

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 extent of the total mineral wealth of Australia cannot yet be regarded as completely ascertained, as large areas of country still await systematic prospecting. 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 Strzlecki 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. **Quantity and Value of Production during 1920.**—The value of production from the mineral industry in 1920 shewed an increase of £2,732,000 over that for the preceding year. All States participated in this increase with the exception of Western Australia, where there was a falling off amounting to £82,000. In New South Wales and Queensland the increases amounted to £983,000 and £893,000 respectively. Next came South Australia with £376,000, Victoria £277,000, Tasmania £119,000, and Northern Territory £8,000. In New South Wales the increase was chiefly in coal, but there were decreases in gold, copper, silver, lead, and zinc. Victoria shewed increases in gold, coal, and diatomaceous earth. Queensland recorded increases in copper, tin, and silver-lead, but these were to some extent offset by reductions in gold, wolfram, molybdenite, and bismuth. For South Australia there were improved returns from iron ore, copper, salt, and phosphate. Although increases in copper and coal were recorded in Western Australia, these were more than counterbalanced by a falling off in gold, silver, and tin, the lessened yield in the case of gold amounting to £273,000. Tasmania shewed increases in osmiridium, lead, silver, copper, and coal.

The table hereunder and the succeeding one shew respectively the quantity of the various minerals produced during 1920 in each State, and the values apportioned thereto in the form in which the items were reported to the Mines Departments. The quantities and values given represent the amounts which the Departments consider may fairly be taken as accruing to the mineral industry as such. Thus, the item pig iron in New South Wales represents metal produced from locally-raised ore only and so reported to the Mines Department. South Australia, as the table shews,

receives credit for ironstone in the crude stage, but the quantity and value of the pig iron produced therefrom in New South Wales cannot be taken as a product of the New South Wales mineral industry. Similarly lead, silver-lead, and zinc are credited in the form reported to the State of origin—chiefly New South Wales—although the actual metal extraction is carried out to a large extent elsewhere. Information in regard to the quantity of metal extracted at the various smelting and refining works in the Commonwealth, together with that contained (estimated) in the ores, concentrates, etc., exported or sold for export, is given in §18 hereinafter.

QUANTITIES OF PRINCIPAL MINERALS PRODUCED, COMMONWEALTH, 1920.

Minerals.	Unit.	N.S.W.	Vic.	Q'land.	S. Aust.	W. Aust.	Tas.	N.T. (d)
Alunite	ton	634	..	..	20	..	..	..
Antimony ore ..	..	200	961	..	..	3	..	..
Asbestos .. ..	..	664	..	..	5	156	..	..
Bismuth	cwt.	1,520	..	(a) 1,000	..	..	2	..
Brown coal	ton	..	162,682	..	..	..	..	..
Chromite .. ..	..	1,460	..	158	..	..	..	..
Coal .. ..	..	10,715,999	442,241	1,109,913	..	462,021	75,429	..
Coke .. ..	..	567,569	..	..	..	..	..	..
Copper (ingot and matte) .. ..	..	1,290	..	15,897	4,339	..	4,792	..
Copper ore .. ..	..	..	..	(b)	..	1,511	..	67
Diatomaceous earth ..	..	384	1,000	..	..	..	..	..
Gold	fine oz.	48,908	152,792	115,229	1,697	617,843	6,246	939
Gypsum	ton	..	3,393	..	40,192	..	..	..
Iron (pig) (e) .. ..	..	86,096	..	..	..	..	..	..
Iron oxide .. ..	..	1,574	..	..	..	1	..	..
Ironstone .. ..	..	2,881	..	10,709	413,038	..	..	..
Kaolin .. ..	..	2,788	2,130	..	693	..	..	..
Lead .. ..	..	413	..	1,709	..	1,930	3,856	..
Lead and silver ore, concentrates, etc. ..	..	8,890	..	..	82	3,427	..	17
Limestone flux .. ..	..	80,145	..	105,068	30,508	..	..	..
Magnesite .. ..	..	6,474	151	..	185	..	..	..
Manganese ore .. ..	..	2,531	..	15	514	..	..	..
Molybdenite	cwt.	800	965	579	..	10	..	..
Phosphate	ton	154	4,222	..	8,753	..	..	..
Platinum	oz.	796	..	..	..	..	..	..
Pyritic ore	ton	..	..	..	..	6,020	4,440	..
Salt .. ..	..	..	(c)	..	70,871	..	..	..
Scheelite .. ..	..	21	..	2	..	2	105	..
Shale (oil) .. ..	..	21,004	..	..	..	..	140	..
Silver	fine oz.	158,934	6,231	274,235	1,005	130,692	623,359	..
Tin and tin ore	ton	2,486	844	1,486	..	243	1,310	180
Wolfram .. ..	..	14	71	81	..	..	71	270
Zinc concentrates .. ..	..	71,043	..	..	..	..	9	..

(a) Including 931 cwt. bismuth and wolfram. (b) Included with metal. (c) Not available for publication. (d) Year ended 30th June, 1920. (e) *Vide* letterpress preceding paragraph.

The comparative value of the production of minerals raised in each State during 1920 is given in the following table:—

VALUE OF COMMONWEALTH MINERAL PRODUCTION IN 1920.

Minerals.	N.S.W.	Victoria.	Q'land.	S. Aust.	W. Aust.	Tas.	N.T. (c)	C'wealth.
	£	£	£	£	£	£	£	£
Alunite	2,536	..	..	150	..	..	..	2,686
Antimony ore	2,505	14,238	..	..	45	..	..	16,788
Asbestos	7,404	..	..	90	7,286	..	..	14,780
Bismuth	33,886	..	(a) 5,286	..	..	9	..	39,181
Brown coal .. ..	..	64,180	..	..	..	..	..	64,180
Chromite	5,090	..	158	..	..	..	..	5,248
Coal	7,723,355	464,739	841,551	..	350,346	64,005	..	9,443,996
Coke	844,191	..	..	..	..	..	..	844,191
Copper (ingot and matte)	127,978	..	1,551,995	423,601	2,698	528,237	..	2,634,509
Copper ore .. ..	..	..	(b)	(b)	22,467	..	780	23,247
Diamonds	6,282	..	..	..	..	..	..	6,282
Diatomaceous earth ..	923	5,000	..	..	..	..	..	5,923

(a) Including bismuth and wolfram, £14,756. (b) Included with metal. (c) Year ended 30th June, 1920.

VALUE OF COMMONWEALTH MINERAL PRODUCTION IN 1920—*continued.*

Minerals.	N.S.W.	Victoria.	Q'land.	S. Aust.	W. Aust.	Tas.	N.T. (c)	Commonwealth.
	£	£	£	£	£	£	£	£
Gems (unspecified)	2,041	..	65,831	..	..	..	..	67,872
Gold ..	275,109	859,461	648,168	9,546	3,475,392	35,134	5,282	5,308,092
Gypsum ..	..	1,696	..	31,604	..	..	..	33,300
Iron (pig) (e)	645,720	..	..	..	..	..	..	645,720
Iron oxide ..	1,247	..	..	..	17	..	..	1,264
Ironstone ..	3,726	..	24,852	478,436	..	..	..	507,014
Kaolin ..	3,201	2,264	..	1,287	..	..	..	6,752
Lead ..	9,905	..	65,098	..	69,136	142,268	..	286,407
Lead and silver- lead ore, concen- trates, etc. ..	76,634	..	(a)	2,420	84,743	..	299	164,096
Limestone flux ..	30,920	..	(d)42,921	9,538	..	..	..	83,379
Magnesite ..	9,891	453	..	347	..	..	..	10,691
Manganese ore ..	2,008	..	60	4,626	..	..	..	6,694
Molybdenite ..	8,442	3,616	13,333	..	5	..	..	25,396
Opal ..	23,600	..	500	24,000	..	..	..	48,100
Phosphate ..	732	4,222	..	12,309	..	..	..	17,263
Platinum ..	16,672	..	..	..	..	..	..	16,672
Pyritic ore ..	..	..	..	..	7,276	7,346	..	14,622
Salt ..	..	(b)	..	141,742	..	..	..	141,742
Scheelite ..	3,805	..	462	..	395	17,905	..	22,567
Shale (oil) ..	46,082	..	..	..	..	172	..	46,254
Silver ..	36,942	1,714	70,461	226	36,605	166,767	..	312,715
Tin and tin ore ..	413,794	12,815	252,054	..	49,449	369,362	27,610	1,125,084
Wolfram ..	2,212	355	14,027	..	..	13,626	45,648	75,868
Zinc concentrates	249,456	..	..	..	..	334	..	249,790
Unenumerated ..	19,881	382	21,113	10,927	4,516	81,277	482	138,578
Total ..	10,636,170	1,435,135	3,617,870	1,150,849	4,110,376	1,426,442	80,101	22,456,943

(a) Included with metal. (b) Not available for publication. (c) Year ended 30th June, 1920.
 (d) Portion of the limestone raised was used in the manufacture of lime and cement. (e) See
 letterpress § 3.

It may be pointed out in connexion 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 and pottery 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. By restricting the comparison to items in connexion 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 1920 consist of—lime, £80,412; marble, £2,315; Portland cement, £719,435, and brick and pottery clays in the "unenumerated" class. In Queensland, arsenic to the value of £16,760 is included under the heading unenumerated. For South Australia the principal items in the unenumerated class are flint pebbles, £1,604; and barytes, £7,362; while this class in Tasmania includes osmiridium to the value of £77,114.

4. Total Production to end of 1920.—In the next table will be found the estimated value of the total mineral production in each State up to the end of 1920. The figures given in this table are also exclusive of the same items referred to in connexion with the preceding table. Thus the total for New South Wales falls short by £7,344,000 of that published by the State Department of Mines, the principal items excluded being cement, £5,376,000; lime, £672,000; and marble, £40,000.

COMMONWEALTH MINERAL PRODUCTION TO END OF 1920.

Minerals.	N.S.W.	Victoria.	Q'land.	S. Aust.	W. Aust.	Tas.	Nor. Ter. (a)	C. wealth.
	£	£	£	£	£	£	£	£
Gold ..	62,979,870	300,877,399	83,945,619	1,594,555	144,835,788	8,703,515	2,272,875	605,299,621
Silver and lead ..	88,012,745	260,178	3,193,536	377,681	1,703,342	6,873,884	62,515	100,483,881
Copper ..	15,256,078	216,656	24,138,588	32,550,723	1,636,042	15,585,355	231,710	89,615,152
Iron ..	3,495,493	15,641	465,808	2,300,790	36,712	52,110	..	6,366,554
Tin ..	12,342,297	891,583	9,802,419	..	1,477,556	15,088,739	512,396	40,114,990
Wolfram ..	271,642	11,885	1,061,041	301	1,441	17,617	206,530	1,724,457
Zinc ..	13,444,001	..	..	15,993	5,437	36,320	..	13,501,751
Coal ..	105,867,620	5,167,654	9,621,507	..	2,674,257	1,012,273	..	124,343,311
Other ..	12,490,053	660,939	2,149,544	2,078,711	78,915	499,315	28,278	17,985,755
Total ..	314,159,799	308,101,935	134,378,062	38,918,754	152,449,490	48,113,128	3,314,304	999,435,472

(a) To 30th June, 1920.

The "other" minerals in New South Wales include alunite, £193,517; antimony, £343,688; bismuth, £222,928; chrome, £113,301; coke, £5,844,746; diamonds, £140,269; limestone flux, £885,588; molybdenite, £214,007; opal, £1,498,184; scheelite, £192,375; and oil shale, £2,548,495. In the Victorian returns antimony ore was responsible for £549,165. Included in "other" in the Queensland production were opal, £179,695; gems, other, £455,602; bismuth, £308,728; molybdenite, £350,134; and limestone flux, £604,552. The chief items in South Australian "other" minerals were salt, £1,259,039; and limestone flux, £211,086. Considerable values from gypsum and rock phosphates are also included. In the Tasmanian returns limestone flux was responsible for £91,739, and osmiridium for £199,491, while the figures for recent years include values for iron pyrites.

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) METALLIC MINERALS.

§ 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 this remark applies to some extent also to the returns for Western Australia and Tasmania.

In New South Wales the yield for 1920 was about 17,000 ozs. lower than in 1919, and was the lowest recorded since 1851. In Victoria the yield for 1920 shewed an increase of 17,000 ozs. fine on that for the preceding year. In Queensland the yield in 1920 was about 6,000 ozs. less than in the preceding year. As in the case in other States where there is a diminishing production, the decline is due to the gradual depletion of the mines in the principal fields. The returns for South Australia for 1920 dwindled to about half the output for the previous year. For Western Australia the

figures shew a decrease of over 116,000 ozs. in 1920 as compared with 1919, diminished returns being recorded in the outputs from all the fields except Coolgardie, East Coolgardie, Peak Hill, and Pilbara For Tasmania there was a decline of over 1,400 ozs.

VALUE OF GOLD RAISED IN AUSTRALIA, 1851 TO 1920.

Year.	N.S.W.	Victoria.	Queensland.	S. Aust.	W. Aust.	Tasmania.	Nor. Ter.	C'wealth.
	£	£	£	£	£	£	£	£
1851	468,336	851,596	..	..	..	(b)28,737	..	1,348,669
1852	2,680,916	9,116,140	..	..	..	472,615	..	12,279,701
1853	1,781,172	10,976,392	..	..	..	217,538	..	12,975,102
1854	773,209	8,873,932	..	..	..	65,030	..	9,712,171
1855	654,594	11,277,152	..	..	..	(c)	..	11,931,746
1856	689,174	12,214,976	..	..	..	(c)	..	12,904,150
1857	674,477	11,320,852	..	..	..	1,146	..	11,996,475
1858	1,104,175	10,384,924	..	..	..	850	..	11,489,949
1859	1,259,127	9,394,812	..	..	..	2,188	..	10,656,127
1860	1,463,373	8,896,276	14,565	..	..	460	..	10,376,674
1861	1,806,172	8,140,692	3,928	..	..	32	..	9,950,824
1862	2,467,780	6,920,804	625	..	..	..	..	9,389,209
1863	1,796,170	6,779,276	14,802	..	..	..	..	8,590,248
1864	1,304,926	6,489,788	83,292	..	..	..	..	7,878,006
1865	1,231,243	6,446,216	92,938	..	..	..	..	7,770,397
1866	1,116,404	6,187,792	85,561	..	..	1,044	..	7,390,801
1867	1,053,578	6,005,784	189,248	..	..	4,382	..	7,252,992
1868	994,665	6,739,672	593,516	..	..	2,536	..	8,330,389
1869	974,149	6,179,024	523,045	..	..	514	..	7,676,732
1870	931,016	5,217,216	489,539	..	..	3,666	..	6,641,437
1871	1,250,485	5,475,768	616,907	(a)550,000	..	23,467	..	7,916,627
1872	1,644,177	5,325,508	600,396	6,363	..	27,314	..	7,663,758
1873	1,396,375	4,681,588	717,540	293	..	18,390	..	6,814,186
1874	1,011,614	4,390,572	1,356,071	4,175	..	18,491	..	6,810,923
1875	877,694	4,273,668	1,498,433	7,034	..	11,982	..	6,668,811
1876	613,190	3,855,040	1,438,111	9,888	..	44,923	..	5,961,152
1877	471,448	3,283,612	1,317,265	..	..	23,239	..	5,050,614
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	(d)52,500	4,760,708
1880	444,252	3,316,484	944,869	..	..	201,297	(e)26,522	4,933,424
1881	573,582	3,333,512	957,570	880	..	216,901	111,945	5,194,390
1882	526,522	3,458,440	785,868	4,634	..	187,337	80,720	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	68,775	4,665,401
1888	317,241	2,500,104	1,690,477	34,205	13,273	147,154	34,602	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	2,354,210	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	109,193	5,878,005
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	2,330,232	33,479	787,099	217,024	109,621	7,502,038
1895	1,315,929	2,960,344	2,150,561	26,094	879,748	206,115	102,784	7,641,575
1896	1,073,360	3,220,348	2,132,979	14,360	1,068,808	237,574	81,200	7,828,629
1897	1,104,315	3,251,064	2,552,668	39,103	2,564,977	296,660	81,127	9,889,914
1898	1,201,743	3,349,028	2,750,348	10,721	3,990,698	291,496	84,744	11,678,778
1899	1,623,320	3,418,000	2,838,446	15,582	6,246,732	327,545	63,565	14,533,160
1900	1,070,920	3,229,628	2,871,578	14,554	6,007,611	316,220	67,923	13,578,434
1901	737,164	3,102,753	2,541,764	16,613	7,235,653	295,176	88,415	14,017,538
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	28,665	8,770,719	254,403	69,801	16,302,900
1904	1,146,109	3,252,045	2,714,934	76,025	8,424,226	280,015	42,054	15,935,408
1905	1,165,013	3,173,744	2,157,295	45,853	8,305,654	312,380	51,653	15,571,597
1906	1,078,866	3,280,478	2,313,464	27,000	7,622,749	254,963	49,117	14,626,637
1907	1,050,730	2,954,617	1,978,938	20,540	7,210,749	277,607	21,681	13,514,862
1908	954,854	2,849,838	1,975,554	12,300	6,999,882	242,482	24,191	13,059,101
1909	869,546	2,778,956	1,935,178	30,206	6,776,274	190,201	31,103	12,611,469
1910	802,211	2,422,745	1,874,955	28,000	6,246,818	157,370	25,521	11,557,650
1911	769,353	2,140,853	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	1,059,674	26,581	5,237,353	111,475	9,754	8,728,946
1915	562,819	1,397,793	1,060,703	25,830	5,140,228	78,784	(f)3,781	8,269,938
1916	459,370	1,090,194	913,951	33,000	4,508,532	67,072	(g)3,861	7,075,980
1917	349,038	857,500	761,639	30,334	4,121,645	61,577	(g)3,677	6,185,410
1918	369,743	674,655	567,371	26,252	3,723,183	44,724	(g)2,229	5,408,157
1919	336,240	691,632	618,101	16,465	3,748,882	39,252	(g)4,234	5,454,806
1920	275,109	859,461	648,168	9,546	3,475,392	35,134	(g)5,282	5,308,092
Total	62,979,870	300,877,399	83,945,619	1,594,555	144,835,788	8,793,515	2,272,875	605,299,621

(a) Mines Department estimate of gold production to 1871. (b) Including gold dust to the value of £3,920 exported in 1850. (c) Not available. (d) Estimate prior to 17th August, 1880. (e) 17th August to 31st December, 1880. (f) 1st January to 30th June. (g) Year ended 30th June.

