MINERAL RESOURCES.

ALMOST all the principal metals of economic value are found in Australasia, and many are common to several colonies. In dealing with the occurrence and value of mineral deposits, a classification has been made into noble and other metals, carbon minerals, salts, stones and clays, and diamonds and other gem stones.

GOLD.

Gold, the most valuable of noble metals, is found throughout Australasia, and the present prosperity of the colonies is largely due to discoveries of this metal, the development of other industries being, in a country of varied resources, a natural sequence to the acquisition of mineral treasure. Settlement in Australia was still young when many-tongued rumour spoke of the existence of the precious metal, but it was not until the 16th February, 1823, that the Government was officially apprised of a discovery destined to be the precursor of a prosperity seldom surpassed in the history of nations. On the date mentioned Mr. Assistant-Surveyor M'Brien reported that at a spot on the Fish River, about 15 miles east of Bathurst, he had discovered gold. Mention is made in the early records of New South Wales of several other finds, but it remained for Count Strzelecki and the Rev. W. B. Clarke to demonstrate the existence of the precious metal in payable quantities, and to assert their belief in its abundance, an opinion strongly supported in England by several eminent authorities, and substantiated by Hargraves' discovery in the year 1851. The gold-fields of Lewis Ponds and Summer Hill Creek had hardly been opened up when, on the day that witnessed the severance of the Port Phillip district from the mother colony of New South Wales, Mr. J. M. Esmond discovered gold in Victoria. Shortly afterwards a rush set in for Ballarat, and the gold fever took possession of Australia. The following year (1852) saw gold found in South Australia and Tasmania; the rush to Canoona, in what is now Queensland, took place in 1858; and gold was discovered in New Zealand in the same year, though it was not until 1861 that a large population was, by the prospect of rapidly obtaining wealth, attracted to the last-mentioned colony. The last of the seven colonies in which extensive deposits of the precious metal were found was Western Australia, to which province a great rush set in but a few years ago, although gold was discovered in payable quantities in 1882.

From the date of its first discovery, gold to the value of nearly 429 million pounds sterling, has been obtained in Australasia. Victoria, which has in a period of forty-eight years contributed more than 254 millions to this total, has since the year 1897 given place to Western Australia as the largest annual producer of the precious metal, the yield of the latter colony in 1899 exceeding that of Victoria by more than two-and-three-quarter millions. Nevertheless, the output for the colony has shown a steady increase during recent years, the yield of 854,500 oz. in 1899 being the highest since the year 1882. Victorian gold is remarkably pure, and the quantities just quoted represent 804,235 oz. fine, so that on an average Victorian gold is worth £4 per oz. Several causes have contributed to this satisfactory development of gold-mining. Amongst these may be mentioned the great improvement in gold-saving appliances during recent years, and the application of a large amount of new capital to the working of new mines. The State, too, has done its share in helping the industry, and the Mines Development Act of 1896 authorised the expenditure of £140,000 during the ensuing three years. Mining tracks have been cut through the mountainous districts on a much more extended scale than hitherto, with the object of opening up the areas which were found difficult of access; and in other directions efforts have been made to stimulate the industry. In 1899 the Sandhurst district, with 235,596 oz., supplied the largest portion of the gold yield of the colony, followed by the Ballarat district with 208,920 oz., and Beechworth with 104,278 oz. There were 30,114 men engaged in the search for gold in Victoria at the end of 1899. Of these, approximately, 1,500 were Chinese, but the miners of this race are steadily decreasing in number. The value of machinery on the gold-fields of Victoria may be set down at £1,914,270.

Queensland promised at one time to overtake Victoria in the value of its annual gold yield, but in 1899 its production amounted to £2,838,119, as compared with £3,418,000 in the southern colony. Queensland, as a gold-producer, therefore, ranks third amongst the Australian colonies. The actual quantity of gold won was 946,894 oz., representing 667,792 oz. fine; the average value was, therefore, about £3 per oz. The yield for 1899 is the largest yet recorded. This result is due to the now universal application, wherever practicable, of the cyanide process to the treatment of the mill tailings, and the gold recovered in this manner last year constituted a little more than one-third of the total yield. The increase over the yield of 1898 is not so marked as is the case in some of the neighbouring provinces, but on all the larger fields much energy has been devoted to developing mines which will probably become productive during the current year. In some of the northern fields the enforced idleness of the mills, from want of water, prevented many thousands of tons of stone being treated, the contents of which would otherwise have been added to the year's output. To the production of the colony Charters Towers contributed

511,021 oz., valued at £1,357,517, the largest yield in the history of the field. Charters Towers is a field of deep sinking, and much interest has attended the progress of the shaft of the Day Dawn Consolidated Mine. In January, 1900, a gold-bearing reef was intersected at a depth of 1,815 feet.

The yield of the Mount Morgan gold-field is almost entirely that of the celebrated Mount Morgan mine, which, in 1899, produced 172,389 oz. of gold, valued at £703,449, or about one-fourth of the total production of the colony. The average yield of all ore treated—15 dwt.—was slightly less than that of the preceding year, the decrease being attributed to the inclusion of large quantities of ore that had been left in the mine as too poor for profitable treatment before the initiation of the present system of reduction. Large additions have lately been made to the machinery, the total value now being £466,765. A dam capable of holding 225 million gallons, from which it is proposed to furnish the town supply, has also been constructed. No less than 2,000 men are employed in the mine and works. The number of men engaged in gold-mining in Queensland at the end of 1899 was 9,758, of whom 710 were Chinese. As in Victoria, the number of Chinese finding employment on the gold-fields is decreasing. The estimated value of machinery on the Queensland gold-fields during 1899 was £1,591,963.

In New South Wales the greatest annual production of gold occurred in 1852, soon after the first discovery of the precious metal, when it was valued at £2,660,946. The only other year which saw a production in excess of two millions sterling was 1862, the amount reaching £2,467,780. In 1874 the yield had fallen to 271,166 oz., valued at £1,041,614, and thenceforth the industry declined considerably in importance, reaching its lowest point in 1888, when only 87,541 oz., valued at £317,241, were produced. From that date a steady improvement took place, and in 1894 the Government took the step of furnishing large numbers of the unemployed with miners' rights and free railway passes, and sending them to the abandoned alluvial fields as fossickers. This action, with the increased attention paid to quartz-mining, nearly doubled the production, the quantity obtained during the year being set down at 324,787 oz., valued at £1,156,717; while in 1895 the yield reached 360,165 oz., of a value of £1,315,929—the highest since 1873. In 1896, however, this yield was not maintained, the production amounting to 296,072 oz., valued at £1,073,360. Since 1896 there has been a decided improvement in the annual production. During 1897, 302,817 oz., valued at £1,128,164, were won, and in the following year the production reached 340,493 oz., of a value of £1,244,330. In 1899 the production was 496,196 oz., valued at £1,751,815, making a total yield to date of 12,862,922 oz., of a value of £47,546,013. The quantity and value of gold won in 1899 far exceeded the return of the previous year, and, with the exception of five years, was the highest total recorded. In the absence of any new finds of importance, the increase is doubtless due to the steady improvement

in the methods of mining and in plant used for treating the ores, and also to the inauguration of the gold-dredging system. This is quite a new form of mining in New South Wales, and is receiving much attention. At the end of 1899 the machinery on the gold-fields was valued at £861,828. The principal seats of alluvial mining in the colony are the Bathurst and Mudgee districts, and the country watered by the various feeders of the Upper Lachlan, and also the Tumut and Adelong and Braidwood districts; while the principal quartz-veins are situated near Adelong, Armidale, Bathurst, Hill End, Orange, Parkes, and Wyalong. The most important finds in recent years were the Mount Drysdale gold-field, in the Cobar district, discovered in 1893, and the Wyalong field, situated in the Lachlan district. The first prospecting claim on the latter was registered on the 26th December, 1893, and in the early part of the following year there were over 10,000 persons on the ground. The population now numbers about 4,200, of whom 1,600 are miners. In 1899 the quantity of gold obtained from this district, which now holds the premier position among the gold-fields of the colony, was 44,675 oz., valued at £178,700.

Until quite recently, Western Australia was considered to be destitute of mineral deposits of any value, but it is now known that a rich belt of mineral country extends from north to south. The first important discovery was made in 1882, when gold was found in the Kimberley district, but it was not until a few years later that this rich and extensive area was developed. In 1887 gold was found at Yilgarn, about 200 miles east of Perth, the find possessing importance as the precursor of the discovery of the immense tracts of gold-bearing country, the knowledge of the existence of which has drawn population from all parts of Australasia and brought the colony into the prominent position which it occupies at the present time. General attention was first attracted to these fields by further discoveries at Southern Cross, to the east of Yilgarn; and the sensational finds at Coolgardie, which followed in 1892, resulted in a rush to Western Australia which was reminiscent of the experiences of the fifties in the older-settled portions of the continent. Thereafter, before the march of the prospector, the known gold-bearing area was rapidly extended, and in 1894 the country was divided into separate gold-fields, so extensive were the preparations for its exploitation. At the present time, there are eighteen gold-fields in the colony, the most important, from the point of production in 1899, being East Coolgardie, Coolgardie, and North Coolgardie, in the eastern district; and Murchison, in the central district. For the past two years Western Australia has held the premier position among the Australasian colonies for its gold production, and the wonderful progress of the industry in 1898 has not only been fully maintained during 1899, but in many respects has surpassed anticipations. Steady progress has been exhibited on nearly all the gold-fields, but it is the East Coolgardie field which was mainly responsible for the increased production during 1899, which was nearly 57 per cent. higher than in 1898.

North-east Coolgardie was the only gold-field which did not show an increase for the year, but this may be accounted for by the partial depletion of the alluvial deposits near Kanowna. It is estimated that there are now 21,000 miners actively engaged on the gold-fields. In 1899 the production amounted to 1,643,877 oz., valued at £6,246,733, as compared with 1,050,184 oz., valued at £3,990,698 in 1898, and 30,310 oz., valued at £115,183, in 1891.

In New Zealand, the production of gold in 1899 was valued at £1,513,173—the highest yield since 1873. There has been a decided improvement in the production during the last two years, due to the completion of the extensive operations of a developmental character that were carried out on many of the mining properties acquired by English capitalists. The introduction of capital has enabled the claims not only to be opened up at greater depths, but also to be worked in a more systematic and economical manner. The improved appliances introduced in dredging and hydraulic elevating and sluicing machinery have made it possible to treat material at a cost of from 1d. to 3d. per cubic yard, so that alluvial drifts containing only a few grains of gold to the ton can be profitably worked. A great deal of attention is, therefore, being paid to the auriferous deposits in river-beds and in deep wet ground on the southern gold-fields. It is estimated that 85 dredges, each of which is said to have cost between £2,500 and £8,500, are now working in Otago, Southland, and the West Coast districts, and others are in course of construction. As showing the profitable nature of dredging, the value of the gold obtained in this manner during the year ended 31st March, 1899, was £169,689, and constituted 61·4 per cent. of the alluvial gold exported.

Prospecting work is still being vigorously pursued in the Auckland district, especially in the dense bush localities which have hitherto escaped exploration on account of their inaccessibility. It is stated that numerous lines of reef have been discovered, and that a large number of men are engaged in opening up the lodes.

In 1899 the number of gold-miners in the colony was 13,291, of whom 1,716 were Chinese.

Although payable gold was found in Tasmania in 1852, yet it was not until the seventies that the metal was mined for on an extensive scale, the total production to the end of 1870 being less than 4,000 oz. Beaconsfield is the principal gold-field in the colony. It is situated on the west side of the river Tamar, 26 miles north-west of Launceston, and formerly produced a large quantity of alluvial gold, while the existence of a deep lead carrying good gold has now been proved. The Tasmania mine, on this field, is the largest gold-producer in the colony, and up to the end of 1899 yielded 472,727 oz., valued at £1,723,294, out of which £706,072 has been paid in dividends. Although its yield is at present small, the Lefroy field has been another important centre of gold-production. The reefs are now being proved to a greater depth. At Mathinna a large quantity of gold has also been obtained. The

principal mine on this field is the New Golden Gate, the deepest in the colony, its main shaft being 1,330 feet. This mine has yielded 144,000 oz. of gold, valued at about £533,000, and at 31st December, 1899, had paid £240,000 in dividends. At Mangana, active prospecting has been going on for some time, and some rich stone has been obtained. In the Western District a little alluvial gold is obtained, while north of the Pieman River there is a large extent of auriferous country, but owing to the dense vegetation prospecting is difficult.

