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 400 million pounds sterling, has been obtained in Australasia. Victoria,

which has, in a period of forty-five years, contributed about 250 millions to this total, is still the largest producer, its yield of the precious metal in 1896 being nearly three times as great as that of Western Australia, and more than one-fourth greater than the production of Queensland.' There has been a notable increase in the output of gold in the colony during the past five years, the yield of 805,087 oz. in 1896 being the highest since the year 1882. This development is said to be due to the great improvement in gold-saving appliances; the prominence attained by the large and only partially-developed gold-fields of North and East Gippsland; and the investment of foreign capital in the mines. Attention has also been given by the State to the question of rendering practical assistance to the mining industry, and the Mines Development Act of 1896 authorises 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 1896 the Sandhurst district, with 191,941 oz., supplied the largest portion of the gold yield of the colony, followed by the Ballarat district with 160,317 oz., and Gippsland, with 116,056 oz. In Gippsland the increase in the output of late years has been very striking, the yield in 1892 having been only 39,919 oz. There were 32,123 men engaged in the search for gold in Victoria in 1896. Of these, 1,939 were Chinese, but the miners of this race are steadily decreasing in number.

Queensland promised at one time to overtake Victoria in the value of its annual gold yield, but in 1896 its production only amounted to £2,341,348, as compared with £3,220,348 in the southern colony. The output of Queensland, although higher than that of 1895, was less than in 1894, and did not quite reach expectation—due, first, to the dry season, and, second, to the failure of the mines to attract foreign capital. To the total production of the colony, the Mount Morgan mine contributes about one-fourth. At this mine the returns for the year showed a satisfactory advance on those of the previous twelve months. Large additions which are now being made to the reduction works will permit of the production of ore in greater quantity, and of the treatment of lower-grade material. When the new works are completed it is estimated that the capacity will be equal to an additional 50,000 tons per annum. In 1896 there were 1,541 men employed in the mine, being an increase of 400 during the twelve months. The number of men engaged in gold-mining in the whole of the colony was 10,364, of whom 758 were Chinese. As in Victoria, the number of Chinese finding employment on the gold-fields is decreasing.

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 270,823 oz., valued at

£1,040,329; and thenceforth the industry declined considerably in importance, reaching its lowest point in 1888, when only 87,503 oz., valued at £317,100, 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, making a total yield to date of 11,717,616 oz., of a value of £43,399,958. 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, Bathurst, Armidale, Hill End, Orange, Parkes, and Wyalong. Besides the Mount Drysdale gold-field, in the Cobar district, discovered in 1893, the most important find of recent years was made at Wyalong, in the Lachlan district. The first prospecting claim on this field 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. This number has now been reduced to reasonable proportions. In 1896 the quantity of gold obtained from this field was 33,495 oz., which was only exceeded by the yield from the Hillgrove district.

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 in Yilgarn, about 200 miles east of Perth, the find possessing importance because 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 thirteen gold-fields in the colony, the most important, from the point of production in 1896, being East Coolgardie and Coolgardie, in the eastern district;

and Murchison, in the central district. It is estimated that there are now over 20,000 miners actively engaged on the gold-fields. In 1896 the production amounted to 281,265 oz., valued at £1,068,808, as compared with 30,310 oz., valued at £115,183, in 1891.

In New Zealand, the production of gold in 1895 was valued at £1,162,164—the highest yield since 1880. There was a falling off in the following year; not, however, due to any scarcity of the precious metal, but mainly to the acquirement of many of the mining properties by English capitalists, and to the suspension of active operations necessitated by a change of policy involving development on a more extensive scale. Prospecting work is 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. Greater attention is also being paid to the auriferous deposits in river-beds, and in deep wet ground on the southern gold-fields. It is estimated that seventy dredges, each of which is said to cost between £3,000 and £6,000, will shortly be at work upon these deposits. In 1896, the number of gold-miners in the colony was 14,889, of whom 1,989 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 has yielded to date £652,000 in dividends; while it is proposed to develop some of the outside mines with British capital. 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 1,280 feet. In about eight years it has yielded gold to the value of £350,000, and has paid £163,000 in dividends. At Mangana active prospecting has been going on for some time, and some rich stone was struck in 1898. 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. On the whole, the gold-mining industry of the colony has made satisfactory progress during the last few years; indeed, the production in 1896, amounting to £237,574, was the highest recorded, and was nearly 63 per cent. higher than in 1893.

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 millions sterling. In the province proper the yield is very small, amounting to but 4,031 oz. in 1896, the balance of 22,977 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, who are erecting the works necessary to their proper development. Of the 1,831 men engaged in gold-mining in the Northern Territory in 1896, no fewer than 1,638 were 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 1896, with the proportion due to each province :—

Colony.	Production of Gold.	
	Value.	Proportion raised in each Colony.
	£	per cent.
New South Wales	43,399,958	11·2
Victoria	244,138,728	62·8
Queensland	39,196,465	10·1
South Australia	1,918,456	0·5
Western Australia	4,104,041	1·0
Tasmania	3,383,921	0·9
New Zealand	52,392,430	13·5
Australasia	388,533,999	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 1896,

with the quantity obtained from alluvial deposits and the yield from quartz crushings where such information is available, is given below :—

