

SECTION XII.

MINES AND MINING.

§ 1. The Mineral Wealth of Australia.

1. **Place of Mining in Australian Development.**—The value of production from the mineral industry is now considerably less than that returned by the agricultural or the pastoral industry, nevertheless it was the discovery of gold in payable quantities that first attracted population to Australia, and thus laid the foundation of its nationhood. Prior to 1851, the year when Hargraves' memorable discovery was made, coal and copper had both been mined to some extent, and the existence of deposits of other minerals, including gold, had been proved. But it was the news of the sensational finds of the precious metal in 1851 and the year immediately following that brought about a constant stream of immigration, and caused an increase in population from 221,000 at the end of 1841 to upwards of 1,168,000 at the end of 1861.

2. **Extent of Mineral Wealth.**—The large production of gold, silver, copper, and tin, the extent of the coal deposits, the presence of large quantities of iron ore, and the great variety of minerals found in appreciable quantities, suggest that the future history of mining will, in all probability, be even more remarkable than that of the past. For the extent of the total mineral wealth of Australia cannot yet be regarded as well ascertained, since the mineral exploration of the country is, after all, still in its infancy. The presence of considerable deposits of valuable minerals has long been known. Thus, coal was discovered in 1797, and a shipload was exported to Bengal in 1799; silver was discovered by Count Strzelecki as early as 1839, and was worked as early as 1864; copper mining dates back to 1844; lead to about 1848; iron to about 1850; while the discovery of gold in payable quantities dates back to 1851. Cobalt, nickel, manganese, chromium, tungsten, molybdenum, mercury, antimony, bismuth, zinc, radio-active ores, etc., have all been found, some in fairly large quantities.

Among the more valuable non-metalliferous substances may be mentioned coke, kerosene shale, graphite, alunite, asbestos, diatomaceous earth, clays, ochres, etc.; in building stones, sandstones, syenites, granites, basalts, augite-andesite, porphyries, serpentines, slates, limestones, and marbles; in precious stones, diamonds, emeralds, rubies, sapphires, amethysts, precious opal, turquoise, topazes, garnets, chrysolites, cairngorm, agates, etc. In general it may be said that the variety of Australian mineral wealth is very great.

3. **Value of Production during 1912.**—Compared with the returns for 1911 the total mineral production of the Commonwealth shews an increase in 1912 of over £2,149,000. The largest advance is exhibited in the figures for New South Wales, where the total was over £1,821,000 in excess of that for the preceding year. In Queensland the increase amounted to £516,617. South Australia and Tasmania also shewed increases amounting to £147,000 and £144,000 respectively. The improvement in the States mentioned was, however, counterbalanced by more or less heavy decreases in the remaining States, the return for Western Australia shewing a falling-off amounting to about £346,000, while there was a decline in the Victorian yield to the extent of £133,000. In Victoria the decline is attributed to the falling-off in the gold yield, due to diminished returns from the lode mines at Ballarat, Scarsdale and Berringa, and the deep alluvial workings at Rutherglen and Ararat. In Western Australia, the gold yield shewed a falling-off of £375,000, through diminished returns, principally from the Mt. Margaret fields.

The decline in the gold yield for the Commonwealth amounted to about £672,000, South Australia and Tasmania alone shewing an increased output over the total for the preceding year.

The comparative value of the production of minerals raised in each State during 1912 is given in the following table:—

COMMONWEALTH MINERAL PRODUCTION IN 1912.

Minerals.	N.S.W.	Victoria.	Q'land.	S.A.	W.A.	Tas.	N. T.	C'wealth.
	£	£	£	£	£	£	£	£
Alunite ...	13,700	...	...	...	...	...	...	13,700
Antimony ...	355	16,162	...	...	...	...	...	16,517
Asbestos ...	...	...	...	...	...	...	...	...
Bismuth ...	1,210	...	19,261	...	...	2,646	...	23,117
Coal ...	3,660,015	259,321	338,264	...	135,857	24,548	...	4,418,025
Coke ...	162,454	...	...	...	...	...	...	162,454
Copper ...	579,791	...	1,698,280	461,500	60,537	440,444	3,998	3,244,550
Diamonds ...	2,001	20	...	...	...	...	...	2,021
Diatomaceous earth	132	3,400	...	...	...	...	...	3,532
Gems (unspecified)...	...	...	40,016	...	...	...	...	40,016
Gold ...	702,129	2,039,464	1,477,979	28,000	5,448,385	161,300	22,671	9,879,928
Gypsum ...	...	3,359	...	9,000	...	...	...	12,359
Iron ...	130,708	...	...	...	...	...	...	130,708
Iron oxide ...	4,763	...	...	...	...	...	...	4,763
Ironstone flux ...	761	...	9,035	26,375	...	...	...	36,171
Kaolin ...	185	342	...	...	...	...	...	527
Lead (pig, etc.) ...	264,530	...	55,667	...	22,565	...	...	342,762
Limestone flux ...	11,066	...	24,176	12,500	...	...	...	47,742
Manganese ...	...	60	1,281	...	4	...	...	1,345
Molybdenite ...	3,706	...	17,349	...	...	...	...	21,055
Opal ...	35,008	...	3,000	...	...	...	...	38,008
Platinum ...	3,880	...	...	...	...	...	...	3,880
Salt ...	...	...	...	40,187	...	...	...	40,187
Scheelite ...	4,963	...	...	...	...	...	...	4,963
Shale ...	34,770	...	...	...	...	...	...	34,770
Silver ...	251,652	2,200	66,188	326	16,353	...	...	336,719
Silver-lead bullion	3,229,614	...	...	...	...	309,098	820	3,539,532
Silver-lead ore	...	...	...	...	...	...	...	...
Tin ...	338,074	5,733	364,503	...	70,578	543,103	27,001	1,348,992
Wolfram ...	16,584	574	57,821	20	...	6,601	3,330	84,930
Zinc ...	1,766,242	...	...	...	217	...	...	1,766,459
Unenumerated ...	8,309	659	2,535	6,550	5,711	*5,742	...	29,506
Total ...	11,226,602	2,331,294	4,175,355	584,458	5,760,207	1,493,502	57,820	25,629,238

* Osmiridium.

It may be pointed out in connection with the figures given in the above table that the totals are exclusive of returns relating to certain commodities, such as stone for building and industrial uses, sand, gravel, brick clays, lime, cement, and slates, which might rightly be included under the generic term "mineral." Valuations of the production of some of these may be obtained from the reports of the various Mines Departments, but in regard to others it is impossible to obtain adequate information. In some instances, moreover, the published information is of little value. Thus, the New South Wales Mines Report supplies the value of exports only in connection with building stone, and it is obvious that such figures are of little value as regards production, while the Victorian figures are incomplete. It has therefore been considered advisable to discard both totals. By restricting the comparison to items in connection with which properly comparable information can be obtained for each State, it is believed that a satisfactory estimate of the progress of the mineral industry can be more readily obtained. The items excluded from the total for New South Wales in 1912 consist of—lime, £44,478; marble, £1340; Portland cement, £368,280; building stone, £559; and grindstones, £176. The South Australian figures are exclusive of—chalk, £600, and flint pebbles, £420.

4. **Total Production to end of 1912.**—In the next table will be found the estimated value of the total mineral production in each State up to the end of 1912. The figures given in this table are also exclusive of the same items referred to in connection with the preceding table. Thus the total for New South Wales falls short by £2,146,000 of that published by the State Department of Mines, the principal items excluded being cement, £1,839,700, lime £278,000, and building stone, £21,176.

COMMONWEALTH MINERAL PRODUCTION TO END OF 1912.

Minerals.	N.S.W.	Victoria.	Q'land.	S. Aust.	W. Aust.	Tas.	North'n Territ'y.	C'wealth.
	£	£	£	£	£	£	£	£
Gold ...	59,462,975	291,703,453	75,217,830	920,810	109,298,871	7,407,282	2,065,688	546,076,900
Silver and lead ...	60,221,900	219,935	2,245,656	338,854	708,981	6,258,748	74,819	70,068,893
Copper ...	11,784,102	215,761	10,948,399	27,746,552	1,113,065	10,256,981	329,406	62,394,266
Tin ...	9,327,609	782,680	8,110,704	...	1,054,125	11,972,602	328,898	31,576,618
Coal ...	69,087,688	3,462,390	5,377,235	...	1,069,435	572,963	...	78,569,711
Other ...	17,488,353	409,147	2,001,649	1,420,413	85,005	201,203	43,962	21,649,732
Total ...	227,372,627	295,793,366	103,901,473	30,426,629	113,329,482	36,669,779	2,842,773	810,336,129

The "other" minerals in New South Wales include antimony, £305,224; bismuth; £128,537; chrome, £101,468; coke, £2,138,667; diamonds, £120,408; iron, £2,113,786; opal, £1,330,207; oil shale, £2,322,831; wolfram, £132,517; and zinc, £7,539,913. In the Victorian returns antimony ore was responsible for £224,712. Included in "other" in the Queensland production were opal, £172,195; gems, other, £226,202; bismuth and wolfram, £846,674; antimony ore, £50,953; manganese, £64,709; limestone flux, £279,398; and ironstone flux, £202,776. The chief item in South Australian "other" minerals was salt, £815,381. In the Tasmanian returns limestone flux was responsible for nearly £100,000, and iron ore for about £26,000.

It will be convenient in the succeeding pages to deal first with gold and the various metals, then with non-metallic minerals and precious stones, and finally to furnish some account of the extent of employment in mining generally.

(A) METALS.

§ 2. Gold.

1. **Discovery of Gold in Various States.**—The discovery of gold in payable quantities was an epoch-making event in Australian history, for, as one writer aptly phrases it, this event "precipitated Australia into nationhood." A more or less detailed account of the finding of gold in the various States appears under this section in Official Year Books Nos. 1 to 4, but considerations of space preclude the insertion of this matter in the present issue.

2. **Production of Gold at Various Periods.**—In the table hereunder will be found the value of the gold raised each year in the several States and in the Commonwealth from the dates when payable discoveries were first reported. Owing to defective information in the earlier years the figures fall considerably short of the actual totals, for during the first stages of mining development large quantities of gold were taken out of Australia by successful diggers, who preferred to keep the amount of their wealth secret. For South Australia the records in the earlier years are somewhat irregular, and the remark applies to some extent also to the returns for Western Australia and Tasmania.

In New South Wales the yield for 1912 was much below the average, the output being the lowest recorded since 1902. The decreased yield is in large measure due to the circumstance that the demand for miners in other branches of the industry, coupled with the steady employment obtainable in other pursuits, has led to a slackening of operations at small claims and a neglect of prospecting. In Victoria the decrease was mainly due to the falling-off in the returns from the deep alluvial mines at Rutherglen and Ararat, and the quartz lodes at Ballarat, Scarsdale and Berringa. The deficiency in Queensland was due to the reduced returns from some of the chief centres such as Charters Towers, Gympie, and Rockhampton. More than half the fall in the gold production of Western Australia is attributable to a decline in the yield for the Mount Margaret field. There were decreases also in the East Coolgardie, Murchison, North and North East Coolgardie, Dundas, East Murchison, Phillips River and Ashburton fields. An improvement was shown in other fields, particularly at Yilgarn, where the yield was the highest for many years.

VALUE OF GOLD RAISED IN AUSTRALIA, 1851 to 1912.

Year.	N.S.W.	Victoria.	Q'sland.	S.A.	W.A.	Tas.	N.T.	C'wealth.
	£	£	£	£	£	£	£	£
1851	468,336	851,596	...	...	...	...	...	1,319,932
1852	2,660,946	9,146,140	...	...	...	...	...	11,807,086
1853	1,781,172	10,976,392	...	...	...	...	...	12,757,564
1854	773,209	8,873,932	...	...	...	...	...	9,647,141
1855	654,594	11,277,152	...	...	...	...	...	11,931,746
1856	689,174	11,214,976	...	8,800	...	...	...	12,912,950
1857	674,477	11,320,852	...	876	...	...	...	11,996,205
1858	1,104,175	10,384,924	...	£2,348	...	...	...	11,491,447
1859	1,259,127	9,394,812	...	730	...	...	...	10,654,669
1860	1,465,373	8,896,276	11,631	...	...	...	...	10,373,280
1861	1,806,171	8,140,692	3,137	...	...	...	...	9,950,000
1862	2,467,780	6,920,804	499	12,442	...	...	...	9,401,525
1863	1,796,170	6,779,276	11,820	...	...	...	...	8,587,266
1864	1,304,926	6,489,788	66,513	...	...	...	...	7,861,237
1865	1,231,243	6,446,216	74,216	...	...	...	...	7,751,675
1866	1,116,404	6,187,792	68,325	...	...	...	...	7,372,521
1867	1,053,578	6,005,784	151,125	...	...	4,382	...	7,214,869
1868	994,665	6,739,672	479,956	2,936	...	2,536	...	8,213,765
1869	974,149	6,173,024	417,681	15,593	...	514	...	7,586,961
1870	831,016	5,217,216	309,925	24,217	...	7,475	...	6,570,849
1871	1,250,485	5,475,768	492,635	6,000	...	14,218	...	7,239,106
1872	1,644,177	5,325,508	527,365	6,363	...	16,055	...	7,519,468
1873	1,336,375	4,681,588	572,996	293	...	18,390	...	6,669,642
1874	1,041,614	4,390,572	1,082,899	4,175	...	18,491	...	6,537,751
1875	877,694	4,273,668	1,196,583	7,034	...	11,382	...	6,366,961
1876	613,190	3,855,040	1,140,282	9,888	...	44,923	...	5,663,323
1877	471,448	3,238,612	1,043,780	...	...	93,289	...	4,777,129
1878	430,200	3,032,160	1,149,240	1,225	...	100,000	...	4,712,825
1879	407,219	3,035,788	1,034,216	90	...	230,895	...	4,708,208
1880	444,253	3,316,484	944,869	...	...	301,237	...	4,906,903
1881	573,582	3,333,512	957,570	880	...	216,301	111,945	5,194,390
1882	526,522	3,458,440	785,868	3,080	...	187,937	82,274	5,043,521
1883	458,530	3,121,012	736,810	10,534	...	176,447	77,195	4,580,520
1884	396,669	3,114,472	1,062,471	15,469	...	160,404	77,935	4,826,510
1885	378,665	2,940,872	1,062,514	18,295	...	155,309	70,414	4,626,069
1886	366,294	2,660,784	1,187,189	32,535	1,148	117,250	63,193	4,428,339
1887	394,579	2,471,004	1,481,930	72,003	18,517	158,533	68,774	4,655,400
1888	317,241	2,500,104	1,690,477	34,205	13,273	147,154	34,802	4,737,256
1889	434,784	2,459,352	2,695,629	37,305	58,871	119,703	47,651	5,853,295
1890	460,285	2,354,240	2,182,563	20,808	86,664	75,888	80,769	5,261,217
1891	559,231	2,305,586	2,030,312	27,380	115,182	145,459	98,701	5,281,861
1892	575,299	2,617,824	2,164,391	26,097	226,284	158,917	109,658	5,878,470
1893	651,286	2,684,504	2,167,794	12,561	421,385	141,326	108,130	6,186,886
1894	1,156,717	2,867,816	2,330,282	33,401	787,099	217,024	109,699	7,502,038
1895	1,315,929	2,960,348	2,150,561	26,060	879,748	206,115	109,816	7,641,573
1896	1,073,360	3,220,348	2,132,979	14,350	1,068,808	237,574	81,210	7,828,629
1897	1,104,315	3,251,064	2,552,668	39,020	2,564,977	296,660	81,210	9,889,914
1898	1,201,743	3,349,028	2,750,948	10,676	3,990,698	291,496	84,789	11,678,778
1899	1,623,320	3,418,000	2,838,446	15,582	6,246,732	327,545	63,565	14,533,190
1900	1,070,920	3,229,628	2,871,578	14,494	6,007,610	316,220	67,988	13,578,438
1901	737,164	3,102,753	2,541,764	16,613	7,235,653	295,176	76,609	14,005,732
1902	684,979	3,062,028	2,720,512	24,878	7,947,661	301,573	70,325	14,811,947
1903	1,080,029	3,259,482	2,839,801	28,650	8,770,719	254,403	61,600	16,294,684
1904	1,146,109	3,252,045	2,714,934	76,025	8,424,226	260,015	3,983	15,897,337
1905	1,165,013	3,173,744	2,517,295	45,853	8,305,654	312,380	30,971	15,550,910
1906	1,078,866	3,380,478	2,313,464	27,000	7,622,749	254,063	54,225	14,631,745
1907	1,050,730	3,954,617	1,978,938	20,540	7,210,749	277,607	21,923	13,515,109
1908	954,854	2,849,898	1,975,554	12,300	6,999,882	242,482	23,943	13,058,853
1909	869,546	2,778,956	1,935,178	30,206	6,776,274	190,201	24,148	12,604,509
1910	802,211	2,429,745	1,874,955	28,000	6,246,848	157,370	21,711	11,553,840
1911	769,353	2,140,855	1,640,323	15,000	5,823,075	132,108	30,910	10,551,624
1912	702,129	2,039,464	1,477,979	28,000	5,448,385	161,300	22,671	9,879,928
Total	£ 59,462,975	£ 291,703,453	£ 75,217,830	£ 920,810	£ 109,298,871	£ 7,407,282	£ 2,065,688	£ 546,076,909

The amount of gold raised in the Commonwealth in any one year attained its maximum in 1903, in which year Western Australia also reached its highest point. For the other States of the Commonwealth the years in which the greatest yields were obtained, were as follows:—New South Wales, 1852; Victoria, 1857; Queensland, 1900; South Australia, 1904, and Tasmania, 1899.

The following table shews the quantity in fine ounces of gold raised in each State and in the Commonwealth during each of the last ten years, the value of one ounce fine being £4 s. 11 $\frac{1}{2}$ d.:—

QUANTITY OF GOLD PRODUCED IN THE COMMONWEALTH, 1903 to 1912.

