

THE
MINERAL RESOURCES

OF

TASMANIA:

BY

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GEOLOGICAL SURVEYOR FOR TASMANIA,

BY ORDER OF

THE HONORABLE ALFRED T. PILLINGER,

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THE Mineral Industry of Tasmania, though yet far from being well developed, is one of its most important sources of wealth, and bids fair to increase in importance as the wilder and more inaccessible portions of the country become opened up by settlement. A great extent of mineral country still remains practically unexplored, and even the best-known fields cannot be said to be thoroughly tested, so there is every reason to believe that with progress of time there will be numerous new mineral discoveries, and a great extension of the mining industry. A very large proportion of the total area of the Colony is made up of likely mineral-bearing formation, in which every here and there valuable discoveries have already been made. The distribution of these is best seen by looking at the geological map of the country. This shows a wide strip, averaging over 50 miles in breadth, lying parallel with the West Coast, composed almost entirely of Archæan and older Palæozoic rocks, often penetrated by granite and serpentine igneous intrusions, a conjunction of older sedimentary and plutonic formations, which has all the world over proved most favourable for deposits of metallic minerals. Along the North Coast the same formations are seen, but are a great deal covered over by more recent ones; but they again are largely developed in the important North-eastern mineral district. A narrow strip of the older rocks, with granite associated, also runs down the East Coast through Freycinet Peninsula and Maria Island. The central and eastern parts of the Colony are not rich in metallic minerals, being mostly occupied by Permo-carboniferous and Mesozoic strata, which form the coal-measures of this country, and by intrusive volcanic dykes and sheets of diabase greenstone or gabbro of Mesozoic Age. Though unimportant as sources of metallic ores, these formations supply coal, fireclay, freestone, limestone, hydraulic limestone, bluestone for building purposes, concrete, road-metal, and brick-clay. Besides the above, there are also Tertiary and recent formations, which are sources of minerals consisting of sand and gravel deposits of lacustrine and fluvial origin, which in parts contain valuable alluvial deposits of gold and tin ore. Beds of brick-clay and lignite are also found in these strata, which are frequently overlaid by basalts of Tertiary age, which furnish building stone and road-metal, and are of great importance to the agriculturist, as the richest land in the Colony is the brown chocolate soil, resulting from their decomposition.

The value of the Mineral Industry to the Colony is well shown by the following Table, which shows the proportion of the value of the mineral and metal exports to the total exports, for the last Seven years:—

	Per cent.
1888	42·44
1889	33·08
1890	30·38
1891	37·89
1892	38·60
1893	44·46
1894 (first nine months)	49·95
Mean	39·54

The rapid increase in the relative importance of the Mineral Industry since 1890 is seen from this to be very marked.

For its area and population, Tasmania is one of the largest producers of metals and minerals of all the Colonies of Australasia, standing third as production per head of population, and second as to the value yielded in proportion to area. The following Table shows the relation of area and population to value of mineral production in these Colonies, during the years 1888 to 1892, later figures being not yet available:—

	Area, Sq. Miles.	Relative Size.	Mean Annual Population, 1888-92.	Mean Annual Population per 100 sq. miles, 1888-92.	Mean Annual Value of Mineral Products.	Annual Mineral Production per head of Population.	Annual Mineral Production per 100 sq. miles.
					£	£	£
Tasmania	26,215	1	144,600	552	505,881	3·5	1929·7
Victoria	87,884	3½	1,114,891	1268	2,461,825*	2·21	2802·3
New Zealand	104,471	4	621,979	505	1,651,313	2·65	1580·6
New South Wales	310,700	12	1,105,756	356	5,180,972	4·7	1667·5
Queensland	668,497	25½	401,913	60	2,507,832*	6·24	375·1
South Australia	903,690	34	313,386	35	302,308*	1·18	412·3
Western Australia	1,060,000	40	47,673	4½	134,244*	2·86	12·7

* Mean of years 1889-92 only, figures for 1888 not being at hand.

During the past two years the mineral production of Tasmania has increased very considerably, the value for the year 1892-3 being £678,622, and for 1893-4, £707,820, as against £505,881 for the period 1888-92 shown in the above table, the present production being about £2700 per 100 square miles of area, or very nearly equal to that of Victoria. The advance is due to an increased production of gold and to a very great expansion of the silver-lead production of the West Coast district, and is the more noteworthy as it has been made in spite of the great fall in the prices of silver and tin, and a considerable falling off in the value of the latter produced.

As will be seen from the tables quoted below, tin has been the metal which has brought in the largest return to the Colony, gold and coal being next in importance. Silver-lead, is, however, now becoming of more consequence than either gold or coal, and bids fair to rival tin, while copper, though not yet exported in large quantity, should before long figure prominently in the returns. Bismuth and nickel also are likely to be of importance.

GOLD.

Gold has been found in Tasmania more or less in all the districts where the older Palæozoic formations occur, especially the Lower Silurian. The Beaconsfield, Lefroy, Mathinna, Mount Victoria, Mount Horror, and Gladstone fields are all referred to the Lower Silurian System, and in all probability in the greater part of the West Coast goldfield, the parent reefs from which alluvial gold has been derived, are also in rocks of this age, but the Queen River field and those at Middlesex and Bell Mount seem rather to be of Upper Silurian formation. Much, however, has still to be learned as to the stratigraphical relations of the West Coast rocks. At the Lisle and Golconda fields gold is found in veins in an intrusive granite, which has burst through the Lower Silurian series, and in certain parts of the West Coast Range there is a little gold in tuffaceous deposits of volcanic origin, but as a rule the igneous rocks have not yet proved favourable matrices of the precious metal in this Colony. The following table, from the "Tasmanian Official Record, 1892," shows the principal localities where gold has been mined and their relative importance as producers:—

GOLD Produced in the various Mining Districts of Tasmania between 1866 and 1890.

District.	Gold.			Per cent. to Total.
	Alluvial.	Quartz.	Total.	
	oz.	oz.	oz.	
Beaconsfield	33,896	296,634	330,530	56·15
Lefroy and Back Creek	9378	85,093	94,471	16·05
Lisle	74,760	...	74,760	12·70
Fingal, Mangana, and Mathinna	9261	29,088	38,349	6·52
West Coast	26,907	3180	30,087	5·11
Mount Victoria	10,031	10,031	1·71
Denison, Golconda	535	3242	3777	·64
Other places, including Gladstone, Hellyer, Minnows, Forth, and Cam Rivers, Branxholm, &c.	4374	2246	6620	1·12
	159,111	429,514	588,625	...
Per cent. to Total	27·03	72·97	...	100·0

The Beaconsfield field is situated in the County of Devon, on the west side of the estuary of the Tamar. The alluvial ground has not been much worked of late years, the shallower parts having been pretty well worked out. It has been shown, however, by shafts and borings, that a "deep lead" runs along the foot of the eastern slope of the Cabbage Tree Hill at a depth as much as 375 feet below the surface or about 270 feet below sea-level. From its position with regard to the auriferous reefs of the district, and the fact that gold has been found on the bedrock on the slopes of the old valley, it is hoped, with much reason, that this lead will be a valuable one when opened up. The Ballarat Gold Mining Company have lately sunk a shaft, and driven under the gutter, but were unable, through financial difficulties, to go on with the work. Some years ago a good deal of gold was got on a false bottom about 112 feet below the surface, consisting of black clay, with much ligneous matter and numerous impressions of leaves and fruits, from which the age of the lead has been determined as probably Miocene. Four or five miles from Beaconsfield the Salisbury Hydraulic Gold Mining Company have recently begun hydraulic sluicing a deposit of auriferous "wash," which probably is portion of this old lead. This deep lead is one of the many in Tasmania which are well worth testing by mining, but require a considerable amount of money for their proper development, which has hitherto not been forthcoming.

