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, the classification into noble metals, metallic minerals, carbon minerals, soluble and insoluble salts, diamonds and other gem stones, has been adopted.

NOBLE METALS.

Gold, the most valuable of noble metals, is found throughout Australasia, and the present prosperity of the Colonies is largely due to gold discoveries, the development of other industries being, in a country of varied resources, a natural sequence to the acquisition of mineral treasure. Gold.

Settlement in Australia was still young when many-tongued rumour spoke of the existence of gold, 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 Strzlecki 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 Discovery of gold.

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 also discovered in New Zealand in the same year, though it was not until 1861 that a large population was, by the prospect of rapidly obtained wealth, attracted to the last-mentioned Colony.

Gold in Western Australia.

In Western Australia gold was first found in 1868, although it was not until 1887 that any diggings of importance were discovered. The richest field is at the Yilgarn Hills, 200 miles east of Perth, which has yielded to the end of July, 1892, 29,800 oz. valued at £109,130. Until quite recently this Colony was considered to be destitute of mineral deposits of any value, but now it is known that a rich belt of mineral country extends from north to south. The Kimberley gold-field, in the north-eastern portion of the Colony, is considered likely to become an important reefing district, as the lodes are rich and easily worked.

Value of gold raised.

The following table gives the value of gold raised from the commencement of mining in the various Colonies to the beginning of the year 1892, and the proportion due to each :—

Colony.	Value.	Proportion of value raised by each Colony.
	£	Per cent.
New South Wales	38,633,488	11·1
Victoria	229,787,892	66·0
Queensland	28,052,199	8·0
South Australia	1,295,297	0·4
Western Australia	720,717	0·2
Tasmania	2,388,499	0·7
New Zealand	47,433,117	13·6
Australasia	348,311,209	100·0

During the year 1892 gold valued at £569,178 was won from the New South Wales mines.

Effect of gold discovery in Victoria.

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 as the alluring dazzle of the gold-seeker's life was gradually dimmed by privation and frequent disappointment, people turned to safer, if less brilliant, fields of employment. 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.

Progress of gold-mining.

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, owing chiefly to the increased production of Queensland. It will be seen from the following figures, showing the quantity and value of gold obtained up to the beginning of 1892, that the annual production of Queensland is now almost equal in value to that of Victoria. The returns from South Australia include 98,140 oz., the production of the Northern Territory :—

Colony.	Weight.			Value.	Proportion of value raised by each Colony.
	Alluvial.	Quartz.	Total.		
	oz.	oz.	oz.	£	Per cent.
New South Wales.	52,915	100,421	153,336	558,306	8·9
Victoria	188,548	387,852	576,400	2,305,596	36·7
Queensland	16,021	560,418	576,439	2,017,536	32·1
South Australia ...	.....	.....	35,533	125,529	2·0
Western Australia	.....	.....	30,311	115,182	1·8
Tasmania.....	6,759	32,444	39,203	149,816	2·4
New Zealand	.....	.....	251,296	1,007,488	16·1
Australasia ...	.....	.....	1,663,218	6,279,453	100·0

Quantity of gold per miner.

The average value of gold to 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 Colonies where a revival of mining has lately been experienced, it is natural to expect a fall in the 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. 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 shows the number of miners at work in 1891, with the quantity and value of gold won per man, for those Colonies for which returns are available :—

Colony.	No. of Miners.	Amount won per Miner.	Value per Miner.
		oz.	£ s. d.
New South Wales	11,166	13·73	50 0 0
Victoria	23,763	24·26	97 0 6
Queensland	9,195	62·69	219 8 4
Tasmania	1,056	37·12	141 16 5
New Zealand	12,724	19·80	79 3 7

Yield of quartz.

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 material from all the principal mining centres. The results obtained for the last five years ending 1891 were as follow. 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 the Colony, and in 1891 nearly one-fourth :—

	New South Wales.			Victoria.			Queensland.			Tasmania.		
	oz.	dwt.	gr.	oz.	dwt.	gr.	oz.	dwt.	gr.	oz.	dwt.	gr.
1887	0	9	5	0	9	10	1	15	10	1	5	21
1888	1	0	18	0	9	18	1	14	11	1	5	2
1889	1	0	2	0	9	19	1	17	20	0	17	16
1890	0	15	8	0	9	4	1	7	15	0	16	12
1891	0	18	13	0	9	4	1	3	21	1	5	4

It is not pretended that the above figures have any great statistical value, but they may, nevertheless, 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.

Deep mines in Victoria.

The greatest development of quartz-reefing is found in Victoria, some of the mines being of a great depth. The ten deepest mines at the close of 1891 were as follows :—Lansell's, at Sandhurst, 2,640 feet; New Chum and Victoria Company, 2,448 feet; Magdala-Moonlight, 2,409 feet ; North Old Chum Company, 2,310 feet; Victorian Quartz, 2,302 feet; Victory and Pandora, 2,300 feet; Lazarus Company, 2,264 feet; Old Chum, 2,210 feet; "Garibaldi," 2,183 feet; and New Chum Railway, 2,180 feet.

Value of machinery.

The value of machinery on the gold-fields of those Colonies from which returns were obtainable, was during 1891 as given below. For 1892 the value of machinery on the gold-fields of New South Wales was returned at £570,143 :—

Colony.	Value.
	£
New South Wales	574,416
Victoria	1,848,218
Queensland	1,123,046
Tasmania	215,285
New Zealand	395,985

Large nuggets.

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 the weight and value of which were never published. Victoria's record is the best, and includes the following nuggets:—

Victorian 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	1	17
	93	1	11
	84	3	15
	69	6	0
	52	1	0
	30	11	8
	30	11	2

Nuggets found in New South Wales.

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 to 1,393 oz., and others, of 357, 347 (the "Jubilee"), 200, 47, 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 during the year 1873, for this mine, 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 are, however, insignificant when compared with the enormous yield of the Mount Morgan Mine, in Queensland, which has already paid nearly £2,750,000 in dividends, and may be designated one of the wonders of the world. It is a huge mound of ore, highly

The Mount Morgan Mine.

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.

