are capped with gravel and there are some low terraces which have been worked a little. On the south side of Lincoln's Creek, opposite the face that is being worked, there seems to be a very large mass of gravel, but it has not apparently been cut into anywhere yet. The working face in Brooks' claim is of considerable size, about a chain long, and at the top a chain wide, and is from 45 to 50 feet deep. In the bottom limestone bedrock is seen, which is dipping underfoot towards the north-west a little. The lower wash is very clayey, but towards the top it gets whiter and more gravelly. The gold obtained is very coarse, and probably unevenly distributed, for it is very seldom that any gold can be found when prospecting with the dish. Very satisfactory results have, however, been obtained by sluicing, though owing to want of water the owners often cannot work more than two hours a day: if they had constant water they express themselves as highly confident that the ground would pay handsomely. This claim is splendidly situated for working, having a high face of wash-dirt and a big terrace to open into, while there is good fall for the sluices and tailings. About 4 chains below the face there is a waterfall over a limestone cliff quite 50 feet high into a deep valley that would hold an immense quantity of tailings. The fall in the creek below this cliff, however, seems great enough to cause the tailings to run right down to the Savage River without lodging to any great extent. The foot of the face is about 265 feet above sea level, so if a high level water-race were in existence along the divide between the Whyte and Savage Rivers splendid pressure would be obtainable from it. It is said that a good winter water-supply can be got by making a water-race some 4 miles in length to Tim's or Timb's creek, but this is a matter of which I know nothing personally. If the ground is nearly as good as it is said to be by the owners this terrace should pay well when water is brought on to it sufficient for constant working.

Whyte River Fall.—On the slope from the divide towards the Whyte River the principal workings are on Sailor Jack's Creek and its branches and on the White Creek, and a good deal of work has been done in past years by the Jansen Brothers, Mr. H. Middleton, and others. Want of water has, however, always been a great drawback, and only the gutters of the watercourses have been worked to any extent: these have mostly been sluiced out, but very little has yet been done to the terraces on each side of them. The ground closely resembles that on the other side of the divide on Middleton's Creek, and shows a succession of terraces lying on the slopes of the valley and cut through by numerous small watercourses. In the workings the black sandy false bottom is seen generally, but down towards the Whyte River the true bedrock makes its appearance. The workings on the White Creek are to the east of the Waratah-to-Corinna track at about two miles from the ferry: the head of the creek is crossed by the track. At this crossing there is a large hole

worked out some years ago by Mr. P. Lynn, in which he obtained 18½ ounces of gold: the ground slipping in and becoming dangerous, he had to leave it. Dish prospects about this spot gave me very fair results, and the ground seems well worth working by sluicing. The terraces on each side of the creek here are extensive and contain likely looking gravel; the surface stuff shows a little gold on washing. A little lower down the creek we come to Lawson's workings, where there is a face of from 4 to 8 feet of white friable washdirt resting on the usual black sandy false bottom; fairly good prospects were got here, and the ground is said to pay for working in winter time when there is water. A great deal of concretionary chalcedony occurs in these workings. Lower down the creek we reach what is known as Middleton's Big Face, a large excavation two to three chains long and one and a half to two chains wide, which was worked some years ago and is said to have paid well. A small race was made five miles in length to bring water on to this ground, and Mr. Middleton is reported to have made £6 a week while the water lasted. The face of wash left standing is as much as 18 feet in depth, and the gravel is somewhat light and sandy. An excellent sluicing prospect was obtained by washing some of the stuff while I was examining this ground. The bottom of this face is some 100 feet above the Whyte River, and excellent fall for a tail-race is easily obtainable. With a good water supply there should be great hopes of successful working in this creek; the slopes of the hill on each side of it are deeply covered with gravel, and there is every appearance of there being constant work for many years to sluice it all away. In an old shaft of small depth some three or four chains to the north of the creek the wash-drift on the spurs was seen to be a fine light gravel, but carried a little gold; the hole had not reached the bottom, and probably when sunk deeper heavier and richer gravel would be got.

To the north of the White Creek lies Sailor Jack's Creek, which has several branches, most of which have been worked by sluicing out the gutters. On the spurs between the various branches of the creek there are what seems to be deep deposits of gravel which have been very little prospected; wherever they have been tried, however, they always contain some gold. About 180 feet above the Whyte River a big face was sluiced out by the Jansen Brothers; it has now become much covered up by slipped stuff, but was 40 feet high, all wash-drift, when they were working. A great deal of heavy conglomerate boulders and hard cement found through the stuff interfered very seriously with working, but the results obtained, if correctly reported, would show that with a better water supply and the aid of machinery in removing the heavy boulders the ground should be payable. There is plenty of fall for tailings. Lower down the creek some small faces have been opened, showing considerable deposits of gravel, which often prospect very well, and at an elevation of about 160 feet above the Whyte River the limestone bedrock makes its appearance. At about 100 feet a small creek is seen running out from a cave in the limestone: it is said to be about the same size all the year round, and on the day of my visit carried about 1½ sluice-heads of water. This would be very useful for flushing the tail-races. To the north of Jansen's Big Face, over a spur of gravel, we find Olsen's workings, where a little gold is being obtained when water is plentiful. I saw some nice payable prospects washed at this place. Above the Big Face the creek has been worked about 30 feet wide for a long distance, nearly up to its head. On each side there are still considerable depths of wash to be sluiced away. On the whole, the prospects washed from various points along this creek during my visit were satisfactory, and led me to form the opinion that hydraulic sluicing on a large scale would most likely result profitably. At the head of the workings in the gully a small race made by the Jansens comes in; along the course of this the ground is seen to be mostly gravel for a long distance. Not far from the highest workings a shaft was sunk by the Messrs. Jansen to a depth of 27 feet through fine gravel containing a little gold, but they did not reach the bedrock. There seems to be a very large terrace at this point.

Going along the Jansen's race for some 10 to 15 chains we come to another creek, which was worked by them also, with fairly good results. The wash is somewhat cemented, and some of it would require blasting before being sluiced. It is mostly a white gravel resting on cemented, hard black sandy false bottom. In places good prospects of gold can be washed from this false bottom, the gold being water-worn and often stained with iron and manganese oxides. Four dishes washed from it gave me 0·412 grains of gold, or at the rate of 8·86 grains per ton, or 12·9 grains per yard. Below the workings there is rather a flat part of the creek through which a deep tail-race would have to be cut in order to go on with sluicing satisfactorily; this flat is about 12 chains long and is very likely to contain a good deal of gold. The slate bedrock shows at the lower end of it. In order to get good fall for a tail-race it would be necessary to go some distance down the creek. According to a rough measurement made by myself with tape and aneroid at a point 32 chains down from the foot of the working face, the elevation above the Whyte River is about 195 feet, while at the face it is 265 feet. Below the point measured to the creek falls rapidly, so that there is no doubt that a tail-race with a good working grade is practicable.

To the north of these workings very little has been done, and though the gravel still continues on the top of the divide it seems to have been all removed from the slopes, and the bedrock crops out. Some 11 years ago a race was surveyed from a point a little higher than Jansen's race to Hunter's Creek, a distance altogether of some four or five miles. I went along the line of this to examine the country. The bush is not very dense, and the slopes of the hills as a rule not very steep, so there should be no great difficulty in making the race. At one point, in order to save a long detour, there is a tunnel projected; this would be about 350 feet in length. Near the intake

the ground becomes steeper and more rocky, and the water would probably have to be carried in fluming for some distance. The intake is at about 445 feet above sea level, just below the junction of two branches of Hunter's Creek, where there is a fairly good place for making a dam. At the time of my visit there did not appear to be much more than 1½ sluice-heads of water in the creek, but this was just at the end of an unusually dry season. From the appearance of the creek it is clear that during heavy rains it must carry a large body of water, and ordinarily it probably carries not less than six or seven heads at the least. The Corinna Hydraulic Gold Mining Company, No Liability, have begun a survey of the race from this creek, keeping somewhat higher than the old one, in order to bring water on to Jansen's old workings; and no doubt during the progress of this it will be ascertained with some exactness what is the amount of water ordinarily available in the stream. From all appearances it seemed to me to promise a fair winter supply.

The country rock over which the race will pass is mostly schist and slate: it contains one or two reefs that may prove worth developing, and when cutting the race there is a possibility of finding others.

Some gold has been found in the upper branches of Hunter's Creek, possibly derived from the older gravels lying on the ridges, but which may also have come from reefs in the bedrock. One of these is seen crossing one of the branch creeks as a body of quartz impregnated with iron and copper pyrites: it is from 3 to 4 feet wide, runs a north and south course in schist country, and looks rather promising. Samples from it, however, when assayed yielded only traces of gold and silver.

Brown's Plains.—These are from 7 to 9 miles from Corinna, and were not at all closely examined by me on this visit. There are very extensive deposits of gravel on parts of these plains, especially on the ridge between the Whyte River and the flatter ground falling towards the Savage River, but in other parts the bedrock is occasionally seen cropping out. A good deal of gold has from time to time been got by cradling the water-courses, but as there is no permanent water supply all the higher ground has been left untouched by sluicing. About 400 yards east of the 8-mile peg on the road from Corinna there is a considerable hill known as Blackguard Hill, which seems to be all gravel. Some drives have been put in on the west side, so as to take out the stuff lying immediately upon the schist bedrock. This was pretty rich at times. In Harvey's tunnel the wash in the roof of the drive is cemented to a hard conglomerate, which would be troublesome in sluicing. If water could be brought on to these plains there seems great likelihood that a great many portions of them could be profitably worked, and the rich creeks running from them would no doubt then be thoroughly sluiced out.

Water Supply.—The future of the district all depends on getting a satisfactory water supply to enable work to be carried on continuously for at least nine months in the year. This can only be obtained by making a long and expensive water-race. Two water schemes have been proposed, one to bring water from the Heazlewood River, from a point some distance above where the road crosses it; the other to bring the water from the junction of the Heazlewood and Whyte Rivers. According to Mr. D. Jones, District Surveyor, the junction of the Whyte and Heazlewood Rivers is 425 feet above the Corinna Post Office (= 440 feet above sea level): the intake of the Heazlewood race according to Mr. J. Power, surveyor, whose chart of the proposed route has been kindly lent to me by Mr. E. Gaunt, is 992 feet above sea level. The lower race is estimated to be likely to be about 20 miles in length: allowing a fall of eight feet to the mile, this would allow of water being delivered on Sailor Jack's Creek at an elevation of about 280 feet above the Whyte River, which would command the greater part of Jansen's old workings and the whole of the White Creek workings, and could be brought over the saddle at the head of the White Creek so as to command all the lower gravels in Middleton's Creek. This would be a most useful race, and there would be plenty of work for all the water carried by it. A constant supply of not less than 50 sluice-heads of water could be pretty confidently relied upon all the year round. The great disadvantages of this scheme are that it would not avail to work the high gravels on the divide, leaving a very large quantity of washdrift untouched, and secondly it would have to come through rather rugged country. Being so low it would have to traverse the rough valley of the Whyte River, which is much broken by deep gullies. The Heazlewood scheme, on the other hand, would not give nearly so large a quantity of water, the supply falling probably to not more than twenty-five sluice-heads at most in very dry weather. For nine months of the year, however, it is probable that 50 heads could be obtained. Keeping as high as possible this race would head most of the rough gullies running into the Heazlewood and Whyte rivers, would skirt Long Plain, and come out on to easy country at Brown's Plain, after which it could be kept right along the top of the divide, commanding practically all the gravels. Much higher pressure would be procurable for working the not uncommon areas of cemented wash, and the high pressure would also be of very great value in working Pelton wheels for derricks used in removing large boulders of conglomerate and masses of hard cement. The race would probably be 26 to 28 miles in length, but from the easier country passed over it seems very probable that it would cost no more than the shorter lower one.

No proper engineering surveys have yet been made of either route, and until they have been carried out it is quite premature to say positively which scheme is the better one. There is no doubt

that the high-level scheme would be of the greatest benefit to the district generally, but it is quite possible that the lower one may be more to the advantage of the company which proposes to construct it. Both routes should be surveyed, and while doing so it would also be desirable to ascertain if the Savage River, or any of its large branches, could be made use of. Careful measurements of the streams should also be made at various times, so that accurate data could be obtained as to what supply could be got from them; at present everything is to a great extent guesswork.

The Corinna Hydraulic Gold Mining Company, No Liability, has been formed to acquire land in the neighbourhood of Jansen's and Middleton's old workings, on the 1000 acres now withheld from leasing, and to bring in a water supply. It is intended first of all to make the race from Hunter's Creek that is now being surveyed, and to test the ground practically with this while the preliminary surveys of the longer races are being made. The Hunter's Creek race can be got across the divide at a low saddle about three miles from Corinna, so as to test Middleton's Creek, as well as the slopes to the Whyte River. This seems to me a cautious and commendable policy. Should the ground turn out as well as is expected, I have little doubt that both the upper and lower level water-races will be required, and it may be pointed out that a good deal of water from the high-level race used in the vicinity of Brown's Plains could be picked up again by the lower race. The whole question of water supply requires very careful consideration, and much expense in surveying, but it is to be hoped that no trouble will be spared to get all data before coming to a decision. As the extent of auriferous ground commanded by the upper race is very much larger than can be held by the company making it, the sale of water to outside owners would be a constant source of revenue, and in the interests of the district it is to be hoped that the company will set aside a liberal proportion of the supply to be sold to applicants for it.

Townsend's Terrace, Pieman River.—Going up the Pieman River from Corinna it is seen that every here and there there are terraces of river gravel, and one of these on the south bank of the river, a little below the Paradise landing, is worth notice. Here a small terrace of gravel is found just above high-water mark, and Mr. Townsend, by digging out the bottom layer and cradling it, got 9 or 10 ounces of gold in a short time. This shows that all these little terraces are worth attention, and also makes it probable that there is a good deal of gold in the bed of the Pieman River itself, which may perhaps be got at by dredging.

Frenchman's Spur.—From the Nancy Creek landing a track leads to the Lucy Spur and to the Rocky River diggings. Going up this the slate bed-rock is visible up to a height of 630 feet, where waterworn wash is met with on the top of the spurs. The first gravel come upon does not appear to have been worked, but after crossing a deep little gully another deposit is met with at about the same height on what is known as the Frenchman's Spur. Here I saw an old shaft 31 feet deep sunk through fine quartz gravel, but not bottomed on the bedrock. About five chains from this shaft on the point of the spur a face almost 40 feet long and up to 12 feet deep has been sluiced away by C. M'Lean and his mate, who obtained 7 ounces of gold in three weeks. Mr. M'Lean considers the ground as payable with a good water supply, but this is difficult to get. The top of the spur is about 680 feet above sea level.

Conroy's Spur.—After crossing another gully we come upon another quite similar gravel terrace at a height of about 600 feet, known as Conroy's Spur. Gold has been got here, but very little work has been done. There are splendid large bodies of gravel on this and the Frenchman's spurs, and if on prospecting further they prove payable and water can be obtained, they will form good sluicing properties.

Lucy Spur.—From Conroy's Spur the track descends about 150 feet to cross a small branch of the Lucy Creek, which has been worked for gold. The bedrock here is mostly schist. We then rise to the Lucy spur, the top of which is about 730 feet above sea level. This is a long level spur, portion of a considerable stretch of approximately level country, which runs back to the foot of the Livingstone Range; it is probably 15 to 20 chains in length, and from one to eight or ten chains in width. The top of the spur is pretty level, and is all composed of more or less deep layers of gravel, much waterworn. The spur runs about E. S. E. from the camp at the northern end, where the track comes upon it and where the principal workings are situated. These consist of two large faces that have been worked out on the eastern side of the spur, and three small tunnels. The northern face is probably two chains in length, and the stuff has been worked out for perhaps 30 or 40 feet in width, the depth of the wash being from 6 to 20 feet. The gravel gets deeper towards the south, and the bottom dips to the westward, showing that the deposit will be deeper under the crown of the ridge than where now opened. The southern face is about 40 feet in diameter, and about 15 feet deep in the middle, but if cleaned down to the bottom it would probably be quite 20 feet deep. In both faces the top wash is much cemented, in parts becoming conglomerate. The heavy lumps of conglomerate have been troublesome in working. Over 20 ounces of gold have been taken from the northern, and 22 ounces from the southern face. Much of the gold is waterworn, but some of it is quite angular, and pieces with quartz still adhering to them are not infrequently found: these may be derived from a reef in the vicinity or from leaders in the schist bedrock. One auriferous leader has been laid bare in sluicing, but is very small. The schist bedrock is on its surface decomposed

to a black sandy material not unlike the black false bottom in Middleton's Creek and the Jansens' workings above-mentioned, but here it is clearly only the old weathered surface of the bedrock upon which the gravels have been laid down : it often contains gold. There is some gold through all the drift, but the richest stuff lies right on the bottom, where nice coarse gold is frequently obtained. To test the ground and get at the bottom layer of gravel two small tunnels have been driven on the east side of the spur, below the faces worked. One of these is still in progress, and has gone 52 feet through soft schist bedrock, but has not yet reached the gravel : the other, some 30 or 40 feet further south, goes in for over 50 feet, then rises into the wash, and has been carried on along the bottom for 30 or 40 feet. The bottom dips to the westward, and at last water gathering stopped further progress. In this drive the wash-drift is similar to what is seen in the open faces, but coarser in character : the bottom layer prospects very well and should pay for working. On the western side of the spur there is another small tunnel driven towards those just spoken of, and in this the bottom dips to the eastward, that is, in the opposite direction to what is seen in the others ; and we therefore must conclude that there is some sort of a gutter under the crown of the spur.

I saved the gold from several prospects washed from the working faces on the Lucy Spur, and have weighed it with the following results :—

Fifty-six pounds weight of stuff from the lowest foot and a half of wash from the tunnel on the east side, taken from several different spots, yielded 0·745 grains of gold, equal to 29·8 grains to the ton or 43·2 grains to the cubic yard.

One hundred and sixty pounds from the southern open face taken from top to bottom of the face gave 0·190 grains of gold, equal to 2·66 grains to the ton, or 3·86 grains to the cubic yard. Nearly all the gold, however, in this came from about 60 lbs. taken from the bottom foot and a half of gravel.

One hundred and thirty pounds of stuff from different parts of the northern face gave 2·550 grains of gold, equal to 43·94 grains to the ton, or 63·71 grains to the cubic yard. As in the last instance, nearly all the gold came from the bottom layer, there being very little in the dishes of stuff from above the bottom.

With the gold there was in every case a good deal of black sand, mostly rutile, chromic iron, and tourmaline.

