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 1914.**—The outbreak of war in August, 1914, naturally had a very serious effect on the mineral industry in Australia, and especially in New South Wales, where the total production for the year shewed a decrease of over £1,614,000 as compared with 1913. Operations on the Broken Hill field were seriously curtailed, the output of silver, lead, zinc hence shewing a decline of about £1,090,000 compared with the previous year, while the export of zinc concentrates dropped by £527,000.

The comparative value of the production of minerals raised in each State during 1914 is given in the following table :—

COMMONWEALTH MINERAL PRODUCTION IN 1914.

Minerals.	N.S.W.	Victoria.	Q'land.	S.A.	W.A.	Tas.	N.T.	C'wealth.
	£	£	£	£	£	£	£	£
Alunite ...	12,160	...	...	40	...	...	...	12,200
Antimony	464	29,365	...	...	...	...	...	29,829
Bismuth ...	2,837	...	15,601	...	635	1,666	...	20,739
Coal ...	3,737,761	289,099	416,292	...	148,684	27,853	...	4,619,689
Coke ...	213,069	...	...	...	...	...	...	213,069
Copper ...	274,671	...	1,118,648	417,487	38,174	496,041	4,860	2,349,881
Diamonds	1,440	...	...	...	...	...	...	1,440
Diatomaceous earth	94	4,000	...	...	...	...	...	4,094
Gems (unspecified)...	...	...	15,800	...	...	...	...	15,800
Gold ...	528,873	1,755,236	1,059,674	26,581	5,237,353	111,475	10,757	8,729,949
Gypsum ...	...	924	...	12,207	...	...	...	13,131
Iron ...	254,257	...	...	...	...	...	...	254,257
Iron oxide	5,584	...	...	...	...	...	...	5,584
Ironstone flux	...	...	39,459	37,137	...	...	...	76,596
Kaolin ...	364	875	...	16,382	...	...	...	17,621
Lead (pig, etc.)	370,106	...	12,134	...	46,315	...	....	428,555
Limestone flux	11,674	...	32,581	16,892	...	...	...	61,147
Manganese	...	70	27	...	...	...	...	97
Molybdenite	11,451	...	38,190	...	...	...	...	49,641
Opal ...	26,534	...	2,000	...	...	...	...	28,534
Platinum	2,129	...	...	...	...	...	...	2,129
Salt ...	...	...	...	48,750	...	...	...	48,750
Scheelite	5,852	...	...	...	...	...	...	5,852
Shale ...	27,372	...	...	...	...	75	...	27,447
Silver ...	307,198	1,540	26,506	529	22,913	...	...	358,686
Silver-lead bullion / Silver-lead ore	2,934,065	...	...	...	...	96,225	545	3,030,835
Tin ...	267,130	4,955	176,197	...	35,649	259,300	15,200	758,431
Wolfram...	14,438	...	21,764	24	40	4,327	4,025	44,618
Zinc ...	1,020,711	...	...	...	379	...	...	1,021,090
Unenumerated	4,804	119	1,407	14,587	3,848	*10,076	420	35,261
Total ...	10,035,038	2,086,183	2,976,280	590,616	5,533,990	1,007,038	35,807	22,264,952

* 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 1914 consist of—lime, £46,700; marble, £2180; Portland cement, £415,000; building stone, £404; and grindstones, £148. The South Australian figures are exclusive of flint pebbles, £829. For South Australia the principal items in the unenumerated class were phosphate rock, £6691; and radium and uranium ore, £5215.

4. **Total Production to end of 1914.**—In the next table will be found the estimated value of the total mineral production in each State up to the end of 1914. 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 £3,079,000 of that published by the State Department of Mines, the principal items excluded being cement, £2,657,000; lime, £366,000; and building stone, £26,000.

COMMONWEALTH MINERAL PRODUCTION TO END OF 1914.

Minerals.	N.S.W.	Victoria.	Q'land.	S. Aust.	W. Aust.	Tas.	North'rn Territ'y.	C'wealth.
	£	£	£	£	£	£	£	£
Gold ...	60,627,551	295,306,164	77,406,272	975,191	120,117,925	7,660,633	2,089,695	564,183,431
Silver and lead ...	68,007,136	223,549	2,418,417	340,783	863,708	6,674,970	77,592	78,606,155
Copper ...	12,657,506	218,590	13,727,225	28,653,025	1,293,039	11,128,686	334,748	68,012,819
Tin ...	10,016,031	794,594	8,630,570	...	1,171,076	12,763,885	369,624	33,745,780
Coal ...	76,595,824	3,026,429	6,197,294	...	1,371,733	626,183	...	87,817,463
Other ...	21,130,466	481,700	2,355,856	1,680,765	90,616	238,160	51,547	26,029,110
Total ...	249,034,514	300,051,026	110,735,634	31,649,764	124,908,097	39,092,517	2,923,206	858,394,758

The "other" minerals in New South Wales include antimony, £306,095; bismuth, £132,576; chrome, £102,617; coke, £2,560,725; diamonds, £126,989; iron, £2,554,295; opal, £1,386,234; oil shale, £2,357,543; wolfram, £159,992; and zinc, £10,108,611. In the Victorian returns antimony ore was responsible for £285,501. Included in "other" in the Queensland production were opal, £177,195; gems, other, £285,294; bismuth and wolfram, £937,863; antimony ore, £50,953; manganese, £64,899; limestone flux, £350,181; and ironstone flux, £269,797. The chief item in South Australian "other" minerals was salt, £912,881. 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 its repetition in the present issue.

2. **Production of Gold at Various Periods.**—In the following table 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 1914 was much below the average, the output being the lowest recorded since 1890. Apart from the dredging industry, the business of gold-mining is at present apparently in a somewhat languishing state. In Victoria the yield for 1914 shewed a decrease of 21,714 ozs. fine on that for the preceding year. Over 14,000 ozs. of this decrease resulted from the closing of two deep alluvial mines, the Great Southern at Rutherglen, and the Burnt Creek at Dunolly. From the cyaniding of old tailings, the yield shewed a decline of 5500 ozs., and from dredging of 8637 ozs. Although several of the lode mining areas reported decreases, there were increased yields at Ballarat, and from Ararat and Stawell. The deficiency in Queensland was due to the reduced returns from some of the chief centres such as Charters Towers, Croydon, Cloncurry, Ravenswood, and Rockhampton. The chief increases were shewn by Chillagoe and Gympie. It is stated, however, that the later months in 1914 evidence an upward tendency. The future of the Charters Towers field is largely dependent on the persistence of ore in depth, but the arguments for and against such persistence do not at present admit of a definite pronouncement on the matter. For Western Australia the figures shew a decrease of over 81,000 oz. in 1914, as compared with 1913, diminished

returns being recorded at all the principal fields, with the exception of Yilgarn, Mt. Margaret, North Coolgardie, and Phillips' River. For Tasmania there was a decline of about 7000 ozs.

VALUE OF GOLD RAISED IN AUSTRALIA, 1851 to 1914.

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	...	...	...	...	7,861,227
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	473,956	2,936	...	2,536	...	8,213,765
1869 ...	974,149	6,179,024	417,681	15,593	...	514	...	7,586,961
1870 ...	931,016	5,217,216	390,925	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 ...	1,396,375	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	...	11,962	...	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	...	...	23,289	...	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	...	...	201,297	...	4,906,903
1881 ...	573,582	3,333,512	957,570	880	...	216,901	111,945	5,194,390
1882 ...	526,522	3,458,440	785,868	3,080	...	187,337	82,274	5,043,521
1883 ...	458,530	3,121,012	736,810	10,534	...	176,442	77,195	4,580,523
1884 ...	396,059	3,114,472	1,062,471	15,469	...	160,404	77,935	4,826,810
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	63,139	4,428,339
1887 ...	394,579	2,471,004	1,481,990	72,003	18,517	158,533	68,774	4,665,400
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	2,305,596	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	6,186,986
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	2,960,344	2,150,561	26,060	879,748	206,115	102,816	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	2,750,348	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 ...	684,970	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	280,015	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	3,280,478	2,313,464	27,000	7,622,749	254,963	54,225	14,631,745
1907 ...	1,050,730	2,954,617	1,978,938	20,540	7,210,749	277,607	21,928	13,515,109
1908 ...	954,854	2,849,838	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	2,422,745	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
1913 ...	635,703	1,847,475	1,128,768	27,800	5,581,701	141,876	13,250	9,376,573
1914 ...	528,873	1,755,236	1,059,574	26,581	5,237,353	111,475	10,757	8,729,949
Total £	60,627,551	295,306,164	77,406,272	975,191	120,117,925	7,660,633	2,089,695	564,183,431

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 4s. $11\frac{5}{11}$d.:—

QUANTITY OF GOLD PRODUCED IN THE COMMONWEALTH, 1905 to 1914.

Year.	N.S.W.	Victoria.	Q'land.	S. Aust.	W. Aust.	Tas.	Nor. Ter.	C'wealth.
	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.
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	31,101	7,277	2,484,068
1912	165,295	480,131	347,946	6,592	1,282,658	37,973	7,811	2,328,406
1913	149,657	434,933	265,735	6,545	1,314,044	33,400	3,119	2,207,433
1914	124,507	413,218	249,468	6,258	1,232,977	26,243	2,532	2,055,203

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, 1905 to 1914.

State.	Annual Average of Gold Production, 1905 to 1914.	Percentage on Common-wealth.	State.	Annual Average of Gold Production, 1905 to 1914.	Percentage on Common-wealth.
	£			£	
Commonwealth ...	**11,945,200**	**100.00**	New South Wales	855,728	7.16
Western Australia	6,525,267	54.64	Tasmania ...	198,176	1.66
Victoria ...	2,524,341	21.13	South Australia	26,128	0.22
Queensland ...	1,790,213	14.98	North'n Territ'y	25,347	0.21

4. **Methods of Gold Mining adopted in 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 Tallawang. 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 employed also 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 4807 ozs. in 1914, the chief yields being—Uralla, 226 ozs.; Hill End, 381 ozs.; Windeyer, 500 ozs.; Braidwood, 213 ozs.; Major's Creek, 404 ozs.; Adelong, 291 ozs.; Sofala, 281 ozs. The quantity obtained by dredging was 25,290 ozs.; the largest returns being obtained at Araluen, 11,310 ozs.; Adelong, 6851 ozs.; Nundle, 326 ozs.; Braidwood, 947 ozs.; Gundagai, 3283 ozs.; Stuart Town, 1353 ozs.; Sofala, 411 ozs. The dredges in operation during 1914 numbered 69, of which 23 were of the bucket type and 46 were suction plants. In the recovery of gold 18 bucket dredges and 8 pumping plants were employed, while 5 bucket dredges and 38 pumping plants were engaged in the winning of stream tin. The value of the plants in operation was estimated at £339,571. The quantity of gold won from quartz amounted to 91,615 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 17,868 ozs. and 30,759 ozs. Next come the Adelong field with 6589 ozs.; Hillgrove, 5744 ozs.; Wyalong, 5406 ozs.; Peak Hill, 4125 ozs.; and Gundagai, 3909 ozs. The Mount Boppy mine in the Cobar district has for some years been the premier gold mine in the State.

The table below shews as far as can be ascertained the yield from alluvial and quartz mining in each of the principal districts during 1914. Owing to the circumstance that it was impossible to obtain complete returns from all 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, 1914.

District.	Alluvial.		Quartz.	Total.
	Other than by Dredging.	By Dredging.		
	ozs.	ozs.	ozs.	ozs.
Albert	41	...	2,282	2,323
Bathurst	819	...	4,327	5,146
Clarence and Richmond	119	...	658	777
Cobar	...	...	48,997	48,997
Hunter and Macleay	9	...	221	230
Lachlan	247	3,283	9,162	12,692
Mudgee	708	...	6,401	7,109
New England	247	...	155	402
Peel and Uralla	519	577	6,180	7,276
Southern	835	12,647	3,931	17,413
Tambaroora and Turon	639	1,764	2,569	4,972
Tumut and Adelong	624	7,019	6,732	14,375
Total	4,807	25,290	91,615	121,712

(ii.) *Victoria.* Lode mining 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, 1914, 4614 and 4318 feet deep respectively. Altogether there were at the close of 1914 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

1914 being 79, of which 45 were bucket dredges, 21 pump hydraulic sluice, and 13 jet elevator. The total quantity of gold won from dredge mining in 1914 was 56,540 ozs., and from sluicing by gravitation, 255 ozs., the total area treated being 455 acres. Tin to the value of £4358 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, 1914.

District.	Alluvial.	Quartz.	Total.
	Ozs.	Ozs.	Ozs.
Ararat and Stawell	32,284	4,309	36,593
Ballarat	10,386	48,218	58,604
Beechworth	47,151	17,398	64,549
Bendigo	2,860	155,623	158,483
Castlemaine	11,421	47,279	58,700
Gippsland	4,678	9,628	14,306
Maryborough	27,273	11,885	39,158
Total	136,053	294,340	430,393

The largest output from lode mines in 1914 was furnished by the Ajax Central at Daylesford, with 12,512 ozs.; followed by the Great Extended Hustlers at Bendigo, with 9130 ozs., and the North British at Maldon, with 8991 ozs. Of the deep alluvial mines the Cathcart Central Company, at Ararat, produced 15,495 ozs., the Cathcart 8098 ozs., and the Duke and Main Leads Consols at Maryborough, 6671 ozs. In dredging, the Campbell's Creek, at Castlemaine, headed the list with an output of 3071 ozs.

(iii.) *Queensland.* Operations in Queensland are at present chiefly confined to reefing, the yield from alluvial in 1914 being only 1598 ozs., of which 430 ozs. were won at the Gympie field, while the quantity produced from stone treated was 129,922 ozs.; from copper and other ores 114,052 ozs.; and from old tailings 3896 ozs.; making a total production of 249,468 ozs., valued at £1,059,674. The yields from the principal fields are given below:—

GOLD WON IN QUEENSLAND, ALLUVIAL AND QUARTZ, 1914.

District.	Alluvial.	From Stone Treated.	From Copper and other Ores and old Tailings.	Total.
	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.
Charters Towers	168	62,440	2	62,610
Gympie	430	40,830	1,069	42,329
Mount Morgan	72	216	106,232	106,520
Ravenswood	23	11,225	588	11,836
Croydon	6	3,515	1,484	5,005
Etheridge, Oaks and Woolgar ...	35	6,404	193	6,632
Cloncurry	26	...	4,866	4,892
Gladstone	41	304	813	1,158
Rockhampton	2	34	2,384	2,420
Chillagoe	16	3,117	161	3,294
Other districts	779	1,837	156	2,772
Total	1,598	129,922	117,948	249,468

(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 1914 were Tarcoola and Deloraine.

The total output of gold for 1914 from the Northern Territory amounted to 2532 fine ounces, valued at £10,757.

(v.) *Western Australia.* The auriferous deposits of Western Australia may be grouped under three headings—(1) Superficial deposits, (2) Deposits in beds of conglomerate, and (3) Lode and vein deposits. The first class includes a number of deposits of alluvial type, either in the beds of existing watercourses or in deep leads, up to 100 feet or more below present surface level. Associated with these are deposits of crystalline gold in "pug," oxide of iron, and soft weathered portions of underlying bed rock. Considerable areas of auriferous surface soil are also found, and these have apparently originated from the denudation by weathering of the bed rock and its associated veins. The shallow surface deposits have been worked by ground sluicing wherever water was available, but the most of the ground has been worked by "dry-blowing." The pug and clayey bedrock are usually treated in puddling machines or stamp batteries and Huntington mills or by a combination of both methods. In regard to (2) it may be noted that in several localities on the Pilbara goldfield and in one on the Yalgoo, gold has been found in conglomerate of the Nullagine series of rocks, now tentatively accepted as of Cambrian age. The gold is crystalline and is confined to the interstitial cementing material. Occasional occurrences of gold are met with in laterite conglomerate of tertiary and post tertiary age, and at Kintore in conglomerate of the same age. Lode and vein deposits alluded to in (3) are found in great variety in Western Australia. The gold is always found associated with iron pyrites in the unoxidised portions of the lodes, and often also with copper pyrites, arsenical pyrites and galena. Tellurides of gold occur at times, and scheelite is a common accessory mineral. The principal auriferous rocks are of very great geological age, most probably pre-Cambrian, and possibly Archæan, and have all been subjected to intense metamorphism. It is found that the rich veins are not restricted to any one particular description of rock—granite, quartz, porphyry, quartz dolerite, diorite, etc., and even metamorphic sedimentary country rock have been found to carry them in various parts of the State. The total production of gold from all sources during 1914 was 1,232,977 ounces, of which only about 0.2 per cent. was alluvial. The yields in each district were as shewn below:—

GOLD WON IN WESTERN AUSTRALIA, ALLUVIAL AND QUARTZ, 1914.

Goldfields.	Alluvial.	Dollied and Specimens.	Crushed.	Total.
	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.
East Coolgardie	140	1,700	681,056	682,896
East Murchison	6	2,367	68,435	70,808
Mount Margaret	308	667	95,818	96,793
Murchison	370	2,778	112,574	115,722
North Coolgardie	52	79	72,057	72,188
Coolgardie	413	230	20,339	20,982
Phillips River	...	...	4,665	4,665
North-east Coolgardie	64	140	9,930	10,134
Yilgarn	...	30	88,714	88,744
Broad Arrow	8	308	8,970	9,286
Peak Hill	55	10	2,538	2,603
Pilbara	582	16	4,579	5,177
Dundas	12	498	26,081	26,591
Yalgoo	...	201	5,825	6,026
West Pilbara	92	...	931	1,023
Kimberley	453	...	...	453
Other goldfields	4	...	144	148
Total	2,559	9,024	1,202,656	1,214,239

The figures in the previous table are compiled from returns from the individual mines and are somewhat incomplete; the total is therefore less than that shewn on page 403, which represents mint and export returns.

(vi.) *Tasmania.* The yield from Tasmania is 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 1914 are given below :—

GOLD WON IN TASMANIA, ALLUVIAL AND QUARTZ, 1914.

District.	Quartz.	Alluvial.	Cyanide.	Blister Copper.	Total.
	Ozs.	Ozs.	Ozs.	Ozs.	Ozs.
Beaconsfield	9,260	21	6,124	...	15,405
Mathinna	1,006	...	...	...	1,006
Mt. Victoria	71	134	...	...	205
Mt. Cameron					
Lefroy	37	...	...	...	37
Lisle	3	126	...	...	126
Golconda					
Lilydale					
West Coast	...	27	...	9,898	9,928
Total	10,377	308	6,124	9,898	26,707

The total production was valued at £111,475, equal to 26,243 ozs. fine, of which about 11,000 ounces were produced by the Tasmania Gold Mine Ltd., at Beaconsfield. About 10,000 ounces were contained in blister copper produced on the West coast.

(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 being 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 Cosmopolitan mine was the chief producer in 1914.

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. It may be noted, however, that in 1913 nuggets yielding 180 ozs., 50 ozs., and 23 ozs. were obtained at Poseidon in Victoria. In the same State also, and near the spot at Moliagul where the famous "Welcome Stranger," weighing 2284 ozs., was discovered in 1869, a mass of quartz yielding 94 ozs. of gold was obtained in 1913. A small lump of quartz from a mine at Tallangatta furnished 44 ozs. In an alluvial deposit at Corindhap four nuggets weighing respectively 100, 60, 60, and 30 ozs. were obtained at a depth of 13 feet.

