

CHAPTER XXVII.

MINERAL INDUSTRY.

NOTE.—Further detailed information on the subjects dealt with in this chapter is contained in the annual printed Bulletin *Primary Industries, Part II.—Non-Rural Industries and Value of Production* issued by this Bureau, and in *The Australian Mineral Industry—Annual Review* and other publications issued by the Bureau of Mineral Resources, Geology and Geophysics, which also issues, in co-operation with this Bureau, a quarterly publication *The Australian Mineral Industry*, comprising two parts—Part I.—Quarterly Review, and Part II.—Quarterly Statistics. The mimeograph statistical bulletin *Mining and Quarrying* of this Bureau contains annual statistics of the industry prepared and published as soon as possible after the data have been compiled. A monthly statistical bulletin *The Gold Mining Industry, Australia* is issued also, and other current information on mining or mine products is contained in the *Quarterly Summary of Australian Statistics*, the *Monthly Review of Business Statistics*, the *Digest of Current Economic Statistics*, and the *Monthly Bulletin of Production Statistics*.

§ 1. Introduction.

1. **Sources of Statistics.**—In the main, the data contained in this chapter consist of official statistics of the Mines Departments of the several States and of the Northern Territory Mines Branch. The particulars shown have been compiled as far as practicable on the standardized basis which has been used in Australia since 1950, and this presentation has involved some rearrangement of official statistics published by the Mines Departments in some States. These statistics have been supplemented, as necessary, by data obtained from the Statisticians of the several States, the Commonwealth Bureau of Mineral Resources, the Joint Coal Board, the Australian Mines and Metals Association (Inc.), the Mineral Resources Division of the United Kingdom Overseas Geological Surveys and from several other sources.

2. **Presentation of Mineral Statistics.**—(i) *Mineral Industry Data.* The mineral industry includes all mining and quarrying and the recovery of minerals from ore dumps, tailings, etc. Ore-dressing and elementary smelting of metallic minerals (e.g., in the case of gold) and miscellaneous treatment of non-metallic minerals, where these are carried out in an associated plant at or near the mine, are included in the mineral industry. However, establishments primarily engaged in smelting and/or refining (including the smelting and refining sections of the large plants operated at Mt. Morgan and Mt. Isa in Queensland and at Mt. Lyell in Tasmania) are omitted and classified to the manufacturing industry.

For mines and quarries which produce more than one product, it is not possible to apportion some particulars relating to the operations of the mine (employment, salaries and wages paid, and costs incurred in production) to the minerals produced. It is, therefore, the practice to record these data only as a total for each mine and then to classify each mine to the industry of the most important mineral produced. Thus a mine producing, say, both tin and tungsten minerals, would be classified as a tin mine if tin were the more important product by value, or vice versa if tungsten were the dominant product.

The mineral industries are classified into four major groups, namely, Metal Mining, Fuel Mining, Non-metal (excluding Fuel) Mining, and Construction Material Quarrying.

Mineral industry data have been obtained annually, since 1952, from the Mining and Quarrying Census. This census is carried out in collaboration with the several Mines Departments and involves the uniform collection of particulars from all establishments employing on the average four or more persons during the period worked by the mine. A representative specimen collection form is included in the Bulletin *Primary Industries, Part II.*, No. 53, 1958–59, pages 47 and 48. For smaller mines, either simplified Census returns covering number of persons employed and value of output are collected or these particulars are compiled from data made available by the Mines Departments.

Particulars of the uranium-mining industry are excluded, as are operations associated with the exploration for minerals, e.g. oil-search.

(ii) *Mineral Product Data.* In the preparation of Australian mineral production statistics, the quantities and values of individual minerals produced are reported in terms of the products in the form in which they are dispatched from the locality of each mine. For example, in the case of a metal mine, the output is recorded as ore when no treatment is undertaken at the mine, or as a concentrate where ore-dressing operations are carried out in associated works in the locality of the mine. In addition to the basic quantity data, the contents of metallic minerals and contents or average grade of selected non-metallic minerals

are reported. Whenever practicable, contents (based on assay) of metallic minerals are shown for each metal which is a "pay metal" or a "refiners' prize" when present in the particular mineral. Other metallic contents which are not recovered are excluded.

Minerals are divided into four major groups, namely, Metals, Fuels, Non-metals (excluding Fuels) and Construction Materials. In this chapter, individual mineral products are arranged in these four groups.

Particulars relating to uranium-bearing minerals are excluded.

3. Occurrences of Minerals.—The greatest part of the area of outcropping rock on the Australian continent is Precambrian in age. These basement rocks form the western and central core of the continent and are flanked by younger Palaeozoic rocks which, along the eastern edge of the continent, form a belt several hundred miles wide extending from north Queensland to Tasmania. Smaller areas of Palaeozoic rocks occur in other States. Mesozoic sediments overlies large areas of the continent and reach their greatest development in central Queensland. Cainozoic rocks occur mainly in the southern parts of Victoria and South Australia and as residual basalt cappings over an extensive area of the Palaeozoic rocks of eastern Australia.

Minerals occur widely throughout the Precambrian and Palaeozoic rocks of the continent. Palaeozoic mineralization is perhaps more varied, but the deposits now being worked are in general smaller than those found in Precambrian rocks. Most of the larger deposits of minerals now being mined in Australia are shown in the following table according to the geological era in which they were formed.

PRINCIPAL AUSTRALIAN MINERAL DEPOSITS.

Age of Geological Formation in which Located.	Metal or Mineral.	State or Territory.	Locality.
Precambrian (more than 520 million years old)	Copper ..	Queensland ..	Mt. Isa
	Gold ..	Northern Territory ..	Tennant Creek
		Western Australia ..	Kalgoorlie and other localities
	Iron ..	South Australia ..	Middleback Ranges
		Western Australia ..	Yampi Sound
	Lead-Silver-Zinc	New South Wales ..	Broken Hill
Palaeozoic (between 200 and 520 million years old)		Queensland ..	Mt. Isa
	Uranium ..	Queensland ..	Mary Kathleen
		South Australia ..	Radium Hill
		Northern Territory ..	Rum Jungle and South Alligator River Area
	Black Coal ..	New South Wales ..	Hunter Valley, Lithgow, South Coast
		Queensland ..	Baralaba, Blair Athol, etc.
		Western Australia ..	Collie
	Copper-Gold ..	Queensland ..	Mt. Morgan
		Tasmania ..	Mt. Lyell
	Lead-Silver-Zinc	New South Wales ..	Captain's Flat
		Tasmania ..	Mt. Read and Rosebery
	Tin (lode) ..	Queensland ..	Herberton
Mesozoic (between 75 and 200 million years old)		Tasmania ..	North-east of State
	Tungsten ..	Tasmania ..	King Island and North-east of State
	Black Coal ..	Queensland ..	Ipswich
		South Australia ..	Leigh Creek
		Tasmania ..	St. Marys
Cainozoic (less than 75 million years old)	Mineral Sands(a)	New South Wales ..	North Coast
		Queensland ..	South Coast
	Brown Coal ..	Victoria ..	Gippsland
	Tin (alluvial) ..	New South Wales ..	Tingha
		Queensland ..	Herberton
		Tasmania ..	North-east of State

(a) The deposition of mineral sands, derived from Palaeozoic granites, continued throughout the Cainozoic Era.

The large bauxite (aluminium) deposits of Cape York Peninsula in Queensland, for which an extensive mining programme is planned, were formed during the early part of the Cainozoic Era as a result of climatic conditions then prevailing.

Of the non-metallic minerals, many, such as clay, sand and silica, etc., are not restricted to the rocks of any particular era. However, Precambrian rocks do contain important deposits of asbestos in Western Australia, limestone and dolomite in South Australia, and mica in the Northern Territory. All crude salt is produced by the evaporation of water from pans constructed along the sea coast or from inland lakes.

4. Mineral Concentrates.—Concentration is a physical process involving the removal of mineral impurity from the ore. Most mines now dispatch ore in concentrate form as this considerably reduces the transport costs and produces a saleable product in the form required by smelters. Most concentrates are nearly pure mineral and the ore-dressing processes (with the exception of that for uranium) involve no chemical change to the mineral being won. Various methods are used in concentration. Sulphide ores which now comprise the greatest tonnages treated are, in most instances, separated from the gangue by flotation. In this method of concentration, the ore is ground finely enough to liberate the individual mineral particles, aerated, and agitated in tanks of water to which chemicals have been added. Under certain conditions, particles of one sulphide mineral adhere to the froth bubbles and are collected in the froth overflow, while gangue and even other sulphides are depressed. By treating the tailings of one flotation process with different chemicals and conditions, it is often possible to separate a further concentrate, as is done at Broken Hill where the zinc sulphide is recovered from the tailings of the lead sulphide concentration process. Differential flotation is most extensively developed at Captain's Flat, in New South Wales, where successive concentrates of copper, lead, zinc and pyrite are obtained from a lead-silver-zinc-copper ore.

Other methods of concentration used are gravity (alluvial tin, mineral sands, some lead-zinc ores), electromagnetic (wolfram, scheelite, glauconite and mineral sands) and electrostatic (mineral sands).

Particulars of an average Broken Hill ore mined during 1959, showing metal contents before and after differential flotation, are shown in the following table. It should be noted that in both the ore and the concentrate, lead and zinc are contained as the minerals lead sulphide and zinc sulphide respectively. Most of the silver is contained in minerals which are collected with the lead sulphide.

ORE TREATED AND CONCENTRATES PRODUCED BY DIFFERENTIAL FLOTATION AT BROKEN HILL (a), 1959.

Particulars.	Quantity.	Proportion of weight of ore mined.	Average Assays.			Proportion of Metal Distribution.		
			Lead.	Silver.	Zinc.	Lead.	Silver.	Zinc.
	tons.	%	%	f. oz.	%	%	%	%
Ore treated ..	1,869,528	100.0	13.0	4.5	11.2	100.0	100.0	100.0
Lead Concentrate	308,519	16.5	75.5	25.3	4.1	95.9	92.8	6.1
Zinc Concentrate	358,036	19.2	0.9	0.8	52.0	1.3	3.5	88.8
Residues(b) ..	1,202,973	64.3	0.6	0.3	0.9	2.8	3.7	5.1

(a) Average particulars for the five operating companies. (b) These are of no economic use at present and are either pumped as filling for underground workings or otherwise discarded.

§ 2. The Mineral Industry.

1. Persons Engaged.—In the following table, which shows particulars collected in the Population Censuses of Australia at 30th June, 1947 and 1954, the numbers of persons whose "industry" was stated to be "mining and quarrying" are shown together with the numbers engaged in all primary industries and the total work force.

PERSONS ENGAGED, AUSTRALIA.

Particulars.	At 30th June—	
	1947.	1954.
Persons Engaged in—		
Mining and Quarrying No.	57,574	62,107
All Primary Industries No.	563,697	560,100
Total Work Force No.	3,196,431	3,702,022
Persons Engaged in Mining and Quarrying as a proportion of—		
All Primary Industries %	10.2	11.1
Total Work Force %	1.8	1.7

Corresponding details from the 1961 Population Census are not yet available.

Particulars of the numbers of persons engaged in the various mining and quarrying industries, as collected in the Annual Mining and Quarrying Census, are included in paras. 4 (ii) and (iii), pages 1039–40.

2. **Size Classification of Mines and Quarries.**—Most of the mines and quarries worked during 1959 employed less than four persons, including working proprietors. However, more than half of the persons engaged in mining and quarrying were in the 55 mines each employing 200 persons or more. The following table shows the total number of mines grouped according to sizes in accordance with the average number of persons employed during the period worked by each mine in 1959. The details of persons employed are not directly comparable with the Population Census figures shown in the preceding table. For particulars of the method of compiling these industry statistics, *see* para. 2 (i), page 1033.

MINING AND QUARRYING: SIZE CLASSIFICATION OF ESTABLISHMENTS, 1959.

Mines and Quarries employing on the average(a)—	N.S.W.	Vic. (b)	Q'land.	S.A.	W.A.	Tas.	N.T.	Aust. (b) (c)
Less than 4 persons—								
Establishments ..	570	65	285	330	261	75	37	1,628
Persons ..	1,015	129	447	537	748	139	75	3,095
From 4 to 20 persons—								
Establishments ..	163	105	90	93	80	38	12	582
Persons ..	1,314	949	882	773	652	285	114	4,975
From 21 to 200 persons—								
Establishments ..	91	33	71	12	29	15	1	253
Persons ..	6,734	1,523	(d)	(d)	1,794	727	94	14,755
More than 200 persons—								
Establishments ..	32	3	4	2	10	3	1	55
Persons ..	13,600	1,556	(d)	(d)	5,176	1,675	235	26,877
Total—								
Establishments ..	856	206	450	437	380	131	51	2,518
Persons ..	22,663	4,157	8,705	2,422	8,370	2,826	518	49,702

(a) Average during period worked. Includes working proprietors. producers in Victoria for which employment figures are not available.

(b) Excludes 13 salt
(c) Includes Australian

(d) Not available for publication; included in totals.

3. **Value of Production.**—(i) *General.* In 1959, the local value of mining and quarrying in Australia (the value of output, or the selling value of mine and quarry products at the mine or quarry) was £164,985,000, or 11.6 per cent. of the production of all primary industries. The most important State was New South Wales with £71,090,000, followed by Queensland with £33,329,000 and Western Australia with £21,787,000.

(ii) *Local and Net Values of Production, 1959.* Local and net values of mining and quarrying production for each State are shown for 1959 in the following table. A more detailed reference to the value of production of mining and quarrying and other industries in Australia as well as a brief explanation of the terms used will be found in Chapter XXX.—Miscellaneous.

MINING AND QUARRYING: LOCAL AND NET VALUES OF PRODUCTION, 1959.
(£'000.)

State or Territory.	Local Value (Value of Output at Mine or Quarry).	Cost of Power, Fuel, Light and Other Materials and Stores Used.	Net Value. (a)
New South Wales	71,090	14,759	56,331
Victoria	14,935	2,834	12,101
Queensland	33,329	8,848	24,481
South Australia	13,209	2,511	10,698
Western Australia	21,787	7,022	14,765
Tasmania	7,639	2,241	5,398
Northern Territory	2,727	525	2,202
Australian Capital Territory	269	90	179
Australia	164,985	38,830	126,155

(a) Local value less cost of power, fuel, light and other materials and stores used; depreciation and maintenance costs have not been deducted.

(iii) *Local Values, 1955 to 1959.* In the following table, the local values of mining and quarrying production are shown by States and Territories for the years 1955 to 1959:—

MINING AND QUARRYING: LOCAL VALUE OF PRODUCTION.(a)
(£'000.)

Year.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	A.C.T.	Aust.
1955 ..	84,244	10,917	26,892	10,512	19,746	10,744	1,691	125	164,871
1956 ..	88,790	11,891	30,204	11,910	20,230	10,555	2,594	146	176,320
1957 ..	83,170	12,728	25,576	11,872	20,979	8,421	2,195	170	165,111
1958 ..	71,414	13,694	27,632	12,308	20,777	7,358	2,564	208	155,955
1959 ..	71,090	14,935	33,329	13,209	21,787	7,639	2,727	269	164,985

(a) Value of output or selling value of products at the mine or quarry.

(iv) *Net Values of Production, 1955 to 1959.* In the following table, the net value of production of mining and quarrying products and the value per head of population are shown by States and Territories for the years 1955 to 1959.

MINING AND QUARRYING: NET VALUE OF PRODUCTION.(a)

Year.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	A.C.T.	Aust.
NET VALUE OF PRODUCTION.(a) (£'000.)									
1955	69,262	8,869	21,732	8,452	14,143	8,612	1,377	63	132,510
1956	72,053	9,457	24,148	9,487	14,350	8,298	2,084	105	139,982
1957	66,091	9,944	18,810	9,320	14,889	5,897	1,741	110	126,802
1958	55,801	10,987	19,796	9,999	14,454	5,168	1,997	134	118,336
1959	56,331	12,101	24,481	10,698	14,765	5,398	2,202	179	126,155
NET VALUE OF PRODUCTION(a) PER HEAD OF POPULATION. (£.)									
1955	19.8	3.5	16.2	10.3	21.4	27.2	80.8	1.9	14.4
1956	20.3	3.6	17.7	11.2	21.2	25.8	116.4	3.0	14.8
1957	18.2	3.6	13.5	10.7	21.5	17.9	93.0	2.9	13.2
1958	15.1	4.0	14.0	11.1	20.5	15.3	103.9	3.3	12.0
1959	15.0	4.3	17.0	11.6	20.5	15.7	107.5	3.8	12.5

(a) Local value, or value of output, less cost of power, fuel, light and other materials and stores used; depreciation and maintenance costs have not been deducted.