Year.	N.S.W.	Victoria.	Q'land.	S. Aust.	W. Aust.	Tas.	Nor. Ter.	C'wealth.
	Pine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.
1903	254,260	767,347	668,546	8,650	2,064,803	59,892	12,597	3,830,095
1904	269,817	765,596	639,150	17,897	1,983,230	65,921	938	3,742,549
1905	274,267	747,163	592,622	10,983	1,955,317	73,540	7,103	3,660,995
1906	253,987	772,290	544,636	8,037	1,794,548	60,023	11,085	3,444,606
1907	247,363	695,576	465,882	5,609	1,697,555	65,354	4,389	3,181,728
1908	224,792	670,909	465,085	2,908	1,647,912	57,085	5,624	3,074,315
1909	204,708	654,222	455,579	7,111	1,595,270	44,777	5,685	2,967,352
1910	188,857	570,362	441,402	6,603	1,470,633	37,048	5,100	2,720,005
1911	181,120	504,000	386,165	3,537	1,370,868	31,191	7,277	2,484,068
1912	165,295	480,731	347,946	6,592	1,282,658	37,973	7,811	2,328,406

3. **Changes in Relative Positions of States as Gold Producers.**—A glance at the figures in the table shewing the value of gold raised will sufficiently explain the enormous increase in the population of Victoria during the period 1851 to 1861, when an average of over 40,000 persons reached the State each year. With the exception of the year 1889, when its output was surpassed by that of Queensland, Victoria maintained its position as the chief gold-producer for a period of forty-seven years, or up to 1898, when its production was outstripped by that of Western Australia, the latter State from this year onward contributing practically half the entire yield of the Commonwealth. New South Wales occupied the second place on the list until 1874, when Queensland returns exceeded those of the parent State, a condition of things that has been maintained ever since. South Australia has occupied the position of lowest contributor to the total gold yield of the Commonwealth since the year 1871. Taking the average of the last ten years, the relative position of each State in regard to the gold production of the Commonwealth was as follows:—

RELATIVE POSITION OF STATES AS GOLD PRODUCERS, 1903 to 1912.

State.	Annual Average of Gold Production, 1903 to 1912.	Percentage on Commonwealth.	State.	Annual Average of Gold Production, 1903 to 1912.	Percentage on Commonwealth.
Commonwealth ...	£ 13,353,855	100.00	New South Wales	£ 961,884	7.21
Western Australia	7,162,856	53.64	Tasmania ...	226,283	1.69
Victoria ...	2,815,222	21.08	South Australia	31,159	0.23
Queensland ...	2,126,842	15.93	North'n Territ'y	29,609	0.22

4. **Methods of Gold Mining adopted in Each State.**—The circumstances of gold mining in the various States are not quite identical, for which reason reference is made to that of each State.

(i.) *New South Wales.* In New South Wales the earlier "rushes" were to surface alluvial or shallow-sinking grounds. Many of these were apparently soon worked out, but there is reason to believe that in some instances payable results would be obtained by treating the rejected wash-dirt on more scientific principles. With the exhaustion of the surface deposits discoveries were made by sinking to what are called deep alluvial leads, representing the beds of old drainage channels in Pliocene and Pleistocene times. The first of these deep alluvial leads was discovered at Forbes, in New South Wales in 1862. The Tertiary deep leads at Gulgong were discovered in 1871. Cretaceous leads occur at Tibooburra, and detrital gold has been found in permo-carboniferous conglomerates at Talawang. The method of dredging is at present being extensively used for winning gold from the beds of running streams, and from loose river flats and other wet ground where sinking would be impracticable. The system was introduced from New Zealand, where it was originally applied with great success on the Clutha River, and there are now dredges working on practically all the auriferous rivers of New South Wales. Hydraulic sluicing

is also employed in several places, the necessary machinery being fitted to a pontoon for convenience in moving from place to place. The quantity of alluvial gold obtained, other than by dredging, amounted to 6987 ozs. in 1912, the chief yields being—Braidwood, 1036 ozs.; Orange 637 ozs.; Windeyer, 500 ozs.; and Hill End 296 ozs. The quantity obtained by dredging was 20,649 ozs.; the largest returns being obtained at Araluen, 7950 ozs.; Stuart Town 2609 ozs.; Gundagai, 2178 ozs.; Adelong, 1527 ozs., and Nundle, 1297 ozs. The dredges in operation during 1912 numbered 67, of which 21 were of the bucket type and 46 were suction plants. In the recovery of gold 17 bucket dredges and 11 pumping plants were employed, while four bucket dredges and 35 pumping plants were engaged in the winning of stream tin. The value of the plants in operation was estimated at £355,096. The quantity of gold won from quartz amounted to 135,638 ozs. At the present time the Cobar district is the chief centre of the production from quartz, the yields from the Cobar and Canbelego fields included therein being respectively 51,175 ozs. and 17,305 ozs. Next come the Wellington field with 11,714 ozs.; Adelong, 7884 ozs.; Hillgrove, 6500 ozs.; Wyalong, 5882 ozs.; and Murrumburrah, 5863 ozs.

The table below shews as far as can be ascertained the yield from alluvial and quartz mining in each of the principal districts during 1912. Owing to the circumstance that it was impossible to obtain complete returns from the whole of the mine and battery owners the total for the State necessarily falls short of that given in preceding pages.

GOLD WON IN NEW SOUTH WALES, ALLUVIAL AND QUARTZ, 1912.

District.	Alluvial.		Quartz.	Total.
	Other than by Dredging.	By Dredging.		
	ozs.	ozs.	ozs.	ozs.
Albert	167	...	1,666	1,833
Bathurst	1,391	...	2,746	4,137
Clarence and Richmond	118	...	666	784
Cobar ... ..	...	...	69,690	69,690
Hunter and Macleay ... ..	...	...	168	168
Lachlan	311	2,178	19,067	21,556
Mudgee	918	81	16,371	17,370
New England	137	...	69	206
Peel and Uralla	967	2,568	6,695	10,230
Southern	1,250	9,555	9,538	20,343
Tambaroora and Turon	769	4,416	974	6,159
Tumut and Adelong	1,019	1,851	7,988	10,858
Total	7,047	20,649	135,638	163,334

(ii.) *Victoria.* Quartz-reefing predominates in Victoria, although a considerable amount of gold is obtained from alluvial workings, both surface and deep leads. The deepest mines in Australia are found in the Bendigo district, where the two deepest shafts were at the 31st December, 1912, 4614 and 4318 feet deep respectively. Altogether there were at the close of 1912 no less than fifty-three shafts in this district which had reached a depth of over 2000 feet. A considerable amount of attention is given to dredging and hydraulic sluicing, particularly in the Beechworth, Maryborough, Castlemaine, Ararat, Stawell, and Ballarat districts, the number of plants in operation at the end of 1912 being 93. The total quantity of gold won from dredge mining in 1912 was 73,214 ounces, and from sluicing 567 ounces, the total area treated being 672 acres. Tin to the value 2624 was also won. The yields from alluvial workings and quartz reefs as returned (in crude ounces) from the chief mining districts of the State during last year were as follows:—

GOLD WON IN VICTORIA, ALLUVIAL AND QUARTZ, 1912.

District.	Alluvial.	Quartz.	Total.
	ozs.	ozs.	ozs.
Ararat and Stawell	11,438	8,104	19,542
Ballarat	11,034	53,315	64,349
Beechworth	70,493	15,252	85,745
Bendigo	2,812	169,204	172,016
Castlemaine	11,268	61,278	72,546
Gippsland	6,497	16,418	22,915
Maryborough	42,486	25,720	68,206
Total	156,028	349,291	505,319

The largest output from lode mines in 1912 was furnished by the Central Red, White and Blue, at Bendigo, with 13,650 ozs.; followed by the Lord Nelson, St. Arnaud, with 13,146 ozs.; the North Nuggetty Ajax, Daylesford, with 11,474 ozs.; and the Johnson's Reef, Bendigo, with 9962 ozs. Of the deep alluvial mines the Great Southern at Rutherglen produced 11,332, and the Duke and Main Leads Consols, at Maryborough, 9951 ozs. In dredging, the Tewkesbury Amalgamated, at Bright, headed the list with a return of 4438 ozs.

(iii.) *Queensland.* Operations in Queensland are at present chiefly confined to quartz reefing, the yield from alluvial in 1912 being only 3830 ounces, of which 1274 ozs. were won at the Batavia River field, while the quantity produced from quartz was 207,939 ounces; from copper and other ores 130,931 ounces; and from old tailings 5246 ounces; making a total production of 347,946 ounces, valued at £1,477,979. The yields from the principal fields are given below:—

GOLD WON IN QUEENSLAND, ALLUVIAL AND QUARTZ, 1912.

District.	Alluvial.	Quartz.	From Copper and other Ores and old Tailings.	Total.
	fine ozs.	fine ozs.	fine ozs.	fine ozs.
Charters Towers	368	95,392	286	96,046
Gympie	236	37,733	1,539	39,508
Mount Morgan	195	28,081	108,960	137,236
Ravenswood	109	22,480	40	22,629
Croydon ... ..	...	5,950	2,413	8,363
Etheridge, Oaks and Woolgar	704	13,804	563	15,071
Cloncurry	59	...	12,980	13,039
Gladstone	72	1,105	1,306	2,483
Rockhampton	26	86	6,628	6,740
Other districts	2,061	3,308	1,462	6,831
Total	3,830	207,939	136,177	347,946

(iv.) *South Australia.* In South Australia alluvial gold has been worked for many years in the gullies round Adelaide, while a fair amount of gold has been obtained by this method at Teetulpa, in the northern areas. The battery and cyanide returns as published in the "Mining Review" shew that the chief producing centres in 1912 were Tarcoola and Tarcoola Blocks, Deloraine, Kirkeek's Treasure, Nillinghoo, Kitticoola, Reedy Creek, and Mt. Grainger.

The total output of gold for 1912 from the Northern Territory amounted to 7811 ounces, valued at £22,671.

(v.) *Western Australia.* In Western Australia operations are confined principally to quartz reefing, the returns from ordinary alluvial and hydraulic sluicing being comparatively small. The total production of gold from all sources during 1912 was 1,282,658 ounces, of which only about 0.3 per cent. was alluvial. The yields in each district were as shewn below :—

GOLD WON IN WESTERN AUSTRALIA, ALLUVIAL AND QUARTZ, 1912.

Goldfields.	Alluvial.	Dollied and Specimens.	Crushed.	Total.
	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.
East Coolgardie	521	1,488	754,786	756,795
East Murchison	21	2,200	96,910	99,131
Mount Margaret	1,054	493	101,423	102,970
Murchison	396	1,828	103,149	105,373
North Coolgardie	79	113	58,078	58,270
Coolgardie	449	302	41,431	42,182
Phillips River	26	44	4,131	4,201
North-east Coolgardie	201	1,364	12,291	13,856
Yilgarn	3	38	30,634	30,675
Broad Arrow	47	419	12,909	13,375
Peak Hill	367	28	1,467	1,862
Pilbara	513	267	5,219	5,999
Dundas ... ..	...	338	24,976	25,314
Yalgoo	224	36	5,906	6,166
West Pilbara	98	...	1,020	1,118
Ashburton	39	...	...	39
Kimberley	272	...	...	272
Other goldfields	7	...	240	247
Total	4,317	8,958	1,254,570	1,267,845

The figures in the above table are compiled from returns from the individual mines and are somewhat incomplete; the total is therefore less than that shewn on page 407, which represents mint and export returns.

(vi.) *Tasmania.* The yield from Tasmania is also chiefly obtained from quartz reefing, although there is a little alluvial mining carried on, as shewn in the table hereunder. The yields as returned from each district in 1912 are given below :—

GOLD WON IN TASMANIA, ALLUVIAL AND QUARTZ, 1912.

District.	Quartz.	Alluvial.	Cyanide.	Blister Copper.	Silver Lead Bullion.	Total.
	Ozs.	Ozs.	Ozs.	Ozs.	Ozs.	Ozs.
Beaconsfield	11,122	...	9,933	...	...	21,055
Mathinna	74	...	262	...	...	336
Mt. Victoria	31	255	...	...	...	286
Warrantinna						
Mt. Cameron	19	18	...	...	...	37
Lefroy						
Lisle ... ..	...	189	...	...	...	189
Golconda						
Lilydale						
West Coast ... ..	...	100	...	7,351	8,673	16,124
Total	11,246	562	10,195	7,351	8,673	38,027

The total production was valued at £161,300, equal to 37,973 ozs. fine, considerably more than half of which was produced by the Tasmania Gold Mine Ltd., at Beaconsfield.

(vii.) *Northern Territory.* Pine Creek is the chief mining field in the Northern Territory, but operations have for many years been carried on in a desultory manner, chiefly by Chinese labour. It is stated that the field has been unfairly exploited, the rich pockets only having been scooped out without any systematic prospecting. Confidence in the auriferous prospects of the area has been shaken by the failure of various companies, but in the view of the Mines Department the ground has not been properly tested or systematically mined, and the Department proposes to sink to a depth of 300 feet and prove that with proper methods the area is worthy of renewed exploration. The chief yields in the Pine Creek district were from the Eleanor and Kohinoor mines, which returned gold to the value of £11,086 and £1506 respectively.

5. **Remarkable Masses of Gold.**—Allusion has already been made in preceding Year Books to the discovery of "nuggets" and other remarkable masses of gold, but it is not proposed to repeat this information in the present issue.

6. **Modes of Occurrence of Gold in Australia.**—This subject has been alluded to at some length in preceding issues of the Year Book, but considerations of space will not permit of repetition in the present issue.

7. **Place of Commonwealth in the World's Gold Production.**—In the table given below will be found the estimated value of the world's gold production, and the share of the Commonwealth therein during the ten years 1903 to 1912. The figures given in the table have been compiled chiefly from returns obtained direct by the Commonwealth Bureau of Census and Statistics from the gold-producing countries of the world.

WORLD'S GOLD PRODUCTION, 1903 to 1912.

Year.	World's Production of Gold.	Gold produced in Commonwealth.	Percentage of C'wealth on Total.
	£	£	%
1903	66,701,000	16,295,000	24.43
1904	70,611,000	15,897,000	22.51
1905	76,974,000	15,551,000	20.20
1906	83,290,000	14,632,000	17.57
1907	84,827,000	13,515,000	15.93
1908	91,434,000	13,059,000	14.28
1909	93,337,000	12,605,000	13.51
1910	93,719,000	11,554,000	12.33
1911	94,949,000	10,552,000	11.11
1912	95,358,000	9,880,000	10.36

While the production of gold in the Commonwealth shews a slight decrease during the sixteen years from 1897 to 1912, the world's total production practically doubled itself in the same period. The following table will be found interesting, as shewing the various foreign countries where the chief increases have taken place during the interval in question:—

INCREASE IN GOLD YIELD, VARIOUS COUNTRIES, 1897 to 1912.

Country.	1897.	1900.	1910.	1911.	1912
	£	£	£	£	£
United States ...	11,787,000	16,269,000	19,781,000	19,909,000	18,840,000
Canada ...	1,240,000	5,742,000	2,097,000	2,010,000	2,599,000
Mexico ...	2,045,000	1,884,000	4,930,000	5,069,000	4,974,000
Transvaal ...	11,654,000	1,481,000	31,973,000	35,041,000	38,686,000
Rhodesia ...	800	308,000	2,563,000	2,648,000	2,707,000
Gold Coast ...	85,000	38,000	780,000	1,079,000	1,499,000
Madagascar ...	8,500	142,000	442,000	389,000	289,000
India ...	1,571,000	1,893,000	2,202,000	2,238,000	2,272,000
Korea ...	208,000	371,000	955,000	953,000	961,000
Japan ...	142,000	290,000	596,000	639,000	639,000
Java ...	24,000	112,000	723,000	625,000	550,000
Costa Rica ...	2,000	31,000	96,000	149,000	95,000

The largest increase was recorded in the Transvaal, where the production more than trebled itself in the sixteen years 1897 to 1912.

8. **Employment in Gold Mining.**—The number of persons engaged in gold mining in each State in 1901 and during each of the last five years is shewn in the following table:—

PERSONS EMPLOYED IN GOLD MINING, 1901 and 1908 to 1912.

Year.	N.S.W.	Victoria.	Q'land.	S. Aust.	W. Aust.	Tas.	N. Terr.	C'w'ith.
	No.	No.	No.	No.	No.	No.	No.	No.
1901 ...	12,064	27,387	9,438	1,000	19,771	1,112	200	70,972
1908 ...	6,363	20,853	7,736	880	16,075	843	333	53,083
1909 ...	5,585	18,671	7,150	920	17,027	713	257	50,323
1910 ...	5,247	16,553	6,115	950	16,279	682	306	46,132
1911 ...	4,650	14,015	5,227	920	15,428	570	358	41,168
1912 ...	3,898	11,856	5,500	920	13,700	485	263	36,622

§ 3. Platinum and the Platinoid Metals.

1. **Platinum.**—(i.) *New South Wales.*—The existence of platinum was first noted in New South Wales in 1851 by Mr. S. Stutchbury, who found a small quantity near Orange. Since the year 1878 small quantities of the metal have been obtained from beach sands in the northern coastal district. Platiniferous ore was noted in 1889 at Broken Hill. The chief deposits at present worked in the State are situated at Fifield, near Parkes, but the entire production in 1912 was small, amounting to only 610 ozs., valued at £3880, while the total production recorded to the end of 1912 amounted to 12,990 ozs., valued at £29,010.

The bulk of the production in 1912 was obtained by individual miners working with somewhat crude methods. Gold is found in association with platinum in the washdirt, the proportion being about 4 to 8 parts of platinum to 1 of gold.

(ii.) *Victoria.* In Victoria the metal has been found in association with copper at the Walhalla Copper Mine in Gippsland. The mine was worked extensively from 1874 to 1881 and then abandoned, but was reopened in 1910. It is stated that there are 70,000 tons of ore in sight, assaying three to four per cent. copper, and containing also platinum and silver. The production of platinum in 1911 amounted to 184 ozs., valued at £989.

2. *Osmium, Iridium, etc.*—(i.) *New South Wales.* Small quantities of osmium, iridium, and rhodium are found in various localities. As far back as 1860, the Rev. W. B. Clarke states that he found native iridium. Platinum, associated with iridium and osmium, has been found in the washings from the Aberfoil River, about 15 miles from Oban; on the beach sands of the northern coast; in the gem sand at Bingara, Mudgee, Bathurst, and other places. In some cases, as for example in the beach sands of Ballina, the osmiridium and other platinoid metals amount to as much as 40 per cent. of the platinum, or about 28 per cent. of the whole metallic content.

(ii.) *Victoria.* In Victoria, iridosmine has been found near Foster, and at Waratah Range, South Gippsland.

(iii.) *Tasmania.*—For many years osmiridium has been known to exist in the bed of the Savage River, on the West Coast, and in rivulets and creeks in the Serpentine country, but it was not until early in 1911 that efforts were made to work the deposits. During that year the price paid for the mineral was as high as £7 10s. per oz., and about 100 men were engaged in the search for it. The quantity produced amounted to 272 ozs., valued at £1888. In 1912 the production was 779 ozs., valued at £5742, or an average of £7 7s. 9d. per oz. Early in 1913 a prospector was reported to have found near the Pieman River a piece of osmiridium weighing two ounces, the largest "nugget" of this metal ever found.

§ 4. Silver.