About six chains or so south of the working faces a shaft has been sunk in the centre of the spur, 19 feet through light gravel, without reaching bottom. Further south still a good distance a small face has been opened on the western slope, and some gold was obtained.

On the east side of the spur, a few chains above the camp, there is a cave about 60 feet wide across the mouth and 50 feet deep, which seems to have been formed by a small stream of water which issues from it, removing gravel and soft bedrock from beneath an overhanging sheet of conglomerate (very hard cemented gravel). The same tendency of the gravel to dip in towards the Crown of the spur that was noticed in the tunnels is here again observable.

The gravel in this spur being on the top of a high ridge, without higher ground close to it, is not easily commanded by a water supply, and hitherto the only work that has been done has been gone on with during very wet weather, when a small supply was available for a few days at a time. With a good water supply there seems every reason to believe that this would be an excellent sluicing venture. The quantity of gravel is very great, the prospects are good, and the facilities for disposing of tailings are unexceptionally favourable. Two or three years ago an attempt was made to bring in a water-race, but the cost was under-estimated, and it was never completed. The syndicate who were instrumental in getting the ground round the Lucy Spur withdrawn from leasing are, I understand, trying to bring in water from the Paradise and Rocky rivers, a distance of probably 10 or 12 miles. Not having gone to these rivers where the race would strike them, I am not able to say what water could be obtained from them, but as both streams have large catchment basins, and are generally carriers of large flows of water, it is probable that they would give the supply required. The country over which the races would have to come seems pretty flat, though rising a little towards the ranges, and would be easy if it were not for the deep gullies that every here and there cut deeply into it. Surveys and estimates should be made to find what water could be got, and the cost of bringing it in. One thing seems pretty certain, there is no ground to carry a race at a level much higher than the Lucy Spur itself, and therefore considerable difficulty must be anticipated in getting a pressure exceeding, say, 50 feet. It is to be hoped that in laying out the race every endeavour will be made to keep it at as high a level as possible, in order that all the possible pressure may be available for the nozzles.

Lucy Spur to Whyte River.—Going from the Lucy Spur to the Whyte River suspension bridge, we pass first over a considerable stretch of flat country, often covered with gravel, which seems plainly part of the original plateau from which the Lucy, Conroy's, and the Frenchman's spurs have been severed by the action of running water. The track goes through Tinpot Gully, where some gold and tin have been obtained, and goes down to the junction of the Rocky River

with the Whyte. Less than a mile up from the junction the largest nuggets of gold ever found in the Colony were obtained by M'Ginty, Griffin, and party, in the bed of the Rocky River, and the greater portion of it has since been worked at one time and another. I noticed, however, several rather nice-looking terraces along the banks of the Rocky River that do not appear to have been tried. These might be worth looking into, and some of them at least might pay for sluicing.

The past summer is said to have been the driest for five years, there having been hardly any rain for the first three months of it, and in consequence diggers have been able to get into the bed of the Whyte River a few miles above its junction with the Rocky, and have made some good finds. It seems likely that river-mining on a larger scale than is possible for poor working diggers would be profitable in this river. A very good trial of it could be made at one spot more especially, close to the Whyte River suspension bridge. Here there is a loop-like bend in the river, the narrow part of the loop being a steep narrow ridge known as the Razorback. A tunnel about 350 feet in length through this would allow of the river being diverted through the spur, so as to lay bare about 64 chains of its bed. This venture seems well worth trying, having quite a good chance of being successful; any company undertaking it, however, would do well to have a working capital of not less than £6000, in order to be ready to meet contingencies that are likely to arise, river-mining being notoriously subject to disastrous interruptions by floods.

Conclusion.—In concluding this report, I desire to express the opinion that there is undoubtedly an excellent field for hydraulic sluicing in the terraces along the Savage, Whyte, and Pieman rivers, and on the plateau lying south of Mount Livingstone. It will be an expensive matter to bring in adequate supplies of water for working these deposits, and a difficult matter to arrange so that a monopoly of all the available water will not be conceded to one or two companies. I do not think that the fields will be very rich, nor that every company that undertakes to work them will be successful, but I am confident that when once the water difficulties are surmounted there will be a fair proportion of paying claims.

I have to thank Messrs. Ritchie, Fitzpatrick, Lynn, Devlin, Forster, M'Lean, and many others for much assistance when going through the district, and for a great deal of information as to workings in past years.

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

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

The Secretary for Mines, Hobart.

REPORT ON THE LAWRENNY-LANGLOH COAL FIELD.

Geological Surveyor's Office, Launceston, 10th May, 1894.

SIR,

ON the 14th of April, 1892, I had the honor to send you a preliminary Report on the coal-bearing ground at Langloh Park near Hamilton, portion of Mr. Joseph Clarke's Lawrenny estate. During the latter half of 1892 four bores were put down in different parts of the field with No. 2 Diamond Drill, and much new information was gained. On the 11th of April last I again visited the locality for the purpose of ascertaining by survey the exact positions of the bores, and levelling sections between them, and I have now the honor to forward to you the present Report, which embodies that previously sent in, with such small alterations as the further information now available renders necessary, and contains in addition much new matter. Two sheets of drawings are also forwarded, the first showing a plan of the field, and the second sections between the various bores and of the strata cut through by each.

The locality shown in the plan is about two miles from the township of Hamilton, County of Cumberland, along the road to the Ouse. In sinking a well close to the Langloh Park homestead many years ago coal was discovered, and in 1891 the well was enlarged and made into a small mining shaft (marked "shaft" on plan) and a quantity of coal was raised, and tried by analysis and practical tests. Some of the results of these tests kindly supplied to me by Mr. F. Milne, of Macquarie Plains, are now quoted, but in addition to these he has shown me twenty-five certificates from various practical users of coal, which all speak highly of the Langloh product for steam-raising, bakehouse and blacksmithing purposes.

ANALYSIS OF LANGLOH COAL (FROM SHAFT).

By Mr. F. Danvers Power, of Melbourne.

	Per cent.
Moisture	3·02
Volatile Hydrocarbons	24·02
Fixed Carbon	63·40
Ash (grey, pulverulent)	9·53
Coke (soft)	72·96
Sulphur (hurtful)	0·01696
Sulphur (harmless)	0·5994
Total Sulphur	0·61636

ANALYSIS OF LANGLOH COAL (FROM SHAFT).

By Mr. W. F. Ward, Government Analyst, Hobart, 9th March, 1891.

	Per cent.
Fixed Carbon (by difference)	66·3
Matter volatile at red heat	23·5
Mineral Matter (ash)	6·2
Moisture lost at 212° F.	4·0

When the powdered coal is heated in a covered vessel, the gases driven off burn with a bright flame, and the residue is slightly coherent, but is not a true coke.

COPY of Letter reporting comparative Trial of Langloh and Fingal Coals on the Government Railways.

T.G.R., Locomotive Department,
Hobart, 6th June, 1891.

To the Locomotive Superintendent.

In compliance with your instructions I have made comparative working tests of Langloh and Fingal coals. The trials were conducted on engine G1 working the suburban trains on the 4th inst. with Langloh, and on the 5th inst. with Fingal, *i.e.*, Mount Nicholas and Cornwall mixed, as supplied to all our engines. Total mileage each day, 160.

The general characteristics of the coals tested are strikingly alike. Appended find tabulated results :—

LANGLOH.

No. of Miles.	Coal consumed.	Residue.	Per cent. of Residue.	Coal consumed per Train Mile.
160	5060 lbs.	547 lbs.	11·03	31·62 lbs.
		FINGAL.		
160	5235 lbs.	541 lbs.	10·34	32·71 lbs.

The loads hauled on both days were approximately the same. See engineman's returns attached.

(Sd.) WILLIAM R. DEEBLE.

COPY of Letter re *Comparative Trial on Express Train.*

Tasmanian Government Railways,
Locomotive Superintendent's Office, Launceston, 3rd July, 1891.

Memo. for the General Manager, Hobart.

Subject—Trial of Langloh Coal.

I arranged for a trial of this coal on the express from Hobart to Launceston on the 24th ultimo : it was a light train. The coal kept steam very well all through the journey, with a consumption somewhat less than the coal from the Fingal district ; we had not time to weigh it all, and consequently cannot speak with exactness. On the whole it is equal to that from the Fingal mines.

(Sd.) W. E. BATCHELOR, *Locomotive Superintendent.*

Abridged particulars of Comparative Trial of Langloh and Fingal Coals on Express Train from Hobart to Launceston, from data kept by Mr. F. Milne, who saw both trials.

	Langloh.	*Fingal.*
Date of trial	24th June, 1891	26th June, 1891.
Coal consumed	3478 lbs.....	4536 lbs.
Distance travelled	133 miles	133 miles.
Coal consumed per train mile	26 lbs. 3 ozs.	34 lbs.

The same engine was used for both trials and the same number of carriages.

Abridged particulars of Test of Langloh Coal for Quantity and Quality of Gas, by Mr. T. S. Cleminshaw, Engineer of the Launceston Gasworks, 4th December, 1891.

Quantity per ton (average of three tests)	10,400 cubic feet.
Illuminating power, corrected (average of three tests)	11·06 candles.

The residue of coal from the retort showed just the slightest approach to cokeing, and weighed 75·91 per cent. of the total. Ordinary Newcastle coal gives from 9500 to 10,000 cubic feet of gas per ton of a quality from 16 to 18 candles.

The above tests all show that the Langloh coal is of good marketable quality, able to compete in our local markets with the Tasmanian coals now occupying them. The low illuminating power of the gas obtained in Mr. Cleminshaw's tests shows that it would not be of value for gas-making, but at the same time the quantity of gas produced indicates that the coal would burn with much flame, a character useful for many domestic purposes and for steam-raising. When I saw the heap of coal at the shaft in 1892 it had been exposed to the weather for nearly a year, but had resisted the crumbling action of air and rain very well; on my last visit, this year, however, some of the large blocks were a good deal split and beginning to crumble a little. On the whole we may say it resists weathering fairly well. It is a strong coal, clean to handle, of a somewhat dull colour, but with occasional bright streaks, and is pretty free from visible stony interlaminations ; a little pyrites is seen now and then in it, as in most coals. The mine being full of water I could not examine the seam ; Mr. Milne informs me that it is about five feet in thickness, with only one clayey parting one half inch thick, about one foot from the top. It was struck at a depth of 40 feet from the surface ; at 45 feet the coal was passed through and a bed of fire-clay was met with, into which the shaft was sunk five feet without getting through it. From the knowledge now obtained from the diamond-drill borings to be below described, especially the No. 2 bore, as it is nearest the shaft, it is pretty clear that the bottom of the shaft must be only a very short distance above a second seam of coal.

When boring with the diamond drill was begun it was believed that the coal was dipping about 1 in 20 to N. 10° W. ; this has been since proved to be entirely wrong, the dip being a few

degrees to the south of west. The first bore was therefore put down 15 chains N.E. from the shaft, and as shown by the sections must have gone down just outside the outcrop of the seam. The following section was obtained :—

* 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 $\frac{1}{4}$-inch band of clod at 54 feet 6 inches	1 1	54 7
Dark fireclay	2 6	57 1
Grey tufaceous sandstones, 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

* Compiled from Diamond Drill Foreman's weekly reports.

As it was suspected from this bore that the main seam must be dipping more westerly than had been at first assumed, a second bore was then put down about 10 chains N.W from the shaft ; this passed through seven seams of coal.

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
Gray 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 : 7 feet workable coal	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 : 4 feet workable coal	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 $6\frac{1}{2}$
Coal	0 $6\frac{1}{2}$	132 1
band — No. 3 seam : 2 feet workable coal	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
Gray 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 : too thin for working	1 $3\frac{1}{2}$	185 5
Light and dark shales	1 6	186 11
Gray 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 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

BORE No. 2.—*continued.*

Strata.	Thickness.	Total depth.
	ft. in.	ft. in.
Coal	1 5	270 9
dark band } No. 5 Seam, 3⅓ ft. workable coal.....	0 8½	271 5½
Coal	1 11	273 4½
Hard clod	0 2½	273 7
Hard dark fireclay	6 6	280 1
Dark tufaceous sandstone, with coal streaks	17 11	298 0
Black clod, with fern impressions	9 0	307 0
Coal—No. 6 seam : of no importance	0 1½	307 1½
Black clod.....	1 10½	309 0
Mixed shale and tufaceous sandstone.....	9 3	318 3
Coal—No. 7 seam : of no importance.....	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.

By Mr. W. F. Ward, 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° F.....	4·7	4·1	5·3	3·5
	100·0	100·0	100·0	100·0

The samples of coal analysed were taken by breaking pieces from all the pieces of core saved, and should fairly represent the average value of the stuff as it would go to market. No doubt more favourable results would have been obtained if only picked pieces of the best coal had been analysed, and, in comparing the above analyses with those published of coal from other localities it should be borne in mind that it is a very common practice to send picked samples to be tested, and only very rarely is any trouble taken to get true samples of the average product as it goes to market. Analyses of coal, to be of the greatest practical value, should be made in exactly the same way as parcels of metallic ores are tested on a large scale before purchase by smelters, by taking thoroughly representative average samples from large stacks of the coal.

No. 3 Bore was next put down on the line of the shaft and No. 2, nearly 22½ chains N.W. of the latter, and proved that the dip of the seam continued at the same angle. The seams, however, were further apart than in No. 2, as will be seen from the section.

BORE No. 3.—Commenced 11th July, 1892 ; finished 24th August, 1892.

Strata.	Thickness.	Total depth.
	ft. in.	ft. in.
Surface soil	9 0	9 0
Firm brown tufaceous sandstone.....	33 6	42 6
Grey tufaceous sandstone	11 10	54 4
Black clod.....	0 1	54 5
Very hard grey sandstone	0 7	55 0
Grey tufaceous sandstone.....	10 6	65 6
Hard sandy shale	1 3	66 9
Tufaceous sandstone.....	32 2	98 11
Clod	0 7	99 6
Coal—No. 1 seam : not workable.....	0 9½	100 3½
Fireclay.....	2 0	102 3½
Fine-grained sandstone	1 7	103 10½
Sandy shale	1 3	105 1½
Tufaceous sandstone.....	45 10½	151 0
Very hard sandstone	0 9	151 9

BORE No. 3.—*continued.*

Strata.	Thickness.	Total depth.
	ft. in.	ft. in.
Tufaceous sandstone	12 0½	163 9½
Hard clod	0 2	163 11½
Tufaceous sandstone	0 11	164 10½
Greenish mudstone, full of pyrites	0 7½	165 6
Sandstone	1 7	167 1
Mixed shale and sandstone	10 6	177 7
Tufaceous sandstone with veins of calcite and pyrites	27 0	204 7
Mixed shale and sandstone	0 6	205 1
Tufaceous sandstone	3 11	209 0
Mixed shale and sandstone	3 3	212 3
Hard dark shale	0 9	213 0
Sandstone	0 8	213 8
Coal	3 5½	217 1½
band } No. 2 Seam: 4 ft. 7½ in. workable coal	0 1½	217 3
Coal	1 2	218 5
Fireclay	2 3	220 8
Coal—No. 3 Seam: 3 ft. 4 in. workable coal	3 4	224 0
Sandy shale and sandstone	2 7	226 7
Fine-grained tufaceous sandstone	8 6	235 1
Hard black clod	1 6	236 7
Greenish sandy shale	3 5	240 0
Coal	0 11½	240 11½
band	0 2	241 1½
Coal	0 5	241 6½
band } No. 4 Seam: 3 ft. 6 in. workable coal	0 1	241 7½
Coal	1 5	243 0½
Coal and band	0 5	243 5½
Coal	0 8½	244 2
Tufaceous sandstone	0 5	244 7
Shale	1 0	245 7
Soft fine tufaceous sandstone	0 9	246 4
Coal	1 0	247 4
band	0 1½	247 5½
Coal } No. 5 Seam, too small for working	0 2¾	247 8¼
band	0 2¼	247 10½
Coal	0 3½	248 2
Shale	3 0	251 2
Tufaceous sandstone	48 10	300 0
Clod	0 10	300 10
Coal, No. 6 Seam, too small for working	0 8	301 6
Hard dark shale	10 7	312 1
Sandstone with viens of calcite	20 0	332 1
Sandstone, last 18 inches altered and hard	53 3	385 4
Diabase greenstone	2 6	387 10

No. 1 seam in No. 3 Bore is not cut in No. 2, which, as shown in the sections, begins below its outcrop. The No. 1 seam of No. 2 Bore has now divided into two, the 6½ inch fireclay layer having increased in size to 2 ft. 3 inches; Nos. 2 and 3 seams of No. 3 Bore are therefore the same as No. 1 seam of No. 2 Bore, and the quantity of workable coal has increased from seven to eight feet. The fireclay band between Nos. 1 and 2 seams in No. 2 Bore has increased in size from 3ft. 10½ in. to 16 ft., and has changed to sandstone and shale. The No. 2 seam of No. 2 Bore corresponds very closely in its number and size of layers of coal and bands with No. 4 of No. 3 Bore, but the latter has six inches less coal. The fireclay below this seam in No. 2 has got thinner, and changed to shale and sandstone in No. 3, and the next seam has also become smaller, and unfit for working. The No. 4 seam of No. 2 Bore, or No. 6 of No. 3 Bore, has likewise become smaller. Nos. 5, 6, and 7 seams of No. 2 Bore are not seen at all in No. 3, the intrusive greenstone having risen further into the coal measures at this point and cut them out.

The No. 4 Bore is nearly 76 chains S.W. from the shaft, and 79 chains S.S.W. from No. 3 Bore; it is in a small gully near the old Kimbolton homestead, now pulled down. The No. 1 seam of No. 3 Bore was not cut in this one, but in an old well beside the Kimbolton house a small coal seam was cut which was no doubt this one. This well is on a ridge, the top of which is 80 feet above the gully in which No. 4 Bore is situated, and the section shows that No. 1 seam of No. 3 Bore should strike into this ridge. The well is 50 feet deep, but has become much filled with rubbish, and has probably been much deeper; there is no record of the depth at which the coal was cut in it.

BORE No. 4.—Commenced 4th September, 1892; finished 11th October, 1892.