Colony.	Weight of Gold.			Value of Gold.	
	Alluvial.	Quartz.	Total.	Total.	Proportion raised in each Colony.
	oz.	oz.	oz.	£	per cent.
New South Wales	68,534	227,538	296,072	1,073,360	11·8
Victoria	284,756	520,331	805,087	3,220,348	35·5
Queensland	30,724	609,661	640,385	2,341,348	25·8
South Australia	.....	.....	27,008	95,528	1·0
Western Australia	29,043	252,222	281,265	1,068,808	11·8
Tasmania	6,584	56,007	62,591	237,574	2·6
New Zealand	54,930	208,764	263,694	1,041,428	11·5
Australasia	.....	.....	2,376,102	9,078,394	100·0

In 1897 the production of gold in Australasia was 2,950,580 oz., an increase of 574,478 oz. on the quantity raised in the previous year. The increase or decrease in the yield of each of the colonies will be seen from the following table :—

Colony.	Gold yield in 1897.	Increase on previous year.	Decrease from previous year.
	oz.	oz.	oz.
New South Wales	292,217	.....	3,855
Victoria	812,766	7,679	.....
Queensland	807,928	167,543	.....
South Australia	33,899	6,891	.....
Western Australia	674,994	393,729	.....
Tasmania	77,131	14,540	.....
New Zealand	251,645	.....	12,049
Australasia	2,950,580	574,478	.....

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. In those provinces where a revival of mining has lately been experienced, or, as in the case of Western Australia, where the colony is in its first stage of mining development, it is natural to expect a low average yield per miner, for mining as now carried out is not an industry from which immediate returns can be expected. It is probable that the number of gold-miners in New South Wales 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 following table shows the number of miners at work in 1896, with the quantity and value of gold won per man, in those colonies for which definite information is available :—

Colony.	Miners Employed.	Average production of Gold.	
		Quantity.	Value.
	No.	oz.	£ s. d.
New South Wales.....	22,207	13·33	48 6 8
Victoria	32,123	25·06	100 5 0
Queensland	10,364	61·79	225 18 3
Western Australia	20,236	13·90	52 16 4
Tasmania.....	1,461	42·84	162 12 3
New Zealand	14,889	17·71	69 18 11

Attempts have been made to ascertain the average yield from quartz, but the number of tests made and the quantity of stone treated are inconsiderable ; furthermore, it has not been found possible to obtain returns from all the principal mining centres. The results obtained for the five years ended 1896 were as given below. The high average yield for Queensland is due to the Mount Morgan mines, which for some years yielded one-third of the total gold production of that colony :—

Year.	New South Wales.			Victoria.			Queensland.			Northern Territory.			Western Australia.			Tasmania.		
	oz.	dwt.	gr.	oz.	dwt.	gr.	oz.	dwt.	gr.	oz.	dwt.	gr.	oz.	dwt.	gr.	oz.	dwt.	gr.
1892	0	19	19	0	9	23	1	6	20	.....			.....			0	14	19
1893	0	16	11	0	9	6	1	6	8	.....			.....			0	13	22
1894	0	14	8	0	8	8	1	4	5	0	13	12	.....			1	1	10
1895	1	7	1	0	8	7	1	1	6	0	19	3	.....			0	18	8
1896	0	17	20	0	9	10	1	3	10	0	14	4	1	10	5	0	19	23

It is not pretended that these figures have any great statistical value ; nevertheless they may be accepted as giving an approximate idea of the average yield of quartz-reefs. Alluvial deposits are generally richer than those in reefs ; but the precious metal is so unevenly distributed that any attempt to obtain a reliable average would be futile.

The greatest development of quartz-reefing is found in Victoria, some of the mines being of a great depth. At the end of 1896 there were five mines in the Bendigo district over 3,000 feet deep, and other five over 2,700 feet deep. In Lansell's 180 Mine a depth of 3,352 feet had

been reached, and in the Lazarus Mine, 3,185 feet. In the Stawell district a depth of 2,409 feet had been reached in the Magdala Mine.

The value of machinery on the gold-fields of those colonies from which returns were obtainable is appended. In all cases the figures refer to the year 1896 :—

Colony.	Value.
	£
New South Wales	693,198
Victoria	1,769,748
Queensland	1,199,123
Western Australia	880,475
Tasmania	412,500
New Zealand	819,111

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 £4,500,000 in dividends. This mine, which may be designated one of the wonders of the world, is a huge mound of ore,

highly ferruginous, and contains gold to the extent of several ounces to the ton, the peculiar formation, in the opinion of the Government Geologist of Queensland, being due to the action of thermal springs.

For the ten years ended 1896, the world's production of gold is estimated to have been as follows :—

Year.	Value.	Year.	Value.
	£		£
1887	21,500,000	1892	29,900,000
1888	21,985,000	1893	32,600,000
1889	23,835,000	1894	36,765,000
1890	24,260,000	1895	41,000,000
1891	26,700,000	1896	45,000,000

Of the production of £45,000,000 in 1896, the Australian colonies produced 21·7 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 in the Broken Hill and Silverton districts during 1896 was £1,754,515 ; while the machinery employed was valued at £929,300. The aggregate output of the mines in the Barrier country to the end of the year named was valued at £21,189,665. 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 erected on their lease 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, 1897, the company treated 3,299,331 tons of silver and silver-lead ores, producing 87,526,567 oz. of silver and 326,060 tons of lead, valued in the London market at £17,133,184. They have paid dividends and bonuses to the amount of £6,416,000, besides the nominal value of shares from the several "Blocks" sold to other companies. The sum spent in the erection and construction of plant from the opening of the property is about £750,000. The mine wages and salary sheet for the twelve months represented a sum of £407,315, including £79,056 paid to contractors, and £55,766 for quarrying. The net profit for the year was £300,120.