1. *Occurrence in Each State.*—Particulars regarding the occurrence of silver in each State will be found in preceding Year Books, Nos. I. to V., but considerations of space preclude the repetition of this matter in the present volume.

2. *Development of Silver Mining.*—In illustration of the development of silver mining in Australia the following table has been compiled, shewing the production of silver, silver-lead and ore, and lead from each State during the years 1881, 1891, 1901, and the five years ending 1912:—

PRODUCTION OF SILVER AND LEAD, AUSTRALIA, 1881 to 1912.

Year.	N.S.W.	Vic.	Q'land.	S. Aust.	W. Aust.	Tasmania.	North Terr.	C'wealth.
	£	£	£	£	£	£	£	£
1881	...	5,239	13,494	1,182	11,224	...	...	31,139
1891	3,621,614	6,017	21,879	1,787	250	62,138	4,140	3,717,825
1901	1,954,964	6,550	69,234	3,886	7,718	325,335	...	2,367,687
1908	2,346,941	2,835	206,716	9,000	23,883	322,007	30	2,911,412
1909	1,839,688	2,310	167,636	673	19,977	298,880	...	2,329,164
1910	2,110,040	2,090	123,086	907	20,210	247,576	...	2,503,909
1911	2,652,548	2,070	79,765	140	33,335	*253,361	...	3,021,219
1912	3,745,796	2,000	121,855	326	38,918	309,098	820	4,218,813

* Exclusive of silver to the estimated value of £42,831 contained in blister copper.

(i.) *New South Wales.* The figures quoted for New South Wales in the above table represent the *net* value of the product (excluding zinc) of the silver-lead mines of the State. In explanation of the values thus given, it must be noted that the metallic contents of the larger portion of the output from the silver-lead mines in the State are extracted outside New South Wales, and it is considered, therefore, that the State should not take full credit for the finished product. Hence the *net* value referred to above relates to that of the ore, concentrates, and bullion, as declared by the several companies to the Customs Department at date of export. The real importance of the State as a producer of silver, lead, and zinc is thus to some extent lost sight of. The next table, however, which indicates the quantity and value of these metals locally produced, and the quantity and value of concentrates exported during the last five years, will shew the estimated total value of the yield:—

**VALUE OF PRODUCTION FROM SILVER-LEAD MINES OF NEW SOUTH WALES,
1908 TO 1912.**

Year.	Value of Silver, Lead, and Spelter produced within the C ^w wealth.	Value of Concentrates Exported.	Total.
	£	£	£
1908	2,008,410	2,400,997	4,409,407
1909	1,176,394	2,707,680	3,884,074
1910	1,755,220	3,180,850	4,936,070
1911	1,949,271	3,259,246	5,208,517
1912	2,477,442	3,692,352	6,169,794

As regards silver alone, the following table, which has been prepared on a basis similar to that on which the preceding table was compiled, shews the estimated total quantity and value of that metal yielded by the mines of New South Wales up to the end of 1903 and during the last nine years:—

**ESTIMATED QUANTITY AND VALUE OF SILVER YIELDED BY MINES OF
NEW SOUTH WALES, TO END OF 1912.**

Period.	Produced in Australia.		Contained in Concentrates, etc., Exported.		Total Production.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
To the end of 1903 ...	Fine ozs. 82,947,404	£ 13,807,421	Fine ozs. 104,659,834	£ 18,330,147	Fine ozs. 187,607,238	£ 32,137,568
1904	7,751,667	920,947	2,945,058	349,891	10,696,725	1,270,838
1905	6,804,934	852,533	3,480,561	436,050	10,285,495	1,288,583
1906	5,575,410	775,409	3,111,013	432,669	8,686,423	1,208,078
1907	5,921,457	795,982	6,228,225	845,845	12,149,682	1,641,827
1908	6,484,288	693,034	5,499,381	567,768	11,963,669	1,280,802
1909	3,717,016	382,605	6,867,775	732,563	10,584,791	1,115,168
1910	5,196,323	561,280	7,608,336	843,257	12,804,659	1,404,537
1911	5,731,468	620,578	8,797,677	973,210	14,529,145	1,593,788
1912	5,220,538	641,707	8,293,711	1,036,715	13,514,249	1,678,422
Total	135,350,505	20,051,496	157,491,571	24,568,115	292,842,076	44,619,611

3. Chief Centres of Silver Production.—Broken Hill, in New South Wales, and Zeehan, in Tasmania, are the great centres of silver production in Australasia. The production in Queensland has, however, considerably expanded during the last few years.

(i.) *New South Wales.* (a) *Broken Hill.* A description of the silver-bearing area in this district is given in preceding issues of the Year Book. Owing to the high prices ruling for the various metals, the years 1911 and 1912 were characterised by great activity in the Broken Hill district, and each of the mines on the line of lode worked to its fullest capacity. The value of the output in 1912 was £4,437,000 as compared with £3,832,000 in 1911.

Although the returns are not complete in all cases, the following table relating to the mines at Broken Hill will give some idea of the richness of the field:—

RETURNS OF BROKEN HILL SILVER MINES TO END OF 1912.

Mine:	Authorised Capital.	Value of Output to end of 1912.	Dividends and Bonuses Paid to end of 1912.
	£	£	£
Broken Hill Proprietary Co. Ltd. ...	600,000	34,710,053*	10,256,000
Broken Hill Proprietary Block 14 Co. ...	155,000	3,448,108	536,660
British Broken Hill Proprietary Co. ...	339,000	2,682,937	474,100
Broken Hill Proprietary Block 10 Co. ...	1,000,000	3,993,513	1,280,000
Sulphide Corporation Ltd. (Central Mine) ...	1,100,000	13,409,085†	1,230,625
Broken Hill South Silver Mining Co. ...	200,000	4,978,900	1,195,000
North Broken Hill Mining Co. ...	600,000	2,708,202†	658,940
Broken Hill Junction Lead Mining Co. ...	150,000	838,569†	85,000
Junction North Broken Hill Mine ...	250,000	1,359,044	79,793
The Zinc Corporation Ltd. ...	†	870,271	10,000†
Broken Hill South Extended Ltd. ...	337,500	150,344	50,000
Totals ...	4,731,500	69,149,026	15,856,118

* The value of the ores purchased during the years 1908 to 1912 is not included. † Incomplete.
 ‡ This company went into liquidation on 24th July, 1911, and after that date the mine was worked by the Zinc Corporation Ltd. Separate details regarding capital not available.

(b) *Yerranderie.* The mines on the Yerranderie field in the Southern Mining District produced 676,095 ozs. of silver in 1912, besides 1438 ozs. of gold, and 1906 tons of lead, the total production being valued at £121,859. Mining operations in this locality are carried on under considerable difficulties owing to the heavy cost of transport, but it is hoped that with the construction of a railway to the field, it will be possible to treat lower grade ores with profit.

(c) *Kangiarra.* The yield from the Kangiarra field, in the Yass district, consisted of 93,088 ozs. of silver, besides gold, 233 ozs.; lead, 1177 tons; and copper, 250 tons; the total production being valued at £45,536.

(d) *Conrad.* The ore raised by the Conrad Mines Ltd., at Howell, in the Tingha division, amounted in 1912 to 21,958 tons, valued at £51,097. The ore contents were estimated at 395,244 ozs. of silver; 1646 tons lead; 435 tons of zinc; and 220 tons of copper. The number of men employed in 1912 was 193, and the value of plant and machinery, £11,150.

(e) *Cobar.* A considerable quantity of silver is obtained from the Great Cobar Ltd. Mine and attached properties, the production in 1912 amounting to 202,330 ozs. At the Cobar Peak Silver Mine the production was 8135 ozs.

(ii.) *Tasmania, West Coast.* The production of silver-lead ore in 1912 was 90,124 tons, valued at £309,098, to which the Hercules Mine at Dundas contributed 30,887 tons, valued at £95,526. The next highest yield came from the Primrose at Rosebery, with £40,141, followed by the Zeehan Montana at Zeehan with £29,505, the North Mt. Farrell £24,662, and the Comet, Dundas, with £15,597.

(iii.) *Queensland.* The yield for the chief silver-producing centres in 1912 was as follows:—Chillagoe, £19,197; Herberton, £9988; Charters Towers, £7091; Stanthorpe, £8078; Cloncurry, £4712:

(iv.) *South Australia.* Rich specimens of silver ore have been discovered at Miltalie, near Cowell, in South Australia. The surrounding district is highly mineralized, but, so far, has not been thoroughly prospected.

4. **World's Production of Silver.**—The world's production of silver during the last ten years is estimated to have been as follows:—

WORLD'S PRODUCTION OF SILVER, 1903 to 1912.

Year	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.	1911.	1912.
World's production in 1000 fine ozs.*	173,222	176,840	181,338	184,552	183,386	212,570	227,291	240,223	254,214	250,979

* Add 000 to figures for fine ounces.

Australasia's share in the world's silver production in 1912 was estimated at 16,112,000 ounces, or about 6½ per cent. on the total production.

5. **Prices of Silver.**—As the production of silver is dependent to a very large extent on the price realised, a statement of the average price per standard ounce paid by the London Mint at various periods and during the last five years is given below:—

PRICE OF SILVER, 1871 to 1912.

Year	1871.	1881.	1891.	1901.	1908.	1909.	1910.	1911.	1912.
Pence per standard oz.	60½	51½	45½	27½	24½	23½	24½	24½	28½

During the month of November, 1906, owing to the small sales in New York, and also to the fact that the Indian, American, and Mexican Governments were all buying silver, the price rose to 33½d., the highest realised since 1893, when the average stood at 36½d.

6. **Employment in Silver Mining.**—The number of persons employed in silver mining in 1901 and during each of the last five years is given below:—

NUMBER OF PERSONS EMPLOYED IN SILVER MINING, 1901 and 1908 to 1912.

Year.	N.S.W.	Victoria.	Q'land.	S. Aust.	W. Aust.	Tasmania.	N. Terr.	C'wealth.
	No.	No.	No.	No.	No.	No.	No.	No.
1901...	6,298	...	40	150	...	2,414*	†	8,902‡
1908...	7,560	3	496	50	5	1,740	†	9,854
1909...	6,207	...	354	40	5	1,516	†	8,122
1910...	7,999	...	590	60	21	1,173	65	9,908
1911...	8,495	...	433	30	43	1,125	47	10,173
1912...	9,062	...	208	30	60	1,681	...	11,041

* Including copper miners. † Included in South Australia. ‡ Including copper miners in Tasmania.

As the table shews, the bulk of the employment was in New South Wales and Tasmania, the quantity of silver raised in the other States, excepting Queensland, being unimportant.

§ 5. Copper.

1. **Production of Copper.**—The production of copper in the various States of the Commonwealth has been influenced considerably by the ruling prices, which have undergone extraordinary fluctuations. The quantity and value of the production in earlier years and for 1908 to 1912 is shewn in the following tables:—

PRODUCTION OF COPPER, AUSTRALIA, 1881 to 1912.

State.	1881.	1891.	1901.	1908.	1909.	1910.	1911.	1912.
QUANTITY.								
	Tons.	Tons	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
N.S.W. ... { Copper	*	*	6,087	8,679	6,857	8,435	10,618	8,990
{ Ore			645	392	109	4,455	1,462	2,044
Victoria... { Copper	*	*	...	983	17	150	36	...
{ & Ore			...	...	...	...	...	...
Q'land ... { Copper	330	85	3,061	14,961	14,494	16,387	20,384	23,120
S. Aust. ... { Copper	3,824	3,551	6,736	6,152	5,776	75,199	5,922	6,295
{ Ore	21,638	13,239	2,353	...	1,345	...	...	...
W. Aust. ... { Copper	...	*	10,157	479	833	1,281	10,654	8
{ Ore	...	...	2,503	2,503	6,959	6,309	9,556	9,556
Tasmania { Copper	...	...	9,730	8,833	8,638	8,864	8,308	6,528
{ Ore	...	...	10,029	1,185	1,588	...	...	...
Northern Territory	...	...	...	...	...	...	163	377
C'wealth { Copper	...	...	25,614	44,167	36,598	40,166	57,567	56,918
{ Ore	...	...	23,184	...	10,018	10,914	...	...

* Not available.

+ Including 97 tons of copper, Northern Territory.

VALUE.

	£	£	£	£	£	£	£	£
New South Wales...	227,667	119,195	412,292	502,812	424,737	486,257	590,102	579,791
Victoria ...	8,186	216	...	3,928	44	450	2,088	...
Queensland ...	19,637	3,554	194,227	893,535	853,196	932,489	1,151,351	1,698,280
South Australia ...	418,296	235,317	500,077	345,968	342,329	*307,316	332,500	461,500
Western Australia	...	4,463	75,246	57,091	104,644	95,928	78,118	60,537
Tasmania ...	...	...	1,026,748	609,651	608,038	566,972	408,649	440,444
Northern Territory	...	...	...	...	...	...	1,470	3,998
Commonwealth ...	673,786	362,745	2,208,590	2,412,985	2,332,988	2,389,412	2,564,278	3,244,550

* Including £1196, Northern Territory.

A short account of the discovery of copper in the different States is given in the earlier Year Books.

2. Sources of Production.—(i.) *New South Wales.* The principal seat of the copper-mining industry at the present date is in the Cobar district, the value of the deposits there being first recognised in 1869. The value of the output from this district in 1912 was £410,155, out of a total for the State of £579,791. Operations at the Great Cobar Mine were to some extent interfered with owing to lack of skilled labour, nevertheless the output of copper totalled 6650 tons as against 6548 tons in 1911.

From the Grafton Company's mine at Cangai the output was valued at £57,161, as compared with £33,288 in the preceding year. The metallic products comprised 788 tons of copper, 320 ozs. of gold, and 6410 ozs. of silver. The Kyloe mine, in the Cooma division, contributed materially to the total output, the production from this mine being valued at £52,459. The Kangiara mines, in the Yass division, raised 3856 tons of copper ore, estimated to contain 250 tons of copper valued at £17,040.

The Electrolytic and Refining and Smelting Company of Australia Limited, established at Port Kembla, had a successful year, the output of electrolytic copper being 16,888 tons, most of which was made from imported blister copper.

(ii.) *Victoria.* The copper produced in this State was obtained from the mine near Walhalla operated by the Gippsland Copper, Platinum, and Gold Mining and Smelting Company. During 1911 the company smelted 1116 tons of copper ore and 18 of auriferous quartz, and from the resultant 91 tons of matte, copper was produced to the value of £2088, silver valued at £65, gold at £220, and platinum at £989. There was no production recorded in 1912.

(iii.) *Queensland.* The yield in this State amounted in 1912 to 23,120 tons, valued at £1,698,280, to which the Cloncurry field contributed 10,435 tons, valued at £761,755. Next in order were Mount Morgan with 7068 tons, valued at £516,000; Gladstone, 1764 tons, £128,916; Rockhampton, 1345 tons, £105,921; Etheridge, 1242 tons, £93,600; Cloncurry, 1142 tons, £83,366; Mount Perry, 443 tons, £30,567; and Chillagoe, 417 tons, £31,376.

Exploration of the deeper ground at Cloncurry has confirmed the belief in the richness of the field, and the district is now generally recognised as the most extensive and richest cupriferous area in Australia.

(iv.) *South Australia.* Taking the entire period over which production extended, the yield of copper in South Australia easily outstrips that of any other State in the Commonwealth. In recent years, however, Tasmania, Queensland, and New South Wales have come to the front as copper producers, as the table on the preceding page will shew. Deposits of copper ore are found over a large portion of South Australia. The Kapunda mine, discovered in 1842 by Messrs. Dutton and Bagot, is situated fifty miles north of Adelaide, and is the oldest copper mine in the State. Up to the end of 1879 the production amounted to 70,000 tons, the metal possessing such a high standard of purity that it always obtained the highest prices in the world's markets. During the nine years 1870 to 1878 the production was valued at £157,000. The Burra Burra mine, located in 1845 by a shepherd named Pickett, is situated about 100 miles north of Adelaide. The original capital invested in this mine was £12,320 in £5 shares, on which no call was ever made, while dividends to the amount of £800,000 were paid. For many years this mine produced from 10,000 to 13,000 tons of ore, averaging 22 to 23 per cent. of copper. During the 29½ years in which the mine was worked the production was valued at £4,749,000. In 1859 as many as 1170 persons were employed on it. The mine has lain practically idle for many years.

Yorke's Peninsula, between Spencer's Gulf and St. Vincent's Gulf, contains a large area of copper-bearing country. The principal mines at Wallaroo and Moonta are situated a few miles from Port Wallaroo, and date back to 1860. For about thirty years the Moonta mines were worked independently, selling their ores to the Wallaroo company. During its separate existence the Wallaroo field produced about £2,600,000 worth of copper, while Moonta yielded £5,396,000, and was the first Australian mining field to produce £1,000,000 in dividends. The amalgamation took place in 1889, and since that year the united properties have produced about £4,281,000 worth of copper. The entire yield from the date of first working is estimated at about £12,500,000. The mines just enumerated represent a very small proportion only of those opened on the copper-bearing areas of the State. The bulk of the production in 1912 came from the Moonta and Wallaroo mines.

(v.) *Western Australia.* The value of copper exported from this State in 1912 was £60,537. According to the returns, the production in the West Pilbara field was 12,284 tons, valued at £104,289, while the Phillips River field shewed a production of 1318 tons, valued at £15,815. A small quantity of copper ore was raised at the Murchison goldfields.

(vi.) *Tasmania.* The quantity of blister copper and copper ore produced in Tasmania during 1912 was 6528 tons, valued at 440,444, the bulk of the production being due to the Mount Lyell Mining and Railway Co. Ltd. This Company treated 259,013 tons of ore in 1912, and produced 5136 tons of blister copper, containing copper to the value of £385,739; silver, £45,225; and gold, £31,242. The Mount Balfour field raised 1220 tons of ore, valued at £8013, and the Jasper Copper Co., at Heazlewood, 14 tons, valued at £325.

(vii.) *Northern Territory.* The production in 1912 was returned at £3998, but as in the case of other minerals the deposits have not yet been scientifically mined. There is an extensive lode at Coronet Hill and a large area of cupriferos country in the surrounding district. Good copper shows have been located at Woollogarang on Settlement Creek. It is proposed to make further tests of the deposits near Rum Jungle.

3. **Price of Copper.**—The great variation in price that the metal has undergone is shewn in the following table, which gives the average price in London and New York during 1901 and in each of the last five years. The figures are given on the authority of "The Mineral Industry."

FLUCTUATION IN VALUE OF COPPER, 1901 and 1908 to 1912.