The principal mine at Beaconsfield is the one owned by The Tasmania Gold Mining and Quartz Crushing Company Registered, which has been a wonderfully good producer of gold. Since June, 1877, when the reef was first discovered, to June 30th, 1894, 246,886 tons of quartz have been crushed from it for a yield of 314,987 ounces of gold, of value £1,131,829, which is an average of 1 oz. 5 dwts. 12 grs. per ton of quartz, or by value £4 11s. 9d. a ton, an unusually high average over such a large quantity of stone. The mine has experienced great trouble with water, heavy influxes of which have been very frequent, and has lately been provided with one of the most powerful pumping plants in the Australasian Colonies at a cost, erected complete, of £35,739 3s. 4d. The engine is a compound tandem condensing one, with cylinders 45 inches and 72 inches in diameter, and stroke of 10 feet, supplied with steam from four Galloway boilers, each 26 feet long and 7½ feet diameter. It works two 24-inch plungers, which, at 4½ strokes a minute (the average speed for the first half of 1894), throw about 96,600 gallons of water per hour. The main shaft is 730 feet deep. For crushing purposes there are two batteries, one of 65 heads of stamps at the Middle Arm of the Tamar, connected with the mine by a tramway, and the other of 40 heads at the mine. It is proposed shortly to erect a Lührig concentrating plant to treat the pyrites which has become plentiful in the stone at the lower levels. This fine mine is as yet only worked but little below the 500 feet level, and as it has a long length of known gold-bearing stone below the worked-out portions, and the reef is a strong and rich body

where cut in the 600 and 718 feet levels, a further great production of gold may be confidently expected from it. During the year 1893-4 very little stone was crushed, work being suspended in the mine till the lower levels from the new main shaft were opened, but since the resumption of crushing on 14th April, 1894, up to October 6th, 1894, 4032 tons have been reduced for a yield of 8755 ounces of gold, an average over 2 ozs. 3 dwts. per ton, exclusive of what is contained in a quantity of pyrites yet to be treated, which shows that the stone now being obtained from the lowest levels is not lower but rather higher in value than that from the upper parts of the mine.

Of the other mines at Beaconsfield, the Little Wonder, Moonlight, and Amalgamated West Tasmania mines have been considerable producers of gold, but at the present time are not at all successful in their operations.

The Lefroy field is situated in the County of Dorset, about six miles east of George Town. The Back Creek field is some five or six miles still further east. A considerable amount of alluvial gold has been got in shallow workings on both fields, but as yet no work has been done to prove the large areas of deep alluvial ground existing in both. A "deep lead," the bottom of which near its outlet must be considerably below sea-level, runs along the course of the Back Creek Valley, and another similar one crosses the reefs of the Lefroy field. Borings with diamond drills have shown these deep gutters to exist, and the East Pinafore Company have done some work on one of the branch leads which feed the main channel, but so far they have not had a proper mining trial though well worth attention.

The reefs at Lefroy are generally roughly parallel to one another, and run, roughly, east and west. The Chums, Pinafore, Native Youth, and Volunteer lines have all yielded a good deal of gold, but so far the deeper levels have not been remunerative on this field. Exploration of the reefs at still deeper levels is probably all that is required to find the gold again. The above table, giving the production of the district to the end of 1890, includes the bulk of the gold from the older mines, the New Chum, West New Chum, East New Chum, New Native Youth, Unity, City of Launceston, New Golden Point, and Land o' Cakes, but includes very little of the yield of the mines now actively at work. Of these the New Pinafore has produced from November, 1890, to August, 1894, 37,302 oz. 11 dwts. of gold from 40,407 tons of stone, and paid in dividends, £69,500; the West Pinafore from August, 1891, to May, 1894, has given 4279 oz. 17 dwts. 16 grs. from 5889 tons of quartz; and the Volunteer from March, 1892, to September, 1894, has yielded 16,204 ounces from 5963 tons, and paid dividends amounting to £19,375. A great deal of prospecting is going on in the district, and several promising reefs are being tested, so there is much hope of valuable new discoveries being made.

The Lisle field is situated on the north-east slope of Mount Arthur, County of Dorset. It has yielded a large quantity of alluvial gold, and still continues to put out a little, though there are now only a few men

at work on it. Considerable quantities of terrace gravels remain still untouched which would pay for working by hydraulic sluicing, but there is a good deal of difficulty in getting an adequate supply of water. This field is by no means worked out, and will very likely yet be a considerable source of gold. No reefs of size sufficient to account for the large quantities of alluvial gold that have been found have yet been discovered.

The Denison and Golconda fields are a few miles to the north of Lisle, but are at present unimportant. The presence of gold in reefs, in granite, at Golconda is noteworthy: the granite is the same as that forming the bed-rock under the alluvial gravels at Lisle.

The Beaconsfield, Lefroy, and Denison goldfields are practically all portions of one auriferous area, which is separated from another which contains the Waterhouse, Gladstone, Mount Horror, Branxholm, Mount Victoria, Scamander, Mathinna, and Mangana fields, by the granitic area round Scottsdale. In these there has not been much alluvial gold found, though some has been got at Mangana, Mathinna, and Mount Horror. It is probable that the deep alluvial gravels of the South Esk River may contain considerable amounts of gold; and near Mount Horror and Branxholm there are also signs of deep leads. The reefs of the Waterhouse, Branxholm, Mount Victoria, and Upper Scamander districts are characterised by having a large per-centage of arsenical pyrites in the stone, which renders it rather difficult to save the gold in an ordinary battery. Greater attention should be given to saving the rich sulphurets than is now usual. The Mathinna field is at present the principal one of the above-named, its reputation depending mainly on one mine, the New Golden Gate, though the old City of Hobart, Black Boy, White Boy, Eldorado, and several other mines have also produced a good deal of gold from time to time. The New Golden Gate mine has since 1889, up to the end of July, 1894, crushed 52,932 tons of quartz for 48,674 ounces of gold, worth £174,616. Dividends have been paid to the amount of £64,400. The main shaft is 823 feet deep,—the deepest in the Colony,—and it is intended shortly to sink it to 1000 feet. The mine has a large body of quartz, especially at the junction of its two reefs, where the stone is taken out as much as thirty feet in width at times. (Up to October 19th, 1894, the production of this mine has been 51,511 ounces, from 56,267 tons of quartz, equal to a value of £185,034 8s. 1d.) A winding plant capable of sinking to 3000 feet is on the mine, and there is a good 30-head battery, with an excellent equipment of Frue Vanners for concentrating the pyrites from the tailings, and lighted by electricity.

The West Coast goldfield comprises a large number of disconnected auriferous areas at intervals along the belt of older Palæozoic rocks, which forms the western side of the Island. The basin of the King River and its tributaries has yielded a great deal of gold, nearly every creek being more or less auriferous, and the ground being generally shallow, it has been easily gone over by diggers. A good many men still make a living in the creeks, and it is probable that as the dense bush becomes better opened up by tracks a good deal of new ground

will be tried. In the upper part of the King River there are some flats which require capital for working which have not been able to be worked by diggers, and will require hydraulic elevators and high-pressure supplies of water. Several reefs carrying gold have been found in this field,—at Lynchford, Guilfoyle Creek, Princess River, Woody Hill, and the Howard Plains,—and though operations hitherto have not met with much success, there are good grounds for hoping that some of them will yet come to the front. The Mount Lyell mines are also in the King River goldfield area, but will be discussed more fully under the heading of Copper Mines. The outcrop of the Mount Lyell mine was at first worked as a gold mine, containing by assay over an ounce of gold to the ton, and a good deal of the alluvial gold in the Linda Creek has probably been derived from this and similar pyrites bodies.