Platinum and *iridosmine*, though not specially sought for by miners, have been found in New South Wales and New Zealand, but few efforts have been made to ascertain whether either mineral can be extracted with satisfactory commercial results. The same remarks apply to the noble metal *tellurium* which is found in New Zealand, associated with gold and silver (*petzite*) and with silver only (*hessite*). Platinum and Iridosmine. Tellurium.

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, or argentiferous lead ores, the largest deposits of the metal being found in the last-mentioned form. Silver.

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 this 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, also at Silverton, and Broken Hill at 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. During the year 1891 the Company raised from their mine 35,287 tons of ore and smelted 39,046 tons, the production from which was valued at £104,565. The Company possesses smelting plant to the value of £16,024, and gives employment to 350 men. New South Wales silver mines.

The field of Silverton has proved to be of immense value. Discoveries have been made along the Barrier Range at Broken The Silverton silver mines.

Hill, Umberumberka, The Pinnacle, and many other points. The yield of minerals in the Broken Hill and Silverton districts during 1891 showed a total value of £3,960,677, while the machinery employed is valued at £535,164. The aggregate output of the mines in the Barrier country to the end of 1891 was valued at £10,079,857. 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.

Barrier Ranges and Broken Hill silver-lead mines.

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 beginning of June, 1892, the Company treated 984,350 tons of silver and silver-lead ores, producing 36,512,445 oz. of silver and 151,946 tons of lead, valued in the London market at £8,252,138. They have paid dividends to the amount of £3,880,000, and bonuses amounting to £592,000, besides the nominal value of shares from the several "Blocks," sold to other Companies, amounting to about £1,744,000, or a total return from the mine of £6,216,000. The sum spent in the erection and construction of plant, from the opening of the property, was £471,322. During the year 3,203 men were employed, of whom 1,686 were engaged

Broken Hill Proprietary Company.

under ground. The net profit for the half-year ending May 31st, 1892, was £906,552. The nominal value of this mine at the end of March, 1893, had declined to £3,292,963, as against six and a half millions at the end of 1890.

The quantity and value of silver and silver-lead ore exported to the end of 1892 from New South Wales is shown in the following table :— Silver and silver-lead ore exported.

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	.....	541,052	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
Total.....	5,291,801	1,038,699	352,718 8	195,438 15	12,622,016	13,660,715

It will be seen that the production of silver in New South Wales has, during the past few years, considerably increased, until that of 1891 exceeded the largest annual production of gold, even in the palmiest days of the diggings. The number of miners engaged in silver and lead mines in 1891 was 7,645, and the average value of mineral won, per miner engaged, amounted to £473 9s. 2d. The lower results shown by the figures for 1892 are due to the stoppage of work for some three months by reason of a general strike amongst the mining hands of the Broken Hill district. Increase in production of silver.

Although indications of silver abound in all the other Colonies, no fields of great importance have yet been discovered. The value Silver in other Colonies.

of the yield of Australasia to the end of 1891, exclusive of that of New South Wales, was only £927,298, of which amount Queensland contributed more than one-half. The leading silver mines of Queensland are south-west of Cairns, in the Herberton district, and it is from these fields that the largest proportion of the total production was raised.

Silver in New Zealand.

In New Zealand silver is found in various localities throughout the Colony, principally in the Te Aroha, Thames, and Coromandel fields, but it is generally worked for in conjunction with gold-mining.

Silver in Tasmania.

The silver-mining industry in Tasmania is steadily developing, principally in the Mount Zeehan and Dundas districts, from which almost the whole quantity produced in the Colony is obtained. In the first-named district, argentiferous lead ore has been found over 30 square miles of country, and the Mount Dundas field, almost adjoining, extends north as far as the Pieman River. The extent of ground taken up in the Zeehan and Dundas districts for silver-mining in 1890 was 87,000 acres. The total area leased for silver-mining in Tasmania during 1891 was 108,327 acres.

Silver in Victoria and Western Australia.

There are no silver mines in Victoria or Western Australia, the small silver production of the former Colony being found associated with gold. The quantity of silver extracted from gold during the year at the Melbourne Branch of the Royal Mint was 30,039 ounces.

Silver in South Australia.

The production of silver in South Australia is very limited, and it is remarkable 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 the mother Colony.

Percentage of silver production to each Colony.

Up to the end of 1891 New South Wales had produced over 92 per cent. of the total value of silver raised in Australasia, Queensland followed, with 4·1 per cent., the remaining small proportion being distributed among the other Colonies, New Zealand claiming

the largest share. The total production of silver in Australasia, during 1891, and up to the end of that year, was :—

Colony.	During 1891.		Total production to 31st December, 1891.	
	Value.	Proportion due to each Colony.	Value.	Proportion due to each Colony.
	£	Per cent.	£	Per cent.
New South Wales	3,619,589	97·7	11,302,095	92·4
Victoria	6,008	0·2	94,930	0·8
Queensland	21,879	0·6	498,590	4·1
South Australia	....	.....	101,727	0·8
Western Australia	250	0·0	250	0·0
Tasmania	52,284	1·4	91,653	·8
New Zealand	5,151	0·1	140,148	1·1
Australasia	3,705,161	100·0	12,229,393	100·0

It will be seen that the silver production of the group during 1891 was little less than one-third of the total production of Australasia to the end of that year.

METALLIC MINERALS.

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 offered £10,000 for the first 10,000 tons of lead smelted in the Colony. Works were erected, but up to the present without success. Western Australia has, since 1845, exported 34,025 tons of lead ore, valued at about £169,250. The chief mining centres for this mineral are in the Northampton district, between Geraldton and Murchison. Lead.

Mercury, in the form of sulphides or cinnabar, is found in New South Wales, Queensland, and New Zealand. Few attempts, Mercury.

however, have been made to ascertain whether the deposits are of sufficient value to warrant the expenditure of capital in this direction.

Copper.