The gold-mining industry of the colony has made very satisfactory progress during the last ten years; indeed, the yield in 1899, amounting to £327,545, has never been exceeded, and was more than 10 per cent. higher than the previous record production in 1897, during which year gold to the value of £296,660 was won.

Of all the Australasian colonies, South Australia has produced the smallest quantity of gold, the total output from the commencement of mining operations being valued at less than two and a quarter millions sterling. In the province proper the yield is very small, amounting to but 3,893 oz. in 1899, the balance of 19,230 oz. being obtained from the Northern Territory. Here the mines are largely in the hands of Chinese, but a number of properties have recently been acquired by an English company, which has erected the works necessary for their proper development. Included in the total of 1,486 men engaged in gold-mining in the Northern Territory in 1899, were 1,372 Chinese. About a fourth of these Chinese are physically incapable of doing a fair day's work, and are dangerous from a sanitary point of view. Possessed of no means whatever, and with no proper tools for the search for the precious metal, they eke out a miserable existence by mining a little alluvial gold.

The following table gives the value of gold raised from the commencement of mining to the close of the year 1899, with the proportion due to each province:—

State.	Production of Gold.	
	Value.	Proportion raised in each State.
	£	per cent.
New South Wales	47,546,013	11·1
Victoria	254,156,820	59·3
Queensland	47,338,074	11·1
South Australia	2,212,787	0·5
Western Australia	16,906,449	3·9
Tasmania	4,282,192	1·0
Commonwealth	372,442,335	86·9
New Zealand	55,966,498	13·1
Australasia	428,408,833	100·0

It will be readily understood from the foregoing figures how Victoria, although in area the smallest of the group with the exception of Tasmania, achieved the foremost position amongst the colonies, and retained that place so long as the powerful attraction of gold continued. But although the discovery of such extraordinary deposits as those of Mount Morgan, in Queensland, may astonish the world and give princely dividends to shareholders, the thirst for gold—so powerful in the past—cannot now entice any considerable proportion of the population from other pursuits, and this notwithstanding that only a small portion of the auriferous area of the continent has been explored, and a still smaller portion fully developed.

The production of gold, which had been declining steadily for many years, reached the lowest point in 1886. Since then there has been a marked revival, and, as will have been gathered from the previous pages, there is considerable activity in gold-mining in all the colonies at the present time. The production of gold in each province in 1899, with the quantity obtained from alluvial deposits and the yield from quartz crushings where such information is available, is given below :—

State.	Weight of Gold.			Value of Gold.	
	Alluvial.	Quartz.	Total.	Total.	Proportion raised in each State.
	oz.	oz.	oz.	£	per cent.
New South Wales	91,477	404,719	496,196	1,751,815	10·8
Victoria	270,405	584,095	854,500	3,418,000	21·1
Queensland	21,794	925,100	946,894	2,838,119	17·6
South Australia	.....	.....	23,123	79,041	0·5
Western Australia	63,208	1,580,669	1,643,877	6,246,733	38·6
Tasmania	11,513	72,479	83,992	327,545	2·0
Commonwealth	.....	.....	4,048,582	14,661,253	90·6
New Zealand	....	....	389,558	1,513,173	9·4
Australasia	.....	.....	4,438,140	16,174,426	100·0

The average value of gold won by each miner is given below, but as the conditions under which mining is carried on are by no means the same in every colony, the figures, which vary considerably, may be somewhat misleading. It is probable that the number of gold-miners in several of the provinces is largely overstated, otherwise the industry must be carried on at a great loss; and this will be the more apparent when it is remembered that a fairly large quantity of gold is obtained with other metals, the men employed at the working of which are not classified as gold-miners. Most likely many of the men employ themselves in mining for only a portion of their time, and devote the rest

to more remunerative pursuits. But when full allowance is made on this score, it will be evident that, in some colonies at least, the search for gold is not a profitable occupation. The small return for South Australia is due to the large number of Chinese engaged in the industry, many of them not possessing proper appliances for working the claims. The following table shows the number of miners at work in 1899, with the quantity and value of gold won per man :—

State.	Miners Employed.	Average production of Gold.	
		Quantity.	Value.
	No.	oz.	£ s. d.
New South Wales	19,348	25·65	90 10 10
Victoria	30,114	28·38	113 10 0
Queensland	9,758	97·04	290 17 0
South Australia	1,986	11·64	39 16 0
Western Australia	21,000	78·28	297 9 3
Tasmania	1,296	64·81	252 14 8
New Zealand	13,291	29·31	113 17 0

The greatest development of quartz-reefing is found in Victoria, some of the mines being of a great depth. At the end of 1899 there were seven mines in the Bendigo district over 3,000 feet deep, and fourteen over 2,500 feet deep. In the Lazarus mine a depth of 3,424 feet had been reached, and in Lansell's 180 Mine, 3,352 feet. On other fields there were seven mines over 1,400 feet deep, the principal of which were the South Star mine in the Ballarat district, where the shaft is down 2,520 feet, and the Magdala mine in the Stawell district where a depth of 2,410 feet has been reached.

A notice of gold-mining would be incomplete without some reference to the remarkably large finds made at various times. Information on this point is meagre and not altogether reliable, as doubtless many nuggets were unearthed of which particulars were never published. Victoria's record is the best, and includes the following nuggets :—

	lb.	oz.	dwt.
"The Welcome Stranger," found 9th February, 1869	190	0	0
"The Welcome," found 9th June, 1858	184	9	16
One found at Canadian Gully, 31st January, 1853	134	11	0

And others of the following weights :—98 lb. 1 oz. 17 dwt., 93 lb. 1 oz. 11 dwt., 84 lb. 3 oz. 15 dwt., 69 lb. 6 oz., 52 lb. 1 oz., 30 lb. 11 oz. 8 dwt., and 30 lb. 11 oz. 2 dwt.

New South Wales can boast of having produced some splendid specimens. In 1851 a mass of gold was found on the Turon, weighing 106 lb.; another, from Burrandong, near Orange, produced when melted at the Sydney Mint 1,182 oz. 6 dwt. of pure gold; and a third, the

"Brennan," was sold in Sydney in 1851 for £1,156. During 1880–82 several nuggets were discovered at Temora, weighing from 59 oz. to 1,393 oz.; and others, of 357 oz., 347 oz. (the "Jubilee"), 200 oz., 47 oz., and 32 oz. respectively, were found during the year 1887 in various parts of the colony. Veins of gold of extraordinary richness have been worked in New South Wales. In January, 1873, at Beyers and Holterman's claim, at Hill End, 1·02 cwt. of gold was obtained from 10 tons of quartz, and a mass of ore, weighing 630 lb. and estimated to contain £2,000 worth of gold, was exhibited. The Mint returns for this mine during the year 1873 were 16,279·63 oz., valued at £63,234 12s.; obtained from 415 tons of stone. From Krohman's claim, at Hill End, gold to the value of £93,616 11s. 9d. was obtained during the same year. The foregoing figures, however, are insignificant when compared with the enormous yield of the Mount Morgan Mine, in Queensland, which, has paid over £5,400,000 in dividends. This mine, which may be designated one of the wonders of the world, is a huge mound of ore, highly ferruginous, the peculiar formation, in the opinion of the Government Geologist of Queensland, being due to the action of thermal springs. To the end of May, 1900, 2,156,273 oz. of gold had been won from 1,293,963 tons of ore, yielding an average of 1 oz. 13 dwt. 8 gr. per ton of ore treated.

For the ten years ended 1899, the world's production of gold is estimated to have been as follows:—

Year.	Value.	Year.	Value.
	£		£
1890	23,780,000	1895	41,413,000
1891	26,130,000	1896	44,077,000
1892	29,260,000	1897	49,023,000
1893	31,110,000	1898	58,987,000
1894	38,035,000	1899	64,138,000

Of the production of £64,138,000 in 1899, the Australian colonies produced 25·2 per cent.

Silver.

Silver has been discovered in all the colonies, either alone or in the form of sulphides, antimonial and arsenical ores, chloride, bromide, iodide, and chloro-bromide of silver, and argentiferous lead ores, the largest deposits of the metal being found in the last-mentioned form. The leading silver mines are in New South Wales, the returns from

the other colonies being comparatively insignificant. Up to the year 1882 the quantity of silver raised in New South Wales was very small, but in that and the following years extensive discoveries of the metal, associated principally with lead and copper ore, were made in various parts of the colony, notably at Boorook, in the New England district, and later on at Sunny Corner, near Bathurst, and at Silverton and Broken Hill on the Barrier Ranges in the Western district. The Sunny Corner Silver mines in 1886 paid handsome dividends, and produced £160,000 worth of silver, but since that period the yield has largely fallen off.

The fields of the Western district of New South Wales have proved to be of immense value. The yield of silver-lead ore in the Broken Hill and Silverton districts during 1899 was valued at £1,588,856 ; while the machinery employed was valued at £610,000. This is much less than the value previously set down, the reduction being chiefly due to the removal of machinery to Port Pirie, in South Australia, where the smelting operations of the Proprietary Company are now wholly carried on. The aggregate output of the mines in the Barrier country to the end of the year named was valued at £25,969,594. This rich silver-field, which was discovered in 1883 by Charles Rasp, a boundary rider on Mount Gipps Run, extends over 2,500 square miles of country, and has developed into one of the principal mining centres of the world. It is situated beyond the river Darling, and close to the boundary between New South Wales and South Australia. In the Barrier Range district the lodes occur in Silurian metamorphic micaceous schists, intruded by granite, porphyry, and diorite, and traversed by numerous quartz reefs, some of which are gold-bearing. The Broken Hill lode is the largest as yet discovered. It varies in width from 10 feet to 200 feet, and may be traced for several miles, the country having been taken up all along the line of the lode, and subdivided into numerous leases, held by mining companies and syndicates.

The Broken Hill Proprietary Company hold the premier position. They have at Port Pirie, in the neighbouring colony of South Australia, a complete smelting plant on the latest and most approved principles, and have enlisted the services of competent managers, whose experience has been gained in the celebrated silver-mining centres of the United States. From the commencement of mining operations in 1885 to the end of May, 1899, the company treated 4,125,729 tons of silver and silver-lead ores, producing 98,558,617 oz. of silver and 385,793 tons of lead, valued in the London market at £20,560,959. Dividends and bonuses to the amount of £6,968,000 have been paid, besides the nominal value of shares from the several "Blocks." The sum spent in the erection and construction of plant, from the opening of the property, has been about £991,680. The mine wages and salary sheet for the twelve months represented a sum of £367,013, including £50,417 paid to contractors, and £51,953 for quarrying. The net profit for the year was £230,000.

The quantity and value of silver and silver-lead ore exported by New South Wales to the end of 1899 is shown in the following table :—

Year.	Silver.		Silver-Lead.			Total value.
			Quantity.		Value.	
	Quantity.	Value.	Ore.	Metal.		
Up to 1882	oz.	£	tons cwt.	tons cwt.	£	£
1883	765,397	187,429	203 12	.....	5,385	192,814
1884	77,066	16,488	105 17	.....	1,625	18,113
1885	93,660	19,780	4,668 1	.....	123,174	142,954
1886	794,174	159,187	2,095 16	190 8	107,626	266,813
1887	1,015,434	197,544	4,802 2	.....	294,485	492,029
1888	177,308	32,458	12,529 3	.....	541,952	574,410
1889	375,064	66,668	11,739 7	18,102 5	1,075,737	1,142,405
1890	416,895	72,001	46,965 9	34,579 17	1,899,197	1,971,198
1891	496,552	95,410	89,719 15	41,319 18	2,667,144	2,762,554
1892	729,590	134,850	92,383 11	55,396 3	3,484,739	3,619,589
1893	350,661	56,884	87,504 15	45,850 4	2,420,952	2,477,836
1894	531,972	78,131	155,859 1	58,401 3	2,953,589	3,031,720
1895	846,822	94,150	137,813 8	42,513 2	2,195,339	2,289,489
1896	550,142	81,858	190,192 19	29,687 7	1,560,813	1,642,671
1897	202,789	26,518	267,363 1	19,573 4	1,758,933	1,785,451
1898	150,005	16,711	270,913 14	18,105 7	1,681,528	1,698,239
1899	533,059	59,278	388,460 4	10,108 13	1,644,777	1,704,055
	692,036	76,913	424,337 5	20,289 10	1,993,744	2,070,657
Total	8,798,626	1,472,258	2,187,657 0	394,117 1	26,410,739	27,882,997

This amount was approximately made up of 133,656,650 ozs. of silver, valued at £21,559,566; and of 523,179 tons of lead, valued at £6,323,431. It will be seen that the production of silver in New South Wales rapidly increased until 1891, when it exceeded in value the largest annual production of gold, even in the palmiest days of the diggings. Since that year, however, as will be seen from the returns, the ore now being worked does not carry the same quantity of silver or lead as formerly, while a heavy fall in the price of the metal has considerably reduced the value of what has been won. The number of miners engaged in silver and lead mines in 1899 was 7,893, and the average value of mineral won by each miner engaged amounted to £262 6s. 10d., as compared with £266 8s. 6d. in 1898, £273 14s. 8d. in 1897, and £321 8s. 3d. in 1896.