4. Statistics of the Principal Mining and Quarrying Industries.—(i) *Summary, 1959.* In the next table, statistics of numbers of mines and quarries, persons employed, local and net value of production and other particulars are shown for the major industry groups for the year 1959. For particulars of the method of compiling these industry statistics, see para. 2 (i), page 1033.

MINING AND QUARRYING: SUMMARY OF OPERATIONS, INDUSTRY GROUPS, AUSTRALIA, 1959.

Industry Group.	Mines and Quarries.	Persons Employed. (a)	Salaries and Wages Paid. (b)(c)	Local Value of Production. (d)	Total Fuel, Materials, etc., Used.	Net Value of Production. (e)	Value of Additions and Replacements to Fixed Assets.(b)
	No.	No.	£'000.	£'000.	£'000.	£'000.	£'000.
Metal Mining ..	756	20,256	26,218	77,522	21,545	55,977	10,229
Fuel Mining ..	226	20,197	25,147	55,334	10,759	44,575	11,361
Non-metal (excluding Fuel) Mining(f) ..	687	2,975	2,631	10,555	2,359	8,196	1,454
<i>Total, All Mining ..</i>	<i>1,669</i>	<i>43,428</i>	<i>53,996</i>	<i>143,411</i>	<i>34,663</i>	<i>108,748</i>	<i>23,044</i>
Construction Material Quarrying(g) ..	862	4,116	3,490	21,574	4,167	17,407	1,408
<i>Total All Mining and Quarrying</i>	<i>2,531</i>	<i>47,544</i>	<i>57,486</i>	<i>164,985</i>	<i>38,830</i>	<i>126,155</i>	<i>24,452</i>

(a) Average number employed (including working proprietors) during whole year. (b) Excludes mines and quarries employing less than four persons. (c) Excludes drawings by working proprietors; he amounts are net after deducting value of explosives sold to employees. (d) Value of output or selling value of products at mine or quarry. (e) Local value less cost of power, fuel, light and other materials and stores used; depreciation and maintenance costs have not been deducted. (f) Incomplete for some industries outside the normal administrative control of State Mines Departments (e.g., clays and salt). (g) Incomplete owing to difficulties of coverage.

In the next table, statistics of numbers of mines and quarries, persons employed, local and net value of production are shown for each State, the Northern Territory, and the Australian Capital Territory for the year 1959:—

MINING AND QUARRYING: SUMMARY OF OPERATIONS, 1959.

State or Territory.	Mines and Quarries.	Persons Employed. (a)	Salaries and Wages Paid. (b)(c)	Local Value of Production. (d)	Total Fuel, Materials, etc., Used.	Net Value of Production. (e)	Value of Additions and Replacements to Fixed Assets. (b)
	No.	No.	£'000.	£'000.	£'000.	£'000.	£'000.
New South Wales ..	856	21,998	27,084	71,090	14,759	56,331	8,091
Victoria ..	219	3,507	4,558	14,935	2,834	12,101	4,539
Queensland ..	450	8,434	11,044	33,329	8,848	24,481	7,095
South Australia ..	437	2,243	1,917	13,209	2,511	10,698	1,039
Western Australia ..	380	8,105	8,845	21,787	7,022	14,765	2,695
Tasmania ..	131	2,724	3,276	7,639	2,241	5,398	521
Northern Territory ..	51	492	723	2,727	525	2,202	471
Aust. Cap. Territory ..	7	41	39	269	90	179	1
Australia ..	2,531	47,544	57,486	164,985	38,830	126,155	24,452

(a) Average number employed (including working proprietors) during whole year. (b) Excludes mines and quarries employing less than four persons. (c) Excludes drawings by working proprietors; the amounts are net after deducting value of explosives sold to employees. (d) Value of output or selling value of products at mine or quarry. (e) Local value less cost of power, fuel, light and other materials and stores used; depreciation and maintenance costs have not been deducted.

(ii) *Employment in Mining and Quarrying, 1959.* The following table shows the average numbers engaged in the various mining industries in each State or Territory in 1959.

MINING AND QUARRYING: EMPLOYMENT(a), 1959.

Industry.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	A.C.T.	Aust.
Metal Mining—									
Gold Mining ..	8	244	131	6	5,404		155	..	5,948
Lead-Silver-Zinc Mining ..	5,601	..	(b)	(b)	47	(b)	..	..	9,031
Copper-Gold Mining ..	29	(b)	(b)	7	202	(b)	240	..	2,301
Tin Mining ..	126	..	283	..	43	454	20	..	926
Mineral Sands Mining ..	601	..	326	..	92	..	..	..	1,019
Other Metal Mining ..	74	(b)	32	(b)	369	(b)	12	..	1,031
Total, Metal Mining	6,439	258	(b)	(b)	6,157	2,097	427	..	20,256
Fuel Mining—									
Black Coal Mining—									
Underground ..	13,296	401	(b)	..	(b)	(c) 314	..	..	c 18,094
Opencut ..	149	..	(b)	251	(b)	..	..	..	584
Total ..	13,445	401	3,172	251	1,095	314	..	..	18,678
Brown Coal Mining ..	..	1,519	..	..	..	..	..	..	1,519
Total, Fuel Mining	13,445	1,920	3,172	251	1,095	314	..	..	20,197
Non-metal (excluding Fuel) Mining(d) ..	1,042	283	(b)	(b)	565	137	26	(e)	2,975
Total, All Mining	20,926	2,461	7,892	1,331	7,817	2,548	453	(e)	43,428
Construction Material Quarrying(f) ..	1,072	1,046	542	912	288	176	39	41	4,116
Total, All Mining and Quarrying ..	21,998	3,507	8,434	2,243	8,105	2,724	492	41	47,544

(a) Average employment during whole year, including working proprietors. (b) Not available for publication. (c) Includes persons engaged by one mine which has both underground and opencut workings. (d) Incomplete for some industries outside the normal administrative control of State Mines Departments (e.g. clays and salt). (e) Not available for publication; included with "Construction Material Quarrying". (f) Incomplete owing to difficulties of coverage.

(iii) *Employment in Mining and Quarrying, 1955 to 1959.* The following table shows particulars of mining employment in Australia for the years 1955 to 1959. The figures show the average number of persons employed during the whole year.

MINING AND QUARRYING: EMPLOYMENT(a), AUSTRALIA.

Industry.	1955.	1956.	1957.	1958.	1959.
<i>Metal Mining—</i>					
Gold Mining	6,753	6,488	6,205	5,901	5,948
Lead-Silver-Zinc Mining	10,076	10,627	10,354	9,461	9,031
Copper-Gold Mining	2,127	2,301	2,151	2,057	2,301
Tin Mining	937	938	856	944	926
Mineral Sands Mining	891	1,592	2,062	1,102	1,019
Other Metal Mining	1,273	1,407	1,300	1,030	1,031
<i>Total, Metal Mining</i>	<i>22,057</i>	<i>23,353</i>	<i>22,928</i>	<i>20,495</i>	<i>20,256</i>
<i>Fuel Mining—</i>					
Black Coal Mining	25,660	23,895	22,345	20,795	18,678
Brown Coal Mining	1,502	1,566	1,579	1,540	1,519
<i>Total, Fuel Mining</i>	<i>27,162</i>	<i>25,461</i>	<i>23,924</i>	<i>22,335</i>	<i>20,197</i>
<i>Non-metal (excluding Fuel) Mining(b)</i>	<i>2,678</i>	<i>2,708</i>	<i>2,749</i>	<i>2,728</i>	<i>2,975</i>
<i>Total, All Mining</i>	<i>51,897</i>	<i>51,522</i>	<i>49,601</i>	<i>45,558</i>	<i>43,428</i>
<i>Construction Material Quarrying(b)</i>	<i>4,197</i>	<i>4,329</i>	<i>4,640</i>	<i>4,581</i>	<i>4,116</i>
Total, All Mining and Quarrying ..	56,094	55,851	54,241	50,139	47,544

(a) Average employment during whole year, including working proprietors.

(b) Incomplete.

(iv) *Salaries and Wages Paid in Mining, 1955 to 1959.* Salaries and wages paid in the mining and quarrying industries in Australia during each year 1955 to 1959 are shown in the following table. Information regarding rates of wages paid in the mining industry is shown in Chapter XII.—Labour, Wages and Prices (p. 426) and also in the *Labour Report*.

MINING AND QUARRYING: SALARIES AND WAGES PAID(a), AUSTRALIA.

(£'000.)

Industry.	1955.	1956.	1957.	1958.	1959.
<i>Metal Mining—</i>					
Gold Mining	6,344	6,551	6,422	6,492	6,504
Lead-Silver-Zinc Mining	15,154	17,299	16,241	13,462	13,944
Copper-Gold Mining	1,867	2,114	2,289	2,362	2,710
Tin Mining	734	733	753	737	814
Mineral Sands Mining	819	1,644	2,177	1,327	1,188
Other Metal Mining	1,328	1,504	1,402	1,108	1,058
<i>Total, Metal Mining</i>	<i>26,246</i>	<i>29,845</i>	<i>29,284</i>	<i>25,488</i>	<i>26,218</i>
<i>Fuel Mining—</i>					
Black Coal Mining	26,065	25,862	25,105	24,501	23,437
Brown Coal Mining	1,761	1,649	1,640	1,694	1,710
<i>Total, Fuel Mining</i>	<i>27,826</i>	<i>27,511</i>	<i>26,745</i>	<i>26,195</i>	<i>25,147</i>
<i>Non-metal (excluding Fuel) Mining(b)</i>	<i>2,105</i>	<i>2,300</i>	<i>2,400</i>	<i>2,384</i>	<i>2,631</i>
<i>Total, All Mining</i>	<i>56,177</i>	<i>59,656</i>	<i>58,429</i>	<i>54,067</i>	<i>53,996</i>
<i>Construction Material Quarrying(b)</i>	<i>2,439</i>	<i>2,738</i>	<i>3,219</i>	<i>3,241</i>	<i>3,490</i>
Total, All Mining and Quarrying ..	58,616	62,394	61,648	57,308	57,486

(a) Excludes mines and quarries employing less than four persons, and drawings by working proprietors; the amounts are net after deducting value of explosives sold to employees. (b) Incomplete.

(v) *Accidents in Mining.* Particulars of numbers of persons killed and injured in accidents in mines and associated treatment plants are recorded by State Mines Departments. Numbers injured are not reported on a uniform basis in all States, as varying criteria are used in determining what constitutes injury for the purpose of these records. In 1959, 29 persons were recorded as having been killed and 1,565 as having been injured in mining (excluding quarrying) accidents. Recorded deaths and injuries in that year were highest in black coal mines (13 and 444, respectively), lead-silver-zinc mines (8 and 434) and gold mines (3 and 406).

(vi) *Local and Net Values of Mining and Quarrying Production, 1959.* The following two tables show particulars of the local and net value of production for individual mining and quarrying industries and for all mining and quarrying for the year 1959. It should be noted that these statistics are on an industry basis and not by product. For particulars of the method of compiling these industry statistics see para. 2 (i), page 1033.

MINING AND QUARRYING: LOCAL VALUE OF PRODUCTION(a), 1959.

(£'000.)

Industry.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	A.C.T.	Aust.
<i>Metal Mining—</i>									
Gold Mining	7	585	272	(b)	14,153	..	901	..	15,918
Lead-Silver-Zinc Mining ..	20,947	..	(c)	1	82	(c)	..	..	40,294
Cooper-Gold Mining	25	(c)	(c)	4	322	(c)	1,455	..	7,546
Tin Mining	151	..	959	..	152	906	7	..	2,175
Mineral Sands Mining ..	2,453	..	2,362	..	317	..	..	..	5,132
Other Metal Mining ..	148	(c)	113	4,340	1,499	(c)	43	..	6,457
<i>Total, Metal Mining</i>	<i>23,731</i>	<i>616</i>	<i>23,784</i>	<i>4,345</i>	<i>16,525</i>	<i>6,115</i>	<i>2,406</i>	<i>..</i>	<i>77,522</i>
<i>Fuel Mining—</i>									
Black Coal Mining ..	37,437	455	7,354	946	2,357	662	..	..	49,211
Brown Coal Mining ..	..	6,123	..	..	..	..	..	..	6,123
<i>Total, Fuel Mining ..</i>	<i>37,437</i>	<i>6,578</i>	<i>7,354</i>	<i>946</i>	<i>2,357</i>	<i>662</i>	<i>..</i>	<i>..</i>	<i>55,334</i>
<i>Non-metal (excluding Fuel)</i>									
<i>Mining—</i>									
Clays(d)	1,003	1,144	99	351	197	84	..	(e)	2,878
Gypsum	206	53	..	348	33	..	..	..	640
Limestone	953	589	(c)	812	(c)	224	..	..	3,145
Salt .. ..	..	108	(c)	716	(c)	..	20	..	1,023
Other Non-metal (excluding Fuel) Mining	642	5	20	695	1,447	15	45	..	2,869
<i>Total, Non-metal (excluding Fuel) Mining ..</i>	<i>2,804</i>	<i>1,899</i>	<i>718</i>	<i>2,922</i>	<i>1,824</i>	<i>323</i>	<i>65</i>	<i>(e)</i>	<i>10,555</i>
<i>Total, All Mining ..</i>	<i>63,972</i>	<i>9,093</i>	<i>31,856</i>	<i>8,213</i>	<i>20,706</i>	<i>7,100</i>	<i>2,471</i>	<i>(e)</i>	<i>143,411</i>
<i>Construction Material Quarrying(d) ..</i>	<i>7,118</i>	<i>5,842</i>	<i>1,473</i>	<i>4,996</i>	<i>1,081</i>	<i>539</i>	<i>256</i>	<i>269</i>	<i>21,574</i>
<i>Total, All Mining and Quarrying ..</i>	<i>71,090</i>	<i>14,935</i>	<i>33,329</i>	<i>13,209</i>	<i>21,787</i>	<i>7,639</i>	<i>2,727</i>	<i>269</i>	<i>164,985</i>

(a) Value of output or selling value of products at the mine or quarry.

(b) Less than £500.

(c) Not available for publication.

(d) Incomplete.

(e) Not available for publication; included with "Construction Material Quarrying".

MINING AND QUARRYING: NET VALUE OF PRODUCTION(a), 1959.
(£'000.)

Industry.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	A.C.T.	Aust.
Metal Mining—									
Gold Mining ..	6	441	214	(b)	9,400	..	788	..	10,849
Lead-Silver-Zinc Mining ..	15,564	..	(c)	(c)	66	(c)	..	..	29,927
Copper-Gold Mining ..	(d)—9	(c)	(c)	3	145	(c)	1,141	..	4,221
Tin Mining ..	133	..	714	..	83	728	5	..	1,663
Mineral Sands Mining ..	1,829	..	1,739	..	216	..	..	..	3,784
Other Metal Mining ..	129	(c)	107	(c)	1,141	(c)	34	..	5,533
Total, Metal Mining	17,652	471	(c)	(e)	11,051	4,161	1,968	..	55,977
Fuel Mining—									
Black Coal Mining ..	29,447	336	6,186	770	1,765	541	..	..	39,045
Brown Coal Mining ..	..	5,530	..	..	..	..	..	..	5,530
Total, Fuel Mining ..	29,447	5,866	6,186	770	1,765	541	..	..	44,575
Non-metal (excluding Fuel) Mining—									
Clays(e) ..	793	1,083	(f) 99	324	104	77	..	(g)	(h)2,480
Gypsum ..	165	43	..	275	28	..	..	..	511
Limestone ..	635	320	(c)	692	(c)	161	..	..	2,176
Salt ..	..	(f) 108	(c)	563	(c)	..	(f) 20	..	(h) 831
Other Non-metal (excluding Fuel) Mining ..	521	(f) 5	(f) 20	(c)	(c)	13	43	..	(h)2,198
Total, Non-metal (excluding Fuel) Mining ..	2,114	1,559	(c)	(c)	1,206	251	63	(g)	8,196
Total, All Mining ..	49,213	7,896	23,508	7,125	14,022	4,953	2,031	(g)	108,748
Construction Material Quarrying(e) ..	(f)7,118	4,205	973	3,573	743	445	171	179	h 17,407
Total, All Mining and Quarrying ..	56,331	12,101	24,481	10,698	14,765	5,398	2,202	179	126,155

(a) Local value (i.e., value of output at mine) less cost of power, fuel, light and other materials and stores used; depreciation and maintenance costs have not been deducted. (b) Less than £500. (c) Not available for publication. (d) Cost of materials used, etc., exceeds value of output. (e) Incomplete. (f) No allowance has been made for costs of power, fuel, light and other materials and stores used, particulars for which are not available. (g) Not available for publication; included with "Construction Material Quarrying". (h) For this industry, refer to footnote (f) for the States concerned.