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, 1856; 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 taken at £4 4s. 11¹/₂d., except in 1919, when it was taken as £5 2s. 1¹/₂d., and in 1920, at £5 12s. 6d. :—

QUANTITY OF GOLD PRODUCED IN THE COMMONWEALTH, 1911 TO 1920.

Year.	N.S.W.	Victoria.	Q'land.	S. Aust.	W. Aust.	Tasmania.	Nor. Ter.	C'wealth.
	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.
1911 ..	181,121	504,000	386,165	3,531	1,370,868	31,101	7,277	2,484,063
1912 ..	165,295	480,131	347,946	6,592	1,282,659	37,973	5,337	2,325,933
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	1,232,978	26,243	2,296	2,054,968
1915 ..	132,498	329,068	249,711	6,081	1,210,113	18,547	(a) 890	1,946,908
1916 ..	108,145	256,653	215,162	7,769	1,061,399	15,790	(b) 909	1,665,827
1917 ..	82,170	201,873	179,305	7,141	970,318	14,496	(b) 866	1,456,169
1918 ..	87,045	158,827	133,570	6,180	876,512	10,529	(b) 525	1,273,188
1919 ..	65,839	135,428	121,030	3,224	734,066	7,686	(b) 829	1,068,102
1920 ..	48,908	152,792	115,229	1,697	617,843	6,246	(b) 586	943,301

(a) 1st January to 30th June.

(b) Year ended 30th June.

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, and so far as recent years are concerned more than 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, 1911 TO 1920.

State.	Annual Average of Gold Production, 1911 to 1920.	Percentage on Commonwealth.	State.	Annual Average of Gold Production, 1911 to 1920.	Percentage on Commonwealth.
	Ozs.			Ozs.	
Commonwealth ..	1,742,589	100.0	New South Wales ..	114,519	6.6
Western Australia ..	1,067,080	61.2	Tasmania ..	20,201	1.2
Victoria ..	306,692	17.6	South Australia ..	5,502	0.3
Queensland ..	226,332	13.0	Northern Territory	2,263	0.1

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 practically all the auriferous rivers of New South Wales have been worked by dredges. 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 1,759 ozs. in 1920, the chief yields being—Sofala, 243 ozs.; Hill End, 178 ozs.; Trunkey, 160 ozs.; Tumut, 138 ozs.; Windeyer, 140 ozs.; and Wattle Flat, 125 ozs. The quantity obtained by dredging was 15,810 ozs.; the largest returns being obtained at Adelong, 6,949 ozs.; Gundagai, 5,033 ozs.; Araluen, 2,419 ozs.; Stuart Town, 750 ozs.; and Corowa, 518 ozs. During 1920 there were 14 bucket dredges and 1 pump dredge in operation. Their combined value was £63,056, and they gave employment to 126 men. The quantity of gold won from quartz amounted to 20,851 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 737 ozs. and 10,630 ozs. Next come the Adelong field with 6,998 ozs.; Hill End, 2,535 ozs.; Hillgrove, 1,808 ozs.; and Gundagai, 995 ozs.

The table below shews as far as can be ascertained the yield from alluvial and quartz mining in each of the principal districts during 1920. 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, 1920.

District.	Alluvial.		Quartz.	Total.
	Other than by Dredging.	By Dredging.		
	Ozs.	Ozs.	Ozs.	Ozs.
Albert	11	..	..	11
Bathurst	572	..	1,685	2,257
Clarence and Richmond	10	..	39	49
Cobar .. .. .	..	..	11,367	11,367
Hunter and Macleay .. .. .	..	..	209	209
Lachlan	35	5,033	1,911	6,979
Mudgee	199	..	590	789
New England	53	6	3	62
Peel and Uralla	90	..	1,869	1,959
Southern	107	2,504	593	3,204
Tambaroora and Turon	469	750	2,536	3,755
Tumut and Adelong	213	7,517	49	7,779
Total	1,759	15,810	20,851	38,420

(ii) *Victoria.* Lode mining predominates in Victoria, although gold is also obtained from alluvial workings, both surface and deep leads. The deepest mines in Australia are found in the Bendigo district, where there are two shafts 4,614 and 4,318 feet deep respectively. Altogether there were some few years ago no less than fifty-three shafts in this district which had reached a depth of over 2,000 feet. A considerable amount of attention is given to dredging and hydraulic sluicing, particularly in the Beechworth, Maryborough, Castlemaine, Ararat, Stawell, Gippsland, and Ballarat districts, the number of plants in operation at the end of 1920 being 43, of which 15

were bucket dredges, 4 pumps, 18 jet elevators, and 6 sluicing by gravitation. The total quantity of gold won by dredging and sluicing in 1920 was 19,855 ozs. About 80 tons of tin were also recovered. 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, 1920.

District.	Alluvial.	Quartz.	Total.
	Ozs.	Ozs.	Ozs.
Ararat and Stawell	5,619	4,231	9,850
Ballarat	2,622	2,728	5,350
Beechworth	14,670	25,753	40,423
Bendigo	587	87,274	87,861
Castlemaine	4,627	13,146	17,773
Gippsland	2,942	858	3,800
Maryborough	1,319	261	1,580
Total	32,386	134,251	166,637

The largest output from lode mines in 1920 was furnished by the Constellation (Bendigo) with 40,992 ozs. The Carlisle and Unity mines, in the same area, yielded respectively 9,993 and 6,323 ozs. It was hoped that the consolidation of the mines in the "Central area" at Bendigo would result in a more extended treatment of the low-grade ore. No great development, has, however, taken place in this direction, and the success of the Bendigo Amalgamated Goldfields Co. which controls and works nearly all the mines has been due to the high-grade quartz raised from the Constellation mine, where 19,038 tons gave a yield of 40,992 ozs. Amongst other important yields from lode mines were those from the A.1 Gold Mines at Gaffney's Creek in the Beechworth District, 8,470 ozs., and the Rose, Thistle and Shamrock in the same division, 4,577 ozs., while the Ajax North, Daylesford, produced 4,151 ozs. Of the deep alluvial mines the Chiltern Valley (Beechworth) produced 3,424 ozs. In dredging, Cock's Pioneer, at Beechworth, was the most successful, with 6,284 ozs. Tin ore to the value of upwards of £11,000 was also won by this company.

(iii) *Queensland.* Operations in Queensland are at present chiefly confined to reefing, and to the production of gold in connexion with the smelting of copper and other ores, the yield from alluvial in 1920 being only 588 ozs., while the quantity produced from stone treated was 18,372 ozs.; from copper and other ores 93,887 ozs.; and from old tailings 2,383 ozs.; making a total production of 115,230 ozs. The yields from the principal fields are given below :—

GOLD WON IN QUEENSLAND, ALLUVIAL AND QUARTZ, 1920.

District.	Alluvial.	From Stone Treated.	From Copper and other Ores and old Tailings.	Total.
	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.
Charters Towers	287	3,963	1,372	8,622
Gympie .. .. .	..	3,781	62	3,843
Mount Morgan	51	..	90,665	90,716
Ravenswood .. .. .	..	1,126	..	1,126
Etheridge, Oaks and Woolgar	94	2,337	270	2,701
Cloncurry	9	..	2,790	2,799
Clermont	1	1,483	660	2,144
Chillagoe .. .. .	..	2,070	..	2,070
Other districts	146	612	451	1,209
Total	588	18,372	96,270	115,230

As shewn in the table the Mount Morgan field easily takes first place amongst Queensland gold-producing areas. During 1920 this field also produced copper to the value of about £612,000.

(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 area. The battery and cyanide returns as published in the *Mining Review* shew that the chief producing centres in 1920 were Deloraine and Tarcoola.

(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 most of the ground has been worked by “dry-blowing.” The pug and clayey bedrock are usually treated in puddling machines. 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. 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 1920 was 626,660 ounces, of which only about 1 per cent. was alluvial. The yields in each district as reported to the Mines Department were as shewn below, the total differing somewhat from that given on a preceding page, which represents gold actually exported or minted :—

GOLD WON IN WESTERN AUSTRALIA, ALLUVIAL, QUARTZ, ETC., 1920.

Goldfields.	Alluvial.	Dollied and Specimens.	Crushed.	Total.
	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.
East Coolgardie	235	230	401,031	401,496
East Murchison	4	73	19,523	19,600
Mount Margaret	64	589	76,683	77,336
Murchison	64	2,927	43,613	46,604
North Coolgardie .. .. .	..	22	12,002	12,024
Coolgardie	81	99	5,806	5,986
Phillips River .. .. .	..	..	1,423	1,423
North-east Coolgardie	8	424	1,307	1,739
Yilgarn .. .. .	..	7	37,629	37,636
Broad Arrow .. .. .	..	282	7,163	7,445
Peak Hill	5	58	1,593	1,656
Pilbara	120	1	3,931	4,052
Dundas .. .. .	..	282	6,259	6,541
Yalgoo .. .. .	..	..	2,965	2,965
West Pilbara	44	..	90	134
Other goldfields .. .. .	..	8	15	23
Total	625	5,002	621,033	626,660

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 331, which represents mint and export returns.

(vi) *Tasmania*. The yield from Tasmania in gold mining is chiefly obtained from quartz reefing, and the returns from each district in 1920 are given below:—

GOLD WON IN TASMANIA, 1920.

District.	Total.	District.	Total.
	Ozs.		Ozs.
Beaconsfield	9	Lisle	105
Mathinna	562	Golconda	
Mt. Victoria	40	Mt. Claude	225
Warrentinna		North-West and West Coasts	5,318
Mt. Cameron	106		
Lefroy		Total	6,365

The total production was equal to 6,246 ozs. fine. During 1920 the blister copper produced by the Mt. Lyell Mining and Railway Co. Ltd. contained approximately 5,273 ozs. of gold.

(vii) *Northern Territory*. The production for 1920 amounted to 586 ozs.. It is stated that the potentialities of the older fields have by no means been exhausted, although a revival of the industry depends on the expenditure of large sums of money, either by the Government or by mining speculators, on developmental work.

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. (See Year Book No. 4, page 500.)

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 the 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 1911 to 1920. 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, 1911 TO 1920.

Year.	World's Production of Gold.	Gold Produced in Commonwealth.	Percentage of Commonwealth on Total.
	£	£	%
1911	94,977,167	10,551,624	11.11
1912	96,518,440	9,879,928	10.24
1913	93,018,747	9,376,573	10.08
1914	90,358,762	8,728,946	9.66
1915	95,704,643	8,269,938	8.64
1916	93,042,223	7,075,980	7.61
1917	87,721,190	6,185,410	7.05
1918	77,301,571	5,408,157	7.00
1919	89,646,033	5,454,806	6.08
1920	90,248,708	5,308,092	5.88

While the production of gold in the Commonwealth shews a considerable decrease during the twenty-three years from 1897 to 1920, the world's total production increased by over 87 per cent. 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 :—

GOLD YIELD, VARIOUS COUNTRIES, 1897 TO 1920.

Country.	1897.	1900.	1918.	1919.	1920.
	£	£	£	£	£
United States ..	11,787,000	16,269,000	13,841,000	14,695,000	13,581,000
Canada ..	1,240,000	5,742,000	2,972,000	3,916,000	4,303,000
Mexico ..	2,045,000	1,884,000	3,457,000	3,873,000	4,154,000
Brazil ..	247,000	476,000	544,000	664,000	710,000
Colombia ..	458,000	246,000	959,000	1,482,000	1,578,000
Transvaal ..	11,654,000	1,481,000	35,759,000	42,548,000	45,890,000
Rhodesia ..	1,000	308,000	2,682,000	3,030,000	3,108,000
Gold Coast ..	85,000	38,000	1,338,000	1,508,000	1,167,000
India ..	1,571,000	1,893,000	2,060,000	2,304,000	2,609,000
Corea ..	208,000	371,000	604,000	463,000	510,000
Japan ..	142,000	290,000	1,159,000	1,247,000	1,337,000
Netherlands East Indies	24,000	112,000	431,000	472,000	500,000

The largest increase amongst the more important producing countries was recorded in the Transvaal, where the production was nearly four times as great in 1920 as in 1897. During the last three years, however, as the table shews, there has been a general increase except in the case of Gold Coast and the United States.

The next table shews the average yearly value in order of importance of the yield in the chief gold producing countries for the decennium 1911-20 :—

AVERAGE ANNUAL VALUE, GOLD YIELD, CHIEF PRODUCING COUNTRIES, 1911 TO 1920.

Country.	Value.	Country.	Value.
	£		£
Transvaal ..	38,738,000	Canada ..	3,349,000
United States ..	17,453,000	India ..	2,301,000
Australasia ..	8,826,000	Gold Coast ..	1,488,000
Commonwealth ..	7,623,000	Colombia ..	1,122,000
Russia ..	4,366,000	New Zealand ..	1,157,000
Mexico ..	3,160,000	Japan ..	1,137,000
Rhodesia ..	3,216,000		

The comparison has been restricted to countries where the average for the period is in excess of a million sterling.

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 1916 TO 1920.

Year.	N.S.W.	Victoria.	Q'land.	S. Aust.	W. Aust.	Tas.	Nor. Ter.	C'wealth.
	No.	No.	No.	No.	No.	No.	No.	No.
1901 ..	12,064	27,387	9,438	1,000	19,771	1,112	200	70,972
1916 ..	2,317	6,402	1,900	150	9,824	176	99	20,868
1917 ..	1,823	6,069	1,375	150	8,752	155	92	18,416
1918 ..	2,540	3,547	929	100	7,790	125	84	15,115
1919 ..	1,656	3,065	792	100	7,242	73	60	12,988
1920 ..	1,712	3,742	611	100	7,087	48	20	13,320

§ 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 principal deposits at present worked in the State are situated at Platina in the Fifield division, near Parkes, and the production in 1920 amounted to 796 ozs., valued at £16,672, while the total production recorded for the period 1894 to 1920 amounted to 15,689 ozs., valued at £16,672. The production in 1920 was nearly four times larger than that in the preceding year, the increased activity being due to the high prices realised for the metal.

At Platina, gold is found in association with the platinum, and it is estimated that there are 200 acres of metalliferous country sufficiently rich to yield a satisfactory return, provided it were worked on a large scale with an abundant water supply. The metal is also found in the Goulburn division, and small quantities are obtained in beach mining in the Ballina Division.

(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 during recent years.

(iii) *Queensland.* Platinum associated with osmiridium has been found in the beach sands between Southport and Currumbin, in creeks on the Russell goldfield near Innisfail, and in alluvial deposits on the Gympie goldfield.

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 stated 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 reached £7 10s. per oz., and about 100 men were engaged in the search for it. The quantity produced amounted to 271 ozs., valued at £1,188. In 1912 the production was 779 ozs., valued at £5,742, or an average of £7 7s. 9d. per oz. The yield in 1918 amounted to 1,607 ozs., valued at £44,833, in 1919 to 1,670 ozs., valued at £39,614, and in 1920 to 2,009 ozs., valued at £77,114. 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. The declining production in 1915 and 1916 was due to difficulty in disposing of the metal. In 1917 the price increased from £11 to £18 10s. per oz., and for selected parcels £22 10s. per oz. was paid, while in 1918 the price of £37 5s. per oz. was reached. The average price in 1919 was £23 14s. 5d. per oz. In February, 1920, as much as £40 per oz. was realised, while in October the record price of £42 per oz. was obtained, but there was a fall in December to £35, and in some cases sellers accepted £30 per oz. Besides a steady and increasing use in the manufacture of fountain pens there is a demand for iridium and osmiridium for 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. 1 to 5, 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 1920 :—

PRODUCTION OF SILVER AND LEAD, AUSTRALIA, 1881 TO 1920.

Year.	N.S.W.	Victoria.	Q'land.	S. Aust.	W. Aust.	Tas.	Nor. Ter.	C'wealth.
	£	£	£	£	£	£	£	£
1881 ..	14,651	5,021	13,494	1,182	11,224	50	..	45,622
1891 ..	3,621,614	6,277	50,000	1,787	250	52,284	4,140	3,736,352
1901 ..	1,954,964	6,657	69,234	3,196	7,609	206,228	710	2,248,598
1916 ..	4,084,623	3,338	50,588	5,173	109,221	153,796	(a)1,068	4,407,807
1917 ..	5,110,096	1,406	55,181	12,351	178,872	152,122	(a)275	5,510,303
1918 ..	5,739,509	1,319	36,645	10,492	189,636	127,176	(a)200	6,104,977
1919 ..	1,647,878	1,607	28,511	180	107,508	189,967	(a)132	1,975,783
1920 ..	123,481	1,714	135,559	2,646	190,484	309,035	(a)299	763,218

(a) Year ended 30th June.