Copper is known to exist in all the Colonies, but has been mined for most extensively in South Australia, New South Wales, and Queensland. 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 Kapunda Mine, opened up in 1842, is the oldest copper-mine in South Australia. Unfortunately information regarding the total quantity of ore raised is not available, but the average yearly output has been estimated at 2,000 tons. Three years later than Kapunda the celebrated Burra Burra Mine was discovered. This mine proved to be very rich, and paid about £800,000 in dividends to the original owners. For a number of years the mine has been suffered to remain unworked, partly in consequence of the low price of copper, but principally 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. During the twenty-nine and a half years that 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. The Wallaroo and Moonta mines were discovered in 1860 and 1861. Up to the year 1886 these two mines had put out 927,196 tons of ore, valued at £6,609,240. The yield of copper ranged from 10 to 20 per cent. The Moonta Mine at one time employed upwards of 1,600 hands, and up till 1891 employed fully 1,100 men, but shortly after that date the industrial operations were disturbed, owing to labour and other difficulties, which were only terminated during the opening month of 1892.

South Australian copper mines.

Principal copper-mines of New South Wales.

The principal mines in New South Wales are those of Cobar and Nymagee, situated in the centre of the Colony, and within 80 miles of each other. The former at one time employed over 500 men and boys, but is now idle; the deepest shaft is 566 feet, and the

width of the lode from 2 to 50 feet. From the date of the commencement of operations in 1876, that company treated 213,182 tons of ore, giving a return equal to 23,611 tons of refined metal, an average production of 11·07 per cent. of copper per ton of ore, and the sum of £154,000 has been paid in dividends to the shareholders. Nymagee employed a complement of 250 persons, and its ores contain an average proportion of copper equal to 11·42 per cent. Since its formation in 1883, to the end of 1891, this mine has paid in dividends £94,000. The yield for 1891 was 9,355 tons of sulphide ore, which when melted produced 901 tons of copper, valued at £45,050. The production for 1892 was returned as 6,238 tons of ore, valued at £31,360. The mine is now closed. The refined Nymagee copper is superior to that of Cobar, and commands a higher price in the market. A depth of 734 feet has been reached in sinking through the lode, which varies from 8 to 20 feet. The New Mount Hope and the Great Central copper-mines are also said to be rich in payable ores. The first mentioned employed 36 men and 4 boys in 1891, and raised 1,094 tons of ore, equal to 208 tons of copper, valued at £9,158. The total yield of the Cobar district during 1891 is estimated at 1,109¼ tons of copper, valued at £54,208. The Burraga Mine yielded during 1889, 476 tons of copper, valued at £36,625 ; and during 1890, 420 tons, worth £24,150. Owing to the low price of copper this mine was closed during 1891, but the furnaces were still at work upon 2,000 tons of ore at grass. The deepest shaft is 300 feet, and the lode is said to be 15 feet wide. The output for 1892 was only 800 tons of ore.

Nymagee copper mine.

Cupriferous deposits abound in Queensland, and at one time there was considerable speculation in copper-mining stock. 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

Copper in Queensland.

of the copper-fields in this 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 is greatly retarded for 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.

Copper in Western Australia.

In Western Australia copper deposits have been worked for some years, and form with lead the principal elements of the mineral production of that Colony. Very rich lodes of both metals 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 copper industry, however, is almost at a standstill, at present, through the low ruling price of copper, and the heavy expense of cartage, but it is anticipated that the cost of carriage will be reduced, and then several of these mines may be worked at a profit. The total export of copper since 1845 was 8,521 tons, valued at about £140,000.

Victorian copper.

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 production during 1891 was 60 tons of ore, valued at £216.

New Zealand and Tasmanian copper.

The copper deposits of New Zealand and Tasmania have been worked to a small extent only.

Virgin copper.

The metal is sometimes found in the Australasian mines in a virgin state, of which beautiful specimens have been exhibited at different times, but 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.* Stannine.

The number of men employed in copper-mining in New South Wales, during 1891, was 481, whilst but a few hands were employed in Queensland and Tasmania. Number of copper miners.

The total value of copper produced in Australasia during and up to the end of 1891, and the proportion furnished by each Colony are given below. The value of copper produced in New South Wales during 1892 was £163,242 :— Australasian production of copper.

Colony.	During 1891.		Total Production to 31st December, 1891.	
	Value.	Percentage of each Colony.	Value.	Percentage of each Colony.
	£	Per cent.	£	Per cent.
New South Wales ...	119,195	33·2	3,481,923	13·5
Victoria	216	....	191,423	0·7
Queensland	865	0·2	1,958,112	7·6
South Australia	235,317	65·4	19,986,767	77·5
Western Australia...	4,462	1·2	144,462	0·6
Tasmania	.....	.....	617	.....
New Zealand	4	.....	17,866	0·1
Australasia.....£	360,059	100·0	25,781,170	100·0

In 1872, copper realised as much as £172 per ton, whilst in December, 1886, the lowest price on record was touched, and only £38 7s. 6d. could be obtained for Chili bars. At the end of 1887 the price had risen to £74 per ton, and in August, 1888, to £81 5s. In January, 1893, the quotation had fallen to £46 per ton. Price of copper.

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 Tin.

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.

Tin in New South Wales.

In New South Wales this mineral occurs principally in the granite and basaltic country in the extreme north of the Colony, near Tenterfield and Vegetable Creek, now called Emmaville, Tingha, and in other districts of New England. Tin has also been discovered in the Barrier Ranges, at Poolamacca; near Bombala, in the Monaro district, and in the Valley of the Lachlan, but none of these deposits have as yet been utilised to any extent. The deposits occur in the shape of stream and lode tin, and are worked by European and Chinese miners. Although this mineral was discovered by the Rev. W. B. Clarke as far back as the year 1853 the opening of the tin-fields of New South Wales only took place in the year 1872, and since that date the output from the mines has been considerable. The chief tin-mining centres are at Emmaville and Tingha in the northern portion of the Colony. The production of these fields has been until lately from alluvial deposits which are now said to be practically exhausted. In the former district several lodes have been opened up, the principal of which is at the Ottery mines, the yield from which was 75½ tons during 1891.

Chief tin-mining centres.

Tin in Tasmania.

In Tasmania, as in New South Wales, nearly all the tin hitherto produced has been from alluvial deposits, the lodes in the vicinity of Heemskirk, Mount Bischoff, and Ben Lomond have remained almost untouched. Considerable areas of alluvial tin ground in the eastern and north-eastern divisions are now worked out, and the miners have been obliged to turn their attention to the development of the other branch of tin-mining. Considerable energy is now being thrown into lode tin-mining in the Blue Tier district, where there are deposits containing a payable percentage of tin.