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 1905 to 1914. The figures given in the table have been compiled chiefly from returns obtained directly by the Commonwealth Bureau of Census and Statistics from the gold-producing countries of the world.

WORLD'S GOLD PRODUCTION, 1905 to 1914.

Year.	World's Production of Gold.	Gold produced in Commonwealth.	Percentage of C'wealth on Total.
	£	£	%
1905	77,026,000	15,555,000	20.19
1906	83,170,000	14,636,000	17.60
1907	84,741,000	13,518,000	15.95
1908	92,157,000	13,062,000	14.17
1909	92,924,000	12,611,000	13.57
1910	93,452,000	11,554,000	12.36
1911	94,938,000	10,552,000	11.11
1912	96,820,000	9,880,000	10.20
1913	92,361,000	9,377,000	10.15
1914	92,008,000	8,730,000	9.49

While the production of gold in the Commonwealth shews a considerable decrease during the seventeen years from 1897 to 1914, 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 1914.

Country.	1897.	1900.	1912.	1913.	1914.
	£	£	£	£	£
United States ...	11,787,000	16,269,000	19,203,000	18,144,000	19,074,000
Canada ...	1,240,000	5,742,000	2,599,000	3,411,000	3,272,000
Mexico ...	2,045,000	1,884,000	4,974,000	3,861,000	3,737,000
Transvaal ...	11,654,000	1,481,000	38,686,000	37,373,000	35,657,000
Rhodesia ...	800	308,000	2,730,000	2,931,000	3,580,000
Gold Coast ...	85,000	38,000	1,499,000	1,649,000	1,744,000
Madagascar ...	8,500	142,000	289,000	231,000	182,000
India... ...	1,571,000	1,893,000	2,272,000	2,292,000	2,338,000
Corea ...	208,000	371,000	544,000	677,000	616,000
Japan ...	142,000	290,000	915,000	897,000	920,000
Java	24,000	112,000	550,000	531,000	547,000
Costa Rica ...	2,000	31,000	82,000	88,000	104,000

The largest increase was recorded in the Transvaal, where the production more than trebled itself in the seventeen years 1897 to 1914.

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 1910 to 1914.

Year.	N.S.W.	Victoria.	Q'land.	S. Aust.	W. Aust.	Tas.	N. Terr.	C'w'lth.
	No.	No.	No.	No.	No.	No.	No.	No.
1901 ...	12,064	27,387	9,438	1,000	19,771	1,112	200	70,972
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	3,981	920	13,700	485	263	35,103
1913 ...	3,570	11,931	3,123	800	13,445	481	175	33,525
1914 ...	3,443	10,398	2,793	375	12,110	402	180	29,701

§ 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 Platina in the Fifield division, near Parkes, but the entire production in 1914 was small, amounting to only 244 ozs., valued at £2129, while the total production recorded to the end of 1914 amounted to 13,676 ozs., valued at £34,274.

At Platina, gold is found in association with the platinum, and it was proposed to provide a permanent water supply with the object of treating the washdirt on an extensive scale. The falling off in the price of the metal, coupled with the lower grade of the washdirt, has, however, resulted in decreased attention being given to the industry.

(ii.) *Victoria.* In Gippsland, Victoria, the metal has been found in association with copper. The production of platinum in 1913 amounted to 127 ozs., and was contained in matte produced by the Gippsland Copper, Platinum, and Gold Mining and Smelting Company, from ores raised from the old mine at Cooper's Creek. There was no production in 1914.

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. The production in 1913 amounted to 1262 ozs., valued at £12,016, and in 1914, to 1019 ozs. valued at £10,076. A specimen found by a prospector at the Whyte River weighed 2 ozs. 8 dwt. 7 gr. It is stated that the selling price has occasionally reached as high as £11 per oz., but this extraordinary value is dependent on causes which are not too well known. Owing to the war, the market in 1914 was for a time closed, but a parcel of 13 ozs. forwarded to America was sold at an average of £5 13s. 6d. per oz. Besides a steady and increasing use in the manufacture of fountain pens there is at present some demand for iridium and osmiridium in connection with the prevailing fashion in hard platinum jewellery.

§ 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 1914:—

PRODUCTION OF SILVER AND LEAD, AUSTRALIA, 1881 to 1914.

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
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	41,995	309,098	820	4,221,890
1913	4,173,867	2,074	134,121	1,400	82,422	319,997	2,228	4,716,109
1914	3,611,369	1,540	38,640	529	69,228	96,225	545	3,818,076

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

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 the Mines Department 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, 1910 TO 1914.

Year.	Value of Silver, Lead, and Spelter produced within the C'wealth.	Value of Concentrates Exported.	Total.
	£	£	£
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
1913	2,709,867	3,759,691	6,469,558
1914	2,592,322	3,004,248	5,596,570

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 1904 and during the last ten years:—

ESTIMATED QUANTITY AND VALUE OF SILVER YIELDED BY MINES OF NEW SOUTH WALES TO END OF 1914.

Period.	Produced in Australia.		Contained in Concentrates, etc., Exported.		Total Production.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Fine ozs.	£	Fine ozs.	£	Fine ozs.	£
To the end of 1904 ...	90,699,071	14,728,368	107,604,892	18,680,038	198,303,963	33,408,406
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	587,768	11,983,669	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
1913	5,908,638	719,249	8,596,251	1,038,714	14,504,889	1,757,963
1914	5,481,286	630,658	7,879,240	820,754	13,360,526	1,451,412
Total	146,740,429	21,401,403	173,967,062	26,427,583	320,707,491	47,828,986

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. During 1913 the output of ore from the mines in this division amounted to 1,744,000 tons, the highest recorded in the history of the field, but owing to the dislocation caused by the war the quantity raised in 1914 decreased to 1,442,000 tons. The value of the output in 1914 was £4,221,000 as compared with £4,968,000 in 1913.

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 1914.

Mine.	Authorised Capital.	Value of Output to end of 1914.	Dividends and Bonuses Paid to end of 1914.
	£	£	£
Broken Hill Proprietary Co. Ltd.	600,000	37,421,721*	10,638,100
Broken Hill Proprietary Block 14 Co. Ltd. ...	155,000	3,602,292	562,660
British Broken Hill Proprietary Co. Ltd. ...	339,000	3,366,847	633,800
Broken Hill Proprietary Block 10 Co. Ltd. ...	1,000,000	4,302,433	1,352,500
Sulphide Corporation Ltd. (Central Mine) ...	1,100,000	15,511,800†	1,519,375
Broken Hill South Silver Mining Co. ...	200,000	6,144,800	1,635,000
North Broken Hill Mining Co. Ltd. ...	600,000	4,060,379	1,048,940
Broken Hill Junction Lead Mining Co. ...	150,000	975,176†	85,000
Junction North Broken Hill Mine	250,000	1,929,412†	79,793
The Zinc Corporation Ltd.	‖	1,363,258	10,000
Barrier South Ltd.	168,000	151,517	50,000
Totals	4,562,000	78,829,635‡	17,615,168

* The value of the ores purchased during the years 1908 to 1914 is not included. † Output understated owing to incomplete returns. ‡ Incomplete. ‖ Not available.

(*b*) *Yerranderie.* The mines on the Yerranderie field in the Southern Mining District produced 520,880 ozs. of silver in 1914, besides 1061 ozs. of gold, and 1269 tons of lead, the total production being valued at £82,053. Mining operations in this locality are carried on under considerable difficulties owing to the heavy cost of transport, the cost of cartage to and from Camden railway station—£2 5s. per ton—preventing successful exploitation of the lower grade ores.

(*c*) *Cobar.* A considerable quantity of silver is obtained from the Great Cobar Ltd. Mine and attached properties, the production in 1914 amounting to 24,305 ozs. Owing to the dislocation of the industry caused by the war the yields from outlying mines were comparatively insignificant.

(ii.) *Tasmania, West Coast.* The production of silver-lead ore in 1914 was 11,566 tons, valued at £96,225, to which the Zeehan Montana contributed £11,335 and the Mt. Zeehan £10,441. In the Mt. Farrell District the North Mt. Farrell contributed £23,722.

(iii.) *Queensland.* The yield for the chief silver-producing centres in 1914 was as follows:—Chillagoe, silver £2976, lead £4677; Charters Towers, silver £3,698, lead £1377; Cloncurry, silver £5891; Mt. Morgan, silver £3539. Production in the Chillagoe district was seriously affected by the closing down of the Chillagoe Smelters in March, since very few of the mines could bear the cost of sending the ore away to Southern smelters. In the Etheridge district the increasing difficulty of disposing of low grade ore at a profitable rate has greatly restricted operations. Work was suspended at the famous Silverspur Mine, near Texas, in the Stanthorpe District.

(iv.) *South Australia.* Rich specimens of silver ore have been discovered at Miltalie, about 18 miles from Franklin Harbour, also at Mount Malvern, and near Rapid Bay. The surrounding district is highly mineralized, but, so far, has not been thoroughly prospected.

(v.) *Northern Territory.* Silver-lead ores have been found at O'Neill's Creek about 24 miles east of Pine Creek, at Mount Bonney, and at Iron Blow.

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

WORLD'S PRODUCTION OF SILVER, 1905 to 1914.

Year	1905.	1906.	1907.	1908.	1909.	1910.	1911.	1912.	1913.	1914.
World's production in 1000 fine ozs.*	181,338	184,552	183,386	212,570	227,291	240,223	254,214	250,979	214,391	215,700

* Add 000 to figures for fine ounces.

Australasia's share in the world's silver production in 1913 was estimated at 18,855,000 ounces, or about $8\frac{4}{5}$ 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 in the London market at various periods and during the last five years is given below:—

PRICE OF SILVER, 1881 to 1914.

Year	1881.	1891.	1901.	1908.	1909.	1911.	1912.	1913.	1914.
Pence per standard oz. ...	$51\frac{3}{4}$	$45\frac{1}{16}$	$27\frac{5}{16}$	$24\frac{3}{8}$	$23\frac{11}{16}$	$24\frac{9}{16}$	$28\frac{1}{16}$	$27\frac{9}{16}$	$25\frac{5}{16}$

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 $33\frac{1}{8}$d., the highest realised since 1893, when the average stood at $36\frac{5}{16}$d.

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 1910 to 1914.

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‡
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
1913...	9,357	...	204	30	132	1,272	16	11,011
1914...	8,242	...	130	25	100	491	10	8,998

* 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 1910 to 1914 is shewn in the following tables :—

PRODUCTION OF COPPER, AUSTRALIA, 1881 to 1914.

State.	1881.	1891.	1901.	1908.	1910.	1911.	1912.	1913.	1914.
QUANTITY.									
	Tons.	Tons	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
N.S.W. ... Copper	*	*	6,087	8,679	8,435	10,618	8,990	9,153	5,081
N.S.W. ... Ore	*	*	645	392	4,455	1,482	2,044	308	1,526
Victoria... Copper & Ore	*	*	...	983	150	36	...	36	...
Q'land ... Copper	330	85	3,061	14,961	16,387	20,384	23,120	23,655	18,436
S. Aust. ... Copper	3,824	3,551	6,736	} 6,152	{ †5,199	5,922	6,295	7,161	6,881
S. Aust. ... Ore	21,638	13,239	2,353		...	...	...	...	...
W. Aust.... Copper	...	...	...	479	1,281	10,654	28	82	183
W. Aust.... Ore	...	*	10,157	2,503	6,309	...	9,536	4,339	3,913
Tasmania Copper	...	...	9,730	8,833	8,864	8,308	6,528	6,535	7,509
Tasmania Ore	...	...	10,029	1,18	...	...	...	...	3,288
Northern Territory	...	...	...	...	...	163	377	41	405
C'wealth Copper	...	...	25,614	} 44,167	{ 40,166	} 57,567	56,918	51,310	47,222
C'wealth Ore	...	...	23,184		{ 10,914				

* Not available. † Including 97 tons of copper, Northern Territory.

VALUE.

	£	£	£	£	£	£	£	£	£
New South Wales...	227,667	119,195	412,292	502,812	486,257	590,102	579,791	598,733	274,671
Victoria	8,186	216	...	3,928	450	2,088	...	2,829	...
Queensland ...	19,637	3,554	194,227	893,535	932,489	1,151,351	1,698,280	1,660,178	1,118,648
South Australia ...	418,296	235,317	500,077	345,968	*307,316	332,500	461,500	488,986	417,487
Western Australia	...	4,463	75,246	57,091	95,928	78,118	59,824	142,513	38,174
Tasmania... ...	...	...	1,026,748	609,651	566,972	408,649	440,444	375,664	496,041
Northern Territory	...	...	...	...	...	1,470	3,998	482	4,860
Commonwealth ...	673,786	362,745	2,208,590	2,412,985	2,389,412	2,564,278	3,243,837	3,269,385	2,349,881

* Including £1,196 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 1914 was £116,460, out of a total for the State of £274,671. At the Great Cobar Mine the Company's smelters closed down on the 9th April, 1914, and the output of copper amounted to only 1410 tons as compared with 5,985 tons in the preceding year.

The Cadia Copper mine, at Cadia, in the Orange division, produced 1103 tons of copper matte valued at £41,000. The Cobar Gladstone mine returned a total of £15,000. The Lloyd Copper mine, in the Burraga division, after five years' idleness was reopened in 1913, and produced 35,000 tons of ore estimated to contain copper to the value of £92,000. In 1914, however, the production fell away to £29,912.

The Electrolytic and Refining and Smelting Company of Australia Limited, established at Port Kembla, produced 17,570 tons of copper valued at £1,074,000, chiefly from matte and ore imported from other States, especially from Queensland. The *English and Australian Copper Co. Ltd.*, at Waratah, obtained 313 tons valued at £18,633 from local ores.

(ii.) *Queensland.* The yield in this State amounted in 1914 to 18,436 tons, valued at £1,118,648, to which the Cloncurry field contributed 8215 tons, valued at £497,098. Next in order were Mount Morgan with 7796 tons, valued at £471,658; Gladstone 996 tons, £60,249; Rockhampton, 590 tons, £38,803; Mount Perry, 318 tons, £19,239; Etheridge, 188 tons, £11,404; Chillagoe, 175 tons, £10,617; and Mackay 110 tons, £6,655.

The Cloncurry district is by far the most important copper-bearing area in Queensland, but production was hampered in 1914 by the closing of the Mount Elliott smelters, and the falling off through the war of the output of ore from the smaller mines in the area. At the Hampden smelters 60,836 tons of ore were treated, resulting in a yield of 6,079 tons of copper, 1970 oz. of fine gold, and 51,949 oz. of silver, the whole being valued at £383,000. It is now generally recognised that Cloncurry constitutes the richest and most extensive cupriferous area in Australia.

(iii.) *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, Queensland, Tasmania, 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 £4,500,000 worth of copper. The entire yield from the date of first working is estimated at nearly £13,000,000. 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 1914 came from the Moonta and Wallaroo mines.

(iv.) *Western Australia.* The value of copper exported from this State in 1914 was £38,174. According to the returns, the production in the West Pilbara field was 7,764 tons, valued at £40,607, while the Phillips River field shewed a production of 4841 tons, valued at £37,524. Small quantities were also produced at Murchison and Peak Hill.

(v.) *Tasmania.* The quantity of blister copper produced in Tasmania during 1914 was 7509 tons, valued at £518,935, and of copper and copper ore, 3,288 tons, valued at £18,680, the bulk of the production being due to the Mount Lyell Mining and Railway Co. Ltd. This Company treated 338,957 tons of ore in 1914, and produced 7509 tons of blister copper, containing copper to the value of £427,704; silver, £49,657; and gold, £41,574. About 2000 men are employed at the company's mines and reduction works. In the Zeehan district, the Ring Valley mine produced 112 tons of ore valued at £2415, and the Copper-Nickel Property Syndicate sold 3089 tons of copper-nickel ore for £15,815. The Mount Balfour field raised 44 tons of ore, valued at £178. From the Jasper Copper mine in the Heazlewood district, 20 tons of ore were raised, valued at £436.

(vi.) *Northern Territory.* Copper has been found at various places, including Copperfield, 4 miles west of Pine Creek, the Daly and Mary Rivers, Mount Davis and Mount Diamond, Woollagarong, Rum Jungle, Brock's Creek, Maude Creek, Kilgour River, and Coronet Hill.

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." No quotations were recorded for the months—August, September and October, in the London price, and the average given is based on the returns for the remaining nine months.

FLUCTUATION IN VALUE OF COPPER, 1901 and 1910 to 1914.

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
1910	57.05	13.04	12.74
1911	55.97	12.63	12.38
1912	72.94	16.56	16.34
1913	68.35	15.69	15.27
1914	61.52	..	13.50

* 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. During the last five months of 1913 sales by the Lake Superior Companies were scattered and irregular.

4. **World's Production of Copper.**—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 1910 to 1914.

Year	1901.	1910.	1911.	1912.	1913.	1914.
World's production—(short tons)	583,517	966,998	969,750	1,114,769	1,104,517	1,018,395

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 1910 to 1914.

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‡
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
1913	2,629	12	3,687	4,000	213	2,162	53	12,756
1914	1,357	...	2,578	3,000	192	2,099	88	9,314

* 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 1910 to 1914:—

TIN PRODUCED IN AUSTRALIA, 1881 to 1914.

State.	1881.	1891.	1901.	1910.	1911.	1912.	1913.	1914.
QUANTITY.								
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
New South Wales { Ingots	5,824	1,454	648	847	958	900	903	650
New South Wales { Ore	609	203	11	1,021	970	1,175	2,118	1,667
Victoria ... ... Ore	‡	‡	77	41	33	48	57	53
Queensland* ... Ore	‡	‡	1,661	2,953	3,091	3,230	3,197	2,085
West Australia (Ore & Ingot)	...	‡	734	500†	495	651	484	363†
Tasmania ... ... Ore	‡	‡	1,790	3,701	3,953	3,714	4,010	2,573
Northern Territory Ore	...	‡	81	364	239	271	258	160
Commonwealth { Ingots, ore, etc.	‡	‡	5,002	9,427	9,739	9,989	11,027	7,551
VALUE.								
	£	£	£	£	£	£	£	£
New South Wales... { Ingots	531,303	124,320	76,080	127,700	191,000	183,000	182,800	191,400
New South Wales... { Ore	37,492	9,643	464	100,456	116,089	155,074	238,492	165,730
Victoria ... ... Ore	7,334	5,092	4,181	3,706	3,417	5,733	6,959	4,955
Queensland ... Ore	193,699	116,387	93,723	243,271	307,847	364,503	343,669	176,197
West Australia (Ore & Ingot)	...	10,200	40,000	45,129	55,220	79,738	72,142	35,649
Tasmania ... ... Ore	375,775	293,170	212,542	399,393	513,500	543,103	531,983	259,300
Northern Territory Ore	...	1,938	5,586	31,113	22,900	27,001	25,526	15,200
Commonwealth ...	1,145,603	560,750	432,576	950,768	1,209,973	1,358,152	1,401,571	758,431

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

2. **Sources of Production.**—(i.) *New South Wales.* A large proportion of the output in New South Wales was obtained by dredging, the quantity so won in 1914 being 1205 tons, valued at £119,167. In the Tingha division the yield amounted to 795 tons, valued at £77,651, the yield from dredging being estimated at £47,973. The Emmaville division in the New England district shewed a yield of 991 tons of ore, valued at £85,211, of which dredging produced 509 tons, valued at £49,659. In the Wilson's Downfall division, 125 tons, valued at £11,665, were raised. The Glen Innes division, also in the New England district, returned a yield of 101 tons, valued at £10,671. The Ardlethan field in the Lachlan division, discovered in January, 1912, produced ore and concentrates to the value of £25,332.