The heavy falling-off in the production for 1919 and 1920 as compared with previous years was due to the suspension of operations owing to industrial troubles at the principal mines on the Broken Hill field. In addition to causing a cessation of mining operations and treatment of tailings on the Broken Hill field, the trouble there resulted in the closing of the smelting works at Cockle Creek, upon which most of the silver-lead mines in other parts of the State depend for the sale of their ores.

It must be understood that the totals 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 may 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 of these metals locally produced, and the contents by average assay of concentrates exported during the last five years, will shew, as regards New South Wales, the estimated total production and the value accruing to the Commonwealth from the three metals :—

TOTAL PRODUCTION FROM SILVER-LEAD MINES OF NEW SOUTH WALES, 1916 TO 1920.

Year.	Metal Produced within Australia.				Contents of Concentrates exported.			
	Silver.	Lead.	Zinc.	Value.	Silver.	Lead.	Zinc.	Value.
	ozs. fine.	tons.	tons.	£	ozs. fine.	tons.	tons.	£
1916 ..	6,382,518	128,438	5,277	5,238,276	1,725,374	16,428	69,141	1,139,607
1917 ..	7,562,236	138,006	4,694	5,765,094	983,693	6,181	43,912	668,934
1918 ..	8,724,018	155,306	5,622	6,744,034	535,943	3,178	21,926	232,210
1919 ..	5,886,947	80,175	(a)7,119	4,109,466	417,871	2,425	18,146	253,751
1920 ..	196,111	1,749	(b)10,565	615,728	479,221	3,025	21,742	274,061

(a) Including 169 tons of Zinc Oxide valued at £3,112.

(b) Including 692 tons of Zinc Oxide and Zinc Lead Oxide, valued at £31,459.

The figures given above are quoted on the authority of the Mines Department of New South Wales, which in the year 1918 amended the totals for silver previously published for the years 1915–17, while in 1919 considerable modifications were made in the figures relating to quantity and value of concentrates exported.

3. **Chief Centres of Silver Production.**—Broken Hill, in New South Wales, is the great centre of silver production in Australia.

(i) *New South Wales.* (a) *Broken Hill.* A description of the silver-bearing area in this district is given in earlier 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. For the four years 1915 to 1918 the ore raised averaged over 1,200,000 tons, but, owing to the cessation of operations through industrial troubles and the fall in the price of metals the production in 1919 dwindled to 415,400 tons, and in 1920, when operations were only carried on for a few weeks, to 38,661 tons.

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 1920.

Mine.	Authorised Capital.	Value of Output to end of 1920.	Dividends and Bonuses Paid to end of 1920.
	£	£	£
Broken Hill Proprietary Co. Ltd. ..	3,000,000	(a)48,277,455	12,185,154
Broken Hill Proprietary Block 14 Co. Ltd. ..	155,000	3,905,668	630,660
British Broken Hill Proprietary Co. Ltd. ..	339,000	4,843,822	821,280
Broken Hill Proprietary Block 10 Co. Ltd. ..	1,000,000	4,916,484	1,425,000
Sulphide Corporation Ltd. (Central Mine) ..	1,050,000	(b)20,646,054	2,709,375
Broken Hill South Ltd. ..	800,000	10,069,981	2,535,000
North Broken Hill Mining Co. Ltd. ..	600,000	6,495,775	1,978,940
Broken Hill Junction Lead Mining Co. ..	150,000	1,148,700	87,500
Junction North Broken Hill Mine ..	375,000	2,631,520	160,814
The Zinc Corporation Ltd. ..	(c)	2,987,089	10,000
Barrier South Ltd. ..	168,000	151,517	50,000
Totals ..	7,637,000	106,074,065	22,593,723

(a) The value of the ores purchased during the years 1908 to 1914 is not included. understated owing to incomplete returns.

(b) Output

(c) Not available.

The returns relating to dividends and bonuses paid are exclusive of £1,744,000, representing the nominal value of shares in Block 14, British, and Block 10 companies, allotted to shareholders of Broken Hill Proprietary Company.

If the output of the companies engaged in treating the tailings, etc., be taken into consideration the totals for output and dividends shewn in the table would be increased to about 111½ millions and 26½ millions respectively.

(b) *Yerranderie.* The mines in the Yerranderie division in the Southern Mining District produced 299,123 ozs. of silver in 1920, besides 439 ozs. of gold and 740 tons of lead, the total production being valued at £88,869.

(c) *Cobar.* A considerable quantity of silver is obtained from the Great Cobar 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 yield in 1915 fell to 1,838 ozs. but it rose again in 1916 to nearly 48,000 ozs., and in 1918 to 98,000 ozs. In 1919, however, the return fell to 18,000 ozs., but rose again in 1920 to 51,000 ozs.

(d) *Sunny Corner.* In this division of the Bathurst Mining District 30,000 ozs. of silver and 155 ozs. of gold were produced in 1920.

(e) *Other Areas.* Small quantities were produced during the year in the Condobolin division of the Lachlan District, in the Hillgrove and Tingha divisions of the Peel and Uralla Mining District, from Leadville in the Mudgee division, from the Tumbarumba area in the Tumut and Adelong District, and in the New England Mining District.

(ii) *Tasmania.* The silver produced in 1920 amounted to 623,359 ozs., valued at £166,767, and the lead to 3,856 tons, valued at £142,268. The principal producers of

silver were Mt. Lyell, 169,949 ozs. (contained in blister copper); the Zeehan Mines, 159,810 ozs.; North Mt. Farrell, 140,582 ozs.; Magnet Mines, 99,358 ozs.; and Round Hill, 53,661 ozs. Lead to the amount of 1,241 tons was produced by the Zeehan Mines; 600 tons by the Magnet Mines; 1,349 tons by the North Mt. Farrell, and 665 tons by the Round Hill Mines.

(iii) *Queensland*. The yield for the chief silver-producing centres in 1920 was as follows:—Chillagoe, silver £18,854, lead £40,795; Cloncurry, silver £7,321; Etheridge, silver £8,659, lead £5,297; Mt. Morgan, silver £6,283; Herberton, silver £18,138, lead £11,929; Stanthorpe, silver £5,294. Towards the end of the year 1918 a discovery of argentiferous lead ore was made at Indooroopilly, one of the suburbs of Brisbane. This deposit yielded in 1920, 90 tons of lead, valued at £3,449, and 14,410 ozs. of silver, valued at £3,708.

(iv) *South Australia*. Rich specimens of silver ore have been discovered at Miltalie and Poonana, in the Franklin Harbour district, also at Mount Malvern and Olivaster, near Rapid Bay, and in the vicinity of Blinman and Farina. The surrounding district is highly mineralized, but, so far, has not been thoroughly prospected. Attention has recently been devoted to the silver-lead ores at Eukaby, near Baratta. The production of silver and silver-lead ore in 1920 was valued at £2,646.

(v) *Western Australia*. The quantity of silver obtained as a by-product and exported in 1920 was 130,692 ozs., valued at £36,605. In addition, lead and silver-lead to the value of £84,743, and 1,930 tons of pig lead, valued at £69,136, were exported.

(vi) *Northern Territory*. Silver-lead ores are found near Pine Creek, and at Mount Shoebridge near Brock's Creek railway station. Production in 1920 was small, amounting to a little over 17 tons, valued at £299. There are a number of fair-sized galena lodes in the Pine Creek and McArthur River districts but owing to costs of transport and realisation little attention is devoted to them.

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, 1911 TO 1920.

.. ..	1911.	1912.	1913.	1914.	1915.	1916.	1917.	1918.	1919.	1920.
World's production in 1,000 fine ozs.(a)	254,214	250,979	214,391	171,429	185,443	168,693	174,188	197,394	174,517	171,200

(a) Add 000 to figures for fine ounces.

The Commonwealth's share in the world's silver production in 1919 was estimated at 7,000,000 ozs., or about 4 per cent. on the total production, but in 1920, owing to the cessation of operations at the Broken Hill field, the total local extraction fell to 681,000 ozs., and the estimated silver contents of the ores, bullion, and concentrates exported to 1,122,000 ozs. The figures for the world's production of silver are given on the authority of *The Mineral Industry*.

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 decennial intervals from 1881 to 1911, and during the last six years is given below:—

PRICE OF SILVER, 1881 TO 1920.

Year	1881.	1891.	1901.	1911.	1915.	1916.	1917.	1918.	1919.	1920.
Pence per standard oz. ..	51 $\frac{1}{2}$	45 $\frac{1}{8}$	27 $\frac{1}{8}$	24 $\frac{1}{8}$	23 $\frac{1}{2}$	31 $\frac{1}{8}$	40 $\frac{1}{2}$	47 $\frac{1}{2}$	57 $\frac{1}{8}$	61 $\frac{1}{8}$

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 $\frac{1}{2}$ d., the highest realised since 1893, when the average stood at 36 $\frac{1}{2}$ d. The high average in 1917 was succeeded by a further rise to 47 $\frac{1}{2}$ d. in 1918, the monthly averages ranging from 43.2d. in March to 49 $\frac{1}{2}$ d. in September and October. Prices in 1919 shewed a sensational rise. Beginning with an average of about 48d. per ounce during each of the first four months of the year, prices rose rapidly until in September the high average of 61.7d. was reached, followed by 64d. in October, 70d. in November,

and 76.4d. in December. In January, 1920, the price rose to 79.8d., and in February the record figure of 85d. per oz. was reached. Next month, however, there was a drop to a little over 74d., and from August, when the price was 59.87d., the quotations fell rapidly, the figure in December being 41.85d.

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 1916 TO 1920.

Year.	N.S.W.	(e) Victoria.	Q'land.	S. Aust.	W. Aust.	Tasmania.	Nor. Terr.	C'wealth.
	No.	No.	No.	No.	No.	No.	No.	No.
1901 ..	6,298	..	40	150	..	2,414(a)	(b)	8,902(c)
1916 ..	6,461	..	62	25	(d)244	555	86	7,433
1917 ..	7,619	..	71	..	(d)328	646	33	8,697
1918 ..	7,585	..	98	..	(d)382	631	10	8,706
1919 ..	6,556	..	145	..	(d) 74	798	3	7,576
1920 ..	1,931	..	143	..	(d)238	517	2	2,831

(a) Including copper miners. (b) Included in South Australia. (c) Including copper miners in Tasmania.

(d) Lead ore. (e) The silver produced in Victoria is obtained in gold refining at the Mint.

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. The closing of the mines on the Broken Hill field during the greater part of the year was responsible for the falling-off in the total for 1920.

§ 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 local production as reported and credited to the mineral industry in earlier years and for 1916 to 1920 are shewn in the following tables :—

PRODUCTION OF COPPER, AUSTRALIA, 1881 TO 1920.

State.	1881.	1891.	1901.	1908.	1916.	1917.	1918.	1919.	1920.
QUANTITY.									
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
N.S.W. { Ingot & Matte	4,124	2,363	6,087	8,679	5,617	6,576	6,510	1,460	1,290
Ore ..	1	347	645	392	554	..	..	..	..
Victoria { Ingot & Matte	583	60	983	14,698	19,520	19,062	18,980	9,997	15,897
Ore ..	331	85	3,087	9,741	5,628	7,279	7,213	7,169	2,517
Q'land { Ingot & Matte	3,824	3,592	9,741	5,628	7,279	7,213	7,169	2,517	4,339
Ore ..	21,638	13,035	1,869	..	..	..	..	..	..
S. Aust. { Ingot & Matte	..	..	880	479	457	535	478	4	137
Ore ..	..	263	2,661	2,503	650	966	1,643	455	1,511
W. Aust. { Ingot & Matte	..	..	9,981	8,833	6,305	5,845	5,559	5,071	4,792
Ore ..	..	..	10,029	1,185	97	771	444	..	..
Tasmania { Ingot & Matte	..	..	..	100	..	..	..	..	..
Ore ..	..	257	483	424	(a)950	(a)48	(a)619	(a)159	(a) 67
Northern Territory { Ingot & Matte	..	..	..	..	..	..	..	..	..
Ore ..	..	..	..	..	..	..	..	..	..

VALUE.

	£	£	£	£	£	£	£	£	£
N.S.W...	267,884	119,195	412,292	502,812	598,733	814,154	696,580	139,296	127,978
Victoria	8,186	216	1,994	1,994	2,829	..	..	..	..
Q'land ..	19,637	4,064	182,256	882,901	1,060,178	2,208,232	2,087,751	952,501	1,551,995
S. Aust.	418,296	235,817	491,617	338,000	488,986	902,493	828,556	228,930	423,601
W. Aust.	..	4,402	110,769	57,091	142,363	85,738	66,148	10,105	25,165
Tasmania	..	..	1,010,037	609,651	375,664	847,754	776,108	558,694	528,237
Nor. Terr.	..	3,619	8,460	7,968	482	(a)5,517	(a)9,648	(a)2,349	(a) 780
C'wealth	714,003	367,373	2,215,431	2,400,417	3,269,235	4,863,890	4,464,787	1,891,875	2,657,756

(a) Year ended 30th June.

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

2. *Sources of Production.*—(i) *New South Wales.* During the greater portion of the year 1920, the mines on the Cobar field, the largest producers of copper in past years, were non-productive. The plant at the Great Cobar was dismantled, and it is stated that a renewal of operations depends on improved methods of treatment. Owing to an outbreak of fire in the workings, the C.S.A. mine was sealed down for the greater part of the year, and the cessation of operations brought about the closing of other mines dependent on it for the purchase and treatment of their ores. The total yield of copper from the Cobar field in 1920 was 821 tons, as compared with 1,319 tons in 1919, and 5,237 tons in 1918. Values of the more important yields furnished during 1920 were as follows:—C.S.A., £23,260; Cobar Gladstone, £12,700; Mount Royal Mines, Tottenham, £12,339.

(ii) *Queensland.* The yield in this State amounted in 1920 to 15,897 tons valued at £1,551,995, to which the Cloncurry field contributed 7,672 tons, valued at £749,041. Next in order were Mount Morgan with 6,263 tons, valued at £611,527; Etheridge, 1,139 tons, valued at £111,204; Herberton, 409 tons, £39,889; Chillagoe, 218 tons, £21,283; and Gladstone, 147 tons, £14,341.

The Cloncurry district—reckoned the richest and most extensive cupriferous area in Australia—under normal circumstances produces more than half the copper output of the State, and its yield far exceeds in value the total gold output. The increase in production recorded in the Herberton, Chillagoe, and Etheridge fields was due to the re-opening of the Chillagoe smelters as a State enterprise.

(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 shews. Deposits of copper ore are found over a large portion of South Australia. A short account of the discovery, etc., of some of the principal mining areas, such as Kapunda, Burra Burra, Wallaroo, and Moonta, is given in preceding issues of the Official Year Book. During 1920 the output amounted to 4,339 tons, valued at £423,601, the bulk of the production being from the Wallaroo and Moonta Company which in normal times employs about 1,500 hands. About 170 tons of high grade copper ore were sold in 1920 by the Dome Rock Copper Mine near Boolcoomatta.

(iv) *Western Australia.* The value of copper and ore exported from this State in 1920 was £25,165. According to the returns, the production in the West Pilbara field was 1,700 tons, valued at £32,059, while the Phillips River field shewed a production of 217 tons, valued at £4,125. The Peak Hill field produced 35 tons, valued at £1,401, and Pilbara 9 tons, valued at £360.

(v) *Tasmania.* The quantity of copper produced in Tasmania during 1920 was 4,792 tons, valued at £528,237, the bulk of the production being due to the Mount Lyell Mining and Railway Co. Ltd. This Company treated 175,033 tons of ore in 1920, of which 63 tons were purchased from other mines, and produced 4,836 tons of blister copper, containing copper, 4,791 tons; silver, 169,949 ozs.; and gold 5,273 ozs., the whole being valued at £598,148. The employees in 1920 numbered 1,577, of whom 781 were miners, 655 were engaged in the reduction works, and 141 in the railway department.

(vi) *Northern Territory.* Copper has been found at various places, including Copperfield, 5 miles south-east of Pine Creek, Mount Diamond and Burns Wolfram, 45 miles east of Pine Creek, at Coronet Hill, Daly River, Maude Creek, Kilgour Creek, Woolagorang, and Borroloola. The total production in 1920 was 67 tons of ore, valued at £780, raised chiefly at Mt. Diamond. Although there are many promising copper propositions in the Territory, lack of capital prevents their development.

3. Prices 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 seven years. The figures are given on the authority of *The Mineral Industry*.

FLUCTUATION IN VALUE OF COPPER, 1901 AND 1914 TO 1920.

Year.				London Price per Ton Standard Copper.	New York Price in Cents per lb. Electrolytic Copper.
				£	Cents.
1901	..	..	..	66.79	16.11
1914	..	..	..	61.52	13.60
1915	..	..	..	72.53	17.28
1916	..	..	..	116.03	27.20
1917	..	..	..	124.89	27.18
1918	..	..	..	115.53	24.63
1919	..	..	..	90.80	18.69
1920	..	..	..	97.48	17.46

4. World's Production of Copper.—The world's production of copper in 1901, and during the five years 1916 to 1920, is estimated to have been as follows :—

WORLD'S PRODUCTION OF COPPER, 1901 AND 1916 TO 1920.

Year	..	..	..	1901.	1916.	1917.	1918.	1919.	1920.
World's production— (short tons)	..	..	..	583,517	1,552,347	1,582,595	1,537,884	1,085,000	1 044,000

The Commonwealth production is estimated at about 2.8 per cent. of the total.

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 1916 TO 1920.