The present difficulty is to provide suitable appliances for saving the metal, but no doubt a means will be found to work the deposits profitably. The Mount Bischoff Mine and the Ringarooma mines in the north-eastern and north-western divisions respectively yielded more than three-fourths of the annual tin production of Tasmania.

The Queensland tin-mines.

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 borders of New South Wales. The Herberton is the chief tin-mining centre of Queensland, and the output for 1891 was valued at £68,850; the tin in this district being chiefly obtained from lodes. Herberton and Stanthorpe have produced more than three-fourths the total production of Queensland to the end of 1891.

Tin in Victoria.

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; 140 men are now engaged mining on these fields; small deposits have likewise been found in the Beechworth district at Indigo and Mitta Mitta, where 23 miners are employed. The total yield for these fields during 1891 was 1,778½ tons of tin-ore, valued at £5,092.

In South Australia and Western Australia tin-mining is unimportant, the yields up to date being slight, while in New Zealand no production is officially recorded. During 1890 some small fields were reported to have been found in Stewart Island, but there is no record that they were worked during 1891.

Fluctuations in the price of tin.

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 fell to £72 in 1884. The highest price—£168 per ton—was attained in the year 1887 owing to the operations of French syndicates. In January, 1893, Australian tin was quoted in the London market at £96 10s. per ton.

The value of the production of tin during 1891, and up to the end of that year, was as given below. During 1892 tin to the value of £152,994 was produced in New South Wales:—

Colony.	During 1891.		Total Production to 31st December, 1891.	
	Value.	Percentage of each Colony.	Value.	Percentage of each Colony.
	£	Per cent.	£	Per cent.
New South Wales...	133,963	24·0	5,675,663	36·3
Victoria	5,092	·9	679,111	4·4
Queensland.....	116,387	20·8	3,925,310	25·1
South Australia.....	68	.....	18,388	·1
Western Australia..	10,200	1·8	15,900	·1
Tasmania.....	293,170	52·5	5,301,355	34·0
Australasia.....	558,880	100·0	15,615,727	100·0

Number of tin-miners.

The number of persons engaged in tin-mining in 1891, was as follows:—In New South Wales, 1,951; Tasmania, 1,443; Queensland, 984; and Victoria, 163.

Titanium.

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

Wolfram.

Wolfram (tungstate of iron and manganese) occurs in some colonies, notably New South Wales, Victoria, and New Zealand. 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. None of these minerals—titanium, tungsten, and molybdenum—have been systematically mined for.

Zinc.

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.

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 important deposits of rich iron-

ores, together with coal and limestone in unlimited supply, 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. During 1890 a mining expert from England was sent out in the interest of English capitalists to inspect the iron, coal, and limestone deposits of New South Wales, and to report upon the probable cost of manufacturing iron in the Colony.

Iron manufactories in N.S. Wales.

The only works for the manufacture of iron from the ore are situated at Eskbank, near Lithgow, where the metal treated is red siliceous ore, averaging 22 per cent., and brown hematite, yielding 50 per cent. metallic iron. 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 principal work now carried on is the re-rolling of old rails, the manufacture of iron bars, rods, and nails, and of ordinary castings.

Magnetite.

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.

Iron smelting in New Zealand.

Works for the treatment of local titanic iron ore were erected some years ago at Taranaki, on the west coast of New Zealand, but it was found that the cost of smelting left no margin for profit, and the works were consequently abandoned.

Extent of deposits of iron ore.

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 through being in 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.

Pyrites. Sulphuretted iron ores (*pyrites*) are of little intrinsic value, but are often 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, 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.

Nickel. *Nickel*, so abundant in the island of New Caledonia, has, up to the present, been found in none of the Australasian Colonies except Queensland; but no attempt has been made to prospect systematically for this valuable mineral.

Cobalt. *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 results have not been of an encouraging nature, and the development of this industry is in abeyance. The manganese ores of the Bathurst district often contain a small percentage of cobalt, sufficient, indeed, to warrant further attempts in this direction.

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 being 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 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 during 1891 was valued at £2,634, and the total yield up to the end of that year £53,925. New South Wales is the only other Colony producing even a small quantity of this mineral.

Chrome iron.

Chrome Iron or chrome ore has been found in New Zealand and Tasmania, but the only attempt to work this mineral in this part of the world is that made at New Caledonia.

Sulphur.

Sulphur exists in large quantities in the volcanic regions of New Zealand, where it will doubtless some day become an article of commerce. Professor Liversidge, in his work on the minerals of New South Wales, states that sulphur occurs in small quantities at Mount Wingen, in the Upper Hunter district of that Colony, and also at Tarcutta, near Wagga Wagga, and on Louisa Creek, near Mudgee.

Arsenic.

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.

Antimony.

Antimony is widely diffused throughout Australasia, and is sometimes found associated with gold. Extensive fields have been discovered in the northern tablelands of New South Wales, especially at Hillgrove, in the vicinity of Uralla. In Victoria the production for the last few years was small compared to former periods; only 35 men were engaged mining for this metal during 1891, as against 238 in 1890. The fluctuation in the price of this mineral on the London market is the cause of this great falling-off in the number of miners. The principal mine is at Castlemaine, but several fields are being explored in the Sandhurst and Beechworth districts. In Queensland the fields are all showing development, as the output of 1891 proves, there being a considerable increase compared with that of late years. In New Zealand very little antimony ore was obtained during the

year. The quantity of ore exported from that Colony in 1891 was 413 tons, valued at £4,950. Good lodes of stibnite (sulphide of antimony) have been found near Roebourne, in Western Australia.

Value of antimony.

The following table shows the value of antimony produced in Australasia up to the end of 1891 :—

Colony.	Value.	Percentage produced.
	£	
New South Wales	115,798	31·7
Victoria	173,760	47·6
Queensland	34,412	9·4
New Zealand	41,140	11·3
Australasia	365,110	100·0

The antimony produced by New South Wales in 1891 was valued at £22,057 ; that produced by New Zealand was worth £4,950 ; Queensland, £3,625 ; and Victoria, £1,188. In 1892, New South Wales produced antimony to the value of £14,680.

Bismuth.