§ 3. Mineral Production.

1. Quantity of Principal Minerals Produced in 1959.—In the following table, particulars of the quantity of the principal minerals produced during 1959 are shown for each State and the Northern Territory:—

QUANTITY OF PRINCIPAL MINERALS PRODUCED, 1959.

Mineral.	Unit.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	Aust. (a)
METALLIC MINERALS.									
Antimony Ore and Concentrate ..	ton	1,021	1	..	..	..	..	..	1,022
Bauxite ..	..	4,244	3,464	..	..	7,277	..	..	14,985
Beryllium Ore ..	..	48	..	1	1	267	..	..	317
Chromite ..	..	..	120	..	..	..	..	..	120
Copper Ore(b) ..	..	58	120	65,505	(c) 160	11,859	..	36	77,738
Copper Concentrate ..	..	4,843	263,815	..	..	4,409	50,144	35,563	358,774
Copper Precipitate ..	..	124	..	29	..	..	25	1,201	1,379
Gold Concentrate ..	..	..	1,487	..	..	..	..	..	1,487
Gold—Other Forms(d) ..	oz.	515	36,486	(e)	(e)	(e)	(e)	(e)	(e)
Ilmenite Concentrate ..	ton	230	..	..	..	83,347	..	..	83,577
Iron Ore(f) ..	'000 tons	181	..	12,468	(c) 44	727	..	..	4,141
Lead Ore(g) ..	ton	..	..	..	..	..	..	..	12,693
Lead Concentrate ..	..	323,633	..	120,091	..	1,903	15,428	..	461,055
Lead-Copper Concentrate ..	..	..	..	..	..	..	6,010	..	6,010
Manganese Ore ..	..	2,578	..	9,666	..	75,733	..	1,994	89,971
Pyrite Concentrate ..	..	34,550	..	17,410	57,534	53,030	60,480	..	223,004
Rutile Concentrate ..	..	46,283	..	35,522	..	100	..	..	81,905
Tantalite-Columbite Concentrate ..	lb.	..	..	..	..	18,950	..	..	18,950
Tin Concentrate ..	ton	240	..	1,547	..	250	1,252	15	3,304
Tungsten Concentrates—	..	..	..	..	..	..	..	..	..
Scheelite Concentrate ..	..	1	..	..	..	..	..	..	1
Wolfram Concentrate ..	..	..	..	..	..	..	891	12	903
Zinc Concentrate ..	..	387,452	..	26,619	..	..	59,205	..	473,276
Zircon Concentrate ..	..	71,777	..	34,792	..	6,787	..	..	113,556

NOTE.—See next page for footnotes.

QUANTITY OF PRINCIPAL MINERALS PRODUCED, 1959—*continued*.

Mineral.	Unit.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	Aust. (a)
FUEL MINERALS.									
Coal, Black—									
Semi-anthracite ..	'000 tons	..	..	52	..	..	2	..	54
Bituminous ..	"	15,712	90	2,477	..	..	297	..	18,576
Sub-bituminous ..	"	..	..	66	690	912	..	..	1,668
<i>Total</i> ..	"	15,712	90	2,595	690	912	299	..	20,298
Coal, Brown (Lignite) ..	"	..	13,035	..	..	..	..	..	13,035

NON-METALLIC (EXCLUDING FUEL) MINERALS.

Asbestos ..	short ton	726	..	..	..	17,149	..	..	17,875
Barite ..	ton	60	..	..	6,145	..	9	..	6,214
Clays—									
Brick Clay and Shale...	'000 tons	1,894	(c) 1,122	290	441	(c) 398	154	..	4,299
Other(h) ..	"	441	196	9	92	50	35	..	823
Diatomite ..	ton	4,409	680	..	..	..	..	..	5,089
Dolomite(i) ..	"	3,776	..	2,000	151,401	..	2,907	..	160,084
Felspar ..	"	4,700	..	..	654	1,396	..	..	6,750
Gypsum ..	"	101,143	81,101	..	296,816	37,731	..	..	516,791
Limestone(i) ..	'000 tons	2,056	1,120	(j)	1,017	(j)	230	..	5,305
Magnesite ..	ton	59,777	..	..	790	19	..	..	60,586
Mica—Muscovite, trimmed	lb.	..	..	..	..	..	..	33,665	33,665
Salt, Crude ..	ton	..	70,135	(j)	357,802	(j)	..	1,221	467,532
Silica (Glass, Chemical, etc.)(h) ..	"	125,918	..	1,594	13,607	7,140	6,519	..	154,778
Talc ..	"	1,089	..	..	11,239	4,048	..	..	16,376

CONSTRUCTION MATERIALS.(k)

Sand ..	'000 tons	2,145	1,158	(l)	1,307	(l)	9	4	4,623
River Gravel and Gravel	"	..	..	..	..	..	..	..	..
Boulders ..	"	1,408	143	(l)	559	(l)	382	32	2,524
Dimension Stone ..	"	157	4	6	44	72	(m)	(m)	283
Crushed and Broken Stone	"	2,441	6,566	2,358	6,986	928	432	111	19,822
Other (Decomposed Rock, etc.) ..	"	13,034	651	(l)	(l)	(l)	11	3	13,699

(a) Excludes Australian Capital Territory where production is confined to brick clay mining and construction material quarrying. (b) Includes cupreous ore for fertilizer. (c) Estimated.
 (d) Bullion, alluvial, retorted gold, etc. (e) Gross weight not available. (f) Iron oxide for metal extraction. (g) Includes lead-silver ore. (h) Incomplete; figures relate only to production reported by Mines Departments. (i) Excludes quantities used directly as a building or road material. (j) Not available for publication. (k) Incomplete owing to difficulties of coverage. (l) Not available.
 (m) Less than 500 tons.

NOTE.—Particulars of uranium concentrate produced are not available for publication and have been excluded from the table above.

2. Quantities of Principal Minerals Produced, Australia.—The following table shows the quantities of the principal minerals produced in Australia during the years 1955 to 1959.

QUANTITIES OF PRINCIPAL MINERALS PRODUCED: AUSTRALIA.(a)

Mineral.	Unit.	1955.	1956.	1957.	1958.	1959.
METALLIC MINERALS.						
Antimony Ore and Concentrate	ton	650	547	852	1,116	1,022
Bauxite	"	7,563	10,329	7,707	6,909	14,985
Beryllium Ore	"	206	318	395	247	317
Chromite	"	..	6,096	3,049	776	120
Copper Ore(b)	"	47,381	47,209	56,447	58,109	77,738
Copper Concentrate	"	192,770	205,304	222,168	279,976	358,774
Copper Precipitate	"	182	134	557	1,536	1,379
Gold Concentrate	"	(c)171	107	(c)959	1,855	1,487
Gold—Other Forms(d)	oz.	(e)	(e)	(e)	(e)	(e)
Ilmenite Concentrate	ton	535	4,274	71,155	69,948	83,577
Iron Ore(f)	'000 tons	3,562	3,914	3,801	3,917	4,141
Lead Ore(g)	ton	23,483	20,121	20,758	21,854	12,693
Lead Concentrate	"	484,941	475,731	497,404	492,908	461,055
Lead-Copper Concentrate	"	5,878	6,315	7,366	7,630	6,010
Manganese Ore	"	47,356	59,384	77,010	59,683	89,971
Pyrite Concentrate	"	217,621	171,859	229,125	226,744	223,004
Rutile Concentrate	"	59,613	96,816	128,903	83,328	81,905
Tantalite-Columbite Concentrate	lb.	27,139	159,655	50,038	13,507	18,950
Tin Concentrate	ton	2,890	2,926	2,867	3,128	3,304
Tungsten Concentrates—						
Scheelite Concentrate	"	1,449	1,495	1,449	733	1
Wolfram Concentrate	"	788	877	656	517	903
Zinc Concentrate	"	492,549	530,777	556,763	503,752	473,276
Zircon Concentrate	"	48,673	72,458	88,561	59,269	113,356

FUEL MINERALS.

<i>Coal, Black—</i>						
Semi-anthracite	'000 tons	82	81	71	57	54
Bituminous	"	17,610	17,681	18,229	18,616	18,576
Sub-bituminous	"	1,583	1,512	1,619	1,769	1,668
<i>Total</i>	"	<i>19,275</i>	<i>19,274</i>	<i>19,919</i>	<i>20,442</i>	<i>20,298</i>
Coal, Brown (Lignite)	"	10,112	10,560	10,741	11,644	13,035

NON-METALLIC (EXCLUDING FUEL) MINERALS.

Asbestos	short ton	5,994	9,709	14,670	15,568	17,875
Barite	ton	6,264	6,009	9,778	6,802	6,214
<i>Clays—</i>						
Brick Clay and Shale	'000 tons	3,556	3,426	3,531	3,829	4,299
Other(j)	"	778	717	748	775	823
Diatomite	ton	5,042	5,789	6,221	4,240	5,089
Dolomite(j)	"	111,417	115,564	192,103	138,832	160,084
Felspar	"	20,833	18,629	8,819	7,016	6,750
Gypsum	"	470,014	463,355	478,436	504,938	516,791
Limestone(j)	'000 tons	3,998	4,264	4,572	5,324	5,305
Magnesite	ton	57,674	64,685	83,473	69,391	60,586
Mica—Muscovite, trimmed	lb.	56,649	28,837	36,713	31,391	33,665
Salt, Crude	ton	369,323	408,689	427,600	429,534	467,532
Silica (Glass, Chemical, etc.)(i)	"	121,268	142,485	149,339	145,483	154,778
Talc	"	12,691	13,160	14,441	15,393	16,376

NOTE.—See next page for footnotes.

QUANTITIES OF PRINCIPAL MINERALS PRODUCED: AUSTRALIA(a)—*continued.*

Mineral.	Unit.	1955.	1956.	1957.	1958.	1959.
CONSTRUCTION MATERIALS. (k)						
Sand	'000 tons	3,732	4,314	4,126	4,118	4,623
River Gravel and Gravel Boulders	"	1,743	2,116	1,764	2,265	2,524
Dimension Stone	"	274	231	230	272	283
Crushed and Broken Stone	"	13,367	14,817	15,404	15,543	19,822
Other (Decomposed Rock, etc.)	"	10,758	11,113	12,546	12,722	13,699

(a) Excludes Australian Capital Territory where production is confined to brick clay mining and construction material quarrying. (b) Includes cupreous ore for fertilizer. (c) Includes a small quantity of gold ore. (d) Bullion, alluvial, retorted gold, etc. (e) Gross weight not available. (f) Iron oxide for metal extraction. (g) Includes lead-silver ore. (h) Includes a small quantity of lead-zinc ore. (i) Incomplete; figures relate only to production reported by Mines Departments. (j) Excludes quantities used directly as a building or road material. (k) Incomplete owing to difficulties of coverage.

NOTE.—Particulars of uranium concentrate produced are not available for publication and have been excluded from the table above.

3. Contents of Metallic Minerals Produced in 1959.—The following table shows the contents of metallic minerals produced in 1959 which were "pay metals" or which were recovered as "refiners' prizes". Further particulars for earlier years are shown in the following paragraph and in the sections later in this chapter covering principal contents.

CONTENTS OF METALLIC MINERALS PRODUCED, 1959.

Content of Metallic Minerals Produced.	Unit.	N.S.W.	Vic.	Q'land.	S. Aust.	W. Aust.	Tas.	N.T.	Aust.
Alumina (Al ₂ O ₃)	ton	1,648	1,991	..	..	(a) 3,275	..	..	6,914
Antimony	"	1,279	1	..	..	..	..	..	1,280
Beryllium Oxide (BeO)	unit (b)	560	..	(a) 5	(a) 12	3,010	..	..	3,587
Cadmium	ton	801	..	..	..	..	59	..	860
Chromic Oxide (Cr ₂ O ₃) .. .. .	"	..	..	(a) 60	..	..	..	(a) 60	60
Cobalt	"	60	..	..	..	..	(c) 9,953	..	94,950
Copper	"	3,728	14	66,798	16	2,197	12,244	..	1,085,104
Gold	fine oz.	13,275	34,662	91,687	16	860,969	21,353	63,142	(e) 2,700
Iron(d)	'000 tons	..	..	54,415	(a) 2,219	481	..	..	316,293
Lead	ton	246,449	..	(a) 4,350	8	1,382	14,039	..	40,966
Manganese(f)	"	620	..	..	..	35,996	..	..	..
Manganese Dioxide (MnO ₂)g	"	907	..	..	..	162	..	1,406	2,475
Monazite	"	173	..	77	..	(a) 81	..	..	331
Osmiridium .. .. .	"	..	..	..	..	..	3	..	3
Silver	oz.	..	..	..	..	..	..	..	..
Sulphur(h)	fine oz.	8,555	2	4,954	(c) 180	1,369	101	..	15,161
Tantalite-Columbite (Ta ₂ O ₅ + Nb ₂ O ₅)	ton	188,892	..	17,464	a 27,616	24,473	52,100	..	310,545
Tin	lb.	..	..	1,104	..	8,499	..	..	8,499
Titanium Dioxide (TiO ₂)	ton	174	..	..	..	174	890	9	2,351
Tungstic Oxide (WO ₃)	"	44,903	..	34,736	..	45,662	..	..	125,301
Zinc	"	(c) 202,675	..	13,983	..	..	645	8	653
Zircon	"	71,156	..	34,504	..	6,692	32,475	..	249,133
									112,352

(a) Estimated. (b) 1 unit = 22.4 lb. (c) Less than half the unit of quantity shown. (d) Excludes iron content of iron oxide not intended for metal extraction. (e) Partly estimated. (f) Content of metallurgical grade manganese ore. (g) Content of manganese ore of other than metallurgical grade. (h) Sulphur content of pyrite and other minerals from which sulphur is extracted.

NOTE.—Particulars of production of uranium oxide (U₃O₈) are not available for publication and have been excluded from the table above.

4. Contents of Metallic Minerals Produced in Australia, 1955 to 1959.—Particulars of the contents of metallic minerals produced in Australia in the years 1955 to 1959 are shown in the following table. Graphs showing details of the mine production of principal metals and coal from 1930 to 1960 may be found on pages 1063 and 1064.

CONTENTS OF METALLIC MINERALS PRODUCED: AUSTRALIA.

Content of Metallic Minerals Produced.	Unit.	1955.	1956.	1957.	1958.	1959.
Alumina (Al_2O_3) ..	ton	3,406	4,618	3,758	3,533	6,914
Antimony ..	"	922	903	1,209	1,356	1,280
Beryllium Oxide ..	"	"	"	"	"	"
(BeO) ..	unit(a)	2,428	3,768	4,570	2,900	3,587
Bismuth ..	lb.	2,800	5,120	1,344	2,328	..
Cadmium ..	ton	844	922	979	872	860
Chromic Oxide ..	"	"	"	"	"	"
(Cr_2O_3) ..	"	"	2,624	(b) 1,420	(h) 386	(c) 60
Cobalt ..	"	61	59	68	71	60
Copper ..	"	47,312	54,547	59,255	75,715	94,950
Gold ..	fine oz.	1,049,039	1,029,821	1,083,941	1,103,980	1,085,104
Iron(d) ..	'000 tons	2,297	2,536	2,463	2,539	2,700
Lead ..	ton	295,944	299,485	333,753	328,347	316,293
Manganese(e) ..	"	20,462	25,856	34,904	25,623	40,966
Manganese Dioxide ..	"	"	"	"	"	"
(MnO_2)(f) ..	"	1,378	1,464	1,239	2,819	2,475
Molybdenum Disulphide(MoS_2)(c) ..	lb.	5,381	190	5,236	8,568	..
Monazite ..	ton	149	93	132	423	331
Osmiridium ..	oz.	21	27	69	43	3
Platinum ..	"	7	18	17	22	..
Silver ..	'000	"	"	"	"	"
Sulphur(g) ..	fine oz.	14,604	14,617	15,811	16,340	15,161
Tantalite-Columbite ..	ton	264,383	306,072	342,474	322,619	310,545
($\text{Ta}_2\text{O}_5 + \text{Nb}_2\text{O}_5$) ..	lb.	15,454	85,690	23,499	6,736	8,499
Tin ..	ton	2,017	2,078	1,952	2,237	2,351
Titanium Dioxide ..	"	"	"	"	"	"
(TiO_2) ..	"	57,505	95,502	163,751	119,233	125,301
Tungstic Oxide ..	"	"	"	"	"	"
(WO_3) ..	"	1,482	1,582	1,409	850	653
Zinc ..	"	256,564	278,082	291,582	263,044	249,133
Zircon ..	"	48,210	71,769	87,703	58,745	112,352

(a) 1 unit = 22.4 lb. (b) Partly estimated. (c) Estimated. (d) Excludes iron content of iron oxide not intended for metal extraction. Partly estimated. (e) Content of metallurgical grade manganese ore. (f) Content of manganese ore of other than metallurgical grade. (g) Sulphur content of pyrite and other minerals from which sulphur is extracted.