Year.	N.S.W.	Victoria.	Q'land.	S. Aust.	W. Aust.	Tas.	Nor. Ter.	C'wealth.
	No.	No.	No.	No.	No.	No.	No.	No.
1901	2,964	4	814	4,000	321	(a)	(b)	8,103(c)
1916	1,661	..	2,922	2,000	113	1,719	97	8,512
1917	2,074	..	3,154	2,000	154	1,671	92	9,145
1918	1,529	..	3,209	2,000	158	1,597	60	8,553
1919	1,148	..	2,521	400	72	1,571	12	5,724
1920	583	2	1,815	1,285	116	1,577	2	5,380

(a) Included with silver miners. (b) No returns. (c) Excluding Tasmania and Northern Territory.

§ 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 tables below shew the quantity and value of the production as reported to the Mines Departments in each of the Commonwealth States during the years 1881, 1891, 1901, 1916, 1917, 1918, 1919, and 1920 :—

TIN PRODUCED IN AUSTRALIA, 1881 TO 1920.

State.	1881.	1891.	1901.	1916.	1917.	1918.	1919.	1920.
QUANTITY.								
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
New South Wales { Ingots	5,824	1,454	649	909	1,109	1,182	1,146	..
{ Ore	609	203	11	1,220	963	738	1,546	2,486
Victoria .. { Ingots	70	..	..	..	..	..	..	..
{ Ore	20	1,678	77	122	139	135	113	84
Queensland { Ingots	479	193	477	(b)	(b)	(b)	(b)	(b)
{ Ore (a)	2,977	2,043	1,184	1,707	1,177	1,311	994	1,486
Western Australia { Ingots	..	..	97	..	..	..	..	..
{ Ore	..	204	507	463	383	415	318	243
Tasmania .. { Ingots	4,120	3,236	1,789	2,219	2,637	2,256	1,580	1,310
{ Ore	4	56	79	(c)	(c)	(c)	(e)	(c)
Northern Territory Ore	..	29	80	(d)147	(d)270	(d)246	(d)162	(d)180
VALUE.								
	£	£	£	£	£	£	£	£
New South Wales ..	568,795	133,963	76,544	306,497	373,696	548,876	416,623	413,794
Victoria ..	7,620	5,092	4,181	12,955	19,709	24,481	17,561	12,815
Queensland ..	193,699	116,387	93,723	181,401	160,600	251,755	143,167	252,054
Western Australia ..	..	10,200	52,102	49,101	45,288	76,952	47,269	49,449
Tasmania ..	375,775	292,990	216,186	350,852	427,917	488,798	395,794	369,362
Northern Territory ..	..	1,870	5,498	(d)14,700	(d)27,120	(d)41,432	(d)30,021	(d)27,610
Total ..	1,145,889	560,502	448,234	915,506	1,054,330	1,432,294	1,050,435	1,125,084

(a) Dressed tin ore, about 70 % tin.

(b) Included with ore.

(c) Included with ingots.

(d) Year ending 30th June.

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 1920 being valued at £176,834. In the Tingha division of the Peel and Uralla district the yield amounted to 687 tons, valued at £121,841. The Emmaville division in the new England district shewed a yield of 892 tons, valued at £150,110, the Vegetable Creek mine in this area being the chief producer of tin in the State with an output in 1920 of 248 tons, valued at £47,819. In the Wilson's Downfall division, 113 tons, valued at £20,498, were raised. The Glen Innes division, also in the New England district, returned a yield of 166 tons, valued at £30,856, and the Torrington division 117 tons, valued at £18,908. The Ardlethan field, in the Lachlan division, produced ore and concentrates to the value of £59,454.

(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 1920 was obtained by dredging and sluicing, the Cock's Pioneer Gold and Tin Co. in the Beechworth district contributing 75 tons, valued at £11,575.

(iii) *Queensland.* The chief producing districts in Queensland during 1920 were Herberton, 836 tons, valued at £142,166; Stanthorpe, 158 tons, £28,349; Cooktown, 125 tons, £22,633; Chillagoe, 95 tons, £15,837; and Kangaroo Hills, 260 tons, £40,843. The high prices realised for tin early in 1920 had a stimulating effect on the industry, the total production for the year being 1,486 tons, as compared with 994 in 1919.

(iv) *Western Australia.* The export of tin ore for the State during 1920 amounted to 243 tons, valued at £49,449. The production from the Greenbushes field amounted to 190 tons, valued at £31,249, and from the Pilbara field 41 tons, valued at £7,616. There was no production from the other fields in 1920.

(v) *Tasmania.* During 1920 the quantity of metallic tin won amounted to 1,310 tons, valued at £369,362. The bulk of the production for the year came from the North-Eastern Division with 604 tons, valued at £168,963. Of the total yield in this division, 306 tons were contributed by the Pioneer and Gladstone districts, 239 tons by the Ringarooma, Derby, and Branxholm districts, and small quantities from Moorina district and Straits Islands. The next highest output was returned from the North-Western division with 381 tons, to which the celebrated Mt. Bischoff contributed 296 tons, and the Mt. Bischoff Extended, 69 tons. In the Eastern division, the Avoca mines produced about 109 tons out of a total of 200 tons. The mines in the Western division produced 124 tons of metallic tin in 1920, the highest contributors being the Federal with 38 tons, Heemskirk 29 tons, and Dreadnought Boulder 21 tons.

(vi) *Northern Territory.* The yield of tin ore in 1920 amounted to 180 tons, valued at £27,610, of which the Marranboy field contributed 180 tons, valued at £9,151, and Mt. Wells about 33 tons, valued at £5,051. Small yields were returned also from Crest of Wave, Horseshoe Creek, Hayes Creek, Umbrawarra, and other districts. Two batteries for the treatment of tin ore have been erected by the Government, one at Marranboy, costing £20,163, and one at Hayes Creek, at an expense of £3,294.

3. World's Production of Tin.—According to *The Mineral Industry* the world's production of tin during each of the last five years was as follows. The figures have been slightly amended since last issue.

WORLD'S TIN PRODUCTION, 1916 TO 1920.

1916.	1917.	1918.	1919.	1920.
Tons. 115,306	Tons. 125,223	Tons. 122,513	Tons. 116,385	Tons. 119,211

The yields from the chief producing countries in each of the last three years were as follows:—

	1918.	1919.	1920.
Malaya ..	37,300 ..	36,900 ..	34,900
Bolivia ..	29,300 ..	28,900 ..	29,500
Banka ..	13,200 ..	12,000 ..	14,000
Siam ..	9,100 ..	8,800 ..	9,000 (a)
Cornwall ..	4,000 (a) ..	3,300 (a) ..	2,900
Billiton ..	7,500 (a) ..	7,400 (a) ..	7,500 (a)
Nigeria ..	6,000 (a) ..	5,000 (a) ..	5,200
China ..	8,700 (b) ..	8,300 (b) ..	8,000 (a)
Australia ..	4,700 (c) ..	4,300 (c) ..	4,200 (c)
South Africa ..	1,200 ..	1,000 ..	1,500
India ..	1,000 (a) ..	500 (a) ..	1,200 (a)

(a) Estimate. (b) Shipments to Europe and U.S.A. (c) According to returns furnished by the Australian Metal Exchange the figures for Australia for the three years were 4,600, 4,100, and 4,100 tons respectively.

Based on the results for the last three years, Australia's share of the world's tin production would appear to be about $3\frac{1}{2}$ per cent.

4. **Prices of Tin.**—The average price of the metal in the London market for the years 1897 and 1907 and from 1911 to 1920 was as follows:—

PRICE PER TON OF TIN, 1897 TO 1920.

Year.	Price per Ton.		Year.	Price per Ton.	
	£	s. d.		£	s. d.
1897	61	8 0	1915	164	4 0
1907	172	12 9	1916	182	3 5
1911	192	7 0	1917	237	13 1
1912	209	8 5	1918	329	11 2
1913	206	5 7	1919	257	9 8
1914	156	12 7(a)	1920	296	1 7

(a) Quotations incomplete.

According to *The Mineral Industry* the monthly average in December, 1917, reached £298 10s. 3d. per ton. Conditions in 1917 were, however, quite abnormal, and, instead of London prices ruling the market, each consuming country tended to fix its own rates, with the result that widely different quotations were recorded from London, New York, France, and Italy. Owing to various causes such as shortage of labour, plant, and supplies, increases in wages, difficulty of obtaining information as to the relative position in the producing centres, interference with the ordinary course of trade, etc., prices in 1918 mounted to phenomenal heights. Quotations in January averaged £293 6s. 1d. per ton and increased rapidly until May when the price reached £364 7s. 8d. A falling-off in the next two months was succeeded by a rise to the sensational figure of £380 16s. 8d. in August. Thenceforward a sharp decline was experienced, and for the closing month of the year the average was recorded as £267 14s. 3d. In January, 1919, the average price was given as £248 9s. 11d., but the market fell in the succeeding months until July, when there was a rise to £253 5s. 1d. An upward tendency was manifested in the latter months of the year, the average for December being £314 5s. 1d. The year 1920 opened with an average in January of £376 12s. 9d., but in February the price reached the tremendous figure of £395 16s. 6d. Thereafter prices fell considerably until June, when £250 18s. 6d. was realised. An upward tendency was manifested until August, when the average stood at £274 5s. 10d., but the closing months of the year were characterized by a heavy fall, the December price, £212 11s. 8d., being much lower than in any preceding month during the last three years.

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 1916 TO 1920.

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
1916	1,938	135	1,093	235	1,217	154	4,772
1917	1,779	42	878	211	1,311	151	4,372
1918	2,352	52	1,110	292	1,260	190	5,256
1919	2,171	38	1,114	209	1,303	190	5,025
1920	1,822	48	920	187	1,318	120	4,415

§ 7. Zinc.

1. **Production of Zinc.**—The production of zinciferous concentrates 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. During the earlier years of mining activity on this field a considerable amount of zinc was left unrecovered in tailings, but from 1909 onwards improved methods of treatment resulted in the profitable extraction of the zinc contents of the accumulations at the various mines.

As the metallic contents of the bulk of the concentrates, etc., raised in the Broken Hill District are extracted outside New South Wales, the mineral industry of that State cannot be credited with the value of the finished product. The figures given hereunder, therefore, refer to the quantity and value of the zinc concentrates actually exported during the years specified.

NEW SOUTH WALES.—EXPORTS OF ZINC CONCENTRATES, ETC., 1889 TO 1920.

Year.	Quantity of Zinc Concentrates, etc., Exported.	Value.	Year.	Quantity of Zinc Concentrates, etc., Exported.	Value.
	Tons.	£		Tons.	£
1889	97	988	1917	113,531	441,486
1891	219	2,622	1918	87,019	295,413
1899	49,879	49,207	1919	72,294	247,395
1916	209,741	961,849	1920	71,043	249,456

A statement of the quantity of zinc locally extracted, and the estimated zinc contents of concentrates exported during the five years 1917 to 1921, will be found in § 18 hereinafter.

At the Silver Spur mine at Texas, in the Stanthorpe division of 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 connexion with the mine. Zinc sulphide is produced by the Mount Garnet Mine in the Herberton district, and during 1916 several hundred tons of good quality ore were raised, but until a suitable treatment plant has been erected, it is stated that production cannot be economically undertaken.

During the year 1916, a small quantity of zinc, valued at £630, was produced in Western Australia, but there was no production recorded for subsequent years.

The Tasmanian mineral returns for 1920 included an item of 9 tons of zinc ore, valued at £334, raised at the Swansea Mine, near Zeehan.

Investigations in regard to the Read-Roseberry zinc-lead deposits in Tasmania have proved the existence of 1,680,000 tons of ore, which, added to an estimated quantity of 915,000 tons of "probable" ore, make a total supply of 2,595,000 tons. It is stated that the metallurgical treatment of the ore can be successfully carried out, and that the deposits are amongst the richest and most important in the world.

2. **Prices of Zinc.**—During the four years 1911 to 1914, the price of zinc averaged £23 15s. per ton, ranging from £21 in 1914 to £26 3s. 4d. in 1912. Owing to the heavy demand and other circumstances arising out of the war, the prices in 1915 and 1916 reached the very high average of £67 11s. 1d. and £72 1s. 5d. per ton respectively. For 1917 the average recorded was £52 8s. 3d., for 1918, £54 3s. 7d., for 1919, £42 17s. 7d., and for 1920, £44 7s. 5d. per ton.

§ 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 1908-14.* 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 up to June, 1914, of bounties of 12s. per ton on Australian pig iron, puddled bar iron, and steel, and of 10 per cent. on the value of galvanized sheet or plate, wire netting, wire, and iron or steel pipes and tubes. During the period from 30th June, 1909, to 30th June, 1915, a sum of £173,671 was paid in connexion with these bounties. (For details see Official Year Book No. 11, p. 452.)

(ii) *The Iron Bounty Act 1914-15.* This Act repealed the *Manufactures Encouragement Act 1908-14*, and provided for a bounty on Australian pig iron up to the end of 1916. The rate of bounty was 8s. per ton, and the total amount authorized £60,000. Provision was made for transfer, if required, to the State, of lands, buildings, etc., used in the manufacture of pig iron. During the three years 1915 to 1917 the respective bounties amounted to £19,808, £24,465, and £11,454, and the corresponding tonnages of pig iron to 49,520, 61,162, and 28,635 tons. New South Wales is the only State where bounty has been claimed.

(iii) *The Iron and Steel Bounty Act 1918.* This Act provides a total sum of £200,000 payable up to the 30th September, 1923, by way of bounty on black steel sheets and galvanized sheets. When the rate of freight from the United Kingdom to Australia is £2 10s. per ton or under, the bounty on black steel sheets is £1 10s. per ton, and on galvanized sheets £2 per ton, including the bounty (if any) paid on the black steel sheets from which the galvanized sheets are made. These bounties are decreased accordingly when the freight rises above £2 10s. per ton. At the end of 1921 bounty to the amount of £5,150 was paid on 4,898 tons of galvanized sheets.

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 iron-works at Lithgow, will be found in earlier issues of the Year Book (see No. 3, p. 508). During 1920 the following materials were received at the blast furnace at the Eskbank Iron Works, Lithgow:—Iron ore, 158,746 tons; limestone, 63,562 tons; and coke, 126,516 tons. The iron ore was raised from quarries at Tallawang, Cadia, and Carcoar, and the output was 86,096 tons of pig iron.

The following table shews the quantity and value of pig iron, produced in New South Wales, during the last seven years from locally-raised ores only:—

NEW SOUTH WALES.—PRODUCTION OF IRON (LOCAL ORE), 1914 TO 1920.

Particulars.	1914.	1915.	1916.	1917.	1918.	1919.	1920.
Quantity .. Tons	75,150	76,318	52,556	45,025	68,072	80,941	86,096
Value .. £	254,257	267,000	197,085	247,637	350,000	445,175	645,720

The figures quoted above refer to production from *local* ores only, and as such credited to the New South Wales mineral industry. They do not, of course, represent the total production of pig iron in New South Wales, since, as shewn in the succeeding paragraph, a considerable quantity of ore raised in South Australia and credited therefore to the mineral returns of that State is treated in New South Wales.

The Broken Hill Proprietary Company 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, which are connected with the seaboard at Whyalla, a distance of about 36 miles, by the Company's tramway. The ore quarried for the year ending December, 1921, amounted to 463,578 tons. Extensive limestone works and loading bin at Devonport, Tasmania, as well as quarries in New South Wales for dolomite, magnesite, etc., are also owned by the Company. The limestone quarried in 1921 amounted to 95,268

tons. The steel works consist of three blast furnaces of a nominal daily producing capacity of 1,200 tons, and a fourth furnace of 100 tons for the production of foundry iron. The output of pig iron for the year amounted to 262,312 tons. With seven 65-ton open hearth steel furnaces, the present output is over 3,400 tons weekly. The actual output of steel ingots during 1921 was 255,437 tons. The works are supplied with a 28-in. bloom and rail-rolling mill, able to deal with 500 tons of finished rails daily. There are also in operation an 18-in., 12-in., and 8-in. mill for merchant steel, as well as a rod mill for production of rods for wire drawing capable of an output of 350 to 400 tons of rods per week down to size No. 5 (.212 of an inch). The output from the mills during the twelve months ending 1921 was as follows :—

Rails	79,525 tons
Billets and Blooms	9,286 „
Fishplates	2,475 „
Structural Steel	20,162 „
Round and Octagon Steel	19,865 „
Flat Steel	24,608 „
Plates	950 „
Square Steel	1,591 „
Rods	31,117 „
Rabble Bars	996 „
Locking Bars	993 „
Miscellaneous	1,188 „
Total	192,756 tons

The Company is producing its own coke for the furnaces, having already 214 by-products ovens in operation. Coke produced for the year amounted to 256,899 tons. The tar and sulphate of ammonia produced during 1921 amounted to 2,561,718 gallons and 4,081 tons respectively.

A quantity of iron oxide is purchased by the various gasworks for use in purifying gas, and it is also to some extent employed as a pigment, the output in New South Wales being drawn chiefly from the deposits in the Port Macquarie, Moss Vale and Yass Divisions. During 1920 the iron oxide raised amounted to 1,574 tons, valued at £1,247. The smelting companies utilise a certain amount of ironstone for fluxing purposes, the quantity so used in 1920 amounting to 2,881 tons, valued at £3,726.

(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 at 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 are mined chiefly for fluxing purposes in connexion with the reduction of gold and copper ores. During the year 1920, 19,709 tons of ironstone flux, valued at £24,852, were raised, the bulk of which came from Iron Island in the Rockhampton district. It is stated that Queensland possesses within its own borders an abundance of the ore, fuel, and fluxes required for the carrying on of a large ironworks.

(iv) *South Australia.* South Australia possesses some rich deposits of iron ore capable of being mined for an indefinite period. The best known deposit is the Iron Knob, a veritable hill of iron ore of high percentage, situated about 40 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, and the amount raised for the year 1920 was 413,038 tons, valued at £478,436.