The quantity and value of silver and silver-lead ore exported by New South Wales to the end of 1896 is shown in the following table :—

Year.	Silver.		Silver-Lead.			Total value.
			Quantity.		Value.	
	Quantity.	Value.	Ore.	Metal.		
Up to	oz.	£	tons cwt.	tons cwt.	£	£
1882	765,397	187,429	203 12	.....	5,385	192,814
1883	77,066	16,488	105 17	.....	1,625	18,113
1884	93,660	19,780	4,668 1	.....	123,174	142,954
1885	794,174	159,187	2,095 16	190 8	107,626	266,813
1886	1,015,434	197,544	4,802 2	.....	294,485	492,029
1887	177,308	32,458	12,530 3	.....	541,952	574,410
1888	375,064	66,668	11,739 7	18,102 5	1,075,737	1,142,405
1889	416,895	72,001	46,965 9	34,579 17	1,899,197	1,971,198
1890	496,552	95,410	89,719 15	41,319 18	2,667,144	2,762,554
1891	729,590	134,850	92,383 11	55,396 3	3,484,739	3,619,589
1892	350,661	56,884	87,504 15	45,850 4	2,420,952	2,477,836
1893	531,972	78,131	155,859 1	58,401 3	2,953,589	3,031,720
1894	846,822	94,150	137,813 8	42,513 2	2,195,339	2,289,489
1895	550,142	81,858	190,192 19	29,687 0	1,560,813	1,642,671
1896	202,789	26,518	267,363 1	19,573 4	1,758,933	1,785,451
Total	7,423,526	1,319,356	1,103,946 17	345,613 4	21,090,690	22,410,046

This amount was approximately made up of 115,964,200 ounces of silver, valued at £17,196,800; and of 435,800 tons of lead, valued at £5,213,246. 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 1896 was 5,555, and the average value of mineral won by each miner engaged amounted to £321 8s. 3d., as compared with £352 13s. 1d. in 1895, £544 1s. 7d. in 1894, and £643 16s. 3d. in 1893.

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. The process adopted at the Sulphide Corporation's works at Cockle Creek is that known as Ashcroft's, and is a most remarkable and interesting one. The capital of the company is £1,000,000; and the result of their operations will be watched with the very greatest interest.

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 1896, exclusive of that of New South Wales, being only £2,854,641. 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 five years. In 1896 the quantity of ore exported was 20,817 tons, valued at £222,948. 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. Five years ago smelting works were erected on the Mount Zeehan field, but the mines were not then sufficiently developed to keep them at work. It is expected, however, that another effort in this direction will be made at an early date. At the present time most of the ore is sold to agents of the Australian and German smelting works, although a few companies ship direct. The principal mine at Mount Zeehan is the Western, which has yielded about 25,000 tons of ore, valued at £300,000, and paid nearly £85,000 in dividends. A little mining is carried on at the Whyte River and Hazlewood fields; and at the Magnet Range, near Waratah, high-class ore is being opened up.

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 1896. In that year the production was valued at £32,162, and the industry gave employment to 40 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 1896 was 94,307 ounces, valued at £10,589.

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 silver extracted from gold during 1896 at the Melbourne Branch of the Royal Mint was 52,975 ounces. Prospecting for silver ores is now being carried on at Deddick, East Gippsland, Victoria. 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. In 1896 a small quantity of silver, valued at £194, was obtained in the province proper; and 20 tons of silver ore, valued at £1,250, were exported from the Northern Territory. This was obtained from workings near the McKinley and Mount Wells leases.

Up to the end of 1896 New South Wales had produced nearly 89 per cent. of the total value of silver raised in Australasia; Tasmania came second, with 4·3 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 1896, and up to the end of that year, was as follows:—

Colony.	During 1896.		To end of year 1896.	
	Value.	Proportion raised in each Colony.	Value.	Proportion raised in each Colony.
	£	per cent.	£	per cent.
New South Wales ...	1,785,451	86·7	22,410,046	88·7
Victoria	7,158	0·3	827,981	3·3
Queensland	32,162	1·6	661,715	2·6
South Australia	1,444	0·1	103,171	0·4
Western Australia ...	.....	.....	250	0·0
Tasmania	222,948	10·8	1,079,672	4·3
New Zealand	10,589	0·5	181,852	0·7
Australasia	2,059,752	100·0	25,264,687	100·0

The world's production of silver during the ten years ended 1896 is estimated to have been as follows:—

Year.	Ounces.	Year.	Ounces.
1887	96,124,000	1892	152,940,000
1888	108,827,000	1893	162,162,000
1889	120,214,000	1894	167,354,000
1890	126,095,000	1895	169,356,000
1891	137,171,000	1896	158,189,000

The annual output of the colony of New South Wales alone is therefore rather more than one-twelfth 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 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 a gradual rise in the price of the metal, copper-mining is again attracting considerable attention in Australasia. South Australia has so far supplied over three-fourths 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 production in 1897 had 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 has been laid down to Teapookana, on the King River, through most difficult country. 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 the first quarter of 1898 the dividends had amounted to £145,000. Over 2,400 men find employment with the Company. It is estimated that there are 4½ million tons of ore in sight, of an average value of 4·5 per cent. copper, 3 oz.

silver, and 0·125 oz. gold per ton. Other mines on the same field are at work, and in various parts of the colony copper-mining is receiving attention. In 1897 the copper ore and metal exported were valued at £323,650, making the total mineral production of Tasmania for the year nearly a million sterling. In the previous year only sixteen men were employed in mining copper in the colony.