NOTE.—Particulars of production of uranium oxide (U_3O_8) are not available for publication and have been excluded from the table above.

5. Local Value of Minerals Produced, 1955 to 1959.—Particulars of the estimated values of minerals (mine and quarry products) produced during the years 1955 to 1959 are shown in the following table. The values represent the estimated selling value at the mine or quarry of minerals produced during the years concerned.

LOCAL VALUE OF MINERALS PRODUCED: AUSTRALIA.
(£'000.)

Mineral.	1955.	1956.	1957.	1958.	1959.
METALLIC MINERALS.					
Copper Ore, Concentrate, etc.(a) ..	15,120	18,287	12,345	14,770	21,165
Gold Ore, Concentrate, Other forms, etc. ..	15,536	15,509	16,090	16,251	15,853
Iron Ore	(b)4,004	(b)4,449	(b)4,295	(b)4,393	4,633
Lead and Lead-Silver Ore and Concentrate, Lead-Copper Concentrate, etc.(a) ..	32,308	34,552	28,810	22,493	21,477
Manganese Ore	192	337	589	460	626
Pyritic Ore and Concentrate	1,091	1,023	1,166	1,112	1,068
Rutile Concentrate	2,995	6,430	8,577	4,524	3,838
Tin Concentrate	1,554	1,599	1,612	1,739	2,043
Tungsten Concentrates	3,375	3,332	2,167	871	410
Zinc Ore and Concentrate	7,879	8,215	3,655	2,565	4,888
Zircon Concentrate	392	604	854	487	1,008
Other Metallic Minerals	179	415	602	525	512
<i>Total Metallic Minerals</i>	<i>84,625</i>	<i>94,752</i>	<i>80,762</i>	<i>70,190</i>	<i>77,521</i>

FUEL MINERALS.					
Coal, Black	53,737	52,439	52,279	51,658	49,211
Coal, Brown	4,382	4,644	5,228	5,418	6,123
<i>Total Fuel Minerals</i>	<i>58,119</i>	<i>57,083</i>	<i>57,507</i>	<i>57,076</i>	<i>55,334</i>

NON-METALLIC (EXCLUDING FUEL) MINERALS.(c)					
<i>Total Non-metallic (excluding Fuel) Minerals</i>	<i>7,303</i>	<i>8,041</i>	<i>9,002</i>	<i>10,192</i>	<i>10,533</i>

CONSTRUCTION MATERIALS.(d)					
<i>Total Construction Materials</i>	<i>14,824</i>	<i>16,444</i>	<i>17,840</i>	<i>18,497</i>	<i>21,597</i>

TOTAL.					
<i>Total, All Minerals and Construction Materials (c)</i>	<i>164,871</i>	<i>176,320</i>	<i>165,111</i>	<i>155,955</i>	<i>164,985</i>

(a) Prior to 1958, the value of lead-copper concentrate was included with Copper Ore, Concentrate, etc.
 (b) Includes the value of iron oxide for fluxing.
 (c) Excludes Australian Capital Territory, details of which are included with construction materials.
 (d) Incomplete owing to difficulties of coverage.

NOTE.—Particulars of the value of uranium concentrate produced are not available for publication and have been excluded from the table above.

6. **Local and Net Value of Mining and Quarrying Production by Industry, 1959.**—Particulars of the local value (or value of output) and net value (or value of production) of production of the principal Mining and Quarrying industries for the year 1959 are shown in para. 4 (vi.), page 1041. Owing to the necessity of classifying individual mines according to the principal mineral produced, the values in the tables on pages 1041–2 for mining industry groups differ slightly in some cases from totals of the corresponding groups of mine products shown in the table in para. 5 above.

§ 4. Gold.

1. **Historical.**—The earliest definite record of the discovery of gold in Australia was made on 15th February, 1823, by James McBrien, a surveyor, while surveying the Fish River between Rydal and Bathurst, New South Wales, and there are records of gold having been identified in several places during the next 27 years. It is believed that the first authentic

discovery of gold from which actual mining operations resulted was made in January, 1846, about 10 miles east of Adelaide, South Australia. However, credit for the first discovery of payable gold is generally given to E. H. Hargraves, who notified the Government of New South Wales on 3rd April, 1851, of his find, located at the junction of the Summerhill and Lewis Pond Creeks in the Bathurst (N.S.W.) district. This caused a gold rush, and prospecting started in many localities.

The Colony of Victoria was separated from New South Wales on 1st July, 1851, and within a few days of its inception, the new government was notified of the discovery of gold in several places. It would appear that the Hon. W. Campbell discovered gold near Clunes (Victoria) in March, 1850, but temporarily concealed the fact, and his discovery was not disclosed until 8th July, 1851. The discovery of gold at Ballarat and Bendigo followed soon afterwards.

The early discoveries were of alluvial gold, and only crude equipment was required to work them. As a consequence, cities and towns were depleted of their population as large numbers rushed to the diggings. The Australian population growth from 438,000 at the end of 1851 to 1,168,000 at the end of 1861 can be said to be largely due to the discoveries of gold.

Discoveries continued to be made, including such important fields as Canoona (Queensland) in 1858, Forbes (New South Wales) in 1862, Gympie (Queensland) in 1868, and Charters Towers and Mount Morgan (both in Queensland) in 1882. With the discovery at Mt. Lyell (Tasmania) in 1886, the major discoveries in the eastern States ceased.

Western Australia did not enter the field for a considerable time after gold mining had become well established in most of the other States. Although some specimens had been found between 1850 and 1870, it was not until 1886 that the Kimberley field was discovered, followed by Yilgarn in 1887. In 1892, Bayley and Ford discovered Coolgardie, and in May of the following year Hannan and Flannigan found Kalgoorlie. In the year since, there have been no further discoveries of major goldfields although many profitable deposits in other localities have been found and worked.

The amount of gold won in Australia in any one year attained its maximum in 1903, the year in which Western Australian production reached its highest level. For the other States, 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. In recent years, output from the Northern Territory has expanded considerably and the highest annual production was recorded as recently as 1956.

Owing to the exhaustion of the more easily worked deposits and increased costs due to deep mining, the production of gold in Australia declined from 3,837,979 fine oz. in 1903 to 427,160 fine oz. in 1929, the lowest output since its discovery. Increased activity in prospecting due to prevailing economic conditions resulted in some improvement in 1930, but the marked development between that year and 1939 was caused by the heavy depreciation of Australian currency in terms of gold. Following the outbreak of the 1939–45 War, there was a sharp fall in gold production to 656,867 fine oz. in 1944 and 657,213 fine oz. in 1945, but with the release of man-power after the war, there has been a slight upward trend in mine production of gold, which in 1953 exceeded 1,000,000 fine oz. for the first time since 1942. The devaluation of Australian currency in September, 1949, gave an impetus to gold production, but this was offset in the following years by increasing costs which brought about the closing of several large producers in New South Wales, Victoria and Western Australia.

2. Present Methods of Mining and Treatment.—Gold ores can be divided into two types, namely, free-milling and refractory. Free-milling ores are those that, when finely ground, will yield their gold content to amalgamation and/or cyanidation, and these are found in most of the gold deposits of Australia.

Some refractory ores, which are not amenable to amalgamation, allow their gold to be dissolved by cyanidation, from which solution the gold is then precipitated. However, on the Coolgardie field, where gold bearing sulphide and telluride minerals occur, it is necessary first to recover these from gangue by flotation. This concentrate is then roasted and the resulting calcine, an impure oxide containing free gold, is cyanided to yield gold. This is usually smelted as bullion, in which form it leaves the vicinity of the mine.

3. **Mine Production.**—The table hereunder shows the mine production of gold (gold content of minerals produced) during 1959 according to the mineral in which it was contained and the State or Territory of origin. It should be noted that the minerals shown below contain, in addition to gold, certain other metals.

GOLD : MINE PRODUCTION, 1959.

(Fine oz.)

Mineral in which contained.	N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N.T.	Aust.
Copper Ore, Concentrate, etc. ..	2,699	..	74,988	..	1,345	6,915	11,715	97,662
Gold Ore, Concentrate, etc. ..	461	34,662	16,645	16	859,624	112	51,427	962,947
Lead Concentrate ..	8,396	..	54	..	..	3,615	..	12,065
Lead-Copper Concentrate ..	..	..	..	..	..	8,436	..	8,436
Pyrite Concentrate..	..	..	..	..	(a)	..	..	(a)
Zinc Concentrate ..	1,719	..	..	..	..	2,275	..	3,994
Total Gold ..	13,275	34,662	91,687	16	860,969	21,353	63,142	1,085,104

(a) A small quantity of gold recovered from pyrite concentrate dispatched from Kalgoorlie for sulphuric acid manufacture is included with Gold Ore, Concentrate, etc.

The principal sources of production during 1959 were as follows:—

(i) *New South Wales.* There are now no mines employing four or more hands engaged solely in gold mining in New South Wales. Most of the gold produced during 1959 was contained in lead and zinc concentrates produced at Broken Hill and copper, lead, zinc and gold concentrates milled at Captain's Flat.

(ii) *Victoria.* At Chewton, near Castlemaine, one mine produced nearly half of the State's production. In addition, four gold mines located in the north-east of the State each produced more than 1,000 fine oz.

(iii) *Queensland.* The copper concentrate produced at Mt. Morgan contained more than three-quarters of the State's output of gold, nearly all the remaining production coming from a mine at Cracow.

(iv) *South Australia.* The only gold produced was won by prospectors.

(v) *Western Australia.* More than half of the total production came from the Coolgardie goldfields, while most of the remaining production came from the Dundas, Murchison and Yilgarn goldfields. A single mine at Fimiston maintained its position as the largest gold producer in Australia, mining 172,420 fine oz. during 1959, and three other mines each produced over 100,000 fine oz. in the same period.

(vi) *Tasmania.* Copper concentrate produced at Mt. Lyell contained most of the gold produced in Tasmania during 1959, while most of the remaining production was included in lead-copper, lead and zinc concentrates milled at Rosebery. A small quantity of gold was recovered from alluvial tin-mining operations.

(vii) *Northern Territory.* Gold production in the Northern Territory is centred around Tennant Creek.

The following table shows the recorded mine production of gold (i.e., gold content of minerals produced) in the several States and in Australia as a whole during each of the ten decennial periods from 1851 to 1950, and in single years from 1951 to 1959. Owing to defective information in the earlier years, it is likely that the recorded production falls considerably short of the actual totals.

GOLD : MINE PRODUCTION.(a)

('000 fine oz.)

Period.	N.S.W.	Vic.	Q'land.	S. Aust.	W. Aust.	Tas.	N.T.	Aust.
1851-60	2,714	21,973	3	..	..	1	..	24,691
1861-70	3,220	15,327	489	..	..	3	..	19,039
1871-80	2,019	9,564	2,527	136	..	165	19	14,430
1881-90	1,014	6,689	3,259	58	42	357	168	11,587
1891-1900	2,432	7,040	5,648	52	5,252	550	214	21,188
1901-10	2,253	7,095	5,512	73	17,784	604	111	33,432
1911-20	1,145	3,067	2,263	55	10,671	202	23	17,426
1921-30	204	593	434	10	4,557	43	2	5,843
1931-40	569	1,052	1,021	53	8,474	130	84	11,383
1941-50	572	800	750	13	6,683	157	148	9,123
1951	49	66	79	(b)	648	15	39	896
1952	39	68	85	(b)	727	16	45	980
1953	26	64	92	(b)	823	17	53	1,075
1954	32	53	98	(b)	862	19	54	1,118
1955	30	38	64	(b)	835	17	65	1,049
1956	29	39	56	(b)	814	17	75	1,030
1957	31	46	63	(b)	850	20	74	1,084
1958	19	41	75	(b)	875	22	72	1,104
1959	13	35	92	(b)	861	21	63	1,085
Total, 1851-1959 ..	16,410	73,650	22,610	450	60,758	2,376	1,309	177,563

(a) Gold content of minerals produced.

(b) Less than 500 fine oz.

4. Refinery Production.—Amalgam and gold slimes from cyanide extraction are treated at the mines to produce gold bullion, which at some mines may be partly refined before dispatch to the Royal Mints, located in Melbourne and Perth. By-product gold from lead smelting is refined at Port Pirie in South Australia, while the gold contained in copper refinery sludges, resulting from electrolytic copper refining at Mount Lyell and Port Kembla, is recovered at Port Kembla. Gold bullion and other gold-bearing materials are also refined in Sydney.

Details of the refinery production of gold in Australia and the value of refined newly-won gold of Australian origin are shown in the following table for each of the years 1956 to 1960. The value of the refined newly-won gold is based on the price fixed by the Commonwealth Bank, but allowance is made for premiums on sales of gold overseas and for industrial purposes in Australia.

PRODUCTION OF REFINED GOLD IN AUSTRALIA.

Particulars.	1956.	1957.	1958.	1959.	1960.
QUANTITY (FINE OZ.).					
Australian Origin—					
Newly-won Gold	1,044,164	1,078,419	1,069,774	1,067,129	1,045,139
From Scrap	20,106	21,480	17,350	20,617	22,699
Overseas Origin—					
Newly-won Gold	161,065	171,970	136,998	141,624	142,526
From Scrap	708	1,248	888	1,075	1,164
Total	1,226,043	1,273,117	1,225,010	1,230,445	1,211,528
VALUE (£'000).					
Newly-won Gold of Australian Origin	16,346	16,872	16,720	16,677	16,396

5. **Changes in Stocks of Gold held in Australia.**—The following table shows particulars of production, imports and exports of gold and changes in stocks of gold held in Australia for each of the years 1955 to 1959.

CHANGES IN STOCKS OF GOLD HELD IN AUSTRALIA.

(Fine oz.)

Particulars.	1955.	1956.	1957.	1958.	1959.
Mine Production of Gold(a) ..	1,049,039	1,029,821	1,083,941	1,103,980	1,085,104
Imports of Gold(b)(c) ..	150,606	201,883	159,998	160,232	136,674
<i>Total</i>	<i>1,199,645</i>	<i>1,231,704</i>	<i>1,243,939</i>	<i>1,264,212</i>	<i>1,221,778</i>
Exports of Gold(b)	1,136,575	531,010	783,814	128,550	128,052
Gold Content of Ores and Concentrates Exported ..	15,748	18,177	19,561	22,453	17,941
Net Industrial Consumption of Gold	33,217	33,778	33,028	29,135	33,938
<i>Total</i>	<i>1,185,540</i>	<i>582,965</i>	<i>836,403</i>	<i>180,138</i>	<i>179,931</i>
Changes in Stocks of Gold held in Australia(d)	+ 14,105	+ 648,739	+ 407,536	+ 1,084,074	+ 1,041,847

(a) Gold content of minerals produced in Australia. (b) Includes gold contained in matte.
(c) Excludes gold imported in some minor minerals. (d) Includes gold content of change in stocks of mineral products awaiting refining; excludes gold specie.

6. **Production in Principal Countries.**—The quantities of gold produced in the principal producing countries and the estimated world total production in each of the years 1955 to 1959, according to data published by the Mineral Resources Division of the United Kingdom Overseas Geological Surveys, are shown in the table hereunder.

GOLD: PRODUCTION IN PRINCIPAL COUNTRIES.

('000 fine oz.)

Country.	1955.	1956.	1957.	1958.	1959.
Union of South Africa ..	14,601	15,897	17,031	17,656	20,066
Canada	4,542	4,384	4,434	4,571	4,445
United States of America ..	1,880	1,827	1,794	1,739	1,604
Australia	1,049	1,030	1,084	1,104	1,085
Ghana	687	638	790	853	913
Rhodesia and Nyasaland ..	527	540	540	559	572
Philippines	419	406	380	423	403
Colombia	381	438	325	372	398
Belgian Congo	370	374	374	356	351
Mexico	383	350	346	332	314
<i>Estimated World Total(a) ..</i>	<i>26,800</i>	<i>27,000</i>	<i>29,000</i>	<i>29,900</i>	<i>32,000</i>

(a) Excludes U.S.S.R. The United States Bureau of Mines has estimated U.S.S.R. production at 9-10 million ounces per annum in recent years.