Year.	London Price per Ton Standard Copper.	New York. Price in Cents per lb.	
		* Lake Copper.	Electrolytic Copper.
	£	Cents.	Cents.
1901	66.79	16.55	16.11
1908	59.90	13.42	13.21
1909	58.73	13.34	12.98
1910	57.05	13.04	12.74
1911	55.97	12.63	12.38
1912	72.94	16.56	16.34

* The term "Lake" copper is used to designate all copper sold in the trade as such, regardless of the process by which it is refined.

4. **Relationship to World's Production.**—The world's production of copper in 1901 and during the last five years is estimated to have been as follows:—

WORLD'S PRODUCTION OF COPPER, 1901 and 1908 to 1912.

Year	1901.	1908.	1909.	1910.	1911.	1912.
World's production— (short tons)	583,517	835,623	942,408	966,998	969,750	1,114,769

5. **Employment in Copper Mining**—The number of persons employed in copper mining during 1901 and in each of the last five years was as follows:—

PERSONS ENGAGED IN COPPER MINING, 1901 and 1908 to 1912.

Year.	N.S.W.	Victoria.	Q'land.	S. Aust.	W. Aust.	Tasmania.	Nor. Ter.	C'wealth.
	No.	No.	No.	No.	No.	No.	No.	No.
1901	2,964	4	814	4,000	321	*	†	8,103‡
1908	2,745	9	3,540	4,470	283	2,076	88	13,211
1909	2,024	2	3,241	4,450	497	2,038	54	12,306
1910	2,286	40	2,418	4,150	559	2,042	49	11,544
1911	2,151	57	2,458	4,030	317	1,565	29	10,607
1912	2,384	6	3,457	4,500	223	1,681	52	12,303

* Included with silver miners. † No returns. ‡ Excluding Tasmania.

§ 6. Tin.

1. **Production of Tin.**—The development of tin mining is, of course, largely dependent on the price realised for the metal, and, as in the case of copper, the production has been subjected to somewhat violent fluctuations. The table below shews the production in each of the Commonwealth States during the years 1881, 1891, 1901, and 1908 to 1912:—

TIN PRODUCED IN AUSTRALIA, 1881 to 1912.

State.	1881.	1891.	1901.	1908.	1909.	1910.	1911.	1912.
QUANTITY.								
	Tons.	Tons.	Tons.	Tons.	Tons	Tons.	Tons.	Tons.
New South Wales { Ingots	5,824	1,454	648	954	951	847	958	900
{ Ore	609	203	11	841	992	1,021	970	1,175
Victoria ... Ore	†	†	77	79	89	41	33	48
Queensland* ... Ore	†	†	1,661	4,885	3,326	2,953	3,091	3,230
West Australia (Ore & Ingot)	...	†	734	1,093†	698†	500†	495	575
Tasmania ... Ore	†	†	1,790	4,521	4,511	3,701	3,953	3,714
Northern Territory Ore	...	†	81	441	427	364	239	271
Commonwealth { Ingots,	†	†	5,002	12,814	10,994	9,427	9,739	9,913
{ ore, etc.								
VALUE.								
	£	£	£	£	£	£	£	£
New South Wales... { Ingots	531,303	124,320	76,086	126,292	127,089	127,700	307,089	338,074
{ Ore	37,492	9,643	464	79,155	83,940	100,456	3,417	5,733
Victoria ... Ore	7,334	5,092	4,181	6,070	7,067	3,706	3,417	5,733
Queensland ... Ore	193,699	116,387	93,723	341,566	244,927	243,271	307,847	364,503
West Australia (Ore & Ingot)	...	10,200	40,000	83,595	65,959	45,129	55,220	70,578
Tasmania ... Ore	375,775	293,170	212,542	421,580	418,165	399,393	513,500	543,103
Northern Territory Ore	...	1,938	5,586	35,876	32,741	31,113	22,900	27,001
Commonwealth ...	1,145,603	560,750	432,576	1,094,134	979,888	950,768	1,209,973	1,348,992

* Dressed tin ore, about 70% tin. † Tin ingot and ore. ‡ Not available.

2. **Sources of Production.**—(i.) *New South Wales.* The bulk of the output in New South Wales was obtained by dredging, the quantity so won in 1912 being 1621 tons, valued at £223,813. In the Tingha division the yield amounted to 1006 tons, valued at £139,865, the yield from dredging being estimated at £104,006. The Emmaville division in the New England district shewed a yield of 1118 tons of ore, valued at £156,590, of which dredging produced 743 tons, valued at £104,090. In the Wilson's Downfall division 167 tons, valued at £23,285, were raised. The new field at Ardlethan, discovered in January, 1912, produced about 500 tons of ore, of which 379 tons realised £7741.

(ii.) *Victoria.* In Victoria lode tin has been discovered at Mt. Wills, Beechworth, Eldorado, Chiltern, Stanley, and other places in the north-eastern district; and stream tin has been found in a large number of places, including those just mentioned in the north-eastern district. The bulk of the production in 1912 was obtained by the Cocks Pioneer, at Beechworth, and the Walwa Tin Mining Company, at Walwa.

(iii.) *Queensland.* The continued high price of the metal during 1912 was reponsible for renewed activity in tin mining, particularly in the Herberton district, where there was increased development in existing mines, while great attention was devoted to recent discoveries and also to deposits hitherto regarded as insufficiently productive. Besides the ordinary creek and stream alluvial, extensive layers of stanniferous wash capping many of the ridges have been profitably worked. The yield for this district amounted in 1912 to £209,893. From the other chief districts the yields were as follows:—Chillagoe, £51,777; Cooktown, £36,233; Stanthorpe, £21,428 and Kangaroo Hills, £20,340.

(iv.) *Western Australia.* The production of tin ore and ingot for the State during 1912 amounted to 575 tons, valued at £70,578, to which the Greenbushes field contributed 430 tons, valued at £50,166, and the Pilbara field 123 tons, valued at £14,993. Production at the former field shewed increased activity during the year, but in view of the high prices ruling for the metal the decrease at the latter is difficult to understand.

(v.) *Tasmania.* The tin ore raised in 1912 amounted to 3713 tons, valued at £543,103, the largest contributor to the total being the Mount Bischoff Co. in the North Western Division. This company treated 230,506 tons of ore from which 1200 tons of tin oxide valued at £168,000 were obtained. The dividends paid for the year amounted to £75,000, and the total to the end of 1912 to £2,362,500. The Mt. Bischoff Extended produced 171 tons of calcined tin oxide. In the North-Eastern Division, the Briseis Co. produced 538 tons of black tin, valued at £82,000; the Pioneer obtained 463 tons, valued at £75,000. In the Eastern Division the Anchor Co. Ltd. produced 143 tons, valued at £20,000. In the Western Division the Renison Bell produced 62 tons of metallic tin, valued at £12,716.

(vi.) *Northern Territory.* Mount Wells, in the Burrundie district, has yielded a fair output of tin since 1886, but the present system of handling the ore is reported to be costly, the mining being done by tributors, whose parcels have to be kept separate. About 60 men, mostly Chinese, are employed at the mine. Copper, silver lead and tin shows occur abundantly in the district, but little work has been done on them. Great hopes for the future are placed by the Department in the Horseshoe Creek tinfield, although, so far, it has been worked in the usual slipshod way. The production of tin in 1912 amounted to 271 tons, of which 100 tons were obtained at Burrundie, 40 tons at Horseshoe Creek and Mount Todd, 30 tons at Umbrawarra, and 21 tons at the West Arm and Bynoe Harbour.

3. *World's Production of Tin.*—According to "The Mineral Industry" the world's production of tin during each of the last five years was obtained as follows:—

THE WORLD'S TIN SUPPLIES, 1908 to 1912.

Country in which Smelted.	1908.	1909.	1910.	1911.	1912.
	Tons.	Tons.	Tons.	Tons.	Tons.
Australia	6,700	6,450	5,500	5,150	5,130
Austria-Hungary	39	52	39	16	14
Banka, Sales in Holland	11,710	12,150	13,631	15,147	16,111
Billiton, Sales in Holland and Java	2,270	2,280	2,240	2,240	2,243
Bolivia, Exports to England	1,174	834	1,003	464	552
China, Exports	4,836	4,516	6,510	6,056	8,785
France ... ..	...	...	...	500	500
Germany, mainly Bolivian ores	6,374	8,995	11,394	12,426	12,500
Japan	26	23	23	155	175
Straits Settlements, Exports	63,690	61,540	57,490	57,944	61,528
United Kingdom, domestic ores	5,133	5,282	4,874	4,950	5,061
United Kingdom, imported ores	11,614	11,890	13,055	13,850	13,600
Total (metric tons)	113,566	114,012	115,759	118,898	126,199

The totals are exclusive of output from the native smelters in Central and South Africa, exports from Siam and the Dutch East Indies to India, China, Korea and Japan, and local consumption in Straits Settlements, Siam, and Dutch East Indies, omissions in these and a few other cases being due to lack of returns.

4. **Prices of Tin.**—The average price of the metal in the London market for the year 1897 and from 1902 to 1912 was as follows:—

PRICE PER TON OF TIN, 1897 to 1912.

Year.			Price per Ton.			Year.			Price per Ton.		
			£ s. d.						£ s. d.		
1897	...	...	61	8	0	1907	...	...	172	12	9
1902	...	...	120	14	5	1908	...	...	133	2	6
1903	...	...	127	6	5	1909	...	...	134	15	6
1904	...	...	126	14	8	1910	...	...	155	6	2
1905	...	...	143	1	8	1911	...	...	192	7	0
1906	...	...	180	12	11	1912	...	...	209	8	5

According to "The Mineral Industry" the maximum price obtained for tin during the period 1897-1912 was reached in October, 1912, when the metal was quoted at £228 9s. 1d. per ton.

5. **Employment in Tin Mining.**—The number of persons employed in tin mining, in 1901 and during the last five years is shewn below:—

PERSONS ENGAGED IN TIN MINING, COMMONWEALTH, 1901 and 1908 to 1912.

Year.	N.S.W.	Victoria.	Qld.	W. Aust.	Tas.	Nor. Ter.	C'wealth.		
	No.	No.	No.	No.	No.	No.	No.		
1901	1,428	...	1,148	413	1,065	...	4,054
1908	2,456	53	2,140	614	1,588	384	7,235
1909	2,037	48	2,158	406	1,576	355	6,580
1910	2,028	25	1,932	326	1,598	322	6,231
1911	2,225	34	1,860	321	1,755	280	6,475
1912	2,646	57	2,153	409	1,762	287	7,314

7. Zinc.

1. **Production of Zinc.**—The production of spelter is practically confined to the Broken Hill district of New South Wales, where zinblende forms one of the chief constituents in the enormous deposits of sulphide ores.

Gratifying results have been achieved in the work of the profitable extraction of the zinc contents of the large heaps of accumulated tailings and from the ore raised on the Broken Hill field. The year 1909 witnessed the passing of this problem out of the experimental stage, and the practical solution of the difficulty which had confronted the mining companies for many years. At present not only is the zinc being obtained in a marketable form, but the silver and lead contents are being turned to profitable account. During 1912 the various process plants on the field were all in continuous operation, and improvements were effected tending towards simplicity of construction and increased capacity. In 1899 the exports of zinc (spelter and concentrates) amounted to 49,879 tons; in 1909 they totalled 373,906 tons, valued at £1,041,280; and in 1912, 520,518 tons, valued at £1,766,242, the great bulk of the production being obtained from tailings. The following table shews the production of zinc in New South Wales from 1889 to 1912:—

NEW SOUTH WALES.—PRODUCTION OF ZINC, 1889 to 1912.

Year.	Quantity of Zinc (Spelter and Concentrates) Produced.	Value.	Year.	Quantity of Zinc (Spelter and Concentrates) Produced.	Value.
	Tons.			Tons.	
1889	97	£ 938	1909	373,906	1,041,280
1891	219	2,622	1910	468,627	1,289,634
1899	49,879	49,207	1911	516,378	1,414,980
1908	276,720	600,883	1912	520,518	1,766,242

The total quantity of zinc (spelter and concentrates) produced in New South Wales to the end of the year 1912 was 2,819,718 tons, valued at £7,539,913. The average price of spelter per ton in the London market during the last seven years was £23 19s. 8d., ranging from £20 8s. 3d. in 1908 to £27 0s. 5d. in 1906. The price in 1912 was £26 8s. 5d.

At the Silver Spur mine at Texas, in the Stanthorpe division in Queensland, part of the ore is high in zinc and lead, but low in silver. Profitable extraction of the zinc and lead depends, however, on railway connection with the mine.

During the year 1912, 14 tons of zinc, valued at £217, were raised in Western Australia.

The zinc contents of the ores treated by the Tasmanian Smelting Company at Zeehan were stated to have amounted to 12,000 tons for the year ended June, 1913.

§ 8. Iron.

1. **General.**—The fact that iron-ore is widely distributed in the Commonwealth has long been known, and extensive deposits have been discovered from time to time at various places throughout the States. It will appear, however, from what is stated below, that until quite recently, little has been done in the way of converting these deposits into a marketable commodity.

(i.) *The Manufactures Encouragement Act 1908-12.* It was hoped that the passing by the Commonwealth Parliament of the Manufactures Encouragement Act, which came into force on the 1st January, 1909, would assist in firmly establishing the iron industry in Australia on a remunerative basis, both in the smelting of pig iron and in the production of bar iron and steel from Australian ore. The Act referred to, together with its amendment in 1912, provides for the payment of bounties on iron in accordance with the terms set out hereunder:—

BOUNTIES PAYABLE ON AUSTRALIAN PIG IRON, BAR IRON, STEEL, Etc.

Description of Goods	Rate of Bounty.	Total Amount which may be authorised.	Date of Expiry of Bounty.
CLASS 1.			
Pig iron made from Australian ore	12s. per ton	£150,000	30th June, 1914
Puddled bar iron made from Australian pig iron	„		
Steel made from Australian pig iron	„		
CLASS 2.			
Galvanised sheet or plate iron or steel (whether corrugated or not) made from Australian ore	10 per cent. on value	£30,000	30th June 1914
Wire netting, not being prison made and being made from Australian ore or from wire manufactured in the United Kingdom	10 per cent. on value		
Wire made from Australian ore	10 per cent. on value		
Iron and steel tubes or pipes (except riveted or cast), not more than six inches internal diameter, made from Australian pig iron or steel	10 per cent. on value		

Particulars of the bounties paid under the above Act during the half-year ended the 30th June, 1909, and during the financial years 1909-10 to 1912-13, are shewn in the following statement:—

PARTICULARS OF BOUNTIES PAID ON AUSTRALIAN PIG IRON, BAR IRON, STEEL, Etc., 1909 to 1913.

Description of Goods.	Steel made from Australian Pig Iron.	Puddled Bar Iron made from Australian Pig Iron.	Pig Iron made from Australian Ore.	Galvanised Sheet Iron made from Australian Ore.	Wire netting made from wire manufactured in the United Kingdom	Total.
	£	£	£	£	£	
Half-year ended 30th June, 1909	575	568	2,314	192	...	3,649
1909-10	1,491	1,254	23,510	287	6,036	32,578
1910-11	1,940	2,080	20,462	121	4,824	29,427
1911-12	723	671	15,611	74	5,968	23,047
1912-13 ... ..	...	38	16,949	...	1,110	18,097
Total	4,729	4,611	78,846	674	17,938	106,798

So far New South Wales is the only State where bounty has been claimed, and the above figures, taken in conjunction with those in the succeeding table, show that production has not been as rapid as might have been expected.

2. Production of Iron.—(i.) *New South Wales.* Reference to the extent of the deposits of iron ore in the State, and the events leading up to the establishment of ironworks at Lithgow, will be found in earlier issues of the Year Book (see No. III., p. 508). During 1912 the following materials were received at the blast furnace:—Iron ore, 55,170 tons; limestone, 20,399 tons; and coke, 51,102 tons. The output was 36,277 tons of pig iron. No steel ingots were made during the year.

The Broken Hill Proprietary Company has obtained the necessary powers, and proposes to undertake the manufacture of iron and steel on a large scale at Newcastle. It is estimated that the plant and works will be in operation in about two years.

The following table shews the quantity and value of finished iron, pig iron, etc., made in New South Wales during the last seven years, chiefly from scrap iron, but since 1908 partly from the smelting of iron ore:—

NEW SOUTH WALES.—PRODUCTION OF IRON, 1906 to 1912.

Particulars.		1906.	1907.*	1908.†	1909.‡	1910.§	1911.§	1912.§
Quantity	Tons	8,000	29,902	40,207	29,762	40,487	36,354	32,677
Value ...	£	112,848	178,632	118,224	106,357	161,948	145,416	130,708

* Includes 18,631 tons pig iron, valued at £60,550, produced from 34,500 tons of iron ore raised within the State. † Includes 30,393 tons pig iron, valued at £98,777, from 51,206 tons of ore raised within the State. ‡ Includes 26,762 tons pig iron, valued at £100,357, from 46,740 tons of iron ore raised within the State. § From ore raised within the State.

The bounty paid in 1911 and 1912 on iron and steel made from ores mined in New South Wales was as follows:—

BOUNTY PAID ON IRON AND STEEL, NEW SOUTH WALES, 1911 and 1912.

Description.	1911.		1912.	
	Tonnage.	Bounty.	Tonnage.	Bounty.
Pig iron	24,658	£ 14,795	31,104	£ 18,663
Puddled bar iron	1,789	1,073	549	329
Steel	2,633	1,580	...	...
Total	29,080	17,448	31,653	18,992

A quantity of iron oxide is purchased by the various gasworks for use in purifying gas, the output in New South Wales being drawn chiefly from the deposits at Port Macquarie, while smaller quantities are obtained from Mittagong and Goulburn. During 1912 the quantity raised was 3757 tons, valued at £4763, while the total output to the end of that year was 23,696 tons, valued at £30,747. The quantity of ironstone disposed of for flux is decreasing, since the requirements of the smelting companies have fallen off, owing to suitable ores being obtained. In 1912 the quantity raised was 1093 tons, valued at £761, as against 1216 tons, valued at £861, in the preceding year.

(ii.) *Victoria.* Iron ore has been located at various places in Victoria, particularly at Nowa Nowa, in the Gippsland district, and at Dookie. A blast furnace was erected in 1881 near Lal Lal, on the Moorabool River, and some very fair quality iron was produced, which was used for truck wheels and stamper shoes in the Ballarat mines. The fall in the price of the metal, however, led to the closing of the works. In his report for 1905 the Secretary for Mines states that without special assistance to the industry there does not seem to be any prospect of the deposits being profitably worked.

(iii.) *Queensland.* Queensland possesses some extensive deposits of iron ore, which is mined chiefly for fluxing purposes in connection with the reduction of gold and copper ores. During the year 1912, 15,526 tons of ironstone, valued at £9035, were raised, the bulk of the production being in the Chillagoe and Cloncurry districts.