(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 1914 was obtained in the Toora district.

(iii.) *Queensland.* The chief producing districts in Queensland during 1914 were Herberton, 1141 tons valued at £86,327; Chillagoe, 228 tons, £18,588; Cooktown, 223 tons, £22,335; Stanthorpe, 211 tons, £22,000; and Kangaroo Hills, 163 tons, £16,082.

(iv.) *Western Australia.* The production of tin ore and ingot for the State during 1914 amounted to 363 tons, valued at £35,649, to which the Greenbushes field contributed 245 tons, valued at £21,145, and the Pilbara field 87 tons, valued at £8,168. There was no production from the other fields in 1914.

(v.) *Tasmania.* The tin ore raised in 1914 amounted to 2573 tons, valued at £259,300, a considerable falling-off as compared with the previous year when the production was returned as 4010 tons, valued at £531,983. This heavy decline was due to the paralysis of the tin market occasioned by the war, coupled with the dry weather conditions which prevailed, especially in the eastern and north-eastern areas. The bulk of the production in 1914 came from the North-Eastern Division with 1067 tons of ore, valued at £111,894. Of the total yield in this division, 628 tons were contributed by the Pioneer and Gladstone districts, 243 tons by Derby, and 136 tons by Branxholm. The next highest output was returned from the North Western Division with 889 tons, to which the celebrated Mt. Bischoff contributed 698 tons, and the Mt. Bischoff Extended, 111 tons.

(vi.) *Northern Territory.* Mount Wells, in the Burrundie district, has yielded a fair output of tin since 1886, and recent developments have proved that the lodes are increasing in size and quality. Copper, silver-lead and tin shows occur abundantly in the district, but little work has been done on them. The recently discovered tin field at Maranboy Springs, about 40 miles east of the Katherine telegraph station, promises to yield good returns. A fairly extensive deposit has been located at Hayes Creek, about 11 miles from Brock's Creek and only 6 miles from the railway line. Efficient prospecting would probably reveal the existence of other deposits. Small yields were also obtained during the year at Horseshoe Creek, Snadden's Creek, West Arm, Hidden Valley, Rum Jungle, and Mary River.

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

THE WORLD'S TIN SUPPLIES, 1909 to 1913.

Country in which Smelted.	1909.	1910.	1911.	1912.	1913.
	Tons.	Tons.	Tons.	Tons.	Tons.
Australia	6,450	5,500	5,150	5,130	4,870
Austria-Hungary	52	39	16	14	13
Banka, Sales in Holland	12,150	13,631	15,147	16,111	15,173
Billiton, Sales in Holland and Java ...	2,280	2,240	2,240	2,243	2,243
Bolivia, Exports to England	834	1,003	464	552	300
China, Exports	4,516	6,510	6,056	8,785	3,889
France	...	...	500	500	1,200
Germany, mainly Bolivian ores ...	8,995	11,394	12,426	10,646	11,500
Japan	23	23	155	36	50
Straits Settlements, Exports	61,540	57,490	57,944	61,528	65,640
United Kingdom, domestic ores ...	5,282	4,874	4,950	5,338	5,300
United Kingdom, imported ores ...	11,890	13,055	13,850	13,600	16,700
Total (metric tons)	114,012	115,759	118,898	124,483	126,878

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 1904 to 1914 was as follows:—

PRICE PER TON OF TIN, 1897 to 1914.

Year.	Price per Ton.	Year.	Price per Ton.
	£ s. d.		£ s. d.
1897	61 8 0	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
1907	172 12 9	1913	206 5 7
1908	133 2 6	1914	156 11 0*

* Quotations incomplete.

According to "The Mineral Industry" the maximum price obtained for tin during the period 1897-1914 was reached in April, 1914, when the metal was quoted at £231 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 1910 to 1914.

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
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
1913	2,362	116	2,102	403	1,947	267	7,197
1914	2,168	65	1,570	217	1,523	186	5,729

§ 7. Zinc.

1. **Production of Zinc.**—The production of spelter is practically confined to the Broken Hill district of New South Wales, where zincblende 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. 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 1914, 359,310 tons, valued at £1,020,711, 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 1914:—

NEW SOUTH WALES.—PRODUCTION OF ZINC, 1889 to 1914.

Year.	Quantity of Zinc (Spelter and Concentrates) Produced.	Value.	Year.	Quantity of Zinc (Spelter and Concentrates) Produced.	Value.
	Tons.	£		Tons.	£
1889	97	988	1911	516,378	1,414,980
1891	219	2,622	1912	520,518	1,766,242
1899	49,879	49,207	1913	506,661	1,547,987
1910	468,627	1,289,634	1914	359,310	1,020,711

The total quantity of zinc (spelter and concentrates) produced in New South Wales to the end of the year 1914 was 3,685,700 tons, valued at £10,109,000. The average price of spelter per ton in the London market during the last eight years was £23 5s. 4d., ranging from £20 3s. 3d. in 1908 to £26 8s. 5d. in 1912. The price in 1914 averaged £22 10s. 4d., but the quotation for December was £27 7s. 5d. per ton.

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 1914, a small quantity of zinc, valued at £379, was produced in Western Australia.

§ 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, provided 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			
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 1914-15, are shewn in the following statement :—

PARTICULARS OF BOUNTIES PAID ON PIG IRON, BAR IRON, STEEL, etc., 1909 to 1915.

Period.	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
1913-14	7,136	...	40,121	...	4,554	51,811
1914-15	2,474	...	31,813*	...	593	34,880
Total	14,339	4,611	150,780	674	23,085	193,489

* Including £19,808 under Iron Bounty Act.

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 fluctuated.

(ii.) *The Iron Bounty Act 1914.* This Act repealed the Manufactures Encouragement Act 1908-14, and provides for a bounty on Australian pig iron up to the end of 1915. The rate of bounty is 8s. per ton, and the total amount authorised is £30,000. Provision is made for transfer, if required, to the State, of lands, buildings, etc., used in the manufacture of pig iron.

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 1914 the following materials were received at the blast furnace at the Eskbank Iron Works, Lithgow :—Iron ore, 135,316 tons ; limestone, 45,938 tons ; and coke, 97,224 tons. The output was 75,150 tons of pig iron, and 24,420 tons of steel ingots.

The Broken Hill Proprietary Company has established works for the manufacture of iron and steel on a large scale at Newcastle, and operations were started early in 1915. The Company is utilising the immense deposit of iron ore at the Iron Knob quarries in South Australia, abundant stores of first quality coal can be obtained from the various coalfields in the vicinity of Newcastle, and arrangements have been made for the local supply of the necessary quantities of limestone. The works have been planned so as to allow of ready extension as the business develops. By the end of August 1915 the works had produced 36,214 tons of pig iron, from which were made 17,134 tons of billets and blooms, and 11,574 tons of rails. The Company has contracts for over 100,000 tons of steel rails in Australia. Provision has been made for increasing the originally calculated output from 125,000 tons to 170,000 tons of steel per annum.

The following table shews the quantity and value of finished iron, pig iron, etc., made in New South Wales during the last seven years from locally-raised ores.

NEW SOUTH WALES.—PRODUCTION OF IRON, 1908 to 1914.

Particulars.	1908.	1909.	1910.	1911.	1912.	1913.	1914.
Quantity Tons	40,207	29,762	40,487	36,354	32,677	46,563	75,150
Value ... £	118,224	106,357	161,948	145,416	130,708	186,252	254,257

The bounty paid in 1912, 1913 and 1914 on iron and steel made from ores mined in New South Wales was as follows:—

BOUNTY PAID ON IRON AND STEEL, NEW SOUTH WALES, 1912, 1913, and 1914.

Description.	1912.		1913.		1914.	
	Tonnage.	Bounty.	Tonnage.	Bounty.	Tonnage.	Bounty.
		£		£		£
Pig iron ...	31,104	18,663	40,490	24,294	58,528	35,117
Puddled bar iron	549	329	...	...	...	...
Steel	...	...	1,088	653	14,929	8,957
Total ...	31,653	18,992	41,578	24,947	73,457	44,074

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. At Turrawa, in the Narrabri division, a deposit of ore said to contain from 55 to 65 per cent. of pure iron oxide has been found. During 1914 the quantity raised was 3144 tons, valued at £5584, while the total output to the end of that year was 30,000 tons, valued at £39,895. Up to the end of 1912 a certain amount of ironstone was raised each year for fluxing purposes, but as the smelting companies obtained suitable ores for treatment there was no production of ironstone flux in 1913 or 1914. Up to the end of 1912 the total raised amounted to 107,000 tons, valued at £81,618.

(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 1914, 48,090 tons of ironstone, valued at £39,459, were raised, of which 41,000 tons, valued at £35,000, came from the Rockhampton district, and nearly 7000 tons, valued at about £4000, from the Cloncurry field. A small quantity was also raised in the Chillagoe area.

(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 utilises 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.* Large bodies of rich ironstone have been discovered in various parts of the Territory, particularly between the Adelaide River and Rum Jungle. Owing to the lack of coal deposits, however, the deposits possess no immediate value.

(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 63,211,000 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. Unfortunately, complete returns for a later year than 1911 are not available.

§ 9. Other Metals.

1. **Antimony.**—This metal is widely distributed in the north-eastern portion of New South Wales, between the 148° meridian and the coast, and has been found native at Lucknow, near Orange. Dyscrasite, a silver antimonide, has been found in massive blocks in the Broken Hill lodes. Owing to the low price ruling for the metal in 1914 production was small, the quantity raised being stated at 36 tons, valued at £464. The ore was raised in the Hillgrove division, where it is found in association with scheelite and gold. The total quantity of antimony ore raised in New South Wales up to the end of 1914 was 16,708 tons, valued at £306,095. The production of antimony ore in Victoria during 1914 amounted to 7603 tons, valued at £29,365. Practically the whole of the ore was raised by a company 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.

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, in the Deepwater division, and also at Whipstick, in the Pambula division, its discovery dating from 1877. About 15 tons of metal and ore, valued at £2837, were exported from New South Wales during 1914; the total quantity exported to the end of that year was

565 tons, valued at £132,576. In Queensland wolfram, molybdenite, and bismuth have been found in various districts, but the chief centres of production in 1914 were the Herberton and Chillagoe fields. The total production in 1914 was valued at £37,365, of which £21,764 was returned as wolfram, £282 as bismuth, and £15,319 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 5 tons, valued at £1609, were raised in 1914 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 quantity raised in 1914 being 649 tons, from an area at Woods' Reef, Barraba. The total exports to the end of 1914 amounted to 31,984 tons, valued at £102,617. 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 1914, and the total produced since 1560 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, lead in the form of pig, carbonate, and chloride, exported in 1914, amounted to 25,989 tons, valued at £370,106. The total lead exported to the end of 1914 was 187,735 tons, valued at £2,737,000. 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 1914 amounting to 724 tons, valued at £12,134, of which 260 tons, valued at £4,677, were produced from the mines in the Chillagoe district, 132 tons, valued at £1481, from Herberton, 95 tons, valued at £1710, from the Etheridge district, and 156 tons, valued at £2808, from the Burketown district. Lead ore to the value of £59,002 was exported from Western Australia in 1913, the Northampton mineral field being the chief centre of production. 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 quicksilver has been small, the total being only a little over 1000 lbs. At Pulganbar, in the Copmanhurst division, about 700 tons of ore were treated in the reducing plant, but as the condensers were not cleared up at the end of the year, no returns can be given of production in 1914. During the year, work was resumed at the Ewengar Cinnabar mine in the Drake division. 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, and it is also found in New Guinea.

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 1914 to 6 tons of ore, valued at £27. Small quantities of manganese ore were raised in Victoria during 1914 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, Tumby, 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, at Rocky River, in the Tenterfield division, in the Bathurst division, and at Whipstick in the Pambula division, the export in 1914 being 61 tons, valued at £11,451, as compared with 79 tons, valued at £6802, in the previous year. It is stated that shortly before the war £500 and upwards per ton was paid for the mineral by German and other buyers. The production in Queensland for 1914 was 78 tons, valued at £38,190, practically the whole of which was contributed by the mines in the Chillagoe field. A small quantity was produced in 1914 from mines in the Moonta district in South Australia, and the occurrence of the metal is reported from various other localities. The existence of molybdenite in the Darling Range, in Western Australia, has been known for many years, and the high price of the metal is causing renewed attention to be devoted to the deposits.

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. Monazite from Pilbara, Western Australia, has been shewn to give off radium emanations. This mineral has been called "pilbarite." 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. From the 30th June, 1913, to the end of May, 1914, the works produced 239 milligrams of high grade radium preparation.

13. **Tungsten.**—Wolfram and scheelite, the principal ores of tungsten, are both mined to a small extent in New South Wales. During 1914 the export of wolfram was 139 tons, valued at £14,438, and of scheelite 57 tons, valued at £5852. Wolfram was mined chiefly at Torrington, in the Deepwater division, and scheelite at Hillgrove. In Victoria small quantities of ore were raised during 1913 at Benambra and Linton. In Queensland, tungsten ores are found in several districts, the chief centres of production in 1914 being Chillagoe and Herberton. (See also Bismuth). 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. About 47 tons of wolfram, valued at £4327, were produced in Tasmania during 1914, 14 tons valued at £1478 being raised at Avoca, and

24 tons, valued at £2012, at Middlesex. In the Northern Territory 6 tons of wolfram were raised during 1914 in the Wolfram Camp area, and there was a small output at Yenberrie. Numerous samples of good wolfram ore have been obtained at the Frew River in Central Australia.

In Western Australia a deposit of wolfram was discovered in the West Kimberley district about 70 miles to the north-east of Derby. The export in 1914 was, however, trifling. Wolfram is mined at various points in Tasmania, the production for 1914 being 47 tons, valued at £4327, 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 radium is regarded as one of the products of disintegration of uranium.

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 1914 amounted to 10,390,622 tons, valued at £3,737,761, or a decrease of about 24,000 tons in quantity, and £33,000 in value, as compared with the output in 1913, the highest yet recorded.

(iii.) *Victoria.* During 1914, 620,251 tons of coal were raised, valued at £289,099. Of this total 550,107 tons, valued at £247,548, were raised by the State coal mine at Wonthaggi. The total production for 1914 was about 23,000 tons higher than in the preceding year.

(iv.) *Queensland.* The quantity of coal raised in 1914 was 1,053,990 tons, valued at £416,292, the highest yet recorded. Twenty-nine collieries were working in the Ipswich district, seven on the Darling Downs, four in the Wide Bay and Maryborough districts, one in the Central district, and four at Blair Athol. The industry is at present in a 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 1914, and the output for the year was 319,210 tons, or about 5,000 tons more than in 1913. The improvement is due to the more general use of up-to-date plant and machinery.

(vi.) *Tasmania.* The principal collieries in Tasmania are the Cornwall and Mount Nicholas, the former producing 24,000 and the latter 34,000 tons out of a total yield in 1914 of 61,000 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 1914.

Year.	N.S.W.	Victoria.	Q'land.	S. Aust.	W. Aust.	Tas.	C'w'lth.
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
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
1913	10,414,165	596,896	1,037,944	...	313,818	55,043	12,417,866
1914	10,390,622	620,251	1,053,990	...	319,210	60,794	12,444,867
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
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
1913	3,770,365	274,940	403,767	...	153,614	25,367	4,628,053
1914	3,737,761	289,099	416,292	...	148,684	27,853	4,619,689

The Victorian figures for 1914 include about 2700 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 2884 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 1914:—

COAL RAISED IN NEW SOUTH WALES, 1881 to 1914.

District.	1881.		1901.		1911.		1914.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons.	£	Tons.	£	Tons.	£	Tons.	£
Northern ...	1,352,472	437,270	3,999,252	1,669,519	5,793,646	2,320,673	7,113,991	2,734,873
Southern ...	253,283	115,505	1,544,454	407,196	2,066,621	636,163	2,362,741	749,394
Western ...	163,842	50,473	424,720	102,214	831,337	210,329	913,890	253,494
Total ...	1,769,597	603,248	5,968,426	2,178,929	8,691,604	3,167,165	10,390,622	3,737,761

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, 2645 tons of brown coal, valued at £529, were raised in 1914, while 70 tons, valued at £35, were raised by the Minerals Development Co., at Morwell.

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

PRODUCTION OF COAL IN VICTORIA, 1905 to 1914.

Year.	State Coal Mine.	Outtrim Howitt Company	Jumbunna Coal Company	Coal Creek.	Silkstone Co-operative Company	Austral Coal.	Other Companies.	Total Production.	Value.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	£
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
1913	486,238	22,460	38,795	6,218	...	33,462	9,723	596,896	274,940
1914	550,107	16,597	24,236	5,887	...	20,034	3,390	620,251	289,099

Included in the total "for other companies" is an amount of 95 tons raised by the Kilcunda Coal Mining Co., and 580 tons by the Co-operative Colliery Limited at Kilcunda. The figures also include about 2700 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. Arrangements have been made for opening up a deposit of brown coal at Bowen on the Morgan Railway Line, about 87 miles from Adelaide.

(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 1914.

Year	1861.	1871.	1881.	1891.	1901.	1914.
Quantity ... Tons	14,212	17,000	65,612	271,603	539,472	1,053,990
Value ... £	9,922	9,407	29,033	128,198	189,877	416,292

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

QUEENSLAND COLLIERIES, 1913 and 1914.

Collieries.	1913.		1914.	
	Tons Raised.	Average Value at Pit's Mouth.	Tons Raised.	Average Value at Pit's Mouth.
		s. d.		s. d.
Ipswich	695,422	7 1	718,205	7 1
Darling Downs	103,588	8 6	105,645	8 9
Nundah (Brisbane)	...	...	625	5 3
Wide Bay and Maryborough	129,611	10 11	118,120	11 4
Rockhampton	13,574	10 4	7,818	8 9
Clermont	95,799	7 7	102,980	8 5
Mount Mulligan (Chillagoe)	...	...	597	17 2
Total	1,037,944	7 9	1,053,990	7 11

It is estimated that about one-third of the production from Ipswich was shipped as bunker coal, while the total amount shipped at the South Brisbane railway wharf for bunkers, cargo, and other purposes was returned at 324,000 tons. The average value of Queensland coal in 1914 was the highest recorded since the year 1900.

(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 1914.

Year	1901.	1908.	1909.	1910.	1911.	1912.	1913.	1914.
Quantity Tons	117,836	175,248	214,302	262,166	249,890	295,079	313,818	319,210
Value £	68,561	75,694	90,965	113,699	111,154	135,857	153,614	148,684

(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 1914.