Bismuth is known to exist in all the Australian Colonies, but up to the present time has been mined for in New South Wales and Queensland alone. 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 the Colony first mentioned. The principal mine 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 closed. The value of bismuth produced up to the end of 1891, in New South Wales and Queensland, was £36,642, and £21,331 respectively.

The Diamond.

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.

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 was discovered near Undercliff, in the New England district, and Western Australia, where, however, owing principally to difficulties of transit, very little of it has been worked.

Mineral fuel.

The Australasian Colonies have been bountifully supplied by Nature with mineral fuel. Five distinct varieties of black coal, forming well characterised types, may be distinguished, which form, with the two extremes of brown coal, or lignite, and anthracite, 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 under the three main heads—lignite, coal, and anthracite only.

Lignite.

Brown coal or *lignite* occurs principally in the Colonies of New Zealand and Victoria. Attempts have frequently been made to use this mineral for ordinary fuel purposes, but its inferior quality has prevented its use extending very largely. In Victoria, during 1891, 6,322 tons were raised in the Ballarat district, valued at £1,673. The fields of lignite in New Zealand are roughly estimated to contain about 500 million tons.

Ordinary coal.

Black coal forms one of the principal mineral resources of New South Wales, and in New Zealand 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 has been discovered in Victoria, and raised in small

quantities for some years past; but the industry is still in its experimental stage. Excellent steam coal has been found in Tasmania, and coal-mining in that Colony is becoming a well established industry. From time to time reports have been raised of the discovery of coal in South Australia, but no very definite or satisfactory information on the subject has been brought forward, such as would warrant the employment of capital, except in the direction of prospecting researches. 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. Brown coal, of a somewhat poor quality, has been discovered on the south-eastern coast of the Colony, but black coal, of fairly good quality, has been found on the Fly Brook, near Cape Leeuwin, and in the bed of the Collie River, near Bunbury, to the south of Perth. Mr. Jack, the Government Geologist of Queensland, considers the extent of the coal-fields of that Colony 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. Coal-mining has been an established industry in Queensland for some years, and is progressing satisfactorily.

Tasmanian coal.

Coal in Western Australia.

Queensland coal.

Discovery of coal.

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's 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 the Company's 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 under the monopoly of this Company, the quantity raised had in 1891 expanded to the large figure of 4,037,929 tons, valued at £1,742,796. In 1892, however, the output was only 3,780,968 tons, valued at £1,462,388.

Coal-fields of New South Wales.

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 tableland; 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 of coal underlying each acre of ground has been computed to be 63,700 tons.

Thickness of coal seam at Greta.

Coal-mines registered in New South Wales.

The number of coal-mines registered in New South Wales during 1892 was 101, as compared with 102 in the previous year. These gave employment to 10,514 persons, of whom 8,624 were employed under ground, and 1,890 above ground. The average quantity of coal extracted per miner was 360 tons, as against an average of 463 tons for the previous year. In 1882 the weight per miner stood at 578 tons; but the yield has since gradually declined, and the average for 1890 was less than that of any of the preceding ten years, owing to the collieries standing idle for several months during the year on account of the general strike; however, the average for 1891 was the highest since

Production to each miner.

1885. The average quantity of coal extracted per miner, calculated upon the basis of the output for the last ten years, is 456 tons, which, at the mean price of coal at the pit's mouth, is equivalent to £202 14s. 6d. This production is certainly very 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 given by Mulhall :—

Country.	Tons of coal raised per miner.	Value at the pit's mouth per ton.	Total value of coal raised per miner.
		£ s. d.	£ s. d.
New South Wales	456	0 8 11	202 14 6
Great Britain	330	0 6 0	111 0 0
United States	347	0 8 4	139 0 0
Germany	336	0 5 3	78 0 0
France	196	0 9 0	88 0 0
Belgium	168	0 7 6	63 0 0
Austria	270	0 5 0	57 0 0

Earnings of miners.

In the absence of information as to the average amount of wages paid to coal-miners in other countries an exact comparison is not possible, but it is abundantly clear, that in spite of the acknowledged drawbacks to a miner's lot in the Australian Colonies, in no other country is it so satisfactory. The foregoing table proves this, for on the improbable supposition that the miner everywhere receives in wages the same proportion of the value of the coal as in New South Wales, that is, about 40 per cent. of the selling price at the pit's mouth, the average earnings in each country would be :—

Country.	Coal per miner.	Wages per ton of coal.	Earnings of miner per annum.
	Tons.	s. d.	£ s. d.
New South Wales	456	3 7	81 14 0
Great Britain	330	2 5	39 17 6
United States	347	3 4	57 16 8
Germany	336	2 1	35 0 0
France	196	3 7	35 2 4
Belgium	168	3 0	25 4 0
Austria	270	2 0	27 0 0

Local consumption.

The Colony was its own chief customer during 1891, when out of a total production of 4,037,929 tons, the consumption amounted to 1,793,200 tons, or over 44 per cent. Victoria came next, with 954,277 tons, or 38 per cent. of a total export of 2,514,368 tons. In 1892, when the total production amounted to 3,780,968 tons, the home consumption was 1,589,263 tons, or about 42 per cent. Victoria took 879,068 tons, or 40 per cent. of a total export of 2,191,705 tons. The quantity of coal required for local consumption denotes a satisfactory increase during most years.

Consumption per head.

The annual consumption per head increased from 15 cwt. in 1876 to 24½ cwt. in 1888; it was 31 cwt. in 1891, and 27 cwt. in 1892. The larger use of steam for railway locomotives, 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 increasing 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 1891 was little short of 300,000 tons.

Export of coal from New South Wales.

The progress of the export trade, from 1881 to 1891, is shown in the following table, also the direction of the trade at those periods:—

Country.	Quantity.		Value.	
	1881.	1891.	1881.	1891.
	Tons.	Tons.	£	£
Australasian Colonies	657,135	1,510,976	255,572	755,509
India, Ceylon, and China	136,511	98,817	59,944	55,219
Mauritius	6,249	19,760	2,414	10,813
Pacific Islands	19,526	141,055	8,011	75,803
United States	150,002	365,623	68,172	200,851
South America	8,017	221,700	3,243	123,136
Other Countries	52,404	156,437	20,174	85,299
Total	1,029,844	2,514,368	417,530	1,306,630

Export of coal from New Zealand.