(iv.) *South Australia.* In South Australia iron ore is raised for fluxing purposes only, although the State possesses some rich deposits capable of being mined for an indefinite period. The best known deposit is the Iron Knob, a veritable hill of iron of high percentage, situated about forty miles W.S.W. from Port Augusta. The estimated quantity of iron ore in sight at the Iron Knob and Iron Monarch has been set down at 21,000,000 tons. The Broken Hill Company intends to treat ore from this quarry at its ironworks at Newcastle, New South Wales.

(v.) *Western Australia.* This State has some very rich deposits of iron ore, but owing to their geographical position, the most extensive fields at the present time are practically unexploited, the production in the State being confined chiefly to that needed for fluxing purposes. The Murchison field possesses some extensive deposits of high-grade ore. There are also deposits on Koolan Island at Yampi Sound.

(vi.) *Tasmania.* The existence of large quantities of iron ore in Tasmania was noted as far back as 1822, when Surveyor-General Evans alluded to the "surprising abundance of iron within a few miles of Launceston." A company known as the Tasmanian Charcoal Iron Company was formed to work these deposits, and commenced operations in June, 1876. Unfortunately, however, the presence of chromium rendered the pig iron so hard and brittle that the works had to be abandoned. Extensive deposits of specular iron ore are also found in the neighbourhood of the Blythe and Gawler Rivers. The total production of iron ore in 1908 was 3600 tons, valued at £1600, and

was all raised by the Tasmanian iron mine at Penguin, but owing to the closing down of that mine in 1909, there has been no further production. Iron pyrites for the manufacture of sulphuric acid and of manures, is produced on the West Coast.

(vii.) *Northern Territory.* Boulders of pure hematite have been found in the country between Eureka and Pine Creek, and it is stated by the Director of Mines that these are probably derived from large accretions in the neighbouring mountains.

(viii.) *World's Production of Iron, 1911.* The quantity of iron produced in Australia is but a very small proportion of the world's production, which in 1911 amounted to 63,252,000 metric tons (pig iron). The leading position for magnitude of production is held by the United States, which in 1911 produced 24,028,000 tons, compared with Germany's 15,280,000 tons, and the United Kingdom 9,875,000 tons. The position of the three countries named is similar to what it has been for several years past.

§ 9. Other Metals.

1. **Antimony.**—This metal is widely distributed in New South Wales, and has been found native at Lucknow, near Orange. Dyscrasite, a silver antimonide, has been found in masses up to one ton in weight in the Broken Hill lodes. Antimony is also obtained in the Hillgrove district, and deposits are being worked in the Port Macquarie Division and at Yulgilbar in the Copmanhurst Division. Deposits are occasionally worked in the Macleay and Bellinger River Districts when market values afford a margin of profit. It has also been found at various places in Victoria, chiefly in association with gold. In 1912 the export of antimony metal and ore from New South Wales amounted to £355. The total quantity of antimony ore raised in New South Wales up to the end of 1912 was 16,654 tons, valued at £305,224. The production of antimony ore in Victoria during 1912 amounted to 2430 tons, valued at £16,162. The ore was raised by a syndicate operating at Costerfield. In Queensland extensive deposits were discovered at Neerdie, in the Wide Bay district, during 1872, also at Wolfram Camp on the Hodgkinson field, on the Palmer River, in the Ravenswood district, and on the Mitchell River in the Herberton district. In Western Australia lodes of stibnite carrying gold have been found in the Roeburne district.

2. **Arsenic.**—In the form of arsenopyrite, arsenic is of wide distribution in Victoria, but the deposits are worked to a limited extent only. At Ballarat a small quantity of the oxide is obtained from the flues of roasting furnaces. In New South Wales about 200 tons of arsenic were obtained in 1910 by the Conrad Mines Ltd. at Howell.

3. **Barium.**—A valuable lode of barium sulphate has been discovered near Dalwin, on the North Lyell railway, in Tasmania, and it is proposed to develop the deposit. It is stated that the lode is from 2½ to 7 feet wide over a length of over 40 chains.

4. **Bismuth.**—This metal has been found in New South Wales, near Glen Innes, and also in the vicinity of Pambula, its discovery dating from 1877. About 6 tons of metal and ore, valued at £1210, were exported from New South Wales during 1912; the total quantity exported to the end of that year was 541 tons, valued at £128,537. In Queensland wolfram, molybdenite, and bismuth have been found in various districts, but the chief centres of production in 1912 were the Herberton and Chillagoe fields. The total production in 1912 was valued at £77,082, of which £57,821 was returned as wolfram, £2835 as bismuth, and £16,426 as bismuth and wolfram. In South Australia deposits are found at Balhannah, at Mount Macdonald, and at Murninnie, on the shores of Spencer's Gulf. In Tasmania 7 tons, valued at £2606, were raised in 1912 by the Shepherd and Murphy mine at Middlesex.

5. **Chromium.** In New South Wales chromium is found at Bowling Alley Point, on the Peel River, at Barraba, at Gordon Brook, in the Clarence River district, at Bingara, Wallendbeen, and near Gundagai. The production during recent years has been trifling. The total exports to the end of 1912 amounted to 30,835 tons, valued at £101,468. Chrome iron ore is found in Queensland in the Rockhampton district, where the Elgalla mine, at Cawarral, produced a small quantity in 1911. There was also some production from the mine near Broadmount.

6. **Carnotite.**—A discovery of carnotite ore was made in 1906 twenty miles E.S.E. from the Olary railway station in South Australia. (See also "Radium.")

7. **Cobalt.**—This metal was found at Carcoar in New South Wales in 1889, and subsequently at Bungonia, Port Macquarie, and various other places. There was no export of cobalt in 1912, and the total produced since 1860 amounted in value to only a little over £8000. Deposits have been noted in South Australia near Bimbourie, and South Blinman; in Western Australia at Norseman and Kanowna; and at various places in Victoria.

8. **Lead.**—This metal was first noted in New South Wales in 1849, when small specimens of native metal were found by the Rev. W. B. Clarke. At present lead mining *per se* is not practised to any extent in the Commonwealth, the supply of the metal being chiefly obtained in conjunction with silver. In New South Wales the lead contents of the bullion produced within the State amounted in 1912 to 17,251 tons, valued at £264,530. The total lead production to the end of 1912 was 138,192 tons, valued at £2,000,911. In Victoria oxides, sulphides, and carbonates of lead are found in the reefs of most of the goldfields. The deposits are not, however, of sufficient extent to repay the cost of working. In Queensland the deposits are worked chiefly for the silver, copper or gold contents of the ore, the lead produced in 1912 amounting to 3108 tons, valued at £55,667, of which 1956 tons, valued at £35,938, were produced from the mines in the Chillagoe district, 689 tons, valued at £11,713, from Herberton, and 204 tons, valued at £3729, from the Etheridge district. Lead ore to the value of £22,565 was exported from Western Australia in 1912. Complete information is not available as to the lead contents of Tasmanian silver lead ores. At one time South Australia produced a fair amount of lead, £22,303 worth being raised in 1902, but the production rapidly decreased, there having been no output for the last two years.

9. **Mercury.**—In New South Wales mercury was first recorded by the Rev. W. B. Clarke in 1841. Cinnabar has been found in lodes and impregnations at various places, such as Bingara, Clarence River, etc. Up to the present the production of quick-silver has been small, the total being only a little over 1000 lbs. In Victoria native mercury and cinnabar have been found at Silver Creek, a tributary of the Jamieson River. Lodes of cinnabar have been found in Queensland at Kilkivan, and at Black Snake, in the Wide Bay district; about four tons were produced between 1824 and 1891. Between O.K. and Mungana several shows have been prospected with encouraging results. Small quantities have been found disseminated over a large area near Willunga in South Australia.

10. **Manganese.**—Ores of this metal occur in widely separated districts in New South Wales, but the low price of the metal precludes mining to any great extent, and the production to date has been trifling. In Queensland there are extensive deposits at Mount Miller, at Gladstone, and Mount Nansen, near Gympie, the product being utilised chiefly by the Mount Morgan mine. The production from the Mount Miller mine amounted in 1912 to 308 tons of ore, valued at £1281. Small quantities of manganese ore were raised in Victoria during 1912 from mines in the vicinity of Heathcote. Extensive deposits of the ore were mined at Boolcunda in South Australia some years

ago, but latterly the production has ceased. Deposits have also been noted at Kangaroo Island, Quorn, Tumbly, and various other parts of the State. In Western Australia ores of the metal are found widely scattered, the black oxide being especially plentiful in the Kimberley district.

11. **Molybdenum.**—In New South Wales molybdenite (associated with bismuth) is obtained at Kingsgate, near Glen Innes, at Deepwater, and at Whipstick, in the Pam-bula division, the export in 1912 being 57 tons, valued at £3706, as compared with 20 tons, valued at £2591, in the previous year. The production in Queensland for 1912 was 102 tons, valued at £17,349, practically the whole of which was contributed by the mines in the Chillagoe field.

12. **Radium.**—(i.) It is reported that there have been several definite discoveries in Australia of the occurrence of minerals containing radium. The discovery at Olary, in South Australia, of carnotite, which is an alteration product of pitchblende, the compound from which radium is obtained, has already been referred to. In 1910 pitchblende was identified in portion of the workings at Olary, and a specimen, exhibiting a high degree of radio-activity, was obtained. This is the first authentic discovery of the mineral pitchblende in Australia. The deposits of radio-active uranium ores found at Radium Hill are now being mined, and the concentrates forwarded to Sydney for treatment at the company's works at Woolwich. In another case a monazite from Pilbara, Western Australia, has been shewn to give off radium emanations. This mineral has been called "pilbarite." Yet another specimen of mineral having the composition of a secondary pitchblende has been discovered by a prospector. The exact place where this specimen was found is uncertain, but it is believed that it came from the New England district of New South Wales. It is stated that its radio-activity is very marked, the mineral being 1 per cent. more active than the Bohemian variety, and that it contains only such elements as were readily separable from one another by the methods used to obtain pure uranium and radium from Bohemian pitchblende. Lastly, it is stated that the ores obtained at the Moonta mines, South Australia, contain from one-tenth to one-fifteenth of the amount of radium found in high-grade pitchblende, and that a product having a fairly high degree of radio-activity can be extracted therefrom with comparative ease.

(ii.) *Production of Radium Bromide.*—At the end of November, 1912, a small quantity of radium bromide was produced at the Radium Hill Co.'s works at Woolwich, Sydney, this being the first occasion on which a marketable amount of this salt has been obtained outside of Europe. It is estimated by the chemist in charge that the present plant at the works is capable of providing £600 worth of radium weekly.

13. **Tungsten.**—Wolfram and scheelite, the principal ores of tungsten, are both mined to a small extent in New South Wales. During 1912 the export of wolfram was 172 tons, valued at £16,584, and of scheelite 56 tons, valued at £4963. Wolfram was mined chiefly at Torrington, in the Deepwater division, and scheelite at Hillgrove. A mine near Omeo, in Victoria, was developed during 1909, and 5 tons of concentrates, valued at £464, were produced during 1912, and 3 tons, valued at £60, produced at Bendoc. In Queensland, tungsten ores are found in several districts, the chief centres of production in 1912 being Chillagoe and Herberton. (See also Bismuth, page 426.) A deposit of wolfram was discovered near Yankalilla in South Australia as far back as 1893, but the production up to date has been small. In the Northern Territory 27 tons of wolfram, valued at £4160, were raised during 1912 in the Wolfram Camp area, and 11 tons, valued at £960, at Yenberrie.

In Western Australia a deposit of wolfram was discovered in the West Kimberley district, about 70 miles to the north-east of Derby; nine tons, valued at £826, were raised during 1911, but there was no production in 1912. Wolfram is mined at various points in Tasmania, the production for 1912 being 66 tons, valued at £6601, obtained chiefly at Avoca and from the Shepherd and Murphy mine at Middlesex. Scheelite has been discovered on King Island in Bass Strait.

14. **Tantalum.**—Tantalite in small quantities has been found in the Greenbushes mineral field of Western Australia for some time past, but recently a lode of fairly extensive proportions was located at the Wodgina tinfield. Up to the end of 1905 the production of this mineral in Western Australia amounted to 73 tons, valued at about £10,000, but early in 1906 it was found that the supply exceeded the demand and production was temporarily stopped; in 1908 a small quantity valued at £400 was exported. About £327 worth was reported as having been raised in the Greenbushes and Pilbara fields during 1909, but none was exported owing to the entire absence of any market. No production was recorded subsequently. Small quantities of the mineral are also found in the Northern Territory.

15. **Uranium.**—This mineral has been discovered in South Australia in the country between Mount Painter and Mount Pitts, about 80 miles east from Farina. The uranium ores occur most frequently in the form of torbernite and autunite, and are found over a considerable area. The discovery is therefore of considerable importance, since ores of this mineral are found to a very limited extent in other parts of the world, and uranium is the chief source from which radium is derived.

In addition to the metals enumerated above there is a large number of others occurring in greater or less degree, while fresh discoveries are being constantly reported.

(B). NON-METALLIC MINERALS.

§ 10. Coal.

1. **Production in each State.**—(i). *Historical.* A historical account of the discovery of coal in each State will be found in preceding issues of the Year Book. (See No. III., pp. 515-6.)

(ii.) *New South Wales.* The production in 1912 amounted to 8,885,815 tons, valued at £3,660,015, the highest yet recorded.

(iii.) *Victoria.* During 1912, 593,155 tons of coal were raised, valued at £259,321. Of this total 455,659 tons, valued at £184,056, were raised by the State coal mine at Wonthaggi.

(iv.) *Queensland.* The number of collieries contributing to the output in 1912 was 48, and the quantity of coal raised was 902,166 tons, valued at £338,264, as against 891,568 tons, valued at £323,998, for the preceding year. Thirty-four collieries were working in the Ipswich district, seven on the Darling Downs, and seven in the Central district. The industry is at present in very satisfactory position in the northern State, and owing to the wide area over which the deposits stretch, practically no limit can be set to its possibilities of extension.

(v.) *Western Australia.* Six collieries were in operation on the Collie field during 1912, and the output for the year was 295,079 tons, or about 45,000 tons more than in 1911. The improvement is due to the more general use of up-to-date machinery.

(vi.) *Tasmania.* The principal collieries in Tasmania are the Cornwall and Mount Nicholas, the former producing 22,000 and the latter 30,000 tons out of a total yield in 1911 of 57,067 tons.

The quantity and value of coal produced in each State and in the Commonwealth at various periods since 1881, are shewn in the following table:—

PRODUCTION OF COAL, AUSTRALIA, 1881 to 1912.

Year.	N.S.W.	Victoria.	Q'land.	S. Aust.	W. Aust.	Tas.	C'w'lh.
QUANTITY.							
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
1881	1,769,597	...	65,612	...	...	11,163	1,846,372
1891	4,037,929	22,834	271,603	...	...	43,256	4,375,622
1901	5,968,426	209,329	539,472	...	117,836	45,438	6,880,501
1908	9,147,025	113,962	696,332	...	175,248	61,068	10,193,635
1909	7,019,879	128,673	756,577	...	214,302	66,162	8,185,593
1910	8,173,508	369,709	871,166	...	262,166	82,455	9,759,004
1911	8,691,604	659,998	891,568	...	249,890	57,067	10,550,127
1912	9,885,815	593,155	902,166	...	295,079	53,560	11,729,775
VALUE.							
	£	£	£	£	£	£	£
1881	603,248	...	29,033	...	...	4,465	636,746
1891	1,742,796	19,731	128,198	...	...	17,303	1,908,028
1901	2,178,929	147,228	189,877	...	68,561	18,175	2,602,770
1908	3,353,093	64,778	244,922	...	75,694	24,427	3,762,914
1909	2,615,596	76,945	270,726	...	90,965	26,464	3,089,696
1910	3,009,657	189,254	322,822	...	113,699	48,609	3,684,041
1911	3,167,165	301,141	323,998	...	111,154	26,214	3,929,672
1912	3,660,015	259,321	338,264	...	135,857	24,568	4,418,025

The Victorian figures for 1912 include about 4000 tons of brown coal, the bulk of which was raised at Altona.

2. **Distribution and Quantity of Coal in each State.**—(i.) *New South Wales.* Estimates have from time to time been made as to the total quantity of coal available for working in the deposits in New South Wales, and while these naturally differ to some extent, they agree in placing the amount at well over a thousand million tons, without taking into consideration the deposits existing below a depth of 4000 feet. According to Mr. E. F. Pittman, the coal-bearing rocks of New South Wales may be classified as follows:—

COAL-BEARING ROCKS OF NEW SOUTH WALES.

Geological Age.	Maximum Thickness of Coal-bearing Strata.	Locality.	Character of Coal.
I. Tertiary—Eocene to Pliocene	Approx. 100 ft.	Kiandra, Gulgong, and Chouta Bay	Brown coal or lignite.
II. Mesozoic—Triassic or Trias-Jura	2,500 "	Clarence and Richmond Rivers	Coal suitable for local use only.
III. Palæozoic—Permo-Carboniferous	13,000 "	Northern, Southern and Western Coalfields	Good coal, suitable for gas, household and steaming.
IV. Palæozoic—Carboniferous	10,000 "	Stroud, Bullah Dellah.	Very inferior coal with bands; of no value.

In regard to the Tertiary deposits, it may be noted that no serious attempt has been made to use the coal as fuel in New South Wales. At Kiandra a deposit of lignite was found to possess a maximum thickness of 30 feet, but as a general rule the seams vary from 3 to 4 feet in thickness. The Triassic or Trias-Jura deposits in the Clarence and Richmond districts contain numerous seams, but the coal is largely intersected by bands, while its large percentage of ash renders it unfit for use as fuel for industrial purposes. These beds extend under the great western plains but the presence of artesian water

precludes the possibility of their being worked. The Clarence basin extends into Queensland, and at Ipswich thick and valuable seams of coal are worked. It is in the Permo-Carboniferous division that the great productive coal seams of the State are found, the area which they cover being estimated at about 16,550 square miles. The deepest part of the basin is somewhere in the vicinity of Sydney, where the "Sydney Harbour Colliery" is working the top seam at a depth of 2384 feet. Towards the north, south and west the seams rise towards the surface, and outcrop in the neighbourhood of Newcastle, Bulli and Lithgow. The coal from the various districts embraced in this division differs considerably in quality—that from the Newcastle district being especially suitable for gas-making and household purposes, while the product of the Southern (Illawarra) and Western (Lithgow) is an excellent steaming coal. At the present time the Greta coal seams are being extensively worked between West Maitland and Cessnock, and this stretch of country, covering a distance of fifteen miles, is now the most important coal mining district in Australasia. The Permo-Carboniferous measures have in various places been disturbed by intrusions of volcanic rocks, which in some instances have completely cindered the seams in close proximity to the intrusive masses, while in other instances the coal has been turned into a natural coke, some of which has realised good prices as fuel.