District.	1901.	1908.	1909.	1910.	1911.	1912.	1913.	1914.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
North-western ...	2,952	...	1,543	1,720	1,496	956	1,167	1,074
Eastern ...	37,239	55,539	57,227	71,115	54,296	51,205	52,759	58,743
Midland ...	1,536	...	560	721	635	679	847	847
South-eastern ...	...	5,529	6,832	8,899	640	720	270	130
South-western ...	3,711							
Total	45,438	61,068	66,162	82,455	57,067	53,560	55,043	60,794

The bulk of the output in 1914 was raised from the Cornwall and Mt. Nicholas mines, which produced 24,466 and 34,177 tons respectively.

3. **Production of Coal in Various Countries.**—The total known coal production of the world in 1912 amounted to about 1100 million tons (exclusive of brown coal or lignite), towards which the Commonwealth contributed 11 million tons, or about 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 1908 to 1914 where the returns are available:—

COAL PRODUCTION, BRITISH EMPIRE, 1901 and 1908 to 1914.

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	1,228	712
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	271,892	12,716	11,908	10,550	2,066	6,933
1912	260,416	14,706	15,237	11,730	2,178	7,248
1913	287,430	14,708	13,404	12,418	1,888	8,660
1914	270,070	16,214	12,133	12,445	2,276	8,313

COAL PRODUCTION, FOREIGN COUNTRIES, 1901 and 1908 to 1914.

Year.	Russian Empire.	Sweden.	German Empire.	Belgium.	France.	Spain.	Japan.	United States.
	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	8,885	261,875
1908	25,888	243	144,602	23,140	36,519	3,799	14,806	411,432
1909	26,736	298	148,645	23,532	37,030	3,751	15,429	379,744
1910	25,914	307	156,033	22,683	37,902	3,605	17,349	417,111
1911	28,414	355	172,065	22,603	38,602	3,853	17,632	405,907
1912	30,640	360	174,875	22,972	40,648	3,626	19,640	450,105
1913	32,206	364	190,109	22,858	39,410	4,293	21,415	478,523
1914	33,113	...	161,535	...	...	3,600	19,372	...

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

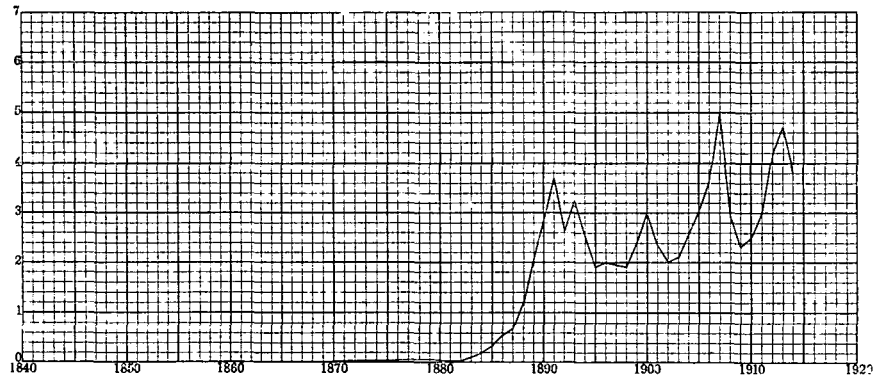
4. **Export of Coal.**—The exports of coal from the Commonwealth are practically confined to New South Wales.

The total quantity of coal of Australian production (exclusive of bunker coal) exported from the Commonwealth to other countries in 1914 was 2,009,529 tons, valued at £1,061,127, of which amount 1,997,565 tons, valued at £1,059,323, were exported from New South Wales.

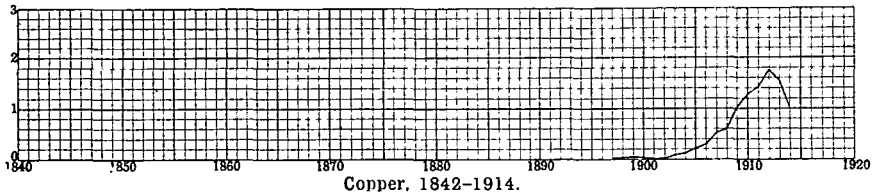
GRAPHS SHEWING VALUES OF THE PRINCIPAL MINERALS PRODUCED IN THE COMMONWEALTH, 1840 to 1914.

Gold, 1851–1914.

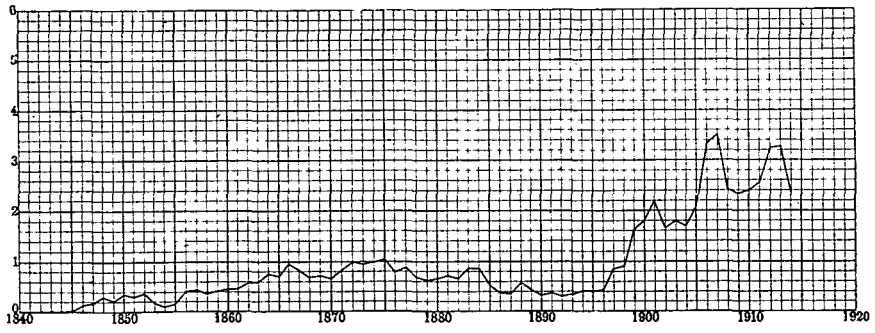
Silver and Lead, 1843–1914.



Zinc, 1897–1914.



Copper, 1842–1914.

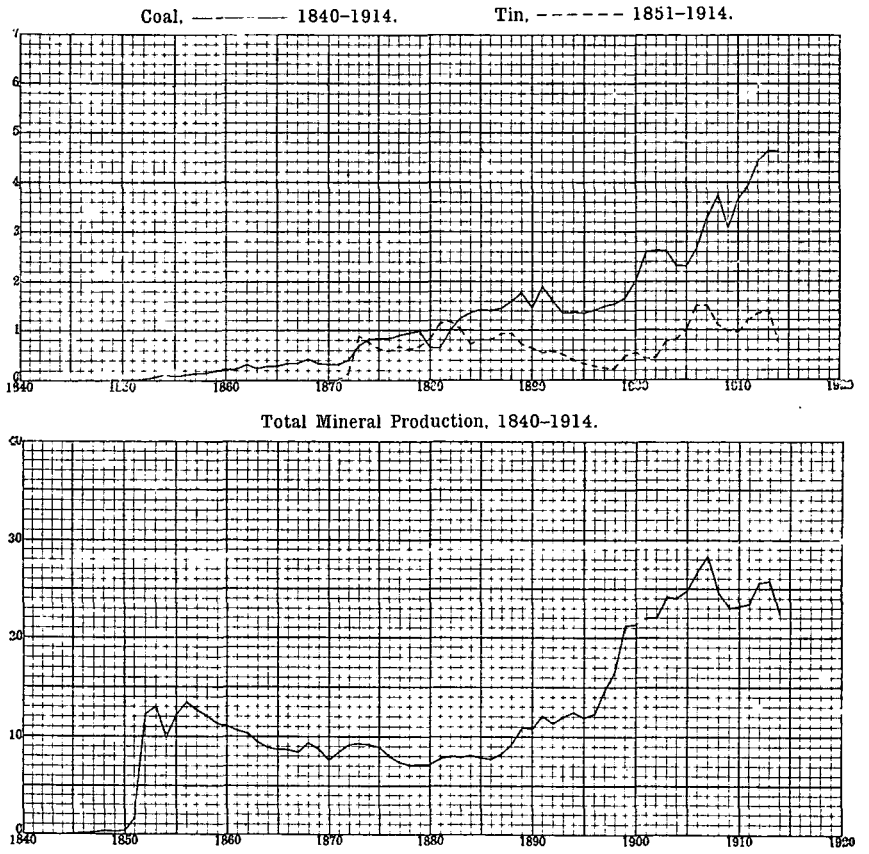


(See pages—for gold, 402; silver, 410; zinc, 418; copper, 413.)

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 1914.

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, 1840 to 1914.



(See pages 426 for coal; 416, tin; and 400 total mineral production.)

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 1840 to 1914.

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.

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 1915.

Year.	1881.	1891.	1901.	1910.	1911.	1912.	1913.	First 6 months of 1914.	1914-15.
Quantity. 1000 tons... ...	1,030	2,514	3,471	4,690	5,024	6,053	6,232	1,860	2,471
Value ... £1000... ...	417	1,307	1,682	2,459	2,664	3,233	3,342	1,023	1,360

The principal oversea countries to which coal was exported from New South Wales during the year 1914-15 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, 1914-15.

Country.	Quantity.	Value.	Country.	Quantity.	Value.
	Tons.	£		Tons.	£
Chile	236,017	122,447	United States ...	105,623	51,627
Philippine Islands...	94,602	48,936	India	80,699	40,446
Straits Settlements	84,100	44,751	Java	169,073	90,453
Fiji	43,598	21,729	Mauritius ...	10,579	5,653
New Zealand ...	357,298	192,128	Ecuador	30,497	16,507
Peru	21,558	11,855	New Caledonia ...	15,124	8,245
Hawaii	80,182	43,500			

The quantity of bunker coal taken from New South Wales by oversea vessels was about 1,100,000 tons, valued at £641,000.

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

DISTRIBUTION OF TOTAL OUTPUT OF NEW SOUTH WALES COAL, 1910 to 1914.

Year.	Exports to Australasian Ports.	Exports to other Ports.	Local Consumption.	Total.
	Tons.	Tons.	Tons.	Tons.
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
1913	3,465,787	2,765,937	4,182,441	10,414,165
1914	3,221,783	2,646,250	4,522,589	10,390,622

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, 1910 to 1914.

Year.	Quantity of Coal Consumed.			
	Home Produce.	Produce of the United Kingdom.	Produce of Other Countries.	Total.
	Tons.	Tons.	Tons.	Tons.
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
1913	8,671,491	872	3,577	8,675,940
1914	8,944,867	23,066		8,967,933

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. The bunker coal taken away in 1914 is estimated to have been 1½ million 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 1914, 7s. 2d. 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), 1910 to 1914.

Year.	Northern District.	Southern District.	Western District.
	s. d.	s. d.	s. d.
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
1913	7 9.91	6 1.13	5 1.85
1914	7 8.26	6 4.12	5 6.33

(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 1912, 8s. 9d; for 1913, 9s. 3d., and for 1914, 9s. 4d. These averages are exclusive of brown coal, the production of which in 1914, was valued about 4s. 2d. per ton.

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

PRICE OF COAL, QUEENSLAND, 1910 to 1914.

District.	Value at Pit's Mouth.				
	1910.	1911.	1912.	1913.	1914.
	Per ton. s. d.	Per ton. s. d.	Per ton. s. d.	Per ton. s. d.	Per ton. s. d.
Ipswich	6 11	6 5	6 7	7 0½	7 1
Darling Downs		8 5	8 6½	8 6	8 9
Nundah (Brisbane)	..	..	..	..	5 3
Wide Bay and Maryborough ...	10 5¼	10 10	10 10½	10 11	11 4
Rockhampton	11 9	10 4½	10 6	10 4	8 9
Clermont	8 0	7 6	7 6	7 7	8 5
Mount Mulligan (Chillagoe) ..	...	..	..	..	17 2

(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.; in 1912, 9s. 2d.; in 1913, 9s. 9d., and in 1914, 9s. 4d. 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.; in 1911 and 1912, 9s. 2d.; in 1913, 9s. 3d., and in 1914, 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, excluding Russia, for which no information is available, for the five years ended 1912, was as follows:—

PRICE OF FOREIGN COAL, 1908 to 1912.

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.
1908 ...	8 11	10 3½	12 11¾	13 1½	5 11¾
1909 ...	8 0¾	10 2½	12 5½	11 8¼	5 7½
1910 ...	8 2¼	9 11¾	12 3½	11 10¼	5 10¼
1911 ...	8 1¾	9 9¼	12 5¼	12 0	5 10¾
1912 ...	9 0¾	10 6¼	12 8½	13 5½	6 1

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, 1908 to 1912.

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.
1908	5 3	7 4½	10 4½	10 8	6 9½
1909	4 8¼	7 6½	10 10½	10 10½	6 3½
1910	4 1	7 6½	11 1¼	11 0¼	5 10½
1911	3 11¼	7 5½	10 10¼	10 9¼	5 8½
1912	4 6	7 6½	10 11¼	11 5¼	5 6¼

8. **Employment and Accidents in Coal Mining.**—The number of persons employed in coal mining in each of the States during the year 1914 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 coal mining in the principal countries of the world as 3¾ millions, the number in the United Kingdom being 1,068,000; the United States, 723,000; Germany, 628,000; France, 199,000; Russia, 169,000; Belgium, 146,000; Austria, 75,000; India, 133,000; and Japan, 145,000.

Recent returns shew the rate in the United Kingdom in respect of deaths through accidents in coal mines as 1.17, 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, 1914.

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 ...	19,977	17	73	0.85	3.65	611,000	142,000
Victoria	1,405	2	21	1.42	14.95	310,000	30,000
Queensland ...	2,227	3	43	1.35	19.30	351,000	25,000
Western Australia ...	525	...	90	...	171.43	...	3,500
Tasmania ...	152	...	2	...	13.16	...	30,000
Commonwealth	24,286	22	229	0.91	9.43	566,000	54,000

§ 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 1914 amounting to 23,084 tons, valued at £24,657, the bulk of which came from Germany, and was taken chiefly by South Australia. The table hereunder gives the production in New South Wales during the last five years:—

COKE MADE IN NEW SOUTH WALES, 1910 to 1914.

Year.	1910.	1911.	1912.	1913.	1914.
Quantity ... Tons	282,337	264,687	241,159	298,612	304,800
Value, total ... £	189,069	184,337	162,454	208,989	213,069
Value per ton	13s. 4d.	13s. 11d.	13s. 5d.	14s. 0d.	13s. 11d.

The output for 1914 is the largest yet recorded, and would have been much greater but for the unsettled conditions resultant on the war.

A small quantity of coke is made in Queensland, the quantity returned in 1914 being 16,685 tons, but the bulk of that used in ore reduction is imported, mainly from New South Wales. The following table shews the amount manufactured locally during the last five years:—

QUEENSLAND.—COKE MANUFACTURED LOCALLY AND IMPORTED, 1910 to 1914.

Year.	1910.	1911.	1912.	1913.	1914.
Manufactured locally ... ... tons	11,188	35,025	38,136	14,942	16,685
Imported ... ... „	*32,054	†	†	†	†

* Nine months only. † Not available.

The Queensland State Mining Engineer points out that from 50,000 to 60,000 tons of coke are obtained yearly from New South Wales. During 1914 the shipments from oversea consisted of 1988 tons from Germany and 2580 tons from the United Kingdom, both consignments being landed at Rockhampton.

§ 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 1914 amounted to 50,049 tons, valued at £27,372, as compared with 16,985 tons, valued at £7340 in 1913. The larger returns in 1914 were occasioned chiefly by increased activity at the British Australian Oil Company's deposits in the Northern districts. During the greater part of the year, however, comparatively little was done by the Commonwealth Oil Corporation on their properties at Wolgan, Newnes, and Glen Alice.

(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. Oil-bearing 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 Munduran Creek, near Gladstone, Casuarina Island, Redbank plains in the Ipswich District and Murphy's Creek, near Toowoomba. It is stated that the borings have not so far penetrated to a sufficient depth to properly test the strata.

(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. A bonus of £5000 for the discovery of oil has been offered by the South Australian Government. An oil expert engaged by the Government reported adversely on the prospects, but his conclusions have been challenged by other investigators. A large number of licenses to search for oil have been taken out, and boring operations have been started at Wanilla, near Port Lincoln, and in the vicinity of Kingston.

(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. In July, 1912, the Railton-Latrobe Shale Oil Company acquired the leases and plant of the Tasmanian Shale and Oil Company, at Latrobe, and it is intended to develop the deposits on a large scale. The production in 1914 was, however, small, amounting to 75 tons, valued at £75.

(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. Results so far, however, have been negative, and experts 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. It is proposed to test the deeper deposits where indications warrant expectation of a copious supply.

2. **Export of Shale.**—In 1914 New South Wales exported 279 tons of shale, valued at £873.

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 OIL 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 1913, the bounties paid in New South Wales amounted to £985 on 118,000 gallons of kerosene, and £809 on 324 tons of refined paraffin wax. As the bounty expired on the 30th June, 1913, the articles mentioned were produced prior to that date.

§ 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 1914, 44,310 tons had been exported, valued at £140,643, the exports for the year 1914 being 3040 tons, valued at £12,160.

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. A trial shipment has been forwarded to England. Another deposit has been located near Warnertown.

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 1914. 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 goldfield, 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 1914 about 158 tons of barytes, valued at £276, were obtained in the Mudgee division. Small quantities were produced also at Bunyan, in the Cooma division.

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. In New South Wales the production of kaolin in 1914 amounted to 413 tons, valued at £364, raised in the Mudgee, Cootamundra, Parkes, and Goulburn divisions. Fireclay to the amount of 150 tons, valued at £150, was raised in the Bathurst division, and 12,100 tons, valued at £1990, were raised in the Wollongong division. Deposits of steatite near Wallendbeen were worked during 1914, the quantity raised during the year amounting to 80 tons. Near Morangaroo 2000 tons of silica were raised by the Silica Fire Brick Company. In Victoria 325 tons of kaolin were obtained at Axedale, 300 tons at Pyalong, and 181 tons at Egerton, the total value being given as £1407. In Queensland 5317 tons of fireclay, valued at £875, were mined during the year 1914, 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, as well as at various localities on Kangaroo Island. 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. (See also § 12., iv.) While the origin of coorongite is still in doubt, it is held by some observers that it is not a petroleum product.

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. A deposit has been located in the hundred of Roberts, about 9 miles N.W. from Arno Bay in South Australia. In Western Australia deposits occur at various points in the South Western area, and it is proposed to work the one at Kendenup.

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 used largely 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 1914 there was a production of 1077 tons, valued at £924, of which 1032 tons were obtained at Boort, and 45 tons at Fairley. A deposit of gypsum sand containing practically an inexhaustible supply is found on the edge of Lake Austin in Western Australia.

9. **Magnesite.**—Small quantities of this mineral have been discovered at Fifield, in New South Wales, and at Heathcote, in Victoria, and a deposit of exceptional purity has been located in the vicinity of Tumby Bay, in South Australia, about five miles from the township of Tumby. The Broken Hill Co. is working a small deposit near the Beetaloo Waterworks.

10. **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, 25 tons of diatomaceous earth, valued at £94, were produced in 1914. In Victoria there is a remarkably pure deposit at Lillicur, 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 Lillicur, 1000 tons, valued at £4000, were obtained in 1914. A fairly extensive deposit of tripolite exists in Queensland, between Nerang and Beaudesert, but the various outcrops have as yet been only partially examined.

11. **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 from which salt can be profitably obtained 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 Rottnest Island, near Fremantle, and Middle Island, near Esperance, but the greater part of that now produced is obtained at Port Gregory.