Strata.	Thickness.	Total depth.
	ft. in.	ft. in.
Surface soil	12 0	12 0
Jointy brown tufaceous sandstone	6 0	18 0
Hard brown shale	8 3	26 3
Coal	1 4½	27 7½
band — No. 1 steam: 2 ft. 1½ in. workable coal	0 0½	27 8
Coal	0 9	28 5
Soft clay	0 6	28 11
Fine-grained sandstone	8 2	37 1
Sandy shale	3 8	40 9
Coal	0 10	41 7
band — No. 2 seam: 2 ft. 6 in. workable coal	0 0½	41 7½
Coal	1 8	43 3½
Shale	2 6	45 9½
Tufaceous sandstone	3 3	49 0½
Shale	1 9	50 9½
Tufaceous sandstone	2 0	52 9½
Blue sandy shale	10 4	63 1½
Coal.—No 3 seam: rather too small to work	1 7½	64 9
Shale	4 5½	69 2½
Coal—No. 4 seam: not workable	0 6	69 8½
Tufaceous sandstone	3 0	72 8½
Shale	1 4	74 0½
Hard gray tufaceous sandstone	1 4	75 4½
Tufaceous sandstone	9 5	84 9½
Shale	2 5	87 2½
Clod	0 10	88 0½
Coal—No. 5 seam: 2 ft. 8 in. workable coal	2 8	90 8½
Brown shale	0 6	91 2½
Shale and sandstone in layers	19 7	110 9½
Gray tufaceous sandstone, coal stained	29 2	139 11½
Shale	0 9	140 8½
Coal—No. 6 seam: too thin to work	0 9	141 5½
Tufaceous sandstone	6 5	147 10½
Shale	1 6	149 4½
Tufaceous sandstone, coal stained	38 7	187 11½
Gray and dark shale	4 6	192 5½
Dark and gray tufaceous sandstone	2 6	194 11½
Coal—No. 7 seam: not workable	0 4	195 3½
Gray tufaceous sandstone	8 5	203 8½
Gray sandy shale	13 10	217 5½
Black clod	3 3	220 8½
Dark tufaceous sandstone	4 6	225 2½
Gray sandstone, coal stained	4 9	229 11½
Fine-grained sandstone	3 11	233 10½
Dark shale	4 5	238 3½
Dark sandstone	5 5	243 8½
Gray sandstone, with thin layers of black shale	6 0	249 8½
Gray sandstone	9 11½	259 8
Coal	0 0½	259 8½
Sandstone	2 3	261 11½
Coal—No. 8 seam: not workable	0 7	262 6½
Sandstone, with layers of shale	6 6	269 0½
Dark sandy shale	1 2	270 2½
Grey sandstone	3 6	273 8½
Close-grained dark sandstone	2 7	276 3½
Blue sandy shale	5 2	281 5½
Sandstone	0 10	282 3½
Coal	0 0½	282 4
Black clod — No. 9 Seam: not workable	0 2½	282 6½
Coal	0 4	282 10½
Clod	0 3	283 1½
Blue sandy shale	2 0	285 1½
Fine grained sandstone	3 11	289 0½
Sandy shale and sandstone	15 0	304 0½
Hard grey sandstone	0 6	304 6½
Dark shale	3 0	307 6½
Sandstone	2 2	309 8½
Blue and black shale	5 4	315 0½
Dark sandstone	1 5	316 5½

BORE No. 4.—*continued.*

Strata.	Thickness.	Total depth.
	ft. in.	ft. in.
Black clod and sandstone	7 0	323 5½
Grey sandstone	18 3	341 8½
Sandstone with mud pebbles	0 6	342 2½
Grey sandstone	7 11	350 1½
Firm dark shale	7 7	357 8½
Firm dark sandstone	10 7	368 3½
Very close grained grey sandstone	7 0	375 3½
Very hard white sandy shale	5 11	381 2½
Hard white sandstone	1 0	382 2½
White shale	10 4	392 6½
Hard white silicious sandstone	4 6	397 0½
Hard altered shale	0 8	397 8½
Altered sandstone	1 5	399 1½
Diabase greenstone	0 4	399 5½

[Compiled from the Diamond Drill Foreman's weekly reports.]

Comparing the strata met with in this bore with those cut through in No. 3, we find that the coal seams have generally become smaller, and are separated by thicker layers of shale and sandstone. Samples from seams Nos. 1, 2, 3, and 5 were analysed by the Government Analyst, Mr. W. F. Ward, with the following results:—

	No. 1 Seam.	No. 2 Seam.	No. 3 Seam.	No. 5 Seam.
	Per cent.	Per cent.	Per cent.	Per cent.
Ash	15·80	14·20	15·6	16·40
Moisture	6·40	5·30	5·4	6·20
Sulphur	0·58	1·03	0·7	0·85
Loss at red heat	24·27	25·60	21·2	23·65
Fixed carbon	52·95	53·87	57·1	52·90
	100·00	100·00	100·0	100·00

None of these coals form a true coke.

The following tabular statement shows the thickness of coal in each seam at the various points where they have been cut, and also shows which seams in each bore are identical with those in the other bores.

Seam.	No. 4 Bore.	No. 3 Bore.	No. 2 Bore.	No. 1 Bore.	Shaft.
	Seam Thickness ft. in.	Seam Thickness ft. in.	Seam Thickness ft. in.	Seam Thickness ft. in.	Seam Thickness ft. in.
A.	Not seen	No. 1: 0 9½	Not seen	Not seen	Not seen
B.	No. 1: 2 1½	No. 2: 4 7½	No. 1: 4 0	ditto	No. 1: 5 0
C.	No. 2: 2 6	No. 3: 3 4	No. 1: 3 1	ditto	
D.	No. 3: 1 7½	No. 4: 3 6	No. 2: 4 0	ditto	Not seen
E.	No. 4: 0 6			ditto	ditto
F.	No. 5: 2 8	No. 5: 1 6	No. 3: 2 1½	ditto	ditto
G.	No. 6: 0 9	No. 6: 0 8	No. 4: 1 3½	No. 1: 1 1	ditto
H.	No. 7: 0 4	Not seen	No. 5: 3 4	Not seen	ditto
K.	No. 8: 0 7	ditto	No. 6: 0 1½	ditto	ditto
L.	No. 9: 0 4	ditto	No. 7: 0 5	ditto	ditto

In bore No. 4 the thickness of workable coal in seams B, C, and F, leaving D and E out of account as not being of workable size, is 7 ft. 3½ in.; in Bore No. 5, in seams B, C, and D, we have 11 ft. 5½ in. workable coal; and in Bore No. 2, in B, C, D, and F, there are 13 ft. 2½ in. Seam H., in No. 2 Bore, is not counted, as it is of no value on account of the very high percentage of ash (34 per cent.) in it. The mean thickness of workable coal in Bores Nos. 4, 3, and 2 is therefore 10 ft 8 in., and I think it would be fair to estimate it throughout the proved portion of the field at 10 feet. Taking the quantity of coal in an acre at 1600 tons for every foot in thickness, 10 feet of coal would give us 16,000 tons per acre. In the triangle enclosed by lines from No. 4 Bore to No. 3, from No. 3 to the shaft, and from the latter back to No. 4, there are 122 acres, but we

might fairly assume that there are 250 acres proved by the borings; this area would contain 4,000,000 tons of coal. But the probable area over which the coal extends is much larger, being at a safe estimate about 900 acres, without counting on the probable extension of the field under the basalt hills to the northwards; this would contain 14,400,000 tons. Deducting 40 per cent. for losses in working, there would still remain 8,640,000, or roundly, 8½ million tons available. The present annual consumption of the Colony of both local and imported coal being about 85,000 tons per annum, it is seen that this field could supply the whole of the island at the present demand for 100 years.

As is clearly shown by the sections, the seams get smaller and further apart going from the shaft towards No. 4 and No. 3 Bores: this may indicate that the edge of the original coal basin lay to the westward, and that the seams will thin out as they are followed in that direction. Two more bores at points marked A. and B. on the plan would be useful in determining if the apparent divergence and thinning of the seams get any worse, and at the same time would prove a large area of ground. Should the seams not get too thin it would be, of course, advisable to have the main working shaft of the colliery near the road on the edge of the flat ground, so that it could be easily connected by a siding with the proposed Derwent Valley Railway Extension. There would not be any difficulty in bringing the railway itself about half a mile further to the north than its present surveyed line so as to pass quite close to the mine. Should bores B and A, however, show that the seams continue to thin out, the best site for a main working shaft would be in the gully in which No. 4 Bore is situated, but ten chains or so higher up it. A tramway about a mile and a quarter in length with a good grade could be thence easily constructed to connect with the railway. The seams would be cut at a shallow depth, so that the expenses of winding need not be great, and all the portion of the field lying between the gully and Langloh homestead could be worked to the rise of the coal. It is very unlikely that there will be much water to pump out of the mine. The facilities for working are therefore very fair; and if the Derwent Valley Railway were extended to here the coal could be put into Hobart much cheaper than that from the Fingal mines, the distances of railway carriage being respectively 53 and 141 miles, a handicap in favour of Langloh coal of 88 miles, or 5*s*. 6*d*. a ton at ¾*d*. mile for freight.

The fireclay lying under some of the seams may be useful for making pottery of a rough sort, but is too fusible for the manufacture of good fire-bricks for smelting purposes. An analysis of the clay under the seam in the shaft, made by Mr. Danvers Power, has been given to me by Mr. Milne, as follows:—

	Per cent.
Silica	71·35
Alumina	17·60
Iron	2·89
Lime	2·67
Moisture	2·61
Loss (alkalies, magnesia, &c.)	2·88
	100·00

Several samples of the clay tested by Mr. W. F. Ward were all found to be fusible at a high temperature, and consequently of poor quality as fireclay. Blowpipe tests of my own also showed that the clay could be melted without much trouble, thin splinters being very easily rounded on the edges in the flame. Bricks good enough for many purposes requiring a better class of goods than the ordinary red brick could nevertheless be made from the clay, and so it may turn out out to be of some value.

Taking the group of seams B, C, D, E, F in Bores Nos. 4, 3, and 2, the mean depths from surface are respectively 58 ft. 6 in., 230 ft. 11 in., and 121 ft. 4 in.; the heights above sea level of the tops of the bores being 467 ft. 6 in., 754 ft. 10 in., and 694 ft. 2 in. From No. 2 to No. 3 the dip is 48·96 feet in 1481·4 feet, or 1 in 30·26, equal to an angle of 1° 53½′. From No. 2 to No. 4 there is a dip of 163·8 feet in a distance of 4963·7 feet, or 1 in 30·30, also equal to practically the same angle as before. Taking the seams in the shaft as of the same thickness as in No. 2 bore, the mean depth of the group would be 52 ft. 4½ in., and the height of the top of the shaft is 647 ft. 2 in. above sea level. The dip from the shaft to No. 3 bore would then be 70·9 feet in 2150·3 feet, or 1 in 30·32 (= 1° 53½′), and to No. 4 bore 185·8 feet in 4983·5 feet, or 1 in 26·82 (= 2° 8′) The angle contained between lines joining the shaft with bores Nos. 3 and 4 is 84° 9′. From these data the true dip is calculated to be 1 in 21·08 (= 2ft. 43 in.) towards S. 86° 35′ W.

Taking seam G in the same way, and calculating from bores Nos. 1, 3, and 4, the dip is found to be 1 in 18·78 (= 3° 3′) towards S. 86° 57′ W. The mean of the two determinations should be very nearly correct, and we may therefore take the mean angle of dip as 2° 53′, or 1 in 19·93, and the direction of the line of dip as S. 86° 46′ W. For all practical purposes the strike of the seam is north and south, and the dip due west.

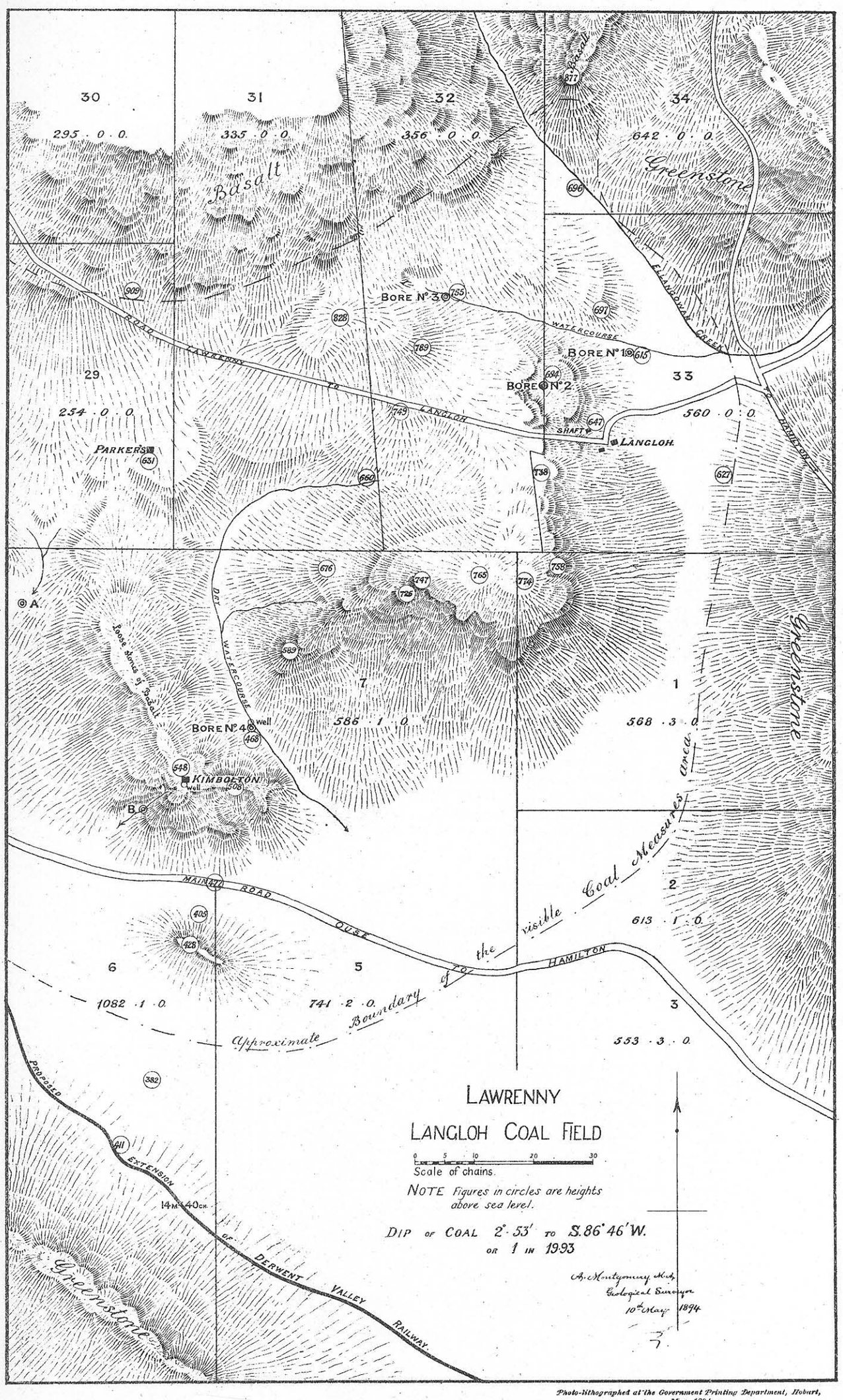
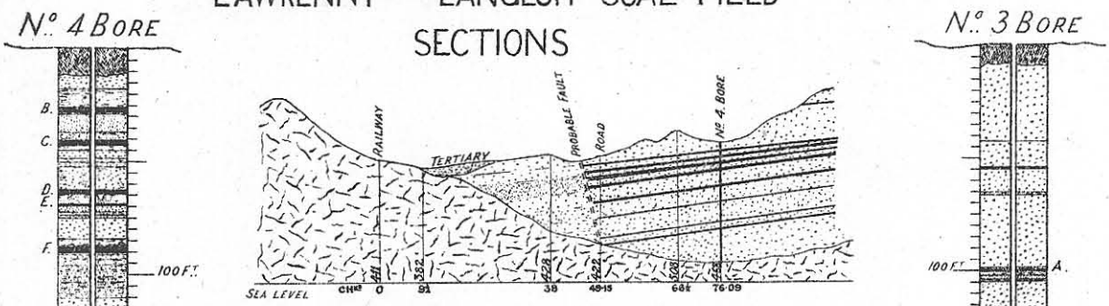


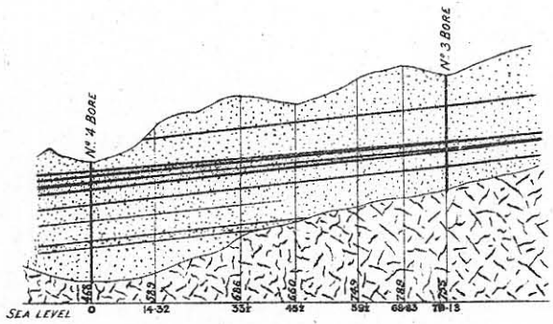
Photo-lithographed at the Government Printing Department, Hobart, May, 1894.

5 cm

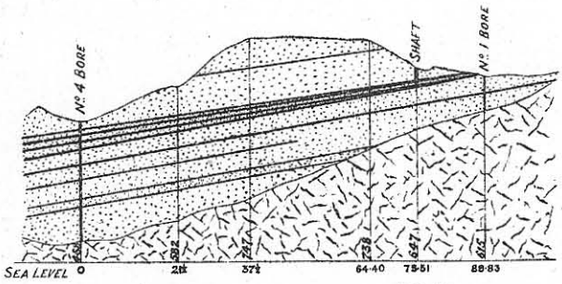
LAWRENNY — LANGLOH COAL FIELD SECTIONS



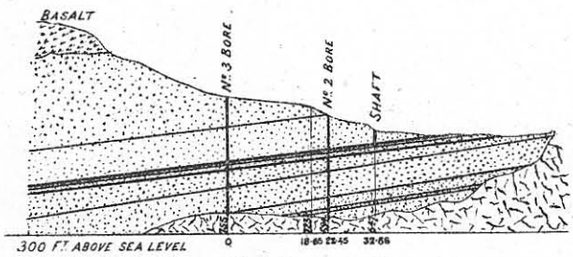
FROM RAILWAY AT 14 M. 51 Chs TO No. 4 BORE



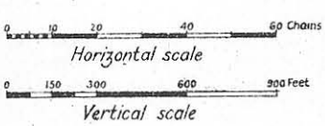
FROM No. 4 TO No. 3 BORE



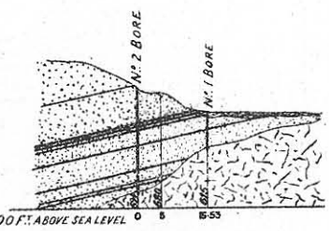
FROM No. 4 BORE TO SHAFT AND No. 1 BORE



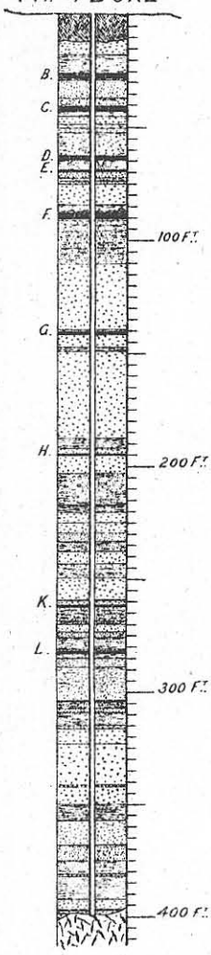
FROM No 3 BORE TO SHAFT

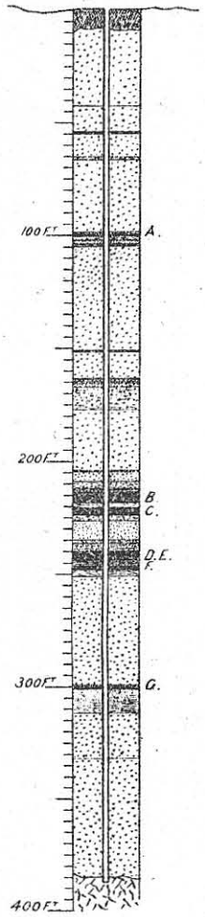


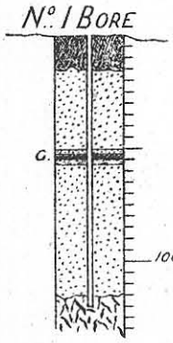
A. Montgomery, M.A.
Geological Surveyor
May 10th 1894



FROM No. 2 BORE TO No. 1.