7. **Prices of Gold.**—Under existing legislation, all gold produced in Australia is sold to the Reserve Bank. The official price of gold is fixed by the Reserve Bank, and on 1st May, 1954, it was raised from £15 9s. 10d. to £15 12s. 6d. per fine oz. The current price reflects the "parity" value of Australian currency established by the International Monetary Agreement Act 1947. Previously, the price of gold was based on the price for which gold could be sold abroad in official markets, less costs of movement.

Average prices of gold per fine oz. at mints in Australia and on the London gold market, for the years 1956 to 1960, are shown in the following table.

PRICES OF GOLD: AUSTRALIA AND LONDON.

(per fine oz.)

Place of Sale.	1956.	1957.	1958.	1959.	1960.
At Mints in Australia £A. s. d.	15 12 6	15 12 6	15 12 6	15 12 6	15 12 6
London .. fstg. s. d.	12 10 2	12 10 3	12 9 9	12 9 10	12 11 2

8. **Sales of Gold on Oversea Premium markets.**—In November, 1951, the Commonwealth Government decided to allow Australian gold producers to benefit from the high prices then being paid for gold on some overseas markets. To implement this decision, the Gold Producers' Association Limited was incorporated in December, 1951, and the first sales were made in that month. By arrangement with the Reserve Bank of Australia, the total quantity of newly-won gold delivered to the Bank by members of the Association in any calendar month, less the quantity required for industrial purposes in Australia, is available to the Association for sale on overseas premium markets during the ensuing two calendar months. The net proceeds from premium sales are distributed to members in proportion to their production of gold. The actual volume of sales on overseas premium markets has been dependent largely on the premium over the Australian fixed price. Towards the end of 1953, the price of gold on overseas premium markets fell sharply and by the end of 1957 regular monthly sales had virtually ceased. However, following the sharp rise in the price of gold on the London and other free gold markets in October, 1960, premium sales once again commenced in that month.

The following table shows the quantity and value of gold sold on overseas premium markets and the average price realized for these sales during the years 1956 to 1960. It should be noted that this series is in no way indicative of the average return to gold producers for all gold produced.

GOLD SOLD ON OVERSEA PREMIUM MARKETS.

Particulars.	Unit.	1956.	1957.	1958.	1959.	1960.
Quantity ..	fine oz...	505,262	687,115	189,537	37,346	383,970
Value ..	£A. f.o.b.	7,919,646	10,760,214	2,964,638	584,129	6,056,003
Average Price ..	£A. s. d.	15 13 6	15 13 2	15 12 10	15 12 10	15 15 5

9. **Assistance to the Gold-Mining Industry.**—(i) *Gold Subsidy.* After the collapse of high premium prices late in 1953, conditions in the gold-mining industry again became acute and many producers were faced with the prospect of closing down. To meet this situation, the Gold-Mining Industry Assistance Act was assented to on 18th November, 1954. The purpose of this Act was to assist the gold-mining industry in Australia and the Territories of Papua and New Guinea by the payment of a subsidy, subject to certain conditions, on the production and sales of gold. To be eligible for the subsidy, the value of a producer's output of gold must exceed 50 per cent. of the total value of his mine output. The subsidies paid under the original Act were increased under amendments enacted on 22nd October, 1957, and 22nd May, 1959. Under the Act as it now stands, the subsidy payable to small producers whose annual output does not exceed 500 fine oz. is £2 8s. 0d. per fine oz., irrespective of cost of production. For large producers, subsidy is paid at the rate of three quarters of the excess of the average cost of production over £13 10s. 0d. per fine oz. with a maximum amount of subsidy of £3 5s. 0d. per fine oz. Where a producer receives an amount in excess of the official price of £15 12s. 6d. per fine oz. as a result of

sales on oversea premium markets or otherwise, the subsidy payable shall be reduced by the amount of the excess. The subsidy is also limited to the extent that the annual net profit of a producer shall not, with the addition of the subsidy, exceed 10 per cent. of the capital investment in the company. The maximum expenditure on development allowable in determining costs is £5 5s. 0d. per fine oz. A further condition of the Act is that the recovery rate of the mine shall not fall below nine-tenths of that for the year previous to the commencement of the Act. Payments under the Act are to continue until 30th June, 1962.

Payments under the Act commenced in March, 1955, and the amounts paid to gold producers in the various States and Territories of Australia in each of the years 1956 to 1960 are shown in the following table.

NET SUBSIDY PAYMENTS TO GOLD PRODUCERS.
(£.)

Year.	New South Wales.	Vic.	Q'land.	S. Aust.	W. Aust.	Tas.	Nor. Terr.	Papua and New Guinea.	Total.
1956 ..	17	31,478	2,848	..	496,819	..	1,020	63,979	596,161
1957 ..	34	56,044	620	..	512,708	..	8,345	10,761	588,512
1958 ..	26,951	38,380	3,958	..	623,394	..	16,360	44,485	753,528
1959 ..	107	41,500	2,937	55	652,266	..	39,181	52,449	788,495
1960 ..	14	45,881	881	35	698,242	..	4,253	65,292	814,598

(ii) *Income Taxation Exemption.* Income from gold mining is exempt from taxation in the hands of the producer. If the producer is a company, such income is exempt from taxation in the hands of the shareholders when paid as dividends.

10. *Employment in Gold Mining.*—Particulars of the numbers of persons employed in gold mining are shown in paras. 4 (ii) and (iii), pages 1039–40.

§ 5. Lead, Silver and Zinc.

1. *Historical.*—Prior to the discovery of the great Broken Hill lead-silver-zinc lode in 1883 by Charles Rasp, a boundary rider, the mining of lead-silver-zinc ores at other localities in New South Wales had been intermittent and only small quantities were produced. The Broken Hill lode has proved to be one of the biggest in the world and to date over 80 million tons of ore have been raised. The Broken Hill Proprietary Co. Ltd., now engaged in steel manufacture, was the company first formed to operate at Broken Hill and continued operations there until 1939 when the ore in its leases became exhausted. The first ores mined at Broken Hill were oxidized and required only simple smelting to produce a lead-silver bullion. No initial attempt was made to recover zinc and it was not until 1897 that the first commercial zinc concentrate was produced. The exhaustion of the oxidized ore early this century led to the mining of the deeper sulphide ores. The need to produce separate lead and zinc concentrates for smelting purposes, with economic metal recoveries, resulted in the perfection at Broken Hill of the differential ore flotation process. The preparation of sulphide concentrates by flotation methods is now used throughout the world. Mining operations at Broken Hill are now mainly carried on to the north and south of the original leases. In 1939, Lake George Mines Ltd. at Captain's Flat, near Canberra, commenced large-scale mining of a lead-zinc-copper ore body which had been first worked in 1882. The Captain's Flat mine is expected to cease operations during 1962 because of the exhaustion of ore reserves.

Lead-silver-zinc ores have been mined in Queensland since 1870, but it was not until 1923 that the largest ore-body, at Mt. Isa, was discovered by John Miles. Mt. Isa Mines Ltd. commenced mining operations at this centre in 1931. Mt. Isa is now the second largest centre in Australia producing lead-silver-zinc ores and the largest producer of copper. During the 1939–45 War, mining of lead-silver-zinc ores at Mt. Isa was suspended in favour of copper production.

Lead-silver ores were first discovered in Western Australia in the Northampton District in 1848 and most of the subsequent production in that State has been from that District.

The first recorded production of lead in Tasmania was in 1888, and of zinc, in 1919. Production has been restricted to the West Coast.

2. *Present Methods of Mining and Treatment.*—Nearly all ores now mined are composed of deep-lying sulphide minerals and it is therefore necessary to mine these ores by underground methods. At all large mines, it is the practice to produce separate lead and zinc concentrates,

with the lead concentrate containing most of the silver. These concentrates are prepared by differential flotation except in cases where a satisfactory concentrate can be obtained by gravity methods. In flotation plants, the ore is finely ground and by differential flotation a lead concentrate is first produced, with the zinc concentrate subsequently separated from the tailings. At Captain's Flat, differential flotation methods are used to produce successive concentrates of copper, lead, zinc and pyrite.

Particulars of representative Broken Hill lead and zinc concentrates are shown in para. 4, page 1035.

3. **Mine Production.**—The following table shows for 1959 the mine production (metal content of ores and concentrates produced) of lead, silver and zinc in Australia, and the respective minerals in which these metals were contained.

**LEAD, SILVER AND ZINC: CONTENT OF ORES AND CONCENTRATES
PRODUCED, 1959.**

Mineral in which contained.	N.S.W.	Vic.	Q'land.	S.A.	W.Aust.	Tas.	N.T.	Aust.
LEAD (tons).								
Lead Ore(a) ..	33	..	1,074	8	..	..	..	1,115
Lead Concentrate ..	242,323	..	52,948	..	1,382	9,742	..	306,395
Lead-Copper Con- centrate ..	..	..	..	..	..	2,521	..	2,521
Zinc Concentrate ..	4,093	..	393	..	..	1,776	..	6,262
Total Lead ..	246,449	..	54,415	8	1,382	14,039	..	316,293
SILVER (fine oz.).								
Copper Ore ..	10	..	128	..	..	..	60	198
Copper Concentrate ..	56,217	..	380,157	..	8,596	32,960	101,074	579,004
Gold Concentrate, etc. ..	47	2,016	22,648	..	169,890	..	4	194,605
Lead Ore(a) ..	5,109	..	31,108	394	..	..	..	36,611
Lead Concentrate ..	8,169,920	..	4,419,088	..	1,115	483,165	..	13,073,288
Lead-Copper Con- centrate ..	..	..	..	..	..	671,412	..	671,412
Silver Ore ..	..	..	29,175	..	..	..	..	29,175
Zinc Concentrate ..	323,900	..	70,905	..	..	181,533	..	576,338
Total Silver ..	8,555,203	2,016	4,953,209	394	179,601	1,369,070	101,138	15,160,631
ZINC (tons).								
Zinc Concentrate ..	202,675	..	13,983	..	..	32,475	..	249,133

(a) Includes lead-silver ore.

The principal sources of production of lead, silver and zinc during 1959 were as follows:—

(i) *New South Wales.* Lead and zinc concentrates, produced only at Broken Hill and Captain's Flat, contained nearly all the New South Wales production of lead and silver and all of the zinc. The five Broken Hill mines now operating, are:—Zinc Corporation Ltd., New Broken Hill Consolidated Ltd., North Broken Hill Ltd., Broken Hill South Ltd., and Barrier Central Pty. Ltd. These mines, during 1959, produced (in terms of the contents of all ores and concentrates produced) over 70 per cent. of Australia's lead and zinc and more than one half of the silver. Small quantities of lead-silver ore were produced, mainly in the Broken Hill district. In addition, the copper concentrate produced at Captain's Flat contained silver, as did small quantities of copper ore produced in other parts of the State and gold bullion produced from gold mining operations.

(ii) *Victoria.* All the silver produced was obtained from gold mining operations. No zinc bearing minerals are mined in Victoria and lead was last mined in 1957.

(iii) *Queensland.* Mt. Isa produced all the zinc concentrate and nearly all the lead concentrate in Queensland during 1959. These contained most of the State's production of lead and silver and all the zinc. Small quantities of lead ore were mined mainly at Mt.

Isa and in the surrounding district. Copper concentrates containing silver were produced at Mount Morgan, while some silver is also contained in gold bullion derived from gold ores, mainly at Cracow.

(iv) *South Australia.* Very small quantities of lead and silver were contained in lead ore mined in South Australia during 1959. No zinc ore for fertilizer was mined during that year.

(v) *Western Australia.* Most of the silver produced in Western Australia was obtained from gold bullion produced by the gold-mining industry. Lead ores, mined chiefly near Geraldton, contained lead and silver, while copper concentrate milled at Ravensthorpe also contained silver. No zinc was produced during 1959.

(vi) *Tasmania.* All the lead, silver and zinc was produced from mines on the West Coast. All the zinc and most of the lead and silver were produced from mines at Rosebery and Mt. Read and milled at Rosebery to produce separate lead, zinc, and lead-copper concentrates. Silver was also contained in copper concentrate milled at Mt. Lyell.

(vii) *Northern Territory.* No ores containing lead or zinc were mined during 1959. However, silver was produced in copper concentrates from Tennant Creek and from Rum Jungle and in small quantities of copper ore mined at various localities.

The table hereunder shows the quantities of lead, silver and zinc contained in minerals won in the several States and the Northern Territory during the years 1955 to 1959:—

LEAD, SILVER AND ZINC: CONTENT OF ORES AND CONCENTRATES PRODUCED.

State or Territory.	1955.	1956.	1957.	1958.	1959.
LEAD (tons).					
New South Wales	234,854	238,319	266,928	246,896	246,449
Victoria .. ..	..	..	4	..	..
Queensland	48,814	43,104	51,269	65,799	54,415
South Australia	2	17	20	13	8
Western Australia	1,007	5,828	3,087	1,854	1,382
Tasmania	11,267	12,217	12,445	13,785	14,039
Australia	295,944	299,485	333,753	328,347	316,293
SILVER (fine oz.).					
New South Wales	8,823,211	9,289,583	9,969,102	8,992,293	8,555,203
Victoria	1,633	2,255	3,157	3,018	2,016
Queensland	4,395,640	3,731,477	4,305,886	5,710,031	4,953,209
South Australia	142	653	975	613	394
Western Australia	200,748	192,589	187,530	189,375	179,601
Tasmania	1,166,307	1,372,881	1,299,062	1,394,818	1,369,070
Northern Territory	16,621	27,365	45,417	49,664	101,138
Australia	14,604,302	14,616,803	15,811,129	16,339,812	15,160,631
ZINC (tons).					
New South Wales	211,478	229,126	241,509	211,667	202,675
Queensland	17,138	16,231	19,536	17,484	13,983
South Australia .. ..	..	7	97	113	..
Western Australia .. ..	..	..	..	20	..
Tasmania	27,948	32,718	30,440	33,760	32,475
Australia	256,564	278,082	291,582	263,044	249,133

4. **Smelter and Refinery Production.**—(i) *Lead Concentrate.* Lead concentrate produced at Broken Hill is railed to Port Pirie, in South Australia, for smelting and refining. Lead-silver bullion is produced from initial smelting, and lead, silver and gold are then refined. Cadmium is obtained from smelter fumes and refined to produce rods of metal. The sulphur dioxide gas formed during pre-smelter sintering operations is used to manufacture sulphuric acid. The antimony contained in the concentrate is alloyed with lead to form marketable antimonial lead while the copper is processed to the matte and speiss stage and sent to copper refineries for copper extraction. Lead concentrates produced at Broken Hill are now in excess of Port Pirie smelter and refinery capacity and part of the Broken Hill production is exported.

Lead ore and concentrate produced at Mount Isa is smelted at the mine to derive a lead bullion which is rich in silver. All of this bullion is exported to the United Kingdom for refining. A lead-copper dross is produced as a by-product of lead smelting and this is also exported.

Lead and lead-copper concentrates produced in Tasmania, and lead concentrates produced at Captain's Flat in New South Wales and in Western Australia, are exported.

(ii) *Zinc concentrate.* About half of the zinc concentrate produced at Broken Hill is exported overseas, and the remainder is shipped from Port Pirie to Risdon, near Hobart, for refining. At Risdon, the Broken Hill concentrate, together with all zinc concentrate produced in Tasmania, is roasted to form zinc oxide, or calcine. Sulphur dioxide formed during this roasting process is used for the manufacture of sulphuric acid. The calcine is leached with a weak solution of sulphuric acid to form a zinc sulphate solution which, after purification, is electrolysed. Zinc of high purity is deposited on the cathodes and this zinc is melted and cast into ingots. Cadmium metal and cobalt oxide are also recovered. Lead-silver residues are recovered and forwarded to Port Pirie for smelting with lead concentrates. Copper residues are sent to Port Kembla for treatment.

Zinc concentrates produced at Mt. Isa and Captain's Flat are exported.

In the following table, details are given of the production and sales of refined primary lead, silver and zinc as recorded from data received from the Bureau of Mineral Resources and the Australian Mines and Metals Association. The figures shown for refined silver production include small quantities recovered from imported materials.

REFINED LEAD, SILVER AND ZINC : PRODUCTION AND SALES, AUSTRALIA.

Particulars.	1955.	1956.	1957.	1958.	1959.
LEAD (tons).					
Refined Lead— Production(a)	187,134	194,506	192,161	191,474	185,805
Sold to Australian consumers(b) ..	45,851	38,616	37,291	39,928	33,563
Sold for export(b)	148,189	151,628	152,432	158,075	133,340
Lead-Silver Bullion— Produced for export (lead content)(a) ..	37,392	41,658	46,891	57,171	50,310
SILVER ('000 fine oz.).					
Production(a)	7,818	8,232	8,011	9,101	7,805
Sold to Australian consumers(b) ..	1,928	1,893	4,410	4,184	4,775
Sold for export(b)	5,793	6,214	3,397	5,074	2,722
ZINC (tons).					
Production(a)	101,090	104,993	110,348	114,773	116,461
Sold to Australian consumers(b) ..	71,355	69,760	78,874	72,844	78,753
Sold for export(b)	34,049	32,718	37,316	37,989	40,950

(a) Source: Bureau of Mineral Resources.