12. **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. Phosphate of lime has been found in small quantities in the limestone caves of New South Wales. In the Wellington division, from the area situated near the Caves, about 700 tons of phosphate rock, valued at £1000, were raised during 1914. In addition to use as a flux at the Lithgow Iron Works, part of the rock is ground up for manures. Although it can hardly be considered a mineral product, mention may be made here of the large accumulations of guano on the Abrolhos 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 quantity raised in 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 diamantiferous 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 $28\frac{5}{16}$ carats. It is difficult to secure accurate returns in connection with the production of precious stones, but the yield of diamonds in 1914 was estimated at 1580 carats, valued at £1440, while the total production to the end of 1914 is given as 186,124 carats, valued at £126,989. The yield in 1914 was contributed chiefly by miners working in the vicinity of Copeton, in the Tingha division. Owing to the closing of the market at the outbreak of war the production in 1914 shewed a great reduction on that for 1913, when 5573 carats, valued at £5141 were won. 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 1914 was valued at £15,800, as compared with £43,292 in 1913. The estimated return for 1914 has been distributed thus:—Purchases by gem buyers, £13,900; stones sold privately, £300; mechanical stones, £1600. The gem mining industry practically collapsed on the outbreak of war, as the German buyers ceased business. An attempt is being made to open a market for sapphires in the United States. 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 1914, however, out of a total production valued at £26,534, the yield from the Lightning Ridge field, near Walgett, amounted to £21,636, while the output from the White Cliffs field was returned at £4,898. 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 6½ carats, being sold in 1910 for £102. It is stated that this locality is the only place in the world where the "black" variety of the gem has been found. The total value of opal won in New South Wales since the year 1890 is estimated at £1,386,000.

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 1914 was estimated at £2000, and up to the end of that year at £177,195. 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 suffers from the peculiar disability that in good seasons there is plenty of work available on the pastoral stations, and most men prefer this to the uncertain results obtainable by fossicking, while in dry seasons when constant work is not obtainable, the search for opal is limited by the difficulty in obtaining sufficient water.

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. Small emeralds of fine quality have been found at Poona, in Western Australia, and it is stated that prospecting at greater depths would possibly reveal the existence of larger specimens. 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 *zircons* 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. The gems also occur plentifully in the bed of Agate Creek, about 4 miles south of Forsayth, on the Etheridge field in Queensland. 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, and at Poona, in Western Australia. 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 1914 the number so employed was as follows :—

NUMBER OF PERSONS ENGAGED IN MINING, 1914.

State.	Number of Persons Engaged in Mining for						Total.
	Gold.	Silver, Lead, and Zinc.	Copper.	Tin.	Coal and Shale.	Other.	
New South Wales ...	3,443	8,242	1,357	2,168	19,977	2,283	37,470
Victoria	10,398	..	...	65	1,405	205	12,073
Queensland	2,793	130	2,578	1,570	2,227	782	10,080
South Australia	375	25	3,000	...	...	855	4,255
Western Australia ...	12,110	100	192	217	525	30	13,174
Tasmania	402	491	2,099	1,523	152	74	4,741
Northern Territory ...	180	10	88	186	...	45	509
Commonwealth ...	29,701	8,998	9,314	5,729	24,286	4,274	82,302

The following table shews the number of persons engaged in mining in the Commonwealth during each of the years 1891, 1901, and 1914, together with the proportion of the total population so engaged:—

PROPORTION OF PERSONS ENGAGED IN MINING 1891, 1901, and 1914.

State.	1891.		1901.		1914.	
	Miners Employed.	No. per 100,000 of Population.	Miners Employed.	No. per 100,000 of Population.	Miners Employed.	No. per 100,000 of Population.
New South Wales ...	30,604	2,700	36,615	2,685	37,470	2,020
Victoria	24,649	2,151	28,670	2,381	12,073	848
Queensland	11,627	2,934	13,352	2,664	10,080	1,493
South Australia	2,683	834	7,007	1,931	4,255	967
Western Australia ...	1,269	2,496	20,895	11,087	13,174	4,073
Tasmania	3,988	2,695	6,923	4,017	4,741	2,390
Northern Territory ...	...	...	...	...	509	..
Commonwealth ...	74,820	2,341	113,462	2,992	82,302	1,673

2. **Wages Paid in Mining.**—Particulars regarding wages paid in the mining industry, which in earlier 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, 1914.**—The following table gives particulars of the number of men killed and injured in mining accidents during the year 1914 :—

NUMBERS KILLED AND INJURED IN MINING ACCIDENTS, 1914.

Mining for—	N.S.W.	Victoria.	Q'land.	S. Aust.	W. Aust.	Tas.	N. T.	Cwlth.
KILLED.								
Coal and shale	17	2	3	...	...	...	...	22
Copper ...	3	...	5	1	...	5	...	14
Gold... ...	6	15	4	...	26	2	...	53
Silver, lead and zinc ...	16	...	...	...	...	3	...	19
Tin	1	...	...	...	...	...	...	1
Other minerals	...	...	...	...	...	...	...	...
Total ...	43	17	12	1	26	10	...	109
INJURED.								
Coal and shale	73	21	43	...	90	2	...	229
Copper ...	1	...	58	2	4	37	...	102
Gold... ...	3	45	44	...	735	4	...	831
Silver, lead and zinc ...	34	...	...	...	...	8	...	42
Tin	...	...	7	...	...	11	1	19
Other minerals	1	...	1	...	...	...	...	2
Total ...	112	66	153	2	829	62	1	1,225

§ 16. State Aid to Mining.

1. **Introduction.**—The terms and conditions under which the States granted aid in mining were 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. A résumé of what is being done in this direction at the present time is given hereunder.

2. **New South Wales.**—The chief aid given in this State is in the direction of assistance to prospectors. Up to the end of 1914 the total sum expended in this manner amounted to £455,180, of which £11,519 was advanced in 1914. During the year the Government subsidy to the Miners' Accident Relief Fund amounted to £14,023.

3. **Victoria.**—Under the Mining Development and Surplus Revenue Acts the sum of £424,210 was expended from revenue, and £233,097 was provided out of votes during the period 1897 to 1914 as follows :—

	£
Advances to mining companies	179,673
Advances to prospectors	73,718
Boring for gold and coal	219,912
Construction of roads and tracks	62,345
Erection of testing plants, batteries, etc.	72,350
Miscellaneous, cyanide patents, Schools of Mines, etc.	49,309
Total ...	657,307

The expenditure in 1914 was £39,664, of which £14,547 was advanced to companies; £3804 was loaned to miners; £307 was spent on constructing roads, etc.; £16,052 on boring for gold, coal, etc., and £4954 on testing plants and miscellaneous. The Government batteries number 27, and of these 15 are managed by local trusts without expense to the Department so far as cost of working is concerned. For the year 1914 the net cost to the Department of the Government batteries was returned as £3009. The repayment of loans by companies amounted to £21,131, by miners £2455, and for cost of boring £8560. The State's contribution to the Coal Miners' Accident Relief Fund amounted in 1914 to £647.

4. **Queensland.**—State assistance to the mining industry in 1914 amounted to £20,546, of which £15,630 consisted of loans in aid of deep sinking; £1816 grants in aid of prospecting; £2368 in aid of roads and bridges to gold and mineral fields; £732 advance under Mining Machinery Advances Act 1906.

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 1914 the total amount of subsidy paid was £60,255, of which £7597 has been recovered, leaving a debit of £52,658. Portion of this amount is represented by machinery that has fallen into the hands of the Government. Repayments are made from profits, but in only two instances have the profits enabled a full return to be made.

6. **Western Australia.**—Under the Mining Development Act of 1902 assistance was granted in 1914 in accordance with the subjoined statement.—Advances in aid of mining work and equipment of mines with machinery, £3098; advances in aid of erection and equipment of crushing plants, including subsidies on stone crushed for the public, £5586; advances in aid of boring, £1085; providing means of transport, £122. In addition, amounts totalling in all £7634 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. Included in this amount of £7634 is a sum of £6671 on account of purchase of tailings. The sum of £5586 shewn above includes £1337 paid to owners of plants crushing for the public at fixed rates.

In 1914 there were 34 State batteries in operation. The amount expended on the erection of State batteries up to the end of 1914 was £91,981 from revenue and £251,230 from loan, giving a total of £343,211. During the year receipts amounted to £48,583, and working expenditure to £55,930.

The total value of gold and tin recovered to the end of 1914 at the State plants was £4,395,000, resulting from the treatment of 1,018,000 tons of gold ore and 68,300 tons of tin ore.

7. **Tasmania.**—Under the terms of the Aid to Mining Act 1912 the expenditure for the year 1914 amounted to £8525. The expenditure under Part A of the Schedule, viz., Mining prospecting and development work undertaken by or under the direction of the Department of Mines, was £8409, and under Part B, viz., Advances in aid of mining and prospecting, was £116. Of the former sum, an amount of £1109 was expended on prospecting and developmental work at Zeehan. Under the Mining and Public Works Appropriation Act 1913, a sum of £27,060 was expended, of which £13,558 was absorbed in making advances on the security of ore produced in the State, £9315 in carrying on the operations of the Tasmanian Gold Mine at Beaconsfield, and £3892 in expenses connected with the State Argent Flat Mine, Zeehan. Under the Public Works Appropriation Act, 1913, a sum of £5446 was expended in carrying out the purposes of the Mining Development Act of 1912, and in assisting prospectors.

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 bona fides of all seeking aid. Provision is made for generous grants to discoverers of metalliferous ores. The total aid granted to prospectors and others in 1914 amounted to £7480.

§ 17. The Building Stones of the Commonwealth.

1. New South Wales.*

It is doubtful whether any country in the world has greater advantages than New South Wales as regards the possession of practically unlimited quantities of good building material. In the Metropolitan area alone, there are extensive deposits of clay-shales and clay, suitable for the manufacture of excellent bricks, as well as high-grade sandstone for building purposes. And at many centres, convenient to rail or water, throughout the State inexhaustible supplies of granite and other igneous rocks, in addition to limestone, marble, and sandstone are obtainable.

Attention was given to the building stones in the early days of settlement, as is evidenced by the number of old buildings now standing throughout the State, and also by the reference in "Mitchell's Three Expeditions into Eastern Australia," published in 1838, wherein it is stated that "a few miles from Towrang a quarry of crystalline variegated marble has been recently wrought to a considerable extent, and marble chimneypieces, tables, &c., now ornament most good houses at Sydney."

The sandstones of the Sydney district were the first stones to be used in the State, but perhaps not so much care was then exercised in the selection of stone as at the present time. For many years the light brown sandstone of the Sydney district, known in the trade as "yellow block" stone, has been deemed the only "correct" material for buildings of any pretensions. It is about sixty years since quarries were first systematically opened up with the object of obtaining the uniform coloured "yellow block stone." The first of these quarries was started at Pyrmont, close to the site of the present quarry, which is the most extensive building stone quarry in the State. Since then a number of quarries have been opened in the metropolitan area, and although several have been abandoned, the bulk of them are now being worked with rock-cutting machinery of the latest type. The stone occurs as lens-shaped masses associated with other sandstones in what is known geologically as the Hawkesbury Stage of the Triassic Period. The lenses vary considerably in size. When freshly quarried, the stone is fairly soft, and of a white to bluish grey colour, but on exposure hardens rapidly and assumes a light brown colour. The Hawkesbury Series consist mainly of sandstones and grits, and attain a maximum thickness of about 1100 feet in the neighbourhood of Sydney. They outcrop over a considerable area in the State. Many excellent beds of freestone apart from the "yellow block" occur in the Series, and have been extensively quarried, mostly for local building and road-making purposes. The stone is generally of a white or light-grey colour, is probably equal to "yellow block" in strength and durability, and is likely to be used in the future in the construction of large city buildings. The number of large quarries now being worked on this class of stone is too extensive to be included in the accompanying tabulated list.

Other good sandstones occur throughout the State in all geological formations from those of Silurian Age up to Cretaceous, and a number of quarries are worked in country districts to meet local requirements.

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* Contributed by E. Fisher Pittman, Esq., A.R.S.M., Under Secretary, Department of Mines, Sydney, at the time when the article was supplied.

Extensive deposits of marble are widely distributed. Although attention has been directed to them since shortly after the foundation of the State, it is only within the past fifteen years that attempts to establish the industry have been successful. During that time a number of quarries have been opened, and within the past twelve years stone to the value of £21,157 has been marketed in Sydney.

The stone varies considerably in colour, pattern and texture, and is eminently suited for architectural purposes, or any description of work for which marbles are employed. Generally the stone is free from flaws and impurity, and, in consequence, it lends itself to thin cutting, and little or no "stopping" is required in the dressed article. Compactness of texture and high compression strength are characteristic of New South Wales marbles.

A white statuary marble has not yet been located in appreciable quantity.

Limestone occurs abundantly, but up to the present only a limited quantity has been used as building stone. The greater number of deposits occur in the eastern and central portions of the State, are very extensive, and belong to several geological ages. They vary from a few chains up to a mile in width, and can be traced for several miles along the line of strike. Practically unlimited quantities of the stone are therefore available. The stone is generally very compact, varies in colour from white to bluish grey, and is well suited for building or ornamental purposes. A number of quarries have been opened and small quantities used locally. The stone is used mainly for the production of quicklime, and in the manufacture of hydraulic cement. Extensive quarries for this purpose are worked at Portland, Taree, and Goulburn.

There are extensive deposits of slate in the State, but all attempts to produce a good roofing slate have, until quite recently, been unsuccessful. Quarries were opened at Moruya, Gundagai, Millamurrah, Caloola, Newbridge, and Grattai, but were abandoned principally owing to the fact that the slates were too hard, and not sufficiently fissile to be profitably worked.

At present there appears to be a reasonable prospect of the slate industry being established in the near future. A belt of slate from 360 feet to 380 feet in width has been located in the Goulburn district. The stone possesses all the qualities for roofing, hearths, slabs, etc., and quarries have been opened up, and up-to-date machinery for dealing with the stone installed.

During the year 1914, 40,000 slates of different sizes were marketed.

Granites suitable for engineering and architectural purposes occur extensively in many parts of New South Wales. They vary considerably in colour and texture, and are equal to most imported granites for building and ornamental purposes. Small quantities have on several occasions been introduced into Australian architecture, but practically no attempt has yet been made to develop the industry, owing probably, to the adequate supply of more cheaply worked stone.

Of recent years a syenite, or what is known commercially as "trachyte," has been extensively used in building construction in the polished and unpolished state.

Other igneous rocks such as porphyries and basalts occur abundantly in the State, but have only been used in small quantities locally for building purposes. Some of the porphyries are very handsome rocks, and well suited for ornamental work.

Serpentine of various shades of green occurs in many districts. The deposits occur in belts extending for considerable distances with broken outcrops. One belt traverses the country for a distance of about 150 miles. The stone is eminently suited for ornamental work, but has so far been quarried for exhibition purposes only. It takes a good polish.

The following tabulated information has been in part compiled from the reports of the Department of Mines, Sydney, and from "Building and Ornamental Stones of Australia," by R. T. Baker, F.L.S., etc.

IGNEOUS ROCKS.

Building Stone.	Locality.	Character.	Quantity.	Examples.
Granite (red)	Burrinjuck, 220 miles from Sydney.	A light coloured rock composed mainly of quartz and felspar. In places the felspar has a greenish tinge. It is hard and has a high specific gravity, and is a high class building stone.	Practically unlimited. The belt of granite outcrops for over 50 miles both north and south from Burrinjuck.	The dam of Burrinjuck Reservoir is constructed mainly of this granite, some of the blocks used weighing as much as 15 tons.
Granite (red)	Near Lithgow, 100 miles from Sydney.	A good red porphyritic granite.	A large quantity is available.	A small quantity has been used locally.
Granite (red)	Tarana, 120 miles from Sydney.	Both coarse and fine-grained granite of good colour. The coarse rock contains large porphyritic crystals of pink felspar.	Unlimited quantity of either variety available.	This is part of an extensive belt of granite in the central western area. Small quantities have been used locally.
Granite (red and grey)	Trial Bay, 225 miles from Sydney by water.	The red variety is a pale-coloured, coarse-grained stone, while the grey is medium grained and of a fresh grey colour. Both take a high polish.	Practically inexhaustible.	The granite outcrop occupies an area of about 1½ miles square. The prison at Trial Bay is built of these granites.
Granite (grey and red)	Braidwood, 180 miles from Sydney.	Both are coarse-grained rocks with white and pink felspars. The red variety is similar in character to the Gabo Island granite, but rather lighter in appearance.	Practically unlimited. The outcrop is very extensive.	A small amount has been quarried and used locally in the construction of churches and dwellings. The proposed railway from the Federal Capital to Jervis Bay passes over this belt of granite.
Granite (grey and red)	Albury, a border town between New South Wales and Victoria.	Several varieties which vary both in colour and texture, and take a high polish. Both pink and white porphyritic crystals occur through the rock.	Large quantities available.	Two of these are really handsome rocks; in one, the base is grey to green in colour, with large pink felspars, while the other has a grey base with porphyritic white felspars. None of these granites has as yet been quarried for building purposes.
Granite (grey)	Bathurst, 144 miles from Sydney.	A coarse-grained light coloured stone.	Large quantities are available.	Used locally for building purposes.
Granite (grey)	Gunning, 164 miles southerly from Sydney.	A fine-grained hornblende granite of a dark grey colour. Takes a good polish, and is a free working granite.	Practically unlimited quantities are available. The outcrop extends over an area of at least 24 square miles.	It has been used locally in the construction of the Anglican church and several private houses.
Granite (grey)	Montague Island, 180 miles southerly from Sydney, by water.	A very handsome and distinct granite in which large crystals of felspar (labradorite) are the chief characteristic. It is a hard close grained rock and takes a high polish.	Only a small amount of quarrying has been done, but a very large quantity is available. About two-thirds of the Island, or at least 130 acres, is composed of this rock.	This stone is specially suited for ornamental building purposes. It has been used as bases for the columns in the General Post Office, Sydney, in the polished and unpolished state, and in the construction of the lighthouse on the island.
Granite (grey)	Moruya, 196 miles from Sydney, by water.	A medium to coarsely crystalline rock with numerous basic segregation. It is of a light grey colour, and takes a high polish.	Although only a limited amount has so far been quarried, the quantity available is practically inexhaustible. The granite outcrop is very extensive.	The stone has been used in the turned columns in the colonnade of the General Post Office, and in the Custom House and other buildings in Sydney.