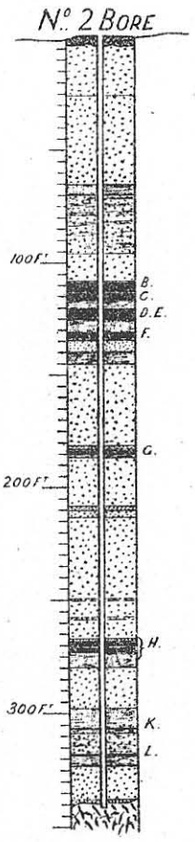


Photo-lithographed at the Government Printing Department, Hobart, May, 1894.

5 cm

The close correspondence of the angles of dip as calculated from triangles having the line from No. 4 to No. 3 bore as base and apices at No. 3 and No. 1 bores and the shaft makes it very unlikely that there are any serious faults in the seams inside the area proved.

As the coal rises to the eastward the outcrop of the main seams should be found easily by trenching and sinking small pits round the eastern slope of the hill between Langloh and No. 4 Bore, and it seems likely that an adit could be driven from a point in the gully about fourteen chains south-east from No. 4 Bore northwards into the hill, which would command enough ground to make a shaft and artificial drainage unnecessary for a very long time to come. This adit would run along the line of strike of the coal $3\frac{1}{4}^{\circ}$ to the west of north, and a glance at the plan will show that it would go well to the westward of even Bore No. 3. It is therefore of very great importance to find the outcrops of the main group of seams in the low ground south-east of No. 4 Bore, so as to ascertain the lowest point from which a main adit could be started. A little coal might also be won from the spur south of No. 4 Bore by an adit going into it from the slope to the main road.

As the analyses of the cores brought up by the diamond drill show a much larger percentage of ash than appears to have been met with by the practical users of the fuel from the shaft, it would be very desirable now to get out a few tons from various places for further bulk tests. As the coal lies near the surface at No. 4 Bore, and it is, as above mentioned, at the same time very desirable to find the outcrop of the seams in this locality, I should recommend that a shaft be sunk, say 8 chains down the gully south-east from No. 4 Bore, to cut seams B and C, and that these seams be prospected by driving north on them some little distance. The coal won should be carefully tested by practical tests and bulk analyses. The cost of this work would be quite light. In prospecting for the outcrop of the seam round the slope of the hill from here to Langloh, other parcels of several tons of coal could no doubt be obtained for testing purposes. The analyses tell strongly against the coal as the matter stands at present, and the test of actual use must now be applied before it can hope to succeed in the market. Should these further trials prove the stuff to be good enough for general use, there can be little doubt that as soon as it was connected by rail with Hobart it would be able to compete successfully with the Fingal coal. The establishment of a successful colliery at Langloh would go far to assist the Derwent Valley Railway to become profitable, and the railway extension, besides making working of the coal possible, would probably have the effect of causing large areas of land now used only for pastoral purposes to be put under crops.

The area of coal-bearing land now proved is large enough to maintain a big output for many years, but if it were desired to prove a still larger area it would be well to have more boring done in the flat ground towards Lawrenny homestead. At surface there is much deep alluvial drift in this direction, and the coal measures are not exposed, but there is much probability of their being found below these later deposits.

The geological features of this coal-field are very similar to those of most of our other Tasmanian deposits belonging to the Upper Coal Measures. The principal rock is a soft tufaceous sandstone, mainly composed of felspathic particles, often much decomposed, and containing very little free quartz; this alternates with soft shaly bands often rich in impressions of ferns characteristic of our Mesozoic Coal-beds. Blocks of silicified wood, often of large size, are frequently found on surface, having been liberated by the wearing away of their softer enclosing matrix. The soft tufaceous sandstones seem all through the country to indicate the horizon of the measures in which coal-beds may be looked for; at a lower horizon we come upon a silicious or quartzose sandstones, composed almost entirely of quartz sand, with often a little mica. These sandstones are the well-known building freestones quarried at Knocklofty near Hobart, Ross, Oatlands, and elsewhere. I am not aware of any coal having yet been found below these beds except the seams belonging to the Lower or Permo-Carboniferous Coal measures. Round Hamilton township these silicious sandstones are common, and they are also seen in the small hill shown on the plan 27 chains south of Kimbolton on the south side of the main road. In the bottom of No. 4 Bore it appears that the horizon of the quartzose sandstones was being reached, but in the higher portions they were not seen at all. As seen by the section from No. 4 Bore to the railway, the beds in the small hill, if the strata had been undisturbed, would have corresponded with those between seams A. and B.; it is evident therefore that a fault exists somewhere near the road, the lower quartzose strata being thrown up on the south side of it. In searching for further coal areas this fault should be borne in mind, and prospecting confined to the localities where the soft tufaceous sandstone occurs.

As shown on the plan the coal-field is almost surrounded by igneous rocks, diabase greenstone forming the hills to the north-east, east, and south, and basalt to the north-west. The greenstone is the usual intrusive rock found associated with nearly all our coalfields, which has burst through the sedimentary strata and in places covered them. At Langloh all the bores bottomed on this rock, and as shown in the sections, it rose to different heights in the strata, cutting out seams H, K, and L entirely in bores Nos. 1 and 3. It is possible that deeper boring might have proved this greenstone to be in the form of intrusive sheets, with sedimentary strata again under them, but it seems more likely to be portion of the main mass of igneous matter of which the greenstone hills are part also. As this intrusive rock is of younger age than the coal seams, it is possible that these

may be in places penetrated and destroyed by intrusions not detected at surface, but the regularity of dip shown by the bores is very reassuring as to there having been no serious disturbance.

The basalt on the north-west side of the field is of Tertiary age, belonging to the series of outflows found at intervals up the valley of the Derwent from Hobart to the Ouse, and particularly well seen in the neighbourhood of the Macquarie Plains Railway Station: it is often vesicular, and even scoriaceous. It probably is only a superficial capping lying upon the coal measures and older greenstones, and there is great likelihood that the coal seams will extend beneath it, but at the same time dykes of basalt cutting through the underlying beds will be liable to be encountered. Boulders of quartzite found on the ridge to the north of Parker's old house, almost at the contact of the basalt with the sandstones, point to alteration of the latter by dykes of the igneous rocks.

In the low ground south of the main road there is a good deal of sand, probably part of the Tertiary deposits found more or less all the way up the Derwent Valley, and which are frequently overlaid by the basalts. At the Ouse there is said to be a large bed of lignite in this formation. These Tertiary deposits may be troublesome at times in pursuing the search for the Coal Measures by concealing them under considerable depths of sand and ferruginous clay. They do not seem, however, to be very extensive, and are mainly confined to the low ground.

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

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

The Secretary for Mines, Hobart.

REPORT ON THE BACK CREEK GOLDFIELD, COUNTY OF DORSET.

Geological Surveyor's Office, Launceston, 15th August, 1894.

SIR,

I HAVE the honor to forward to you the following Report on the Back Creek Goldfield, of which a somewhat detailed survey was made by me in January and February last. Owing to pressure of work requiring immediate attention it has not been possible for me to send you the results of my examination until now, and consequently the present Report is not quite up to date, but deals with the state of the field as seen in February ; in one or two mines it is understood that considerable progress has since then been made.

The Back Creek field lies about six miles north-east from Lefroy, and is reached from there by a fairly good cart road. The principal workings hitherto have been on the west side of the Back Creek, on spurs running from a low range—the Fourteen-mile Bluff Tier,—which separates the basin of the Back Creek from that of Currie's River, but the Major (formerly Leura) and West Major mines are on the east side, on the ridge separating the Back Creek and Piper River basins. Herewith are sent plans of the field, one showing the position of the various workings, and another to a smaller scale the basaltic country along the course of the Back Creek. A plan of the Major and West Major workings also accompanies this Report.

The main geological features of the whole district from the Forester River westward to the Asbestos Ranges on the west side of the Tamar are very clearly shown on the late Mr. C. Gould's map of the Den goldfields and Ilfracombe iron deposits (1866), though numerous details made clear by the mining work that has since been done have, as might be expected, been omitted. It is there shown that the Lefroy and Back Creek goldfields are only portions of a large area of older Palæozoic, probably Lower Silurian formation, which extends from Lefroy eastward to the granite country round Scottsdale. The Denison and Golconda goldfields are also in this formation, and it is again met with in the Waterhouse, Warrentinna, Mount Victoria, and Mathinna fields. Towards the coast the older rocks are much covered with sand and quartz gravel of Tertiary age, which conceal any reefs and auriferous leads that may exist there ; they also often conceal flows of basalt which exist along the valleys of the Nine-mile Creek at Lefroy, Back Creek, and the Piper River ; these are not by any means always covered, however, and are well seen at various points in the Lefroy field and all along the courses of the Back Creek and the Piper River, often forming small stony hills. Along the coast the basalt is well seen at Weymouth, and again at the Black Rock ; at Weymouth it has a very well marked columnar structure, and the columns are broken by numerous horizontal joints, so that the whole mass has the appearance of being built up of layers upon layers of hexagonal and polygonal cakes. At Lefroy and Back Creek borings with diamond drills have shown the existence of Tertiary alluvial gravel under the basalt and between successive flows of it, and it seems likely that the lavas were poured out at intervals during the long subsidence which prevailed throughout this island during the Palæogene period. These basalts would, then, be somewhat older than those of Derby, Branxholm, Scottsdale, and Campbell Town, which appear to mark the termination of the period of subsidence and the beginning of the movement of elevation which has prevailed during Neogene times.

The runs of basalt, no doubt, indicate the position of ancient valleys along which the molten lava flowed, and thus serve to show us where we may expect to find "deep leads." These valleys were cut by the erosive action of prehistoric streams deep into the Silurian bedrock ; and any gold that this may have contained in the veins and reefs traversing it has, no doubt, been largely concentrated in the old beds of these streams. The gradual accumulations of gravel in the channels, due to the movement of subsidence setting in, and the flows of basalt from time to time, have filled up the old valleys, and more or less diverted the streams from their original courses. In order to get to the gold-bearing gravels in the deep channels or "gutters," it is therefore necessary to penetrate right through these later deposits and find the old watercourses. When the old rivers have traversed districts known to contain auriferous veins and reefs, there is every reason to expect to find gold in their channels : we should therefore be likely to get it in the "deep leads" under the basalt at Lefroy, where the streams must have cut across the outcrops of a series of known auriferous lodes, and at Back Creek, where some at least of the country has been proved gold-bearing, and several shallow alluvial "leads," formerly very productive, have been found to dip under the lava sheets. The leads under the long runs of basalt in the valleys of Piper's River and

Piper's Brook do not seem quite so promising for gold; for, except an alluvial deposit derived from the Leura reef, which falls towards the Piper, there have been no important discoveries of gold made along their courses; and the presumption is, according to present knowledge of the country, that the region traversed by them is not richly auriferous. As the Silurian formation prevails throughout their basins, however, it is not at all unlikely that good reefs may yet be discovered in them, in which case these leads also would be worth attention from miners.

The run of basalt in the Back Creek Valley commences almost at the head of the stream, being seen on the road from Lefroy to the Piper, near Batten's saw-mill. In the Den Ranges, close to this point, gold has been found on both sides of the watershed between Back Creek and the Fourteen-mile Creek; and right on the head of Back Creek, near the old Native Industry mine, there is a hill deeply covered on one slope with alluvial matter, in which some gold is obtainable. Between this point and the Back Creek Goldfield proper I have not heard of any quantity of gold being found, though the whole country seems very favourable. From Batten's mill the basalt run follows the course of the creek pretty closely, passing through Horne's and Gillespie's freeholds. About a mile north of Gillespie's, two narrow branch runs of basalt join the main one on opposite sides, no doubt indicating ancient branch creeks joining the principal stream. Still lower down we find several other branches: one very wide run coming in on the west side being that in which the diamond drill borings of 1882–83 were situated, and under which the "Old" or "Back Creek" and the "Cardigan" leads disappear: another smaller one further north being that which covers the continuations of the "Red" and "White" leads, and which was bored through with No. 2 Diamond Drill in 1889. On the east side a branch is crossed by the road from Back Creek to the Piper, and another wider one heads from near the Major Mine. These two flows are somewhat different in character from those on the west side, in that the latter occupy quite low ground, while these run from the top of the watershed down the hill slopes to the bottom of the valley. It seems probable that the basalt issued originally near the watershed, and that these two runs on the east side of Back Creek are simply lava flows poured down the sides of the hills, in which case it would not necessarily happen that any alluvial matter would be covered by them. Under these, therefore, we cannot feel at all certain whether we should find old watercourses likely to contain alluvial gold. From the point near the Major Mine, on the watershed whence, as just said, one of these runs commences, another flow of basalt can be traced towards the Piper River, and the alluvial gold found in some quantity in the Major Company's eastern section seems to become covered by this. As the run of basalt is quite narrow near the watershed, with the Silurian strata visible on each side of it, I cannot agree with Mr. Thureau's opinion (Report on the Back Creek Goldfield, 1882) that this "would most probably constitute the outlet for the Back Creek ancient river, or diluvial gravel system." A very much wider outlet would be required for a valley so deep as the Back Creek one has been proved by boring to have been. It is much more likely that the basalt has issued from a small cone on the watershed and has poured down the slopes on each side towards the Back Creek and the Piper River. From this point northwards a ridge of Silurian strata can be traced to the head of the estuary of the Piper River, making it clear that the ancient valleys of the Back Creek and Piper River could not have sooner joined one another. Not having examined the country on the east side of the Piper, I am unable to say with confidence where the old junction was, but from the information received from residents, it seems probable that the old Piper channel runs off to the eastward from near the junction of the present stream with Yarrow Creek to join with Piper's Brook instead of Back Creek. In Mr. Gould's map the Piper basalt is shown as joining the Back Creek run to the north west from the Yarrow Creek junction; but, as above mentioned, there is an intervening ridge of the bed-rock. On the plan herewith the position of the Back Creek basaltic run is shown as accurately as I can lay it down without actually surveying the boundaries, and it is pretty certain that it does not unite with the Piper basalt further south than the head of the estuary. The largest area of basalt is seen to be in the vicinity of Thos. Adams' 99-acre section, and from the vesicular nature of the stone there, and the shape of the ground, it seems rather likely that this was a central point of eruption. Opposite to this, on the west side of the creek, there is a branch run of basalt for some distance up Paddy's Creek.

The Back Creek Goldfield was at one time one of the most important in the Colony, affording employment to some hundreds of men. Accurate returns of the gold obtained are not procurable, but, according to the best information I have been able to get, it may be estimated that some 9000 ounces of gold were taken from the alluvial workings on the several leads. The gold being of high fineness, sold for 82 to 83 shillings an ounce as a rule. The deposits, being shallow, were soon worked out, and the field has for many years past been almost deserted by alluvial miners, only a few working on it now and then, going over the old ground. Several companies, however, have done a good deal of work from time to time endeavouring to discover reefs from which the alluvial gold may have been derived. These will be dealt with later on, the alluvial deposits being first considered.

On the map of the field herewith the leads are shown in their true positions, having been each traversed and surveyed. They are known as—(1) the White lead, (2) the Red or Albion lead, (3) the Old or Back Creek lead, and (4) the Cardigan or Prince of Wales lead. There is also a small lead on the ridge between the Leura and Piper roads.

The White Lead lies on the northern slope of a small spur running south-easterly from the Union Company's section. For as much as three chains in width in parts the ground is riddled with diggers' shafts, from 10 to 14 feet deep; from these the gravel was taken out and washed in boxes. The upper wash is mostly sandy clay with a good deal of angular and sub-angular quartz through it; the lower gold-bearing layer seems also, from the stones thrown out of the boxes, to have been largely made up of angular quartz. The name of "White" lead is due to the fact that there was much white clay in this wash. The gold obtained was very angular, and often attached to quartz, so it does not appear to have come far from the original matrix. At the boundary of Sections 628-87G and 931-87G the lead is cut through by a small modern water-course, and has not been found any higher. It is noticeable that this water-course has cut a new channel in the bed-rock parallel with the old lead, and has not scoured out the old one, as might have been thought likely. At the east end of the lead the ground rapidly gets deeper, and basaltic clay and basalt begin to be met with, and in the low-lying flat ground the continuation of the lead is deeply covered with lava flows.

The Red Lead gets its name from a reddish colour in the wash due to much oxide of iron. The gold in this also often had much oxide of iron attached to it. Like the White Lead it consists of a strip of clayey alluvial drift, lying for the most part on the northern slope of a low spur running south-easterly, but towards the eastern end it crosses the spur; it is generally from 2 to 3 chains wide, and has been worked by innumerable holes 10 to 15 feet deep. About half-way up it a small branch lead joins it from the head of the Old Lead; this looks to me like a more modern deposit consisting of material re-sluiced from the head of the Old Lead. At the eastern end, like the other leads, this plunges under the basalt, and the bed must get very suddenly steeper, for we find that in the Grand Junction Company's working shaft the slate bed-rock was met with at about 15 feet, while 110 feet E.N.E. from it another shaft went down 80 feet without reaching bottom.