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 unworked, 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. With the object of discovering whether ore exists at depths in the mine, boring operations are now in progress. A depth of 500 feet has been reached, and the prospects are regarded as satisfactory. The Wallaroo and Moonta mines, discovered in 1860 and 1861, proved to be even more valuable than the Burra Burra, the Moonta mine employing at one time upwards of 1,600 hands. At the Wallaroo mines in 1896 the quantity of ore raised amounted to 16,274 tons, yielding 2,226 tons of fine copper; while in 1897 the production was set down at 17,102 tons, yielding 2,136 tons of fine copper, the percentage of metal being lower than in the previous year. In 1896 the Moonta mines had an output of 13,543 tons of ore, from which 2,575 tons of fine copper were obtained; and in 1897, 15,688 tons of ore, yielding 2,937 tons of copper. The cost of producing the copper in 1897, after adding shipping and interest charges and Adelaide expenses, was £47 14s. 1d. per ton. The total dividends paid by these mines is stated to be upwards of £1,700,000. The production of copper in South Australia is again improving, and was greater in 1895 and 1896 than during the previous three years.

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 1896 the output was valued at £197,814, and 810 men were employed in the mines. 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; and, in 1896, 66,431 tons of ore, yielding 2,650 tons of smelted copper, valued at £107,200. 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 whom the mines belong now give employment to 450 men. The Nymagee Copper-mine, which has been acquired by the Great Cobar Syndicate, raised 3,249 tons of ore, yielding 380 tons of smelted copper, valued at £17,948. The Burraga Company produced 4,241 tons of refined copper in 1896, valued at £19,928; 150 men find constant employment at their mines. The production of the Mount Hope Copper Company was 1,092 tons of ore, yielding 141 tons of refined copper; while at South Mount Hope another company raised 454 tons of ore, the refined copper obtained amounting to 55 tons. In other districts considerable activity is also being displayed. It may be mentioned that the Broken Hill Proprietary Company saved copper to the value of £29,070 in the course of their operations during the year.

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. 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; but it is expected that these disabilities will be overcome at no distant date, and a revival of the industry is hoped for, as some of the abandoned fields contain very extensive deposits of copper-ore. The total production of copper in Queensland during 1896 was valued at £21,042, as compared with £13,097 in 1895 and £9,582 in 1894.

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. The industry, however, is not very active at present, although it shows a tendency to revive. In 1896, 25 claims were taken up in the West Pilbarra and Northampton district. The most important workings are at Whim Creek Mine, on the Balla Balla Creek, near Roeburne. To the end of that year, the total export of copper was valued at £166,816.

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 total production to date is valued at £206,395. There was no output in 1896. The copper deposits of New Zealand have been worked to a small extent only, and for a few years have been 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 of copper are generally found in deep sinkings. The metal has also been found associated with tin in the form of stannine.

In 1896 the number of men employed in copper-mining in New South Wales was 810, as compared with 868 in 1895, 645 in 1894, and 283 in 1893. Only a few hands were employed in the other colonies, except South Australia, where the number must have amounted to about 2,000. In 1897 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 1896, and the proportion furnished by each colony, are given below :—

Colony.	During 1896.		To end of year 1896.	
	Value.	Proportion raised in each Colony.	Value.	Proportion raised in each Colony.
	£	per cent.	£	per cent.
New South Wales	197,814	44·7	4,068,169	14·7
Victoria	.....	.....	206,395	0·7
Queensland	21,042	4·7	2,008,116	7·3
South Australia	222,202	50·2	21,037,972	76·0
Western Australia	100	.....	166,816	0·6
Tasmania	1,659	0·4	168,226	0·6
New Zealand	.....	.....	17,866	0·1
Australasia	442,817	100·0	27,673,560	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, and at the close of 1896 the London price of copper stood at £52 10s. per ton. 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 several 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, the 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, yet 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. 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 principal lodes worked during 1896 were the Vegetable Creek Tin-field, near Emmaville; at Tent Hill; at the Mann River, near Glen Innes; at Wilson's Downfall; and at Tingha. In that year the production was valued at £68,546, and the industry gave employment to 1,419 men, of whom 491 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; but the output is not so great as formerly, owing to the low price of the metal and the scarcity of water. Extensive deposits are known to exist in the north-eastern district, and a slight rise in value and a plentiful supply of water would result in a greatly increased production. The Mount Bischoff mine, which is worked as an open quarry, is the largest producer of tin in the colony, and has paid nearly £1,500,000 in dividends. The company have erected smelting works at Launceston, where most of the tin ore raised in the island is treated. In the Blue Tier district, plant has been erected and other preparations made for working the low-grade ores found there; and operations have lately been resumed in the Ben Lomond district. The lodes in the vicinity of Mount Heemskirk and North Dundas, on the west coast, have, however, been comparatively neglected, the present price of the metal rendering mining operations there unprofitable. In 1896 the number of tin-miners in the colony was 1,009, and the production was valued at £159,038, or only half that of ten years before.

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 for 1896 was valued at £31,770. 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. During the past few years the production has greatly decreased in consequence of the low price of the metal; but with a rise in values, and more economic treatment of the ores than is the case at present, the industry should have a great future.