IGNEOUS ROCKS—*continued*

Building Stone.	Locality.	Character.	Quantity.	Examples.
Granite (grey)	Tenterfield, 480 miles north from Sydney.	A porphyritic granite with large pink felspar crystals scattered through a grey-coloured ground mass; really a combination of red and grey granite.	The outcrops are very extensive in the district, and indicate a large quantity.	The stone is most attractive in appearance, and is well adapted for ornamental building purposes. Has not yet been utilised in building construction.
Granite (grey)	Uralla, 344 miles northerly from Sydney.	A medium grained hornblende granite of a rich dark grey colour, which takes an excellent polish.	No quarrying has been done, but there is a large quantity available.	This is a very handsome stone and will no doubt be utilised in the near future. It is a splendid ornamental and monumental stone.
Granite (grey)	Young, 256 miles from Sydney.	A medium to coarse grained rock, with abundance of black mica (biotite).	The rock outcrops over a large area, and the quantity available is practically unlimited.	It has been used locally for building churches and private dwellings.
Syenite ("Trachyte")	Bowral, 80 miles from Sydney.	A fine-grained hard crystalline rock of a light grey or dark grey colour. It takes an excellent polish. In crushing strength it is equal to most granites.	It occurs as an intrusive boss, and outcrops over an area of about 40 acres. A very large quantity is available, and extensive quarries have been opened.	The stone which is known in the trade as "Bowral Trachyte" is really a syenite. The light grey stone looks well when roughly dressed, and a very fine architectural effect is produced by relieving it with a certain proportion of the darker stone in a polished condition. In recent years it has been rather extensively used in the polished and unpolished state. Good examples can be seen at the Equitable Buildings, Commonwealth Bank, Mutual Life of New York, and many other city buildings. It has also been used in the piers of the Hawkesbury Bridge.
Trachyte	Orange, 192 miles from Sydney.	A fine-grained hard crystalline rock of a greenish-grey colour with black spots. It is hard and durable, and takes a good polish.	It comprises the bulk of the Canoblas mountains, and a large quantity is available.	It has been used locally for building and paving.
Porphyry	Goulburn, 134 miles from Sydney.	A dense hard dark green rock which when polished is olive green.	A large quantity available.	It has been used locally in the construction of churches and dwellings.
Porphyry	Canberra, the Federal Capital area.	Dense dark coloured quartz porphyries. They split with rather a flinty fracture.	A large quantity available.	The church at Canberra is in part built of this stone.

Other localities worthy of note and convenient to rail or water carriage, where practically unlimited quantities of granite and other igneous rock suitable for building and ornamental purposes are available, are:—

Grey Granite.—Adelong, Arnprior, Bredbo, Bungendore, Burrowa, Cooma, Cowra, Harden, Oberon, Tumut, Glen Innes.

Red Granite.—Cowra, Bungendore, Grenfell, Carrick, near Michelago, Tarago, near Wellington.

Porphyries.—Bredbo, Burrowa, Cowra, Yass.

Tinguaite.—Barrigan.

Basalts.—Guyra, Glen Innes, Blayney, Millthorpe, Inverell, Kiama, Cooma, Nimmitabel, Merriwa, Molong, Orange, Dorrigo, Murrurundi, Shell Harbour, Uralla, Werris Creek.

SEDIMENTARY ROCKS.

Building Stone.	Locality.	Character.	Quantity.	Examples.
Sandstone (white to pink) *Triassic age.*	Bundanoon, 95 miles from Sydney.	A fine-grained stone varying in colour from white to pink.	A large quantity available.	A quarry has been worked for some years, and the stone used largely in buildings at Goulburn and other towns in the Southern District.
Sandstone (light brown) *Triassic age.*	Bondi, about 4 miles from Sydney, of which it is a suburb.	A fine to medium-grained stone, which is known in the trade as "yellow block." When freshly quarried it is fairly soft and of a bluish-grey colour, and on exposure rapidly hardens and changes in colour from straw to light brown. Possesses all the qualities of a high-class building stone.	A large quantity available. The bed of stone which is now being worked varies in thickness from 20 feet to 30 feet, and was located in driving a tunnel for the sewerage system of the district.	A large amount of stone from this quarry has been used in a number of buildings in the City. Channelling and guttering machines are employed in winning the stone and, as jointing is not common, blocks up to 8 feet in thickness and of almost any desired length and breadth can be obtained. The stone cuts well and is well adapted for carvings, etc.
Sandstone (light brown) *Triassic age.*	Maroubra, about 5 miles from Sydney. Two quarries about half a mile apart, one of which is owned and worked by the State Government.	Medium-grained "yellow block" stones. Although possessing all the qualities of the Bondi stone they tone down to a slightly darker colour on exposure, owing to the presence of more iron in the cementing material. They contain as much as 2.07 per cent. ferrous oxide (Fe. O.).	A very large quantity of high-class stone is available from this district. The beds of sandstone which are being worked are on different horizons and vary from 9 feet to 22 feet in thickness. After systematically testing the ground by means of bores, it has been estimated that there is over 2,000,000 cubic feet of good building stone available at the State Quarry.	Both quarries have only been started within the past three years, and a fair amount of stone from each has been used in buildings in the city and suburbs. The stone is cut out by machinery, and blocks of almost any dimensions can be obtained. A considerable amount of machinery has been installed at the State quarry for dressing the stone.
Sandstone (light brown) *Triassic age.*	Botany, a suburb of Sydney.	Medium-grained "yellow block" stone of good quality.	A fairly large quantity available. The sandstone bed is about 15 feet thick.	A fairly extensive quarry has been opened up, and the product is used in buildings in the city and suburbs. The stone is quarried by hand labour.
Sandstone (light brown) *Triassic age.*	Pyrmont, within the city boundary.	Fine to medium-grained "yellow block" stone, possessing all the qualities of a first class building stone. It has been tried for over fifty years and met all the requirements of a high-grade stone.	A considerable quantity available. A very extensive quarry has been worked here for over fifty years. The bed of stone at present being worked is about 35 feet thick, but it runs as much as 51 feet in places.	The stone from this quarry has been used in most buildings of any pretensions in Sydney, and has been exported to Vancouver, Suva, New Zealand, and the sister States. One shipment was sent to England as a trial, when trade was dull in Sydney. This is the most extensive building stone quarry in the State, and as many as 300 men have been employed at one time in connection with the production of dressed and undressed stones. The quarrying is mostly done by hand labour and the use of explosives.
Sandstone (light brown) *Triassic age.*	Randwick, a suburb about 4 miles from Sydney.	Fine to medium-grained "yellow block" stone, similar to the Bondi stone.	The extent of the bed is not known. There is only a limited quantity available within the area owned by the present quarry proprietor.	A large quarry has been worked for some years, and the stone used in many buildings in Sydney. Both cutting machines and explosives are used in the quarry.

SEDIMENTARY ROCKS—*continued.*

Building Stone.	Locality.	Character.	Quantity.	Examples.
Sandstone (light brown) *Triassic age.*	Waverley, a suburb of Sydney, about 4 miles distant from the city.	Fine to medium-grained "yellow block" stone, resembling that from Pyrmont.	The extent of the bed is not known, but there appears to be a large quantity available.	A quarry has been worked for some years and the stone utilized in a number of buildings in Sydney. The stone is cut out with channelling machines, and blocks of almost any dimensions can be obtained.
Sandstone (Grey) *Permo-carboniferous.*	Waratah, 103 miles from Sydney.	Very fine-grained stone varying in colour from light grey to dark grey.	Practically unlimited quantity available. The bed varies from 30ft. to 70 feet in thickness, and can be traced for several miles.	A quarry has been opened, and the stone used largely in the Newcastle district. The sandstone forms the floor of the celebrated Borehole Coal Seam in the Newcastle district.
Sandstone (Grey) *Permo-carboniferous*	Ravensfield, 103 miles from Sydney.	Fine-grained stone of a brownish or bluish grey tint. The cementing material is partly lime and partly hydrated peroxide of iron.	The quantity available is practically unlimited. The bed is from 12 feet to 15 feet in thickness, and can be traced for a distance of about 20 miles.	A fairly extensive quarry has been opened up, and the stone used in many buildings in Maitland and other Northern towns. Although some of the stone has been exposed for about thirty years it shows little sign of weathering, the sharp edging of the carvings still being retained. The bed forms a well-marked and persistent horizon in the Lower Marine Series of the Maitland district.
Sandstone (Grey) *Silurian age.*	Yass, 190 miles from Sydney.	A fairly even-grained sandstone of a grey colour.	Large quantity available.	Quarries have been opened and some of the stone used locally in the construction of churches, etc.
Sandstone (white and light brown)	Undercliffe, 4½ mls. from Sydney.	Both fine and coarse-grained stone, varying in colour from white to light brown. Some "yellow block" stone is obtained here.	Practically unlimited quantities available.	Several quarries are being worked, and the stone used largely in coursing and rubble work. A limited quantity has been used in some city buildings. The quarries are worked by hand labour.

Good sandstones for building purposes which have not been worked to any appreciable extent occur in the following country districts:—Albury, Barber's Creek, near Goulburn, Galong, Grong Grong, Mundooran, Paterson, Muswellbrook, East Maitland, Wollombi, Morpeth, Greta, Rutherford.

In the Metropolitan area small quarries are worked in a number of the suburbs, and produce sufficient good building stone to meet local requirements.

SEDIMENTARY ROCKS—*continued.*

Building Stone.	Locality.	Character.	Quantity.	Examples.
Marble (red) *Devonian age.*	Attunga, 295 miles northerly from Sydney.	A brecciated marble composed of pale coloured fragments, varying from an inch to 1 foot in diameter, embedded in a red ground mass. Takes an excellent polish.	A very large quantity is available.	One of the most handsome brecciated marbles in the State, and well adapted for large panel work. Only quarried for exhibition purposes.

SEDIMENTARY ROCKS—*continued.*

Building Stone.	Locality.	Character.	Quantity.	Examples.
Marble (mottled) *Silurian age.*	Caleula, 215 miles from Sydney.	A compact to crystalline marble. The variety which is mainly quarried is white and pinkish mottled stone with green streaks of chloritic material.	A fairly large quantity available.	A considerable amount of this stone has been used recently for indoor decorations in many buildings in Sydney. It has been extensively used as wall panels in the recently built Permanent Trustee Co.'s Offices in Sydney.
Marble (red and grey) *Silurian age.*	Borenore, 206 miles from Sydney.	Several brecciated varieties occur here. They range from fine to coarsely crystalline in texture, and vary much in colour. Only two varieties are at present being utilized. (1) Breccia of various shades of red showing many fossils. (2) Breccia of a white to grey colour showing numerous encrinite fossils. This is known in the trade as "Borenore Blue." Both take a high polish.	Practically unlimited quantity available. The limestone is exposed for a distance of about two miles across the belt, and for about 1¾ mls. along the strike.	Four quarries have been opened, and a very large amount of stone produced. It is sent to Sydney in blocks and sawn into slabs, etc. Up to the present more of the red marble has been utilized than any other marble in the State. It has been exported to the other States. Both the grey and red have been extensively used for interior and exterior decorations in a large number of buildings in New South Wales.
Marble (white) *Silurian age.*	Caloola, 170 miles from Sydney.	A coarsely crystalline rock of a white colour, with greyish streaks and clouds. Takes a high polish.	A large quantity available. The rock outcrops over an area of ten acres round the quarry, which has been worked for the past twelve years.	The stone has been extensively utilized in Sydney for indoor decorations, such as wall facings, tessellated pavements, and many other purposes. Examples may be seen in the vestibules of Challis House and Prince Alfred Hospital. *Machinery is used in the* quarry for cutting out the stone.
Marble (mainly red) *Silurian age.*	Fernbrook, 150 mls. from Sydney.	A number of varieties, mainly red, varying in texture occur in the district and take a good polish.	Large quantities available.	A small quarry has been opened, and a plant installed for cutting the blocks into slabs, but up to the present very little has been put on the market. The marbles from here will no doubt be utilized in the future.
Marble (white and red) *Silurian age.*	Marulan, 114 miles from Sydney.	Several varieties varying in colour and texture. One variety which should receive attention is a very handsome rock of a white colour with streaks and blotches of grey and red, and in places resembling the Mexican "Onyx" in texture and translucency.	Practically unlimited quantity available.	It was used in mantelpieces in the early days of the colony, but little has been utilized in recent years. A considerable amount has been quarried for the production of lime.
Marble (grey) *Silurian age.*	Molong, 216 miles from Sydney.	A fine to coarsely crystalline grey rock with white streaks.	The outcrops are very extensive, and the quantity available is practically inexhaustible.	Used locally for building and other purposes. None of the stone has yet been placed on the Sydney market.
Marble (red) *Devonian age.*	Nemingha, 287 mls. from Sydney.	A medium-grained rock with numerous fossil encrinites. The ground mass is of a rich red colour, and the fossils, which are white, are thickly studded in it. Takes an excellent polish.	A fairly large quantity available.	A small amount was quarried and placed on the Sydney market some 25 years ago, but it has received little attention since then, although it is one of the most handsome marbles in the State.

SEDIMENTARY ROCKS—*continued.*

Building Stone.	Locality.	Character.	Quantity.	Examples.
Marble (black and white) *Silurian age.*	Rockley, 166 miles from Sydney.	A medium-grained black ground, studded with fossil crinoid stems. Takes a high polish.	A very large quantity available.	A really handsome marble. It has been used in the staircase of the Sydney Art Gallery and for mantelpieces, etc.
Marble (black and white) *Devonian age.*	Rylstone, 149 miles from Sydney.	A medium-grained dark grey to black, veined with white. Takes an excellent polish.	Practically unlimited quantity.	A quarry has been opened and a fair amount of stone placed on the market for panels and other decorative purposes.
Marble *Devonian age.*	Rylstone, 149 miles from Sydney.	Several varieties scattered throughout the district. (1) "Cudgegong Ivory." A very fine grained rock ranging in colour from cream to red with dark veins (2) "Cudgegong Golden." A brownish yellow ground with lighter rings and veins; extremely fine in texture. (3) "Carwell Satin Grey." A cloudy dark satin grey with lighter coloured patches; of fine texture.	Large quantities of each variety available.	These varieties are in course of being placed on the market. They can be obtained in fair sized blocks. The "Cudgegong Golden" is a unique stone and likely to be largely utilized.
Marble (black) *Silurian age.*	Spring Hill, 187 miles from Sydney.	A beautiful very dark grey to black with white veins and the fossil-shell Pentamerus scattered throughout the mass.	A large quantity available.	The stone has been used largely in a number of buildings in Sydney both for interior and exterior decoration. A good example may be seen at Messrs. Richardson and Wrench's Offices, Pitt Street, Sydney.
Marble *Carboniferous age.*	Warialda, 405 miles north of Sydney.	Several varieties occur here. (1) Red and white mottled marble of medium texture. (2) White with greyish streaks. (3) Grey to greenish base with white patches and streaks.	Large quantity available.	Used locally for building purposes. None of these marbles have yet been placed on the Sydney market.
Marble (black) *Silurian age.*	Windellama, 138 miles from Sydney.	A fine-grained dense black marble. Takes a good polish.	Quantity unknown.	The marble has so far only been quarried in small quantity.
Marble (white) *Silurian age.*	Yass, Coolalie, 190 miles from Sydney.	White and variegated marbles are being quarried, and a black variety occurs close by.	Large quantity available.	The stone is quarried mainly for lime, but small amounts are used locally as building stone.
Marble (red) *Permo-Carboniferous age.*	Kempsey, 311 mls. from Sydney by water.	A medium-grained marble. The ground mass, which is of a red to reddish brown, is studded with small white crinoid stems, and throughout the whole run veins of a white colour. Takes a high polish.	Practically unlimited quantity available.	This is a very fine ornamental marble and eminently suited for decorations on a large scale. The large columns in the National Art Gallery are made of this marble.

Other localities from which large quantities of first-class marble of various shades and patterns, and suitable for ornamental and building purposes can be obtained are:—Binalong, Bingera, Bowan Park, Buckeroo, Bungonia, Burrowa, Cooma, Cow Flat, Cudal, Gilmore, Goulburn, Michelago, Mudgee, Queanbeyan, Tarago, Tumut.

Limestone.—Extensive belts of limestone occur in the State, but up to the present a very limited quantity has been used as building stone. Generally the deposits are of exceptional purity, and little difficulty should be experienced in obtaining practically

unlimited quantities of stone containing from 90 per cent. to 98 per cent. calcium carbonate. Limestones suitable as building stones occur in very great quantities in the following districts:—Kempsey, Taree, Tamworth, Mudgee, Rylstone, Wellington, Molong, Rockley, Bathurst, Trundle, Marulan, Goulburn, Tarago, Michelago, Cooma and Yass.

SEDIMENTARY ROCKS—*continued.*

Building Stone.	Locality.	Character.	Quantity.	Examples.
Slate (Blue and green) *Ordovician.*	Chatsbury, some 17 miles from Goulburn, and 143 miles from Sydney.	The texture is uniformly fine. A few belts of relative hardness occur, but even these are fine in texture and quite suitable for roofing slate. An analysis of the slate gave a return of 66.60 per cent. silica, 16.14 per cent. alumina, 6 per cent. iron oxides, 0.54 per cent. lime and 2.56 per cent. magnesia. It possesses all the qualities of a good roofing slate.	A large quantity available. The width of the good slate belt, as measured across the strike of the beds, is from 360 feet to 380 feet.	Quarries have only recently been opened up. An up-to-date plant has been installed and considerable stripping done. Ten men were employed during the year 1914, and some 40,000 slates of different sizes were marketed for a return of £250.

2. Victoria.*

Victoria is rich in building stones, and certain of the granites, sandstones, marbles, limestones, and basalts have, from time to time, been freely utilized.

The following information has been compiled from reports supplied by officers of the Geological Survey, and from publications issued by certain Victorian Scientific Societies. "The Building Stones of Victoria," Part 1; "Sandstones," by Henry C. Richards, M.Sc. (Proc. Royal Soc., Vic., Vol. XXII. (N.S,), Part 2, 1909); and "Victorian Limestones," by Frederick C. Chapman, A.L.S., F.R.M.S. (Proc. Vic. Inst. of Architects, Vol. X., No. 1, 1912), have been freely consulted.

The more important granites, basalts, sandstones, marbles, and limestones are reviewed, with their localities, general character, and quantity. Examples of the stones may be seen in many of the buildings around Melbourne, and are referred to in the tabulated information herewith.

IGNEOUS ROCKS.

Building Stone.	Locality.	Character.	Quantity.	Examples.
Granite (salmon red)	Point Woolamai, Phillip Island. 90 miles from Melbourne by water.	A medium to coarsely crystalline rock, which takes a fine polish.	There is a large quantity available and a quarry has been opened near the water's edge.	This stone has been utilized in the Equitable Insurance Building, Collins Street, Melbourne.
Granite (brown red)	Werribee River, 5 miles from Bacchus Marsh, and about 36 miles from Melbourne by rail.	A finely crystalline rock which takes an even polish.	The quantity has not been ascertained.	None of this red brown granite, which is considered one of the best in the State, has, as yet, been quarried.
Granite (bright red)	Gabo Island, off the extreme east coast of Victoria, and about 340 miles from Melbourne by water.	A fine to medium crystalline rock of uniform texture.	A large quantity of handsome stone is available, but only a small amount has been quarried.	This stone is specially suitable for ornamental building purposes. It has been used in parts of the Customs House, and the Australian Insurance Co. Office, Melbourne.

* Data supplied by the Secretary for Mines, Mines Department, Melbourne.