(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 and Cockatoo Island at Yampi Sound, and leases on the latter island have been purchased by the Queensland Government. The production of pyritic ore reported in 1920 amounted to 6,020 tons, valued at £7,276.

(vi) *Tasmania.* The amount of ore available in the principal iron-ore deposits in Tasmania has been estimated as follows:—

	Tons.
Blythe River Lode	17,000,000
Dial Range and Penguin	700,000
Beaconsfield and Anderson's Creek	1,300,000
Long Plain	20,000,000
Zeehan District	2,900,000
Nelson River	Unknown
Total	41,900,000

The total production of iron ore in 1908 was 3,600 tons, valued at £1,600, 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, the quantity raised in 1920 being 4,440 tons, valued at £7,346. High grade paints are manufactured from oxides obtained in the Beaconsfield district.

(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 local coal, however, the deposits possess no immediate value.

(viii) *World's Production of Iron and Steel.* The Australian production of iron and steel at present forms a very small proportion of the world output. According to *The Iron Trade Review* the world's production of pig iron in the year 1913 was estimated at roughly 77 million tons; in 1920 at 61 million, and in 1921 at 36 million tons. During each of the three years specified the respective shares of the principal producing countries were as follows:—United States, 31, 36, and 17 millions; Germany, 19, 6½, and 7½ millions; and Great Britain, 10, 8, and 3 millions. The world's steel production for the same three years was estimated at 75, 68, and 41 million tons. To these totals the United States contributed 31, 42, and 20 millions; Germany, 19, 8, and 9 millions; and Great Britain, 8, 9, and 4 million tons.

§ 9. Other Metallic Minerals.

1. *Antimony.*—This metal is widely distributed in the north-eastern portion of New South Wales, between the 148th 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. The production of antimony (metal and ore) in 1920 amounted to 200 tons, valued at £2,505. The ore is raised mainly in the Hillgrove division, where it is found in association with scheelite and gold. During the year prospecting was carried on in the Copmanhurst, Drake, and Kempsey divisions. The total quantity of antimony (metal and ore) raised in New South Wales up to the end of 1920 was 18,907 tons, valued at £343,888. The production of antimony concentrates in Victoria during 1920 amounted to 961 tons, valued at £14,238. The whole of the production came from ore raised by a company operating at Costerfield. In Queensland extensive deposits are found at Neerdie, in the Wide Bay district, at Wolfram Camp, on the Hodgkinson field, on the Palmer River in the Ravenswood district, and at various places in the Herberton district. Ore has also been obtained in the Dividing Range near Herberton, and adjacent to some of the central tributaries of Emu Creek. Owing

to the low price of the metal in 1919 production was practically negligible; while none was recorded in 1920. In Western Australia lodes of stibnite carrying gold have been found in the Roeburne district. During 1917, 12 tons of antimony, valued at £258, were exported, but there was no subsequent production until 1920, when 2 tons, valued at £45, were exported.

2. Arsenic.—In New South Wales, deposits of arsenical ore have been located at various places, but production in 1920 was small, amounting to 70 tons, valued at £2,840. The bulk of this was raised at the Ottery mine, in the Emmaville division, and small quantities were won in the Tumut and Young divisions. During 1917 the high price ruling for arsenic, and the urgency of the need for supplies in connection with the destruction of prickly pear, led to the reservation by the Queensland Mines Department of an extensive area of arsenic-bearing deposits at Jibbinbar, in the Stanthorpe district. During 1920, 285 tons were produced at the State mine; while the Sundown mine in the same district returned an output of 20 tons. There has been a strong demand for the product not only for the destruction of prickly pear but for the manufacture of arsenical dip solutions and other purposes. In South Australia attention is being devoted to arsenic-bearing minerals at Woodside, at Westward Ho, near Mannahill, and on Kangaroo Island. During 1920 Western Australia exported 1,765 tons of arsenical ore, valued at £4,260. 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. Bismuth.—Ores of this metal have been found in New South Wales, near Glen Innes, in the Deepwater division, and at Whipstick, in the Pambula division, its discovery dating from 1877. Deposits are also found in the Oberon, Tenterfield, Young, Gundaroo, Emmaville, and Torrington divisions. About 76 tons of metal and ore, valued at £33,886, were exported from New South Wales during 1920; the total quantity exported to the end of that year was 760 tons, valued at £222,928. In Queensland wolfram and bismuth have been found in various districts, but the chief centres of production in 1920 were the Herberton and Chillagoe fields. The total production for the year was valued at £19,313, of which 81 tons, valued at £14,027, was returned as wolfram, 21 tons, valued at £530, as bismuth, and 49 tons, valued at £4,756, as bismuth and wolfram. In South Australia, deposits are found at Balhannah, at Mount Macdonald, and at Murrinnie, on the shores of Spencer's Gulf. A small quantity of bismuth was exported from Western Australia in 1919, but none was recorded in 1920. In Tasmania 2 cwt., valued at £9, were raised in 1920 by the All Nations mine at Middlesex.

Production of bismuth was restricted in 1920 by the collapse in market values, and the difficulty in disposing of the product.

4. Chromium.—In New South Wales chromium is found at Bowling Alley Point, on the Peel River, at Barraba, at Manilla, at Gordon Brook, in the Clarence River district, at Bingara, Wallendbeen, and near Gundagai. The production during recent years has been small, the quantity raised in 1920 being 1,460 tons, valued at £5,090, of which 1,420 tons, valued at £5,000, were raised at Gobarralong, in the Gundagai division, and the balance in the Bingara division. Profitable mining in the last-mentioned area is handicapped by distance from the railway. Chrome iron ore is found in Queensland in the Rockhampton district, and about 160 tons were raised in 1920 by the Mount Morgan Company at Glen Geddes.

5. 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 since 1911, and the total produced since 1860 amounted in value to only a little over £10,000. Deposits have been noted in Queensland at Selwyn in the Cloncurry area; in South Australia near Bimbourie and South Blinman; in Western Australia at Norseman and Kanowna; and at various places in Victoria. A trial parcel of 50 tons of ore from the Selwyn area was sent to England in 1920.

6. 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 1920, amounted to 413 tons, valued at £9,905. The total lead exported to the end of 1920 was 298,000 tons, valued at £5,785,000. As stated previously, the metallic contents of the major portion of the silver lead ores are extracted outside New South Wales, and these figures refer only to lead values assigned as the produce of the State. The very low yield in 1920 was due to the cessation of operations at Broken Hill for the major portion of the year. 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 1920 amounting to 1,709 tons, valued at £65,098. Of this total the Chillagoe area produced 1,070 tons, valued at £40,795. From the lead ores in the Herberton and Etheridge districts the yields obtained amounted to 313 tons and 128 tons respectively. At one time South Australia produced a fair amount of lead, £22,303 worth being raised in 1902, but the production rapidly decreased, and no output has been recorded since 1910. During 1920 pig lead exports from Western Australia amounted to 1,930 tons, valued at £69,136. Tasmanian lead production in 1920 was returned as 3,856 tons, valued at £142,268, of which the Zeehan mines contributed 1,241 tons, the Mt. Farrell mines, 1,349 tons, Magnet, 601 tons, and Round Hill mines, 665 tons.

7. Manganese.—Ores of this metal occur in widely separated districts in New South Wales, but the low price of the metal in past years precluded mining to any great extent, and the production to date has been small. During 1920, 2,531 tons, valued at £2,008, were raised, chiefly in the Grenfell division. Small quantities were also raised in the Parkes and Bathurst divisions. In Queensland there are extensive deposits at Mount Miller, near Gladstone, in the country to the west and south-west of Gympie, and in the Stanthorpe district. The manganese from the Amamoor mine, about 18 miles from Gympie, is of good quality, and commands a ready sale, but disposal of the product is handicapped by difficulty of transport from the mine to the railway. During 1920, 15 tons, valued at £60, were produced. Small quantities of manganese ore were raised in Victoria during 1916 from mines in the vicinity of Heathcote. Extensive deposits of the ore were mined at Boolconda in South Australia some years ago. Deposits are being actively worked at the present time at Pernatty, Hawker, and Gordon. The production in 1920 was valued at £4,626. In Western Australia ores of the metal are found widely scattered, the black oxide being especially plentiful in the Kimberley district. It is proposed shortly to exploit the extensive deposits existing in a locality 18 miles north-west from Peak Hill. Large deposits in the northern part of the Cue district cannot at present be profitably worked owing to absence of cheap transport facilities.

8. 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 about 3,000 lbs. During 1916 the Pulganbar Company raised 200 tons of ore from their mine at Ewengar in the Drake division. The mercury produced was valued at £180. There was no production recorded in the years 1917 to 1920. 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 1874 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 the metal is also found in New Guinea.

9. 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 production in 1920 being 40 tons, valued at £8,442, as compared with 66 tons, valued at £30,308, in the previous year. Production in 1920 fell away owing to the lack of demand for the product after the expiry of the contract between the Commonwealth and Imperial Governments. In Victoria 48 tons of molybdenite, valued at £3,616, were raised in 1920 at Euerton and Korong Vale. The production in Queensland for 1920 was 29 tons,

valued at £13,333, the bulk of which was raised on the Chillagoe field, while small quantities were produced in the Mount Perry and Star River areas. The Wombah mine near Mount Perry is regarded by geologists as one of the most promising molybdenite producers in Australia. A small quantity was produced in 1914 from the mines in the Moonta district in South Australia, and the occurrence of the metal is reported from various other localities. At the Yelta mine bunches of the ore are scattered through the copper ore, and the molybdenite is picked out during the dressing of the copper ore. The yields for the last three years were, however, trifling. Molybdenite occurs in small quantities at various localities in Western Australia, the production in 1920 being, however, practically negligible. In the Northern Territory, molybdenite is found at Yenberrie, where it is stated that the ore increases in richness as the workings become deeper.

10. Radium.—(i) *General.* It is reported that there have been several definite discoveries in Australia of the occurrence of minerals containing radium. A discovery of carnotite, which is an alteration product of pitchblende, the compound from which radium is obtained, was made in 1906, 20 miles E.S.E. of the Olary railway station, in South Australia. 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 radioactive uranium ores found at Radium Hill were mined some years ago, and the concentrates forwarded to Sydney for treatment at the company's works at Woolwich. As noted in (ii) below, operations are at present at a standstill. Monazite from Pilbara, Western Australia, has been shewn to give off radium emanations. The 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. During 1918 radio-active ore to the value of £686 was raised in South Australia, but there was no production recorded in 1919 and 1920.

(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 was estimated by the chemist in charge that the plant at the works was 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. The industry, however, has since remained inactive.

11. Tungsten.—Wolfram and scheelite, the principal ores of tungsten, are both mined to some extent in New South Wales, but the fall in prices in 1920 reduced the output almost to vanishing point. The production of wolfram was 14 tons, valued at £2,212, and of scheelite 21 tons, valued at £3,805. Wolfram was mined chiefly in the Torrington division of the New England district, and scheelite in the Hillgrove area. In Victoria the production of wolfram was returned in 1920 as $7\frac{1}{2}$ tons, valued at £355, yields being obtained at Mount Murphy and the Tambo River. In Queensland, tungsten ores are found in several districts, the chief centres of production in 1920 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. It is believed that careful examination will lead to increased production from the deposits at Callawonga Creek. In the Northern Territory wolfram to the value of £45,648 was obtained in 1919–20, chiefly from Hatches Creek, Wauchope Creek, Wolfram Creek, Hidden Valley, and Yenberrie. Numerous samples of good wolfram ore have been obtained at the Frew River in Central Australia.

In Western Australia 3 tons of scheelite, valued at £395, were exported in 1920. Production was reported from the North Coolgardie, Coolgardie, Broad Arrow, and Dundas fields. Wolfram is mined at various points in Tasmania, the production for 1920 being 71 tons, valued at £13,626, obtained chiefly at the Avoca mines. Scheelite has been discovered on King Island in Bass Strait, and as a result of operations 199 tons of concentrates of an estimated value of £43,181 were produced in 1919. The low price obtainable for the product in 1920 led to the suspension of operations in the latter half of the year, and the yield was returned as 105 tons, valued at £17,905.

12. 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 further production was recorded until 1916, when 47 tons, valued at £9,375, were exported, consisting of ore which had been raised some years previously at Wodgina. in the Pilbara field. The export in 1917 amounted to 17 tons, valued at £2,513, but there was no record of production in 1918, while the export in 1919 dwindled to £75. and none was recorded in 1920. Small quantities of the mineral are also found in the Northern Territory.

13. 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. 3. pp. 515-6.)

(ii) *New South Wales.* The production in 1920 amounted to 10,715,999 tons, valued at £7,723,355, or an increase of about 2,084,000 tons in quantity and of £2,301,000 in value, as compared with the output in 1919. From the collieries in the Northern district the output in 1920 was 7,320,510 tons; the Southern district supplied 1,902,889 tons; and the Western 1,492,600 tons. The total production for 1920 constitutes a record; the nearest approach to it being that for 1913, when 10,414,165 tons were raised.

(iii) *Victoria.* During 1920 the production amounted to 442,241 tons of black coal, valued at £464,739, and 162,682 tons of brown coal, valued at £64,180. Of the total output, 367,285 tons of black coal were raised by the State coal mine at Wonthaggi, and 162,682 tons of brown coal from the State brown coal mine at Morwell. The production of black coal for 1920 was about 18,000 tons, and of brown coal over 51,000 tons, in excess of that in the preceding year.

(iv) *Queensland.* The quantity of coal raised in 1920 was 1,109,913 tons, valued at £841,551, this production being about 178,000 tons in excess of that in the preceding year. The increase was shared in by all the coal-producing districts except Maryborough, where there was a slight falling off in quantity, but an improvement in the value of the output. Twenty-nine collieries were working in the Ipswich district, 5 on the Darling Downs, 5 in the Maryborough district, 4 in Rockhampton district, 5 at Clermont, 1 at Bowen (State colliery), and 1 at Mount Mulligan in the Chillagoe district. 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.* Five collieries were in operation on the Collie field during 1920, and the output for the year was 462,021 tons, the largest on record, and about 60,000 tons more than in 1919.

(vi) *Tasmania.* The principal collieries in Tasmania are the Cornwall and Mount Nicholas, the former producing 38,000 and the latter 29,000 tons out of a total yield in 1920 of 75,000 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 1920.

Year.	N.S.W.	Victoria.	Q'land.	S. Aust.	W. Aust.	Tasmania.	C'wealth.
QUANTITY.							
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
1881	1,769,597	3	65,612	..	..	11,163	1,846,375
1891	4,037,929	29,156	271,603	..	..	43,256	4,381,944
1901	5,968,426	209,479	539,472	..	117,836	45,438	6,880,651
1916	8,127,161	420,098	907,727	..	301,526	55,575	9,812,037
1917	8,292,867	505,364	1,048,473	..	326,550	63,412	10,236,666
1918	9,063,176	505,775	983,193	..	337,039	60,163	10,949,346
1919	8,631,554	535,573	931,831	..	401,713	66,253	10,566,724
1920	10,715,999	604,923	1,109,913	..	462,021	75,429	12,968,285
VALUE.							
	£	£	£	£	£	£	£
1881	603,248	3	29,033	..	..	5,581	637,865
1891	1,742,796	21,404	128,198	..	..	21,628	1,914,026
1901	2,178,929	147,228	189,877	..	68,561	18,175	2,602,770
1916	3,336,419	216,875	389,348	..	147,823	27,736	4,118,201
1917	4,422,740	345,830	597,360	..	191,822	38,673	5,598,425
1918	4,941,807	367,640	672,305	..	204,319	37,676	6,123,747
1919	5,422,846	406,617	614,307	..	270,355	47,004	6,761,129
1920	7,723,355	528,919	841,551	..	350,346	64,005	9,508,176

The Victorian figures for 1920 include about 163,000 tons of brown coal, valued at £64,000, practically the whole of which was produced at the State mine at Morwell.

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 4,000 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" worked the top seam at a depth of 2,884 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 15 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 1920 :—

COAL RAISED IN NEW SOUTH WALES, 1881 TO 1920.

District.	1881.		1901.		1911.		1920.	
	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	7,320,510	5,580,455
Southern ..	253,283	115,505	1,544,454	407,196	2,066,621	636,163	1,902,889	1,272,168
Western ..	163,842	50,473	424,720	102,214	831,337	210,329	1,492,600	870,732
Total ..	1,769,597	603,248	5,968,426	2,178,929	8,691,604	3,167,165	10,715,999	7,723,355

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. 6, p. 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. Its steaming value is equal to about half that of the Wonthaggi coal. Some large factories already have adopted brown coal for firing boilers, and there is also a fair demand for the product by householders. In 1917 an Advisory Committee appointed to report on the brown coal deposits of Victoria recommended the establishment of an open-cut mine at Morwell in connexion with a comprehensive scheme for electrical power generation and transmission, as well as for the supply of brown coal for other requirements. The recommendations of this Committee

were incorporated in the "Electricity Commissioners Act" of 1918. The Morwell deposits are now being opened up, and the product will be utilised for the generation of electricity, which will be transferred to Melbourne and, if there is sufficient demand, to other towns in Victoria. A large briquetting plant is also in course of construction. It has been stated that the deposits, as a source of energy, have no parallel in the world.

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

PRODUCTION OF COAL IN VICTORIA, 1911 TO 1920.