A company has been formed in London for the purpose of acquiring the rights in New South Wales of a new process for the treatment of sulphide ores. Works have been constructed at Dapto, near Lake Illawarra, and it is intended to smelt refractory gold ores as well as silver ores. The machinery is capable of treating 200,000 tons yearly. Another company has erected at Cockle Creek, near Newcastle, electro-

metallurgical works, which are giving employment to a large number of men, and where experiments with the sulphide ores are also being made.

Although indications of silver abound in all the other colonies, no fields of great importance have yet been discovered, the value of the yield of Australasia to the end of 1899, exclusive of that of New South Wales, being only £3,878,168. Next to New South Wales as a silver-producing province, but far from the position occupied by the former colony, stands Tasmania, where the industry has been steadily developed during the last few years. During 1897 the production of silver and silver lead was valued at £197,225. In 1898 the value of the output had increased to £270,893, and in 1899 to £377,788. This increase is mainly due to the beginning of smelting operations by the Tasmanian Smelting Company. Works have been erected on the Mount Zeehan field, and the Company has thus opened up a market for large quantities of low grade ore, which otherwise could not have been profitably treated. In the Mount Zeehan and Dundas districts almost the whole quantity produced in the colony is obtained. In the first-named district argentiferous lead ore has been found over 30 square miles of country; and the Mount Dundas field, almost adjoining, extends north as far as the Pieman River. The principal mine at Mount Zeehan is the Western, which has paid £102,000 in dividends. A little mining is carried on at the Whyte River and Hazlewood fields; and at the Magnet Range, near Waratah, the Magnet Silver Mining Company has made great progress. Very high class ore has been opened up, and it is the intention of the company to connect the mine with Waratah by tramway, as the increasing output is somewhat in excess of the existing facilities for delivering the ore at the Waratah railway station.

Silver is found in various districts in Queensland, but the greatest activity is at present being shown at Stanthorpe, on the border of New South Wales, and it is from this field that the largest proportion of the production of that colony was raised in 1899. In that year the output was valued at £15,671, and the industry gave employment to 337 miners. In New Zealand silver is found in various localities, principally on the Te Aroha, Thames, and Coromandel fields, but the metal is generally sought in conjunction with gold-mining. The production of the colony during the year 1899 was 349,338 oz., valued at £40,838.

There are no silver-mines in Victoria or Western Australia, the small amount of silver produced by the former colony being found associated with gold. The quantity of fine silver extracted from gold during 1899 at the Melbourne Branch of the Royal Mint was 87,782 oz. The production of silver in South Australia is very limited, and it would seem that the argentiferous lead-ore fields of Broken Hill and Silverton, which are almost on the border of the two colonies, are exclusively confined within the boundaries of New South Wales.

Up to the end of 1899 New South Wales had produced nearly 88 per cent. of the total value of silver raised in Australasia; Tasmania came second, with 6·1 per cent.; and the remaining small proportion was distributed over the other colonies, Victoria claiming the largest share. The total production of silver in Australasia in 1899, and up to the end of that year, was as follows:—

State.	During 1899.		To end of year 1899.	
	Value.	Proportion raised in each State.	Value.	Proportion raised in each State.
	£	per cent.	£	per cent.
New South Wales ...	2,070,657	82·3	27,882,997	87·8
Victoria	10,850	0·5	856,539	2·7
Queensland	15,671	0·6	713,089	2·2
South Australia	400	0·0	106,043	0·3
Western Australia ...	....	.....	250	0·0
Tasmania	377,788	15·0	1,925,578	6·1
Commonwealth..	2,475,366	98·4	31,484,496	99·1
New Zealand	40,838	1·6	276,669	0·9
Australasia	2,516,204	100·0	31,761,165	100·0

The world's production of silver during the ten years ended 1899 is estimated to have been as follows:—

Year.	Ounces.	Year.	Ounces.
1890	126,095,000	1895	182,220,000
1891	137,171,000	1896	176,707,000
1892	152,940,000	1897	182,081,000
1893	162,162,000	1898	179,252,000
1894	178,668,000	1899	174,723,000

The annual output of the colony of New South Wales alone is therefore rather more than one-fourteenth of the total production of silver.

Copper.

Copper is known to exist in all the colonies, and has been mined for extensively in South Australia, and on a much smaller scale in New South Wales, Tasmania, and Queensland. The low quotations which

have ruled for a number of years have had a depressing effect upon the industry, and for some time a few of the mines were closed; but with a consumption which has lately shown a tendency to overtake production, and the advanced price of the metal, copper-mining is again attracting considerable attention in Australasia. South Australia has so far supplied nearly 70 per cent. of the copper produced in these colonies; but Tasmania promises to become a formidable competitor in the output of this mineral. In Tasmania deposits were worked on a limited scale for a long number of years; but the discovery of a rich belt of copper-bearing country, extending from Mount Lyell past Mount Tyndall, Mount Read, Mount Murchison, and north of the Pieman to the Rocky and Savage Rivers, has completely changed the character of the mining industry in the colony, and from a small export of copper ore valued at £1,659 in 1896, the annual production since 1897 has become the largest in Australasia. This expansion was chiefly due to the enterprise shown by the Mount Lyell Mining and Railway Company, whose mine is situated at Gormanston, about 4 miles by road from Queenstown. At the latter place reduction works have been erected, where the ore is treated by the pyritic smelting process, ultimately being converted into blister copper, containing about 98 per cent. of metallic copper. From the reduction works a railway was laid down to Teapookana, on the King River, through most difficult country. This railway has since been extended from Teapookana to Strahan. It is stated that a sum of £400,000 was expended by the Company on construction and development works before any return was received from the mine; but by the end of September, 1899, the dividends had amounted to £436,262. The Company finds employment for 1,822 men, of whom 1,400 are employed at the reduction works, where, for the three years ended June, 1899, the quantity of ore smelted was 406,586 tons, yielding 13,119 tons of blister copper, which contained 12,961 tons of fine copper, 1,363,874 oz. of silver, and 57,467 oz. of gold. Other mines on the same field are at work, and in various parts of the colony copper-mining is receiving attention. In 1897 the value of the copper produced was £323,650. During the following year the production amounted to £382,640, and in 1899 it had increased to £1,227,532, or nearly four times the production of 1897. Of the total production of the Australasian colonies in 1896, the proportion of Tasmania was only 0·4 per cent.; in 1899, however, this colony furnished more than 59 per cent., and the increase is more striking when it is remembered that during the same period the annual output of each of the principal copper-producing colonies has been about doubled.

The discovery of copper had a marked effect upon the fortunes of South Australia at a time when the young and struggling colony was surrounded by difficulties. The first important mine, the Kapunda, was opened up in 1842. It is estimated that at one time 2,000 tons were produced annually, but the mine was closed in 1879. In 1845

the celebrated Burra Burra mine was discovered. This mine proved to be very rich, and paid £800,000 in dividends to the original owners. For a number of years, however, the mine has been suffered to remain idle, chiefly because the deposits originally worked were found to be depleted. For many years the average yield was from 10,000 to 13,000 tons of ore, yielding from 22 to 23 per cent. of copper. For the period of thirty years during which the mine was worked the output of ore amounted to 234,648 tons, equal to 51,622 tons of copper, valued at £4,749,224. Boring operations are being conducted at the mine for the purpose of determining whether payable ore exists at greater depths than those reached by the original workings. One bore was put down to a depth of 1,004 feet, and in the the opinion of the Government Geologist, the result was highly satisfactory, as it proved the continuance downwards of the copper-bearing ground sufficiently to warrant the reopening of a portion of the mine. For the purpose of further testing the ground a second site for boring has been selected. The Wallaroo and Moonta mines, discovered in 1860 and 1861, proved to be even more valuable than the Burra Burra. The Moonta mine employed at one time upwards of 1,600 hands, and still keeps 1,138 men at work. In 1890 these mines were amalgamated, and the estimated value of the copper produced to the end of 1898 is set down at £9,218,482, out of which about £7,000,000 have been expended in wages. About 1,800 miners are now employed. The total dividends paid by these mines is stated to be upwards of £1,700,000. The production of copper in South Australia during 1899 was valued at £406,208, the highest return since 1884, and nearly double that of 1894.

The copper-mining industry in New South Wales reached its highest point in 1883, when the production was valued at £472,982. The low price to which the metal fell greatly diminished the production, some of the principal mines being closed for a few years; but, as in the other colonies, there has lately been a revival in the industry. In 1899 the output was valued at £395,451, as compared with £272,686 for the previous year. The principal deposits of copper are found in the central part of the colony, between the Macquarie, Bogan, and Darling Rivers. Deposits have also been found in the New England and Southern districts, as well as at Broken Hill, showing that the mineral is widely distributed throughout the colony. The more important mines are those of Cobar, where the Great Cobar mine, which recommenced work on tribute early in 1894, raised in the following year 37,845 tons of ore, yielding 1,703 tons of smelted copper; in 1896, 66,431 tons of ore, yielding 2,650 tons of smelted copper, valued at £107,200; and, in 1897, 64,820 tons of ore, yielding 2,462 tons of smelted copper, valued at £108,306. Similar information for subsequent years is not available, but in the division of which the Great Cobar is the principal mine, 3,794 tons of refined copper, valued at £265,580, were obtained in 1899, as compared with 3,514 tons, valued at £178,900, won during 1898. It may be mentioned that the copper extracted from this mine is found to

contain gold more than sufficient to pay for mining and treating the ore. The syndicate to which the mines belong now gives employment to 700 men. In other portions of the Cobar district considerable activity is also being displayed. At Nymagee, copper to the value of £35,125 was produced during 1899, and in the Mount Hope division 2,174 tons of ore were raised, yielding copper valued at £10,498. In 1899, the Burraga Copper-mine was acquired by an English company, and great improvements and additions have been effected in the plant and machinery. During the year 10,256 tons of ore were treated, containing copper to the value of £36,400. About 300 men are employed at the mine.

Cupriferous deposits abound in Queensland, and at one time there was considerable speculation in copper-mining stock of that colony. Peak Downs and Mount Perry acquired great celebrity in the Australian mining market, but afterwards suffered reactionary depression, and were ultimately abandoned—the result, in a large measure, of over-speculation. It is, however, interesting to note that, after a period of twenty years' inactivity, the Peak Downs Copper-mines have been reopened, and it is also anticipated that other mines that have been closed for many years will be reopened. In Northern Queensland copper is found throughout the Cloncurry district, in the upper basin of the Star River, and the Herberton district. The returns from the copper-fields in the colony are at present small, owing to the lack of suitable fuel for smelting purposes, which renders the economic treatment of the ore difficult; and the development of the mines is greatly retarded by the want of easy and cheaper communication with the coast. The great distance from the coast is principally the cause of the stagnation that exists at Cloncurry, a district which is credited with an abundance of mineral wealth. Considerable activity has, however, been displayed in some of the districts. In the Walsh and Tinaroo Mineral Field, the Chillagoe Railway and Mining Co. is making preparations for mining on a very extensive scale. A railway is under construction to connect the mines with Cairns, and the company has leased over 3,000 acres for periods ranging from twenty-five to fifty years. At Rockhampton large quantities of ore have been opened up, and mining and smelting machinery valued at £7,000 is in course of erection. The total production of copper in Queensland during 1899 was valued at £9,498, as compared with £2,166 in 1898.