IGNEOUS ROCKS—*continued.*

Building Stone.	Locality.	Character.	Quantity.	Examples.
Granite (grey)	Trawool, near Yea, 60 miles from Melbourne by rail.	A coarse granite with one of its felspars occurring as porphyritic white crystals throughout the the mass. It is darker than the Harcourt stone and approaches a green-grey colour.	Plenty of good stone is available, and the quarry is close to the railway line.	Examples of this stone can be seen at Sargood Bros.' and Griffiths Bros., Buildings, Flinders Street, Melbourne.
Granite (dark grey)	Dandenong, 19 mls. by rail from Melbourne.	A finely crystalline rock of even texture, and retaining a fine polish.	A large quantity should be available.	Has not been quarried.
Granite (grey)	Harcourt, north of Castlemaine, 93 m. by rail from Melbourne, and within 4 miles of the Harcourt railway station.	A medium to coarsely crystalline light-grey coloured rock. For durability and usefulness it compares favorably with any of the Victorian granites.	This stone can be obtained in huge blocks. A large quarry has been opened and much of the granite utilised.	Examples of this stone may be seen at the Equitable Buildings, Collins St.; Princes Bridge; the State Savings Bank, Elizabeth St.; and Parliament House, Spring St., Melb.
Porphyry (dull pink)	Wangaratta, about 147 miles from Melbourne by rail.	A dense finely crystalline rock. The dull pink colour gives the stone, though mottled, a warm tone. It should prove a most durable and useful stone.	A large quantity is available, and it has been quarried in recent years.	"Collins House," in Collins St., near Queen St. Melbourne, is partly built of this stone. The Roman Catholic Cathedral at Wangaratta is another example.
Gabbro (dark green)	Dewing's Ford, 8 miles west of Geelong. Geelong is 50 miles from Melbourne by water, and 45 miles by rail.	A fine to medium crystalline rock of even texture and green colour. It should be well adapted for ornamental building purposes, but would be expensive to work on account of its hardness.	The outcrops of this rock are extensive, and indicate a large quantity.	Samples of this gabbro have been polished and show it to be an extremely handsome stone. No quarry has, as yet, been opened, nor any of the stone practically utilised.

Other localities worthy of mention, where granites suitable for building purposes occur, include Mt. Martha, Beechworth, Tallangatta, and Somerton.

IGNEOUS ROCKS—*continued.*

Building Stone.	Locality.	Character.	Quantity.	Examples.
Basalt (dark blue-grey)	Lethbridge, 66 mls. by rail from Melbourne.	A close crystalline dark basalt. It is free from flaws, and dresses well.	A large quantity available. Large slabs have been quarried.	Used for certain parts of the Railway Buildings, Spencer St. Melbourne, the steps of Parliament House, Records Office, Crown Law Offices, and the Government Offices, Spring St., Melbourne.
Basalt (dull blue-grey)	Malmsbury, about 64 miles from Melbourne by rail.	Of slightly open texture and subject to joints, but large blocks are obtainable.	Large quantities of useful stone available.	The foundations of State Govt. Offices, Spring St., and the Records Office, Melbourne, are of this stone. It is much used in kerbings, and for foundations for monumental work.
Basalt (dark blue-grey)	Footscray, 4 miles from Melbourne.	A dense, dark blue basalt.	Large quantities available. Extensively quarried.	Some examples of this stone may be seen at St. Patrick's Cathedral, and the Telephone Exchange, Melbourne.

In addition to the preceding there are numerous basalt quarries in Victoria, those around Melbourne including Collingwood, Burnley, Clifton Hill, and Sunshine. All these basalts are valuable for paving and kerbing, and some of them, on account of their high specific gravity, have been used for pier and breakwater construction.

SEDIMENTARY ROCKS.

Building Stone.	Locality.	Character.	Quantity.	Examples.
Sandstone (white) *Carboniferous age.*	At the foot of the Grampian Ranges, 17 miles north-west of Stawell. The quarries are 172 miles from Melbourne by rail, a branch line connecting with the main trunk line at Stawell.	A very hard and compact stone, accompanied by segregation patches and veins of silica, the presence of which renders the stone expensive to dress.	Large quantities of uniform stone are available, and several quarries have been opened.	Buildings of this stone are:—Parliament House, Melbourne; portion of the National Museum, Melbourne; and recent additions to the General Post Office and Town Hall, Melbourne.
Sandstone (light brown) *Carboniferous age.*	Mount Abrupt, 3 miles from Dunkeld, which is 179 miles from Melbourne by rail.	A fine even-grained stone. One defect of this stone is the current bedding.	The stone has not been used to any extent. There is a large quantity obtainable.	Examples may be seen at the Women's Hospital, Carlton; and the Presbyterian Church, Hamilton.
Sandstone (light green-brown) *Jurassic age.*	Barrabool Hills, 5 miles west of Geelong, which is 45 miles by rail from Melbourne.	A fine even-grained soft sandstone. The stone is fairly uniform in texture, and the colour varies from a green-brown to a blue-grey. Grit bands occur here and there, but the stone dresses easily. It is only a fair stone considering the manner in which it weathers.	Large quantities of this stone are available. There are several large quarries which have been operated from time to time.	The old Police Court, and portions of the St. Paul's Cathedral, Working Men's College, Ormond College, and the Medical School Buildings, Melbourne, were partly built of this stone.
Sandstone (light brown) *Jurassic age.*	Apollo Bay, Otway, about 100 miles from Melbourne by water.	A fine even-grained sandstone somewhat similar to the Barrabool stone, but it weathers better.	Stone of this class occurs in quantity along the coast near Apollo Bay, and a quarry has been opened.	It has not been used to any extent. Examples are the recently built Windsor Exchange, and the Cape Otway Lighthouse.
Sandstone (light brown) *Permo-carboniferous age.*	Bald Hill, 3 miles from Bacchus Marsh, which is 32 miles from Melbourne by rail.	A soft even-grained sandstone, not very compact, iron-stained, and not uniform in hardness. It does not stand the weather well, and frets away easily.	A large quantity of this stone is obtainable, and it has been much used in the Bacchus Marsh district.	The Treasury Building, Melbourne, is built of this stone and many of the blocks have had to be replaced on account of weathering.
Sandstone (light buff) *Permo-carboniferous age.*	Darley, 6 miles to the north of Bacchus Marsh, and near Coimaidai. Bacchus Marsh is 32 miles by rail from Melbourne.	This stone is soft and fine-grained, and, as far as worked, proves of a poor quality.	Several small quarries have been opened	The stone has been used in the Parliamentary Library, Melbourne, and the Treasury, Melbourne, to replace the defective blocks, but with little improvement.
Sandstone (white) *Ordovician age.*	Moorabool River, near Egerton. The nearest railway station is Gordons, 57 miles from Melbourne.	Both fine and coarse-grained sandstones occur. Both are very clean, and easily dressed.	At one exposure there is a fair thickness of fine compact stone of uniform colour.	It has been used locally for building purposes.
Sandstone (white to brown) *Permo-carboniferous age.*	Ballan district, notably at Pentland Hills, Pyke's Flat and Greendale. Ballan is 50 miles from Melbourne by rail.	The Ballan stone is close-grained and white. The Pyke's Flat stone is of a blue-white colour, and is open-grained. The Pentland Hills stone is of a light brown colour; and that from Greendale a white to brown coloured serviceable stone.	The quantities available should be large.	These have only been utilized locally.

SEDIMENTARY ROCKS—*continued.*

Building Stone.	Locality.	Character.	Quantity.	Examples.
Marble (dark grey and dove-coloured, etc.) *Devonian age.*	South Buchan, E. Gippsland, 16 miles north of Nowa Nowa, which is 200 miles from Melbourne by rail.	Compact limestone or marble. Three varieties occur:— (i.) Dove-grey showing many fossils; (ii.) Dark grey showing many fossils; (iii.) Black with white veins or streaks.	Large quantities of the marble are available.	These marbles have been used in the additions to the Public Library, Melbourne, Carlyon's Hotel, Spencer Street, Majestic Theatre, Flinders Street, and the Commonwealth Offices, Melbourne. Two quarries are now working to supply marble for the Commonwealth Offices, London. At the Panama Pacific Exhibition, 1915, a gold medal was awarded for an exhibit of this marble.
Marble (various colours) *Silurian and Devonian ages.*	Limestone Creek, county of Benambra, N. Gippsland, over 100 mls. by road from Bairnsdale, which is an additional 171 miles by rail from Melbourne.	Handsome marbles of various colourings occur. Red mottled, red brecciated, green mottled, pink, white and blue-grey streaked, and white and yellow streaked are the main varieties.	Large quantities of the marble occur, but the development of these deposits is retarded by want of railway communication.	This marble has, so far, been quarried for exhibition purposes only.
Marble (grey encrinital) *Silurian age.*	Thomson River, near Toongabbie, Gippsland. Toongabbie is 109 miles from Melbourne by rail.	A compact limestone showing numerous encrinite fossils.	A considerable quantity is probably available, and some quarrying has been done.	It has been used for mantelpieces and table tops.
Marble (salmon pink and grey and dove-grey)	Martin's Creek, 20 miles north of Orbost on the Orbost-Bendoc road, East Gippsland. Orbost is within 230 miles of Melbourne, and will be shortly served by rail.	A very handsome marble of salmon pink and dove grey colour, compact and solid.	Large quantities are available, and a quarry has been opened.	Used in construction of the Agent-General's Office, London. An exhibit sent to the Franco-British Exhibition, 1908, gained a certificate and medal.

Palæozoic marbles also occur at Mt. Wellington (Gippsland), Lilydale, Loyola, Deep Creek (Walhalla), Tyers River, Waratah (South Gippsland), and at Bindi, Wonnangatta, and Wombat Creek (North Gippsland). These have not yet been quarried, although some of them may in future prove to be of importance.

SEDIMENTARY ROCKS—*continued.*

Building Stone.	Locality.	Character.	Quantity.	Examples.
Limestone (yellow to red) *Janjukian age.*	At Batesford, Moorabool River, 5 miles north-west of Geelong, which is 45 mls. by rail from Melbourne.	A yellow to red limestone composed of numerous fossils cemented together by a crystalline calcite base.	Large quantities available along the Moorabool River Valley.	This limestone has been used in the new Police Court Buildings, Melb., in the facings of the Malvern Post Office, and in the Roman Catholic Cathedral, Bendigo.
Limestone (snuff-brown colour) *Janjukian age.*	Waurn Ponds, 6 m. south-west of Geelong, which is 45 miles by rail from Melbourne.	An impure limestone containing iron oxide and clayey matter. It makes a fair building stone when carefully selected.	A large quantity is available, and several quarries have been worked on and off for many years.	It has been utilised in the construction of parts of the Working Men's College, St. Paul's Anglican Cathedral, and the Railway Viaduct Buildings, Melbourne.
Limestone (white) *Janjukian age.*	Portland, 251 miles from Melbourne by rail. Water carriage also available.	A white polyzoal limestone resembling the Mt. Gambier limestone. It is reputed to harden on exposure.	There appears to be a considerable thickness of this limestone.	It would probably make a good building stone.

Other Tertiary limestones of Janjukian age, and of less importance, but suitable as building stones, occur at Torquay, Drysdale, and Grange Burn. At Sorrento and Warrnambool some recent limestones (dune limestones of Pleistocene age) have been used locally for building purposes, being sometimes very hard and durable.

Flagstones and slates occurring in Victoria have been quarried for paving and building purposes. At Castlemaine useful flagstones have been largely employed for paving and hearthstones. A number of quarries were formerly in operation at Castlemaine, and large quantities of stone were made available for the Melbourne building trade, but at present there is no demand for the stone.

At Percydale slates have been quarried for hearthstones, and flagstones of slate were at one time much used. At Gisborne, Glenmaggie, Meredith, and Nowa Nowa, useful slates are known to occur, and those at Nowa Nowa will be fairly accessible on the completion of the Bairnsdale-Orbost railway.

3. Queensland.

Unfortunately there is not sufficient information available to permit of a detailed statement being given in regard to the quantity and quality of Queensland building stones.

4. South Australia.*

The principal building stones that have been employed in the construction of public and private buildings in the State of South Australia are mentioned in the accompanying table. In addition to those which appear in the table there are many others in various parts of the State which are used locally to a limited extent.

It will be seen that the great series of sediments of Cambrian age contributes a considerable portion of the building stone used in the State, and the Tertiary system provides important and useful limestones and dolomite.

There are many known occurrences of rocks which may in the future be utilized as materials of construction, but which have remained undeveloped owing to their relative inaccessibility. For example, the granites at Wudinna and Moody have recently had transport facilities provided by the construction of railway lines on Eyre's Peninsula. Other granites, suitable for building purposes, are those of Midgee, 25 miles north-east of Franklin Harbour, and Cape Willoughby at the eastern extremity of Kangaroo Island.

The felspar porphyry, the largest development of which is in the Gawler Ranges, is a very handsome rock, and would provide excellent material for decorative work or for composite artificial stones.

The Pre-Cambrian sediments of Eyre's Peninsula comprise some marbles which may prove useful in the future. The white marble of medium grain found at Ulgera Gap, 11 miles north-west of Cowell, is perhaps the most accessible of these.

IGNEOUS ROCKS.

Building Stone.	Locality.	Character.	Adaptability and Quantity.	Examples.
Granite *Palæozoic*	West Island, 1 mile S.W. of Rosetta Head, Encounter Bay; about 100 miles by sea from Port Adelaide.	A coarse-grained grey granite, porphyritic through development of large felspar crystals. Resembles the granite of Granite Island and Port Elliott.	Excellent material, and probably the most advantageously situated development of granite in the State. Has been used principally in the construction of bases for important city buildings. Very large quantity available.	Base courses and steps of Parliament House and St. Peter's Cathedral, Adelaide. Bases of the Bank of Australasia and the Bank of New South Wales, Adelaide.

* Data supplied by L. Keith Ward, Esquire, B.A.B.E., Government Geologist, South Australia.

IGNEOUS ROCKS—*continued.*

Building Stone.	Locality.	Character.	Adaptability and Quantity.	Examples.
Granite *Palæozoic*	Swanport, 3½ miles S. S. E. of Murray Bridge, which is 60 miles by rail from Adelaide.	A coarse-grained and pale reddish rock, the colour of which is best shewn by polished surfaces. The roughly-dressed rock is more nearly grey than red.	Can be readily dressed to specified shapes, and polishes well. It makes a handsome and reliable stone for foundations, base courses and monuments. A large quantity available.	Base courses of the Adelaide Railway Station, the new Education block, the Savings Bank, National Mutual Buildings. Bases of the Soldiers' Monument, North Terrace; Colonel Light's and Kingston's statues, Victoria Square; Hughes' Statue at the University of Adelaide.
Granite *Palæozoic*	Palmer, 1 mile N.W. of Palmer and 11 miles W.N.W. of Mannum on the Murray, 40 miles by road from Adelaide.	A coarse-grained granite, porphyritic in part, and to a certain extent gneissose in structure. The colour is pale reddish.	Good material, but handicapped by its position. Very little worked. It is used for the same purposes as those to which the Swanport granite has been applied. Very large quantity available.	Base of the Queen's Statue, Victoria Square. Base courses of the Beehive Buildings, King William Street, Adelaide.
Granite *Palæozoic*	Monarto on the Railway line, 3½ miles E. of Monarto Railway Station and 55 miles from Adelaide.	A pale grey granite of medium to fine grain. The structure is slightly gneissose.	Suitable for foundations and bases, but hitherto neglected in favour of the coarser grained varieties from Swanport and Encounter Bay. Very large quantity available.	A considerable quantity is used by the Municipality of Adelaide for kerbing in the city streets, also facings of the South Australian Gas Company's premises, King William Street, Adelaide.

SEDIMENTARY ROCKS.

Slate *Cambrian*	*Mt. Lofty Ranges* near Adelaide; chiefly at: Glen Osmond, 4 miles by road S.E. of Adelaide; Mitcham, 4 miles by road S. of Adelaide; Tapley's Hill, 8 miles by road S.S.W. of Adelaide.	A dark bluish to yellowish grey clay slate. The rock is thin-bedded, but does not cleave readily along the bedding planes. The joint-planes are somewhat irregularly disposed, and are tinted various shades of yellow and brown by oxide of iron.	The rock is quarried in blocks of convenient size for building purposes, and the blocks are bounded by approximately rectangular faces. The stone is usually employed with the iron-stained joint planes as facers, and the variegated appearance of large walls is pleasing. The buildings constructed mainly of this stone are dressed with sandstone, limestone, brick, or cement. This slate is used in the base courses of many buildings in Adelaide. Very large quantity available.	The Stow Memorial Church and the Baptist Church, in Flinders St., Adelaide, are examples in which the dressings are of sandstone. The Government Printing Office is an example in which the Murray Bridge limestone is used for dressings. Innumerable public and private buildings in Adelaide are constructed of this stone.
Slate *Cambrian*	Various places on the northern railway line, chiefly at: Auburn, 75 miles by rail from Adelaide; and Tarlee, 54 miles by rail from Adelaide.	A rock varying from a thin-bedded clay slate to an argillaceous sandstone, and readily cleavable with the bedding planes into blocks or flags. The unweathered stone is dark slate-blue in colour, and the weathered material brownish grey. Joint planes are stained brown by oxide of iron.	Easily worked stone, obtainable in sizes and shapes convenient for use in building construction. Variable results have been obtained from this stone, but the best material is of good quality. Careful selection of stone in some quarries is necessary, for the good stone is in some places associated with material that rapidly frets away. Very large quantity available.	The Auburn slate has been used for the base courses of the Adelaide School of Mines, and for many buildings at Auburn. Tarlee stone is used in the base of the brick portion of the Museum, and in the construction of many railway stations, *e.g.*—Burra, Farrell's Flat, Riverton, Roseworthy, and Adelaide. It is also used in the Islington Railway Workshops.

SEDIMENTARY ROCKS—*continued.*

Building Stone.	Locality.	Character.	Adaptability and Quantity.	Examples.
Flagstone *Cambrian*	Mintaro, 5½ miles west of Mintaro railway station, which is 83 miles north of Adelaide.	A dense bluish-grey slate or argillaceous sandstone, readily cleavable into flags. The cleavage is coincident with the bedding planes. Very large flagstones are obtainable.	It is used for all purposes to which a high-class flagstone may be put. The quality is unsurpassed, and the reliability has been proved by over 40 years of wear. It has proved adaptable for use in interiors as well as in pavements and steps exposed to the weather and to heavy traffic. Very large quantity available.	As hearthstones, sills, steps, corridor flooring, and paving stones, etc., in many public and private buildings in South Australia. It has been used in the construction of the corridor floors in Parliament House, Adelaide, and of the shelving and corridor floors of the Lands Titles Offices, Melbourne.
Roofing Slate *Cambrian*	Willunga, 34 miles by rail from Adelaide.	A thin-bedded bluish grey slate, the cleavage of which is coincident with the bedding-planes. The prepared slates are thicker and softer than the best Welsh roofing slates, and the thickness cannot be reduced without sacrificing strength. All workings are shallow and the quality of slates may improve in depth.	It has been used chiefly for roofing private dwellings. Attempts to use the thicker slates as flagstones have not been successful, as the stone is too soft and apt to flake. Very large quantity available.	The roofs of most buildings at Willunga, and of many houses in Adelaide, Melbourne and Sydney.
Limestone *Tertiary*	Murray Bridge; chief quarries are situated on the left bank of the river, 1 mile south of Murray Bridge, which is 60 miles by rail from Adelaide.	A light buff-coloured stone, the texture of which is on the whole even and the grain fine. Shells are visible in parts of the rock. The stone, as quarried, requires careful picking in order to remove portions traversed by pipe-like cavities which are either void or filled with clay.	The rock has been used effectively on a large scale in many public buildings, either as the principal material of construction or in the form of dressings for buildings constructed mainly of slate. Very large quantity available.	The Art Gallery, Public Library and Museum, North Terrace, Adelaide; The Register Buildings, Grenfell Street; the superstructure of St. Peter's Cathedral. The dressings of the Government Printing Office, Adelaide.
Limestone *Tertiary*	Mt. Gambier and vicinity. Mount Gambier is 305 miles by rail from Adelaide.	A white porous-textured limestone, composed largely of polyzoal remains. It is soft and easily worked when freshly quarried, but hardens on exposure. It is obtainable in very large blocks.	It can be readily obtained at a low cost in any form desired. The porosity is so marked that buildings constructed of this stone are almost invariably built with hollow walls. It is used in some cases for dressings in buildings built of other limestone, but in Mt. Gambier it is customary to use the polyzoal limestone as the chief building material with dressings of dolomite. Very large quantity available.	The Convent of Mercy, the Methodist Church, the High School, and the Commercial Flour Mills at Mt. Gambier. Many private buildings in the Southern district. In the form of quoins and dressings in the Institute and Presbyterian Church at Penola, and in the Institute at Naracoorte.
Travertine Limestone *Tertiary to Recent*	Northern suburbs of Adelaide and many other places in the State.	A yellowish limestone, generally showing concretionary structure.	A hard and durable stone, obtainable in small blocks and more suitable for building private houses than for larger structures. Very large quantity available.	Many residences in the older parts of North Adelaide; the old portion of the Adelaide Railway Station; Alberton and Bowden Railway Stations.
Limestone *Tertiary to Recent*	Near Port Lincoln, in low lying areas.	Soft white limestone, hardening on exposure.	Suitable for small buildings and private residences. Large quantity available.	Many houses at Port Lincoln.