The table hereunder gives the yields from the various divisions at intervals from 1881 to 1912:—

COAL RAISED IN NEW SOUTH WALES, 1881 to 1912.

District.	1881.		1901.		1905.		1912.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons.	£	Tons.	£	Tons.	£	Tons.	£
Northern ...	1,352,472	437,270	3,999,252	1,669,519	4,645,742	1,473,995	6,913,810	2,798,764
Southern ...	253,283	115,505	1,544,454	407,196	1,556,678	421,768	2,172,800	661,512
Western ...	163,842	50,473	424,720	102,214	429,718	107,698	799,205	199,739
Total ...	1,769,597	603,248	5,968,426	2,178,929	6,632,138	2,003,461	9,885,815	3,660,015

Sydney Harbour Colliery. This colliery possesses considerable interest from the circumstance that its workings are amongst the deepest in the world. Extended reference to the history of its opening will be found in preceding Year Books. (See No. VI., page 504.)

(ii.) *Victoria.* The deposits of black coal in Victoria occur in the Jurassic system, the workable seams, of a thickness ranging from two feet three inches to six feet, being all in the Southern Gippsland district.

Deposits of brown coal and lignite of immense extent occur in gravels, sands, and clays of the Cainozoic period throughout Gippsland, Mornington Peninsula, Werribee Plains, Gellibrand, and Barwon and Moorabool basins. In the Latrobe Valley the beds reach a thickness of over 800 feet. When dried, the material makes good fuel, but owing to its excessive combustibility and friability requires to be consumed in specially constructed grates. Attempts have been made to manufacture briquettes from the brown coal, but so far without any great measure of success. At the Melbourne and Altona Colliery Company's mine at Altona, 3942 tons of brown coal, valued at £850, were raised in 1912.

The output of coal from the chief Victorian collieries during the last ten years was as follows:—

PRODUCTION OF COAL IN VICTORIA, 1903 to 1912.

Year.	State Coal Mine.	Outtrim Howitt Company	Jumbunna Coal Company	Coal Creek Proprietary.	Silkstone Co-operative Company	Austral Coal.	Other Companies.	Total Production.	Value.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	£
1903	...	20,602	18,517	20,727	4,354	...	5,661	69,861	43,645
1904	...	57,328	39,364	22,547	2,014	...	489	121,742	70,208
1905	...	71,989	49,009	27,710	1,624	...	4,804	155,136	79,060
1906	...	74,812	64,222	13,214	3,977	...	4,406	160,631	80,283
1907	...	64,083	61,755	3,762	7,565	...	1,470	138,635	79,706
1908	...	47,633	58,552	...	6,967	...	810	113,962	64,778
1909	2,946	44,156	65,945	3,265	...	10,631	1,730	128,673	76,945
1910	201,053	46,832	61,954	10,968	...	36,052	13,050	369,909	189,254
1911	506,059	28,359	57,397	4,589	...	34,607	28,987	659,998	301,141
1912	455,659	24,326	53,306	4,829	...	31,506	23,529	593,155	259,321

Included in the total "for other companies" is an amount of 16,108 tons raised by the Powlett North Woolamai Collieries. The figures also include about 4000 tons of brown coal, the bulk of which was raised at Altona.

(iii.) *South Australia.* The coal from Leigh's Creek in South Australia is subject to similar disabilities to the Victorian brown coal, and until some means are devised of overcoming these, production will probably languish.

(iv.) *Queensland.* In Queensland the coal-bearing strata are of vast extent and wide distribution, being noted under the greater portion of the south-eastern districts, within 200 miles of the sea, as far north as Cooktown, and under portions of the far western interior. The Ipswich beds are estimated to occupy about 12,000 square miles of country, while the Burrum fields occupy a considerably larger area. At Callide, fifty miles west of Gladstone, a seam of coal free from bands has been struck in a shaft only sixty feet deep, and borings have proved the deposit to be of considerable magnitude. The beds in the Cook district are estimated to comprise rather more than 1000 square miles, but coal measures extend to the south-west far beyond Laura and to the north of the railway. Extensive beds occur in the basin of the Fitzroy River, in the Broadsound district, and at the Bowen River. Amongst other places where the mineral is found may be enumerated Clermont, the Palmer River, Tambo, Winton, Mount Mulligan, and the Flinders River. Boring operations have proved the existence of seams of workable coal for some distance on both sides of the Dawson River. A bituminous coal is yielded by the Ipswich seams, those of the Darling Downs yield a cannel, while anthracite of good quality is furnished by the Dawson River beds.

The quantity and value of coal raised in Queensland at various periods since 1861 were as shewn below:—

PRODUCTION OF COAL IN QUEENSLAND, 1861 to 1912.

Year ...	...	...	...	1861.	1871.	1881.	1891.	1901.	1912.
Quantity	...	Tons	...	14,212	17,000	65,612	271,603	539,472	902,166
Value	...	£	...	9,922	9,407	29,033	128,198	189,877	338,264

At present coal mining in Queensland is in a very satisfactory position, the increasing volume of the trade being chiefly due to the action of the Government in granting concessions to vessels coaling at local ports.

The distribution of production during the last two years was as follows:—

QUEENSLAND COLLIERIES, 1911 and 1912.

Collieries.	1911.		1912.	
	Tons Raised.	Average Value at Pit's Mouth.	Tons Raised.	Average Value at Pit's Mouth.
		s. d.		s. d.
Ipswich	624,071	6 5	598,505	6 7
Darling Downs	85,112	8 5	90,966	8 6½
Wide Bay and Maryborough	98,827	10 10	119,732	10 10½
Rockhampton	16,233	10 4½	13,462	10 6
Clermont	67,325	7 6	79,501	7 6
Total	891,568	7 3	902,166	7 6

Of the total production in 1912, 299,055 tons, or nearly one third, were shipped as bunker coal.

(v.) *Western Australia.* The coal seams in Western Australia belong to the Carboniferous, Mesozoic, and Post-tertiary ages. Most of the coal contains a large proportion of moisture, and belongs partly to the hydrous bituminous and partly to the lignite class. The only coalfield at present worked is at Collie, in the Mesozoic beds of the south-west. The coal produced is bright and clean, but very fragile when free from moisture. The increased output for the last few years is partly due to the establishment of a bunkering trade at Bunbury and Fremantle, and partly to the employment of improved machinery. The production from this field since 1901 was as follows:—

PRODUCTION OF COAL IN WESTERN AUSTRALIA, 1901 to 1912.

Year	1901.	1906.	1907.	1908.	1909.	1910.	1911.	1912.
Quantity Tons	117,836	149,755	142,373	175,248	214,302	262,166	249,890	295,079
Value £	68,561	57,998	55,158	75,694	90,965	113,699	111,154	135,857

(vi.) *Tasmania.* In Tasmania coal occurs in the following geological periods:—
 (1) Permo-Carboniferous: Lower Coal Measures. (2) Mesozoic: Upper Coal Measures.
 (3) Tertiary: Brown Coal and Lignite deposits. Permo-Carboniferous coal is found at Avoca, Mt. Nicholas and Fingal, Thomson's Marshes, Langloh, Seymour, York Plains, Mike Howe's Marsh, Longford, Colebrook, Schouten Island, Spring Bay and Prosser's Plains, Compton and Old Beach, Lawrenny, Longhole, Sandfly, Ida Bay, Hastings and Southport, Recherché and South Coast, Tasman's Peninsula. Deposits of lignite and brown coal are plentiful in beds of Tertiary age, but they have not been exploited to any extent. An estimate gives the approximate quantity of coal available as sixty-five million tons, of which eleven millions are in the Lower Coal Measures and fifty-four millions in the Upper Measures, exclusive of an unknown quantity in strata fringing the Central Tiers.

PRODUCTION OF COAL IN TASMANIA, 1901 to 1912.

District.	1901.	1906.	1907.	1908.	1909.	1910.	1911.	1912.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
North-western ...	2,952	1,878	1,045	...	1,543	1,720	1,496	956
Eastern ...	37,239	46,803	53,214	55,539	57,227	71,115	54,296	51,205
Midland ...	1,536	393	624	...	560	721	635	679
South-eastern ...	...	1,483	} 4,008	5,529	6,832	8,899	640	720
South-western ...	3,711	2,339						
Total ...	45,438	52,896	58,891	61,068	66,162	82,455	57,067	53,560

The bulk of the output in 1912 was raised from the Cornwall and Mt. Nicholas mines, which produced 22,353 and 28,717 tons respectively.

3. Production of Coal in Various Countries.—The total known coal production of the world in 1911 amounted to about 1140 million tons (exclusive of brown coal or lignite), towards which the Commonwealth contributed 10 million tons, or less than 1 per cent. The following table shews the production of the British Empire and the chief foreign countries in units of 1000 tons in 1901 and during each of the years from 1907 to 1911:—

COAL PRODUCTION, BRITISH EMPIRE, 1901 and 1907 to 1911.

Year.	United Kingdom.	British India.	Canada.	Australian C'wealth.	New Zealand.	Union of S. Africa.
	1000 tons.	1000 tons.	1000 tons.	1000 tons.	1000 tons.	1000 tons.
1901 ...	219,047	6,636	5,791	6,881	1,223	712
1907 ...	267,831	11,147	9,385	9,681	1,831	2,766
1908 ...	261,529	12,770	9,720	10,194	1,861	5,137
1909 ...	263,774	11,870	9,376	8,186	1,911	5,534
1910 ...	264,433	12,047	11,526	9,759	2,197	6,351
1911 ...	271,899	12,716	11,082	10,550	2,066	6,780

COAL PRODUCTION, FOREIGN COUNTRIES, 1901 and 1907 to 1911.

Year.	Russian Empire.	Sweden.	German Empire.	Belgium.	France.	Spain.	Austria-Hungary.	Japan.	United States.
	1000 tons.	1000 tons.	1000 tons.	1000 tons.	1000 tons.	1000 tons.	1000 tons.	1000 tons.	1000 tons.
1901 ...	16,215	268	106,795	21,856	31,126	2,609	12,895	8,885	261,875
1907 ...	25,583	300	140,885	23,324	35,411	3,637	14,881	13,656	428,896
1908 ...	25,487	300	145,298	23,179	36,044	3,823	14,843	14,587	371,288
1909 ...	26,232	243	146,397	23,140	36,519	3,799	14,868	14,806	411,432
1910 ...	24,460	298	150,372	23,532	37,030	3,751	14,834	15,429	447,854
1911 ...	22,824	307	158,164	22,683	38,023	...	15,000	15,763	443,025

Including New Zealand the production from Australasia takes second place amongst the possessions of the British Empire, British India coming first in order.

4. Export of Coal.—The exports of coal from the Commonwealth are practically confined to New South Wales.

The total quantity of coal of Australian production (exclusive of bunker coal) exported from the Commonwealth to other countries in 1912 was 2,152,385 tons, valued at £1,147,013, of which amount 2,153,600 tons, valued at £1,145,545, were exported from New South Wales. The quantity of bunker coal taken by oversea vessels was 1,670,841 tons, of which 1,388,000 tons were taken from New South Wales.

In the following table will be found the quantity and value of the exports at decennial intervals since 1881 and during the last five years. The figures for New South Wales are given on the authority of the Mines Department of that State, and include both bunker coal and coal exported from New South Wales to other States of the Commonwealth :—

EXPORTS OF NEW SOUTH WALES COAL, 1881 to 1912.

Year.	1881.	1891.	1901.	1907.	1909.	1910.	1911.	1912.
Quantity ... 1000 tons	1,030	2,514	3,471	5,744	4,394	4,690	5,024	6,053
Value ... £1,000	417	1,307	1,682	2,662	2,234	2,459	2,664	3,233

The principal oversea countries to which coal was exported from New South Wales during the year 1912 were as shewn hereunder. The quantity and value refer strictly to exports, and exclude bunker coal :—

DESTINATION OF NEW SOUTH WALES OVERSEA EXPORTS OF COAL, 1912.

Country.	Quantity.	Value.	Country.	Quantity.	Value.
	Tons.	£		Tons.	£
Chile	850,017	463,231	Peru	65,447	32,644
Philippine Islands ...	104,570	54,932	Hawaii... ..	61,979	31,782
Straits Settlements	113,376	62,005	United States ...	103,609	55,580
Fiji	30,256	14,756	India	123,330	62,045
New Zealand	387,391	209,505	Java	211,316	105,905

The quantity of bunker coal taken from New South Wales by oversea vessels was about 1,388,000 tons, valued at £775,000.

The distribution of the total output from New South Wales collieries during the last five years was as follows ; the particulars given of amounts exported include coal shipped as bunker coal :—

DISTRIBUTION OF TOTAL OUTPUT OF NEW SOUTH WALES COAL, 1908 to 1912.

Year.	Exports to Australasian Ports.	Exports to other Ports.	Local Consumption.	Total.
	Tons.	Tons.	Tons.	Tons.
1908	2,715,310	3,383,366	3,048,349	9,147,025
1909	2,200,769	2,192,834	2,626,276	7,019,879
1910	2,478,497	2,211,936	3,483,075	8,173,508
1911	2,525,776	2,498,304	3,667,524	8,691,604
1912	3,096,179	2,956,939	3,832,697	9,885,815

The figures quoted above are given on the authority of the New South Wales Mines Department. Owing to the abolition of the record of interstate trade it is impossible to give the quantities forwarded to each of the States of the Commonwealth.

5. **Consumption of Coal in Australia.**—An estimate of the consumption of coal in the Commonwealth may be arrived at by adding the imports to the home production, and deducting the exports (including bunker coal taken by oversea vessels). The following table shews the consumption of coal in Australia, computed in the manner specified, for the last five years :—

CONSUMPTION OF COAL IN AUSTRALIA, 1908 to 1912.

Year.	Quantity of Coal Consumed.			
	Home Produce.	Produce of the United Kingdom.	Produce of Other Countries.	Total.
	Tons.	Tons.	Tons.	Tons.
1908	6,087,000	4,000	11,000	6,102,000
1909	5,367,000	1,000	11,000	5,379,000
1910	6,897,000	110,000	198,000	7,205,000
1911	7,407,000	7,000	4,000	7,418,000
1912	7,907,000	1,500	14,000	7,922,500

The figures for 1910 are, of course, abnormal, the comparatively heavy importation from the United Kingdom and foreign countries being due to uncertainty in the local supply on account of the strike of coal-miners in New South Wales. Of the total importation from foreign countries in that year, India supplied 138,000 tons, and Japan 28,000 tons.

6. **Price of Coal.**—(i.) *New South Wales.* The price of coal in New South Wales has been subject to considerable fluctuation since the date of first production. Up to the end of 1857 the average value of the total output was 11s. 10d. per ton. Next year the value had risen to nearly 15s., declining thereafter until in 1871 the price realised was 7s. From 1872 to 1879 there was a rise in value to 12s. Between 1882 and 1891 the price ranged between 8s. and 10s. From 1891 onwards there was a steady decline until 1898, when the average was 5s. 4d. Henceforward prices rose again until 1902, when 7s. 5d. was the average. A decline then set in until 1905, when the price stood at a little over 6s., followed by a rise of one penny in 1906, and a further rise of eightpence in 1907. In 1908 the average was 7s. 4d., and in 1912, 7s. 5d. per ton. The price of New South Wales coal depends on the district from which it is obtained, the northern (Newcastle) coal always realising a much higher rate than the southern or western product. The average rate in each district during the last five years was as follows:—

PRICE OF COAL IN NEW SOUTH WALES (PER TON), 1908 to 1912.

Year.	Northern District.	Southern District.	Western District.
	s. d.	s. d.	s. d.
1908	8 0.78	5 10.91	4 5.52
1909	8 3.48	5 11.91	4 9.34
1910	8 1.44	6 1.76	5 5.56
1911	8 0.13	6 1.88	5 0.72
1912	8 1.15	6 1.06	4 11.98

(ii.) *Victoria.* In Victoria the average price of coal up to the 31st December, 1890, was 19s. 3d. per ton. In 1895 the price was still as high as 12s. 2d., but in the following five years there was a serious decline, the value in 1900 being quoted at 9s. 7d. per ton. In 1901, however, there was an astonishing rise, the figure being as high as 14s. 7d. Since that year, however, the price again declined, the average for 1905 being 10s. 2d.; for 1909, 12s.; for 1911, 9s. 3d.; and for 1912, 8s. 9d. These averages are exclusive of brown coal, the production of which in 1912 was valued at about 4s. 4d. per ton.

(iii.) *Queensland.* Prices in the principal coal-producing districts during the last five years were as follows:—

PRICE OF COAL, QUEENSLAND, 1908 to 1912.

District.	Value at Pit's Mouth.				
	1908.	1909.	1910.	1911.	1912.
	Per ton. s. d.	Per ton. s. d.	Per ton. s. d.	Per ton. s. d.	Per ton. s. d.
Ipswich	6 6½	6 8½	6 11	6 5	6 7
Darling Downs					
Wide Bay and Maryborough ...	9 5½	9 7¾	10 5½	10 10	10 10½
Rockhampton	11 7½	11 6	11 9	10 4½	10 6
Clermont ... ..	...	4 6	8 0	7 6	7 6

(iv.) *Western Australia.* The average price of the Collie (Western Australia) coal up to the end of 1901 was 9s. 4d. per ton, the price in 1901 being 11s. 7d. In 1902 the average stood at 12s. 3d., and from that time the price fell steadily until 1906, when it was 7s. 7½d. per ton. In 1907, the average price was 7s. 8¾d.; in 1908, 8s. 7½d.; in 1909, 8s. 5¾d.; in 1910, 8s. 8d.; in 1911, 8s. 10d. per ton.

(v.) *Tasmania.* The average price per ton of coal at the pit's mouth in Tasmania was 8s. in 1901. In 1902 it was 8s. 7d.; in 1903, 8s. 9d.; in 1904 and 1905, 9s. 8d.; in 1906, 9s. 9d.; in 1907, 1908, and 1909, 8s.; in 1910, 11s. 9d.; and in 1911 and 1912, 9s. 2d.

7. Price of Coal in other Countries.—According to a report published by the Board of Trade the average value of coal at the pit's mouth in the five principal coal-producing countries of the world, for the five years ended 1911, was as follows:—

PRICES OF FOREIGN COAL, 1907 to 1911.