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 1896 only 45 tons of tin, valued at £1,799, were produced. This was chiefly obtained from auriferous wash dirt at Eldorado, and from sluicing operations at Koetong and Cudgewa. In South Australia tin-mining is unimportant. During 1896 a small quantity of 14 tons, valued at £530, was exported from Port Darwin, in the Northern Territory. In Western Australia the tin-fields are situated at Greenbushes; but the industry, owing to the low price of the metal, and the attraction exerted on capital by the gold-fields, is not in a flourishing condition. During 1896 the production in the colony amounted to 137 tons of ore, valued at £4,338. 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; but since that time there has been an almost continuous fall, and in 1896 the London quotations were only £59 12s. 4d. to £60 14s. per ton—prices which have had a depressing effect upon the industry.

The value of the production of tin during 1896, and up to the end of that year, was as given below :—

Colony.	During 1896.		To end of year 1896.	
	Value.	Proportion raised in each Colony.	Value.	Proportion raised in each Colony.
	£	per cent.	£	per cent.
New South Wales	68,546	24·2	6,196,518	34·9
Victoria	1,799	0·6	689,537	3·9
Queensland	49,018	17·3	4,374,789	24·7
South Australia	530	0·2	26,012	0·1
Western Australia	4,338	1·5	70,192	0·4
Tasmania	159,038	56·2	6,387,554	36·0
Australasia	283,269	100·0	17,744,602	100·0

The number of persons engaged in tin-mining in 1896 was as follows :—In New South Wales, 1,419; Tasmania, 1,009; Queensland, 508; Victoria, 20; and Western Australia, 60.

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 1896 was 4,721 tons, valued at £33,283. 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. Iron ore is raised in some places in the colony, but is used chiefly for the purpose of flux.

During the year 1893, the Parliament of New South Wales agreed to a resolution for the manufacture of 30,000 tons of iron piping in the colony, and portions of the work have since been let by tender as opportunity offered. A further order for £75,000 worth of iron pipes was placed by the Government with local firms, in November, 1897. In 1896 tenders were called by the Government for the supply of 150,000 tons of steel rails, with the necessary quantities of fish-plates fish-bolts, and spikes, to be manufactured in New South Wales, from iron ore and other necessary minerals produced in the colony. The tenders closed on the 30th December of that year. The specification provided for the delivery of 15,000 per annum, in equal monthly quantities, the first delivery to take place not later than eighteen months after the signing of the contract. One of the offers received was accepted.

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; while for the first quarter of 1898 the shipments comprised 548 tons, valued at £1 per ton. The Government of South Australia has offered a bonus of £2,000 for the first 500 tons of pig-iron produced in that colony.

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 1896 was £1,834, and up to the end of that year, £183,399. With the exception of 30 tons, valued at £200, raised at Bowraville, the production in 1896 was obtained at Hillgrove. The industry has suffered greatly during the last two 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 1896 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 very little antimony ore was obtained during the year 1896, the quantity exported from that colony being only 21 tons, valued at £450. 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 1896 :—

Colony.	Value.	Proportion raised in each colony.
	£	per cent.
New South Wales	183,399	41·0
Victoria	176,644	39·5
Queensland	34,958	7·8
New Zealand	52,204	11·7
Australasia	447,205	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 1896 in New South Wales and Queensland was £38,212 and £57,535 respectively. In the former colony the production in 1896 was valued at £490 only, while in Queensland there was no output in that year. 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 1896 was valued at £57,993. In that colony the output has shrunk to insignificant proportions, being valued in 1896 at £205. In Queensland during the same year, 300 tons, valued at £900, 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. It is believed that the beach deposits at Ballina and other places on the northern coast might, with improved appliances, be profitably worked for platinum. Fifteen cwt. of sand from this district were forwarded in 1891 to platinum merchants in London for treatment. The tests made proved, however, that the small percentage of metal found and the cost of extraction barely leave a margin of profit. On the northern beaches, a little platinum is being obtained by the miners who are working the black sand for gold. The metal has also been discovered at Fifield, in the Parkes district, and in lodes near Broken Hill and Orange. At Fifield, 2,900 oz. were saved in the course of the gold-washing operations during the year 1896. The Fifield platinum occurs in coarse shotty grains, and is much purer than that obtained from the northern beach-sands. The quantity of platinum exported during 1896 was 3,438 oz., valued at £3,479. 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. The Government of the colony have arranged with a private company for the erection of smelting works on the Swan River, near Fremantle.

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, containing 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 for this purpose, but the operations of the company were not successful, and the works were closed. Since 1845 Western Australia has exported 33,939 tons of lead ore, valued at £370,154. The chief mining centres for this mineral are

in the Northampton district, between Geraldton and Murchison, but nothing was raised in 1896. As will be gathered from the remarks on silver, the association of lead with this metal is the Broken Hill mines of New South Wales adds very greatly to the value of the product. Up to the end of 1896 the quantity of lead in the ores raised is estimated to have been 435,800 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 1896 Queensland produced 3 tons, valued at £60. A few years ago the production was considerably larger. 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.

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 in this direction.

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. In the

Gundagai district the industry was rapidly becoming a valuable one, but the low price of chrome has greatly restricted the output. During 1896 the production reached 1,000 tons, valued at £3,000. The exports of chrome ore during the year amounted to £11,280. In New Zealand chrome ore to the value of £37,367 was extracted between 1858 and 1866, but nothing has been done since.

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; and also at Tarcutta, near Wagga Wagga; and at Louisa Creek, near Mudgee, in that colony.