SEDIMENTARY ROCKS—*continued.*

Building Stone.	Locality.	Character.	Adaptability and Quantity.	Examples.
Dolomite *Tertiary*	Near Compton, about 6 miles N.W. of Mt. Gambier, which is 305 miles by rail from Adelaide.	Crystalline dolomite, either grey or yellowish red in colour.	A dense rock which is more costly to quarry and dress than the polyzoal limestone, and hence used principally in the form of dressings for buildings constructed of the latter rock. Large quantity available.	Red dolomite is used in the columns of St. Peter's Cathedral, Adelaide; in Hospital, Town Hall, the Institute, and Blue Lake Pumping Station at Mt. Gambier. Dolomite is also used in many private buildings at Mt. Gambier.
Marble *Cambrian*	Angaston; 1½ miles south of Angaston railway station, which is 51½ miles from Adelaide.	Coarse-grained white, grey and pink marble, the grey varieties being most abundant and the pink the rarest. Different shades of colour are closely associated.	Very large blocks are obtainable and the stone lends itself to high-class architectural work and to large structures. The grain is too coarse for fine work. The stone has been much in demand for monumental work, and has also been used in the form of flagstones. Very large quantity available.	The Mechanics' Institute at Angaston is built of stone of two shades, grey and almost white. Many dwelling houses in the Angaston district are built of this marble. Pale grey stone is being shipped to London for use in the construction of Australia House.
Marble *Cambrian*	Kapunda; 8 miles S.E. of Kapunda, which is 48 miles by rail from Adelaide.	Coarse-grained white, grey and cream coloured marble. The grey-tinted stone closely resembles that of Angaston.	This marble has been applied to the same uses as that from Angaston. It is rather less easy to work, and is less accessible. Very large quantity available.	The superstructure of Parliament House, Adelaide.
Marble *Cambrian*	Macclesfield; 1 mile west of Macclesfield, which is 25 miles by road from Adelaide.	Medium to fine-grained and pink marble. The pink variety is streaked with grey.	A handsome stone which takes a splendid polish. The parti-coloured varieties are specially suited to decorative and monumental work. Very large quantity available.	The Clarendon weir across the Onkaparinga River is faced with massive blocks of this marble.
Sandstone *Cambrian*	Tea Tree Gully, 13 miles by road N.E. of Adelaide.	White to light buff-coloured stone of even texture.	A sandstone that dresses well and has proved very durable. It may be used with advantage by itself or in the form of dressings in buildings constructed mainly of Mitcham or Glen Osmond slate. It has resisted weathering better than any other South Australian or imported sandstone in Adelaide buildings. Very large quantity available.	The Law Courts, Adelaide; the Town Hall Adelaide; the old portion of the General Post Office, Adelaide.
Sandstone *Cambrian*	Aldgate; half-mile W. of Aldgate Railway station, which is 22 miles from Adelaide.	White to light buff-coloured stone of variable quality. In part argillaceous and friable.	This stone is apt to fret on exposure. It is very soft when quarried. Large quantity available.	The Elder Hall, University of Adelaide; the spires of St. Peter's Cathedral.
Sandstone *Probably Permo-carboniferous*	Finniss River; 2 miles N.W. of Finniss railway station, which is 60 miles from Adelaide.	Pale grey to buff-coloured stone, part of which is notable for a highly-contorted grain which becomes more and more prominent on dressed surfaces as weathering proceeds.	Stone hitherto quarried is of rather variable quality. The sawn surfaces become very rough on long exposure and the stone is apt to fret away. Large quantity available.	The superstructure of the Bank of New South Wales, Adelaide; the pillars and coping stones, University Gates; the Strathalbyn Railway Station.

SEDIMENTARY ROCKS—*continued.*

Building Stone.	Locality.	Character.	Adaptability and Quantity.	Examples.
Sandstone *Cambrian*	Mt. Lofty Ranges near Adelaide, notably: Sheoak Hill, 2 miles E.S.E. of Belair which is 14 miles by rail from Adelaide; immediately to S. of Mt. Lofty railway station, 19½ miles from Adelaide; Mitcham, 5 miles by road S. of Adelaide; Glen Osmond, 5 miles by road S.E. of Adelaide.	Soft pale buff-coloured sandstone, which hardens somewhat after being quarried.	Suitable for small buildings, such as residential villas, of which it forms either the walls or base courses. It is in very many cases used with dressings of red brick. Very large quantity available.	Many private residences in and around Adelaide.

5. Western Australia.*

Western Australia is particularly rich in building stones, but, owing to the fact that the sedimentary series occupy but a very limited area, it naturally follows that they for the most part belong to the crystalline series.

These building stones, although excellent in many ways, are not so good as they will be later when the quarry faces have penetrated further into the virgin rock, but when it is borne in mind that only a very limited quantity of rock has yet been removed, it is remarkable how fresh the stone is.

Although this State contains a great variety of granites, so far only one of these has been worked owing to the fact that it existed in the most accessible positions, but there is not the least doubt that in the near future other fine building stones of this class will be quarried.

The only sedimentary stone worthy of note is the Donnybrook freestone, which is now being used largely in the erection of the principal buildings of the metropolis.

ACID IGNEOUS ROCKS.

Building Stone.	Locality.	Character.	Quantity.	Examples.
Granite (greyish-white)	Mahogany Creek, 19 miles from Perth, on Smith's Mill railway line.	Coarse-grained orthoclase-biotite granite sometimes much kaolinised.	Unlimited.	Basement, ground and 1st floor of New G.P.O., Perth, rock-faced and fine-axed work. A beautiful stone taking a high polish.
Granite (greyish-white)	Boya, 14 miles from Perth, on Smith's Mill railway line.	Medium-grained orthoclase-microcline biotite granite with chloritis-biotite scales considerably kaolinised, but occasionally micacised, while epidote grains are associated with the biotite aggregates. Appearance closely resembles that from Mahogany Creek.	Unlimited.	No buildings. Used exclusively for granite cubes for street pitching and concrete work.
Granite (greyish-white)	Meckering, 89 miles from Perth, on the Eastern Railway line.	Fine-grained chloritis biotite muscovite granite; the felspars are orthoclase and microcline, which are kaolinised and micacised. Weight per cub. ft., 175.7 lbs.	Unlimited.	Basement of Art Gallery and Museum and Supreme Court buildings, where it stands well although looking rusty in places and rather lacking in appearance.

* Data supplied by the Secretary for Mines, Department of Mines, Perth.

ACID IGNEOUS ROCKS—*continued.*

Building Stone.	Locality.	Character.	Quantity.	Examples.
Granite (greyish)	Kellerberrin, 133 miles from Perth, on the Eastern railway line.	Coarse-grained orthoclase-microcline granite with flakes of brown biotite. More or less porphyritic. Weight per cub. ft., 171 lbs.	Unlimited.	New Public Library. Has a good appearance and takes a high polish.
Granite	Roelands, 100 miles from Perth on the South Western Railway line.	Coarse-grained biotite microcline granite with large pseudo crystals of felspar, the latter being generally kaolinised and micacised.	Unlimited.	Bunbury Breakwater.
		BASIC IGNEOUS ROCKS.		
Epidiorite and partially amphibolised dolerite.	Gooseberry Hill, Greenmount and Parkerville, 13 to 19 miles from Perth.	Fine-grained and consisting of hornblende, chlorite, augite, pyrites in varying amounts. Very hard and fairly fresh.	Occurs in large dykes.	Used so far for road-making and pitching.
Basalt (greyish-black)	Bunbury.	Very fine-grained sometimes porphyritic black rock, the porphyritic variety shewing large felspar crystals.	Sheet flow or sill of considerable extent.	Used for road-making and steps to local buildings.
		SEDIMENTARY ROCKS.		
Slate	Bridgetown, 174 miles from Perth.	Almost flinty greenish and greenish-white rock of very imperfect fissility.	Unknown.	Not used so far. Unsuitable for roofing.
Slate (Brown-chocolate) *Silurian?*	Stirling Range, 274 miles from Perth.	Massive slate cleaving into large slabs. Not suitable for roofing owing to the imperfect nature of the fissility.	Unknown.	Not used so far.
Slate (Grey-blue to Chocolate) *Permo-Carb.?*	Armadale, Beenup and Cardup, 19 to 25 miles from Perth on South Western railway line.	Massive slate cleaving into large slabs. Not suitable for roofing.	Unknown.	Used for pavements, but principally for dry-pressed bricks.
Sandstone (white through cream to yellow and brick red, also sometimes variegated) *Permo-Carb?*	Donnybrook, 132 miles from Perth on the railway.	Fine-grained felspathic sandstone with kaolinic cement, an excellent freestone suitable for rock-faced, dressed and all sorts of tooled and carved work. Weight per cub. ft., 129 to 144 lbs.	Large number of quarries over a large area, but quantity unknown.	Upper portion of Parliament House; Supreme Court; Police Court Station and Quarters; Museum, Art Gallery and Library; A.M.P. Buildings; Millars Jarrah Forests Ltd.; G.P.O., Perth; Customs House, Fremantle; Dalgety's Buildings; Haynes, Robinson & Cox; Telephone Exchange; Bunbury Collie and Midland Junction Court Houses; Government Stores, Perth; Public Health Offices, Perth; Perth Technical School; Fremantle Railway Station; Guilford Grammar School Chapel (sculpture and carved work); Tower and Spire of St. John's Church, Fremantle.

SEDIMENTARY ROCKS—*continued.*

Building Stone.	Locality.	Character.	Quantity.	Examples.
Calcareous Sandstone (creamy-white) *Eocene?*	Rottnest Island, 10 miles off Fremantle.	A fine-grained freestone in which the sand grains are cemented by calcareous matter. Suitable for rock-faced dressed and when selected for tooled and carved work. Weight per cub. ft., 142.5 lbs.	In large quantity, but not now worked owing to the superiority of the Donnybrook stone.	Employed in first section of Museum Buildings and in Parliament Houses.
Calcareous Sandstone (creamy-white) *Eocene?*	Cottesloe and Fremantle.	A freestone of variable texture in which the sand grains are united by calcareous matter. Suitable for rock-faced work but not for dressing or carving.	Extensive deposits all along the coast.	Government House Ballroom, and employed extensively in the older buildings of Perth and Fremantle, but now only used for foundations.
Clay Rock (white to terracotta)	Walsh's Quarry, Kalgoorlie.	Fine-grained compact kaolinised clay rock. Soft when freshly quarried, but develops a resistant surface on exposure.	Unknown.	Public Buildings, Kalgoorlie.
Clay-shale (banded brown and white) *Permo-Carb.?*	Moora, 108 miles from Perth on Midland railway.	Fine-grained compact kaolinised shale. Fairly resistant to absorption and developing a surface on exposure. Can be worked and moulded to suit all building requirements.	Unknown.	Court House, Post Office, and Police Buildings, Moora.

Stone of a similar character has been used both at Coolgardie and Yalgoo in public buildings, and in both places it is of a red colour and looks exceedingly well when walled, but is not a good weathering material. At Mullewa, however, there is a supply of a similar stone which will probably be found suitable for building purposes.

SEDIMENTARY ROCKS—*continued.*

Building Stone.	Locality.	Character.	Quantity.	Examples.
Diatomaceous Rock (french-gray *Cretaceous?*	Gingin and Dandaraga, 40 to 80 miles north of Perth on Midland railway.	A very fine-grained rock, composed of the siliceous shells of diatoms with a little kaolin cementing material. It is easily worked and moulded, being soft when freshly quarried, case hardens on exposure to the weather.	Unknown.	Schoolhouse and Post Office at Dandaraga, and private residences at Gingin.

6. Tasmania.*

There is an abundance of building stone in Tasmania, both igneous and stratified. In the districts where it is plentiful, it is employed for buildings, and to a larger extent for road making. The total annual output is about 70,000 tons at present, but this may be expected to increase with the general progress of trade and population.

* Data supplied by the Secretary for Mines, Dept. of Mines, Hobart.

IGNEOUS ROCKS.

Building Stone.	Locality.	Character.	Quantity.	Examples.
Basalt.	On the North Coast generally, in the North West Highlands, the Midlands and Southern Tasmania.	Compact to vesicular. A dark Tertiary basalt. Where fresh, the rock is resistant and would be fairly durable, but is mostly irregularly fissured and short jointed.	Unlimited quantities can be quarried.	The quarries in this stone have been worked only for road metal.
Diabase.	Hobart, Southern Tasmania generally, Midlands, Launceston and Northern Tasmania.	A medium grained to coarse pyroxene-felspar rock, very tough; colour, dark green to greenish grey. The rock is massive and has an irregular fracture. It is consequently difficult to dress. Numerous quarries have been opened in this stone in nearly all parts of the island.	Is available in practically limitless quantities.	It is used extensively for road metalling, road culverts, bridge work, garden walls, pavements, house foundations, and in some instances for the superstructure of buildings. Examples may be seen everywhere in Hobart and Launceston in the foundations of houses and public buildings, and on the public roads. Cottages at the Launceston Electric Generating Station are built wholly of this rock.
Gabbro and Serpentine.	Near Beaconsfield, near Dundas, in Heazlewood and Heemskirk districts, Macquarie Harbour, near Point Hibbs, near Mt. Wedge and on Styx River.	Even grained to coarsely crystalline. Some of it could be used in ornamental architecture, but generally speaking would tend to weather if employed for outside purposes. Some varieties are distinctly handsome.	Large quantities of the rock could be quarried, but the tonnage would be reduced by exclusion of unduly soft and fissured varieties.	The only quarries which have been opened in this rock are those in the Heemskirk and Heazlewood districts for road metalling, and near Beaconsfield for ornamental rock.
Granite.	N.E. and E. Tasmania, Riana, Hampshire Hills and N.W. highlands, Mt. Heemskirk and Meredith Range.	Medium to coarse grained crystalline rock, frequently porphyritic, with large crystals of felspar. Colour ranges *from light grey to pink.* Places for quarries would have to be selected where the rock is fresh.	Would be available in large quantities.	No quarries have been opened in granite so far, and the rock has not been utilised. With increasing population there will be a *wide field open for its* employment in various branches of the building art.

About 60,000 tons of igneous rock are raised annually for building and road construction.

SEDIMENTARY ROCKS.

Numerous quarries have been opened in Tasmania in Trias-Jura sandstones for building materials, and the stone obtained from them has proved of excellent service in building and decorative work. The quarries are always situated in favourable positions on or near main roads or lines of railway, and are thus easily accessible for trade. They are mostly on privately-owned land and as a rule are worked in a more or less intermittent and unmethodical manner. Still, they have supplied good stone for numerous public and private buildings in Tasmania, as well as for some important edifices in Victoria. Some of the deposits are, however, Government reserves.

About 6,000 tons of sandstone are raised annually for building.

SEDIMENTARY ROCKS—*continued.*

Building Stone.	Locality.	Character.	Quantity.	Examples.
Sandstone.	Knocklofty, Hobart Waterworks, Risdon, Bellerive, Tea Tree, Brighton, New Norfolk and other places in Southern Tasmania. At Ross, Campania, Oatlands, Okehampton, Spring Bay, and elsewhere in the Midlands and on the East Coast, on the West Tamar and in the Patersonia district.	Even grained texture, white, through pink, to light brown colour. The pinkish varieties are esteemed for ornamental stone work. When freshly quarried the stone is often rather soft and friable, but hardens with time and exposure. It is easy to dress. The quartzose varieties are sought in selecting a site for a quarry, as some of the stone, particularly when associated with the Trias-Jura coal measures is distinctly felspathic and soft. The Patersonia stone has been tested to a pressure of 10,000 lbs. to the square inch. The better varieties of sandstone are extremely durable.	About 6.000 tons are raised annually for building purposes, but much larger quantities could be obtained if the quarries were worked more regularly and systematically.	The Southern quarries have provided stone for several important public buildings, such as the Tasmanian Museum, Town Hall, General Post Office, St. David's Cathedral, St. George's Church, and numerous other buildings, both public and private. The Tea Tree and Brighton quarries have supplied stone for the Launceston Post Office. The Ross quarries have provided stone for the bridge over the Macquarie at Ross, the Ross Municipal buildings; and for St. John's Church, Commercial Bank of Tasmania, A.M.P. Building and the Commercial, Travellers' Club in Launceston. The Campania quarries yielded stone for the Customs House, Hobart, The Mechanics' Institute, Launceston, is built of stone from the West Tamar quarry. Some of the stone from Patersonia has been used in the enlargement of St. John's Church, Launceston, and other buildings.
Silurian Limestones.	Ida Bay and Tyenna, Southern Tasmania; Winkleigh, Railton, Chudleigh, Mole Creek; Leven, Forth, Don, Iris and Blythe Rivers in Northern Tasmania; Queenstown and Zeehan in Western Tasmania. Gordon, Denison and Franklin Rivers in Western highlands.	Grey to dark bluish limestone, developing in places to impure argillaceous varieties. The pure stone, where unfissured and compact would be of some use for building purposes.	Large and indeterminable quantities could be obtained, but the only quarries opened hitherto are for producing agricultural and building lime, and road metal.	
Flaggstones and Slates. *(Pre-Silurian).*	N. and N.W. Coasts, Surprise River, South Coast and King Island.	Dark grey to bluish. Cleavages apt to be soft jointed. Further prospecting required to locate occurrences of stone suitable for roofing and window-sills, hearthstones, etc.	Small and inconclusive trials have been made of slates on N. W. coast and King Island.	