The Old Lead runs a more southerly course than the above-mentioned, and is a somewhat deeper and larger deposit; the upper portion has been worked by shallow pits, but lower down a large open excavation has been sluiced out, and the ground is seen to be from 18 to 25 feet deep. The bottom is a softish slate; on this was found from three to seven feet of a layer of heavy well waterworn quartz boulders and waterworn lumps of slate and sandstone containing waterworn gold; on this again we find sand and clay in horizontal layers, succeeded by 3 to 6 feet of sandy drift with much angular quartz. Owing to want of fall for the tail-race it is only in the upper part of the excavation that the gutter has been accessible; in the lower parts it dips rapidly under foot under a false bottom made up of large lumps of waterworn slate and sandstone with occasional quartz boulders, all set in sandy clay. A good deal of gold was got on this false bottom by the old Back Creek Company. In later years Mr. L. Schade has worked here a great deal, and in taking up the old tramway he cut down through the false bottom at the top edge where it rests on the bed-rock and got a nice patch of gold on the latter, thus showing that the gold goes below the false bottom as well as over it. In the lower part of the excavation a shaft, known as Moore's, was sunk 50 feet through the false bottom before reaching the slate bed-rock. "Colours" of gold are said to have been obtained through the false bottom and a little gold on the slate, but no driving was done. About 380 feet south of this, near the junction of the Lefroy and Piper roads, a shaft was sunk 100 feet; Mr. Thureau mentions this in his Report of 1882 on the district, and says: "A new shaft could not reach bottom whilst sinking on account of a heavy influx of water, but in the last five feet of gravel very good prospects of gold were obtained, and the following strata were passed through, viz:—clay, with heavy round gold; white and black slate, lying flat; and then the wash, furnishing good prospects of gold in the pan." As there is shallow ground to the east of this shaft it is clear that the lead must run southward into the basaltic flat in which are the 1882-83 diamond-drill bores.

The Cardigan Lead is a very short one, right on the top of a small spur. The workings, which have honeycombed the top of the spur, are quite shallow until we come near the Lefroy road, where they rapidly become deeper, and begin to show layers of basaltic clay (volcanic ashes). The principal shaft was that of the Cardigan Company, which was 52 feet in depth, and reached sandstone bottom. The bottom was found to dip 1 in 2 to S. 30° E. The wash on the bottom was much cemented with oxide of iron, and contained a good many smooth sandstone boulders: it yielded about 1 dwt. of gold to the load, which was not payable. The gold is reported to have been very shotty and rounded. On the east side of the road, opposite the end of the Cardigan spur, we find two shafts 30 and 34 feet deep, which came upon solid basalt, and were abandoned; and further north one 80 feet deep, bottomed on blue slate. In this there were about 12 feet of basaltic clay. The wash contained round sandstone boulders, but I could get no information as to whether there had been any gold found.

In the Cardigan Lead, especially on the north side of it, there is a great deal of hard quartz breccia, or rather angular conglomerate, often in heavy well-rounded blocks, some of them several tons in weight. They are very hard, but appear to me to be formed *in situ*, not mechanically transported, as they are composed of exactly similar material to the surrounding and often underlying loose wash. A little of this conglomerate is seen at the edge of the deep ground at the

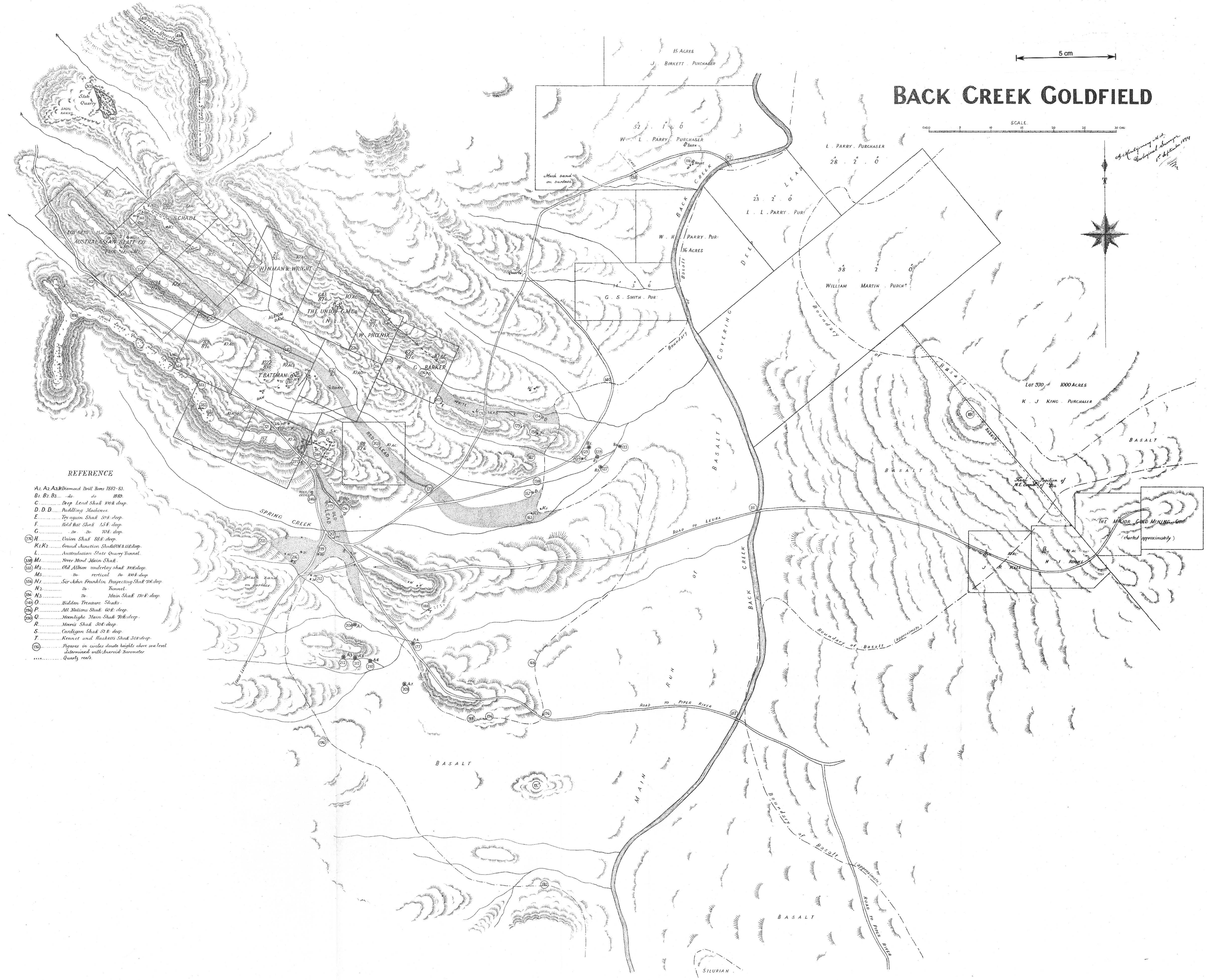
eastern end of the White Lead also, on the spur west of the 70-feet shaft shown on the plan; and it is also seen every here and there along the boundaries of the basaltic country. Mr. Thureau, in his report on the Goldfield in 1882, noticed this rock, and drew from it a conclusion which seems to me unwarranted, and which might be misleading to anyone wishful of opening up the deep leads. He says :—"All these auriferous runs of diluvial gravels demonstrate an immense force of water running in swift torrents in self-eroded channels in prehistoric times, as evidenced by the rounded and semi-angular boulders of a hard silicious breccia, one of which was found imbedded in a reddish clay, and which measured 15 feet across by a thickness exceeding four feet, having evidently travelled over a considerable distance, as I could not discover any similar rock in the district." While agreeing with Mr. Thureau in believing that the streams which laid down these gravels were much larger and more powerful in carrying stones than the existing watercourses, I do not think that there is any necessity to assume the existence of rivers powerful enough to move such a huge rock as that quoted. The explanation of the occurrence is well shown in a section at the west end of the beach at the mouth of the Piper River, where a sheet of this same conglomerate is seen lying between a weathered basalt stream and the Silurian rocks. It is evident that the conglomerate is a quartz gravel cemented together by silicious matter,—the result being most probably brought about by the hot water and steam from the lava flows. The occurrence of the conglomerate only along the edges of the basaltic areas seems to me to bear out this view. The rounding of the boulders of conglomerate was probably due to a later water-action, perhaps during the erosion of the existing water-channels, which must be all much younger than the leads on the spurs.

While on the subject of the alluvial gold deposits of this district, mention may be made of two other occurrences which have some significance. On the western edge of the basaltic country in the flat N.E. from Mr. W. L. Parry's house there is some quartz wash containing "colours" of gold; and perhaps a quarter of a mile further north, in the same flat and on the same edge of the basalt, a small shaft has been sunk in wash 10 feet to slate bottom, and in this a large speck of gold weighing 10 or 12 grains was found. From this it is to be gathered that here too we have auriferous gravels dipping under the basalt. The other case is that of the alluvial workings on the eastern block of the Major Company's ground. Here several shallow shafts have been sunk, and a good deal of gold has been obtained; but going northward the ground becomes deeper, and gets covered with basaltic clay and basalt. The gold here seems evidently derived from the Leura or Major reef, and the fall is to the Piper River; but if the reef is shedding gold on this side of the hill, it is also likely somewhere to yield gold to the Back Creek lead also, as it runs across the dividing ridge. Should it continue westward any distance, it must have been greatly broken away during the erosion of the Back Creek Valley. This case is probably not singular either, as there is a strong probability that the old lead running about north and south must have cut numerous reefs, as these in this district seem to have a somewhat east-and-west course.

As the shallow leads dip under the basalt it is plain that they must be older than it, and belong to the system of watercourses existing before the volcanic disturbances. Their peculiar position on the tops and slopes of spurs may be accounted for as follows :—When the streams that laid down the auriferous gravels were running the present leads were in the bottoms of their valleys; these, during the long period of subsidence which can be shown to have prevailed in Palæogene times in Northern Tasmania, became filled with drift deposits; later on the streams cut down again through these upper drifts, but not exactly in the old channels, and have now cut fresh beds in what were formerly the sides of the old valleys, leaving the old gravel deposits on the slopes and tops of the spurs.

The borings made in 1882-83 and in 1889 with diamond drills gave very important information as to the deep ground in the Back Creek Valley. The positions of the bores of the first series are marked on the gold-field plan A1, A3, A4, A5, A6, and A7, and of the second series, B1, B2, B3, and B4, the figures being the progressive numbers of each set. Unfortunately, no record can be found of the relative positions of the first lot of bores, and in assigning numbers to them I had to go by the information given to me by Mr. W. L. Parry, who has resided in the district for a long time. The positions of Nos. 1, 4, and 7 bores are pretty certainly correct, but it is not certain if the right numbers have been assigned to Nos. 3, 5, and 6, and no trace at all could be found of No. 2 bore, though Messrs. Parry, Schade, and myself searched very thoroughly for it for half a day. The sites of the bores are easily recognisable by the pits sunk for water for the engine, piles of cores, and so on, but there is nothing to show the order in which they were put down, the posts left to mark them having been burned by grass fires. The following sections are compiled from the foremen's weekly reports:—

BACK CREEK GOLDFIELD



FIRST SERIES OF BORES WITH No. 1 DRILL IN 1882–3.

No. 1 BORE (A1 on plan).—Commenced 9th September, 1882; finished 10th October, 1882.

Strata passed through.	Thickness.	Total Depth.
	ft. in.	ft. in.
Surface shaft	9 0	9 0
Sandy clay and soft brown rock	11 0	20 0
Bluestone (basalt)	41 0	61 0
Basaltic clay	12 0	73 0
Gravelly wash	7 0	80 0
Brown sandy clay with decayed wood	51 0	131 0
Black sandy clay with wood	10 0	141 0
White clay	6 0	147 0
Black clay with wood	4 0	151 0
Conglomerate	0 6	151 6
Black clay, wood, and gravel	5 6	157 0
Gravelly wash	8 0	165 0
Cemented sand and gravel	25 0	190 0
Gravelly drift	5 0	195 0
Cemented sand and gravel	14 0	209 0
Drift	5 6	214 6
Gravel	3 10	218 4

No. 2 BORE (A2).—Commenced 27th October, 1882; finished 6th November, 1882.

	ft. in.	ft. in.
Surface shaft	8 0	8 0
Clay	8 0	16 0
Soft brown rock	10 0	26 0
Bluestone and honeycombed basalt	36 0	62 0
Basaltic clay	12 0	74 0
Gravel	6 0	80 0
Clay	10 6	90 6
Slate and sandstone, with thin quartz veins	24 6	115 0

No. 3 BORE (A3).—Commenced 18th November, 1882; finished 29th November, 1882.

	ft. in.	ft. in.
Surface shaft	8 0	8 0
Sandy clay	3 0	11 0
Gravel	1 0	12 0
Clay	12 0	24 0
Soft brown rock and honeycombed basalt	5 0	29 0
Bluestone (basalt)	47 6	76 6
Honeycombed basalt	5 0	81 6
Basaltic clay	15 0	96 6
Gravel	6 0	102 6
Brown and black sandy clay, with wood	27 9	130 3
Conglomerate	0 6	130 9
Brown and black sandy clay, with wood	35 6	166 3
Conglomerate	3 2	169 5
Bluestone and honeycombed basalt	21 0	190 5
Light-coloured sandy clay	9 10	200 3
Brown sandy clay and gravel	3 0	203 3
Soft slate and sandstone	37 3	240 6

No. 4 BORE (A4).—Commenced 11th December, 1882; finished 12th December, 1882.

	ft. in.	ft. in.
Clay	16 0	16 0
Sandstone	24 0	40 0

No. 5 BORE (A5).—Commenced 27th December, 1882; finished 16th January, 1883.

Strata passed through.	Thickness.	Total Depth.
	ft. in.	ft. in.
Clay	12 0	12 0
Soft rock	12 0	24 0
Bluestone (basalt)	54 0	78 0
Honeycombed basalt	5 0	83 0
Basaltic clay	9 0	92 0
Brown and black sand and wood	3 0	95 0
Gravelly wash	3 0	98 0
White clay	2 0	100 0
Brown and black sandy clay, fine gravel, and wood	60 0	160 0
Honeycombed basalt	4 0	164 0
Basalt (lower part honeycombed)	28 6	192 6
Black and brown clay and wood	5 0	197 6
Clay, wood, drift, gravel, and cement	8 6	206 0
Cement and gravel	2 0	208 0
Sandy clay and gravel	4 0	212 0
Gravel	2 0	214 0
Slate reef and sandstone	24 0	238 0

BORE No. 6 (A6.)—Commenced 25th January, 1883; finished 9th February, 1883.

	ft. in.	ft. in.
Clay	33 0	33 0
Bluestone (solid basalt)	25 0	58 0
Honeycombed basalt and bluestone	5 6	63 6
Bluestone and honeycombed basalt	19 0	82 6
Basaltic clay	4 2	86 8
Clay and wood	4 6	91 2
Gravelly wash and drift	10 0	101 2
Clay	3 0	104 2
Sandy clay with wood	5 10	110 0
Gravelly drift, sand, and wood	18 0	128 0
Brown sandy clay and wood	34 0	162 0
Bluestone and honeycombed basalt	21 0	183 0
Basaltic clay	11 0	194 0
Brown sandy clay, gravel, and cement	16 0	210 0
Red-brown sandy clay	27 0	237 0
Sandy clay and a little gravel	2 0	239 0
Sandstone	15 0	254 0

BORE No. 7 (A7.).—Commenced 20th February, 1883; finished 4th May, 1883.

	ft. in.	ft. in.
Clay	8 0	8 0
Gravel	1 0	9 0
Clay	7 0	16 0
Soft rock and bluestone (basalt)	45 0	61 0
Basaltic clay	12 0	73 0
Gravelly wash	7 0	80 0
Brown sandy clay and gravel	10 0	90 0
Black sandy clay with wood and gravel	52 0	142 0
Basaltic clay	6 0	148 0
Sandy clay and gravel	4 0	152 0
Clay with wood and gravel	6 0	158 0
Cemented gravel	7 0	165 0
Cemented sand and gravel, and floating reef	25 0	190 0
Cemented sand and gravel	22 0	212 0
Cemented gravel	4 9	216 9
Gravel	4 3	221 0
Sandstone	2 0	223 0

I have not been able to find any record which would show if any gold was found in the bores, nor to ascertain if No. 1 bore reached the bedrock. A strong stream of water issued from this bore for some years, and even yet there is a little flow from it. The surface heights of the bores have

only been approximately measured (with aneroid barometer), but should not be far from correct. Taking them into account, we get the levels of striking the bed-rock as follows:—

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Height of surface above sea level..	204 0	?	212 0	177 0	212 0	210 0	208 0
Depth of striking bed-rock.....	218 4	90 6	203 3	16 0	214 0	239 0	221 0
Level of bed-rock in bore	14 4 below sea level.	?	8 9 above sea level.	161 0 above sea level.	2 0 below sea level.	29 0 below sea level.	13 0 below sea level.

No. 4 Bore is quite off the deep ground, and No. 2 is also comparatively shallow. Comparing the sections of the remaining bores, it is seen that the lower flow of basalt seen in Nos. 3, 5, and 6 is not met with in No. 1, and is only represented by a bed of basaltic clay in No. 7. No. 6 is actually the deepest bore, but does not seem to have got into the gravels likely to lie in the gutter, and no water seems to have risen in it as in No. 1; the latter, though not quite so deep as No. 6, is nearer the ranges, or further up the old stream, and has probably been more nearly on the old lead than any of the others. No. 7 bore must be on the east side of the gutter, as the bottom rises from No. 6 towards it. The old channel probably lies near No. 1 bore and a little to the east of No. 6, but is likely to be some little distance west of No. 7.

The positions of the second series of bores made with No. 2 Drill in 1889 are fortunately not at all in doubt, like some of those above, and are shown on the plan at points B 1, B 2, B 3, and B 4, the figures denoting the consecutive numbers of the bores. Close to these bores a shaft had been sunk 100 feet without reaching bed-rock; it is said to have gone through a lot of basaltic clay, and in the last 20 feet to have met with, first, boulders of basalt, and then solid basalt. Encountering this hard rock, and the water proving too much for the small engine employed, caused the sinking of the shaft to be abandoned. The sections of the bores are as follows:—

SECOND SERIES OF BORES: WITH No. 2 DRILL, 1889.

No. 1 BORE (B1.)—Commenced 2nd February, 1889: finished 2nd March, 1889.