In Western Australia copper deposits have been worked for some years. Very rich lodes of the metal have been found in the Northampton, Murchison, and Champion Bay districts, and also in the country to the south of these districts, on the Irwin River. As in the other copper-producing provinces, there has been a revival of the industry in Western Australia. During 1899, the value of the production amounted to £35,938, as compared with £4,266 in 1898, and £1,033 for the previous year. The main portion of the copper was obtained from the West Pilbarra district. The most important workings

are at Whim Creek Mine, on the Balla Balla Creek, near Roeburne. The total export of copper to the end of 1899 was valued at £208,053. The number of men engaged in copper-mining during 1899 was 147.

Copper-mining has not attained any great proportions in Victoria, although deposits have been found in several parts of the colony, particularly in the Beechworth district, where they have been traced over an area of some 50 square miles. The value of the total production is estimated at £206,395, but there has not been any output during the last few years. The copper deposits of New Zealand have been worked to a small extent only, and for a number of years have been almost entirely neglected.

Copper is sometimes found in the Australasian mines in a virgin state, and beautiful specimens of the pure metal have been exhibited at different times, but it occurs generally in the form of oxidised copper ores, carbonates, sulphates, phosphates, and silicates of copper. The museums of South Australia, Victoria, and New South Wales contain striking samples of azurite and malachite, magnificent blocks of which have been shown from time to time at exhibitions, not only in the colonies, but also in Europe and America. Copper sulphides and arsenides are generally found in deep sinkings. The metal has also been found associated with tin in the form of stannine.

In 1899 the number of men employed in copper-mining in New South Wales was 2,369, as compared with 1,976 in 1898, 1,710 in 1897, and 810 in 1896. Only a few hands were employed in the other colonies, except South Australia, where the number must have amounted to about 4,000. In 1899 the industry afforded employment to a large number of men in Tasmania.

The total value of copper produced in Australasia during and up to the end of 1899, and the proportion furnished by each colony, are given below :—

State.	During 1899.		To end of year 1899.	
	Value.	Proportion raised in each State.	Value.	Proportion raised in each State.
	£	per cent.	£	per cent.
New South Wales	395,451	19·1	5,019,480	15·9
Victoria	.....	.....	206,395	0·6
Queensland	9,498	0·4	2,032,425	6·4
South Australia	406,208	19·6	21,935,954	69·6
Western Australia	35,938	1·7	208,053	0·7
Tasmania	1,227,532	59·2	2,102,048	6·7
Commonwealth	2,074,627	100·0	31,504,355	99·9
New Zealand	.....	.....	17,938	0·1
Australasia	2,074,627	100·0	31,522,293	100·0

In June, 1872, copper realised as much as £112 per ton, whilst in December, 1886, the lowest price on record until that time was touched, and only £44 could be obtained for South Australian copper. At the end of 1887 the price had risen to £70 per ton, and in September, 1888, to £93. In March, 1889, there was a great fall in the price of the metal, and in April of that year the quotation in London was as low as £43 per ton. This was the lowest price reached until June, 1894, when it fell to £41 10s. From that date there was an upward movement, as the following quotations will show. At the close of 1896 the London price of copper stood at £52 10s. per ton; in February, 1897, £54 10s. was reached; and at the 31st December, 1898, £60 was the market value. This price was further increased during 1899, and in September of that year no less than £77 per ton was quoted. Reference has already been made to the depressing influence exerted on the industry in Australasia by the low prices; but, as previously indicated, the tendency of consumption to increase in a greater ratio than production, and the rise in the price of the metal, has galvanised copper-mining into a state of activity which has not been witnessed for many years.

Tin.

Tin was known to exist in Australasia almost from the first years of colonisation, the earliest mention of the mineral appearing in a report of a discovery by Surgeon Bass on the north coast of Tasmania. In the form of cassiterite (oxide of tin) it occurs in all the colonies, but the richest deposits have been found in Tasmania—the Mount Bischoff being the most celebrated tin-mine in Australasia. The wealth of Queensland and the Northern Territory of South Australia in this mineral, according to the reports of Mr. Jack, a Government Geologist of the former colony, and the late Rev. Tenison Woods, appears to be very great.

In New South Wales lode tin occurs principally in the granite and stream tin under the basaltic country in the extreme north of the colony, at Tenterfield, Emmaville, Tingha, and in other districts of New England. The metal has also been discovered in the Barrier Ranges, at Poolamacca and Euriowie; near Bombala in the Monaro district; at Gundle, near Kempsey; at Jingellic, on the Upper Murray; at Dora Dora, on the Upper Murray; and in the Valley of the Lachlan; but in none of these districts has it been worked to any extent. Although the mineral was discovered by the Rev. W. B. Clarke as far back as the year 1853, the opening of the tin-fields of New South Wales only took place in the year 1872, but since that date the output from the mines has been considerable. In 1881 the industry attained its greatest height of prosperity, the export having increased to £568,795 from £249,779 in 1876. In 1882 the production was but £27,000 less; but

after that year, owing to protracted dry seasons, which in many cases prevented mining operations, combined with the comparatively low price which the metal brought, the value of the output fell considerably, and in 1898 only represented the small sum of £45,638. Another cause of diminished production is that the shallow deposits of stream-tin have to a great extent been exhausted, although the deep deposits and the tin-lodes have as yet scarcely been touched, nearly all the metal hitherto produced having been taken from alluvial deposits. The high price of the metal had a stimulating effect upon the industry during 1899, and the production of the year, valued at £90,482, was the highest since 1893. The principal leads worked were at the Vegetable Creek Tin-field, near Emmaville; at Tingha; at Deepwater; and at Elsmore, in the Inverell district. The only lode worked is the Ottery. The mine is situated at Tent Hill, in the Emmaville district, and was worked continuously throughout the year with very satisfactory results. The number of miners employed during 1899 was 1,489, of whom 418 were Chinese.

Tasmania has been the largest producer of tin in Australasia. As in New South Wales, a very large proportion of the tin hitherto produced has been from alluvial deposits, the lodes, except at the Mount Bischoff mine, having been comparatively neglected. There are considerable areas of alluvial tin ground in the eastern and north-eastern divisions of the colony, and a plentiful supply of water would result in a greatly increased production. Many claims remained unworked on account of the continuous dry weather; nevertheless, the value of the output during 1899, although not so high as in most of the early years of production, exceeded that of any year since 1889. The increase was mainly due to the high price of the metal. The Mount Bischoff mine, which is worked as an open quarry, is the largest producer of tin in the colony, and has paid £1,648,000 in dividends. The company has erected smelting works at Launceston, where most of the tin ore raised in the island is treated. In the Blue Tier district, where several companies have erected plant for working the low grade ores found there, the output is considered very satisfactory. Mining operations have also been resumed in the Ben Lomond district, and during the year crushing was commenced at the Rex Hill mine. The lodes in the vicinity of Mount Heemskirk have, till recently, been neglected, but the present satisfactory price of the metal has stimulated mining in this district, as well as in other parts of the colony, and, although the work done has been of a preparatory character, it is expected that tin ore will shortly be sent away in large quantities. About thirty men are employed on the various claims, and the machinery at the New West Cumberland mine has been thoroughly overhauled. Tin-dredging is also receiving considerable attention. Two companies have commenced operations on the Ringarooma River, with very encouraging results. Dredging claims have also been taken up along the foreshore at St. Helen's Point and George's Bay, and it is anticipated that the new

industry will have a large measure of success. In 1899 the number of tin-miners in the colony was 1,026, and the production was valued at £270,864.

The most important tin-mines in Queensland are in the Herberton district, south-west of Cairns; at Cooktown, on the Annan and Bloomfield Rivers; and at Stanthorpe, on the border of New South Wales. The Herberton is the chief tin-mining centre of Queensland, and the output of this district in 1899 was valued at £58,058. The tin in this district is chiefly obtained from lodes. Herberton and Stanthorpe have produced more than three-fourths of the total production of the colony. In the past few years the production greatly decreased in consequence of the low price of the metal; but with the rise in values, and more economic treatment of the ores, the industry naturally attracted more attention in 1899, when the yield was valued at £77,302, as compared with £36,502 in 1898, and £37,509 in 1897. During 1899 a considerable amount of work was carried out, in connection with the construction of roads, tramways, and reservoirs, and cutting and extending water races. With a continuance of the present satisfactory price the prospects of the industry are extremely encouraging.

The yield of tin in Victoria is very small, and until lately no fields of importance had been discovered, but towards the latter end of 1890 extensive deposits were reported to exist in the Gippsland district at Omeo and Tarwin. In 1899 only 156 tons of tin, valued at £11,200, were produced. In South Australia tin-mining is unimportant. During 1899 a small quantity, valued at £180, was exported from Port Darwin, in the Northern Territory. In Western Australia the tin-fields are situated at Greenbushes; but, until recently, the industry, owing to the low price, and the attraction exerted on capital by the gold-fields, has not been in a flourishing condition. The high price of the metal, however, has again turned attention to tin-mining, and during 1899 the output amounted to £25,270, as compared with £3,960, the average annual production of the three previous years. During the year, tin was discovered near Marble Bar, on the Pilbarra goldfield. A number of leases have been taken up, and there is every prospect of the find developing into a payable field. The industry gave employment to 698 miners during the year. There is no record of any production of tin in New Zealand.

The tin-mining industry has been subject to frequent fluctuations, especially of late years. The value of the metal in the European market was £159 per ton in 1872, £52 in 1878, £114 in 1880 and 1882, and £72 in 1884. A gradual recovery then took place, until in 1888 the price reached £121. During the ten years from 1888 to 1898, tin was subject to an almost continuous fall in price, realising in 1898 only one-half of that obtained a decade before. The metal, however, has now made a great advance in price, London quotations in December, 1899, being £125 10s. per ton, as compared with £82 in 1898, £63 in 1897,

and £59 10s. in 1896, and there has been a still further improvement during the year 1900.

The value of the production of tin during 1899, and up to the end of that year, was as given below :—

State.	During 1899.		To end of year 1899.	
	Value.	Proportion raised in each State.	Value.	Proportion raised in each State.
	£	per cent.	£	per cent.
New South Wales	90,482	19·0	6,382,538	34·3
Victoria	11,200	2·4	706,300	3·8
Queensland	77,302	16·3	4,526,102	24·3
South Australia	180	0·0	26,322	0·1
Western Australia	25,270	5·3	101,497	0·5
Tasmania	270,864	57·0	6,883,306	37·0
Australasia	475,298	100·0	18,626,065	100·0

The number of persons engaged in tin-mining in 1899 was as follows :—In New South Wales, 1,489 ; Tasmania, 1,026 ; Queensland, 913 ; Victoria, 15 ; and Western Australia, 698.

Iron.

Iron is distributed throughout Australasia, but for want of capital in developing the fields this industry has not progressed. In New South Wales there are, together with coal and limestone in unlimited supply, important deposits of rich iron-ores suitable for smelting purposes; and for the manufacture of steel of certain descriptions abundance of manganese, chrome, and tungsten ores are available. The most extensive fields are in the Mittagong, Wallerawang, and Rylstone districts, which are roughly estimated to contain in the aggregate 12,944,000 tons of ore, containing 5,853,000 tons of metallic iron.

Magnetite, or magnetic iron, the richest of all iron ores, is found in abundance near Wallerawang in New South Wales. The proximity of coal-beds now being worked should accelerate the development of the iron deposits, which contain 41 per cent. of metal. Magnetite occurs in great abundance in Western Australia, together with hematite, which would be of enormous value if cheap labour were abundant.

Goethite, limonite, and hematite are found in New South Wales, at the junction of the Hawkesbury sandstone formation and the Wianamatta shale near Nattai, and are enhanced in value by their proximity to coal-beds. Near Lithgow extensive deposits of limonite or clay-band ore are interbedded with coal. Siderite or spathic iron (carbonate of

iron) and vivianite (phosphate of iron) are found in New Zealand. The latter also occurs in New South Wales, intermingled with copper and tin ores.