During 1892 the export of coal from New South Wales equalled 2,191,705 tons, valued at £1,028,395. Of this quantity 1,318,008 tons, valued at £587,016, went to the other Australasian colonies.

New Zealand is the only other Australasian Colony in a position to export coal to any large extent. The export trade of that Colony for 1881 and 1891 was :—

Country.	Quantity.		Value.	
	1881.	1891.	1881.	1891.
	Tons.	Tons.	£	£
Australasian Colonies	6,049	14,277	5,022	8,488
United Kingdom	.....	68,871	.....	76,027
Fiji and Norfolk Island	21	3,282	25	2,469
Pacific Islands, &c.	551	5,234	563	4,189
Total	6,621	91,664	5,610	91,173

The exports to the United Kingdom, both from New South Wales, and from New Zealand, in all probability consisted of bunker coal, for the steamers.

Coal produced in New Zealand.

Most of the coal-beds of New Zealand 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 1891 was 668,794 tons, for the whole Colony, of which Westport contributed 206,184 tons, Greymouth 145,351 tons, and Otago 164,870 tons. The only important coal measures of the North Island are those of the Waikato, which produced 55,869 tons.

Coal in Queensland.

The total production of coal in Queensland for 1891, was, 271,603 tons, valued at £128,198, most of which came from the mines at Ipswich and at Burrum, in the Maryborough district. Queensland exported in 1881, 2,742 tons, valued at £1,783 ; and in 1891, 9,635 tons, valued at £9,043.

The quantity of coal extracted annually in Australasia has now more than reached 5,000,000 tons, valued at £2,293,259.

The proportion due to each Colony for the year 1891 was as follows :—

Colony.	Quantity.	Value.	Proportion of value raised by each Colony.
	Tons.	£	Per cent.
New South Wales	4,037,929	1,742,796	76·1
Victoria	29,156	21,404	·9
Queensland	271,603	128,198	5·6
Tasmania	45,524	21,123	·9
New Zealand.....	668,794	379,738	16·5
Australasia	5,053,006	2,293,259	100·0

Value of coal production.

The total value of coal produced in the Australasian Colonies up to the end of 1891 is shown in the following table :—

Colony.	Quantity.	Total value.	Proportion of value raised by each Colony.
	Tons,	£	Per cent.
New South Wales	53,902,788	25,809,041	82·7
Victoria	103,420	79,191	·2
Queensland	2,903,917	1,341,552	4·3
Tasmania	.....	250,730	·8
New Zealand.....	7,131,986	3,740,958	12·0
Australasia.....	.....	31,221,472	100·0

Number of miners employed.

During the year 1891 this industry gave direct employment, in and about the mines, to the following number of persons in the several Colonies in which the returns were available :—

	Miners.
New South Wales	10,820
Victoria	260
Tasmania	197
New Zealand	1,693

Average prices.

The average price of coal per ton varies in the Colonies very considerably. In New South Wales, from 1846 to 1891, the average price obtained was 9s. 7d., but the mean of the last ten years is a little below these figures. In 1891 the average price per ton

of coal delivered at the mines in the Australasian Colonies was as follows :—

	£	s.	d.
New South Wales	0	8	8
Victoria	0	14	5
Queensland	0	9	5
Tasmania	0	9	0
New Zealand	0	11	4
Australasia	0	9	1

Anthracite.

Anthracite is found on the island of Tasmania. It is a hard and heavy mineral, burning with difficulty, and it possesses very little commercial value in countries where ordinary coal abounds.

The following table shows the coal annual production by the principal countries of the world to the latest date obtainable :—

Country.	Quantity.
	Tons.
Great Britain	181,614,288
United States	125,563,704
Germany	67,342,200
France	24,303,509
Belgium	19,869,980
Canada	2,719,478
Australasia	5,053,006

Kerosene shale.

Kerosene Shale (torbanite) is found in several parts of the Colony of New South Wales. It is a species of cannel-coal, somewhat similar to the Boghead mineral of Scotland, but it yields a much larger percentage of volatile hydrocarbons than can be obtained from the Scottish mineral. The richest quality of Australian kerosene shale yields upwards of 150 gallons of crude oil per ton, or 18,000 cubic feet of gas, with an illuminating power of 38 or 48 sperm candles. The New South Wales Oil and Mineral Company, at Joadja Creek, and at Hartley Vale, not only raise kerosene shale for export, but also manufacture from it petroleum oil and other products. Since the year 1865, when the mines were first opened, to the end of 1892, the quantity of kerosene shale raised amounted to 727,238 tons, worth £1,552,791. The average price realised during that interval was £2 2s. 8d. per ton. The prices ruling in 1892, when

74,197 tons were extracted, averaged £1 16s. 8d. per ton, representing a total value of £136,079, for the production of that year. The export of shale from New South Wales for 1891 and 1892 was :—

Exported to.	1891.		1892.	
	Quantity.	Value.	Quantity.	Value.
	Tons.	£	Tons.	£
Victoria	3,053	8,034	3,559	9,940
United Kingdom	4,725	12,400	7,717	22,879
Netherlands	8,267	23,465	18,578	54,301
Italy	5,621	17,930	1,045	3,330
United States	2,571	7,437	1,210	3,354
Spain	5,272	15,472	3,438	10,528
Brazil	2,977	10,060	4,180	12,285
Chili	.....	.....	1,950	5,616
Other Countries	2,166	6,490	3,119	9,540
Total	34,652	101,288	44,796	131,773

Oil shale in New Zealand

Extensive formations of oil shale have been found 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, but it is valuable for lubricating purposes.

Import of kerosene.

The net import of kerosene into Australasia in 1891 was as follows. No figures are given for Western Australia, as that Colony does not distinguish kerosene from other oils :—

Colony.	Quantity.	Value.
	Gallons.	£
New South Wales	1,885,335	83,748
Victoria	2,314,061	106,025
Queensland	1,229,980	38,811
South Australia	943,150	25,443
Tasmania	188,077	7,173
New Zealand	1,562,458	65,289
Australasia	8,123,061	326,489

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

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

Kauri gum. *Kauri Gum*, a resinous substance somewhat resembling amber in appearance, and like that production an exudation from trees, is found only in New Zealand, where it is included under the head of minerals, although more logically entitled to be considered as a vegetable product. In that Colony kauri gum forms the object of an extensive and lucrative commerce. It is computed that the total value of this product obtained from 1853 to the end of 1891, was £5,831,743. In the year 1891 the quantity obtained represented a value of £437,056.