Strata passed through.	Thickness.	Total depth.
	ft. in.	ft. in.
Surface shaft.....	6 6	6 6
Basaltic clay.....	22 6	29 0
Blue and black clays with decayed wood and cemented pebbles	44 6	73 6
Hard basaltic rock	90 9	164 3
Basaltic clay.....	7 8	171 11
Quartz drift and stones	2 0	173 11
Blue clay	1 11	175 10
Quartz wash	1 0	176 10
Soft slate bottom	15 5	192 3

No. 2 BORE (B2.)—Commenced 9th March, 1889; finished 13th April, 1889.

Surface shaft.....	6 6	6 6
Yellow clay	3 9	10 3
Quartz gravel	2 6	12 9
Basaltic clay.....	37 4	50 1
Black clay and decayed wood.....	10 2	60 3
Basaltic clay.....	9 4	69 7
Hard basaltic rock	99 1	168 8
Basaltic clay.....	5 8	174 4
Quartz wash.....	8 4	182 8
Slate and quartz gravel	8 4	191 0
Black slate bottom	4 0	195 0

No. 3 BORE (B3.)—Commenced 20th April, 1889; finished 18th May, 1889.

Surface shaft.....	11 6	11 6
Basaltic clay.....	14 0	25 6
Soft basaltic rock.....	21 7	47 1
White sandy clay and decayed wood.....	8 8	55 9
Black clay and decayed wood	17 6	73 3
Blue clay	3 0	76 3
Hard basaltic rock	91 10	168 1
Basaltic clay.....	7 9	175 10
Cemented wash.....	0 6	176 4
Brown and blue slate	8 2	184 6
Quartz leader	0 6	185 0
Blue slate	3 4	183 4

No. 4 BORE (B4).—Commenced 24th May, 1889; finished 5th July, 1889.

Strata passed through.	Thickness.	Total Depth.
	ft. in.	ft. in.
Surface shaft	11 0	11 0
Rotten basalt	24 0	35 0
White, brown, and black clays, and decayed wood	27 0	62 0
Soft basaltic rock	3 0	65 0
Hard basaltic rock	116 5	181 5
Basaltic clay	12 4	193 9
Clay and decayed wood	5 1	198 10
Quartz wash	5 11	204 9
Black slate bottom	6 5	211 2

As basalt is seen on the point of the spur west of No. 1 Bore, and again on that south of No. 4, it seems likely that there was a higher flow of basalt all over the valley in which the bores lie, which has been partly removed by denudation. There is not very much difference in the surface heights of the four bores, but taking it into account we get—

	No. 1.	No. 2.	No. 3.	No. 4.
Height of surface above sea level	125 ft.	129 ft.	127 ft.	123 ft.
Depth of striking bedrock	177 ft.	191 ft.	176 ft.	205 ft.
Level of bedrock where struck below sea level	52 ft.	62 ft.	49 ft.	82 ft.

Nos. 2 and 4 Bores seem likely to be near the old gutter, and contain considerable bodies of quartz wash lying on the bed-rock: they may well be nearly on the continuation of the Red Lead, but are probably to the south of the White Lead.

Neither of these two series of bores has, to my mind, been well located,—the endeavour seemingly having been to drop on the gutters by a random shot instead of by carrying out a systematic search. As seen on the plan, both sets of bores are on branch leads running into the main Back Creek Valley lead; and there can be no doubt that the basalt indicates approximately the position of the old valleys into which it flowed. Had a survey been made of the boundaries of the deep ground, it would have been seen at a glance that there are narrower parts of the old valleys lying a little to the east of both sets of bores, where a complete cross-section of the leads could have been made with the same amount of boring, or even less. It should be remembered that the proper use of a diamond drill in searching for deep leads is to locate the deepest ground, not to find gold,—the sample of gravel taken by the drill being so small that the richness or otherwise of the wash cannot be correctly judged by it. For example, in a recent bore in the East Pinafore mine the drill passed through quartz wash lying on the slate bottom under a basalt flow, but no gold was found in the sample brought up; yet, when the shaft was sunk to this point, it was found that there was a good deal of gold in the wash. In boring for a lead the holes should be put down in regular lines across its supposed course, and the dip of the bottom from bore to bore noticed, so that it can be found between which pair of bores the deepest ground must lie: then other bores should be put down between this pair, at short distances apart, if it is required exactly to locate the gutter. This being found, the further testing of it, to be in any way conclusive or satisfactory, must be done by regular mining, independently of whether the drill has brought up gold in the cores of wash or not.

The bores make it quite clear that there is a very deep old lead under the basalt of the Back Creek Valley. Taking into consideration the number of auriferous branches that have been actually worked successfully, the favourable nature of the whole of the formation through which the valley has been eroded, and the great probability that unknown reefs have been cut through during this erosion, I am of opinion that there is a very great probability that the main lead will prove more or less payable when opened for mining. Mr. Thureau, in his Report of 1882, expressed a similar opinion. Inspection of the plan shows that the lead is narrow almost opposite Mr. W. L. Parry's house, and that this narrow place is only a short distance below the junction of the branch from the White and Red Leads with the main valley, and not far below that from the Old and Cardigan Leads, while on the other side there are two branches of basalt coming in which may perhaps cover other leads fed from the Major Reef. Not to go too far from the known gold, I should recommend a trial of the lead in Mr. Parry's 16-acre block. A line of bores along an east and west line through the easternmost corner of this section would prove the depth of the ground, and show the position of the gutter, and depth and character of wash contained in it; they would also show how near to the gutter it would be possible to sink a shaft in reasonably firm ground which would not move and destroy the shaft when blocking out the wash should commence.

It must be anticipated that water will prove a serious difficulty in opening and working this ground. The No. 1 Bore of 1882 has shown that there is water in the deep ground under pressure sufficient to send it to surface, and as the outlet of the old valley must be now a long way below sea

sea-level, it must be expected that it practically forms an underground reservoir which will have to be pumped dry. It is shown above that the deepest ground reached by the bores is already below sea-level on what are only branches of the main lead, and it is quite conceivable that at the point recommended for trial the gutter may lie from 150 to 200 feet below the sea. This is quite in accordance with the evidence obtained in recent borings at Lefroy, which show that there too the bottoms of the deep leads run a long way below sea-level, with that of the Beaconsfield deep lead, which lies some 270 feet below tide-marks, and with the fact that the old channels of the Ringarooma and George's Rivers are much deeper than the existing ones. There has been a great subsidence of the land since the times when the streams ran which eroded these channels.

As the deeper parts of the Back Creek lead must be full of water, it will be necessary for any company attempting to work it to provide very powerful pumps, and to be prepared to go on pumping steadily for a long time until the underground reservoir is emptied: after that the influx of water could probably be controlled easily enough. If there is much of the clayey tight material seen in the bores in the main lead also, the water may not be a very formidable difficulty after all, as it will be mainly confined to the gravel layers. The proposed diamond-drill bores would give very useful information on this point.

Turning now to consideration of the sources of the alluvial gold in the various leads that have been worked, we find that though a great deal of search has been made, and a good many gold-bearing veins of quartz discovered, no really well-defined and permanent-looking reefs have yet been laid bare. In saying this, however, I do not refer to the Major or Leura reef, on the east side of the field, which, though small, is persistent on a straight course for quite a quarter of a mile, and has every appearance of permanency. In the workings of the White and Red Leads a great deal of the gold had quartz attached to it, and was angular and crystalline, showing little abrasion by being transported along the beds of the streams. Though numerous veins of quartz were found in the bedrock, they rarely carried gold; and it has long been a matter of much concern to those interested in the district that no reefs capable of supplying the leads have yet been discovered. When we have described the discoveries made up to the present, we shall be in a better position to discuss the matter, and form an opinion as to whether it is likely that the alluvial gold has been shed from sources now known, or whether the parent reef has yet to be found.

All over the field we come upon considerable outcrops of barren quartz, usually loose and broken from the solid reef, which no doubt lies close by under the soil. In some cases trenches and holes have been sunk on these outcrops, and the solid reefs been found. None of these large bodies have as yet been found to contain payable gold, and the quartz is generally of a very hard and "unkindly" nature. They no doubt supply a large quantity of the barren quartz found so plentifully in the alluvial deposits. One of the largest of these reefs is found on the top of the high hill to the north of the Australasian Slate Quarry, running south-easterly, but gradually bending down to a southerly course. There is a great amount of quartz about the surface, but no mining work has been done that I could find traces of. Possibly this reef is connected with another one seen running along the top of a spur in Sections 931-87G and 628-87G on the north side of the head of the White Lead. Here, too, there is much loose quartz similar to that on the first-named occurrence. A number of trenches have revealed the underlying reef, and shown it to be a large body of quartz, up to 6 feet in width, much mixed with country rock: I have not heard of any gold having been found in it. On the next parallel high spur to the north east there is again some very similar quartz. On the tops of two other spurs running from the hill to the south of the saddle on the road to the slate quarry, we again find large quantities of barren quartz, and in Section 635-87G a trench shows a big reef. In this same section there is an old tunnel, now fallen in, which is said to have been driven about 150 feet to cut this reef, but without finding it, though several large bodies of quartz were met with. The reef along this spur is pretty well parallel to that on the hill north of the slate quarry, and to the one that traverses Section 931-87G, and all three are not far from parallel with the strike of the country strata. The reef coming southerly towards the northernmost corner of Section 840-87G, is again pretty parallel to the branch running south from the hill to the south of the saddle on the road. Where this southern branch meets the south-easterly one which runs towards Section 635-87G, a big outcrop of mixed ironstone, country slate, and quartz is met with, which can be traced to the north west along the spur, as shown on the plan. Similar ironstone is found close to the westernmost corner of Section 83-87G, and in the old Sir John Franklin mine (Section 840-87G.) In the north corner of Section 83-87G there is a strong outcrop of quartz, which has been taken to be part of the Hidden Treasure reef worked in Section 1022-87G; as seen on the plan it strikes nearly straight for the old Hidden Treasure shafts. Two trenches cut across it show a mass of quartz from 3 to 4 feet wide, not known to contain gold.

At the time of my visit to the field, the only mines that were being worked were the Union and the Major, but I was also able to inspect some of the old workings in Section 840-87G. The information I have been able to gather as to the other old mines has been mostly given to me by Mr. W. L. Parry, whose long residence in the district has given him every opportunity of watching its progress. It is not to be supposed, however, that figures as to depths of shafts, lengths of drives, and results of crushings, from memory, however good, can always be strictly accurate; and in

reading the following description of the work that has been done, it must be borne in mind that the information given is from hearsay to a great extent; and, while correct in the main, cannot be guaranteed to be free from occasional errors. As particulars of the old workings must become from year to year more and more difficult to obtain, I shall place on record such as I have been able to get, in as brief a form as possible, in the hope that by doing so the necessity for repeating old work in the future may be as far as possible avoided.

Try-again Shaft.—On White Lead, about 6½ chains east of southernmost corner of 628-87G. Sunk 50 feet in black slate: drives from bottom 70 feet to south and 20 feet to north: nothing of value found.

Hold-fast Shaft.—About 1½ chains east of southern corner of 628-87G: sunk 45 feet: about 70 feet of driving done from the bottom, in which a number of small leaders were cut, but no gold obtained.

Hold-fast Shaft.—On north side of White Lead in Section 628-87G: 70 feet deep: about 35 feet driven north and 35 feet south: leaders cut, but no gold.

Union Mine. Section 643-87G.—The workings of the Union Company are situated at the head of the gully in which the White Lead lies. The main shaft at the time of my visit was 88 feet deep, and levels had been opened at 80, 63, and 30 feet. To the north east of the main shaft are three small ones, from which older workings were made: these communicate with an old north-easterly drive from the main shaft at the highest level. There is no regular lode in the mine,—the gold being found in a white sandstone traversed by numerous small quartz veins. At No. 1 and No. 2 levels this auriferous rock forms the hanging wall of a vein of quartz from 6 to 12 inches wide, accompanied by from 18 inches to 2 feet of broken wall-rock or "mullock:" this vein strikes about N. 65° W. and dips to the S.W. After passing through it no gold is found. At the bottom level the same vein is again met with, but smaller, and towards the south-east end much broken into leaders: here, too, the gold is found mostly on the hanging wall of the quartz vein. At this level, however, a drive to the north east towards the old shaft got some gold almost under the old workings. The gold in these appears to have been in white sandstone, with fine quartz veins through it, lying on the hanging wall of a group of small quartz veins striking to the north east. In the bottom level there are numerous small leaders running about east and west, as if the two sets of veins seen running towards one another in the top level were coming into one course down below. Throughout the mine there are sudden changes of country from white clayey sandstone to black soft slate and soft white slate; and these latter beds, which appear often to lie in flattish layers, do not appear to carry gold like the more porous white sandstone. As will be seen later on, there is reason to believe that the strata of the country in this district have a north-westerly strike and a rather high angle of dip; and this makes it probable that these apparent beds of black and white slate and sandstone are not true members of the series of stratified rocks forming the general country rock, but are altered parts of one or more of these strata, differently acted upon by the solutions that have deposited the gold. The more permeable sandstone strata would have a better chance of being impregnated with gold than the less pervious slates. Be this as it may, we have in this mine an instance of the country rock in the vicinity of a quartz vein containing enough gold to be worth crushing. The width of the gold-bearing zone seems to vary in the different levels,—being about 10 feet wide in the No. 2, and over 15 feet in the top and bottom levels, but not by any means all of it is worth crushing; and in the present state of development of the mine, it is hard to say where to look for the best portions. From the old workings near the surface gold is reported to have been obtained by roughly crushing and cradling the auriferous sandstone: from No. 1 level a crushing is said to have yielded about 15 dwts. to the ton. Samples taken by me from the bottom level gave very little gold, but small prospects were obtainable from the paddock of stuff that had been saved. According to *The Daily Telegraph* of March 4th, 1894, a crushing of 6 tons yielded 1 oz. 16 dwts. of gold, or at the rate of 6 dwts. to the ton.

Since my visit a small battery of five stamps has been put on the mine, so that it will be possible to test it thoroughly. The auriferous sandstone is easily crushed, and the zone of rock containing gold seems pretty wide, so there seems some hope that a very low return may be made to pay, say 2½ to 3 dwts. to the ton. It would of course be necessary to crush large quantities of stone in order to be able to make any profit out of rock of such low value, and at present it cannot be said that there is material in sight that would justify the erection of a large crushing-plant. Nevertheless, the formation is auriferous, and sufficiently promising to deserve continued prospecting, the small battery being used to ascertain the value of the rock coming to hand from time to time. There is a possibility of a more defined body of quartz being found at greater depth, and I should recommend sinking a fair-sized main shaft instead of the small prospecting one now used, to try for gold at lower levels.

Section 840-87G (formerly Sir John Franklin Mine).—This old mine is at the head of the gully in which the Red Lead lies, having a similar relation to this lead to that held by the Union Mine with respect to the White Lead. There is also a considerable similarity in the occurrence of

the gold in the two mines, it being found in connection with groups of quartz veins in sandstone country rather than in regular reefs. The workings from the Sir John Franklin engine-shaft are not now accessible, being full of water, but the tunnel and eastern shaft may still be entered. The engine-shaft is said to have been 170 feet deep, and at that level a cross-cut was put in to the westward a distance of 50 feet, from the ends of which drives were made north and south, each 15 feet, the southern one connecting with a winze from another level at 100 feet, which in turn was connected with the tunnel by a winze. Some gold-bearing leaders and bunches of quartz are said to have been cut in the shaft between 90 feet and 130 feet. The positions of the tunnel and various shafts are shown on the plan of the field. The 60-feet shaft to the west of the mouth of the tunnel is said to have at the bottom a drive 12 feet to the south, which cuts a likely-looking lode-wall running east and west and underlying to the north, but with only a little rubble and flucan upon it. The 80-feet shaft north-west from this has in the bottom a leader of quartz, some 10 inches thick, striking about N. 80° E., which has been followed 30 feet east and the same distance to the west. It is said to have carried gold all the way, but to have become small when followed. About 15 tons of quartz are reported to have been raised and roughly crushed by hand, as much as 3½ ounces having been got from specimens. North-east from this shaft is one 35 feet deep, which cut a small vein carrying gold some ten feet from the surface. No driving has been done on this. Between it and the engine-shaft a lode of quartz, ironstone, and slate is cut in a trench, which agrees in position and direction with a similar vein met with in the tunnel, and picked up again close to the 70-feet eastern shaft. No gold is known to have been got from this. The tunnel is 233 feet in length, and runs a little to the west of north. For the first 140 feet yellowish sandstone is passed through without noteworthy features, but the remainder of the distance is remarkable for the very large number of small parallel quartz veins which are cut through. These strike N. 45° to 50° E., and underlay to the north 1 in 5. Some short drives have been made along the course of some of the largest veins. The quartz is much ironstained; 10 tons of it from this level are said to have yielded gold at the rate of 6 dwts. to the ton. The winze to the 100-ft. level of the engine-shaft is about 55 feet deep, and is connected with it by a crooked drive. The winze from the 100-ft. level to the 170-ft. is some 30 or 40 feet nearer the engine-shaft than the bottom of the upper winze. Thirty tons of stuff from this lower winze are stated to have yielded 22 ounces of gold on crushing (equal to 14 dwt. 16 grs. per ton). About 38 feet from the end of the tunnel the ironstone lode seen on surface is cut through, striking N. 50° W. and dipping 70° to the N.E. It is from one to two feet thick, but is said not to have been met with at the lower level. It runs almost square across the group of small gold-bearing veins. The eastern shaft has two levels, one at 70 feet the other at 43 feet, only the upper one being now accessible. In this we see a number of veins quite similar to those in the tunnel, running about N. 60° E.; in 12 feet driven to the south-east no less than 13 of these little veins are cut through. The country is a soft clayey sandstone, much ironstained, and the quartz veins are also usually brown from oxide of iron. A drive runs to the north-east 33 feet along a group of six small leaders, half an inch to three inches thick, which have been stoped out above the level for about 15 feet in height, 30 tons of the mixed sandstone and quartz being reported to have yielded gold at the rate of 6 dwts. to the ton. At the end of the drive the ironstone lode is met with, running about S. 60° E., and underlaying 1 in 3 to the north-east; it is about two feet in width, and consists of quartz, oxide of iron, and ironstained slate. It does not fault the little north-easterly veins, which continue on the other side of it without dislocation. A winze has been sunk on the ironstone lode to the 70-feet level, and continued below it some 35 or 40 feet, and at the lower level this lode has been driven upon 35 feet to the north-west and 40 feet to the south-east.