The principal works in New South Wales for the manufacture of iron from the ore are situated at Eskbank, near Lithgow, where red siliceous ores, averaging 22 per cent., and brown hematite, yielding 50 per cent., metallic iron, have been successfully treated. Abundance of coal and limestone are found in the neighbourhood. This establishment, however, has for some time abandoned the manufacture of pig-iron, for which it was originally built. The work now carried on consists of the re-rolling of old rails, and the manufacture of iron bars, rods, and nails, and of ordinary castings. The quantity manufactured from scrap during 1899 was 6,500 tons, valued at £55,550. A successful attempt has been made at Mittagong to make gas-pipes, etc., from iron smelted from the ore and taken direct to the mould without first making it into pig-iron. Some years ago the iron smelting works at Fitzroy, Mittagong, were established, but after producing a considerable quantity of pig-iron the operations were discontinued. Some samples of ore, coal, and limestone obtained in this district, with pig-iron and castings manufactured therefrom, were exhibited at the late Mining Exhibition in London, and obtained a first award. Large quantities of iron ore have been raised from the deposits situated in the Marulan, Goulburn, Bredalbane, Mittagong, and Carcoar districts and despatched to the smelting-works at Dapto and Cockle Creek, where it has been used as flux, the gold contents of the ore helping to defray the extra cost of railway carriage. The new industry is giving employment to a large number of men. Parcels of iron oxide have also been sent from the Fitzroy and other ironstone deposits in the Mittagong district to the various gas-works of the Australasian colonies. The oxide is used in purifying the gas.

During the year 1900, the Government of New South Wales agreed to take 100,000 tons of steel rails, delivery to extend over a period of four years, from a large company which purposed erecting iron and steel works in the vicinity of Port Kembla, at a cost of between £500,000 and £750,000. The company has deposited £10,000 with the Treasury as a guarantee of good faith.

In Tasmania, where large deposits of pure red and brown hematite are known to exist, a commencement has been made in the production of iron ore. In 1896, 200 tons of ore, valued at £50, were raised; and in the following year 894 tons of iron ore, of a declared value of £812, were exported. The shipments in 1898 comprised 1,598 tons, valued at £1 per ton; and during 1899 the output increased to 3,532 tons, valued at £3,474. Very extensive iron deposits exist in the vicinity of the Blythe River, on the north-west coast, and a company has recently been formed to develop the mines thoroughly. It is intended to expend £30,000 in constructing a railway and other necessary

works. The Government of South Australia has offered a bonus of £2,000 for the first 500 tons of pig-iron produced in that colony. In Western Australia a limited demand for iron ore by the Smelting Company at Fremantle, resulted in 12,852 tons, valued at £8,939, being mined during 1899. This is the first year in which any record of the production of the mineral exists.

Sulphuretted iron ores (pyrites) are of little intrinsic value, but are frequently of considerable worth on account of the other minerals with which they are associated, common pyrites being often auriferous. Mispickel differs from other pyrites inasmuch as it contains arsenic, and sometimes gold and silver, and is frequently associated with tin and copper ores; but the extraction of gold is rendered difficult on account of the presence of the arsenic. These minerals (pyrites) are common to all the colonies.

Antimony.

Antimony is widely diffused throughout Australasia, and is sometimes found associated with gold. In New South Wales, deposits of antimony occur in various places, chiefly in the Armidale, Bathurst, and Rylstone districts; and at Bowraville on the North Coast. The principal centre of this industry is at Hillgrove, near Armidale, where the Eleanora Mine, one of the richest in the colony, is situated. The ore is also worked for gold. The results of a number of analyses, made by the authorities of the Geological Museum, show from 29·57 to 79·45 per cent. of metal; but, notwithstanding these encouraging assays, the price has not been sufficiently high to tempt Australian producers. A considerable quantity of antimony was raised some years ago at the Corangula mines, in the Macleay district, but these mines are at present idle. Lodes have also been opened and partly worked near Nambucca, Drake, Gulgong, and Razorback. The value of antimony raised during 1899 was £2,694, and up to the end of that year, £190,621. The industry has suffered greatly during the last five years from the low price of the metal, and the output is not likely to improve until the price takes an upward tendency.

In Victoria there has been a still greater falling off in the production of antimony; for from a state of activity in 1890 which gave employment to 238 miners, in 1899 the industry was absolutely at a standstill. In Queensland the fields were all showing development in 1891, when the output exhibited a very large increase compared with that of former years; but, as in the case of Victoria, the production of the metal seems to have ceased. In New Zealand also, the production of antimony has ceased since 1897, during which year only 10 tons, valued at £157, were exported from that colony. Good lodes of stibnite (sulphide of antimony) have been found near Roebourne, in Western Australia; but no attempt has yet been made to work them.

The following table shows the value of antimony produced in Australasia up to the end of 1899 :—

State.	Value.	Proportion raised in each State.
	£	per cent.
New South Wales	190,621	41·8
Victoria	177,174	38·9
Queensland	35,458	7·8
Commonwealth	403,253	88·5
New Zealand	52,361	11·5
Australasia	455,614	100·0

Bismuth.

Bismuth is known to exist in all the Australian colonies, but up to the present time it has been mined for in New South Wales, Queensland, South Australia, and Tasmania only. It is usually found in association with tin and other minerals, but in one instance a mass of native bismuth, weighing 30 lb., was found in New South Wales. The principal mine in the mother colony is situated at Kingsgate, in the New England district, where the mineral is generally associated with molybdenum and gold; this mine, however, is at present practically closed. The value of bismuth produced up to the end of 1899 in New South Wales and Queensland was £50,880 and £58,863 respectively. In the former colony the production in 1899 was valued at £3,355, while in Queensland the output in that year only amounted to £494. In Tasmania a company has been formed to work the bismuth deposits at Bell Mount. The lodes are opening up satisfactorily, and a small quantity of ore has been sent away.

Manganese.

Manganese probably exists in all the colonies, deposits having been found in New South Wales, Victoria, Queensland, New Zealand, and Western Australia—the richest specimens in New South Wales and New Zealand. Little, however, has been done to utilise the deposits, the demands of the colonial markets being extremely limited; but in the event of the extensive iron ores of New South Wales being worked on a large scale, the manganese, plentiful as it is in that colony, will become of commercial importance. The ore generally occurs in the form of oxides, manganite, and pyrolusite, and contains a high percentage of sesquioxide of manganese. The production of manganese in New Zealand

to the end of the year 1899 was valued at £59,644. In that colony the output has shrunk to insignificant proportions, being valued in 1899 at £407. In Queensland during the same year, 735 tons, valued at £2,831, were raised; but in New South Wales nothing was produced in the course of the twelve months.

Platinum.

Platinum and the allied compound metal Iridosmine have been found in New South Wales, but so far in inconsiderable quantities, the latter occurring commonly with gold or tin in alluvial drifts. Beach mining in the Ballina district, where platinum was associated with gold in considerable quantities is now a thing of the past. A special lease of abandoned ground at Macauley's Lead, Jerusalem Creek, has been applied for, and it is the intention of the applicants to try the ground by the cyanide process. Should this prove successful, the output of the metal will be largely increased, as an effort will be made to save any platinum met with in the concentrates. The metal has also been discovered at Fifield, in the Parkes district, and in lodes near Broken Hill and Orange. Mining operations were confined in 1899 to the Fifield gold-field, where the metal is found associated with the gold in washdirt. The total yield of platinum for the year was 638 oz., as compared with 1,250 oz. in 1898. Mining on this field is handicapped by a scarcity of water, and only half-time is put in at the claims. The Fifield platinum occurs in coarse shotty grains, and is much purer than that obtained from the northern beach-sands. The quantity of platinum produced during 1899 was valued at £1,070, and to the end of that year, £11,425. Platinum and Iridosmine have also been found in New Zealand.

Tellurium.

The noble metal Tellurium has been found in New Zealand, associated with gold and silver (petzite) and with silver only (hessite). It has also been discovered in New South Wales at Bingara and other parts of the northern districts, as well as at Tarana, on the Western Line, though at present only in such minute quantities as would not repay the cost of working; while at Captain's Flat it has been found in association with bismuth.

At many of the mines at Kalgoorlie, Western Australia, large quantities of ores of telluride of gold have been discovered in the lode formations.

Lead.

Lead is found in each of the Australasian colonies, but is worked only when associated with silver. In Western Australia the lead occurs in the form of sulphides and carbonates of great richness, but the quantity

of silver mixed with it is very small. The lodes are most frequently of great size, carrying huge masses of galena, and contain so little gangue that the ore can be very easily dressed to 83 or 84 per cent. The Government having offered £10,000 for the first 10,000 tons of lead smelted in the colony, works were erected to treat the ore, but the operations of the company were not successful, and the works were closed. Since 1845 Western Australia has exported 33,960 tons of lead ore, valued at £370,287. The chief mining centres for this mineral are in the Northampton district, between Geraldton and Murchison, but very little has been raised since 1890. As will be gathered from the remarks on silver, the association of lead with this metal in the Broken Hill mines of New South Wales adds very greatly to the value of the product. Up to the end of 1899 the quantity of lead in the ores raised is estimated to have been 523,179 tons.

Other Metals.

Mercury, in the form of sulphides or cinnabar, is found in New South Wales, Queensland, and New Zealand. In New South Wales, in the form of cinnabar, it has been discovered on the Cudgegong River, near Rylstone, and it also occurs at Bingara, Solferino, Yulgilbar, and Cooma. In the latter place the assays of ore yielded 22 per cent. of mercury. Very large and rich deposits have been found on Noggriga Creek, near Yulgilbar, and three 40-acre blocks have been taken up. Cinnabar leases have also been applied for in the Bingara district.

Titanium, of the varieties known as octahedrite and brookite, is found in alluvial deposits in New South Wales, in conjunction with diamonds.

Wolfram (tungstate of iron and manganese) occurs in some of the colonies, notably in New South Wales, Victoria, Queensland, and New Zealand. In Queensland, a temporary rise in the price of this mineral, owing to the depletion of stocks on the English market, so stimulated its production that the yield during 1899 was very much greater than in any former year, and amounted to 259 tons, valued at £10,060. To the end of 1899, 483 tons, of a value of £14,107, have been raised in the colony. Scheelite, another variety of tungsten, is also found in the last-mentioned colony. Molybdenum, in the form of molybdenite (sulphide of molybdenum), is found in New South Wales and Victoria, associated in the former colony with tin or bismuth in quartz-reefs.

Zinc ores, in the several varieties of carbonates, silicates, oxide, sulphide, and sulphate of zinc, have been found in several of the Australasian colonies, but have attracted little attention, except in New South Wales, where the metal is usually found associated with silver, lead, and copper; and various experiments are being made for the purpose of ascertaining whether it can be profitably extracted. During the last few years attention has been directed by the Broken Hill Proprietary

Company to the production of a high grade zinc concentrate from the sulphide ores, and it is anticipated that a fair proportion of the value contained will be realised, although the attempts so far to make a marketable zinc concentrate have only been partially successful. The value of the zinc produced during 1899 was £49,207, as compared with £28,941 in 1898, and £23,688 during 1897. The value of the total production to the end of 1899 was £112,879.

Nickel, so abundant in the island of New Caledonia, has up to the present been found in none of the Australasian colonies except Queensland and Tasmania; but few attempts have been made to prospect systematically for this valuable mineral. In 1894 Tasmania produced 136 tons of nickel ore, valued at £544; but nothing has been raised since that date.

Cobalt occurs in New South Wales and Victoria, and efforts have been made in the former colony to treat the ore, the metal having a high commercial value; but the market is small, and no attempt has yet been made to produce it on any large scale. The manganese ores of the Bathurst district of New South Wales often contain a small percentage of cobalt—sufficient, indeed, to warrant further attempts towards its extraction. The only deposits being worked at the present time are at Port Macquarie, where very promising ore has been opened up. During 1899, 190 tons, valued at £899, were exported.