The basin of the Pieman River is likewise auriferous in many parts. The Ring River, which runs from Mount Reid into it, has within the last four years yielded a good amount of gold; the shallow parts seem now pretty well worked out, but there is a "deep lead" still to be opened up, which promises well. This river heads from Mount Reid, where gold has been found in a deposit of iron and copper pyrites, galena and blende, with silver ores. Further north, on the lower slopes of Mount Murchison, somewhat similar deposits containing gold have also been found. The upper branches of the Pieman River have not yet been proved payably auriferous, most of the gold having been found to the west of Mount Murchison. A little has been obtained between the Huskisson and Macintosh Rivers, but the main goldfield lies south and west of the Meredith Range. Here we find terraces of alluvial gravel at a height of 750 feet, and more above the Pieman River extending from the Lucy and Nancy Creeks northwards to Brown's Plain and the Long Plain. These are cut through and often effaced by the deep gorges of the Rocky River, Whyte River, and their tributaries, which have sluiced away and re-arranged at lower levels much of the older high-terrace gravels. The Donaldson and Savage Rivers have also similar high and lower terraces along their courses. Between the Savage and Whyte Rivers there are very large accumulations of auriferous gravels, which are now about to be worked by hydraulic sluicing. All the rivers and creeks about this district have been worked year after year by diggers with considerable success, but when hydraulic sluicing becomes firmly established the output of gold from the district will far exceed anything yet obtained. This bids fair to be a very important alluvial goldfield. As yet no reefs of any consequence have been discovered in the district, though, doubtless, they will be laid bare as the gravels are swept off the bed-rock by hydraulicicking. The heaviest nuggets of gold found in the Colony were got in the Rocky River in 1883, two weighing 243 ounces and 143 ounces respectively.

The same auriferous belt of country appears to crop out again in the Hellyer, Inglis, and Cam River Fields, where also there are said to be considerable quantities of deep alluvial gravels likely to be worth working.

A little gold has been got in the Middlesex and Bell Mount Fields between the Wilmot and Forth Rivers, some of the Bell Mount gold being in fairly large nuggets. This district has been but little prospected as yet and seems likely to increase in importance.

The gold fields of the Colony are really yet quite in the first stages of their development, and will increase in production as they become more thoroughly and systematically worked. The deep leads of Beaconsfield, Lefroy, Back Creek, the Ring River, and the Corinna district are practically untouched, and the extensive gravel banks of the Whyte and Savage River districts are waiting for treatment by hydraulic sluicing, while in the reefing districts but few of the mines have yet gone to a greater depth than 200 feet. We are therefore justified in expecting a great development in the gold-mining industry in the future, as the numerous untried deposits come into productiveness. The following table shows the yield of gold from the Colony, as far as can be ascertained, but it is notorious that much of the gold obtained by the alluvial diggers has been taken by them to Victoria and sold there without ever being recorded as produce of this country.

PRODUCTION OF GOLD IN TASMANIA.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Ounces.	£		Ounces.	£
* Previous to 1867 ...	843	2708	1881	56,693	216,901
1867 ...	1363	4382	1882	49,122	187,337
1868 ...	692	2536	1883	46,578	176,442
1869 ...	137	514	1884	42,340	160,404
1870 ...	964	3666	1885	41,241	155,309
1871 ...	6005	23,467	1886	31,015	117,250
1872 ...	6969	27,314	1887	42,609	158,533
1873 ...	4661	18,390	1888	39,611	147,154
1874 ...	4651	18,491	1889	32,333	119,703
1875 ...	3010	11,982	1890	23,451	87,114
1876 ...	11,107	44,923	1891	39,203	149,816
1877 ...	5777	23,289	1892	45,110	174,070
1878 ...	25,249	100,000	1893	37,230	145,875
1879 ...	60,155	230,895	1894†	53,000	198,750
1880 ...	52,595	201,297			
			TOTAL ...	763,714	2,908,512

* Production previous to 1867 estimated by difference.

† Production in last quarter of 1894 estimated.

SILVER AND LEAD.

Argentiferous ores are found all over Tasmania in the districts where the older formations occur, being often associated in small quantities with gold in the auriferous reefs, especially as galena and blende, carrying silver. In the Rex Hill tin mine at Ben Lomond argentiferous galena is found in considerable quantity associated with

tin ore, blende, copper pyrites, iron pyrites, and arsenical pyrites; and in the same district there is an occurrence of granite impregnated with galena, which carries both silver and gold. A little silver ore has been raised at Rex Hill, and a little also in the Scamander district, where, in a dyke of granite penetrating Lower Silurian (probably) strata, lodes have been found carrying chloride of silver and a mixture of arsenical and other pyrites with blende and galena, which at times was rich enough to be worth sending away for smelting. At Mount Claude a little argentiferous galena has been extracted and sold, and at Bell Mount some fairly rich ore was obtained: silver has also been found at the Hampshire Hills, and a little in the Upper Forth district, and on the coast at the Penguin. With these exceptions, none of which have yet proved of importance, the silver ores of the Colony are confined to the West Coast district, Mount Lyell, Zeehan, Dundas, Heazlewood, and Waratah being the principal producers. The rich argentiferous copper ore of Mt. Lyell will be referred to later on, under the heading of copper. The Zeehan, Dundas, Heazlewood, and Waratah fields may be considered one, for they are very similar in structure and in character of the ores produced, and are more or less connected. The formation is probably of Upper Silurian age, and has been broken through by the granitic masses of Mt. Heemskirk, the Meredith Range, and the Magnet Range, and also by a series of intrusive serpentines (altered dolerites and gabbros) well seen at Trial Harbour, Comstock, Dundas, and the Heazlewood. Numerous lodes have been found,—the Zeehan district being especially full of them; and new ones are constantly being discovered. They are mostly fissure lodes, from one to six or eight feet in width, but there are also some very large bodies which appear to be contact lodes at the junction of the serpentine and sedimentary strata. The fissure lodes are found both in the stratified country and in the serpentine. The metallic minerals found are principally galena, blende, and iron and copper pyrites; fahlore is less common, as is also antimonial lead ore (Jamesonite). Native silver and chloride of silver have been found, but rather rarely; and oxidised lead ores, oxide, carbonate, sulphate, phosphate, and chromate occur in the oxidised cappings of the lodes. At surface these generally outcrop as gossans, consisting of oxides of iron and manganese mainly, from which most of the metallic contents have been leached out. So thoroughly oxidised are the lodes above water level, and even a good deal below it, that it has not been found possible to extract more than a very small quantity of ore without sinking shafts and removing water by pumping. The climate of the West Coast is very wet, and has fostered a peculiarly dense growth of forest, almost impenetrable in many places. The soil, too, is generally very swampy; and it has been difficult and expensive to make roads by which machinery could be brought on to the mines. Though the Zeehan field was discovered in 1885, it was not till the end of 1891, when a railway was completed to it from the port of Strahan, that any quantity of machinery could be

brought in or ore sent away; and many promising mines are still languishing, or remaining quite undeveloped, on account of the same difficulty of getting transport to and from them. At first only the best clean-picked galena could be sent away for sale, and many of the smaller mines are still in this stage; but there are now several concentrating mills at work at Zeehan, and even small tribute parties clean some of their second-class ore by hand jigging so as to make a marketable product of it. The gauge associated with the galena is mostly carbonate of iron, quartz, and lode-slate; but there is often also a good deal of blende and iron and copper pyrites, which requires to be removed by dressing. In 1892 smelting works were started at Zeehan and Argenton, but only ran a very short time; and at present the produce of the field is all exported as concentrated or picked clean galena: some of this is smelted in Hobart at Messrs. Kennedy's works, but the greater part is sent to Australian and German smelting works. The cost of freights and smelting and selling charges is rarely less than £6 a ton; and a resumption of local smelting would be a great benefit to the industry.

The average value of the West Coast galena is very good, many parcels exported going over 100 ounces of silver to the ton; a mean of 64 per cent. of lead and 65 ounces of silver per ton may, however, be taken as fairly representative of the general run of the ore. Being high in lead it is a very desirable ore for smelting establishments, acting as flux for more siliceous ores from other parts of the world. A large amount of oxidised ore of low value, which would be excellent flux for a local furnace, has, however, to be now left untouched in the mines, as it will not concentrate, and is too poor to pay for exporting.