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 1896, 4,675 tons of brown coal were raised, valued at £1,899; and 1,140 tons of lignite, valued at £242. 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, the Government Geologist of Queensland, considers the extent of the coal-fields of that colony to be practically unlimited, and is of opinion 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. This is the largest output ever reached in a single year. 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 in 1894 the production again took an upward tendency, and in 1895 stood at 3,738,589 tons, of a value of £1,095,327; and in 1896, 3,909,517 tons, valued at £1,125,281. Although the quantity extracted in 1896 has only been exceeded in 1891, the fall in prices has placed the value below that of every year since 1882, with the exception of 1895. To the end of 1896, the total quantity of coal extracted from the New South Wales mines, from their opening in the early years of the century, amounted to 72,282,266 tons, valued at £31,819,331.

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 1896 was 96, as compared with 93 in the previous year. They gave employment to 9,233 persons, of whom 7,538 were employed under ground, and 1,695 above ground. The average quantity of coal extracted per miner was 519 tons, as against an average of 503 tons in the previous year, and 492 tons in 1894. For the ten years ended 1896, the average quantity of coal extracted per miner was 447 tons, which, at the mean price of coal at the pit's mouth, was equivalent to £170 19s. 6d. Taking all persons employed at the mines, both above and under ground, the average for the ten years would be 364 tons, equivalent to £139 2s. 7d. 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	364	7 8	139 2 7
Great Britain	310	6 4	98 4 3
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 1896, out of a total production of 3,909,517 tons, the consumption amounted to 1,434,610 tons, or nearly 36·7 per cent. The colony of Victoria took the next largest share of the output, viz., 714,666 tons, or 29 per cent. of a total export of 2,474,907 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 22 cwt. in 1896. 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 1896 was about 350,000 tons.

The progress of the export trade of New South Wales, from 1881 to 1896, is shown in the following table:—

Exported to—	Quantity.			Value.		
	1881.	1891.	1896.	1881.	1891.	1896.
	tons.	tons.	tons.	£	£	£
Australasian colonies	657,135	1,510,976	1,371,796	255,572	755,509	482,096
India, Ceylon, and China	136,511	188,000	97,238	59,044	105,208	36,497
Mauritius	6,249	19,760	8,466	2,414	10,813	3,228
Pacific Islands	19,526	141,055	99,483	8,011	75,803	37,215
United States	150,002	365,623	303,726	68,172	200,851	119,920
South America	8,017	221,700	376,626	3,243	123,136	139,781
Other countries	52,404	67,254	217,572	20,174	35,310	81,527
Total	1,029,844	2,514,368	2,474,907	417,530	1,306,630	900,264

New Zealand is the only other colony in a position to export coal. Its export trade in 1881, 1891, and 1896 was as follows:—

Exported to—	Quantity.			Value.		
	1881.	1891.	1896.	1881.	1891.	1896.
	tons.	tons.	tons.	£	£	£
Australasian colonies	6,049	14,277	4,132	5,022	8,488	3,301
United Kingdom	.....	68,871	53,918	.....	76,027	54,991
Fiji and Norfolk Island	21	3,282	7,871	25	2,469	5,346
Pacific Islands, etc.	551	5,234	13,603	563	4,189	8,346
Total	6,621	91,664	79,524	5,610	91,173	71,984

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 1896 was 792,851 tons, of which the Coalbrookdale mines contributed 190,975 tons; the Brunner, 92,118 tons; and the Kaitangata, 72,536 tons. There is a steady increase in the quantity of coal raised in the colony, and a corresponding decrease in the importation. In 1896 there were 163 coal-mines in operation in New Zealand, giving employment to 1,937 men.

As showing the various kinds of coal found in New Zealand the following figures relating to the production in 1896 will be of interest:—

Bituminous coal	473,637	tons.
Pitch coal	110,547	,,
Brown coal	179,744	,,
Lignite	28,923	,,
Total	792,851	,,

Coal-mining is an established industry in Queensland, and is progressing satisfactorily. In 1896 the production showed an increase of

48,000 tons over that of the previous year, and 150 more men were employed in coal-mining than in 1895. 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 about 30,000 tons annually to Queensland. Of the total production of 371,390 tons in the northern colony in 1896, 280,094 tons were obtained in the Ipswich district, 80,320 tons at Wide Bay, and 10,976 tons in the Clermont district. There was an export of 17,812 tons, valued at £8,193, during the year, almost wholly to Victoria.

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, The output on this field showed a considerable increase in 1896, and an improvement is taking place in supplying local requirements; but no export trade is at present possible, the mines being situated too far from the seaboard. During the year there were 139 men engaged in coal-mining in the colony, and the production amounted to 43,549 tons, valued at £17,354. Since 1893 the export of coal by New South Wales to Tasmania has fallen from 67,000 to 57,000 tons. 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 further discovery is reported from Swansea, on the East Coast.

Black coal has been discovered in Victoria, and is now being raised in increasingly large quantities. In 1896 the production amounted to 226,562 tons, valued at £113,012, as compared with 22,834 tons, valued at £19,731, in 1891. During this period of five years the export from New South Wales to Victoria has fallen from 954,277 tons to 714,666 tons. The principal collieries in the colony are the Outtrim Howitt, from which 126,012 tons were obtained; followed by the Coal Creek Proprietary, with 35,366 tons; the Jumbunna, with 34,103 tons; and the Korumburra, with 20,818 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. But the results of trials of this coal on the Government railways have 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 on the railways of the colony. A line of railway is being laid down to the

district; and the Government have agreed to connect the mines with the terminus, taking payment in coal.