Year.	United Kingdom.	Germany.	France.	Belgium.	United States.
	Per ton. s. d.	Per ton. s. d.	Per ton. s. d.	Per ton. s. d.	Per ton. s. d.
1907	9 0	9 8¾	12 3	13 8½	5 11½
1908	8 11	10 3½	12 11¾	13 1½	5 11¾
1909	8 0½	10 2½	12 5½	11 8¼	5 7½
1910	8 2½	9 11¾	12 3½	11 10½	5 10½
1911	8 1¾	9 9½	*	12 0	5 10¾

* Not available.

The price of coal at the pit's mouth in the principal British possessions is averaged by the same authority as follows:—

PRICE OF COAL, BRITISH POSSESSIONS, 1907 to 1911.

Year.	British India.	C'wealth of Australia.	New Zealand.	Canada.	Union of Sth. Africa.
	Per ton. s. d.	Per ton. s. d.	Per ton. s. d.	Per ton. s. d.	Per ton. s. d.
1907	4 8	6 10	10 7	10 8½	10 2½
1908	5 3	7 4½	10 4½	10 8	6 9½
1909	4 8½	7 6½	10 10½	10 10½	6 3½
1910	4 1	7 6½	11 1½	10 8½	5 10½
1911	3 11½	7 5½	10 10½	10 9	5 8½

8. **Employment and Accidents in Coal Mining.**—The number of persons employed in coal mining in each of the States during the year 1911 is shewn below. The table also shews the number of persons killed and injured, with the proportion per 1000 employed, while further columns are added shewing the quantity of coal raised for each person killed and injured, this being a factor which must be reckoned with in any consideration of the degree of risk attending mining operations.

Returns published by the Board of Trade, England, give the total known number of persons engaged in mining and quarrying throughout the world as $6\frac{1}{2}$ millions, more than one-half of whom were employed in coal mining, the number in the United Kingdom being 1,033,000; the United States, 725,000; Germany, 694,000; France, 197,000; Belgium, 144,000; Austria, 131,000; and India, 116,000.

Recent returns shew the rate in the United Kingdom in respect of deaths through accidents in coal mines as 1.43, and for the British Empire 1.48 per 1000 persons employed in coal mines. For France the rate is given as 1.17, for Germany 2.30, and the United States 3.35. For foreign countries generally the rate is stated at 2.48 per 1000.

EMPLOYMENT AND ACCIDENTS IN COAL MINING, 1912.

State.	Persons Employed in Coal Mining.	No. of Persons.		Proportion per 1000 Employed.		Tons of Coal Raised for Each Person.	
		Killed.	Injured.	Killed.	Injured.	Killed.	Injured.
New South Wales ...	17,795	30	81	1.70	4.55	330,000	122,000
Victoria ...	1,486	2	19	1.35	12.80	...	31,000
Queensland ...	2,019	...	45	...	22.29	296,000	20,000
Western Australia ...	542	...	58	...	107.00	...	5,000
Tasmania ...	155	...	2	...	13.00	...	27,000
Commonwealth	21,997	32	205	1.05	9.32	367,000	57,000

§ 11. Coke.

1. **Production of Coke.**—Notwithstanding the large deposits of excellent coal in Australia, there is at the present time a fairly considerable amount of coke imported from abroad, the oversea import during the year 1912 amounting to 15,588 tons, valued at £17,694, the bulk of which came from Germany, and was taken chiefly by South Australia and Western Australia. The table hereunder gives the production in New South Wales during the last five years:—

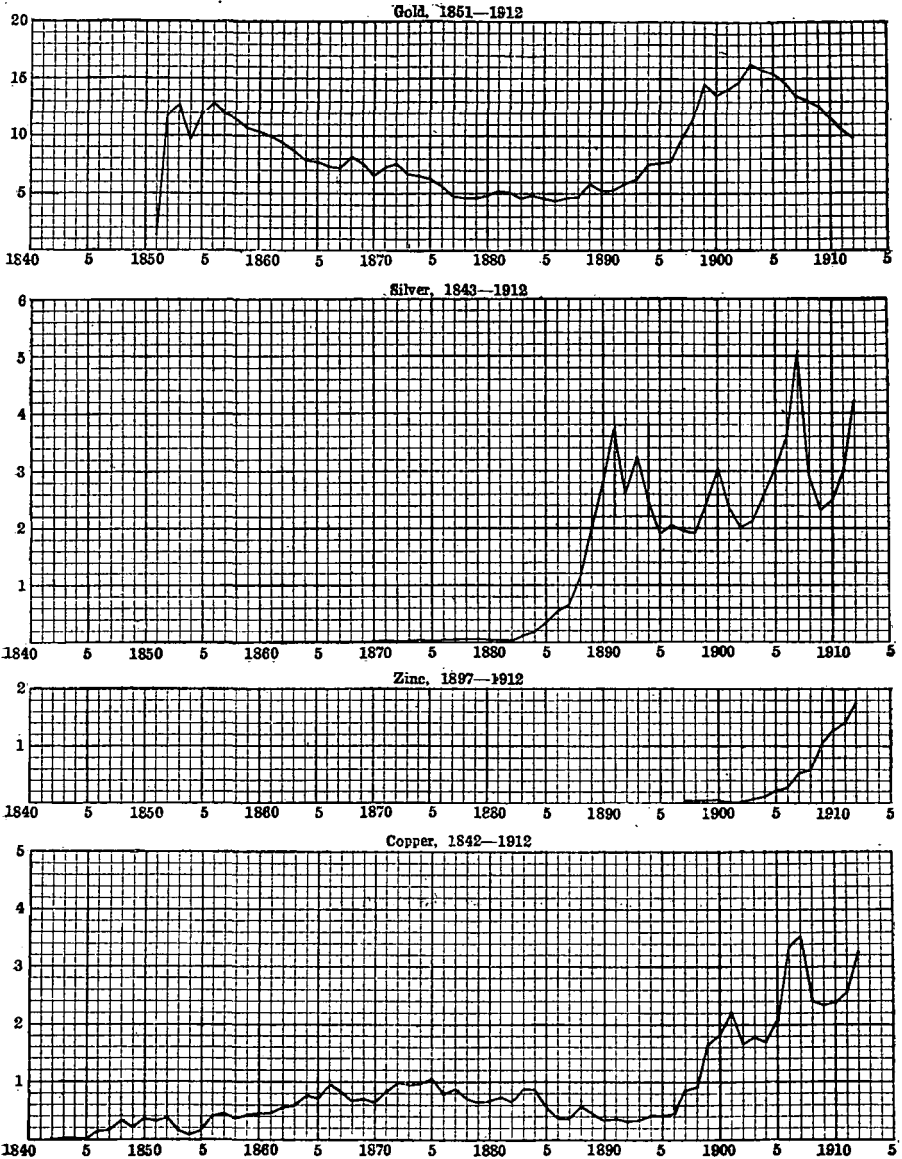
COKE MADE IN NEW SOUTH WALES, 1908 to 1912.

Year.	1908.	1909.	1910.	1911.	1912.
Quantity ... Tons	283,873	204,274	282,337	264,687	241,159
Value, total ... £	199,933	137,194	189,069	184,337	162,454
Value per ton ...	14s. 1d.	13s. 5d.	13s. 4d.	13s. 11d.	13s. 5d.

The falling-off in the returns for 1909 is, of course, due to the shortage of supplies occasioned by the coal strike.

A small quantity of coke is made in Queensland, but the bulk of that used in ore reduction is imported, mainly from New South Wales. The following table shews the amount manufactured locally, and the amount imported during the last five years; the quantities imported include shipments landed from other States of the Commonwealth.

GRAPHS SHEWING VALUES OF THE PRINCIPAL MINERALS PRODUCED IN THE COMMONWEALTH, 1842 TO 1912.

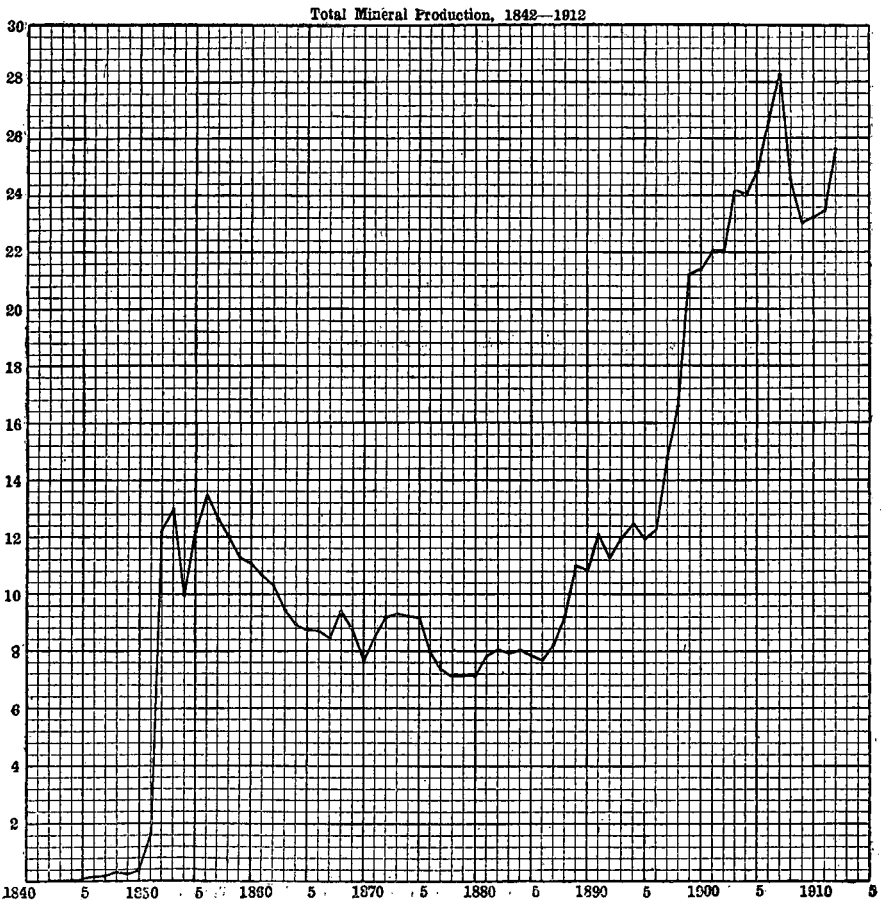
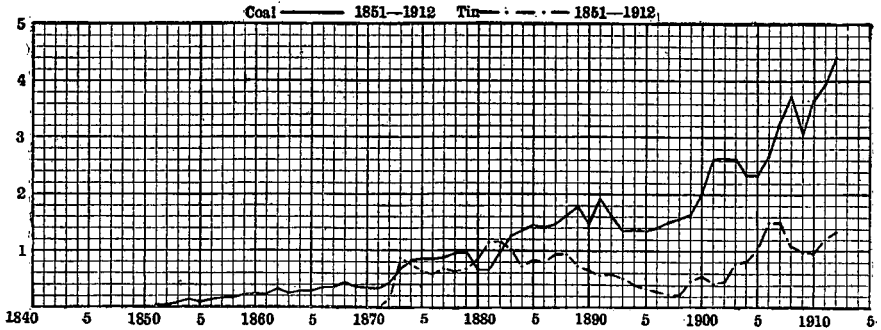


(See pages—for gold, 406; silver, 413; zinc, 422; copper, 417.)

EXPLANATION OF GRAPHS—The values shewn in the above diagrams are those of the total Commonwealth production of certain of the most important minerals in successive years from 1842 to 1912.

The base of each small square represents an interval of one year, and the vertical height represents in the case of gold £1,000,000, and in the case of silver, zinc and copper £200,000.

GRAPHS SHEWING VALUES OF THE PRINCIPAL MINERALS PRODUCED IN THE COMMONWEALTH, 1842 to 1912.



(See pages 430 for coal; 420, tin; and 404 total mineral production.)

EXPLANATION OF GRAPHS—The values shown in the above diagrams are those of the total Commonwealth production of certain of the most important minerals in successive years from 1842 to 1912.

The base of each small square represents an interval of one year, and the vertical height represents in the case of coal and tin £200,000, and in the case of total mineral production £1,000,000.

QUEENSLAND—COKE MANUFACTURED LOCALLY AND IMPORTED, 1908 to 1912.

Year.	1908.	1909.	1910.	1911.	1912.
Manufactured locally tons	10,684	8,633	11,188	35,025	38,136
Imported „	58,804	55,559	*32,054	†	†

* Nine months only. † Not available.

The development in smelting operations in Queensland is reflected in the increased consumption of coke. Of the total production shewn above for 1912, 4539 tons were made in coke works, and the balance at gasworks.

§ 12. Oil Shale and Mineral Oils.

1. **Production of Shale.**—(i.) *New South Wales.* As pointed out by Mr. E. F. Pittman, the name kerosene shale has been rather inaptly applied to a variety of torbanite, cannel, or boghead mineral found at various geological horizons in New South Wales. The mineral does not, as a rule, split in parallel layers, the fracture being rather of a conchoidal type. Pure samples have been found to contain over 89 per cent. of volatile hydro-carbons. The discovery of the mineral in New South Wales dates probably as early as 1802. Its occurrence in the Hartley Vale district was noted by Count Strzelecki in 1845. The mineral has been found at several places in the Upper Coal Measures, and in at least two in the Lower Carboniferous. Production on anything like a large scale commenced in 1868, when about 17,000 tons, valued at £48,000, were raised. The production in 1912 amounted to 86,018 tons, valued at £34,770, as compared with 75,104 tons, valued at £36,980, in 1911. Of the total raised in 1912, 40,185 tons were produced in the Northern District, and 45,833 in the Western District. The large output in the Northern District as compared with the preceding year was due to increased activity of the mine near Murrurundi, owned by the British Australian Oil Company. In the Western District the three producing mines were at New Hartley, Genowian and Crown Ridge, in the Capertee District.

(ii.) *Victoria.* Up to the present no extensive deposit of oil shale has been located in Victoria.

(iii.) *Queensland.* The discovery of natural gas and traces of oil in a deep bore at Roma has fostered the hope that energetic prospecting will lead to the discovery of mineral oil in quantity in this locality. Oilbearing shales are common in many parts of the State. The deposit at Duaringa on the Central railway line shewed a thickness of 6 feet, and contained about 30 gallons of oil to the ton. Inflammable gas and a little oil have been noted in bores put down for coal on the Dawson River. There are shale deposits at Monduran Creek, near Gladstone, Casuarina Island, Redbank plains in the Ipswich District and Murphy's Creek, near Toowoomba.

(iv.) *South Australia.* In this State large areas of bituminous shale, of which the boundaries are only approximately known, occur at Leigh's Creek and Lake Phillipson. Reference to the mineral known as coorongite is made in sub-section 13. Specimens of bitumen have been discovered on Kangaroo Island, and it was supposed that they were the product of a petroleum-bearing area. The Government Geologist states, however, that the island strata are not of such nature as to support this supposition. In regard to the mainland area it is argued by some investigators that the bores so far put down have not been carried to sufficient depth to fairly test the strata.

(v.) *Western Australia.* A deposit of carbonaceous shale of considerable thickness is known to exist at Coolgardie, but the mineral has not yet been raised in any quantity.

(vi.) *Tasmania.* Tasmanite shale has been discovered in the basins of the Mersey, Don, and Minnow Rivers, and the Government geologist estimates the probable capacity of the beds at 12,000,000 tons. The crude oil content of average quality shale has been estimated at 40 gallons to the ton. A small quantity of shale was raised in 1910, but

there was no production in 1911 or 1912. At present mining for the product is only in the developmental stage, but there is apparently no reason why the industry should not in time become of considerable importance.

(vii.) *Northern Territory.* The existence of oil shale has been reported for many years in the Boroloola district, while several oil licenses have been applied for in the Victoria River district. Experts, however, have pronounced unfavourably on the prospects.

(viii.) *Papua.* An expert has reported that the deposits of oil-bearing shale can be worked at a profit, and oil of a satisfactory quality has been obtained from two comparatively shallow bores.

2. **Export of Shale.**—In 1912 New South Wales exported to New Zealand 285 tons of shale, valued at £720.

3. **Shale Oils Bounties.**—The Shale Oils Bounties Act 1910 provides for the payment of bounties on certain goods manufactured in Australia from Australian shale on or after the 1st July, 1910, and before the 1st July, 1913. The total amount to be made available for bounties under this Act is £50,000. Particulars are given in the following tabular statement:—

COMMONWEALTH SHALE OILS BOUNTIES—AMOUNT PAYABLE.

Description of Goods.	Rate of Bounty.	Maximum Amounts which may be paid during the Financial Year 1910-11.	Maximum Amounts which may be paid during each of the Financial Years 1911-12 and 1912-13.	Date of Expiry of Bounty.
Kerosene* ...	2d. per gallon.	£ 8,000	£ 16,000	} 30th June, 1913.
Refined paraffin wax ...	2s. 6d. per cwt.	2,000	4,000	

* The product of shale, having a flashing point of not lower than 73 degrees Fahrenheit, determined by the "Abel Pensky" test apparatus in manner prescribed.

During the year ended 30th June, 1913, the Commonwealth Oil Corporation, at Hartley Vale, New South Wales, received bounty to the amount of £804 on kerosene, and £882 on refined paraffin wax, while the British Australian Oil Company received £1988 on kerosene, and £86 on paraffin wax.

§ 13. Other Non-Metallic Minerals.

1. **Alunite.**—Probably the most remarkable deposit of alunite in the world occurs at Bullahdelah, in the county of Gloucester, New South Wales, a large proportion of a low bluff ridge in the district being composed of this mineral. The deposits are worked by quarrying, and up to the end of 1912, 39,035 tons had been exported, valued at £119,543, the exports for the year 1912 being 3425 tons, valued at £13,700.

Deposits of a high-class alunite are reported to have been discovered near Sunbury, in Victoria.

In South Australia an extensive deposit of the mineral was located in 1913 at Carrickalinga Head, on the coast north of Normanville, and within a short distance of Adelaide. It is stated that the specimens so far analysed have proved richer in valuable constituents than any similar find yet recorded.

2. **Asbestos.**—This substance has been found in various parts of Australia, but up to the present has not been produced in any considerable quantity. In New South Wales the deposits at Jones' Creek, in the Gundagai division, were opened up during the year 1909 and a trial parcel of 15 tons shipped to Germany. There was, however, no record of production in 1912. In Western Australia what may prove to be a valuable deposit of the fibrous chrysolite variety has been located at Tambourah, on the West Pilbara gold-field, and in 1909 £154 worth of this mineral was raised. In 1899 Tasmania raised 200 tons, valued at £363, but there has been no production during the last ten years.

Deposits of asbestos of the mountain leather and mountain cork varieties have been discovered at Oodlawirra, while deposits of a good blue variety have been discovered near Hawker, and about 23 miles from Eudunda, in South Australia.