Year.	State Coal Mine.	Outtrim Howitt Company.	Jumbunna Coal Company.	Coal Creek.	Austral Coal.	Other.	Total Production.	Value.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	£
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
1915 ..	528,922	7,500	28,160	6,338	16,229	3,819	590,968	275,343
1916 ..	354,146	..	31,792	5,688	10,885	17,587	420,098	216,875
1917 ..	405,498	..	22,236	1,958	13,888	61,784	505,364	345,830
1918 ..	389,794	..	16,533	2,378	15,419	81,651	505,776	367,640
1919 ..	361,871	..	21,716	1,465	11,824	138,697	535,573	406,617
1920 ..	376,285	..	19,644	753	12,260	195,981	604,923	528,919

Included in the total for "other" is an amount of 23,310 tons raised by the Powlett North Woolamai, and 9,989 tons raised by the Sunbeam Colliery. The figures also include about 163,000 tons of brown coal raised by the State mine at Morwell.

(iii) *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 60 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 1,000 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 seam of coal at Blair Athol has been proved in places to have a thickness of at least 93 feet, and is stated to be probably the thickest seam of black coal in the world.

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 1920.

Year	1861.	1871.	1881.	1891.	1901.	1920.
Quantity .. Tons	14,212	17,000	65,612	271,603	539,472	1,109,913
Value.. .. £	9,922	9,407	29,033	128,198	189,877	841,551

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

QUEENSLAND COLLIERIES, 1918, 1919, AND 1920.

Districts.	1918.	1919.	1920.
	Tons Raised.	Tons Raised.	Tons Raised.
Ipswich	678,931	620,608	763,590
Darling Downs	94,242	97,454	102,074
Wide Bay and Maryborough	62,948	63,665	61,170
Rockhampton (central)	7,955	8,350	10,522
Clermont	122,812	121,250	145,001
Bowen (State Coal Mine) .. .. .	..	376	3,914
Mount Mulligan (Chillagoe)	16,305	19,998	23,642
Total	983,193	931,631	1,109,913

The increased production in 1920 was due chiefly to the higher output in the Ipswich district, from which coal was exported overseas, in addition to a much larger quantity shipped for bunkering purposes. During the year overseas exports amounted to 52,831 tons, valued at £63,226, forwarded principally to Hong Kong, New Zealand, Straits Settlements, Madagascar, and Réunion.

Operations were commenced at the State Coal Mine on the Bowen field in March, 1919. The coal is of good quality and is well suited for coking. With the completion of the railway to the field, it is anticipated that supplies of coke will be forwarded to the smelters at Chillagoe, Irvinebank and Cloncurry, the coke for which has hitherto been obtained chiefly from New South Wales.

(iv) *South Australia.* The coal from Leigh's Creek in South Australia is subject to similar disabilities to those of the Victorian brown coal, and until some means are devised of overcoming them, production will probably languish. The deposit is situated about 370 miles by rail from Adelaide, and 160 from Port Augusta, the total extent of coal-bearing country being set down as 42 square miles. The main seam has a thickness of over 45 feet. As the result of experiments made it would appear probable that profitable use might be made of the coal in a pulverized form. Investigation is at present being made on the site of a deposit of brown coal near Moorlands on the Pinnaroo line.

(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 Permo-Carboniferous beds. The coal produced is bright and clean, but very fragile when free from moisture. About 293,000 tons of the total production in 1920 was taken by the railways and tramways, the balance being sold for bunkering and local trade. The production from this field since 1901 was as follows :—

PRODUCTION OF COAL IN WESTERN AUSTRALIA, 1901 TO 1920.

Year ..	1901.	1911.	1914.	1916.	1917.	1918.	1919.	1920.
Quantity Tons	117,836	249,899	319,210	301,526	326,550	337,039	401,713	462,021
Value £	68,561	111,154	148,684	147,823	191,822	204,319	270,355	350,346

In 1918 a discovery of coal was made near Wilga on the Donnybrook-Katanning railway.

(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, Langlosh, 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 1920.

District.	1901.	1911.	1915.	1916.	1917.	1918.	1919.	1920.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
North-western ..	2,952	1,496	270	673	350	1,353	2,836	3,392
North-eastern ..	37,239	54,296	63,507	54,284	61,910	56,461	59,509	69,140
Midland ..	1,536	635	691	598	399	1,161	2,899	992
South-eastern ..	3,711	640	68	20	753	1,188	1,009	1,905
South-western ..								
Total ..	45,438	57,067	64,536	55,575	63,412	60,163	66,253	75,429

The bulk of the output in 1920 was raised from the Cornwall and Mt. Nicholas mines in the North-eastern Division, which produced 38,212 and 29,382 tons respectively.

3. *Production of Coal in Various Countries.*—The total known coal production of the world in 1920 amounted to about 1,280 million tons, towards which the Commonwealth contributed nearly 13 million tons, or over 1 per cent. The following table shows the production of the British Empire and the chief foreign countries in units of 1,000 tons during each of the five years from 1916 to 1920 where the returns are available. The figures for the British Empire and the United States are extracted from the official publications of the various countries, while those for other countries are taken from the Official Monthly Bulletin of Statistics published by the League of Nations. The production of lignite is included in those countries in which it is raised :—

COAL PRODUCTION, BRITISH EMPIRE, 1916 TO 1920.

Year.	United Kingdom.	British India.	Canada.	Australian C'wealth.	New Zealand.	Union of S. Africa.
	1,000 tons.	1,000 tons.	1,000 tons.	1,000 tons.	1,000 tons.	1,000 tons.
1916 ..	256,400	17,300	12,900	9,800	2,300	8,900
1917 ..	248,500	18,200	12,500	10,200	2,100	9,300
1918 ..	227,700	20,700	13,400	10,900	2,000	8,800
1919 ..	209,800	22,600	12,200	10,600	1,800	9,200
1920 ..	231,000	..	14,800	13,000	1,800	10,200

COAL PRODUCTION, FOREIGN COUNTRIES, 1916 TO 1920.

Year.	Germany.	Belgium.	France.	Czecho-Slovakia.	Poland.	Netherlands.	Japan.	United States.
	1,000 tons.	1,000 tons.	1,000 tons.	1,000 tons.	1,000 tons.	1,000 tons.	1,000 tons.	1,000 tons.
1916 ..	249,300	16,600	21,000	..	..	2,500	22,500	526,900
1917 ..	258,900	14,700	28,500	..	..	3,000	25,900	531,700
1918 ..	256,800	13,700	25,800	..	..	4,800	27,600	605,600
1919 ..	207,100	18,200	21,500	27,000	..	5,200	30,800	487,700
1920 ..	239,000	21,000	34,100	30,300	6,300	5,200	28,800	576,500

The United States returns include a large proportion of anthracite, the quantity averaging for the last five years about 80 million tons.

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 1920 was 2,161,344 tons, valued at £2,238,996, of which amount 2,064,515 tons, valued at £2,117,426, were exported from New South Wales, and 96,810 tons, valued at £121,509, from Queensland.

In the following table will be found the quantity and value of the exports from New South Wales, at decennial intervals since 1881 and during the last five years. The figures 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 1920.

Year	1881.	1891.	1901.	1911.	1916.	1917.	1918.	1919.	1920.
Quantity, 1,000 tons ..	1,030	2,514	3,471	5,024	3,434	3,264	3,422	3,504	4,987
Value, £1,000	417	1,307	1,682	2,664	1,873	2,384	2,525	2,919	4,591

The principal oversea countries to which coal was exported from New South Wales during the year 1920-21 are as shewn hereunder. The quantity and value refer strictly to exports, and exclude bunker coal :—

DESTINATION OF NEW SOUTH WALES OVERSEA EXPORTS OF COAL, 1920-21.

Country.	Quantity.	Value.	Country.	Quantity.	Value.
	Tons.	£		Tons.	£
Alaska	3,114	3,302	United States ..	29,903	29,865
Italy	3,723	4,049	Java	408,242	422,182
Chile	183,891	190,881	China	11,784	10,251
Straits Settlements	127,624	136,669	New Caledonia ..	30,184	29,630
Fiji	40,802	39,686	Hawaiian Islands	41,950	38,967
New Zealand ..	717,559	734,540	Norway	27,576	30,707
India	60,231	68,240	Sweden	94,588	90,512
Tonga	3,900	3,023	Ceylon	14,911	14,712
Peru	16,342	17,190	Japan	7,639	7,639
Philippine Islands	110,297	111,488	Egypt	104,593	107,430

The quantity of bunker coal taken from New South Wales by oversea vessels was about 1,518,000 tons.

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 including coal shipped as bunker coal :—

DISTRIBUTION OF TOTAL OUTPUT OF NEW SOUTH WALES COAL, 1916 TO 1920.

Year.	Exports to Australasian Ports.	Exports to other Ports.	Local Consumption.	Total.
	Tons.	Tons.	Tons.	Tons.
1916	2,203,659	1,230,439	4,693,063	8,127,161
1917	2,225,228	1,038,569	5,029,070	8,292,867
1918	2,697,033	724,643	5,641,500	9,063,176
1919	1,891,317	1,611,701	5,128,526	8,631,544
1920	2,270,556	2,716,235	5,729,208	10,715,999

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, 1916 TO 1920.

Year.	Quantity of Coal Consumed.		
	Home Produce.	Produce of Other Countries.	Total.
	Tons.	Tons.	Tons
1916	8,266,215	11,068	8,277,283
1917	8,985,599	65,512	9,051,111
1918	9,866,323	23,777	9,890,100
1919	9,036,623	64,673	9,101,296
1920	10,132,442	26,828	10,159,270

The bunker coal taken away in 1920 was estimated at 1,125,000 tons.

6. **Price of Coal.**—(i) *New South Wales.* The price of coal in New South Wales has been subject to considerable fluctuation since the date of first production. Up to the end of 1857 the average value of the total output was 11s. 10d. per ton. Next year the value had risen to nearly 15s., declining thereafter until in 1871 the price realised was 7s. From 1872 to 1879 there was a rise in value to 12s. Between 1882 and 1891 the price ranged between 8s. and 10s. From 1891 onwards there was a steady decline until 1898, when the average was 5s. 4d. Henceforward prices rose again until 1902, when 7s. 5d. was the average. A decline then set in until 1905, when the price stood at a little over 6s., followed by a rise of one penny in 1906, and a further rise of eightpence in 1907. In 1908 the average was 7s. 4d., in 1916, 8s. 2d., while in 1917 the price advanced to 10s. 8d. per ton, the highest recorded since 1879. In 1918 there was a further rise to 10s. 11d., in 1919 to 12s. 7d., and in 1920 to 14s. 5d. 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, NEW SOUTH WALES, 1916 TO 1920.

Year.	Northern District.	Southern District.	Western District.
	Per ton. s. d.	Per ton. s. d.	Per ton. s. d.
1916	9 0.72	7 1.77	5 6.90
1917	11 5.14	9 11.89	7 11.92
1918	11 8.03	9 10.32	8 8.04
1919	13 5.81	11 9.64	9 4.19
1920	15 2.95	13 4.45	11 8.01

(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 up to 1916, the average for 1905 being 10s. 2d.; for 1909, 12s.; for 1912, 8s. 9d.; for 1913, 9s. 3d.; for 1914 and 1915, 9s. 4d.; and for 1916, 10s. 4d. In 1917, however the price rose to 14s. 5d., in 1918 to 15s. 11d., in 1919 to 17s. 7d., and in 1920 to 21s. per ton. These averages are exclusive of brown coal, the production of which in 1920 was valued at 7s. 11d. per ton.

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

PRICE OF COAL, QUEENSLAND, 1916 TO 1920.

District.	Value at Pit's Mouth.				
	1916.	1917.	1918.	1919.	1920.
	Per ton. s. d.	Per ton. s. d.	Per ton. s. d.	Per ton. s. d.	Per ton. s. d.
Ipswich	7 11	10 8	11 0	12 7	14 7
Darling Downs	9 10	12 9	13 5	14 10	16 7
Wide Bay and Maryborough	12 2	15 10	16 9	19 2	23 3
Rockhampton	9 6	11 10	12 4	13 4	16 1
Clermont	7 9	11 5	10 5	11 2	13 0
Bowen (State Coal Mine) ..	..	..	..	15 0	15 10
Mount Mulligan (Chillagoe)	13 4	15 6	16 6	17 8	19 0
Average for State ..	8 7	11 5	11 8	13 2	15 2

The readjustment of prices and wages in the industry was responsible for the increases in the averages during the last four years.

(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. 8½d.; in 1908, 8s. 7½d.; in 1909, 8s. 5½d.; in 1910, 8s. 8d.; in 1911, 8s. 10d.; in 1912, 9s. 2d.; in 1913, 9s. 9d.; in 1914, 9s. 4d.; in 1915, 9s. 8d.; in 1916, 9s. 9d.; in 1917, 11s. 9d.; in 1918, 12s. 1d.; in 1919, 13s. 5d.; and in 1920, 15s. 2d. 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.; in 1914, 9s. 2d.; in 1915, 9s. 5d.; in 1916, 9s. 9d.; in 1917, 12s. 2d.; in 1918, 12s. 6d.; in 1919, 14s. 2d.; and in 1920, 16s. 11½d. per ton.

7. *Price of Coal in the United Kingdom.*—During the five years 1914 to 1918 the average value of coal at the pit's mouth in the United Kingdom has risen rapidly, the price in 1914 being 10s.; in 1915, 12s. 6d.; in 1916, 15s. 7d.; in 1917, 16s. 9d.; and in 1918, 20s. 11d. per ton.

8. *Employment and Accidents in Coal Mining.*—The number of persons employed in coal mining in each of the States during the year 1920 is shewn below. The table also shews the number of persons killed and injured, with the proportion per 1,000 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. A table is also added shewing the rate of fatalities during the last five years.

According to the report of the Chief Inspector of Mines for Great Britain, the average death-rate per 1,000 miners from accidents in coal mines during the quinquennium 1915–19 was 1.27, while, as shewn in the table on the next page, the rate for Australia for the quinquennium, 1916–20, was 1.14. In the United States the fatality rate per 1,000 employees, as stated in "The Mineral Industry," was 3.94 in 1918, 4.39 in 1919, and 3.63 in 1920.

EMPLOYMENT AND ACCIDENTS IN COAL MINING, 1920.

State.	Persons Employed in Coal Mining.	No. of Persons.		Proportion per 1,000 Employed.		Tons of Coal Raised for each Person.	
		Killed.	Injured.	Killed.	Injured.	Killed.	Injured.
New South Wales	19,965	20	113	1.00	5.66	535,800	94,800
Victoria ..	2,011	1	5	0.50	2.49	604,900	121,000
Queensland ..	2,379	2	9	0.84	3.78	555,000	123,300
Western Australia	830	..	94	..	113.25	..	4,900
Tasmania ..	220	..	13	..	59.09	..	5,800
Commonwealth ..	25,405	23	234	0.91	9.21	563,800	55,400

The figures for New South Wales include a small number of shale miners. Owing to lack of uniformity in the definition of "injury," the figures relating to persons injured possess little value.

The next table shews the average number of miners employed, the number of fatalities, and the rate per 1,000 during the quinquennium 1916-20:—

MINERS EMPLOYED AND FATALITIES, COAL MINING, 1916-1920.

State.	Average No. of Coal Miners.	Average No. of Fatal Accidents.	Rate per 1,000 Employed.
New South Wales	17,860	17	0.95
Victoria	1,725	3	1.74
Queensland	2,233	4	1.79
Western Australia	640	1	1.56
Tasmania	193	..	..
Commonwealth	22,651	25	1.14

§ 11. Coke.

1. **Production of Coke.**—Notwithstanding the large deposits of excellent coal in Australia, there was, prior to the war, a fairly considerable amount of coke imported from abroad. During recent years, however, a high standard of excellence has been attained in the local product, and the necessity for import has therefore disappeared. The table hereunder gives the production in New South Wales during the last five years:—

COKE MADE IN NEW SOUTH WALES, 1916 TO 1920.

Year	1916.	1917.	1918.	1919.	1920.
Quantity tons	437,587	455,587	608,492	424,773	567,569
Value, total £	387,571	541,093	647,798	550,127	844,191
Value per ton	17s. 9d.	23s. 9d.	21s. 4d.	25s. 11d.	29s. 9d.

As the table shews, during recent years the industry has made considerable progress, and with the development of local iron and steel works, as well as metal refineries and smelting establishments, its future prospects ought to be assured.

A small quantity of coke is made in Queensland, the quantity returned in 1920 being 19,653 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, 1916 TO 1920.

Year	1916.	1917.	1918.	1919.	1920.
Manufactured locally tons	17,904	13,399	14,437	4,562	19,653

Information regarding the exact quantity of coke imported from New South Wales and elsewhere is not available.

§ 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 1920 amounted to 21,004 tons, valued at £46,082, as compared with 25,453 tons, valued at £37,968, in 1919. For 1920 practically the whole of the production came from Wolgan Valley in the Western District. Up to date there has been no production of petroleum in the State, but various areas in the Dunedoo, Gunnedah, Hay, Inverell, and Sydney divisions have been taken up for the purpose of prospecting for oil.

(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 development will lead to the discovery of mineral oil in quantity in this locality. During 1919 the bore reached a depth of 3,705 feet, but at the latest available date further drilling operations were suspended owing to the tools getting fast in the bore early in the year. In February, 1920, a start was made with the work of attempting to recover the tools, but after using various devices without success the task was abandoned. 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 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 for oil and gas.

(iv) *South Australia.* Bitumen is occasionally washed up on the Southern coasts of the continent from Port Davey in Tasmania to Cape Leeuwin in Western Australia. Specimens found on Kangaroo Island at one time led to the belief that they were the product of a terrestrial petroliferous area. Expert opinion now, however, inclines to the idea that the material is sea-borne, but the source of origin is unknown. Similar occurrences of this mineral have been reported from the coasts of California, South Africa, and New Zealand. In 1920 the finding of accumulations of oily matter on the shores at

Encounter Bay and Kangaroo Island was reported, but investigations by the Mines Department into the geological conditions of the surrounding country do not encourage the hope that the matter is of local origin.