SALTS.

Rock salt. Common *Rock Salt* has been found in New South Wales in rock crevices in several parts of the Colony, but it is not known to exist in large deposits so as to be of commercial importance.

Natron. *Natron* is said to occur in the neighbourhood of the Namoi River, in New South Wales. It appears as a deposit from the mud-wells of that region.

Epsom salt. *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.

Alum stone. Large deposits of *Alum* occur close to the village of Bulladelah, 30 miles from Port Stephens. Up to the end of the year 1892,

about 4,600 tons of alumite had been raised, most of which had been sent to England for treatment. It is said to have yielded well, and a quantity of the manufactured alum has been sent to Sydney for local consumption. During 1892 the Bulladelah mine yielded 1,600 tons of stone, valued at £3,200. In the course of the same year, 210 cwt. of locally manufactured alum, valued at £63, were exported to Victoria and New Zealand.

EARTHY MINERALS.

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. Marble.

Lithographic stone has been found in New Zealand, where another beautiful species of limestone known as the *Omaru 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 this stone for the embellishment of their public edifices. Lithographic stone and Omaru stone.

Limestone is being worked on the Myall Lakes, near Bungwall, and small quantities have been forwarded from this district to Sydney.

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. Gypsum.

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. Apatite.

QUARTZ AND SILICA.

Quartz. *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.

Opals. Common *Opals* are frequently found in the basaltic formations of Australasia. The precious, or noble opal, which might be included under the head of precious stones, has been found 60 miles north-west from Wilcannia, at a few feet from the surface, in layers between hard silicious sandstone. As much as £5 per oz. has been offered for good specimens. During 1890 the quantity of noble opal won from these mines was 195 lb., valued at £15,600. The mines were not worked in 1891. This gem has also been found in basalt, near the Abercrombie River, and in sandstone, near Lismore. In Queensland opals are found in the Windorah district, where the labour of twenty men in 1890, produced opals valued at £3,000. Opal-bearing stone is known to exist in the ranges between Adavale and Cooper's Creek, in the Charleville district, Queensland and the northern portions of New South Wales.

Chalcedony, carnelian, &c. *Chalcedony, carnelian, onyx,* and *cat's eye,* are found in New South Wales; probably also in the other Colonies, particularly Queensland.

Tripoli. *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. *Meerschaum* is reported to have been discovered near Tamworth and in the Richmond River district, in New South Wales.

Mica. *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. Some promising discoveries of mica have recently been made near Herberton, in Northern Queensland.

CLAYS.

Kaolin and other clays.

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.

Asbestos.

Asbestos has been found in New South Wales in the Gundagai, Bathurst, and Broken Hill districts—in the latter in considerable quantities. Several specimens of very fair quality have been met with in Western Australia.

GEMS AND GEMSTONES.

Diamonds.

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.

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 principal diamond-fields are situated in the Bingara and Inverell districts, on the New England tableland, and Cudgegong, in the Wellington district. The Government of New South Wales has, on various occasions, obtained the services of experts to report upon the fields, as well as the gems which have been from time to time extracted from them, and these reports have generally been of an encouraging nature.

Yield and quality of diamonds.

The number of diamonds found in the Colony is estimated to be 97,000, the largest one being 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 are extensive, and have not yet been thoroughly prospected. The New South Wales diamonds are harder and much whiter than the South African diamonds, and are classified on a par with the best Brazilian gems. During the year 1887 the diamond companies at Cope's Creek, near Bingara, produced about 23,000 diamonds, weighing 5,151

carats; but in 1888, owing to the severe drought which occurred, the search for diamonds had to be temporarily abandoned. In 1889 finds are reported to the extent of 2,196 carats, valued at £878. In 1891, 12,000 carats of diamonds were won in the Tingha and Inverell districts, but no value is given. With efficient methods of working this industry bids fair to become a profitable one.

Corundum.

Under the generic name of *Corundum* are included the most valuable gems known to commerce, next to the diamond. The *sapphire*, which is the most common of these gems, is found in all the Colonies, principally in the neighbourhood of Beechworth, Victoria.

Emeralds.

Oriental *emeralds* are found in New South Wales, and in Gippsland in Victoria. An emerald mine, in which the gem occurs in granitic lode, was opened near Emmaville, in the Glen Innes district, during 1890; 225 carats of emeralds were won from the mine during that year and forwarded to London. During 1891, the Emerald Proprietary Company obtained some 25,000 carats, the value of which, when cut and finished, is expected to attain about £2 per carat.

Topaz, amethyst, and ruby.

The yellow corundum, or Oriental *topaz*, has been found in New South Wales. Oriental *amethysts* also have been found in that Colony, and the red corundum, or *ruby*, the most valuable of all these gems, has been found in Queensland, as well as in New South Wales.

Miscellaneous gems.

According to an authority on the subject of gem-stones, 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.

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. *Ziron*, *tourmaline*, *garnet*, and other gem-stones of little commercial value, are found throughout Australasia.

In South Australia some very fine specimens of garnet were found, which caused 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. Garnets.

MINERAL WEALTH OF AUSTRALASIA.

Australasia possesses invaluable mineral resources, and though enormous quantities of minerals of all kinds have been won since their first discovery, 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 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. Summary of the mineral resources of Australasia.

In the year 1891 the total value of minerals raised, and the proportion due to each Colony, also the value per inhabitant, were as follows:— Value of minerals raised in 1891.

Colony.	Total production.	Percentage each Colony.	Per Inhabitant.
	£		£ s. d.
New South Wales	6,395,561	46·1	5 11 10
Victoria	2,339,513	16·8	2 0 10
Queensland	2,299,560	16·6	5 14 6
South Australia	365,945	2·6	1 2 8
Western Australia	130,094	0·9	2 11 1
Tasmania	516,393	3·7	3 9 4
New Zealand	1,840,686	13·3	2 18 5
Australasia	13,887,752	100·0	3 12 3

The total value of minerals raised in 1891 exceeds by about £2,840,000 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. Nevertheless the search for gold led to the expansion of the mining industry into other channels, and although the gold-mining population has decreased, 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 who were so engaged at the time when gold and coal alone were the great elements of the mineral wealth of the Australasian Colonies. The resources known to exist, and yet to be developed in these Colonies, are likely to maintain, for many generations to come, a large and prosperous mining population.