The premier mine of the Zeehan field at present is the Western, which, up to 31st March, 1894, had raised 6902½ tons of marketable ore, worth £80,941, out of which the mine has been opened to a depth of 230 feet (main shaft 275 feet), furnished with winding and pumping machinery, a fine Lübrig concentrating mill, and a tramway or light iron railway worked by a locomotive, and has paid, in addition, £15,000 in dividends, and £2250 to a Reserve Fund. The gross cost of mining, concentrating, bagging, and delivering the marketable ore was, for the half-year ending March, 31st, 1894, £1 4s 4½d. per ton of ore mined. The concentrating mill treated on an average 490·6 tons per week, working 16 hours daily.

The Silver Queen mine has two main shafts and a large number of smaller prospecting ones, there being a great many lodes in the large area of ground held by the company. Many of these are worked by tribute parties. At the No. 2 shaft the lode contained in the upper levels a large quantity of very rich oxidised ore, which was carted to Trial Harbour for shipment, and enabled dividends to be paid for some months. A little over 6000 tons of ore have been raised from the mine, containing considerably over half a million ounces of silver, and returning

to the company close on £65,000. The mine is furnished with a concentrating plant made by May Bros., of Gawler, South Australia.

The Mount Zeehan Silver Lead Mining Company and the Grubb's S. M. Co. have also concentrating mills made by May Bros.; the New Tasmanian and Argent mills are of English make (Green, of Aberystwith); and the Silver King mine has one of American pattern, by the Parke and Lacy Company. These mines are all considerable producers of ore. We may also mention the Montana, Oonah, Junction, Sylvester, Oceana, Comstock, Silver Bell, Sunrise, and New Silverstream, as having contributed considerably towards the output from the Zeehan field. At Dundas the largest producer has been the Maestri's Broken Hill mine, which, however, is now shut down, or only worked by a few tributors; while the Adelaide, Mount Dundas, and Comet mines have also raised a good deal of ore. The Comet has lately struck a large shoot of galena, and promises well for the future. At North Dundas the Owen Meredith and Success mines have sent away a good deal of very rich ore in spite of great expense of transport, and are now building a tramway to facilitate their operations.

In the Heazlewood field there is not much being done at present, the principal work being in the Godkin mine, which, however, has not yet turned out much ore. The largest producer has been the Heazlewood mine, but a little galena has also been sent out by the Heazlewood Extended, Whyte River, and Washington Hay mines, and some rich argentiferous zinc ore from the Godkin Extended. A new mine at the Magnet Range is also said to promise well for future production. At Waratah the Silver Cliff mine has produced a little ore, galena, and antimonial galena, but is now doing little or nothing.

The fall in the price of silver during the past year has militated against the opening of new silver mines, and has caused the shutting down of a large number which were in the prospecting stage: the general depression in business of all sorts which has prevailed in the Australasian Colonies for the last three years has also contributed to this result. The silver fields cover a large area, considerably over 100 square miles, and each lode requires a good deal of capital to be expended on it before it can yield profits. The natural result of the depression has been that the outlying and difficultly accessible mines have been abandoned for the present, and work concentrated more on those which can more easily put ore into the market. As time goes on numbers of these passed over lodes will doubtless be worked, and the fields will support a large population.

As the silver ore raised in the Colony is nearly all galena, and this is not smelted locally, it is not possible to get accurate returns of the silver and lead, quantities and values separately. In the following table the Mount Lyell argentiferous copper ore is included with the Zeehan, Dundas, and Heazlewood silver-lead ores.

PRODUCTION OF SILVER ORE IN TASMANIA.
(Inclusive of some Silver-lead Bullion.)

Year.	Quantity (tons of 2240 lbs.)	Value.
		£
1888.....	417	5838
1889.....	415	7044
1890.....	2053	26,487
1891.....	4810	52,284
1892.....	9326	45,502
1893.....	14,302	198,610
1894 (last quarter estimated)	27,263	327,152
	58,586	£662,917

To the end of June, 1894, Silver-lead Mining Companies have paid in dividends £40,738 9s.

COPPER.

Ores of copper in small quantities are common in association with those of lead and tin throughout the Colony, but only a very few of the deposits have been worth working for this metal. At Saxon's Creek, near Frankford, there is some good copper pyrites, of which a few tons have been mined and exported; but the mine is not now at work, and has never passed out of the prospecting stage. The principal deposits of copper, however, on which rests the hope of the Colony of becoming a producer of the metal, are along the West Coast range, where there are several extensive masses of copper-bearing pyrites. The best known of these is at Mount Lyell, but there are also others at Lake Dora, Mount Reid, Mount Murchison, and also, it is said, at the Savage River. They all appear to be bedded deposits, consisting of more or less cupriforous iron pyrites mixed with some galena and blende, and carrying a little silver and gold. The Mount Lyell Company's pyrites body has been proved to be 300 feet in thickness and at least 800 feet in length, probably much more, and has been tested to a depth of 280 feet below the outcrop by mining works. After a careful study extending over three or four months, Dr. E. D. Peters, jun., the eminent American copper metallurgist, estimated the ore in sight at $4\frac{1}{2}$ million tons, of an average value of $4\frac{1}{2}$ per cent. of copper, 3 ounces of silver per ton, and $2\frac{1}{2}$ dwts. of gold per ton. He reports that the ore can be worked at a profit of £1 10s. 5d. a ton, and ends by saying: "I will only say, in conclusion, that in the past 20 years I have never seen a mining and metallurgical proposition that promises so certainly to be a great and enduring property as this." The mass of pyrites is almost absolutely free from gangue, and is quite similar in composition and mode of occurrence to the celebrated Rio Tinto ore in Spain, but is

nearly three times as rich in copper and the precious metals. On the foot-wall there is a layer of very much richer ore than the above, assaying as much as 20 per cent. copper and 20 oz. silver per ton. At the time of Dr. Peter's visit to the mine some very rich ore was discovered, forming a vein in and on the foot-wall, consisting of silver-copper glance, silver glance, and rich arsenical tetrahedrite (tennantite), assaying from 500 to 6000 ounces of silver to the ton and 20 per cent. and over of copper. Since its discovery this rich vein has been worked constantly, and is still being followed, the ore being bagged and carted to Strahan for export. Up to 28th June, 1894, the ore raised from this vein amounted to 473 tons, containing 571,003 ounces of silver and $112\frac{1}{4}$ tons of copper, and since then there has been a regular output of about 10 tons of ore a week, containing on an average 1000 ounces of silver per ton and 20 to 25 per cent. of copper. This wonderful bonanza has paid all expenses of the mine, including a railway survey from Strahan, and enabled the company to begin constructing the railway. As the mine is opened out it is probable that other similar rich veins will be found which will add greatly to the profits of treatment of the large low-grade mass which will be the mainstay of the mine. It is proposed to build a railway to the mine and then to erect reduction works capable of smelting from 500 to 1000 tons of ore a day, which would raise Tasmania into the front rank of the large producers of copper of the world.

A somewhat similar mass of cupriforous pyrites is seen at the North Mount Lyell mine, and at the adjacent Idaho property a great deal of native copper is to be seen in the surface soil. Some years ago about 40 tons of native copper were sent away by the Stanley Company, who then owned the mine.

There can be no doubt that the West Coast Range of Tasmania is destined before long to be a large producer of copper, and it is quite likely that the value of this and the precious metals associated with it will be equal to at least the total present mineral output of the Colony.

The production of copper ore and its value for this metal, exclusive of silver and gold, to the end of 1894, may be reckoned at a total of 930 tons, of value £8000. The Mount Lyell ore has also a certain value in sulphur, but as yet this is entirely lost.

TIN.