(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. It is stated that small seepages of oil have been noted near Wonnerup, and indications have been reported from the neighbourhood of Albany and Esperance. In 1920 reports were received of discoveries on the Kimberley and West Kimberley goldfield, and areas were allotted to prospectors in the vicinity of the reputed oil-bearing deposits.

(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 was proposed to develop the deposits on a large scale. The production in 1914 was, however, small, amounting to 75 tons, valued at £75, while no return from this source were included in the production records for 1915. In 1916, the Company raised 1,286 tons of shale, valued at £1,286, and in 1919, 600 tons, valued at £900, but in 1920 the output fell to 140 tons, valued at £172. Large pieces of asphaltum have been discovered in places along the sea coast and in several of the bays of Port Davey Harbour, but it is believed that the material originates in submarine beds. A bore was put down in 1916 by a private company on Bruni Island in search of petroleum, but after sinking about 429 feet, operations ceased for lack of funds.

In 1917 a deposit of tasmanite shale was located on the Cam River.

(vii) *Northern Territory.* The existence of oil shale has been reported in the Borooloola district, and several oil licenses were applied for some years ago in the Victoria River district. Results were, however, negative, and experts have pronounced unfavourably on the prospects.

(viii) *Papua.* Many indications suggest that oil-bearing strata exist over an extensive area in the Gulf Division of Papua. Seepages of oil and natural gas are known, and, in addition, light oil of excellent quality has been obtained from sandy strata encountered in most of the prospecting bores put down under the direction of the Commonwealth Government. Reconnaissance surveys have been made of the country where evidences are known to exist, while selected areas are being surveyed in greater detail. Several test bores have been sunk, the deepest being over 1,800 feet; in each case quantities of inflammable oil and gas have been met with, but so far not in sufficient bulk for commercial purposes.

2. Export of Shale.—In 1916-17 New South Wales exported a small quantity of shale. There was no export in the succeeding year. In 1919, 5 tons, valued at £21, were exported, and in 1920, Victoria was credited with an export of 4 tons.

3. Shale Oil Bounties.—The Shale Oils Bounties Act 1910 provided 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 made available for bounties under this Act was £50,000. 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. Under the Shale Oil Bounty Act of 1917 a sum of £270,000 was provided for bounty on crude shale oil at various rates. Bounty to the amount of £26,407 was paid on 2,816,718 gals. of crude shale oil in 1918-19, and in 1919-20 £16,292 was paid on 1,737,845 gallons.

On the 2nd January, 1920, the Commonwealth Government offered a reward of £10,000 for the discovery of petroleum oil in Australia, subject to the fulfilment of certain conditions. The reward was increased to £50,000 on the 23rd September, 1920. During 1920 the New South Wales Government offered the sum of £10,000 as a bonus for the production of 100,000 gallons of petroleum within the State. Under the Native Industries Encouragement Act of 1872, the Government of South Australia offered a bonus of £5,000 on the production within the State of 100,000 gallons of crude petroleum containing not less than 90 per cent of products obtainable by distillation.

§ 13. Other Non-Metallic Minerals.

1. **Alunite.**—One of the most remarkable deposits of alunite in the world occurs at Bullahdelah, in the country 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 from 1890 up to the end of 1920, 54,000 tons had been exported, valued at £194,000, the exports for the year 1920 being 634 tons, valued at £2,536. The falling-off in 1920 as compared with previous years is due to the difficulty of locating a marketable product.

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

According to the Geologist's report, apart from its scientific interest, no commercial importance attaches to the presence of natural alum over the area examined near Boonmoo, on the Chillagoe Railway in Queensland.

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. Fresh discoveries were later reported on the western shores of St. Vincent's Gulf. The mineral returns shew a small production of 60 tons in 1919 and 20 tons in 1920.

The exploitation of the alunite deposits in the North-east Coolgardie field in Western Australia has been retarded pending the result of field experiments to determine the suitability or otherwise of the product as a fertilizer in its unroasted state. Deposits of the mineral are also found in the Kalgoorlie area.

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 656 tons, valued at £7,340, were raised by a company from deposits in the Barraba division, and 8 tons, valued at £64, were raised in the Orange division. In Queensland seams of asbestos have been found over a belt of country extending from Cawarral to Canoona, as well as in other districts. Samples of the fibre proved suitable for the manufacture of fibro-cement sheeting, and tiles, but so far the deposits have not been commercially exploited. In Western Australia a deposit of the fibrous chrysotile variety was located at Soanesville, on the Pilbara gold-field, and £154 worth of this mineral was raised in 1909. During recent years chrysotile of good quality has been found at Hale's Well on the same field. The discovery of a deposit of commercial quality was reported from the Nullagine district in 1917. About 156 tons, valued at £7,286, were raised on the Pilbara field in 1920. In 1899 Tasmania raised 200 tons, valued at £363, but there was no further production until 1916, when a small quantity was raised at Anderson's Creek, near Beaconsfield. In 1917, 271 tons, valued at £271; in 1918, 2,854 tons, valued at £5,008, and, in 1919, 51 tons, valued at £1,275, were produced, but there was no record of production in 1920. Deposits of asbestos have been located at various places in South Australia. During 1920 the product was mined near Robertson in the hundred of Bright, and developmental work was carried out on a deposit in the hundred of Jellicoe. Production in 1920 amounted to 5 tons, valued at £90.

3. **Barytes.**—In New South Wales during 1920 about 222 tons of barytes, valued at £767, were obtained, of which 212 tons were raised at Clefden mine in the Cowra division, and 10 tons at Cavan in the Yass division. The production in South Australia during 1920 was given as 2,542 tons, valued at £7,362. In this State there are extensive deposits of the mineral in the Willunga and other districts. About 1,000 tons of barytes, valued at £4,000, were produced in Tasmania in 1920, the greater portion being won from deposits near Queenstown and Mt. Jukes, and the balance from Beulah and elsewhere.

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 1920 amounted to 2,788 tons, valued at £3,201, of which 825 tons were raised near Manly in the Sydney division, 381 tons in the Gulgong division, 362 tons at Pambula, and 300 tons at Buckaroo, near Mudgee. Deposits of steatite were worked during 1920 in the Murrumburrah division, the quantity

raised amounting to 27 tons, valued at £48. Near Morangaroo 3,200 tons of silica were raised by the Silica Fire Brick Company. Extensive deposits have been located in the parishes of Conyola and Ulladulla in the Milton division, the production in 1920 amounting to 11,784 tons. Red ochre is found in several parts of the Armidale division. In the Dubbo division yellow ochre valued at £600 was produced in 1920, and £100 worth was also raised in the Cobar area. From the Glen Innes division a production of 216 tons of red ochre was recorded, while 53 tons of umber were raised in the Queanbeyan division. In Victoria 2,130 tons of kaolin, valued at £2,264, were produced in 1920 from deposits at Carngham, Stawell, Egerton, Gordon, and Pyalong. A small quantity of pigments was raised from leases in the Balnarring, Lal Lal, and Knowsley areas. In Queensland, 7,539 tons of fireclay, valued at £2,188, were mined during the year 1920 in the Mount Morgan district. At Canoona, in the Rockhampton district, a white substance was mined and disintegrated in a circular puddle, the floating slimes being allowed to sun-dry. Ten tons of the product were put on the market and sold in 1920 as whiting. 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. Ochre deposits of fine quality are found in the Noarlunga area. Production of ochre in 1920 amounted to 260 tons, valued at £1,131. Porcelain and other clays of good quality have been found in Tasmania at Beaconsfield, Sorell, Hagley, etc. Extensive deposits of iron oxide, giving a return of 80 per cent. ochre, have been discovered near Oodlawirra in South Australia. Oil and water paints of good quality have been made from coloured ochres from Sorell, in Tasmania, and a deposit of ochre of good quality has been located near Mowbray. A company is making paints from the latter deposits, and also from deposits on leases near Ilfracombe. At Kingston a valuable clay deposit has been opened up.

5. **Coorongite.**—This peculiar india-rubber 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, 1 (iv.)) While the origin of coorongite is still in doubt, it is held by some observers that it originates from the blue-green algæ which frequently abound in swamps and shallow inland waters. Similar material has been found in Portuguese East Africa, and on the shores of lakes in Siberia.

6. **Fuller's Earth.**—Small quantities of this material were produced in 1920 from deposits in the Boggabri area of the Narrabri division, New South Wales.

7. **Graphite.**—Graphite is found in New South Wales near Undercliff Station, in the county of Buller, and 40 tons were raised during 1920. Owing to the low grade of the ore there is only a limited market for it. In Victoria the mineral occurs in Ordovician slates in several of the gold-fields, but is not worked. In Queensland graphite was raised some years ago by the Graphite Plumbago Company at Mt. Bopple, near Netherby, on the Maryborough—Gympie line. In South Australia deposits are found at various places in Eyre's Peninsula. While a large proportion of the product is not suitable for commercial use, the work so far done shews that flake graphite containing as high as 80 per cent. carbon can be obtained. The Government is offering a bonus of £1 per ton for the production of a marketable graphite. In Western Australia deposits occur at Munglinup Creek, near the Oldfield River, at Northampton, in the Murchison division, and on the Donnelly River, at Kendenup, about 40 miles from Albany. Production in 1920 was small, amounting to 13 tons, valued at £130.

8. **Gypsum.**—This mineral is found in 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. The mineral has been found in the Hay and Hillston divisions in New South Wales, and encouraging results have been obtained from trial shafts at various places in the county of Mossgiel. In

Victoria during 1920 there was a production of 3,393 tons, valued at £1,696, obtained chiefly at Lake Boga. Production was also reported from leases at Boort and Fairley. Numerous deposits of gypsum are found in Southern Yorke's Peninsula in South Australia. The production in 1920 amounted to 40,000 tons, valued at £32,000. A factory for the manufacture of plaster of paris has been erected by the Permasite Co. on its lease at Dry Bone Lake. A deposit of gypsum sand containing practically an inexhaustible supply is found on the edge of Lake Austin in Western Australia, and a large deposit has also been located on the shore of Lake Seabrook.

9. Magnesite.—Deposits of this mineral have been discovered at several localities in New South Wales. During 1920, 3,261 tons, valued at £7,124, were raised in the Fifield division, and 3,199 tons, valued at £2,760, at Attunga, in the Tamworth division. A small quantity was raised in the Bingara division in the parish of Macintyre, and it is proposed to exploit the deposits at Warialda. There are extensive deposits of the mineral at Piedmont in the Barraba division. The mineral is found at Heathcote in Victoria, where 151 tons, valued at £453 were produced in 1920. There are deposits in the neighbourhood of Rockhampton and Bowen in Queensland, 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 cost of transport is a drawback to the production from the Copley (Leigh Creek) district. The Broken Hill Co. is working a small deposit near the Bectaloo Waterworks. Production in 1920 amounted to 185 tons, valued at £347. During 1915, 688 tons of magnesite, valued at £1,196, were exported from Western Australia, but the export in 1916 amounted to 12 tons only, in 1917 to 42 tons, in 1918 to 62 tons, while none was exported in 1919 and 1920. A large area of magnesite-bearing country has been located at Bulong, about 20 miles east of Kalgoorlie.

10 Tripolite, or Diatomaceous Earth.—Although tripolite has been found at various localities in New South Wales, the deposits have not been worked commercially on any considerable scale. From the deposits in the Cooma division 241 tons of diatomaceous earth, valued at £561, were produced in 1920. At Bell's Mountain, in the Barraba division, about 100 tons, valued at £200, were raised, and small quantities were won in the Ballina and Lismore divisions. In Victoria there is a remarkably pure deposit at Lillieur, 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. During 1920, a production of 1,000 tons, valued at £5,000, was recorded. Fairly extensive deposits of diatomite exist in Queensland, in the Nerang, Beaudesert and Canungar areas, but the various outcrops have as yet been only partially examined. In Tasmania a deposit of diatomaceous earth has been located at Oatlands, but its use for the manufacture of explosives is apparently prejudiced by the circumstances that the diatoms are pulverised and contaminated with clay.

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. Figures regarding production are, however, not available for publication. Large quantities are also obtained from the shallow salt lakes of South Australia, chiefly on Yorke Peninsula. Lake Hart, about 60 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 put down near Kingscote, on Kangaroo Island, revealed brine from which salt can be profitably obtained by evaporation. About 71,000 tons of crude salt, valued at £142,000, were produced during 1920. 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, Middle Island, near Esperance, and Port Gregory; but during recent years the bulk of the demand has been supplied from imports.

Attention has recently been devoted to the occurrence of salt in Queensland, more especially to the deposits in the vicinity of the Mulligan River.

12. Natural Manures.—Gypsum has already been mentioned (see 8 *ante*). South Australia possesses deposits of rock phosphate scattered through various districts between Willunga in the south and Carrieton in the north, and between Clinton on Yorke Peninsula and Bright to the north of Eudunda. The production in 1920 was 8,753 tons, valued at £12,309. Phosphate of lime has been found in deposits in the limestone caves of New South Wales; the Ashford caves in the Inverell division containing thousands of tons. The production in 1920 amounted to 154 tons of phosphate rock, valued at £732, raised in the Cowra division. In Victoria, about 4,000 tons of phosphate rock were raised in 1920 at Mansfield. Although it can hardly be considered a mineral product, mention may be made here of the large accumulations of guano found on the Abrolhos Islands, off the coast of Western Australia, in the neighbourhood of Geraldton. The deposits varied in thickness from four to twenty-seven inches, and during the years 1876 to 1880 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 Cudgong 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 $\frac{3}{4}$ carats. It is difficult to secure accurate returns in connexion with the production of precious stones, but the yield of diamonds in 1920 was estimated at 3,523 carats, valued at £6,282, while the total production to the end of 1920 is given at 199,000 carats, valued at £140,000. The yield in 1920 was contributed by miners working in the vicinity of Copeton, in the Tingha division. Small quantities of diamonds are found in Victoria in the gravels of streams running through granite country in the Beechworth district, at Kongbool in the Western District, and near Benalla. The stones are generally small and the production up to date has been trifling. In 1912, eleven small diamonds, valued at £20, were picked out of the sluice boxes of the Great Southern alluvial mine at Rutherglen. A few small diamonds have been found in the Pilbara district in Western Australia. In South Australia diamonds have been found on the Echunga goldfield, the most notable gem being Glover's diamond, which was sold for £70. A few small diamonds have, from time to time, been found in Tasmania, chiefly while sluicing for gold in the Donaldson district.

2. Sapphires.—These gems were discovered in New South Wales in 1851, near Burrandong. They have also been found in the Inverell division, at Tingha and at other localities in the State. During 1920, the production from the Inverell division was valued at about £800, and from the Tingha division at £1,200. 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 shew 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 1920 was valued at £65,831 as compared with £600 in 1915, and over £40,000 in 1913. The gem mining industry practically collapsed on the outbreak of the war, as the German buyers ceased business. With the opening up of markets in London and Paris, however, matters assumed a more satisfactory footing and business remained fairly satisfactory in 1918. During 1919, owing to the keen demand for the gems, prices rose rapidly. It is stated that the increased demand was partly due to the circumstance that many persons in Europe were converting their assets into gems, in view of the international value possessed by the latter, and was partly brought about by development of the gem-cutting industry in France and England. Competition amongst buyers in the early part of 1920 resulted in a phenomenal rise in price which had the effect of over-stimulating

production, this being naturally followed by a period of depression. The market also was affected by adverse exchange. One of the finest stones discovered on the field was obtained during 1920 by a miner at Retreat Creek, the gem realising £200.

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, for a time, contributed the bulk of the production. In 1920, however, out of a total production valued at £23,600, the yield from the Lightning Ridge field, near Walgett, amounted to £20,000, while the output from the White Cliffs field was £600. A new field was opened up in 1919 in the Ballina division, and about £3,000 worth of opal was raised therefrom in 1920. Some very fine stones are at times obtained, one weighing 5 ozs. and valued at £300 being recovered in 1911. Occasionally, black opals of very fine quality are found, one specimen from the Wallangulla field, weighing $6\frac{1}{2}$ carats, being sold in 1910 for £102, while in the early part of 1920 a specimen realised £600. 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 £1,500,000.

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 1920 was estimated at £500, and up to the end of that year at about £180,000. These figures are, however, merely approximations, as large quantities of opal, of which no record is obtained, are disposed of privately to buyers on the fields. At present the industry, which is not followed by practical miners, 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 blocked by the absence of grass and water on the fields.

Precious opal has been discovered in South Australia in a locality 144 miles N. by E. of Tarcoola. The specimens show similar characteristics to those obtained at White Cliffs in New South Wales. Production in 1920 amounted to about £24,000.

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 23 carats in the rough. Altogether 2,225 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 re-opened and worked for a short period during 1908, when about 1,000 carats of emeralds, valued at about £1,650, 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 *zircon*s and *garnet*s. Zircons are found on the Anakie mineral field in Queensland, and in the vicinity of Table Cape in Tasmania. Topazes have been obtained in the Stanthorpe district in Queensland and are common in the tin drifts of Tasmania, where 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. These gems also occur plentifully in the bed of Agate Creek, about four 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, at Fossilbrook, in the Chillagoe district in Queensland, 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 stones 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 fluctuates according to the season, the price of industrial metals, the state of the labour markets, and according also to the permanence of new finds, and the development of the established mines. During the year 1920 the number so employed was as follows:—

NUMBER OF PERSONS ENGAGED IN MINING, 1920.