3. **Barytes.**—In New South Wales during 1912 about 102 tons of barytes, valued at £254, were obtained at Bethungra, in the Cootamundra division, and 292 tons, valued at £498, were raised at Lue in the Mudgee division. About 300 tons of inferior quality stone was produced from a mine at Cobargo.

4. **Clays and Pigments.**—Valuable deposits of clays and pigments of various sorts are found throughout the Commonwealth. There is a considerable local production of earthenware, bricks, and tiles, but the finer clays have not as yet been extensively used. The production of kaolin in 1912 amounted to 394 tons, valued at £185, raised in the Parkes, Murrumburrah, and Goulburn divisions. Fireclay to the amount of 14,152 tons, valued at £1528, was raised in the Wollongong division. Deposits of steatite near Wallendbeen were worked during 1912, the quantity disposed of during the year amounting to 168 tons. In Victoria 288 tons of kaolin, valued at £342, were raised during 1912, of which 238 tons were raised at Egerton, and the balance at Pyalong. In Queensland 6336 tons of fireclay, valued at £2535, were mined during the year 1912, in the Mount Morgan district. On Kangaroo Island, South Australia, where, it is stated, the first pottery mill in the Commonwealth was erected, there are vast deposits of felspar, china, stone, silica, and firebrick clay. There are also very extensive deposits of fireclay near Ardrossan on the Yorke Peninsula. Porcelain and other clays of good quality have been found in the Kingston district in Tasmania. A small parcel of kaolin from the Zeehan district yielded about 50 per cent. after treatment, but it is stated that the product could not be profitably exported to Europe. Deposits of ochre have been opened up at Dubbo, Wellington, and Marulan, in New South Wales, and ochres and pigments of excellent quality have been produced therefrom. Extensive deposits of iron oxide, giving a return of 80 per cent. ochre, have been discovered near Oodlawirra in South Australia.

5. **Coorongite.**—This peculiar indiarubber-like material was first noted many years ago near Salt Creek and in the vicinity of Coorong Inlet, in South Australia. It was thought that the substance owed its origin to subterranean oil-bearing strata, but so far the search for petroleum has not been attended with success.

6. **Fuller's Earth.**—Small quantities of this material were produced in 1912, from leases near Narrabri, in New South Wales, the total sold amounting to 50 tons, valued at £287.

7. **Graphite.**—Graphite is found in New South Wales near Undercliff Station, in the county of Buller, but the deposit is not sufficiently pure to prove remunerative. A small quantity of ore was forwarded in 1911 to England from a site on the Bookookoorara in the Wilson's Downfall division. In Victoria the mineral occurs in Ordovician slates in several of the goldfields, but is not worked. In Queensland graphite was raised some years ago by the Graphite Plumbago Company at Mt. Bopple, near Netherby, on the Maryborough-Gympie line. In Western Australia deposits occur near Bunbury.

8. **Gypsum.**—This mineral is found at various places in the Commonwealth. It occurs in two forms, large crystals, and a floury earth consisting of minute crystals and known as "copi." Both forms are exceedingly pure. It is largely used as a natural manure and to some extent in the manufacture of Portland cement. Gypsum, or hydrous sulphate of lime, when burnt forms plaster of Paris, but in spite of the abundant supply of suitable material it has not yet been used for this purpose. In Victoria during 1912 there was a production of 2078 tons, valued at £3359, of which 1240 tons were obtained at Boort, 813 tons at Lake Boga, and 25 tons at Reedy Lake.

9. **Tripolite, or Diatomaceous Earth.**—Although tripolite has been found at Barraba, Cooma, Wyrallah, and in the Warrumbungle Mountains in New South Wales, the deposits have not yet been worked commercially on any considerable scale. From the deposits at Bunyan, in the Cooma division, 31 tons of diatomaceous earth, valued at £132, were produced in 1912. In Victoria there is a remarkably pure deposit at Lilliacur, near Talbot, while beds of the mineral are also met with at other places in the Loddon valley, near Ballarat, at various places close to Melbourne, at Craigieburn, Lancefield, Portland, Swan Hill, Bacchus Marsh, etc. From the deposit at Talbot, 850 tons, valued at £3400, were obtained in 1912. A fairly extensive deposit of tripolite exists in Queensland, between Nerang and Beaudesert, but the various outcrops have as yet been only partially examined.

10. **Salt.**—Salt is obtained from salt lakes in the Western and North-western Districts of Victoria, and from salterns in the neighbourhood of Geelong. Large quantities are also obtained from the shallow salt lakes of South Australia, chiefly on Yorke Peninsula. Lake Hart, about sixty square miles in area, situated about 120 miles N.W. from Port Augusta, contains immense supplies of salt of good quality, which at present, however, owing to distance from market, possess no economic value. The salt is simply scraped from the beds of the lakes in summer time and carted to the refinery. It is stated that care must be taken not to leave too thin a crust of salt over the underlying mud, as the resultant "crop" after the winter rains will in that case be smaller than usual. A bore recently put down near Kingscote, on Kangaroo Island, revealed brine which can be profitably used by evaporation. In Western Australia supplies are obtained from dried-up shallow lakes and consumed locally or exported. The chief centres of production were formerly Rottneest Island, near Fremantle, and Middle Island, near Esperance, but the greater part of that now produced is obtained at Port Gregory.

11. **Natural Manures.**—Gypsum has already been referred to. (See 8 *ante*.) South Australia possesses deposits of rock phosphate near Port Clinton and Ardrossan on Yorke Peninsula, at Belvedere near Kapunda, and at Kooringa, and also at many other places which have only been prospected to a small extent. Although it can hardly be considered a mineral product, mention may be made here of the large accumulations of guano on the Arolihos Islands, off the coast of Western Australia, in the neighbourhood of Geraldton. The deposits vary in thickness from four to twenty-seven inches. During the years 1876-80 over 36,000 tons were raised; no figures are available shewing the production of recent years.

§ 14. Gems and Gemstones.

1. **Diamonds.**—Diamonds were first noted in New South Wales by E. J. Hargraves in 1851, and in October of the same year by Geological Surveyor Stutchbury. The Cudgegong field was discovered in 1867, and shortly afterwards the Bingara diamondiferous deposits were located. Stones of small size are also found at Cope's Creek and other places in the Inverell district. The largest diamond won in New South Wales was reported to have been obtained in 1905 at Mt. Werong, near Oberon, and weighed 28 $\frac{1}{2}$ carats. It is difficult to secure accurate returns in connection with the production of precious stones, but the yield of diamonds in 1912 was estimated at 2240 carats, valued at £2001, while the total production to the end of 1912 is given as 178,971 carats, valued at £120,408. The yield in 1912 was contributed by miners working in the vicinity of Copeton, in the Tingha division. Small quantities of diamonds are found in Victoria in the gravels of streams running through granite country in the Beechworth district; at Kongbool in the Western District; and near Benalla. The stones are generally small,

and the production up to date has been trifling. In 1912, eleven small diamonds, valued at £20, were picked out of the sluice boxes of the Great Southern alluvial mine at Rutherglen. A few small diamonds have been found in the Pilbara district in Western Australia. In South Australia diamonds have been found on the Echunga goldfield, the most notable gem being Glover's diamond, which was sold for £70.

2. **Sapphires.**—These gems were discovered in New South Wales in 1851, near Burrandong. They have also been found in small quantities near Inverell, and at a few other localities in the State. There is no record of production. Specimens of sapphire have been found in Victoria, but the stones of commercial size are generally of little value owing to flaws.

In Queensland sapphires are found in the gravel of creek beds, between Withersfield and Anakie on the Rockhampton-Winton railway line. The gems show excellent fire and lustre, but the colour is darker blue than the Oriental sapphire. Hyacinths are occasionally found in association with the gems. The production of sapphires in Queensland in 1912 was valued at £40,016, and up to the end of 1912 the total was £226,202. The production in 1912 included industrial corundum to the value of £7644. Sapphires are plentifully found in the tin drifts of the Ringarooma and Portland districts in Tasmania, but the stones are, as a rule, small and not worth saving.

3. **Precious Opal.**—This stone was first discovered in New South Wales at Rocky Bridge Creek on the Abercrombie River, in the year 1877, and later a most important discovery was made at White Cliffs in the Wilcannia district, which, until recently, contributed the bulk of the production. In 1912, however, out of a total production valued at £35,008, the yield from the Lightning Ridge field near Walgett, amounted to £26,180, while the output from the White Cliffs field was returned at £8828. Some very fine stones are at times obtained, one weighing 5 ozs. and valued at £300, being recovered in 1911. Occasionally, black opals of very fine quality are found, one specimen from the Wallangulla field, weighing $6\frac{1}{2}$ carats, being sold in 1910 for £102. The total value of opal won in New South Wales since the year 1890 is estimated at £1,330,000.

Small quantities of precious opal are also found in the Beechworth district in Victoria.

In Queensland, the first recorded discovery of the gem dates from about 1875. The opaliferous district stretches over a considerable area of the western interior of the State, from Kynuna and Opalton as far down as Cunnamulla. The yield in 1912 is estimated at £3000, and up to the end of that year at £172,195. These figures are, however, merely approximations, as large quantities of opal are disposed of privately to buyers on the fields, no record of which is obtained. At present, the industry is not in a very satisfactory position, as the shallower grounds of the older centres have been worked out, and there appears to be little disposition to explore the deeper grounds.

4. **Other Gems.**—Emeralds were found in New South Wales in the year 1890, near the township of Emmaville, the largest specimen found in the district weighing twenty-three carats in the rough. Altogether 2225 carats were sent to London during that year, some of the gems bringing £4 a carat, but the production has since dwindled. The mine at the Glen in the Emmaville division was reopened and worked for a short period during 1908, when about 1000 carats of emeralds, valued at about £1650, were obtained. The largest stone in the rough weighed 60 carats. Amongst other gems found in New South Wales at various times may be mentioned *turquoises*, discovered in 1894, near Bodalla; *topazes*, fine specimens of which have been obtained in the New England district, and *zircon* and *garnets*. Zircons of small size are plentifully found in the vicinity of Table Cape in Tasmania. Topazes are common in the tin drifts of Tasmania, and some fine specimens have been found. Turquoises are also found in thin veins in Victoria. In Gascoigne's mine, situated near the King River, in the parish of Edi, samples of the gem have been found equal in colour to the best Persian stone, and a considerable quantity

of turquoises from this mine has been sold in England and Germany. Fine *agates* are found in many places in Victoria, but have not been made use of to any extent. Garnets are found in Western Australia, and beautiful specimens of *crocidolite* have been obtained at Yarra Creek in the Murchison district. *Rubies* have been found at various places in New South Wales and Queensland. *Tourmaline* has been found on Kangaroo Island, in South Australia, and *beryls* near Williamstown, Victoria. Very large but impure beryl crystals have been found at Ben Lomond in Tasmania. Some fine samples of *chiastolite* or luck stone have been found at Mt. Howden, near Bimbourie, in South Australia.

(C.) GENERAL.

§ 15. Numbers Engaged, Wages Paid, and Accidents in Mining.

1. **Total Employment in Mining.**—The number of persons engaged in the mining industry in each State and in the Commonwealth is an index of the significance of the mineral wealth. During the year 1912 the number so employed was as follows:—

NUMBER OF PERSONS ENGAGED IN MINING, 1912.

State.	Number of Persons Engaged in Mining for						Total.
	Gold.	Silver, Lead, and Zinc.	Copper.	Tin.	Coal and Shale.	Other.	
New South Wales ...	3,898	9,062	2,384	2,646	18,051	1,817	37,858
Victoria	11,856	...	6	57	1,486	163	13,568
Queensland	3,981	208	3,457	2,153	2,019	920	12,738
South Australia ...	920	30	4,500	...	...	1,050	6,500
Western Australia ...	13,700	60	223	409	542	27	14,961
Tasmania	485	1,377	1,681	1,762	155	106	5,566
Northern Territory ...	263	18	52	287	...	92	652
Commonwealth ...	35,103	10,755	12,303	7,314	22,253	4,115	91,848

The following table shows the number of persons engaged in mining in the Commonwealth during each of the years 1891, 1901, and 1912, together with the proportion of the total population so engaged:—

PROPORTION OF PERSONS ENGAGED IN MINING, 1891, 1901, and 1912.

State.	1891.		1901.		1912.	
	Miners Employed.	No. per 100,000 of Popu- lation.	Miners Employed.	No. per 100,000 of Popu- lation.	Miners Employed.	No. per 100,000 of Popu- lation.
New South Wales ...	30,604	2,700	36,615	2,685	37,858	2,180
Victoria	24,649	2,151	28,670	2,381	13,568	1,000
Queensland	11,627	2,934	13,352	2,664	12,738	2,017
South Australia ...	2,683	834	7,007	1,931	6,500	1,541
Western Australia ...	1,269	2,496	20,895	11,087	14,961	4,963
Tasmania	3,988	2,695	6,923	4,017	5,566	2,888
Northern Territory ...	...	...	...	...	652	...
Commonwealth ...	74,820	2,341	113,462	2,992	91,843	1,977

2. **Wages Paid in Mining.**—Particulars regarding wages paid in the mining industry, which in preceding issues of the Year Book were given in this section, have now been transferred to the section dealing with Labour and Industrial Statistics.

3. **Accidents in Mining, 1912.**—The following table gives particulars of the number of men killed and injured in mining accidents during the year 1912:—

NUMBERS KILLED AND INJURED IN MINING ACCIDENTS, 1912.

Mining for—	N.S.W.	Victoria.	Q'land.	S. Aust.	W. Aust.	Tas.	N. T.	Cwlth.
KILLED.								
Coal and shale	30	2	...	...	...	...	...	32
Copper ...	5	...	12	1	1	48	...	67
Gold...	8	16	8	...	34	2	...	68
Silver, lead and zinc	17	...	1	...	...	1	...	19
Tin ...	1	...	1	...	...	2	...	4
Other minerals	...	...	4	...	...	...	...	4
Total ...	61	18	26	1	35	53	...	194

INJURED.								
Coal and shale	81	19	45	...	58	2	...	205
Copper ...	6	...	112	2	...	15	...	135
Gold...	3	75	80	...	432	8	...	598
Silver, lead and zinc	22	...	2	...	1	12	...	37
Tin ...	1	...	1	...	...	16	...	18
Other minerals	...	1	3	...	...	...	...	4
Total ...	113	95	243	2	491	53	...	997

§ 16. State Aid to Mining.

1. **Introduction.**—The terms and conditions under which State aid is granted in mining are alluded to at some length in previous issues (see Year Books IV. and V.), but owing to considerations of space they have been omitted from this issue.

2. **New South Wales.**—The chief aid given in this State is in the direction of assistance to prospectors. Up to the end of 1912 the total sum expended in this manner amounted to £433,359, of which £12,091 was advanced in 1912. During the year the Government subsidy to the Miners' Accident Relief Fund amounted to £14,091.

3. **Victoria.**—Under the Mining Development and Surplus Revenue Acts the sum of £414,529 was expended from revenue, and £166,939 was provided out of votes during the period 1897 to 1912 as follows :—

	£
Advances to mining companies	153,818
Advances to prospectors	65,139
Boring for gold and coal	188,840
Construction of roads and tracks	61,636
Erection of testing plants, batteries, etc.	62,953
Miscellaneous, cyanide patents, Schools of Mines, etc.	49,082
Total	581,468

The expenditure in 1912 was £26,684, of which £3466 was advanced to companies; £3976 was loaned to miners; £166 was spent on constructing roads, etc.; £16,477 on boring for gold, and £2599 on testing plants and miscellaneous. The Government batteries number 25, and of these 15 are managed by local trusts without expense to the Department so far as cost of working is concerned. The repayment of loans by companies amounts to £20,837, by miners £2305, and for cost of boring £6752. The State's contribution to the Coal Miners' Accident Relief Fund amounted in 1912 to £736.

4. **Queensland.**—State assistance to the mining industry in 1912 amounted to £16,622, of which £8778 consisted of loans in aid of deep sinking; £1037 grants in aid of prospecting; £4270 in aid of roads and bridges to gold and mineral fields; £537 advance under Mining Machinery Advances Act 1906; and £2000 grant in aid of coal prospecting at Mount Mulligan.

5. **South Australia.**—Aid is given to the mining industry under the terms of the Mining Act of 1893, and previous measures. Up to the end of 1912 the total amount of subsidy paid was £57,118, of which £7170 has been recovered, leaving a debit of £49,948. Portion of this amount is represented by machinery that has fallen into the hands of the Government. Four Government batteries are in operation in this State.

6. **Western Australia.**—Under the Mining Development Act of 1902 assistance was granted in 1912 in accordance with the subjoined statement.

Advances in aid of mining work and equipment of mines with machinery, £3773; advances in aid of erection and equipment of crushing plants, including subsidies on stone crushed for the public, £3710; advances in aid of boring, £2103; providing means of transport, £253. In addition, amounts totalling in all £34,016 were expended from the Mining Development vote on various matters such as water supply, roads, cartage, and subsidies for development below the 100 feet level in small mines. The sum of £3710 shewn above includes an amount of £999 paid to owners of plants crushing for the public at fixed rates. All water supply works on the goldfields are now carried out by the Water Supply Department.

In 1912 there were thirty-five State batteries in operation. The amount expended on the erection of State batteries up to the end of 1912 was £91,981 from revenue, and £217,859 from loan, giving a total of £309,840. During the year receipts amounted to £40,857, and working expenditure to £49,805.

The total value of gold and tin recovered to the end of 1912 at the State plants was £3,956,337, resulting from the treatment of 900,416 tons of gold ore and 56,884 tons of tin ore.

7. **Tasmania.**—In Tasmania provision is made for State aid to mining under the Deep-Sinking Encouragement Acts of 1899, 1900, and 1901. Under these Acts sums of £5000, £2000, and £1000 respectively were provided for assisting persons and companies to sink shafts or to drive tunnels below a specified depth, the amount advanced in any particular case varying according to the amount expended by the borrower. The total amount advanced to October, 1909, was £6861, granted to five companies in sums ranging from £682 to £1452, leaving an unexpended balance of £1139. None of the companies to whom the advances were made has been successful, and consequently none of the sums advanced, which were to be repaid out of profits, has been refunded. A sum of £1000 was placed on the estimates for 1911-12 for the purpose of assisting prospectors, the money to be expended on the £ for £ principle, and of this £730 was expended. A further sum of £1000 was provided for the year ended 30th June, 1913, and of this the amount expended to the 30th December, 1912, was £332.

8. **Northern Territory.**—Prior to 1912, prospectors were helped by grants of rations and some monetary assistance, but it was found that these privileges were occasionally abused, and steps have now been taken to ensure the bonafides of all seeking aid. Provision is also made for generous grants to discoverers of metalliferous ores.