The tin deposits of Tasmania have been its greatest source of mineral wealth, the value of tin raised being greater than that of all the other minerals put together. They may be grouped as—(1) Alluvial deposits; (2) lodes and veins; (3) impregnations or stock works. They are almost entirely confined to districts composed of granite, or of sedimentary rocks penetrated by quartz-porphry dykes; but at Mount Lyons tin ore is found in silurian strata, 18 miles from the nearest known granite, though probably enough of this lies below at no very great depth. The principal alluvial workings are in the north-eastern district, along the valleys of the Ringarooma and George's Rivers, and their

branches. The deposits range from Miocene to recent in age. At the Brothers' Home and Branhholm the drift is of great depth, and is in parts capped with basalt, requiring either underground mining for extraction of the wash, or else much expense in removal of the overburden. The Triangle and North Brothers' Home, and the New Brothers' Home No. 1 mines have been worked by the former system, by blocking out, and the Krushka's, Briseis, Ringarooma Valley, Arba, and Ormuz, by opencast workings. The first four named are situated on a deep lead corresponding with the existing Cascade River, but lying at a much lower level. The present river is a tributary of the Ringarooma, and in like manner the old lead was a former tributary of an older Ringarooma, which lies lower than the existing stream, but follows much the same general course. This ancient river bed has been gradually filled with alluvial matter, and finally with flows of basalt, and the waters passing down the valley have since cut a new channel, partly through and partly alongside these older deposits. Six or eight miles north-east of Derby the modern channel diverges from the course of the ancient one, running to the east of Mount Cameron instead of to the west of it, as formerly. The main old lead which was once the channel of the original Ringarooma River ought to be a very valuable one, having been the main tail-race through which all the gravels of an extensive area of tin-bearing country have been sluiced for ages by natural processes. This main lead has never yet been tested, lying too deep below the present river to be easily accessible; but the feeders on which the Derby mines are situated (Cascade River Lead), and those at Branhholm (Arba and Ormuz, on the old Branhholm Creek Lead), justify us in entertaining great expectations as to the wealth to be realised from the main lead. The Ringarooma Valley Mine appears to have been on the edge of the main lead, but could only treat the uppermost drift, the deeper and presumably much richer gravels not being able to be touched with the appliances provided. Even these upper gravels, however, ought to pay handsomely if worked by hydraulic elevators, to get which would require the construction of a long water-race.

The Krushka Brothers' Home mine is on the old Cascade lead, where it is cut through by the modern Ringarooma River, the continuation across the river lying in the Triangle and North Brothers' Home mine. The old valley has been sluiced out until there is a huge face 250 feet in height at the upper end of the workings close to the Briseis Company's boundary. The top of the face is basalt, below which are beds of sandy clay and nearly barren drift, but for over a hundred feet in depth the lower gravels contain more or less tin ore. From July 3rd, 1883, to 20th October, 1894, 3192 tons of dressed tin ore have been raised from this mine, and the value of its total produce from the beginning is said to be a quarter of a million pounds sterling. Though the upper parts of the lead are now nearly worked out, the lower portion, where it dips below the Ringarooma, is yet practically untouched.

The Briseis and New Brothers' Home No 1. Companies have

ground side by side upon the lead above the Krushka's workings. The former has a large area of ground, and has spent an immense amount of money in opening it up. Failing to agree with the Krushka brothers as to terms of working through the latter's claim, the natural outlet of the lead, the Briseis Company drove an adit 1200 feet in length through the rim-rock to serve as a tail-race: this cost £7 a foot. It was then continued through the drift a further distance of about 1100 feet, and was connected with the surface by a shaft. Round this sluicing was commenced and carried on until a huge open excavation has been worked out 150 feet in depth, which is gradually being extended up the lead. This mine is only beginning to be in a position to be worked to advantage, and has been much hampered by encountering a great deal of ferruginous cemented drift at the point chosen for opening out the excavation, but now seems in a fair way to be very successful. A feature of its working is the use of a steam shovel or navy for removing the decomposed basalt covering: this is very hard, and would cost probably 1s. 6d. a yard to remove by manual labour, but is excavated by the machine for 2½d. a cubic yard, the spoil being then sluiced away at a further cost of ¼d. a yard. Some of the covering is sluiced away by giant nozzles at a cost of 1½d. a yard. This is the largest hydraulic sluicing claim in the island, employing two 4-inch nozzles for stripping and several smaller ones for breaking down the wash-dirt. From March, 1885, to October, 1894, it has yielded 372 tons 7 cwt. of metallic tin, of value £27,610. The total expenditure up to 30th April, 1894, has been £163,650 14s. 10d., which shows vividly the confidence the owners have in the property eventually turning out well.

The New Brothers' Home No. 1 mine has been worked by driving out successive flat layers of wash drift one below the other, the total depth thus worked being about 45 to 50 feet, the roof being allowed to crush down as each layer was extracted. This is an expensive way of working, requiring an immense amount of timber for support, and only removing a portion of the wash, still the mine has turned out a large quantity of tin and paid some dividends. Figures of the entire production are not at hand, but from July 3, 1883, to the end of December, 1887, the output was 277 tons, and from April, 1892, to July, 1894, 327 tons of ore. During the latter period the cost to the owners of each ton of ore delivered in Launceston was from £18 to £19, and four dividends were paid.

The Triangle and North Brothers' Home mine has been worked by the same system as the New Brothers' Home No. 1, but owing to the washdirt lying mostly below the level of the Ringarooma River and dipping away from it, has not been able to be worked in the lower strata, and has not been very successful. From July 3, 1883, to 20th October, 1894, its output has been 966½ tons of ore. Borings have shown that the wash drift extends over 70 feet at least below the level of the Ringarooma River.

The production of the Ringarooma Valley mine has been 90½ tons of ore. The Arba and Ormuz Companies have produced a large

amount from their workings on the Branxholm Creek branch lead, and have made excavations 120 feet deep. There is about 40 to 50 feet of basaltic clay, rotten basalt, and barren drift to be removed before the tin-bearing gravel is reached. The best method of working these enormous deep deposits of tin-drift along the Ringarooma lead and its branches has yet to be found; some parts lie so deep and have so much basaltic rock covering them that underground mining only is possible, and in this case the problem of extraction of such immense thicknesses of drift with economy and safety, and without leaving an undue proportion behind is one that will much exercise the ingenuity of mining engineers. For the shallower portions with but little superficial covering, but lying for the most part below the level of the Ringarooma River, the main drainage channel of the District, either steam lifting machinery or hydraulic elevators will be required.

The large quantities of tin raised from the mines on the Cascade and Branxholm leads show almost to demonstration that the Ringarooma main lead must contain enormous quantities of tin. Some miles lower down it another opening has been made on the side of the old valley by the Pioneer Company, which has made a very large open excavation, with payable or nearly payable results, but no work yet done has ever touched the real main lead at its deepest part. From the township of Ringarooma to the sea this lies untried, in all probability the greatest storehouse of tin in the country.

There is likewise a very promising old lead near George's Bay, an older bed of the George's River. Some of the upper gravels of this have been worked, but the lower ones, lying probably below sea level in parts, have never been tested, even by boring.

The more modern gravels in the valleys of the Ringarooma and George's Rivers and their branches have been very extensively worked, and still support a large number of alluvial miners; the more easily accessible gravels are, however, getting greatly worked out. In the Gladstone District there are numerous large terraces which are being treated by hydraulic sluicing, and will afford work for many years to come. On the Blue Tier very rich shallow alluvial ground was formerly worked, and the sluicing operations have disclosed lodes and stockworks carrying tin in the matrix. In all the north-eastern district it may be said that the day of shallow simple alluvial working is nearly over, and that the future will depend upon the hydraulic sluicing of the poorer but larger accumulations of terrace gravels.