Chrome iron or chrome ore has been found in New Zealand and Tasmania. In New South Wales chromium is found in the northern portion of the colony in the Clarence and Tamworth districts, and also near Gundagai. It is usually associated with serpentine. The chrome mining industry in the mother colony is of very recent date, although an attempt was made in 1882 to open up deposits at Bowling Alley Point, in the Peel River district; and in 1891 and 1895 in the Clarence River district. The first successful mining operations were carried out near Coolac, in the Gundagai district, 2,000 tons of ore being despatched in 1894 and 1895; and although numerous discoveries of chromite followed, the Gundagai–Tumut district has remained the only scene of profitable mining enterprise. The exports of chrome ore in 1894, 1895, and 1896 amounted to 3,034 tons, 4,299 tons, and 3,852 tons respectively; but the low price obtainable has prejudicially affected the industry, and although in 1897 the export still amounted to 3,379 tons, valued at £10,269, a considerable portion of this was raised in previous years. The production in 1898 decreased to 2,111 tons, valued at £6,301, but increased during 1899 to the considerable amount of 5,243 tons, valued at £17,416. The industry is still confined to the Gundagai district, where the ore abounds. The value of chrome iron ore won to the end of 1899 was £70,975. In New Zealand chrome ore to the value of £37,367 was extracted between 1858 and 1866, but there has been no further production since the latter year.

Sulphur exists in large quantities in the volcanic regions of New Zealand, where it will doubtless some day become an article of commerce.

It is also said to occur in small quantities at Mount Wingen, in the Upper Hunter district of New South Wales; at Tarcutta, near Wagga Wagga; and at Louisa Creek, near Mudgee.

Arsenic, in its well-known and beautiful forms, orpiment and realgar, is found in New South Wales and Victoria. It usually occurs in association with other minerals, in veins.

Coal.

The Australasian colonies have been bountifully supplied by Nature with mineral fuel. Five distinct varieties of black coal, of well characterised types, may be distinguished, and these, with the two extremes of brown coal or lignite, and anthracite, form a perfectly continuous series. For statistical purposes, however, they are all included under the generic name of "coal," and therefore these minerals will be considered here only under the three main heads—lignite, coal, and anthracite.

Brown coal or lignite occurs principally in the colonies of New Zealand and Victoria. Attempts have frequently been made to use the mineral for ordinary fuel purposes, but its inferior quality has prevented its general use. In Victoria, during 1898, 2,869 tons of brown coal were raised, valued at £767. There was no output during 1899. The fields of lignite in New Zealand are roughly estimated to contain about 500 million tons; and a small quantity is raised annually.

Black coal forms one of the principal mineral resources of New South Wales; and in New Zealand and other colonies the rich deposits of this valuable substance are rapidly being developed. That they will form an important source of commercial prosperity cannot be doubted, as the known areas of the coal-fields of this class have been roughly estimated to contain about 500 million tons of coal in New Zealand, and 78,198 million tons in New South Wales. New Zealand also possesses a superior quality of bituminous coal, which is found on the west coast of the Middle Island. An estimate of the probable contents of these coal-fields is given as 200 million tons. Coal of a very fair description was discovered in the basin of the Irwin River, in Western Australia, as far back as the year 1846. It has been ascertained from recent explorations that the area of carboniferous formation in that colony extends from the Irwin northwards to the Gascoyne River, about 300 miles distant, and probably all the way to the Kimberley district. The most important discovery of coal in the colony so far is that made in the bed of the Collie River, near Bunbury, to the south of Perth. The coal has been tested and found to be of good quality; and there are grounds for supposing that there are 250 million tons on this field. Mr. Jack, formerly Government Geologist of Queensland, gave it as his opinion that the extent of the coal-fields of that colony is practically unlimited, and that the carboniferous formations extend to a considerable distance under the Great Western Plains. It is roughly

estimated that the coal measures at present practically explored extend over an area of about 24,000 square miles. In Tasmania and Victoria large deposits of coal have also been found; and in all the colonies named the industry is being prosecuted with vigour.

Coal was first discovered in New South Wales in the year 1797, near Mount Keira, by a man named Clark, the supercargo of a vessel called the Sydney Cove which had been wrecked in Bass Straits. Later in the same year Lieutenant Shortland discovered the river Hunter, with the coal-beds situated at its mouth. Little or no use, however, was made of the discovery, and in 1826 the Australian Agricultural Company obtained a grant of 1,000,000 acres of land, together with the sole right, conferred upon them by charter, of working the coal-seams that were known to exist in the Hunter River district. Although the company held this valuable privilege for twenty years, very little enterprise was exhibited by them in the direction of winning coal, and it was not until the year 1847, when their monopoly ceased and public competition stepped in, that the coal-mining industry began to show signs of progress and prosperity. From the 40,732 tons extracted in 1847, the quantity raised had in 1891 expanded to the large figure of 4,037,929 tons, valued at £1,742,796. In 1892 the production fell to 3,780,968 tons, valued at £1,462,388; while in 1893 there was a further fall to 3,278,328 tons, valued at £1,171,722; but from 1894 to 1898 the production took an upward turn, till in the latter year it amounted to 4,706,251 tons, valued at £1,271,832. This output was the highest recorded, but owing to the steady fall in the price of coal, the value was much less than that of the smaller production of the years 1884–92. The output during 1899 amounted to 4,597,028 tons, valued at £1,325,799. Although the quantity extracted in 1899 was exceeded in 1898, the advance in prices has placed the value above that of every year since 1892. To the end of 1899, the total quantity of coal extracted from the New South Wales mines, from their opening in the early years of the century, amounted to 85,969,136 tons, valued at £35,647,004.

The coal-fields of New South Wales are situated in three distinct regions—the Northern, Southern, and Western districts. The first of these comprises chiefly the mines of the Hunter River districts; the second includes the Illawarra district and, generally, the coastal regions to the south of Sydney, together with Berrima, on the table-land; and the third consists of the mountainous regions on the Great Western Railway, and extends as far as Dubbo. The total area of the carboniferous strata of New South Wales is estimated at 23,950 square miles. The seams vary in thickness. One of the richest has been found at Greta, in the Hunter River district; it contains an average thickness of 41 feet of clean coal, and the quantity underlying each acre of ground has been computed to be 63,700 tons.

The number of coal-mines under inspection in New South Wales at the end of the year 1899 was 88, as compared with 91 in the previous

year. They gave employment to 10,339 persons, of whom 8,217 were employed under ground, and 2,122 above ground. The average quantity of coal extracted per miner was 559 tons, as against an average of 574 tons in the previous year, and 560 tons in 1897. For the ten years ended 1899, the average quantity of coal extracted per miner was 486 tons, which, at the mean price of coal at the pit's mouth, was equivalent to £159 11s. 7d. Taking all persons employed at the mines, both above and under ground, the average for the ten years would be 394 tons, equivalent to £129 7s. 5d. per man. This production is certainly large, and compares favourably with the results exhibited by the principal coal-raising countries of the world, as will be evident from the following figures, giving the averages for the leading countries, based on the number of persons employed :—

Country.	Quantity of coal raised per miner.	Value at the pit's mouth per ton.	Total value of coal raised per miner.
	tons.	s. d.	£ s. d.
New South Wales	394	6 7	129 7 5
Great Britain	286	6 2	90 15 6
United States	447	5 4	118 16 3
Germany	267	6 4	84 7 0
France	202	8 7	86 15 0
Belgium	173	8 0	69 4 6
Austria	203	5 6	56 4 9

New South Wales is its own chief customer. In 1899, out of a total production of 4,597,028 tons, the consumption amounted to 1,798,505 tons, or over 39 per cent. The colony of Victoria took the next largest share of the output, viz., 709,684 tons, or 25 per cent. of a total export of 2,798,523 tons. The quantity of coal required for local consumption shows a satisfactory increase during most years. The annual consumption per head increased from 16 cwt. in 1877 to 27 cwt. in 1899. The larger use of steam for railway locomotives and for manufacturing and other purposes, as well as the multiplication of gas-works, accounts for a great portion of the increase; but it must also be borne in mind that there is a large and growing demand for bunker coal for ocean-going steamers, which appears not as an export, but as required for home consumption. The amount of coal taken by the steamers during 1899 was about 375,000 tons.

The progress of the export trade of New South Wales, from 1881 to 1899, is shown in the following table:—

Exported to—	Quantity.			Value.		
	1881.	1891.	1899.	1881.	1891.	1899.
	tons.	tons.	tons.	£	£	£
Australasian colonies	657,135	1,510,976	1,624,137	255,572	755,509	553,629
India, Ceylon, and China	136,511	183,000	65,710	59,944	105,208	26,153
Mauritius	6,249	19,760	8,071	2,414	10,813	2,903
Pacific Islands	19,526	141,055	190,098	8,011	75,803	72,609
United States	150,002	365,623	189,962	68,172	200,851	72,774
South America	8,017	221,700	411,869	3,243	123,136	161,823
Other countries	52,404	67,254	308,676	20,174	35,310	115,903
Total	1,029,844	2,514,368	2,798,523	417,530	1,306,630	1,005,794

New Zealand is the only other colony in a position to export coal. Its export trade in 1881, 1891, and 1899 was as follows:—

Exported to—	Quantity.			Value.		
	1881.	1891.	1899.	1881.	1891.	1899.
	tons.	tons.	tons.	£	£	£
Australasian colonies	6,049	14,277	66,036	5,022	8,488	63,201
United Kingdom	.....	68,871	4,823	.....	76,027	4,638
Fiji and Norfolk Island	21	3,282	5,877	25	2,469	4,158
Pacific Islands, etc.	551	5,234	12,744	563	4,189	11,088
Total	6,621	91,664	89,480	5,610	91,173	83,085

The exports to the United Kingdom from New Zealand, as well as from New South Wales, consisted entirely of bunker coal for the steamers. Most of the coal-beds of the former colony are on the West coast of the South Island. The chief mines are at Westport, Greymouth, and Otago. The total quantity of coal produced in 1899 was 975,234 tons, of which the Coalbrookdale mines contributed 202,514 tons; the Millerton, 125,417 tons; the Kaitangata, 111,510 tons; and the Brunner, 96,511 tons. There is a steady increase in the quantity of coal raised in the colony, and a corresponding decrease in the importation. In 1899 there were 160 coal-mines in operation in New Zealand, giving employment to 2,153 men.

As showing the various kinds of coal found in New Zealand the following figures relating to the production in 1899 will be of interest:—

Bituminous coal	588,036 tons.
Pitch coal	37,835 ,,
Brown coal	314,542 ,,
Lignite	34,821 ,,
Total	975,234 ,,

Coal-mining is an established industry in Queensland, and is progressing satisfactorily. In 1899 the production showed an increase

of 86,000 tons over that of the previous year, and 1,142 men were employed in coal-mining in 1899. The mines, however, are situated too far from the coast to permit of serious competition with Newcastle in an export trade, and the output is practically restricted to supplying local requirements. New South Wales still exports on an average about 30,000 tons annually to Queensland. Of the total production of 494,009 tons in the northern colony in 1899, 373,655 tons were obtained in the Ipswich district, 111,414 tons at Wide Bay, and 8,940 tons in the Clermont district.

In Tasmania coal of good quality has been found in the lower measures of the permo-carboniferous rocks, principally in the basins of the Mersey and the Don in the north, and at Adventure Bay and Port Cygnet in the south, as well as in the upper measures of the triassic or jurassic rocks, which are extensively developed in the eastern and north-eastern parts of the colony. Mining is carried on in various districts in the island, but the principal mines are the Mount Nicholas and Cornwall in the Mount Nicholas Range, which contribute about 88 per cent. of the annual production. A small quantity of coal is produced at the Mersey and Dulverton Mines, and in 1898 work was resumed at the mines near Port Cygnet. A discovery has been reported from Swansea, on the East Coast, and during 1899 a seam of bituminous coal was found at Eden, on the West Coast. Tasmania still relies largely on New South Wales to supply coal for local requirements. Since 1896 the export of coal from New South Wales to Tasmania has increased from 57,000 tons to 86,000 tons. During 1899 there were 138 men engaged in coal-mining in the colony, and the output amounted to 43,113 tons, valued at £17,008.

Black coal has been discovered in Victoria, and is now being raised in increasingly large quantities. In 1899 the production amounted to 262,380 tons, valued at £113,522, as compared with 22,834 tons, valued at £19,731, in 1891. During this period the export from New South Wales to Victoria has fallen from 954,277 tons to 709,684 tons. The principal collieries in the colony are the Outtrim Howitt, from which 122,921 tons were obtained; followed by the Jumbunna, with 73,652 tons; and the Coal Creek Proprietary, with 56,843 tons. In South Australia, at Leigh's Creek, north of Port Augusta, coal-beds have been discovered. A company has been formed for the purpose of working the deposits, and small quantities have been raised during the last three years. The results of trials of this coal on the Government railways have, however, been unsatisfactory. Great activity is now being shown on the Collie coal-field in Western Australia. Boring operations having proved successful, a coal-mining district was constituted in February, 1896, and thrown open for selection in the following year, 22 square miles being immediately applied for. Satisfactory tests of Collie coal have been made, and it is now used extensively on the Government railways and on the gold-fields, and it has also been proved suitable for naval purposes, one great advantage being that it gives out little or no smoke.