The run of gold-bearing veins seen in this shaft cannot be the same as is seen in the tunnel, but must be a nearly parallel set. In the stuff paddocked at the mouth of the shaft small prospects of loose gold can be obtained, and in bulk it is probably worth 5 to 6 dwts. to the ton. If this return could be relied on to continue a payable mine might be opened up, but further prospecting must be done before a reliable opinion can be formed. Both this set of veins and the one in the tunnel might be mined very cheaply, and if explored and laid open by drives so as to expose large quantities of auriferous material it might be worth while to erect a large battery for crushing. As in the case of the Union mine, the probability is that the bulk of the stuff is too poor to pay for crushing on a small scale, but might perhaps yield a profit if handled in large quantities: it is therefore necessary to find out if the mine can supply the amount of material required to keep a large battery steadily at work. At the same time it would be advisable to sink a deep shaft to try if the veins come together in depth: should they do so there seems to be a good chance of a payable lode being found.

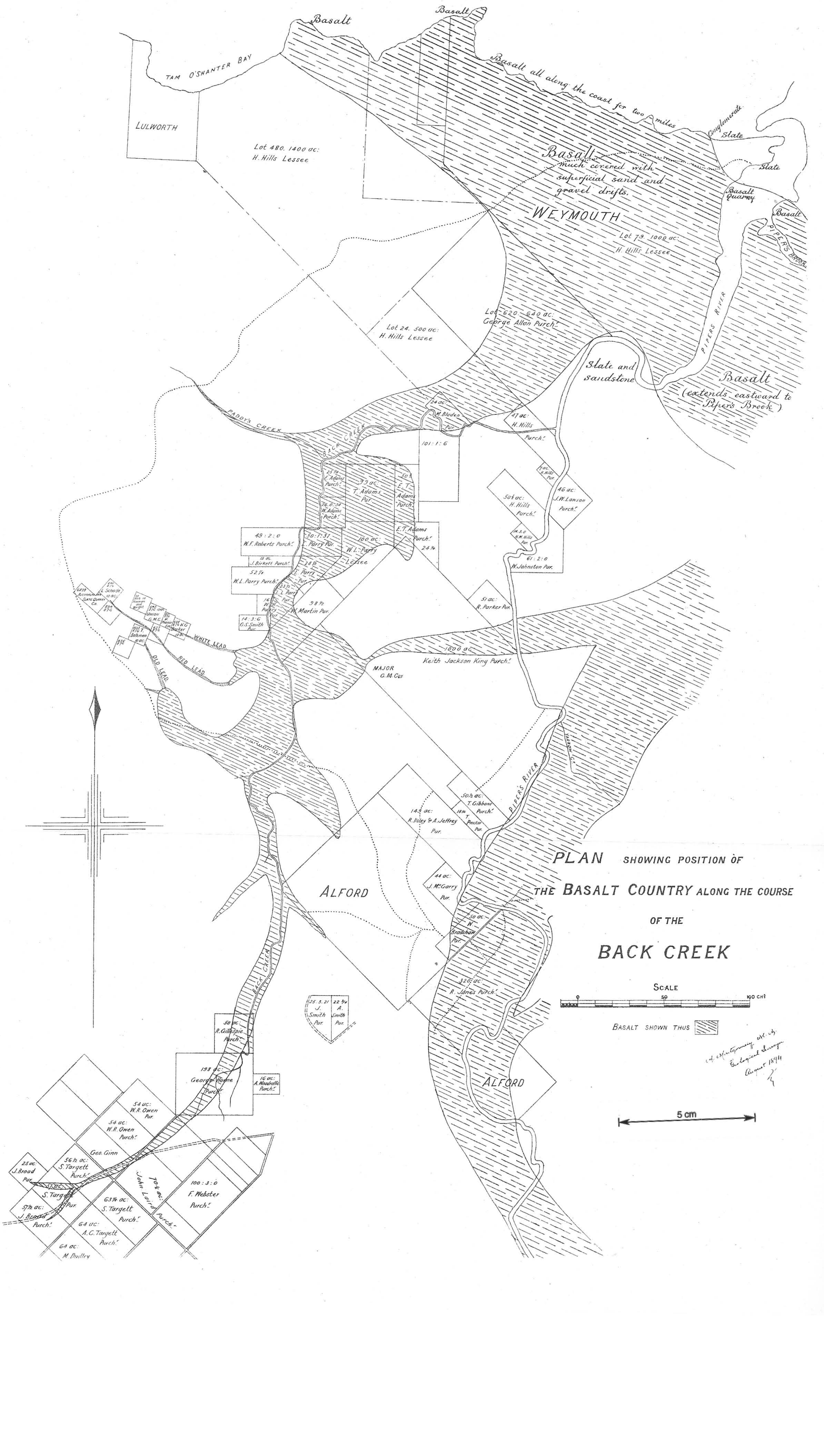
Never Mind Mine.—(Australasian Slate Quarry Company's Freehold, Lot 6879, 15 acres.) On the opposite side of the head of the Red Lead gully are a number of shafts and workings belonging to the old Albion and present Never Mind mines. The most easterly shaft shown on the plan is the new one not long ago put down by the Never Mind Company: it is 100 feet deep. At the bottom a drive put in 15 feet to the southward cut some quartz near where the Albion reef was expected, but men familiar with the character of the stone say that it is not the same. The shaft was inaccessible at the time of my visit, so I am unable to give any opinion of my own on this point. The two shafts close together near the centre of the section were put down many years ago by the Albion Company: the more southerly is vertical for about 15 feet, then follows the

underlay of the reef on which it was sunk. This appears to have been very irregular, being vertical for about 15 feet at surface, then with an underlay to the north-east for some distance, then again vertical, and in the bottom of the shaft once more underlaying to the north-east. The more northerly shaft is a vertical one 100 feet deep which broke into the bottom of the underlay shaft. The reef as far as can now be learned ran a south-easterly course, and at times contained good gold, but appears to have been broken and irregular: it would probably be best to sink still deeper in the new shaft before making much search for it. To the north-west from the Albion shafts there is another old shaft, 70 feet deep, on a somewhat broken quartz vein running east and west: some gold is said to have been got in the surface workings for a short distance each side of the shaft. At the bottom of the shaft a drive was put in to the south 150 feet, and at 20 feet this cut a broken-up body of quartz without walls. From its position the gold-bearing reef found here on surface may have something to do with the run of auriferous veins seen in the Franklin eastern shaft.

New Hidden Treasure.—(Section 1022-87G). In the north-eastern portion of this section there are several old shafts in which gold-bearing stone is said to have been found: they were not able to be entered at the time of my visit. The reef is said to have been somewhat flat at surface and about three feet in thickness, running a more or less east and west course and underlaying to the north. The middle one of the three shafts marked on the plan as lying close together was the principal one: it was 45 feet deep. The quartz in it is said to have averaged from 6 to 8 inches in thickness, but been at times as much as 18 inches; it became thinner at each end when driven on. In the bottom of the shaft the stone was one foot thick, but barren. Seven tons from these workings yielded 28 oz. 18 dwts. of gold on crushing, or at the rate of 4 oz. 2 dwts. 14 grs. to the ton: the shoot of gold, however, appears to have been quite short. About 17 feet north-west of this shaft another one 40 feet deep was sunk to cut the reef on its underlay: some leaders and bunches of quartz were found, but no gold: a drive connects this with the main shaft. Fourteen feet to the south-east of the main shaft is another shaft sunk 45 feet, in which some bunches of quartz containing some gold were found: the water became so heavy in this that sinking had to be discontinued. The country sunk through in these three shafts was white clayey sandstone like that in the Union mine, but is more likely to be a parallel belt than the same one. Still another shaft has been sunk 59 feet south-east from the main shaft: its depth is about 22 feet: from the bottom drives were made both to north and south, about 50 feet in all: several leaders were cut, underlaying to the north, and containing occasional traces of gold. To the westward from the above workings several shafts have been put down, prospecting for the westward continuation of the reef, but without success: they show the belt of white sandstone to have a north-westerly course, with reddish shaly sandstone and slate on the western side of it. Some leaders running east and west, and with a little gold, were found in a shaft 18 feet deep lying about 160 feet north of the north-east corner of Section 635–87G.

Nearly two chains east of the Hidden Treasure shaft are some old workings on a small reef running N.E. and S.W. This was stoped from surface for from 12 to 15 feet in depth, and for a length of two chains. There was about 18 inches in thickness of broken rubbly quartz, 10 tons of which gave 25 ounces of gold on crushing, but going downwards the stone became barren. East of this place on the boundary of the section is an old shaft about 22 feet deep, in which leaders of quartz were found, but no gold, and about a chain further east again is another 25 feet deep, from which a drive went S. 20° E. some 40 or 50 feet: some quartz leaders were passed through, but no gold got. This shaft seems to be about the eastern side of the belt of white sandstone country, hard slate being found in the creek to the east of it. It would seem, then, that in the Hidden Treasure ground two small reefs have been found, both containing good gold at surface, one running about east and west, the other about N.E. and S.W. Though good stone was at first found in them, they appear to have become poor going downwards; still the workings have been only very shallow. It seems quite worth trying the ground at greater depth to see if the reefs improve in size and quality. The water, which prevented sinking by manual labour alone, would probably be easily overcome by a small engine.

Sections 157-87G *and* 190-87G.—In these we find a large number of old shafts, close to the head of the Old Lead, which belonged in past years to the Lady Emily, All Nations, and Moonlight mines. Most of these shafts are in white sandstone country, like that in the Hidden Treasure and Union mines. The shaft furthest west on the plan in Section 157-87G is one of the old Lady Emily shafts, sunk in white sandstone; it does not appear to have struck the reef. East of it a little more than a chain is another of the same Company's shafts, 50 feet deep, on a reef 18 inches to two feet wide, running apparently easterly, and underlaying north. This was followed some 25 or 30 feet to the westward, and 55 to 50 feet eastward, but though some gold was found it was not payable. The same reef is again cut in the All Nations shaft, which lies about 40 feet south-east from the S.E. corner of section 1022-87G, and in another one about a chain south-east from it. The latter is some 22 feet deep, in soft whitish sandy slate; the reef in it was about 12 inches thick, but barren. The All Nations shaft was 60 feet deep, in soft micaceous sandy slate. A cross-cut was put in 30 feet to the southward and cut the reef, 18 inches thick, but with no gold. In this shaft there was a very heavy inflow of water, apparently from the north.



PLAN SHOWING POSITION OF THE BASALT COUNTRY ALONG THE COURSE OF THE BACK CREEK
Basalt
Tam O'Shanter Bay
Lulworth
Lot 480. 1400 ac: H. Hills Lessee
Basalt all along the coast for two miles
Conglomerate
Slate
Slate
Basalt much covered with superficial sand and gravel drifts.
Basalt Quarry
Basalt
Pipers Brook
Weymouth
Lot 79. 1000 ac: H. Hills Lessee
Lot 620. 640 ac: George Allan Purch.
Lot 24. 500 ac: H. Hills Lessee
Pipers River
Slate and sandstone
Basalt (extends eastward to Piper's Brook)
Paddy's Creek
Back Creek
24 ac: M. Bladen Pur.
47 ac: H. Hills Purch.
101 : 1 : 6
25 ¼ E. Adams Purch.
99 ac: T. Adams Pur.
E.T. Adams Purch.
76. 0. 34 W. Adams Purch.
E.T. Adams Purch. 24 ¾
49 : 2 : 0 W.F. Roberts Purch.
50 : 1 : 31 L. Parry Pur.
100 ac: W.L. Parry Lessee
15 ac J. Birkett Purch.
52 ¼ W.L. Parry Purch.
28 ½ L. Parry Pur.
23 ½ L. Parry Pur.
16 W.H. Parry Pur.
98 ½ W. Martin Pur.
14 : 3 : 6 G.S. Smith Pur.
7 ac. H. Hills Pur.
50 ¼ ac: H. Hills Purch.
46 ac: J.W. Lawson Purch.
14.3.0 H.W. Hills Pur.
61 : 2 : 0 W. Johnston Pur.
51 ac: R. Parker Pur.
Australasian Slate Quarry Co.
L. Schade 10 ac.
Hinman and Wright
Union G.M.C.
Phœnix
W.G. Barker 10 ac.
T. Bateman 10 ac.
White Lead
Red Lead
Old Lead
1000 ac: Keith Jackson King Purch.
Major G.M. Co.
Yarrow Ck.
Piper's River
50 ½ ac: T. Gibbons Purch.
18 ¾ T. Proctor Pur.
145 ac: R. Ilsley & A. Jeffrey Pur.
Alford
44 ac: J. McGarry Pur.
50 ac: W. Bradshaw Pur.
320 ac: R. James Purch.
Alford
25. 3. 21 J. Smith Pur.
22 ¾ A. Smith Pur.
50 ac: R. Gillespie Purch.
198 ac: George Horne Purch.
16 ac: A. Woodroffe Purch.
54 ac: W.R. Owen Pur.
54 ac: W.R. Owen Purch.
Geo. Ginn
25 ac: J. Broad Pur.
56 ½ ac: S. Targett Purch.
57 ac: S. Targett Pur.
57 ½ ac: J. Broad Purch.
63 ¼ ac: S. Targett Purch.
70 ¼ ac: John Laird Purch.
100 : 3 : 0 F. Webster Purch.
64 ac: A.C. Targett Purch.
64 ac: M. Dudley
Scale
0 50 100 CHS
Basalt shown thus
Geological Surveyor August 1894
5 cm

About a chain and a half from the north-east corner peg the eastern boundary of Section 157-87G is crossed by another line of reef, running about E.S.E., on which there are seven small shafts. Numbering these from west to east will serve to make the following particulars more easily understood:—No. 1, sunk 30 feet in bluish sandy slate; 15 feet driven to south, and 5 feet to north; reef a mass of small leaders. No. 2, about 30 feet deep; quartz 6 inches thick; no gold. No. 3, about 30 feet deep; reef split up; no gold. No. 4, 20 feet deep; quartz 12 inches; reef cut 12 feet from shaft; no gold in the stone, a trace in the rubble. No. 5, 20 feet deep; reef 2 feet, barren; drives put in 50 feet to north and 30 or 40 feet to south. No. 6, 25 feet deep, in white sandstone; reef 18 inches to 2 feet wide; no gold. No. 7, 25 feet deep, in white sandstone; quartz over a foot in thickness, poor or barren. In No. 7 shaft we have the intersection of this line of lode with a north-easterly one, the Moonlight reef; the latter is heaved about a foot by the passage through it of the easterly lode. To the south of the above seven shafts is another one, about 60 feet deep, in dark sandy slate. In this there is an east and west reef 3 feet wide at surface, but with no gold; at the bottom drives were made 40 feet north and 40 feet south. This reef is probably really part of the same line as the parallel vein to the north of it, and may also be connected with an east and west vein of stone 10 inches wide, which carries a trace of gold, found in a 25-feet shaft three chains further west. This vein, however, does not seem to have been cut in a shaft 30 feet deep, half a chain east of the last-named, or in the drive from it towards another 20 feet deep lying to the south.

The Moonlight line of reef has been traced about 200 feet to the south-west from the main whip-shaft, marked on the plan. This was 70 feet deep, and at the 60-feet level a crosscut was put in to the reef 20 feet, and this was followed for 60 feet. The reef consisted of about 18 inches of loose rubbly quartz and broken country rock, without gold. A good deal of water was met with, and proved troublesome. A little east of the whip-shaft a shaft went down 30 feet on the reef, and from this a drive went north 15 feet. Some very rich gold was got here, as much as 7 dwts. having been washed out in one dish of stuff, but there does not appear to have been any quantity of payable stone. Another east-and-west reef is said to come in at the bottom of this shaft. Between this point and the shaft above called No. 7 there is another shaft 40 feet deep on the reef, which is here 15 inches thick; no gold was found in the bottom, but there was a little at a depth of 20 feet. Going southward another reef running south-easterly is met with, and after passing through this the reef has not been further traced. The cross reef is barren, and runs some distance down the spur to the south-east as a large outcrop of quartz. It seems likely that this reef and the other cross-reef further north may be connected with the big barren reef seen on the top of the spur in Section 635-87G. It may be noted that the Moonlight reef, the eastern one of the Hidden Treasure reefs, the Franklin veins, and some of the Union leaders, all have a more or less north-easterly course. Kennet and Hackett's reef, next to be mentioned, and the Leura reef, also run between north-east and east, and it would therefore seem throughout the district that a strike between east and north-east is rather characteristic of the gold-bearing veins. The gold-bearing veins of the Lefroy district also mostly run much this same course.

Kennet and Hackett's Reef.—This crops out on the spur between the Leura and Piper roads, and a shaft was sunk on it many years ago to a depth of 34 feet. The size of the reef cannot be now seen, but from the stone thrown out it seems likely to be over a foot in thickness. A little gold is said to have been got in it, the stone being estimated to be worth 2 dwts. to the ton. Two or three trenches have been put across the line of the lode to the west of the shaft, and show it to have a north-easterly course, but really very little has been done on it. The stone is striated and laminated, and has many crystal cavities in it, very closely resembling the quartz from the Leura south reef. It is very unlikely, however, that the two are identical, as this one lies a good deal to the north of the Leura line.