At Bell Mount, between the Rivers Forth and Wilmot, a little alluvial tin ore has been obtained; also at Cox's Bight on the South-west Coast, and at Whale's Head and Mount Lyons. At Mt. Heemskirk there is a good deal of tin-bearing gravel, which is now being worked to some extent, and new fields have lately been found at the Stanley River on the south end of the Meredith Range, and at North Dundas on the Ring River. Part of the famous Mt. Bischoff deposit also is of alluvial origin.

Vein or lode-mining for tin has not yet been very successful in Tasmania. In nearly all the granite districts small veins carrying tin ore are not infrequent, and much of the alluvial tin has probably come from these, but lodes of workable size are much less common. The Lottah and Cambria mines at the Blue Tier, the Great Republic mine at Ben Lomond; the West Bischoff, Stanhope, and North Valley at Mount Bischoff; and the New West Cumberland at Mt. Heemskirk are amongst the true veins which have been most extensively worked. All of these have produced a good deal of tin, but none has yet been a really paying mine. At Brookstead, in the St. Paul's River Valley, there are a large number of lodes, some of them very promising, but only one has yet been worked to any extent. The great Mt. Bischoff mine is mainly on a lode, but as the occurrence is not by any means normal it will receive special attention later on.

The stockworks, or impregnations of tin ore, found in several localities are likely to be of very great importance. These are portions of granite, or of quartz-porphry dykes, penetrating the main granite, which have suffered considerable internal chemical and mineralogical changes, and become charged with strings of tin ore and finely-disseminated particles. The material of which they are composed is generally quite similar to that usually found alongside the true veins in this country, and some of these are partly stockworks. The Great Republic ore-shoot is really a small stockwork lying on each side of the vein. Similarly, the Rex Hill "lode" is more of the nature of a stockwork than an ordinary vein. At Gladstone, Bell Mount, and Roy's Hill, stockworks occur at the junction of granite with sedimentary strata, and seem to be the result of hydro-thermal action upon the granite along the contact. In all these bodies very rich bunches of tin ore frequently occur, but its distribution is very irregular. The Blue Tier district is especially noted for this sort of tin deposit, containing several large stockworks which have been worked in a small way. The best known of these is the Anchor mine, which has paid its way for years on a yield of rather less than 1 per cent. of tin ore. This mine is still at work, and if provided with a large crushing mill, would be a large producer. Another Company will soon make a start on a fairly large scale on the "Puzzle" stockwork in the same district. The successful treatment of these enormous masses of low grade tin-bearing rock in the Blue Tier district would lead to a very great increase in the Colony's production of the metal, the quantity of rock being almost unlimited.

The Mount Bischoff mine shows a curious combination of all the different types of tin deposits. On the surface there were large and heavy deposits of waterworn alluvial tin in heavy gravel and boulder drift, and these were close to and upon the parent deposits. These consist of lodes of the fissure and contact types and of dykes of eurite and topaz porphyry impregnated with tin ore. At Mount Bischoff a dyke of quartz porphyry has been thrust through silurian (?) sandstones, and

along the fractured contact tin ore appears to have formed plentifully. Small joints in the sandstones and quartzite beside the main ore body are often seen to be faced with crystals of cassiterite. Parts of the dyke, especially those which are mainly made up of topaz porphyry, carry impregnated tin ore through them, and in the open fissures have been deposited quartz, pyrites, fluorspar, and tin. The Red Face is a huge mass of brown oxide of iron, often with sintery quartz through it, probably the result of oxidation of a great body of iron and arsenical pyrites. In the lower levels only small lodes have been found corresponding in position with this great mass, and these contain much arsenical pyrites, magnetic pyrites, and iron pyrites. The tin ore is very black, and when a large lump is examined it is found to be made up of a very large number of small crystals matted together. The mine is worked as an open quarry, and the stuff knocked down is taken to the dressing-sheds at Waratah by a railway and small locomotive. Till two or three years ago a good deal of the loose friable ore was partly concentrated on the mine by sluicing it in boxes, the concentrated stuff being sent to the battery, but now the whole of the dirt, about 700 tons a week, goes through the mill. This is a very complete establishment, and is arranged in the steep gully of the Waratah Creek, so that the ore passes right through it by gravitation, falling from stamps to jigs, buddles, and slime tables with very little handling. Further down the creek are the Ringtail and Catch'em sheds which re-treat the tailings from the main works, and also those from the Stanhope and West Bischoff mines, and in the former the waste from the mine sluices in addition. Counting the tailings, the sheds treat about 1100 tons a week. The power for the machinery is obtained from a succession of water-wheels, of which there are seven in the Waratah shed, and three in the other works: being placed at successively lower levels, the same water which passes over the higher ones also drives the lower ones. There is a very heavy rainfall at Mount Bischoff, averaging 80 inches per annum, but lying on the top of a high plateau it has not been an easy matter to provide a constant water supply. Some ten dams and over seven miles of water-races have been made for conservation of water, and when a new reservoir now in progress is finished the total storage capacity will be about 800,000,000 gallons. It is due to the care with which all available water is made use of that the operations of the company have been so successful.

In the main shed there are 15 batteries of five stamps each, from which the pulverised material runs into spitzluten and spitzkasten to be classified. The coarser portion is treated on 15 pairs of 2-sieve jigs, the tailings from which pass into 10 concave buddles. The fine material is washed on convex slime-tables, the tailings from which also run into buddles. In the sheds there are in all 23 buddles, 24 single slime-tables, 10 double slime-tables, and two triple slime-tables. The ore is finally cleaned in boxes and tossing-tubs. According to the character of the ore going through, the jigs give from 65 to

75 per cent. of the total yield, the buddles from 4 to 5 per cent., and the slime-tables from 15 to 20 per cent. The average assay of the first-class dressed tin is from 68 to 70 per cent. of metal, and of the second-class from 60 to 62 per cent., the large quantity of oxide of iron in the ore from the Red Face making it uneconomical to dress to a higher percentage. The tailings from the porphyry ore are almost free from tin, while those from the gossan may reach 1-10th per cent., according to the proportion of oxide of iron. Since the commencement of operations about 5,500,000 tons of material have been reduced by sluicing and crushing combined, of which 560,859 tons have gone through the battery, the tin ore produced being 44,560 tons (to 19th October, 1894). This is equal to 7.94 per cent. dressed tin from the crushing dirt, and 0.81 per cent. from the total stuff treated. At present the average yield is from 3 to 3½ per cent. of tin oxide. The cost of crushing and dressing amounts to 10½ pence, and bagging one penny per ton of material crushed. The cost of mining and delivering this at Waratah is 3s. 2½d. a ton, making a total, by the time the dressed ore is ready to leave the mill, of 4s. 2½d. per ton of crude stuff; that is to say, all expenses of mining and dressing are more than covered by ½ per cent. of tin oxide. 210 dividends have been paid, amounting to £1,342,500.

At the North Valley mine the Mount Bischoff Company have been experimenting to find the best way of dealing with the pyritous ore there found, and which is probably similar to that to be found in depth under the Red Face. The ore requires calcination to remove the sulphur, and a plant consisting of rolls, stamps, revolving and reverberating furnaces, jigs, and buddles, has been erected. As yet the operations in this section of the mine have not been profitable.

The Mount Bischoff Company also own smelting works in Launceston, in which not only the Bischoff ore, but also nearly the whole produce of other parts of the Colony is smelted. There are three pairs of reverberating furnaces, in which the ore, mixed with a very little lime as flux, is reduced by means of slack coal, that from New South Wales being used, as the Tasmanian coals are not suitable. During the half-year ending 30th June, 1894, the total quantity of ore smelted was 2119 tons 2 cwt. 0 qr. 24 lb., yielding 1445 tons 10 cwt. 1 qr. 4 lb. of tin. 721 tons of this tin was smelted on account of the Mount Bischoff Company, and 724½ tons on public account. The average assay of the refined tin was 99.89 per cent., and of the slag 5.3 per cent. The total smelting loss is about 4½ per cent.