Diversion of the Mining Industry.

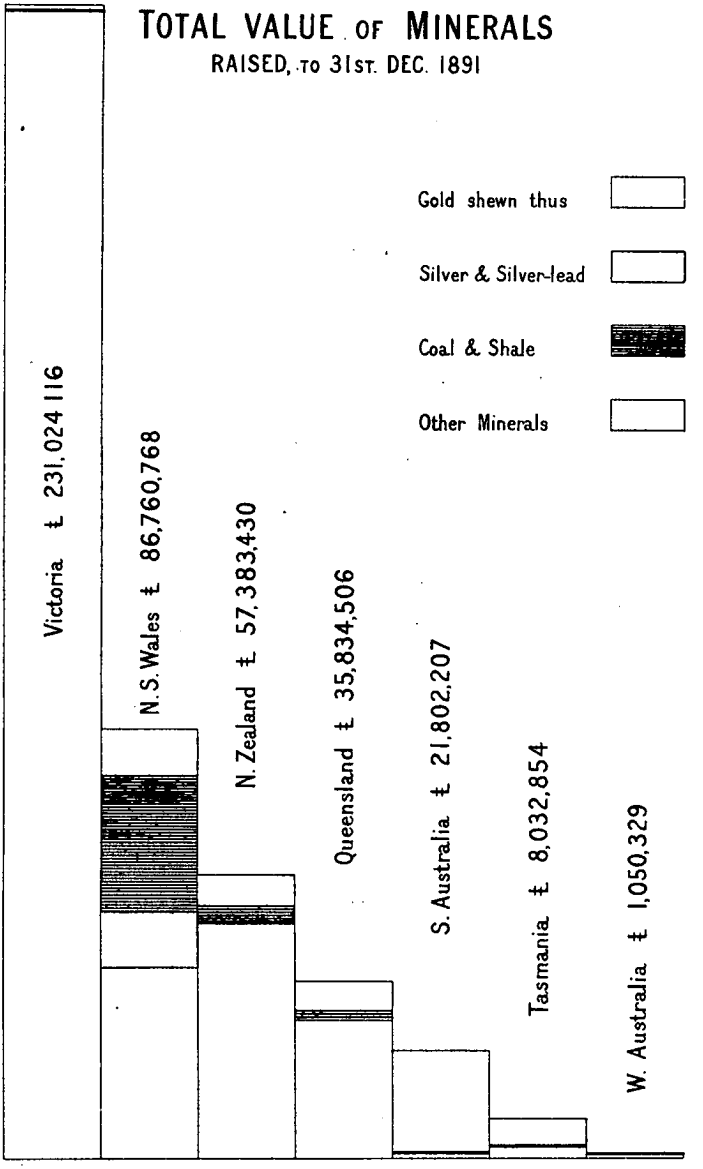
Mineral production per head.

Comparing the value of mineral production with the population the largest share is obtained by Queensland, with £5 14s. 6d. per inhabitant, and New South Wales ranks second with £5 11s. 10d. The high average of Queensland is due to the gold mines, while in New South Wales more than half the year's wealth was contributed by the silver fields. The average per inhabitant for Australasia was £3 12s. 3d.

Minerals produced by each Colony.

The table on the next page shows the value of minerals raised in each of the Colonies during 1891, also the total production up to the end of that year, distinguishing the principal minerals. With regard to some of the Colonies the data are defective in respect to "other minerals," but not to so great an extent as to seriously affect the gross total. 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 1891, the remainder, £441,608,210, represents the value of mineral production from 1852, equal to an average of £11,040,200 per annum for the forty years.

TOTAL VALUE OF MINERALS
RAISED, TO 31ST. DEC. 1891



Printed at the Department of Lands, Sydney, N.S.W. 1893
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Total value of Minerals raised during 1891, and to the end of that year.

Colony.	Gold.	Silver and Silver Lead.	Copper.	Tin.	Coal.	Kerosene Shale.	Other Minerals.	Total.
New South Wales—	£	£	£	£	£	£	£	£
During 1891	558,306	3,619,589	119,195	133,963	1,742,796	78,160	143,552	6,395,561
To end of 1891	38,633,488	11,302,095	3,481,923	5,675,663	25,809,041	1,416,712	441,846	86,760,768
Victoria—								
During 1891	2,305,596	6,008	216	5,092	21,404	.....	1,197	2,339,513
To end of 1891	229,787,892	94,930	191,423	679,111	79,191	.....	191,569	231,024,116
Queensland—								
During 1891	2,017,536	21,879	865	116,387	128,198	.....	14,695	2,299,560
To end of 1891	28,052,199	498,590	1,958,112	3,925,310	1,341,552	.....	58,743	35,834,506
South Australia—								
During 1891	†125,529	.....	235,317	68	.....	.....	5,031	365,945
To end of 1891	1,295,297	101,727	19,986,767	18,388	.....	.....	400,028	21,802,207
Western Australia—								
During 1891	115,182	250	4,462	10,200	.....	.....	.....	130,094
To end of 1891	720,717	250	144,462	15,900	.....	.....	169,000	1,050,329
Tasmania—								
During 1891	149,816	52,284	.....	293,170	21,123	.....	.....	516,393
To end of 1891	2,388,499	91,653	617	5,301,355	250,730	.....	.....	8,032,854
New Zealand—								
During 1891	1,007,488	5,151	4	.....	379,738	.....	*448,305	1,840,686
To end of 1891	47,433,117	140,148	17,866	.....	3,740,958	.....	*6,051,341	57,383,430
Australasia—								
During 1891 ...	6,279,453	3,705,161	360,059	558,880	2,293,259	78,160	612,780	13,887,752
To end of 1891	348,311,209	12,229,393	25,781,170	15,615,727	31,221,472	1,416,712	7,312,527	441,888,210

*Includes Kauri gum, £437,056, during 1891, and £5,831,743 to the end of that year. † Includes production of Northern Territory, valued at £98,149.