Major Mine (formerly known as the Leura Mine).—To save verbal description a plan showing the surface workings of this mine is attached to this Report. The Major Gold Mining Company, No Liability, have secured a lease for mining purposes of two ten-acre sections of ground in Mr. Wm. Ritchie's freehold, lot 970. (This lot bears the name of Keith Jackson King, purchaser, 1000 acres, on the county map.) On the eastern one are the old workings of the Leura mine, which has been abandoned for many years past, but the recent richer stone found by the Major Company is on the western block. The old shafts at the east end of the main lode were mostly sunk for alluvial gold. The following notes give such particulars as I have been able to obtain about them:—

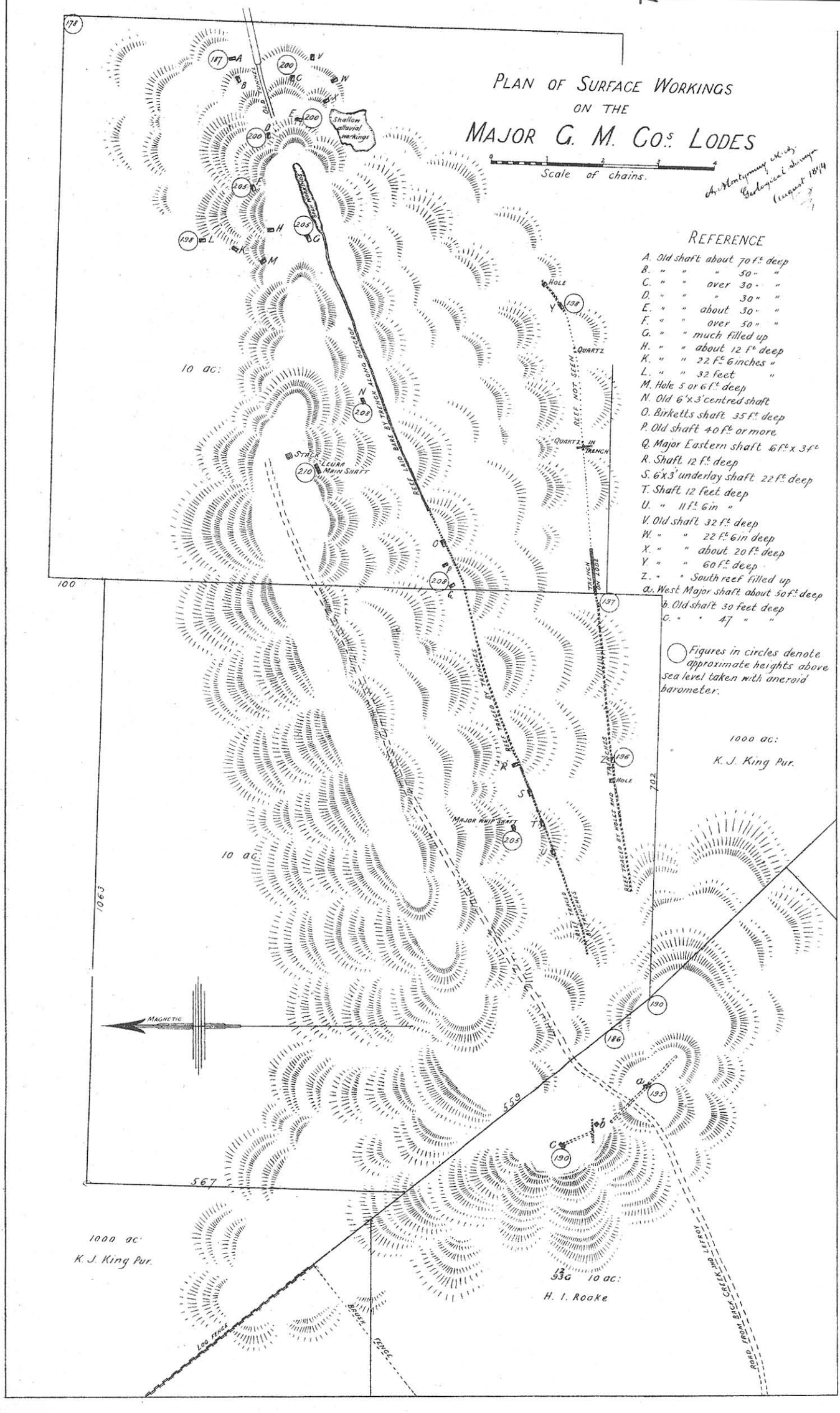
A. About 70 feet deep; white slate bottom; wash on slate bottom at about 50 feet, under basaltic clay.
B. About 50 feet deep to bottom of alluvial stuff; said to be about on the cap of the reef.
C. Alluvial stuff probably over 30 feet deep; bottom dipping to north-east, white slate; quartz conglomerate, as on Cardigan lead, lying about surface.
D. Alluvial shaft over 30 feet deep down to white slate bottom.
E. Said to be from four to five feet of wash-dirt in this shaft, including rich gold-bearing stone.

F. This is a deep old shaft, timbered, probably going down 50 or 60 feet; there is white slate on the tip, and also big blocks of quartz similar to that from the Leura reef, which has no doubt been cut by a cross-cut from the bottom.
G. Is a fairly deep shaft, from which fair dirt is said to have been worked.
H. About 12 feet deep, through basaltic clay; white slate bottom.
K. 22 feet 6 inches deep, mostly through basaltic clay. About 18 inches of cemented quartz rubble on the slate bottom, which gave 3 to 4 dwts. of gold to the ton on crushing.
L. 32 feet deep; similar to *k*.
M. A shallow shaft 6 feet deep; white slate bottom with a little angular quartz-wash upon it covered by basaltic clay.
V. About 32 feet deep, through alluvial matter.
W. About 23 feet deep, through alluvial matter; white slate bottom.
X. About 20 feet deep, through basaltic clay and wash.

The alluvial matter raised from the shafts was puddled, and some of the quartz from it also crushed. It seems pretty certain that all this quartz must have come from the adjacent reef. Close to Shaft G there were some open workings in the alluvial right on the outcrop of the lode; the stuff from these and from E was taken through the old tunnel shown on the plan by a tramway to the puddling machines. There seems a good deal of reason for hoping that in the bottom of the sub-basaltic channel to the north-east of all these alluvial workings some good alluvial gold should be found.

From the open workings the outcrop of the main lode has been followed westward by a trench along it nearly to the boundary of the section, and then further traced through the next section by a number of shafts and trenches. It is said also to have lately been found in the adjoining section, 12-93G, just south of the shaft marked *b* on the plan. There is also, as shown on the plan, another reef, the south reef, which towards the west seems likely to unite with the main one. It has not been traced very far into the east section with any certainty, but it seems likely that the quartz reef seen in Shaft T belongs to it, in which case the lode would appear to have a tendency to run back towards the north reef at this end. In the alluvial workings the main reef is said to have shown two branches, diverging to the westward.

I have not been able to get any good information as to the work done by the old Leura Company. Mr. P. C. Rasmussen in a private report to the shareholders of the Major P.A., which has been kindly placed at my disposal by Mr. W. G. Barker, says that he found good gold going west in the old whip-shaft (N on plan), that this shaft was 50 feet deep, and that a drive was made from it along the reef for 147 feet west, from which it was stoped to surface, and "all proved payable." The main shaft was 100 feet deep, and a cross-cut from it reached the reef, but I have not been able to ascertain what work was done on this. Mr. Rasmussen avers that no stone was taken to the battery from this level, but that he himself saw gold in the solid quartz and got gold by hand-crushing. Others who saw the lode have told me that it contained some gold, and ought to have been more thoroughly tested. While we cannot place much reliance on such hearsay evidence, there is reason to believe that the mine was abandoned prematurely. Within the last two years some very promising discoveries have been made on this reef to the west of the Leura workings. The shaft marked Q on plan yielded some good golden stone, 9 tons returning gold at the rate of 3 oz. 8 dwts. to the ton. From here to the shaft R a little gold may be got where the reef is cut by trenches, but there does not appear to be much stone. In R the reef is 14 inches wide, but rather poor, and underlays to the north. From this shaft to the next one, S, most of the ground has been stoped out, and a crushing of 2 tons gave 7 ounces to the ton. S is an underlay shaft, 22 feet deep, from the bottom of which the reef had been driven on 20 feet to the eastward and 28 feet to the westward at the time of my visit. In this level the quartz vein is small, averaging from 4 to 6 inches in thickness: it is laminated and often much striated, the striations running almost horizontally instead of vertically, as is more usual. This is a very peculiar feature of this reef, both here and in the next shaft, T, where the reef is again sunk on to a depth of 12 feet, and is a little larger. In both shafts there was excellent gold-bearing quartz, the gold being both through the solid stone and in seams along the planes of lamination. Very good prospects could be got from the stuff extracted, and numerous very fine specimens had been picked out during the progress of the work. One dish of stuff from the heap gave me quite half an ounce of gold on washing, some of the pieces of metal being very coarse in size. Since my visit Mr. Barker informs me that 2 tons of the stuff taken from shaft T, which is now rather deeper than when I saw it, yielded on crushing, 18 ozs. 15 dwts. of gold, or at the rate of 9 ozs. 7½ dwts. to the ton. The gold sells for 82*s*. 6*d*. to 83*s*. an ounce, being therefore of very high quality. North of shaft T is a whip-shaft, 56 feet feet deep, from which a cross-cut has been made to the reef at the 50-feet level. Here the lode is larger, being from 2 feet to 2 feet 6 inches thick at the eastern end. The amount of water met with prevented much work being done, and the reef was followed for only some 30 feet or so. 30 tons of stone from it yielded gold at the rate of 19 dwts. to the ton on crushing. The shaft being full of water I did not see the workings, but was informed that some very rich gold-bearing stone was still in sight when work stopped. To the west of shaft T is another shallow one, marked U on


5 cm
PLAN OF SURFACE WORKINGS
ON THE
MAJOR G. M. Co.s LODES
Scale of chains.
A. Montgomery del. &
Geological Survey
August 1914
REFERENCE
A. Old shaft about 70 f.t deep
B. " " 50 " "
C. " " over 30 " "
D. " " " 30 " "
E. " " about 30 " "
F. " " over 50 " "
G. " " much filled up
H. " " about 12 f.t deep
K. " " 22 f.t 6 inches "
L. " " 32 feet "
M. Hole 5 or 6 f.t deep
N. Old 6'x3' centred shaft
O. Birketts shaft 35 f.t deep
P. Old shaft 40 f.t or more
Q. Major Eastern shaft 6 f.t x 3 f.t
R. Shaft 12 f.t deep
S. 6'x3' underlay shaft 22 f.t deep
T. Shaft 12 feet deep
U. " 11 f.t 6 in "
V. Old shaft 32 f.t deep
W. " " 22 f.t 6 in deep
X. " " about 20 f.t deep
Y. " " 60 f.t deep
Z. " " South reef filled up
a. West Major shaft about 50 f.t deep
b. Old shaft 30 feet deep
c. " " 47 " "
Figures in circles denote approximate heights above sea level taken with aneroid barometer.
Shallow alluvial workings
REEF LAID BARE BY TRENCH ALONG OUTCROP
REEF TRACED BY TRENCHES
REEF NOT SEEN
QUARTZ
QUARTZ IN TRENCH
HOLE
STRUCTURE
ILURA MAIN SHAFT
MAJOR KNIP SHAFT
MAGNETIC
10 ac:
1000 ac:
K. J. King Pur.
H. I. Rooke
LOG FENCE
ROAD FROM BACK CREEK TO LEEROY
100
1063
567
559
702

plan, in which the reef is again seen, still small, and westward of this it has been traced a considerable distance by trenches, with a little gold in it all along.

The south reef, where seen in the eastern section at shaft T, appears to be a big body of stone over two feet in width, showing laminated structure and striations like the quartz of the main reef, and also containing numerous crystal cavities. The shaft is said by Mr. Rasmussen to be 60 feet deep, and he states that the stone "all carries gold more or less, but not any of it was ever taken to the battery," from which we may infer that it was not at all rich. In the western section this reef has been traced a good distance by trenches and holes, in which some nice looking quartz occasionally showing gold, is to be seen. A prospecting dishful of the stuff from an old shaft (Z on plan), gave me a nice prospect of gold on washing.

In the adjoining West Major Company's section, 12-93G, we find a main shaft 50 feet deep, (*a* on plan), from which drives have been put in 50 feet to the south-east and 60 feet to the north-west without cutting the reef. To the north-west of this are an old 30 feet shaft, *b*, now filled up, and another, *c*, 47 feet deep, from which a cross-cut has been put in to the south-east. At the end of this drive a reef of quartz 15 inches thick was cut and driven on for about six feet: it contained gold, but not payable, and had an underlay to the south, that is in the opposite direction to the Major reef, which always underlays to the north. Since my visit I have been informed that the small space between the ends of the cross-cuts from shafts *a* and *c* has been cut through and the main reef found in it containing payable gold. The reef must bend to the northward from where it is last seen in the Major ground to get to this place, the cause of the deviation probably being a hard belt of blue slate in which shaft *a* is sunk. It seems likely that the north and south reefs of the Major have run together before getting to these workings.

According to the information given to me, 42 tons in all have been crushed from different portions of the Major workings for a yield of 85 ozs. 9 dwts. of gold, or, say an average of 2 ounces to the ton. Though the reef is small at surface it seems to be widening out going downwards, and in the east end, in the Leura workings, it is a fair size. Very good stone has been got in shafts T. and S., and in shaft Q, while good quartz is reported from the West Major workings, shaft Z. on the south reef, and the whip-shaft, also from the old whip-shaft of the Leura, N. The gold in the alluvial workings at the east end makes it probable that there is another auriferous shoot in the reef in this direction also. Gold having been traced over such a distance along the strike of the reef there is every expectation that, when opened up extensively, numerous gold-bearing shoots will be found in it, and if these are nearly as good as the parts crushed by the Major Company the mine should have a very successful future. The reef as shown on the plan preserves a fairly straight well defined course, and cuts across the strata of the country, so there is a great likelihood of its proving a permanent fissure in depth. With the exception of some hardish blue slate seen in the old Leura tips and the hard belt existing in the West Major shaft the country is soft and "kindly" for the existence of the reef. Both north and south reefs deserve attention, and in my opinion there is very great hope that both will prove valuable mines. As there is a good deal of water to be overcome, as seen in the Leura main shaft and Major whip-shaft, it will be necessary to sink a new main engine shaft in order to work the lodes to advantage; the water raised from the mine will probably be all required for the battery.

The laminated quartz found in this mine is noteworthy from the point of view of the student of mineral deposits and their mode of formation. The reef is often made up of a number of small curved and corrugated slabs of quartz,—the ridges of one piece fitting into the hollows of the next one. The surfaces of the slabs are much smoothed and striated, but both the striations and the main corrugations of the slabs lie horizontally in the reef. A downward movement of either wall of the fissure could not produce these markings,—on the contrary, it would obliterate them, and tend to shear off the interlocking corrugations. The disposition of the stone may be compared to that of the sheets of corrugated iron as packed for transport,—the case being supposed to rest on its longer edge. On the theory of the striations having been produced by movement of the walls, it would be necessary to suppose that there had been a movement in a horizontal plane. At present it is best to wait for more light to be thrown on the subject by future mining work than to attempt an explanation.

Having now described the various reefs that have been found throughout the Back Creek district, we may revert to the question as to whether they account for the gold found in the leads, or whether it is likely that the main sources of this are yet undiscovered. Though the Union, Franklin, Never Mind, and Hidden Treasure reefs are much broken and irregular, it is possible that higher portions of them now worn away were richer than those we see, and that they may have supplied most of the gold. We do not, however, know of any reef from which the Cardigan lead might have been fed. It seems to me most probable that there are many gold-bearing reefs yet to be discovered, and that those at present known are not likely to be the main sources of the gold. From what is known of the gold-bearing veins along the courses of the leads there is a certain amount of fear that the unknown veins will prove to be similar irregular bunches of auriferous leaders, very rich in parts, but often dying out in quite short distances: a great deal of gold might

be shed from such veins. The example of the Major reef, however, encourages us to hope for more defined lines of lode to be yet discovered, and though, with all the work that has been done on the field, it might seem difficult for any extensive lode to have remained hidden, still numerous instances are on record which show this to be quite possible. Continued prospecting of the gold-field is therefore to be recommended. If the deep leads ever come to be extensively worked there is much hope that, as at Ballarat, auriferous veins will be found in the bedrock beneath the wash.

Strike of Strata.—The beds of the Silurian country rock throughout the gold-field consist of slates and sandstones varying in colour and hardness. It is probable that it will be found that some of the strata are more favourable for gold than others, and consequently it becomes a matter of some importance to the miner to know the direction in which the various belts of country are running. This is not so easily made out as usual, for the strata, especially the slates, show very frequently a distinct lamination, probably the result of former crust-pressures, along approximately horizontal planes, whereby the original bedding planes are obliterated. The strata therefore appear at first sight to be lying almost horizontal, a feature also seen in the Lefroy field. On the coast at the mouth of the River Piper, and in the splendid section afforded by the Australasian Slate Quarry, however, it is clearly seen that the lamination is transverse to the true stratification, and that the strata really are inclined at high angles of dip. In the exposure on the sea beach to the west of the Piper mouth the strata are seen to vary somewhat in their strike, but average about N. 52° W. and dip to the N.E.: in the Australasian Slate Quarry they run N. 40° to 55° W. and dip N.E. about 55°: and on the east side of the Piper River Mr. Gould has marked on his map the strike N. 35° W. On the whole, therefore, the strata of the Silurian formation may be taken as striking N.W. and S.E. in this part of the country. This is much the same as the strike of the auriferous series at Beaconsfield. The principal spurs on the Back Creek field run south-easterly from the main range, and probably indicate the outcrops of harder belts of country: the spur in which the slate quarry is situated, for example, may be traced south-easterly through Section 918-87G in which is an old tunnel made for getting slate, and down between the Red and White Leads. The ridge to the north of the White Lead also seems to be hard slate, and it seems quite possible that the hard country in the West Major shaft is part of the same belt. In the excavation on the Old Lead the stratification is very indistinctly seen, but is to the west of north somewhat. The belts of soft white sandstone country that have hitherto proved the most favourable for gold throughout the field may therefore be expected to run a more or less north-west and south-east course.

Australasian Slate Quarry.—No description of the Back Creek district would be complete without some mention of this quarry, though no work has been done in it for many years. It is a huge excavation, and is shown to scale on the plan, and all round it the ground is covered with the spoil banks where the waste material has been tipped. The best slate appears to have been confined to one or two comparatively thin beds, dipping at an angle of about 55°, consequently a great deal of useless rock had to be removed to get at it. In the bottom of the quarry underground mining was resorted to, but a great slip of the hanging wall covered up the workings, and operations have never been resumed. A very large capital was sunk in opening this quarry, making a tramway to Tam o' Shanter Bay, and constructing a jetty there, but the enterprise never became profitable, the slate costing more to raise than it was worth. The slates obtained were of very fair quality, dressing and working well, but the larger ones show a tendency to curve, and are somewhat twisted, which is a serious defect. It seems just possible that by underground mining, the slate in the best beds could be extracted at a less cost than by open working, but in the absence of figures as to percentage of marketable slate obtainable from a given mass of the rock, I can express no opinion as to whether it is likely that work could ever be profitably resumed. The fact that good slate has been found in the district should, however, be borne in mind, as it is quite possible that someone may yet discover it under more favourable conditions for working.

In the old quarry tunnel in Section 918–87G there is a good deal of sulphate of copper found as incrustations on the walls, and seams and veins of copper pyrites are said to have been cut through while driving it. Mr. Thureau also figures a section in the main quarry showing nodules of copper pyrites.

Another interesting mineral occurrence at this quarry is that of the mineral *Wavellite* (phosphate of alumina), which is found in radiated bunches in some of the joints of the slate.

Basalt Quarry.—Near the mouth of the Piper River a quarry has been opened in the basalt rock, and some very fair stone obtained. The place is not very easy of access, or this stone would most likely be used a good deal for building and paving purposes.

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

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

The Secretary of Mines, Hobart.

WILLIAM GRAHAME, JUN.,
GOVERNMENT PRINTER, TASMANIA.