The quantity of coal extracted annually in Australasia now exceeds 5,340,000 tons, valued at about £1,840,000. The production of each colony during the year 1896 was as follows:—

Colony.	Quantity.	Value.	
		Total.	Proportion raised in each Colony.
	tons.	£	per cent.
New South Wales	3,909,517	1,125,281	61·2
Victoria	226,562	113,012	6·2
Queensland	371,390	154,987	8·4
Tasmania	43,549	17,354	0·9
New Zealand	792,851	428,648	23·3
Australasia	5,343,869	1,839,282	100·0

The total quantity and value of the coal produced in the Australasian colonies up to the end of 1896 are shown below. Small quantities have been raised in South Australia and Western Australia, but these are not yet of sufficient importance to warrant inclusion in the table:—

Colony.	Quantity.	Value.	
		Total.	Proportion raised in each Colony.
	tons.	£	per cent.
New South Wales	72,282,266	31,819,331	78·9
Victoria	785,451	468,307	1·2
Queensland	4,395,569	1,992,310	4·9
Tasmania	569,434	331,913	0·8
New Zealand	10,735,900	5,738,124	14·2
Australasia	88,768,620	40,349,985	100·0

During the year 1896 this industry gave direct employment in and about the mines to the following numbers of persons in the several colonies:—

	Miners.
New South Wales	9,233
Victoria	829
Queensland	1,275
Tasmania	139
New Zealand	1,937

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 1896, the average price obtained has been 8s. 10d., but the mean of the last ten years has not been more than 7s. 8d. In 1896 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	10	0
Queensland	0	8	4
Tasmania	0	8	0
New Zealand	0	10	10
Australasia	0	6	11

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.

The following table shows the annual coal production of the principal countries of the world. The figures refer to the year 1896, except those for Austria-Hungary and Belgium, which refer to the year 1895:—

Country.	Tons of 2,240 lb.
Great Britain	195,361,290
United States	171,416,390
Germany	110,680,901
Austria-Hungary	32,144,546
France	28,852,850
Belgium	20,881,547
Canada	3,341,995
Australasia	5,343,869

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 1896, the quantity of kerosene shale raised has amounted to 895,334 tons, worth £1,795,213. The average price realised during that period has been £2 0s. 1d. per ton. The prices ruling in 1896, when 31,839 tons were extracted, averaged £1 1s. 6d. per ton, representing a total value of £34,202 for the production of that year. The export of shale from New South Wales during 1894, 1895, and 1896 was as follows :—

Exported to—	1894.		1895.		1896.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£
Victoria	1,328	2,849	2,137	4,842	81	187
United Kingdom	8,019	21,059	15,423	32,609	1,431	3,156
Netherlands	5,884	15,727	6,031	13,993	2,267	5,000
Italy	1	3	2,176	5,440	5,713	13,675
United States	152	418	370	904	500	1,280
Spain	.....	.....	1,456	3,492	.....	.....
Chili	1,914	4,886	2,892	6,530	2,016	4,148
Other countries	1,561	4,245	4,064	10,124	2,212	5,400
Total	18,859	49,187	34,549	77,934	14,220	32,846

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 1896 is shown below. The figures for Western Australia represent imports of mineral oil :—

Colony.	Quantity.	Value.
	gallons.	£
New South Wales	2,106,901	71,464
Victoria	2,957,983	92,090
Queensland	1,269,865	53,011
South Australia	1,349,543	32,617
Western Australia	853,649	31,953
Tasmania	222,556	8,302
New Zealand	1,713,624	64,048
Australasia	10,474,121	353,485

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 production 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 1896 was £8,114,842. In the year 1896 the quantity obtained represented a value of £431,323, and gave employment to a large number of persons, both European and Maori. Kauri gum is not 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 1896, 5,632 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 1896 the Bulladelah mine yielded 1,372 tons of stone, valued at £4,116. In the course of the same year 130 cwt. of locally-manufactured alum, valued at £39, was exported to Victoria.

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. 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 lately the Western Australian Government has 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 has 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, and Queensland, 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 in the country near Inverell, in the New England district. The number of diamonds found in the colony to the end of 1896 is estimated at 107,000, the largest being one of $5\frac{5}{8}$ carats, or 16·2 grains. 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 no less than 12,000 carats of diamonds were won in the Tingha and Inverell districts, but no value is given. 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 $\frac{1}{5}$ 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 150,000 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 £400, were obtained. No estimate of the returns in 1896 were obtained from this field, but the output from the Bingara diamond-field for the year is set down at 3,000 carats.

The finest Opal known is obtained in the Upper Cretaceous formation at White Cliffs, near Wilcannia, New South Wales, and at these mines over 400 men find constant employment. 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 for 1896 alone the production is estimated at £25,000. 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 1896 it was set down at £23,300. Valuable opal has lately 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. Application has been made for leases covering an area of 239 acres.

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 have been closed for three years.

The sapphire is found in all the colonies, principally 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 operations are being carried on in that colony.