State.	Number of Persons Engaged in Mining for						Total.
	Gold.	Silver, Lead, and Zinc.	Copper.	Tin.	Coal and Shale.	Other.	
New South Wales ..	1,712	1,931	583	1,822	19,965	3,150	29,163
Victoria ..	3,742	..	2	48	2,011	338	6,141
Queensland ..	611	143	1,815	920	2,379	1,037	6,905
South Australia ..	100	..	1,285	..	..	1,430	2,815
Western Australia ..	7,087	238	116	187	830	38	8,496
Tasmania ..	48	517	1,577	1,318	220	714	4,394
Northern Territory ..	20	2	2	120	..	84	228
Commonwealth ..	13,320	2,831	5,380	4,415	25,405	6,791	58,142

The following table shows the number of persons engaged in mining in the Commonwealth during each of the years 1891, 1901, and 1920, together with the proportion of the total population so engaged. The general falling-off since 1901 is due to the stagnation caused by the war, the low price of industrial metals, and largely also to the decline in the gold-mining industry:—

PROPORTION OF PERSONS ENGAGED IN MINING, 1891, 1901, AND 1920.

State.	1891.		1901.		1920.	
	Miners Employed.	No. per 100,000 of Popu- lation.	Miners Employed.	No. per 100,000 of Popu- lation.	Miners Employed.	No. per 100,000 of Popu- lation.
New South Wales ..	30,604	2,700	36,615	2,685	29,163	1,409
Victoria ..	24,649	2,151	28,670	2,381	6,141	406
Queensland ..	11,627	2,934	13,352	2,664	6,905	924
South Australia ..	2,683	834	7,007	1,931	2,815	578
Western Australia ..	1,269	2,496	20,895	11,087	8,496	2,578
Tasmania ..	3,988	2,695	6,923	4,017	4,394	2,088
Northern Territory ..	..	..	..	..	228	..
Commonwealth ..	74,820	2,341	113,462	2,992	58,142	1,085

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, 1920.**—The following table gives particulars of the number of men killed and injured in mining accidents during the year 1920 :—

NUMBERS KILLED AND INJURED IN MINING ACCIDENTS, 1920.

Mining for—	N.S.W.	Victoria.	Q'land.	S. Aust.	W. Aust.	Tas.	N. T.	C'wealth.
KILLED.								
Coal and shale	20	1	2	..	..	..	..	23
Copper ..	..	..	6	1	..	1	..	8
Gold ..	..	3	..	..	20	..	..	23
Silver, lead, and zinc ..	..	..	..	..	1	..	..	1
Tin ..	2	..	1	..	..	..	..	3
Other minerals	2	..	1	..	..	..	..	3
Total ..	24	4	10	1	21	1	..	61
INJURED.								
Coal and shale	113	5	9	..	94	13	..	234
Copper ..	1	..	24	3	..	19	..	47
Gold ..	1	13	4	..	435	..	..	453
Silver, lead, and zinc ..	5	..	..	..	8	3	..	16
Tin ..	2	..	4	..	..	9	..	15
Other minerals	3	..	2	..	1	4	..	10
Total ..	125	18	43	3	538	48	..	775

§ 16. State Aid to Mining.

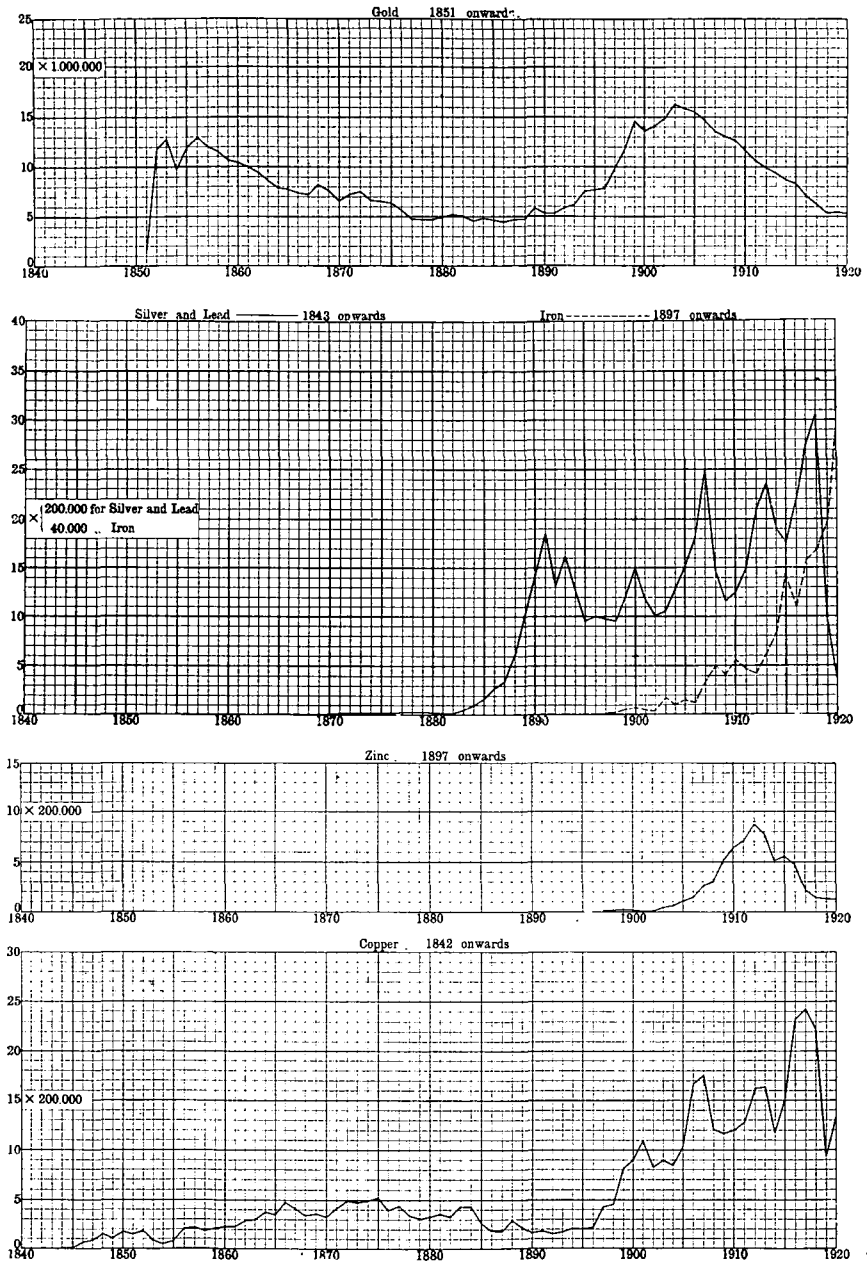
1. **Introduction.**—The terms and conditions under which the States granted aid in mining were alluded to at some length in previous issues (see Year Books 4 and 5), but owing to considerations of space they have been omitted from this issue. A résumé of what is being done in this direction at the present 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 1920 the total sum expended in this manner amounted to £505,037, of which £9,081 was advanced in 1920.

3. **Victoria.**—Since the passage of the Mining Development Act in 1897, the expenditure under its varying provisions has been £733,605, of which £339,635 was disbursed in connexion with advances for prospecting, £211,210 on boring, £69,603 on testing plants, £62,841 on roads and tracks, and £50,316 on purchase of cyanide plant, equipment of School of Mines, and miscellaneous. In 1920–21, £17,617 was expended as follows:—Construction and maintenance of State batteries, £4,611; boring, £11,180, advances to companies and private parties, £1,000, and £826 in geological and other surveys; in addition, £14,000 was lent to the Morning Star Gold Mine at Woods' Point, of which £3,000 has been repaid.

4. **Queensland.**—State assistance to the mining industry in 1920 amounted to £23,998, of which £5,732 consisted of loans in aid of deep sinking; £12,041 grants in aid of prospecting; £5,224 in aid of roads and bridges to gold and mineral fields; and £1,000 towards the cost of developing guano deposits. The Government acquired the smelters and plant of the Chillagoe Company in 1919, and operations were begun early in January, 1920, with two furnaces, one for the treatment of lead ore, and the other for copper ores. About 75 per cent. of the ore smelted in the copper furnace was supplied by the Einasleigh State Mine, and the Girofla Mine of the Mungana group furnished 80 per cent. of the ore dealt with in the lead furnace, the remainder being supplied by small producers. The State treatment works at Irvinebank produced 250 tons of tin from ore supplied by a number of customers. Small quantities of tin, wolfram, bismuth, and molybdenite were produced at the State Battery at Bamford.

GRAPHS SHEWING VALUES OF THE PRINCIPAL MINERALS PRODUCED IN THE
COMMONWEALTH, 1840 TO 1920.

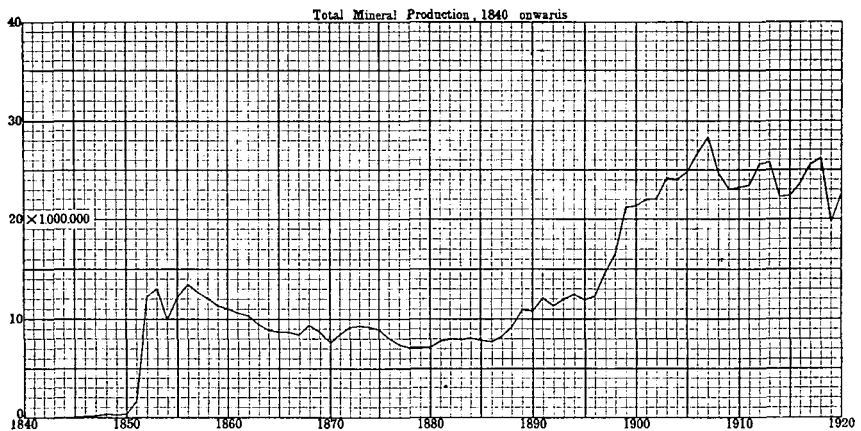
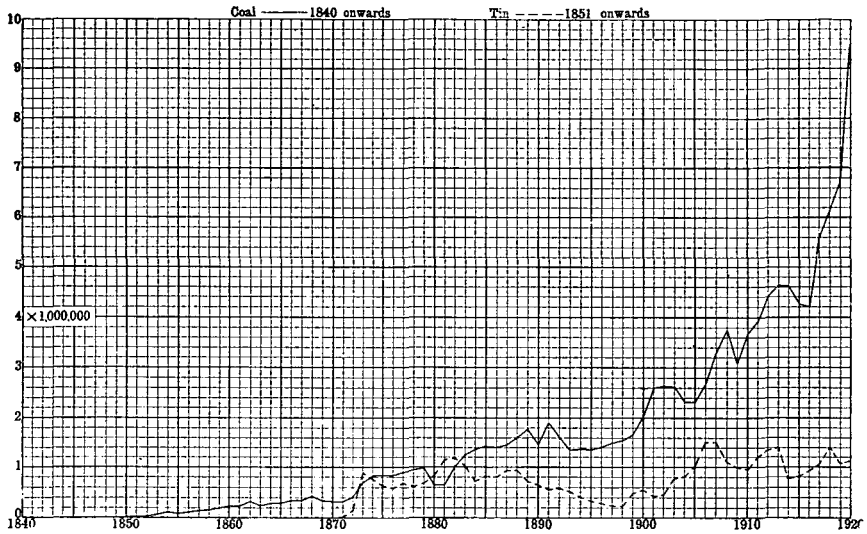


(See pages—for gold, 330 ; silver, 338 ; iron, 348 ; zinc, 347 ; copper, 341.)

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 1920.

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, in the case of silver and lead, zinc, and copper £200,000, and in the case of iron £40,000.

GRAPHS SHEWING VALUES OF THE PRINCIPAL MINERALS PRODUCED IN THE
COMMONWEALTH, 1840 TO 1920—*continued.*



(See pages 355 for coal ; 344 for tin ; and 329 for 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 1920.

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.

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 1920 the total amount of subsidy paid was £65,109, of which £11,265 has been repaid, and £2,250 written off, leaving a debit of £51,594. 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 1920 in accordance with the subjoined statement :—Advances in aid of mining work and equipment of mines with machinery, £23,467; aid to prospectors, £3,486; advances in aid of boring, £3,556; subsidies paid on stone crushed for the public, £291; making a total of £30,800. In addition a sum of £2,555 was expended on various matters such as water supply, assistance in carting ores, etc. The receipts under the Act, exclusive of interest payments, came to £2,653, of which £1,887 consisted of refunds of advances.

In 1920 there were 29 State batteries in operation. The amount expended thereon up to the end of 1920 was £91,981 from revenue and £292,596 from loan, giving a total of £384,577. During the year receipts amounted to £35,951, and working expenditure to £42,314.

The total value of gold and tin recovered to the end of 1920 at the State plants was £5,380,000, resulting from the treatment of 1,284,000 tons of gold ore and 80,000 tons of tin ore, together with a small amount from residues.

7. **Tasmania.**—During the year 1920, the sum of £1,505 was expended in aid to mining, including £450 for salaries, £99 for assay material, £250 assistance to prospectors, and an advance of £600 to the No. 6 Argent Prospecting Syndicate. On the other hand the receipts amounted to £2,237 of which £2,135 was royalty paid by tributers.

Tributers' surveys and assays are made free of charge by the Assay and Survey Office at Zeehan.

8. **Northern Territory.**—During the year 1919–20 the Government expenditure in aid of mining amounted to £4,976, of which £688 represented subsidies; £378 loss on crushing operations at Marranboy battery; £1,233 expenditure on driving and shaft sinking; £2,497 aid to Government prospecting party; and £180 cost of free assays. As it was considered that the method of assisting private prospectors was unsatisfactory the Government took over the control. The Government Prospecting Party was disbanded on the 30th June, 1920, and although no discovery of importance was made, useful information was obtained regarding the Central Tableland area and the headwater valleys and systems of the Katherine, Alligator, Mary, Waterhouse, Roper, and Ferguson rivers.

The Government maintains batteries at Marranboy and Hayes Creek. During the year the Government Assayer made 197 free assays for prospectors and others.

§ 17. Commonwealth Government Control of Industrial Metals.

The proclamation under the Customs Act prohibiting the exportation of metals without the consent of the Minister for Trade and Customs is still in force, but consent is granted in every case where the contract relating to the sale of the metals has been registered with the Australian Metal Exchange.

§ 18. Estimated Metallic Contents of Ores, etc., Produced in Australia.

1. **Local Production.**—According to returns compiled by the Secretary of the Australian Metal Exchange from information obtained from mining companies and metal smelting and refining works, the quantities of the principal metals (exclusive of gold) extracted within the Commonwealth during the five years 1917 to 1921 were as follows :—

REFINED METALS PRODUCED IN AUSTRALIA, 1917 TO 1921.

Metal.			1917.	1918.	1919.	1920.	1921.
Silver	..	ozs.	6,437,079	9,924,322	6,696,788	681,370	4,572,878
Lead, pig	..	tons	125,100	166,731	82,732	4,077	55,749
Zinc	..	tons	4,188	10,029	6,544	9,665	1,681
Copper	..	tons	35,989	44,018	16,182	24,069	18,600
Tin	..	tons	3,990	4,582	4,102	4,108	2,985

2. **Metallic Contents of Ores, Concentrates, etc., Exported.**—The estimated metallic contents of ores, concentrates, etc., exported during the five years 1917 to 1921 are given in the following table :—

ESTIMATED METALLIC CONTENTS OF ORES, CONCENTRATES, ETC., EXPORTED 1917 TO 1921.

Metal.		Contained in—	1917.	1918.	1919.	1920.	1921.
Silver	ozs. {	Lead, Silver, Gold Bullion	1,977,603	..	..	141,263	64,811
		Lead Concentrates	..	..	..	..	210,944
		Zinc Concentrates	1,582,575	5,666,809	1,161,754	980,891	456,317
		Total ..	3,560,178	5,666,809	1,161,754	1,122,154	732,072
Lead	tons {	Lead, Silver, Gold Bullion	22,766	..	..	1,939	580
		Lead Concentrates	..	..	..	4,122	3,950
		Zinc Concentrates	9,138	32,653	7,463	6,345	2,498
		Total ..	31,904	32,653	7,463	12,406	7,028
Zinc	tons {	Lead Concentrates	..	..	..	..	435
		Zinc Concentrates	45,851	23,335	20,608	24,242	19,181
		Total ..	45,851	23,335	20,608	24,242	19,616
Copper	tons	Ores, Matte, etc.	..	..	..	2,117	34
Tin	tons	Concentrates	847	..	..	70	5

The quantities and values of the principal metals, ores, and concentrates of Australian produce exported overseas as recorded by the Customs Department for the year 1920–21 were as follows :—Antimony ore, 463 tons, £10,865 (284 tons to United Kingdom); zinc, bars, blocks, and rods, 3,321 tons, £139,026 (of which 2,745 tons went to United Kingdom); zinc concentrates, 42,350 tons, £224,541 (14,786 tons to United Kingdom and 27,563 tons to Belgium); copper, ingots, 21,183 tons, £2,230,766 (19,124 tons to United Kingdom); copper, in matte, 2,473 tons, £192,408 (to United States); tin, ingots, 2,056 tons, £497,264 (1,381 tons to United Kingdom and 492 tons to United States); lead, pig, 19,769 tons, £667,919 (15,962 tons to United Kingdom, 1,800 tons to United States and 1,078 tons to Japan); lead, matte, 1,208 tons, £37,495 (to United Kingdom); silver and lead concentrates, 1,735 tons, £38,562 (1,193 tons to Belgium); molybdenite, 124 tons, £40,940 (to United Kingdom); wolfram, 311 tons, £48,276 (265 tons to France); platinum, osmium, iridium, etc., 2,586 ozs., £81,143 (587 ozs. to United Kingdom and 1,763 ozs. to United States); and pig iron, 9,034 tons, £75,069 (7,688 tons to New Zealand).