(b) Source: Australian Mines and Metals Association.

5. **Production in Principal Countries and World Total.**—The following table shows, for the years 1955 to 1959, particulars of lead, silver and zinc production (mine basis) in principal producing countries, together with the estimated world total, according to data published by the Mineral Resources Division of the United Kingdom Overseas Geological Surveys.

LEAD, SILVER AND ZINC: MINE PRODUCTION IN PRINCIPAL COUNTRIES.

Country.	1955.	1956.	1957.	1958.	1959.
LEAD ('000 tons).					
U.S.S.R. (a) (b)	250	260	280	300	320
Australia	296	299	334	328	316
United States of America	302	315	302	239	228
Mexico	207	196	211	199	187
Canada	181	169	162	167	167
Peru	117	127	135	132	117
<i>Estimated World Total</i>	2,200	2,200	2,300	2,300	2,300

SILVER ('000 fine oz.).					
Mexico	47,958	43,078	47,150	47,592	44,075
Canada	27,984	28,432	28,823	31,163	32,329
United States of America	37,198	38,948	38,165	34,111	31,194
U.S.S.R. (a)	25,000	25,000	25,000	25,000	25,000
Peru	22,948	22,973	24,845	25,918	24,768
Australia	14,604	14,617	15,811	16,340	15,161
Japan	5,949	6,167	6,544	6,552	6,651
Belgian Congo	4,083	3,794	3,045	3,794	4,758
Bolivia	5,851	7,543	5,375	6,051	4,504
Germany, Eastern (a)	4,500	4,500	4,500	4,500	4,500
<i>Estimated World Total</i>	199,000	201,000	205,000	210,000	201,000

ZINC ('000 tons).					
United States of America	460	484	475	368	380
U.S.S.R. (a) (b)	255	270	300	325	370
Canada	387	377	369	380	352
Mexico	265	245	237	221	260
Australia	257	278	292	263	249
Poland (b)	154	151	156	160	165
Japan	107	121	134	141	139
Peru	163	172	152	133	130
<i>Estimated World Total</i>	2,880	3,040	3,100	3,070	3,050

(a) Estimated.

(b) Smelter production.

6. **Prices of Lead, Silver and Zinc.**—The following table shows average prices of lead, silver and zinc in Australia and on the London Metal Exchange during the years 1956 to 1960.

PRICES OF LEAD, SILVER AND ZINC.

Particulars.	1956.	1957.	1958.	1959.	1960.
<i>Australian Prices, in Australian currency—</i>					
Lead, per ton .. £	140	117	(a) 87	100	100
Silver, per fine oz.(b) s. d.	8 3	8 3	8 0	8 2	8 3
Zinc, per ton(c) .. £	122	104	91	105	113
<i>London Metal Exchange Prices, in sterling—</i>					
Lead, per ton .. £	116	97	73	72	72
Silver, per fine oz. s. d.	6 7	6 7	6 4	6 7	6 7
Zinc, per ton .. £	98	82	65	80	88

(a) Average market price was used for the periods shown prior to 23rd December, 1958, when the minimum price was fixed at £100 per ton. (b) Silver prices shown represent export parity calculated from London Metal Exchange prices.

(c) Prior to 1st January, 1958, and subsequent to 30th June, 1959, the prices shown were average market prices. On 1st January, 1958, a minimum price was fixed at £90 and this minimum was later raised to £100 on 22nd December, 1958. The minimum price was abolished on 1st July, 1959.

7. **Employment in Lead, Silver and Zinc Mining.**—Particulars of the number of persons employed in mining for these metals are shown in paras. 4 (ii) and (iii), pages 1039–40.

§ 6. Copper.

1. **Historical.**—Copper was first discovered in Australia in 1842, at Kapunda in South Australia and in the Northampton district of Western Australia. The subsequent large-scale mining of the South Australian deposits contributed significantly to that State's development, but now only very small quantities are mined in South Australia.

The mining of copper commenced in New South Wales in 1847, near Rockley. Copper was first recognized in the Cobar district in 1869, and large-scale mining continued at Cobar until 1952. Other fields were opened at Mt. Hope in 1878, Nymagee in 1880 and Captain's Flat in 1882, but of these, only Captain's Flat is still producing.

The first important discovery of copper in Queensland was made in 1862, when a rich lode was found near Clermont. Copper was discovered in the Herberton mineral field in 1879 and at Mt. Morgan in 1882. The copper ore body at Mt. Isa was not recognized as an outcrop when the lead-zinc ore body was discovered in 1923, and was discovered as a result of underground development.

Copper mining was first undertaken at Mt. Isa during the 1939–45 War, but it was not until the erection of a copper smelter at that centre that large-scale production commenced. The Mt. Isa mine is today Australia's largest producer of copper.

In Tasmania, the Mt. Lyell deposit was discovered in 1886.

2. **Methods of Mining and Treatment.**—Most of the large copper ore bodies contain the mineral chalcopyrite, an iron-copper sulphide. Copper ore is mined by opencut methods at Mt. Morgan and Mt. Lyell and by underground methods at Mt. Isa, Captain's Flat and Ravensthorpe (Western Australia). Oxidized copper ore is mined at Mt. Isa and at numerous other localities, mainly in Western Australia.

It is the practice for the sulphide ore to be finely ground and for the chalcopyrite contained in it to be recovered by flotation. At Mt. Lyell and Mt. Morgan, the tailings from the copper flotation are subjected to a further flotation and a pyrite concentrate is produced. The oxidised ore mined at Mt. Isa is not concentrated and is fed direct to the smelters.

3. **Mine Production.**—The following table shows for 1959 the copper content of all minerals produced in the several States and the Northern Territory:—

COPPER: CONTENT OF ORES AND CONCENTRATES PRODUCED, 1959.
(Tons.)

Mineral in which Contained.	N.S.W.	Vic.	Q'land.	S. Aust.	W. Aust.	Tas.	N.T.	Aust.
Copper Ore, Concentrate, etc.	964	14	65,801	16	2,197	11,575	9,953	90,520
Lead Concentrate	2,323	..	997	..	..	..	..	3,320
Lead-Copper Concentrate . . . . .	..	..	..	..	..	487	..	487
Zinc Concentrate	441	..	..	..	..	182	..	623
Total	3,728	14	66,798	16	2,197	12,244	9,953	94,950

The following were the principal sources of copper during 1959:—

- (i) *New South Wales.* Most of the copper produced in this State was contained in lead concentrate milled at Broken Hill. At Captain's Flat, nearly all the copper was contained in lead concentrate. Small quantities of copper were precipitated from water pumped from old mine workings, mainly at Cobar.
- (ii) *Victoria.* A small quantity of copper ore was mined in North Gippsland. This was the first production recorded in post-war years.
- (iii) *Queensland.* Mt. Isa was the most important copper producer in Australia, its 1959 output being 61 per cent. of the Australian total. The copper produced at Mt. Isa is contained in copper sulphide concentrate, oxidized copper ore and lead concentrate. Copper concentrate containing appreciable gold and silver, was also produced at Mt. Morgan. Other copper was contained in copper ore mined mainly near Mt. Isa and Cloncurry and in copper precipitate.
- (iv) *South Australia.* Only a negligible quantity of copper was produced from areas which in the past were important for copper.
- (v) *Western Australia.* Approximately one half of the copper mined was contained in copper concentrate produced at Ravensthorpe. The remainder was contained in copper ore won at various localities in the State for fertilizer manufacture.
- (vi) *Tasmania.* Most of the State's production was at Mt. Lyell, where copper was contained in copper concentrate and precipitate. Lead-copper concentrate and zinc concentrate milled at Rosebery made up the remainder of Tasmania's production.
- (vii) *Northern Territory.* At Rum Jungle, a copper concentrate and a copper precipitate were produced in association with uranium mining. A copper concentrate was also produced at Tennant Creek. Small quantities of ore were mined at other localities.

The table hereunder shows the quantities of copper contained in minerals produced in the several States and the Northern Territory during the years 1955 to 1959:—

COPPER: CONTENT OF ORES AND CONCENTRATES PRODUCED.
(Tons.)

State or Territory.	1955.	1956.	1957.	1958.	1959.
New South Wales	3,492	4,289	4,382	4,023	3,728
Victoria . . . . .	..	..	..	..	14
Queensland	31,858	35,708	35,786	50,511	66,798
South Australia . . . . .	..	1	2	1	16
Western Australia	699	740	788	1,107	2,197
Tasmania	8,394	8,807	10,984	11,413	12,244
Northern Territory	2,869	5,002	7,313	8,660	9,953
Australia	47,312	54,547	59,255	75,715	94,950

4. **Smelter and Refinery Production of Copper.**—Most of the copper concentrate milled in Australia is smelted locally, blister copper being produced at Mt. Isa, Mt. Morgan, Mt. Lyell and Port Kembla. Port Kembla smelts all of the concentrate from Captain's Flat and some from Tennant Creek.

Blister copper smelted at Mt. Isa is railed to Townsville for electrolytic refining at the refinery which commenced production there in 1959. Mt. Lyell blister copper is electrolytically refined at Mt. Lyell and the bulk is remelted and cast into primary shapes at Port Kembla. Mt. Morgan blister copper is shipped to Port Kembla, where together with blister produced at Port Kembla, it is refined. Most Port Kembla copper is electrolytically refined, although fire refining, which is a cheaper process and undertaken when there are no other metals to be recovered, is used to a lesser extent. Copper from some copper drosses and speisses, by-products of lead refining operations at Port Pirie, is also extracted at Port Kembla.

At Port Kembla, gold and silver contained in electrolytic refining tank house slimes from Mt. Lyell, Townsville, and Port Kembla are recovered.

In the following table, details are given of the production of blister copper, and the production and sales of refined copper for the years 1955 to 1959:—

METALLIC COPPER: PRODUCTION AND SALES, AUSTRALIA.

(Tons.)

Particulars.	1955.	1956.	1957.	1958.	1959.
Blister Copper—					
Production (a) (b) ..	37,439	49,030	50,403	64,608	68,494
Refined Copper (c)—					
Production (a) ..	28,148	29,307	32,880	43,276	51,593
Sold to Australian Con-					
sumers (d) ..	27,366	29,038	34,114	43,035	43,072
Sold for Export (d) ..	..	650	..	..	..

(a) Source: Bureau of Mineral Resources.
(c) Refined from domestic primary copper.

(b) Production for refining in Australia or overseas.
(d) Source: Australian Mines and Metals Association.

5. **Production in Principal Countries and World Total.**—The following table shows the mine production of copper for the years 1955 to 1959 in the principal producing countries, as published by the Minerals Resources Division of the United Kingdom Overseas Geological Surveys and their estimate of total world production in those years.

COPPER: MINE PRODUCTION IN PRINCIPAL COUNTRIES.

('000 tons.)

Country.	1955.	1956.	1957.	1958.	1959.
United States of America ..	892	986	970	874	736
Rhodesia and Nyasaland ..	354	399	432	401	545
Chile	427	482	478	460	538
U.S.S.R.(a)	350	400	400	430	450
Canada	291	317	321	308	353
Belgian Congo(b) ..	231	246	238	234	278
Australia	47	55	59	76	95
Japan	72	77	80	80	83
Mexico	54	54	60	64	56
Union of South Africa ..	44	46	46	49	50
Philippines	17	27	40	46	49
Peru	43	46	56	53	47
<i>Estimated World Total</i> ..	<i>3,100</i>	<i>3,400</i>	<i>3,500</i>	<i>3,400</i>	<i>3,600</i>

(a) Estimated.

(b) Smelter production.

6. Prices.—Details of the average market price for the years 1956 to 1960 are given in terms of Australian currency and sterling in the following table:—

AVERAGE PRICE OF ELECTROLYTIC COPPER IN AUSTRALIA AND THE UNITED KINGDOM.

(£ per ton.)

Country.	1956.	1957.	1958.	1959.	1960.
Australia — in Australian currency(a)	435	341	284	312	324
United Kingdom—in sterling	304	220	193	235	239

(a) Ex works Port Kembla.

7. Employment in Copper Mining.—Particulars of the numbers of persons engaged in the mining of copper and copper-gold ores are shown in paras. 4 (ii) and (iii), pages 1039–40,

8. Assistance to the Copper-mining Industry.—(i) *Copper Bounty*. The Copper Bounty Act was enacted in 1958, following a Tariff Board inquiry and recommendation, to provide assistance to the industry partly by duty and partly by bounty. The provisions of the Act were reviewed in 1960, and it will continue in its present form until 31st December, 1963. The bounty is payable on copper sold on the Australian market, and provides in effect payment at the rate of £1 for each £1 by which the Australian price falls short of £340, with a maximum of £35 a ton, or, in the case of producers of 50 tons per annum or more, such lesser bounty as will give a return of 10 per cent. on assessed capital employed in the production of copper. The bounty reduced the net effective price of copper to Australian consumers from £340 to £305. A duty is imposed on imported copper when the Australian equivalent of the London Metal Exchange price falls below £290 (£Stg.232), increasing by £1 for each £1 that the Australian equivalent falls below £290. Including freight and other charges, the landed cost is thus expected to be maintained at about £305 so long as the Australian equivalent of the London Metal Exchange price is not in excess of £290.

(ii) *Income Taxation Concession*. One-fifth of the net income from copper mining is exempt from taxation in the hands of the producer. If the producer is a company, this concession also applies to such income when paid to the shareholders as dividends.

§ 7. Tin.

1. Historical.—Although specimens of tin had been found in New South Wales as early as 1851, it was not until tin stone was discovered near Inverell in 1872 that mining operations commenced. The New England area is still the most important producing area in New South Wales.

The first notable discovery of tin in Queensland occurred in 1872, when rich deposits of stream tin were found in the country to the south of Warwick but these alluvial deposits soon became exhausted. In 1879, important discoveries were made in the Herbert River district and rich fields, including that at Herberton, were opened up.

Tin was first discovered in Western Australia in 1888, and since then has been found in several widely separated localities in the State. More than half of the production to date has come from the Greenbushes Mineral Field, and most of the remainder from the Pilbara goldfield.

Tin mining in Tasmania dates from the year 1871, when the Mount Bischoff mine was discovered. Soon afterwards, rich deposits were located in the north-east of the State and near St. Helens. In 1875, tin was discovered at Mt. Heemskirk.

2. Present Methods of Mining and Treatment.—All tin produced in Australia is contained in tin concentrate, which is usually of the mineral cassiterite (tin oxide). The greater proportion of the production is obtained from alluvial workings as a gravity concentrate. In the lode deposits, tin is usually not associated with other recoverable minerals. However, at two mines in Tasmania tin is associated with wolfram and sulphide minerals. At

these mines, a gravity concentrate of tin, wolfram and sulphide minerals is obtained and from this the wolfram is separated by electromagnetic means. The tin and sulphide minerals are separated by flotation, the sulphides being floated off and the tin remaining as tailings.

3. **Mine Production.**—The following table sets out the tin content of tin concentrate produced in Australia during the years 1955 to 1959. No tin is included in minerals other than tin concentrate.

TIN: CONTENT OF TIN CONCENTRATES PRODUCED.

(Tons.)

State.	1955.	1956.	1957.	1958.	1959.
New South Wales	270	269	211	239	174
Victoria	2	..	(a)	..	..
Queensland	770	630	772	1,019	1,104
Western Australia	119	240	182	94	174
Tasmania	853	938	777	883	890
Northern Territory	3	1	10	2	9
Australia	2,017	2,078	1,952	2,237	2,351

(a) Less than half a ton.