The line of railway from Brunswick has now been completed, and contributed not a little to the satisfactory developments that took place during the year, the output having increased from 3,508 tons in 1898 to 54,336 in 1899, of which 49,427 tons were raised at the Wallsend colliery.

The quantity of coal extracted annually in Australasia now exceeds 6,426,000 tons, valued at about £2,146,000. The production of each colony during the year 1899 was as follows:—

State.	Quantity.	Value.	
		Total.	Proportion raised in each State.
	tons.	£	per cent.
New South Wales	4,597,028	1,325,799	61·8
Victoria	262,380	113,522	5·3
Queensland	494,009	175,715	8·2
Western Australia	54,336	25,951	1·2
Tasmania	43,113	17,008	0·8
Commonwealth	5,450,866	1,657,995	77·3
New Zealand	975,234	487,617	22·7
Australasia	6,426,100	2,145,612	100·0

The total quantity and value of the coal produced in the Australasian colonies up to the end of 1899 are shown below. A small quantity has been raised in South Australia, but is not yet of sufficient importance to warrant inclusion in the table:—

State.	Quantity.	Value.	
		Total.	Proportion raised in each State.
	tons.	£	per cent.
New South Wales	85,969,136	35,647,004	76·8
Victoria	1,526,968	793,568	1·7
Queensland	5,658,919	2,458,407	5·3
Western Australia	57,844	27,576	0·1
Tasmania	704,193	385,303	0·8
Commonwealth	93,917,060	39,311,858	84·7
New Zealand	13,458,880	7,099,615	15·3
Australasia	107,375,940	46,411,473	100·0

During the year 1899 this industry gave direct employment in and about the mines to the following numbers of persons in the several colonies :—

	No.
New South Wales	10,339
Victoria	880
Queensland	1,142
Western Australia	192
Tasmania	138
New Zealand	2,153

The average price of coal per ton varies in the colonies very considerably. In New South Wales, from the date of the commencement of mining to the end of the year 1899, the average price obtained has been 8s. 4d., but the mean of the last ten years has not been more than 6s. 7d. In 1899 the average price per ton of coal at the pit's mouth was as follows :—

	£	s.	d.
New South Wales	0	5	9
Victoria	0	8	8
Queensland	0	7	1
Western Australia	0	9	7
Tasmania	0	7	11
Commonwealth	0	6	1
New Zealand	0	10	0
Australasia	0	6	8

Anthracite is found on the island of Tasmania. It is a hard and heavy mineral, burning with difficulty, and possesses very little commercial value in countries where ordinary coal abounds. In Queensland an anthracite seam was recently discovered on the Dawson Coal Field, and observations show that the deposit is a very extensive one.

The following table shows the annual coal production of the principal countries of the world. The figures refer to the year 1898, except those for Great Britain, United States, and Australasia, which refer to the year 1899 :—

Country.	Tons of 2,240 lb.
Great Britain	220,094,780
United States	225,041,760
Germany	125,872,500
Austria-Hungary	37,210,950
France	31,836,100
Belgium	23,063,500
Canada	4,075,670
Australasia	6,426,100

Kerosene Shale.

Kerosene Shale (torbanite) is found in several parts of New South Wales. It is a species of cannel-coal, somewhat similar to the boghead mineral of Scotland, but yielding a much larger percentage of volatile hydro-carbon than the Scottish mineral. The richest quality yields about 100 to 130 gallons of crude oil per ton, or 17,000 to 18,000 cubic feet of gas, with an illuminating power of 35 to 40 sperm candles when gas only is extracted from the shale. The New South Wales Shale and Oil Company, at Hartley Vale, and the Australian Kerosene Oil and Mineral Company, at Joadja Creek and Katoomba, not only raise kerosene shale for export, but also manufacture from it petroleum oil and other products. From the year 1865, when the mines were first opened, to the end of 1899, the quantity of kerosene shale raised has amounted to 995,832 tons, worth £1,908,482. The average price realised during that period has been £1 18s. 4d. per ton. The prices ruling in 1899, when 36,719 tons were extracted, averaged £1 2s. 3d. per ton, representing a total value of £40,823 for the production of that year. The export of shale from New South Wales during 1897, 1898, and 1899 was as follows :—

Exported to—	1897.		1898.		1899.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£
New Zealand	577	1,261	575	1,150	482	1,005
United Kingdom	7,203	14,479	361	725	547	1,100
Netherlands	5,829	11,000	4,802	9,000	2,440	5,700
Italy	3,764	7,600	5,538	11,000	3,890	7,950
United States	33	80	673	1,478	.....	.....
Brazil	2,100	5,000	.....	.....	.....	.....
Chili	1,367	3,000	1,555	3,110	1,538	3,076
Other countries	1,057	2,091	341	734	250	524
Total	21,930	44,511	13,845	27,197	9,147	19,355

Extensive formations of oil shale have been found in New Zealand, in Otago, and at Orepuki, in Southland. Attempts have been made to develop the oil resources of Waipaoa, but so far unsuccessfully. The oil produced does not possess the properties required in illuminating oils, although it is valuable for lubricating purposes.

The net import of kerosene into Australasia in 1899 is shown below :—

State.	Quantity.	Value
	gallons.	£
New South Wales	3,834,772	149,223
Victoria	3,147,005	100,945
Queensland	1,866,251	71,421
South Australia	1,333,403	40,024
Western Australia	1,231,890	37,128
Tasmania	281,235	9,779
Commonwealth	11,694,556	408,520
New Zealand	1,415,341	47,409
Australasia	13,109,897	455,929

Other Carbon Minerals.

Of all the mineral forms of carbon the diamond is the purest, but as it is usual to class this precious substance under the head of gems that custom will be followed in the present instance.

Graphite, or plumbago, which stands second to the diamond in point of purity, has been discovered in New Zealand, in the form of detached boulders of pure mineral. It also occurs in impure masses where it comes into contact with the coal measures. This mineral, up to the present time, has not been found in any of the other colonies except New South Wales, where in 1889 a lode 6 feet wide, but of inferior quality, was discovered near Undercliff, in the New England district; and in Western Australia, in which colony, however, owing principally to difficulties of transit, very little of it has been worked.

Ozokerite, or mineral wax, is reported to have been found at Coolah, in New South Wales.

Elaterite, mineral caoutchouc, or elastic bitumen, is said to have been discovered in New South Wales and South Australia. In the last-named colony a substance very similar to elaterite has been discovered in the Coorong Lagoons, and has received the name of coorongite. Up to the present time neither the extent of these finds nor their commercial value has been ascertained.

Bitumen is known to exist in Victoria, and is reported to have been found near the township of Coonabarabran, in New South Wales.

Kauri Gum, a resinous substance somewhat resembling amber in appearance, and like that product an exudation from trees, is found only in the Auckland province of New Zealand, where it is included under the head of minerals, although more logically entitled to be considered as a vegetable product. The best sort is dug out of the ground,

but considerable quantities of inferior grades are taken from the forks of standing trees. In New Zealand an extensive and lucrative commerce is carried on in kauri gum. It is computed that the total value of this product obtained from 1853 to the end of 1899 was £9,707,538. In the year 1899 the quantity obtained represented a value of £607,919, and gave employment to about 7,000 persons, both European and Maori. Kauri gum is included in the figures in this chapter giving the total mineral production.

Salts.

Common rock salt has been found in rock crevices in several parts of New South Wales, but it is not known to exist in large deposits so as to be of commercial importance. Natron is said to occur in the neighbourhood of the Namoi River, in the same colony. It appears as a deposit from the mud-wells of that region. Epsomite, or epsom salt, (sulphate of magnesia), is seen as an efflorescence in caves and overhanging rocks of the Hawkesbury sandstone formation, and is found in various parts of New South Wales.

Large deposits of alum occur close to the village of Bulladelah, 30 miles from Port Stephens, New South Wales. Up to the end of the year 1899, 10,681 tons of alunite had been raised there, most of which had been sent to England for treatment. It is said to yield well, and a quantity of the manufactured alum is sent to Sydney for local consumption. During 1899 the Bulladelah mine yielded 921 tons of stone, valued at £2,763.

Stones and Clays.

Marble is found in many parts of New South Wales, South Australia, New Zealand, and Tasmania. In New South Wales marble quarries have been opened in several districts, and some very fine specimens of the stone have been obtained.

Lithographic stone has been found in New Zealand, where another beautiful species of limestone known as Oamaru stone is also procured. This stone has a fine, smooth grain, and is of a beautiful creamy tint. It is in great demand for public buildings, not only in the colony where it is found, but in the great cities of continental Australia, which import large quantities of the stone for the embellishment of public edifices.

Limestone was at one time worked on the Myall Lakes, near Bungwall, New South Wales; and large quantities were forwarded from this district to Sydney, where the manufacture of hydraulic lime was commenced, but owing to the lack of a market the operations were discontinued.

Gypsum is found crystallised in clay-beds in New South Wales, and in isolated crystals in the Salt Lakes of South Australia, where a small proportion of sulphate of lime is present in the water. It is also found in portions of Victoria. This mineral is of commercial value for the

manufacture of cement and plaster of Paris, and also as a fertiliser. A company in South Australia has recently raised a considerable quantity for this latter purpose. It is found in the form of an insoluble salt in New South Wales, Victoria, and New Zealand.

Apatite, another mineral of considerable commercial importance, and very valuable as a manure, occurs in several districts of New South Wales, principally on the Lachlan River, at the head of the Abercrombie, and in the Clarence River district.

Quartz is of common occurrence in all parts of Australasia. Rock crystal, white, tinted, and smoky quartz are frequently met with, as well as varieties of crystalline quartz, such as amethyst, jasper, and agate, which possess some commercial value.

Tripoli, or rotten stone, an infusorial earth, consisting of hydrous silica, which has some value for commercial purposes, has been found in New South Wales, Victoria, and New Zealand. Meerschaum is reported to have been discovered near Tamworth and in the Richmond River district, in New South Wales.

Mica is also found in granitic country, chiefly in the New England and Barrier districts. In Western Australia very good mica has been found at Bindoon, and also on the Blackwood River, near Cape Leeuwin. In 1896 mica was being worked near Mingun, on the Upper Gascoyne; and a few years ago the Western Australian Government offered a bonus not exceeding £500 for the export of at least 2 tons of mica, to realise not less than 1s. 6d. per lb., within three months of the 28th March, 1898. Some promising discoveries have been made near Herberton, in Northern Queensland. In the Northern Territory of South Australia mica has been obtained on a small scale for a number of years. In 1895 the production was valued at £2,638; and in 1896, at £732.

Kaolin, fire-clays, and brick-clays are common to all the colonies. Except in the vicinity of cities and townships, however, little use has been made of the abundant deposits of clay. Kaolin, or porcelain clay, although capable of application to commercial purposes, has not as yet been utilised to any extent, though found in several places in New South Wales and in Western Australia.

Asbestos has been found in New South Wales in the Gundagai, Bathurst, and Broken Hill districts—in the last-mentioned district in considerable quantities. Several specimens of very fair quality have also been met with in Western Australia; and the Government of the colony offered a bonus not exceeding £500 for the export of 50 tons of asbestos, of a value of not less than £10 per ton. In the colony of Tasmania, in the vicinity of Beaconsfield, asbestos is known to exist in considerable quantities.

GEMS AND GEMSTONES.

Many descriptions of gems and gemstones have been discovered in various parts of the Australasian colonies, but systematic search has been made principally for the diamond and the noble opal.