The discoveries of tin ore at North Dundas resemble the Mount Bischoff deposit both in character of the ore and in the circumstance that they are in the vicinity of a dyke of quartz porphyry which breaks through strata of Silurian Age. Some very large nuggets of ore have been found here, and there is much reason to expect that valuable mines will be opened up when the ground is made more accessible. There is much pyrites with some of the tin, the ore resembling that of the North Valley mine very closely. The calcination that this will require is one

of the drawbacks to the development of this field, but should not be insuperable by any means.

Ore requiring calcination is also produced by the Rex Hill mine at Ben Lomond, and the Brookstead Mines, St. Paul's River, and it seems probable that works in a central position for treating these dirty tin ores will before long be a necessity.

Tasmania is the third largest producer of tin in the world, being only exceeded by the Straits Settlements and Cornwall. Owing to the fact that a great deal of the Tasmanian and Queensland tin is shipped to Sydney for re-shipment to the United Kingdom, the produce of New South Wales is often shown by statistics as the highest of any of the Australian Colonies, but such is not the case. During the fourteen years ending 1890, Tasmania produced 17.97 per cent. of the tin imported into the United Kingdom, or fully one-sixth. The Mount Bischoff mine has produced nearly one-half of this. Though tin was discovered in 1871, it was not till 1873 that it began to appear as an article of export: the production since then is shown in the following table:—

PRODUCTION OF TIN IN TASMANIA.

Year.	Quantity.*	Value.	Year.	Quantity.*	Value.
	Tons.	£		Tons.	£
1873.....	3	220	1884.....	3698	301,423
1874.....	100	7318	1885.....	4242	357,587
1875.....	366	31,325	1886.....	3776	363,364
1876.....	1453	99,605	1887.....	3606	407,857
1877.....	4760	296,941	1888.....	3775	426,326
1878.....	5369	316,311	1889.....	3786	345,407
1879.....	4378	303,203	1890.....	3213	296,761
1880.....	3953	341,736	1891.....	3277	293,170
1881.....	4123	375,775	1892.....	3195	290,794
1882.....	3647	361,046	1893.....	3129	260,219
1883.....	4100	376,443	1894†.....	3145	269,600
			TOTAL ...	71,094	£6,122,434

* Metallic tin: ore exports reduced to metal.

† Last quarter of 1894 estimated.

IRON.

The Colony has abundant stores of the ores of iron of good quality, but they have not yet been profitably worked. In 1876 and 1877 a large blast furnace was in operation at Ilfracombe, near the mouth of the Tamar, where there are large deposits of iron ore and limestone close to deep water; but the metal produced contained from 5 to 7 per cent. of chromium, and was not at that time saleable, though now it would command a ready market. The establishment was consequently broken up. The ore in this instance was largely magnetite found in serpentine country rock, from which doubtless its chrome contents were derived.

In the same district there are, however, considerable beds of limonite quite free from chromium, from which very good iron has been made on a small scale. At the Blythe River and Penguin there are very large deposits of brown and red hematite of good quality, within easy reach of a shipping place. The Blythe River mine has unusually good facilities for cheap working by open quarrying, and is a first-class Bessemer ore; free from all but traces of phosphorus. It seems likely that an attempt will be made before long to work this mine, the ore being shipped to New South Wales, to one or other of the coalfields on the coast there, to be smelted. It is to be hoped that operations will result successfully, for the establishment of an iron industry would be of the greatest benefit to all the Australian Colonies. The present production of iron ore in this country is not worth tabulating, being confined to a few hundreds of tons annually used for the manufacture of hematite paint, and for the purifiers of gas works; this is mostly obtained at Ilfracombe, and sold on the Australian mainland.

NICKEL.

The serpentine districts of the West Coast appear to contain this metal, two discoveries of it having been made, one near Dundas and the other at Heazlewood. The former is a nickeliferous pyrites, said to be not unlike the Canadian Sudbury ore. A small parcel lately sent from the mine gave a profitable return on its sale in Europe. The Heazlewood deposit consists of zaratite and pentlandite, with pyrites. Neither mine has yet been opened up enough to make sure of its future, but both are promising.

BISMUTH.

This is another metal which seems likely to figure in the Colony's exports, but which has not yet been worked to any extent. A little native bismuth occurs at times in the tin lodes of the Blue Tier, and at Weldborough a very large lump, weighing 55 lbs., was last year found by some alluvial tin miners while sluicing. At Mount Ramsay native bismuth is found in considerable quantity in a hornblende rock, and is said on good authority to be a valuable discovery. Being difficult of access, very little has been done to it. Native bismuth and bismuth sulphide have also been found at Mount Murchison. At Bell Mount carbonate and sulphide of bismuth and some native bismuth have been found in lodes associated with tin ore. The lodes are not very large, but are rich in bismuth. Very little work has yet been done on them but some six tons have been packed out for shipment, which gave an average assay of over 60 per cent. of bismuth. This locality is likely to be a considerable producer of bismuth as well as tin and gold.

OTHER METALS.

Cobalt is found in considerable quantity as *asbolite* (cobaltiferous oxide of manganese), forming with oxide of iron the cementing material binding together the grains of sand in a cement layer in the alluvial deposit worked by the Briseis Tin Mining Company at Derby. Though

this is very far from rich in cobalt, it is likely that by mechanical dressing the asbolite could be separated from the sand sufficiently to make a marketable product. Earthy black oxide of *Manganese*, and some crystalline manganese oxides have been found in the Zeehan district and elsewhere, but not yet thought worth exporting. *Arsenic* is rather common as arsenical pyrites in the gold-bearing lodes of the Waterhouse and Scamander districts, and in the tin lodes at Waratah and North Dundas. *Antimony* has been got at Lefroy as sulphide, but not in workable quantity. *Mercury* is said to have been found native and as cinnabar near Mount Lyell. *Zinc* as blende is common at Zeehan in association with galena; but though considerable quantities of it pass through the dressing works, it is not thought worth saving. *Wolfram* is found near the Pieman River Heads, at Bell Mount, at Ben Lomond, and on the Blue Tier, in some quantity. Scheelite also has been found in small amount. No export of either mineral has however yet been made.

COAL.

The coal supplies of the Colony are at present mostly derived from the Mount Nicholas Range and the Mersey District, but numerous small pits have been worked in a great many places throughout the south-eastern portion of the Island, where the coal-measures are best developed. In age, the measures range from Permo-carboniferous to Mesozoic, (perhaps Triassic and Jurassic), the sequence of the various series of beds being shown from the following Table, taken from a recent paper by R. M. Johnston, F.L.S. :—

	Formations.	Characteristic Form.
PERMO-CARBONIFEROUS.	1. Lower Marine Beds.	
	2. Tasmanite Beds.	<i>Tasmanites Punctatus.</i>
	3. Coal Measures— Mersey, Henty, Tippagory, &c.	<i>Glossopteris, Gangamopteris, Noegerathiopsis.</i>
	4. Upper Marine Beds.	
	5. Adventure Bay Coal Measures. }	<i>Gangamopteris Spathulata</i> and <i>Vertebraria Australis.</i>
	6. Mount Cygnet Coal Measures. }	
	7. Southport Beds.	
MESOZOIC.	8. Lower Sandstone (Lower Mesozoic).	Ganoid fishes. <i>Vertebraria.</i>
	9. Ida Bay Coal Measures.	<i>Pecopteris Lunensis</i> and <i>Zeugophyllites Elongatus.</i>
	10. Upper Coal Measures— Jerusalem, Fingal, Spring Hill, York Plains, Hamilton, Richmond, New Town, Sandfly, Recherche, South Cape, Longford, &c.	<i>Pecopteris, Alethopteris, Thinnfeldia, Sagenopteris, Neuropteris, Zeugophyllites, Baiera, &c.</i>

The Mersey Coal Measures correspond with the lower series of the New South Wales great coal formation, but the Upper Measures of Tasmania are younger than the Newcastle beds. Both the Upper and the Lower Measures are much broken and destroyed in parts by the intrusive Mesozoic greenstones (Diabase or Gabbro), which have so disturbed the country that it is very difficult to correlate the seams of coal even in closely adjacent fields.