The following were the principal sources of production in 1959:—

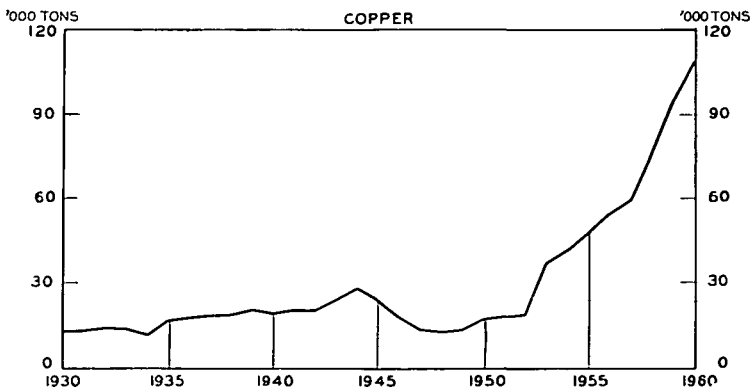
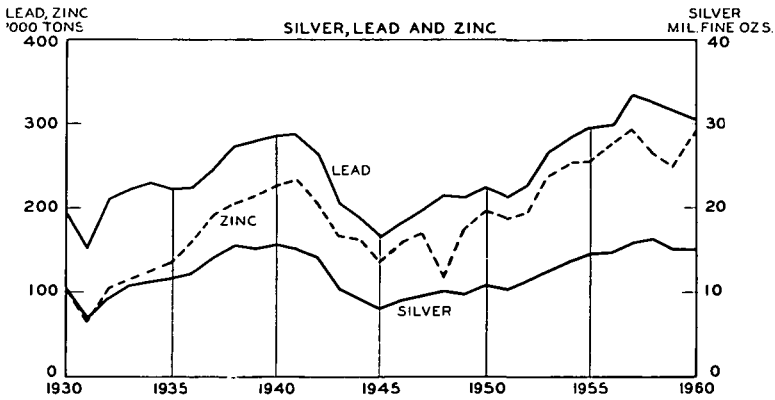
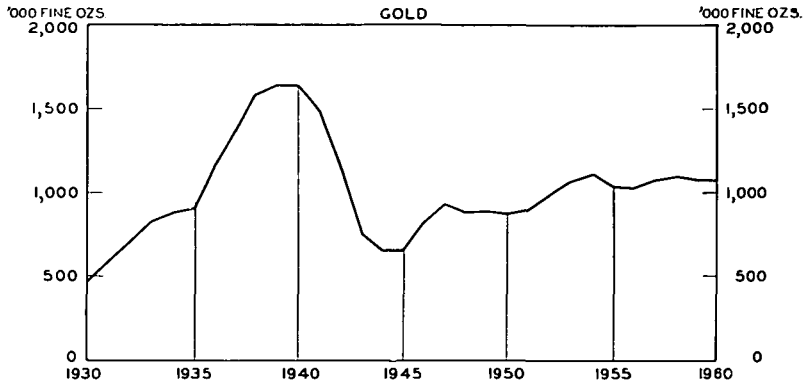
- (i) *New South Wales.* Virtually the whole of the State's production was from alluvial deposits. The New England region mainly around Tingha produced two-thirds of the total production.
- (ii) *Victoria.* No tin was produced in Victoria.
- (iii) *Queensland.* Most of the tin concentrate produced in Queensland was from the Herberton field, alluvial tin concentrate being produced. Tin concentrate was also produced in the Chillagoe, Kangaroo Hills and Cooktown districts.
- (iv) *South Australia.* No tin was produced in South Australia.
- (v) *Western Australia.* Nearly all the tin concentrate produced in Western Australia was lode tin won from the Pilbara field.
- (vi) *Tasmania.* Most of the tin concentrate produced in Tasmania is won in the north-east part of the State, from both lode and alluvial deposits. The largest amount of tin concentrate produced in Australia during 1959 came from a lode deposit in north-east Tasmania, and wolfram concentrate, as well as tin concentrate, was produced.
- (vii) *Northern Territory.* Small quantities were won at various localities.

4. **Smelting and Refining.**—Except for occasional small parcels of concentrate shipped to overseas smelters, all local production is treated by the two tin smelters located in Sydney. The combined capacity of the two smelters is well in excess of the domestic supply of concentrates and there seems little prospect of this capacity being fully utilized in the foreseeable future unless concentrates could be economically imported and smelted.

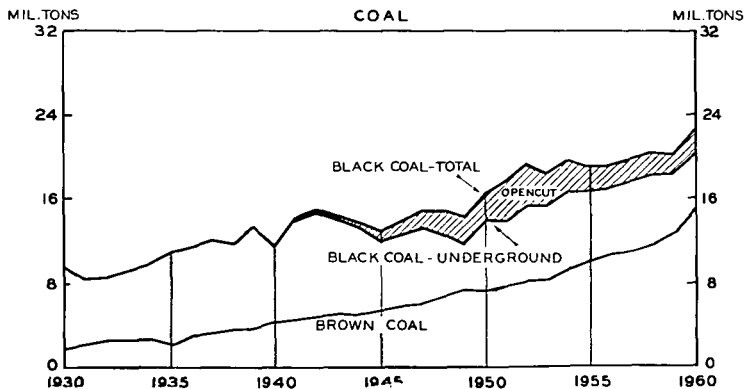
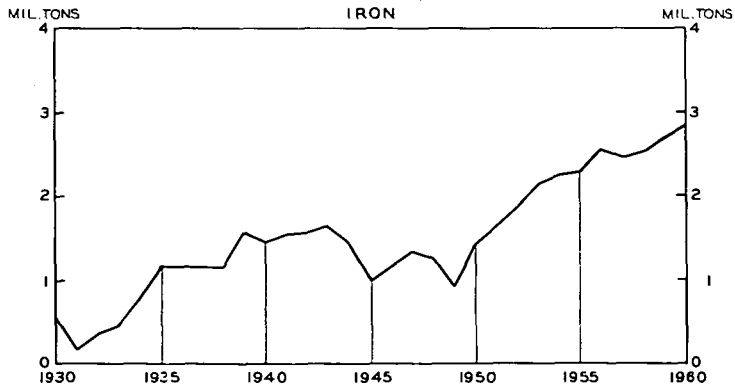
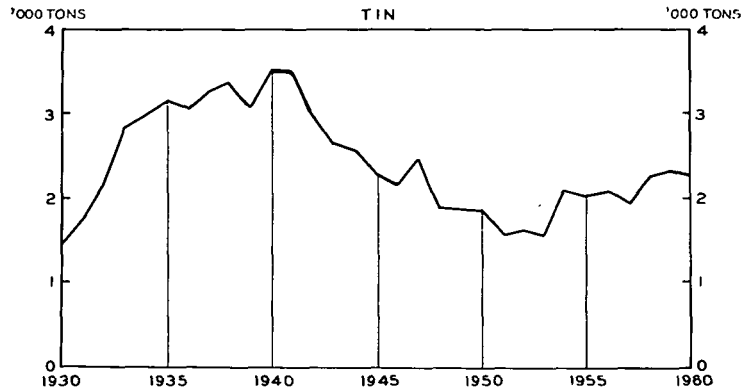
The production of refined tin in Australia from locally produced tin concentrate during recent years, as recorded by the Bureau of Mineral Resources, was as follows:—1956, 1,850 tons; 1957, 1,806 tons; 1958, 2,121 tons; 1959, 2,226 tons; and 1960, 2,254 tons.

5. **Production in Principal Countries and World Total.**—World production of tin reached its maximum in 1941 when 241,400 tons were recorded. Australia's contribution to the world's tin production is about 1 per cent.

MINE PRODUCTION OF PRINCIPAL METALS
(METALLIC CONTENT OF MINERALS)
AUSTRALIA, 1930 TO 1960



MINE PRODUCTION OF PRINCIPAL METALS
AND PRODUCTION OF COAL
(METALLIC CONTENT OF MINERALS)
AUSTRALIA, 1930 TO 1960



The production of tin ore (metal content) as published by the Mineral Resources Division of the United Kingdom Overseas Geological Surveys, for the principal producing countries in 1958 and 1959 was as follows:—

TIN : PRODUCTION IN PRINCIPAL COUNTRIES.

(Tons.)

Country.	Production.		Country.	Production.	
	1958.	1959.		1958.	1959.
Malaya, Federation of	38,458	37,521	Australia ..	2,237	2,351
Indonesia	23,200	21,613	Burma(b)	1,200	1,400
Bolivia	18,000	23,811	Union of South Africa	1,416	1,272
China(a)	17,731	21,000	United Kingdom ..	1,117	1,159
Belgian Congo ..	11,214	10,320	Portugal	1,249	1,129
Thailand	7,726	9,692	Estimated World		
Nigeria	6,154	5,491	Total(c) ..	134,000	141,000

(a) Estimated smelter production.
and Vietnam.

(b) Estimated.

(c) Excludes U.S.S.R., Czechoslovakia

6. Prices.—Details of the movement in average market prices of tin for the years 1956 to 1960 are given in terms of Australian currency and sterling in the following table:—

AVERAGE PRICE OF TIN IN AUSTRALIA AND THE UNITED KINGDOM.

(£ per ton.)

Country.	1956.	1957.	1958.	1959.	1960.
Australia — in Australian currency	1,014	992	995	1,058	1,042
United Kingdom—in sterling	788	755	735	786	794

7. Employment in Tin Mining.—The number of persons employed in tin mining is shown in paras. 4 (ii) and (iii), pages 1039–40.

§ 8. Iron.

1. Historical.—Iron ore was first mined in New South Wales to supply raw material for the ironworks that were established near Mittagong in 1852. Iron ore for the ironworks established later at Lithgow was drawn from Carcoar, near Bathurst.

In South Australia, the iron ore deposits of the Middleback Ranges, near Whyalla, were first mined by the Broken Hill Proprietary Co. Ltd. in 1900 to provide a flux for lead smelting operations at Port Pirie. When that company opened its Newcastle steelworks in 1915, it greatly expanded ore production from the Middleback Ranges and most of the Australian steel industry's requirements of iron ore still come from this source.

Regular shipments of iron ore from Yampi Sound, north of Derby in Western Australia, to the steelworks at Port Kembla commenced in 1951. Iron ore for the iron smelter at Wundowie, which commenced operations in 1948, has in recent years been provided entirely from the deposits at Koolyanobbing, near Southern Cross.

Besides the large quantities of iron ore that are mined for metal extraction purposes, smaller quantities of iron oxide are mined for other purposes, such as gas purification, cement manufacture, coal washing and fluxing.

2. **Methods of Mining and Treatment.**—All iron ore and iron oxide is won by opencut mining. The ore is selectively mined, crushed and screened to provide a standard assay and size for blast furnace use. No concentration is carried out. The iron ore from Yampi Sound, however, is powdery and friable and has to be sintered, or agglomerated, before making up the furnace charge.

3. **Mine Production of Iron Ore.**—Iron oxide deposits exist in all States and in the Northern Territory, but at present iron oxide for metal extraction purposes, termed iron ore in this chapter, is produced in two States only. The following table shows the estimated iron content of iron ore produced during the years 1955 to 1959.

IRON : ESTIMATED IRON CONTENT OF IRON ORE PRODUCED.

(Tons.)

State.	1955.	1956.	1957.	1958.	1959.
South Australia	1,971,693	2,324,825	2,199,981	2,173,922	2,218,846
Western Australia	325,579	211,215	262,519	365,275	480,769
Australia	2,297,272	2,536,040	2,462,500	2,539,197	2,699,615

The producing centres during 1959 were as follows:—

- (i) *South Australia.* During 1959, 3,413,609 tons of iron ore were drawn from the Iron Monarch and Iron Baron deposits in the Middleback Ranges. Selected foundry grade ore was diverted as required to the Whyalla blast furnace, but the greater part was shipped to Newcastle and Port Kembla for smelting.
- (ii) *Western Australia.* During the year, 672,239 tons of ore were shipped from Yampi Sound, north of Derby, to New South Wales for sintering and smelting. A quantity of 54,845 tons was mined at Koolyanobbing, near Southern Cross, for pig iron production at Wundowie.

4. **Mine Production of Iron Oxide.**—Production of iron oxide, excluding that used for metal extraction (iron ore) and mineral pigments, in the several States during 1959, according to end use, is shown in the following table. Only total quantities of iron oxide produced are recorded; particulars of metallic content are not available.

IRON OXIDE PRODUCTION, 1959.

(Tons.)

Use.	New South Wales.	Victoria.	Queensland.	South Australia.	Tasmania.	Australia.
For gas purification ..	1,933	2,241	..	..	181	4,355
For cement manufacture ..	3,281	..	1,323	..	4,881	9,485
For coal washing	30	..	..	..	..	30
For fluxing .. ..	..	..	..	9,600	..	9,600
Total	5,244	2,241	1,323	9,600	5,062	23,470

The principal sources of iron oxide production during 1959 were as follows:—

- (i) *New South Wales.* Quantities of iron oxide for gas purification were obtained from deposits near Port Macquarie, while that used for cement manufacture was mined from the Mudgee and Rylstone mining divisions. Magnetite, used in coal washing, was produced from beach sand deposits near Murwillumbah.
- (ii) *Victoria.* Limonite ore used for gas purification was mined at Buchan.
- (iii) *Queensland.* Iron oxide produced for cement manufacture was mined near Townsville.
- (iv) *South Australia.* A quantity of 9,600 tons drawn from the Middleback Ranges was dispatched to Port Pirie for use as a flux in lead smelting operations.
- (v) *Tasmania.* Iron oxide for gas purification and cement manufacture was mined in the vicinity of Penguin.

Particulars of Australian production of iron oxide for the years 1955 to 1959, according to end use, are shown in the following table.

IRON OXIDE PRODUCTION: AUSTRALIA.
(Tons.)

Use.	1955.	1956.	1957.	1958.	1959.
For gas purification ..	5,328	6,479	5,338	2,864	4,355
For cement manufacture ..	7,400	9,126	9,759	6,093	9,485
For coal washing	183	..	4	25	30
For fluxing	10,605	10,440	4,650	8,100	9,600
Total	23,516	26,045	19,751	17,082	23,470

5. Iron and Steel Production.—(i) *Australia.* The production of pig-iron and steel ingots in Australia, of which New South Wales is the main producing State, is shown in the following table for each of the years ended 31st May, 1951 to 1960.

PIG-IRON AND INGOT STEEL: PRODUCTION, AUSTRALIA.
(Tons.)

Year Ended 31st May.	Pig-iron. (a)	Steel Ingots. (b)	Year Ended 31st May.	Pig-iron. (a)	Steel Ingots. (b)
1951	1,313,332	1,443,831	1956	1,910,521	2,320,289
1952	1,430,027	1,521,386	1957	2,098,352	2,773,995
1953	1,691,693	1,801,028	1958	2,283,925	3,037,705
1954	1,826,711	2,116,813	1959	2,293,709	3,203,584
1955	1,868,841	2,208,708	1960	2,655,237	3,519,719

(a) Includes pig-iron for castings; excludes ferro-alloys.

(b) Includes recovery from scrap.

In 1959, ten blast furnaces were operating in Australia; four at Port Kembla and three at Newcastle, in New South Wales, two at Windowie, Western Australia, and one at Whyalla, South Australia. During 1959, ingot steel was produced from 28 open-hearth furnaces (17 at Newcastle and 11 at Port Kembla) and from 10 electric furnaces (5 at Newcastle, 3 at Melbourne, 1 at Whyalla and 1 at Port Kembla).

(ii) *New South Wales.* The principal producers in Australia, both in New South Wales, are the Broken Hill Proprietary Co. Ltd. at Newcastle and Port Kembla, and Australian Iron and Steel Ltd. at Port Kembla.

(iii) *South Australia.* At Whyalla in South Australia, the Broken Hill Proprietary Co. Ltd. produces pig iron, using locally produced raw materials together with metallurgical coke from New South Wales. A small quantity of steel ingots is produced from an electric furnace.

(iv) *Western Australia.* In Western Australia, the State-owned Wundowie Charcoal Iron and Steel Industry produces pig iron, using charcoal for smelting. This high grade iron is used in the manufacture of spheroidal graphite cast iron, and considerable quantities are exported. At Kwinana, The Broken Hill Proprietary Co. Ltd. produces steel products from billets imported from New South Wales.

6. *Production of Iron and Steel in Principal Countries.*—Particulars of the production in the principal countries and the estimated world total production during the calendar years 1958 and 1959, according to figures published by the Mineral Resources Division of the United Kingdom Overseas Geological Surveys, are shown in the next table.

IRON AND STEEL: PRODUCTION IN PRINCIPAL COUNTRIES.
(’000 Tons.)

Country.	Pig-iron and Ferro-alloys.		Steel Ingots and Castings.	
	1958.	1959.	1958.	1959.
United States of America ..	52,507	55,468	76,120	83,434
U.S.S.R.	39,000	42,293	54,053	59,003
Germany, Federal Republic ..	16,396	18,103	22,425	25,414
United Kingdom	12,975	12,583	19,566	20,186
Japan	7,636	9,695	11,927	16,366
France	11,778	12,275	14,385	14,978
China	13,470	20,200	10,910	13,140
Italy	2,133	2,157	6,172	6,655
Belgium	5,432	5,871	5,886	6,332
Poland	3,803	4,305	5,574	6,062
Czechoslovakia	3,714	4,177	5,423	6,039
Canada	2,832	3,850	3,892	5,287
Luxembourg	3,233	3,357	3,325	3,605
Saar	3,054	3,169	3,406	3,536
Australia	2,276	2,503	3,156	3,382
Germany, Eastern	1,747	1,868	2,995	3,156
Sweden	1,392	1,382	2,369	2,795
Austria	1,789	1,808	2,355	2,472
India	2,102	3,144	1,813	2,429
<i>Estimated World Total ..</i>	<i>197,200</i>	<i>220,000</i>	<i>269,000</i>	<i>300,000</i>

§ 9. Mineral Sands.