Diamonds are found in New South Wales, Victoria, Queensland, and South Australia, but only in the first-named colony have any attempts been made to work the diamond drifts. The existence of diamonds and other gem-stones in the territory of New South Wales had been known for years before an attempt was made to work the deposits in 1872. In the course of the following year several deposits of adamantiferous wash were discovered at Bingara, in the New England district. The number of diamonds found in the colony to the end of 1899 is estimated at 90,275, the largest being one of $5\frac{5}{8}$ carats, or 16·2 grains; but great difficulty has been experienced in obtaining exact statistics of the production, and it is believed that the output is considerably understated. The diamonds occur in old tertiary river drifts, and in the more recent drifts derived from them. The deposits, which occur in the Inverell, Bingara, Mittagong, Cudgegong, and Narrabri districts, are extensive, and have not yet been thoroughly prospected. The best of the New South Wales diamonds are harder and much whiter than the South African diamonds, and are classified as on a par with the best Brazilian gems. During the year 1889 the Malacca Company, near Tingha, found diamonds weighing $2,195\frac{5}{8}$ carats, valued at £878 5s. In 1891, 1,200 carats of diamonds were won in the Tingha and Inverell districts, valued at £1,050. In 1892 as many as 2,250 diamonds were obtained from the Monte Christo Mine at Bingara alone. The majority of diamonds obtained in this district weigh from $\frac{1}{6}$ to $\frac{1}{4}$ carat, while the largest vary from 2 to 3 carats. The total output of the Bingara district to the end of 1893 is said to have been about 15,000 carats, valued at £15,375. In 1894 the only work done was prospecting in the Bingara, Mittagong, and Denison Town districts; and in 1895 the industry was still quiet, but at Boggy Camp Diamond Field, 16 miles west of Tingha, a revival took place during the year, and 4,100 stones, weighing in the aggregate 1,313 carats, and valued at £492, were obtained. No estimate of the returns in 1896 were obtained from this field, but the output of gems in 1897 was 8,489 carats, valued at about £3,000. In 1898 14,920 carats were won, valued at £5,625, the gems being associated with tin in considerable quantities. During that year a quantity of new machinery was erected, and the field was considerably developed, although work was greatly hampered through the scarcity of water. The output from the Bingara diamond-field for 1898 was set down at 1,573 carats, valued at £434; in 1899, a good deal of interest was manifested in the industry, but the scarcity of water during a portion of the year restricted operations on this field to work of an exploratory character. The yield for the year, the majority of which was derived from the Boggy Camp field, is estimated at 25,874 carats, valued at £10,350.

The finest opal known is obtained in the Upper Cretaceous formation at White Cliffs, near Wilcannia, New South Wales, and there are about 750 miners on the field. During the year 1895 good stone was found at a depth of 50 feet, and as the lower levels are reached the patches of opal

appear to improve in quality and to become more regular and frequent. On block 7 a patch of stone was found which realised over £3,000. It is difficult to state with exactitude the value of the production, but it is believed that stone to the value of £23,000 was sold during the three years ended 1895, while the industry has made such great strides during the last four years that in 1896 the production is estimated at £45,000; in 1897, at £75,000; in 1898, at £80,000, and in 1899, at £135,000. The quality of the stone found on the fields varies considerably, some only realising 10s. per oz., whilst the best quality occasionally realises as much as £42 per oz. The best market for the gems is Germany, where they find a ready sale; but it is stated that the principal gem merchants of Europe have now agents on the field for the purchase of the stone.

In Queensland the opal is found in the Cretaceous areas in the far west and south-west, from a few feet to 40 feet below the surface, and its extraction affords employment to a large number of men, who, however, in the majority of cases only follow the industry in the time spared from other occupations. It is difficult to accurately estimate the production from the opal fields of the colony, but in 1899 it was set down at £9,000. Valuable opal has been discovered at Tairua, in the Hauraki district of the North Island of New Zealand; and also in the Mount Peel and Auckland districts, in Canterbury. There is, however, no record of any production during the last few years.

Other gem-stones, including the sapphire, emerald, oriental emerald, ruby, opal, amethyst, garnet, chrysolite, topaz, cairngorm, onyx, zircon, etc., have been found in the gold and tin-bearing drifts and river gravels in numerous localities throughout the colonies. The Emerald Proprietary Company, in the Emmaville district, in the Glen Innes district, New South Wales, have sunk two shafts, 100 feet and 50 feet respectively; and 25,000 carats have been won in a rough state. Their value when cut and finished, if of the best quality, is about £2 per carat. Owing to the difficulties of extraction, and the low price of the gems in the London market, the mines were closed for three years. In 1897 they were again opened up, and, although worked for some time during 1898, they are now closed, the company having obtained a suspension of the labour conditions. No gems were produced during the year.

The sapphire is found in all the colonies, but most abundantly in the neighbourhood of Beechworth, Victoria. The oriental topaz has been found in New South Wales. Oriental amethysts also have been found in that colony; and the ruby has been found in Queensland, as well as in New South Wales.

According to an authority on the subject of gemstones, rubies, oriental amethysts, emeralds, and topaz have been chiefly obtained from alluvial deposits, but have rarely been met with in a matrix from which it would pay to extract them.

Turquoises have been found near Wangaratta, in Victoria, and mining for these gems is being carried on in the locality.

Chrysoberyls have been found in New South Wales; spinel rubies, in New South Wales and Victoria; white topaz, in all the colonies; and yellow topaz, in Tasmania. Chalcedony, carnelian, onyx, and cat's-eye are found in New South Wales; and it is probable that they are also to be met with in the other colonies, particularly in Queensland. Zircon, tourmaline, garnet, and other gemstones of little commercial value are found throughout Australasia.

In South Australia some very fine specimens of garnet were found, causing some excitement at the time, as the gems were mistaken for rubies. The stones were submitted to the examination of experts whose reports disclosed the true nature of the gems, and dispelled the hopes of those who had invested in the supposed ruby-mines of South Australia.

Production of Minerals.

The foregoing pages show that Australasia possesses invaluable mineral resources, and although enormous quantities of minerals of all kinds have been won since their first discovery, yet the deposits, with the exception perhaps of gold, have only reached the first period of their exploitation. Vast beds of silver, tin, and copper ore, and of coal are known to exist, but their development has not reached a sufficiently advanced stage to enable an exact opinion to be expressed regarding their commercial value, though it is confidently held by mining experts that this must be enormous. The mineral production of the various colonies in 1899 will be found below :—

State.	Total Value.	Proportion of each State.	Average value per head.
	£	per cent.	£ s. d.
New South Wales	6,080,516	24·5	4 10 5
Victoria	3,579,322	14·4	3 1 7
Queensland	3,139,620	12·6	6 11 8
South Australia	516,479	2·1	1 8 1
Western Australia	6,346,581	25·5	37 8 6
Tasmania	2,538,737	10·2	14 2 6
Commonwealth	22,201,255	89·3	6 0 0
New Zealand	2,656,554	10·7	3 10 10
Australasia	24,857,809	100·0	5 11 8

The total value of minerals raised in 1899 exceeded by £12,951,164 the average annual amount since 1852. The search for gold has led to the expansion of the mining industry in other directions, and, although seekers of gold have become fewer, the number of miners engaged in the extraction of other minerals has largely increased, and it is a question

whether the total number of persons who gain their livelihood by mining pursuits at the present time is not equal to the number so engaged when gold and coal alone were the elements of the mineral production of the Australasian colonies. The resources known to exist and to be developed in these colonies are likely to maintain for many generations to come a large and prosperous mining population.

The following table shows the value of the mineral production of each colony during the four years 1871, 1881, 1891 and 1899, as well as the value per inhabitant for the whole of Australasia :—

State.	1871.	1881.	1891.	1899.
	£	£	£	
New South Wales	1,650,000	2,121,000	6,396,000	6,081,000
Victoria	5,400,000	3,467,000	2,339,000	3,579,000
Queensland	806,000	3,165,000	2,300,000	3,140,000
South Australia	725,000	421,000	366,000	516,000
Western Australia	5,000	11,000	130,000	6,346,000
Tasmania	25,000	604,000	516,000	2,539,000
Commonwealth	8,611,000	9,789,000	12,047,000	22,201,000
New Zealand	3,100,000	1,528,000	1,841,000	2,657,000
Australasia — Total	11,711,000	11,317,000	13,888,000	24,858,000
Australasia — Per head	£ s. d. 6 1 0	£ s. d. 4 1 6	£ s. d. 3 12 3	£ s. d. 5 11 8

The foregoing table shows that the mineral production of 1899 was nearly eleven millions more than that of 1891. There were increases in all the colonies with the exception of New South Wales, in which colony a decrease of slightly over £300,000 has to be recorded, chiefly owing to the fall in the value of silver, and, to a less extent, to the decline in the price of coal. The most notable increases were in Western Australia and Tasmania; the production of the former colony exceeded that of 1891 by over £6,200,000, mainly on account of the great increase in the gold yield, which advanced in value from £115,182 to £6,246,733 during the period under review. The large increase in the Tasmanian production was due to the output of the Mount Lyell Copper-mines. In the other colonies, the increases were also substantial, ranging from 36 per cent. in South Australia to 53 per cent. in Victoria.

Comparing the value of the mineral production in 1899 with the population, the largest share is taken by Western Australia, with £37 8s. 6d. per inhabitant; Tasmania ranks second, with £14 2s. 6d. per inhabitant; Queensland third, with £6 11s. 8d.; New South Wales fourth, with £4 10s. 5d.; and New Zealand fifth, with £3 10s. 10d. Victoria follows with an average of £3 1s. 7d. per head, and in South Australia the production per inhabitant was only £1 8s. 1d. The

average per inhabitant for Australasia was £5 11s. 8d., and, excluding New Zealand, the average for the States constituting the Commonwealth was £6 per head.

The following table shows the value of production in each of the colonies during 1899, distinguishing the principal minerals. With regard to some of the colonies the data are defective in respect to "other minerals," but not to such an extent as to seriously affect the gross total. The column "other minerals" includes kerosene shale in New South Wales and kauri gum in New Zealand :—

State.	Gold.	Silver and Silver-lead.	Copper.	Tin.	Coal.	Other Minerals.	Total.
	£	£	£	£	£	£	£
New South Wales	1,751,815	2,070,657	395,451	90,482	1,325 799	446,312	6,080,516
Victoria	3,418,000	10,850	.....	11,200	113,522	25,750	3,579,322
Queensland	2,838,119	15,671	9,498	77,302	175,715	23,315	3,139,620
South Australia	79,041	400	406,208	180	.....	30,650	516,479
Western Australia....	6,246,733	.....	35,938	25,270	25,951	12,689	6,346,581
Tasmania	327,545	377,788	1,227,532	270,864	17,008	318,000	2,538,737
Commonwealth ..	14,661,253	2,475,366	2,074,627	475,298	1,657,995	856,716	22,201,255
New Zealand	1,513,173	40,838	.....	.....	487,617	*614,926	2,656,554
Australasia	16,174,426	2,516,204	2,074,627	475,298	2,145,612	1,471,642	24,857,809

* Inclusive of kauri gum of the value of £607,919.

The total mineral production to the end of 1899 is shown in the following table, in which the column "other minerals" again includes kerosene shale and kauri gum :—

State.	Gold.	Silver and Silver-lead.	Copper.	Tin.	Coal.	Other Minerals.	Total.
	£	£	£	£	£	£	£
New South Wales	47,546,013	27,882,997	5,019,480	6,382,538	35,647,004	3,455,913	125,933,945
Victoria	254,156,820	856,539	206,395	706,300	793,568	248,994	256,963,616
Queensland	47,338,074	713,089	2,032,425	4,526,102	2,458,407	262,811	57,330,908
South Australia.....	2,212,787	106,043	21,935,954	26,322	.....	460,931	24,742,037
Western Australia....	16,906,440	250	208,053	101,497	27,576	382,633	17,626,458
Tasmania.....	4,282,192	1,925,578	2,102,048	6,883,306	385,303	328,777	15,907,204
Commonwealth ..	372,442,335	31,484,496	31,504,355	18,626,065	39,311,858	5,135,059	498,504,168
New Zealand	55,966,498	276,669	17,938	.....	7,099,615	*9,934,023	73,294,743
Australasia	428,408,833	31,761,165	31,522,293	18,626,065	46,411,473	15,069,082	571,798,911

* Inclusive of kauri gum of the value of £9,707,538.

Coal was the only mineral raised in New South Wales prior to 1852, and its production up to that date was valued at £279,923. Deducting that amount from the total value of Australasian minerals raised up to the end of 1899, the remainder, £571,518,988, represents the value of mineral production from 1852, equal to an average of £11,906,645 per annum for the forty-eight years.