The principal output from the Mersey field now comes from the Dulverton and Russell collieries, near Latrobe. The coal is a free-burning, long-flame, bituminous coal, very suitable for household and steam purposes, but the seams are unfortunately quite thin—from 20 inches to two feet thick as a rule. The upper measures have, however, numerous seams of workable size and good quality, the coal being non-caking generally. Nearly all of it contains rather too much ash—from 8 to 15 per cent.—to be of first-rate quality, but with properly-designed furnaces it is a good steam coal. The principal output is from the Cornwall and Mount Nicholas collieries at Mount Nicholas, but a little is also raised at Jerusalem, York Plains, and Norwich, near Longford. The Sandfly mines, near Hobart, and the Langloh mine, near Hamilton, have fairly large seams of good coal which are proposed to be opened up. Most of the coal raised is consumed locally, very little now being exported. A few years ago the Cornwall Coal Company used to export a considerable quantity to Melbourne for special purposes, for which it was more suitable than the Victorian and New South Wales coals, but the trade had to be given up on account of the great expense of freight. The coal-fields of Tasmania are capable of great development when the demand for their product will arise, and are quite sufficient to supply the Colony with all the fuel that it will require for all ordinary purposes. For smelting the usual high percentage of ash is much against the local coals, and also the fact that only some three or four seams have yet been found that will yield a coke.

At Barn Bluff, in a high and inaccessible region, a seam of cannel coal has lately been found which in quantity and illuminating power of gas produced from it closely resembles the celebrated Joadja shale of New South Wales. It occurs in the lower measures, and gives hope that in these, in more easily-reached localities, similar cannel may be found.

Statistics of the entire production of coal in Tasmania from the earliest times are not available, but in the following table are given such figures as can be got, together with a rough estimate of the previous production for the purpose of making an approximation to the total.

PRODUCTION OF COAL IN TASMANIA.

Year.	Quantity. Tons.	Value at Market.	Year.	Quantity. Tons.	Value at Market.
		£			£
Previous to 1875	100,000	75,000*	1885...	6654	5989
1875	7719	} 40,000*	1886...	10,391	9352
1876	6100		1887...	27,633	24,870
1877	9470		1888...	41,577	37,420
1878	12,311		1889...	36,700	33,030
1879	9514		1890...	50,519	45,467
1880	12,219	10,998	1891...	43,256	38,930
1881	11,163	10,047	1892...	36,008	32,407
1882	8803	7923	1893...	34,693	27,754
1883	8872	7985	1894†.	31,681	25,345
1884	7194	6475	Total..	512,477	438,992

* Estimated ; no returns.

† Last quarter estimated.

BUILDING STONE AND EARTHY MINERALS.

Excellent *freestone* is quarried from the sandstones of the coal measures, and is much used locally for building. At Okehampton, on the East Coast, some of the very white freestone was quarried for export to Melbourne. *Basalt* is used for road metal and making concrete, also for foundations for buildings. A small quarry for supplying a better class of stone was started at the mouth of the Piper River, but did not work long. *Greenstone* is much used for road metal, pitching, foundations, and rough masonry. *Granite*, though plentiful and of good quality, is not yet used for building purposes, though some of the varieties would make handsome ornamental work. *Roofing slate* of fair quality has been obtained at the Bangor and Australasian Slate Companies' quarries in the East Tamar district, but though an immense amount of money was sunk in opening the quarries and providing plant, neither enterprise was successful, and both have been abandoned. There is, nevertheless, the chance that as good or better slate will yet be discovered in the locality under circumstances that will allow of profitable working. At Beaconsfield, Heazlewood, and Mount Dundas there is very pretty *serpentine* that would make handsome indoor stonework. At Beaconsfield, the Gordon River, Chudleigh, Railton, and elsewhere the crystalline *limestones* of the older Palæozoic formations afford excellent *lime*, and are also fit for building purposes: some of them when polished are seen to be really fine black *marble*. A shell limestone at Maria Island, among the Lower Marine beds of the Coal Measures, also polishes well, being a light grey *shell marble*. At the same place and elsewhere we have *hydraulic limestones* in the same series of beds, some of them being fit for the direct manufacture of Portland cement. A little *kaolin* is raised for pottery purposes, also

ordinary *brick clays*. Near some of the coal seams we get *fireclay*, but most of it is of inferior quality, and has not yet been mined and marketed. *Ochres* and coloured clays for paint manufacture have been worked a little near Ilfracombe. *Lithographic stone* of fair quality has lately been discovered, but is rather inaccessible at present, and is not yet mined. A little *asbestos* (chrysotile) is found in the serpentine districts, and may prove worth mining in some places.

PRECIOUS STONES.

Sapphires of small size are very common in the tin-drifts of the Ringarooma and Portland Districts, but are rarely worth saving: some very large and fine stones have however been obtained. With them we get *Garnets*, *Spinel*s, *Zircons*, *Topazes*, and occasionally *Beryls* and *Chrysoberyls*. Very large but impure beryl crystals have recently been found at Ben Lomond. Topazes are very common in the tin-drifts, some very large ones having been found; they are often cut, and called locally Flinders' Island diamonds, this island being one of the best places for collecting them. *Rock Crystal*, *Amethyst*, and other varieties of crystallised quartz are not uncommon, some of the large smoky quartz crystals of the Mt. Cameron District being much prized by the Chinese, who collect them and send them to their own country for sale. Some very large and flawless crystals have been valued at pretty high figures. Wood-opal is common in the Tertiary drifts of the South Esk basin, but no precious opals are yet known to have been found, though some of the recent basalts show a common variety.

A review of the Mineral Resources of Tasmania shows that she is bountifully endowed with great variety and abundance of mineral wealth. With stores of gold, tin, silver, lead, iron, and coal, plentiful supplies of water, excellent timber, a splendid temperate climate, and great natural advantages as a receiving and distributing centre, there are unusually good facilities for the growth and establishment of metallurgical and manufacturing industries. With the removal of fiscal barriers to the free interchange of products among the Colonies of Australasia, these natural advantages must in the end make her take a leading part, not only as a producer of raw materials, but also as a maker of finished products.

APPENDIX.

LIST of Government Publications containing information as to the Mineral Industry of Tasmania on sale at the places and prices named hereunder :—

Government Printing Department.

	£	s.	d.
The Mining Act, 1893	0	5	6
Regulations under "The Mining Act, 1893"	0	1	0
The Tasmanian Official Record, 1890-1-2, per volume.....	0	3	6
The Handbook of Tasmania, 1892-3, per volume			Free.
Statistics of Tasmania, per volume.....	1	0	0

Survey Department.

Maps of Tasmania, various sizes, from.....	0	1	0
County Maps, per sheet	0	1	0

Mines Department.

Sketch Maps of the West Coast of Tasmania, showing localities of the various mineral deposits, tracks, &c. for use of prospectors, per plan ...	0	1	0
Plans of various gold and mineral fields; viz.—Beaconsfield, Mount Lyell, Lefroy, Mount Zeehan, Parish of Kay, &c., &c., &c., per plan.....	0	1	0
Reports by the Government Geologist upon various mineral localities throughout the Colony, from 1s. to 3s. each.			

At Government Printing Department, or at J. Walch and Sons, Hobart and Launceston.

Geology of Tasmania, with maps, sections, engravings, and drawings of typical fossils, by R. M. Johnston, Esq., F.L.S.	3	3	0
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All information relative to the Mineral Lands of the Colony and the mode of acquiring the use of the same is obtainable at the Office of Mines, Davey-street, Hobart, and at the various branch offices throughout the Colony.