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 1896 will be found below :—

Colony.	Total Value.	Proportion of each Colony.	Average value per head.
	£	per cent.	£ s. d.
New South Wales	4,354,688	31·5	3 7 8
Victoria	3,344,555	24·2	2 16 9
Queensland	2,628,996	19·0	5 12 9
South Australia	321,172	2·3	0 17 11
Western Australia	1,073,246	7·7	8 19 6
Tasmania	638,623	4·6	3 18 2
New Zealand	1,482,918	10·7	2 2 0
Australasia	13,844,198	100·0	3 4 8

The total value of minerals raised in 1896 exceeded by £2,662,255 the average annual amount since 1852. It will, however, be easily understood that the proportion of mineral wealth extracted per head of the population is much less than it was during the prevalence of the gold fever. In comparison with that of the years 1851 to 1871 the production of the precious metals is considerably reduced. The search for gold, however, 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 three years 1871, 1881, and 1891, as well as the value per inhabitant for the whole of Australasia :—

Colony.	1871.	1881.	1891.
	£	£	£
New South Wales	1,650,000	2,121,000	6,395,560
Victoria	5,400,000	3,467,000	2,339,510
Queensland	806,000	3,165,000	2,299,560
South Australia	725,000	421,000	365,950
Western Australia	5,000	11,000	130,090
Tasmania	25,000	604,000	516,390
New Zealand	2,932,000	1,274,000	1,403,630
Australasia — Total	11,543,000	11,063,000	13,450,690
	£ s. d.	£ s. d.	£ s. d.
Australasia — Per head	5 19 4	3 19 8	3 10 0

A comparison of the figures for 1891 with those for 1896 shown in the preceding table reveals the fact that the mineral production of 1896 was about £400,000 more than that of 1891. There were increases in Queensland, Tasmania, New Zealand, and notably in Victoria and Western Australia; and a slight decrease in South Australia; while in New South Wales the decrease amounted to £2,040,000, chiefly owing to the fall in the value of silver and, to a smaller extent, to the decline in the price of coal.

Comparing the value of mineral production in 1896 with the population, the largest share is taken by Western Australia, with £8 19s. 6d. per inhabitant; Queensland ranks second with £5 12s. 9d. per inhabitant; Tasmania third, with £3 18s. 2d.; and New South Wales

fourth, with £3 7s. 8d. The high averages of Western Australia and Queensland are due to the gold-mines, while in New South Wales nearly half the year's wealth was contributed by the silver-fields. The average per inhabitant for Australasia was £3 4s. 8d.

The following table shows the value of production in each of the colonies during 1896, 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 :—

Colony.	Gold.	Silver and Silver-lead.	Copper.	Tin.	Coal.	Other Minerals.	Total.
	£	£	£	£	£	£	£
New South Wales	1,073,360	1,785,451	197,814	68,546	1,125,281	104,236	4,354,688
Victoria	3,220,348	7,158	.....	1,799	113,012	2,238	3,344,555
Queensland	2,341,348	32,162	21,042	49,018	154,987	30,439	2,628,996
South Australia.....	95,528	1,444	222,202	530	.....	1,468	321,172
Western Australia....	1,068,808	.....	100	4,338	.....	.....	1,073,246
Tasmania.....	237,574	222,948	1,659	159,038	17,354	50	638,623
New Zealand	1,041,428	10,589	.....	.....	428,648	*2,253	1,482,918
Australasia	9,078,394	2,059,752	442,817	283,269	1,839,282	140,684	13,844,198

* Exclusive of kauri gum of the value of £431,323.

Corresponding figures for the year 1897 are appended :—

Colony.	Gold.	Silver and Silver-lead.	Copper.	Tin.	Coal.	Other Minerals.	Total.
	£	£	£	£	£	£	£
New South Wales	1,088,413	1,698,239	283,174	49,000	1,230,041	232,860	4,582,627
Victoria	3,251,064	8,253	.....	1,650	108,640	1,397	3,371,004
Queensland.....	2,553,141	25,118	12,645	37,509	130,889	16,202	2,784,504
South Australia.....	120,147	1,522	242,917	10	.....	6,094	370,690
Western Australia ..	2,564,977	.....	1,033	3,275	.....	4	2,569,289
Tasmania.....	289,241	197,225	323,650	109,126	16,928	74	936,244
New Zealand	980,204	20,372	2	.....	420,357	*6,590	1,428,025
Australasia	10,847,187	1,951,229	863,421	201,470	1,915,855	263,221	16,042,383

* Exclusive of kauri gum of the value of £398,010.

The total mineral production to the end of 1897 is shown in the following table, in which the column "other minerals" again includes kerosene shale :—

Colony.	Gold.	Silver and Silver-lead.	Copper.	Tin.	Coal.	Other Minerals	Total.
	£	£	£	£	£	£	£
New South Wales	44,488,371	24,108,285	4,351,343	6,246,418	33,049,372	2,710,842	114,954,631
Victoria	247,389,702	836,234	206,395	691,187	576,947	214,474	249,915,029
Queensland	41,749,606	686,833	2,020,761	4,412,298	2,132,199	226,880	51,228,577
South Australia	2,038,603	104,693	21,280,889	26,022	.....	425,915	23,876,122
Western Australia....	6,669,018	250	167,849	73,467	.....	369,911	7,280,495
Tasmania	3,673,162	1,276,897	491,876	6,496,680	348,841	10,777	12,298,233
New Zealand	53,372,634	202,724	17,868	.....	6,158,481	*213,969	59,965,676
Australasia	399,381,186	27,215,916	28,536,981	17,946,072	42,265,840	4,172,768	519,518,763

* Exclusive of kauri gum of the value of £8,512,852.

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 1897, the remainder, £519,238,840, represents the value of mineral production from 1852, equal to an average of £11,287,801 per annum for the forty-six years.