1. *Historical.*—In recent years, the growing world demand for titanium metal has brought about a rapid expansion of Australian mineral sands mining. Australia is the largest producer of rutile and zircon in the world, and nearly all this production comes from the mineral sands deposits along the beaches of the east coast. The ilmenite produced on the east coast has proved unsuitable for titanium oxide pigment manufacture, and most of the production is discarded. However, ilmenite produced from mineral sands mined in Western Australia since 1956 has a much lower chromic oxide content than east coast ilmenite, and is therefore suitable for paint manufacture.

The first commercial development of the mineral sands deposits commenced at Byron Bay in New South Wales in 1934, when a mixed zircon-rutile-ilmenite concentrate was prepared. Large scale production of zircon-rutile concentrate commenced in Queensland in 1941 when electromagnetic separators were installed to separate the ilmenite. In 1943, after the installation of electrostatic separators, a rutile concentrate was produced. The Commonwealth Government banned the export of mixed concentrates in 1944, and all producers now turn out separate concentrates of rutile, zircon, ilmenite and monazite.

Production of rutile and zircon in 1959 was considerably lower than the record post-war production achieved in 1957, mainly because of reduced prices offering on world markets. Virtually all rutile and zircon concentrates are exported overseas.

2. **Present Methods of Mining and Treatment.**—Mineral bearing sands are usually recovered from sand dunes, but deposits occurring below sea level are recovered by suction dredges. The mineral sands and beach sand (quartz) are gravity concentrated, either by shaking tables or by spiral concentrators, resulting in the complete elimination of quartz and leaving a mixed concentrate of heavy minerals. Magnetic ilmenite and monazite are separated by electromagnetic methods and are then separately recovered, using increasing magnetic intensities. The remaining zircon and rutile are separated, using electrostatic separators. The above method is employed at nearly all plants, but Zircon Rutile Ltd., at Byron Bay, recovers a zircon concentrate from the raw sand using froth flotation.

3. **Mine Production.**—(i) *Titanium Dioxide.* The following table shows the quantities of titanium dioxide contained in rutile and ilmenite concentrates produced during the years 1955 to 1959.

TITANIUM DIOXIDE: CONTENT OF CONCENTRATES PRODUCED.
(Tons.)

State.	1955.	1956.	1957.	1958.	1959.
CONTAINED IN RUTILE CONCENTRATE.					
New South Wales	33,045	62,470	83,363	44,915	44,792
Queensland	24,198	30,772	41,500	35,755	34,736
Western Australia .. ..	..	..	..	285	96
Australia	57,243	93,242	124,863	80,955	79,624
CONTAINED IN ILMENITE CONCENTRATE.					
New South Wales	230	481	485	59	111
Queensland	32	..	78	..	..
Western Australia .. ..	..	1,779	38,325	38,219	45,566
Australia	262	2,260	38,888	38,278	45,677

(ii) *Zircon.* The quantities of zircon mineral contained in zircon concentrate produced during the years 1955 to 1959 are shown in the table below.

ZIRCON: CONTENT OF ZIRCON CONCENTRATE PRODUCED.
(Tons.)

State.	1955.	1956.	1957.	1958.	1959.
New South Wales	32,465	50,135	58,747	32,230	71,156
Queensland	15,745	21,634	28,956	26,412	34,504
Western Australia .. ..	..	..	..	103	6,692
Australia	48,210	71,769	87,703	58,745	112,352

(iii) *Other Products.* Small quantities of monazite concentrate, tin concentrate, magnetite and garnet concentrate were also recovered from mineral sands.

(iv) *Sources of Production.* The principal sources of mineral sands treated during 1959 were:—

(a) *New South Wales and Queensland.* The main deposits of mineral sands occur along 300 to 400 miles of the eastern Australian coast from Swansea, New South Wales to Curtis Island, Queensland. At present, the principal mining operations are located within a 90 mile stretch of coast extending from Byron Bay, New South Wales, to North Stradbroke Island, Queensland.

(b) *Western Australia.* Deposits of mineral sands occur on the south-west coast of Western Australia, in the Bunbury and Albany districts.

4. *Employment in Mineral Sands Mining.*—Particulars of the number of persons employed in mineral sands mining are shown in paras. 4 (ii) and (iii), pages 1039–40.

§ 10. Aluminium.

1. *Mine Production.*—The source of aluminium is the ore bauxite, which is produced in small quantities in New South Wales, Victoria and Queensland. Australian production is used for the manufacture of refractories, all bauxite used for metal extraction during 1959 (except a small quantity of Western Australian ore used for plant tests) being imported, mainly from Indonesia. Large deposits of bauxite exist on the Cape York Peninsula in north Queensland, and it is expected that this raw material will be refined in Australia when mining commences. The alumina content of bauxite produced in Australia during the years 1955 to 1959 is shown in the following table:—

ALUMINA : CONTENT OF BAUXITE PRODUCED.

(Tons.)

State.	1955.	1956.	1957.	1958.	1959.
New South Wales	902	1,578	1,354	633	1,648
Victoria	1,644	2,600	1,910	2,304	1,991
Queensland	(a) 860	(a) 440	(a) 494	(a) 596	..
Western Australia .. ..	..	..	..	..	(a) 3,275
Australia	3,406	4,618	3,758	3,533	6,914

(a) Estimated.

2. *Refinery Production.*—A refinery for the production of alumina and refined aluminium was constructed at Bell Bay on the Tamar River, in Northern Tasmania. The location of this refinery was determined by the availability of large supplies of hydro-electric power. Production of alumina commenced in February, 1955, and of refined aluminium in September, 1955. The following table shows the production of alumina and refined aluminium in Australia during the years 1956 to 1960:—

ALUMINA AND REFINED ALUMINIUM : PRODUCTION, AUSTRALIA.

(Tons.)

Refinery Product.	1956.	1957.	1958.	1959.	1960.
Alumina	16,863	20,116	22,490	26,900	29,801
Refined Aluminium	9,143	10,624	10,869	11,370	11,655

Source: Bureau of Mineral Resources.

§ 11. Uranium.

Uranium concentrate has been produced in Australia since 1954, but particulars of the quantity of U_3O_8 concentrate produced and its value are not available for publication. All U_3O_8 concentrate is exported overseas. During 1959, the principal producing centres were as follows:—

- (i) *Queensland.* Uranium ore was mined by opencut methods at Mary Kathleen, 33 miles east of Mt. Isa.
- (ii) *South Australia.* Uranium ore was mined by underground methods at Radium Hill, 289 miles north-east of Adelaide. A concentrate of heavy minerals is produced at the mine and this is railed to a treatment plant at Port Pirie for the chemical extraction of U_3O_8 concentrate.
- (iii) *Northern Territory.* At Rum Jungle, uranium-copper and copper ores were treated to produce U_3O_8 concentrate, copper concentrate and copper precipitate. Mining operations ceased at Rum Jungle in November, 1958, but sufficient ore was stockpiled to permit the continuation of full-scale production of uranium concentrate for some years.

During 1959, ore was mined in the South Alligator River area. Two companies opened treatment plants in that year.

Income from uranium mining is exempt from taxation in the hands of Australian producers. If the producer is an Australian company, such income is exempt from taxation in the hands of the shareholders when paid as dividends.

§ 12. Other Metallic Minerals.

1. *Tungsten.*—In recent years, Tasmania has been the principal State producing tungsten ores, scheelite being mined on King Island in Bass Strait and wolfram being mined in association with tin ores in the north-east part of the State. Because of low world prices, scheelite production on King Island ceased in August, 1958, but production was recommenced on a limited scale in 1960.

Particulars of the production of tungstic oxide contained in scheelite and wolfram concentrates produced during the years 1955 to 1959 are shown in the following table:—

TUNGSTIC OXIDE (WO_3) : CONTENT OF CONCENTRATES PRODUCED.
(Tons.)

State.	1955.	1956.	1957.	1958.	1959.
CONTAINED IN SCHEELITE CONCENTRATE.					
New South Wales	7	2	1	1	(a)
Queensland	(a)	3	1	..	..
Western Australia	5	..	..	..	..
Tasmania	948	985	948	477	..
Australia	960	990	950	478	(a)
CONTAINED IN WOLFRAM CONCENTRATE.					
New South Wales	1	2	(a)	..	..
Queensland	(b) 51	46	19	5	..
Tasmania	389	443	391	360	645
Northern Territory	81	101	49	7	8
Australia	522	592	459	372	653

(a) Less than half a ton.

(b) Estimated.

2. **Manganese.**—There has been considerable expansion of manganese ore production in recent years, due mainly to the relaxation of some provisions of the embargo on export of manganese ores. Western Australia, where activities were centred around Horseshoe in the Peak Hill District and Ant Hill and Mt. Sunday in the Pilbara District, continues as the main producing State. Northern Territory production is at Mucketty, near Renner Springs.

The following table shows the manganese content of metallurgical grade and the manganese dioxide content of battery and other grades of manganese ore produced during the years 1955 to 1959:—

MANGANESE : CONTENT OF MANGANESE ORE PRODUCED.
(Tons.)

Year.	Metallurgical Grade.				Battery and Other Grades.			
	In terms of Manganese (Mn) Content.				In terms of Manganese Dioxide (MnO ₂) Content.			
	N.S.W.	Q'land. (a)	W. Aust.	Australia.	N.S.W.	W. Aust.	N. Terr.	Australia.
1955 ..	443	35	19,984	20,462	403	..	975	1,378
1956 ..	436	140	25,280	25,856	371	179	914	1,464
1957 ..	391	557	33,956	34,904	385	186	668	1,239
1958 ..	516	3,181	21,926	25,623	511	195	2,113	2,819
1959 ..	620	4,350	35,996	40,966	907	162	1,406	2,475

(a) Estimated.

Zinc concentrates produced at Broken Hill and Rosebery contain manganese. However, in 1959, only 167 tons of manganese dioxide, recovered as a by-product of zinc refining at Risdon, near Hobart, were utilized.

3. **Other.**—The production in 1959 (1958 shown in parentheses) of other metallic minerals worthy of note was as follows:—

Antimony. The antimony content of antimony-bearing minerals produced was 1,280 tons (1,356 tons). Of this amount, 652 tons (664 tons) were in lead concentrate and 628 tons (692 tons) in 1,022 tons (1,116 tons) of antimony ore and concentrate.

Beryllium. Production of beryllium ore was 317 tons (247 tons), which came mainly from Western Australia where the Pilbara gold field was the main producing area. The beryllium oxide content of the ore was 3,587 units of 22.4 lb. (2,900 units).

Chromite. Production of chromite was 120 tons (776 tons) with an estimated chromic oxide content of 60 tons (386 tons). This production came from Rockhampton, in Queensland.

Tantalite-Columbite. The production of tantalite-columbite concentrate was 18,950 lb. (13,507 lb.) and the whole of this output came from Western Australia. The tantalum pentoxide and columbium pentoxide content of the concentrates was 8,499 lb. (6,736 lb.).

Other. A small quantity of native osmiridium was produced in Australia during 1959.

§ 13. Coal.

1. **Historical.**—Coal was probably the first of Australia's mineral products to be discovered, being reported from the neighbourhood of Newcastle in 1796. In the following year, outcrop coal was discovered at Coalcliff, 40 miles south of Sydney, and at the entrance to the Hunter River in the Newcastle district. By 1799, outcrop coal was being exported overseas from the latter field. All production was from the Newcastle district until 1857, when the first coal was produced from the southern field. The estimated production in 1830 was 4,000 tons and this increased to 30,000 tons in 1840, 70,000 tons in 1850, and 370,000 tons in 1860. In 1864, the first coal was discovered in the Greta-Cessnock-Maitland field which has since become the principal Australian source of gas coal.

The discovery of coal in Victoria dates from the year 1825, when the mineral was reported to have been found at Cape Paterson, but only a small quantity of coal was mined in Victoria prior to the opening of the State-owned mine at Wonthaggi in 1909. Present day Victorian production is obtained almost exclusively from this mine. In Victoria, brown coal was discovered at Lal Lal in 1857 and in the Latrobe Valley in 1874. Mining operations were first undertaken in 1889, but it was not until after the 1914-18 War that large scale mining began.

In Queensland, coal was first discovered near Ipswich in 1827 and the first colliery was established there in 1846. At Blair Athol, 240 miles west of Rockhampton, coal was discovered in 1864. This field is unique in that the field's total reserves of 200 million tons are available for opencut mining in a seam attaining a thickness of over 90 feet, the greatest thickness of black coal yet found in Australia.

The deposits of black coal at Leigh Creek, 377 miles north of Adelaide, were discovered in 1888 during dam-sinking operations. Small quantities of coal were mined in 1907 and 1917, but it was not until 1944 that extensive opencut mining operations began.

In Western Australia, coal was first discovered on the Irwin River in 1846, but the discovery of the Collie field in 1883 proved to be of far greater importance. This field is located 120 miles south of Perth and commercial mining began there in 1898.

There appear to be no reliable records of the earliest discoveries of coal in Tasmania. Coal was mined on the Tasman Peninsula to provide fuel for penal settlements in the vicinity and for Hobart, and mining continued there until about 1877. In 1824, coal was discovered at South Cape Bay near the most southerly part of the island. The most important deposit is the Mt. Nicholas-Fingal-Dalmaine (St. Marys) field in the north-east part of the State.

The mining of black coal on a large scale by opencut methods first began in Australia at Blair Athol in Queensland, where in 1937, the first year of production, 18,494 tons (0.2 per cent. of total Australian black coal production for that year) were produced. Opencut mining of black coal was introduced in New South Wales in 1940, in Western Australia in 1943, in South Australia in 1944, and in Tasmania in 1950. The output from opencuts rose slowly up to 1943 when 119,406 tons (0.8 per cent.) were produced, increasing rapidly from 1944 and reaching an output of 4,102,653 tons (21.1 per cent.) in 1952. Since then, however, the output from opencut mining has declined and in 1959 it was only 1,705,374 tons (8.4 per cent.). This decline has been mainly due to the closing down of large opencuts in New South Wales, as over-production of coal began to occur late in 1952.

2. Mine Production of Black Coal.—Production of black coal according to rank in the several States during the years 1955 to 1959 is set out in the following table. The tonnages produced by underground mining and opencut mining are also shown.

BLACK COAL : PRODUCTION.
(Tons.)

Particulars.	1955.	1956.	1957.	1958.	1959.
NEW SOUTH WALES.					
Bituminous	14,720,084	14,792,853	15,376,240	15,840,550	15,712,440
Sub-bituminous ..	16,313	17,312	13,996	10,398	..
Total	14,736,397	14,810,165	15,390,236	15,850,948	15,712,440
Underground mines ..	13,834,824	13,999,615	14,662,155	15,130,633	15,278,162
Opencut mines ..	901,573	810,550	728,081	720,315	434,278
VICTORIA.					
Total(a) ..	132,888	118,827	111,569	108,359	90,438

(a) Bituminous coal from underground mines.

BLACK COAL: PRODUCTION—*continued.*

(Tons.)

Particulars.	1955.	1956.	1957.	1958.	1959.
QUEENSLAND.					
Semi-anthracite ..	80,442	79,316	68,873	55,190	51,849
Bituminous ..	2,459,727	2,472,692	2,475,079	2,392,435	2,476,479
Sub-bituminous ..	206,996	182,651	157,625	132,748	66,059
Total ..	2,747,165	2,734,659	2,701,577	2,580,373	2,594,387
Underground mines ..	2,108,065	2,103,641	2,170,979	2,098,030	2,142,302
Opencut mines ..	639,100	631,018	530,598	482,343	452,085
SOUTH AUSTRALIA.					
Total(b) ..	455,287	481,463	608,913	755,022	690,374
WESTERN AUSTRALIA.					
Total(c) ..	903,792	830,007	838,661	870,882	911,435
Underground mines ..	599,662	621,467	689,882	779,394	800,856
Opencut mines ..	304,130	208,540	148,779	91,488	110,579
TASMANIA.					
Semi-anthracite ..	1,764	1,827	1,847	2,006	2,217
Bituminous ..	297,457	296,886	266,293	274,262	297,151
Total ..	299,221	298,713	268,140	276,268	299,368
Underground mines ..	283,743	280,332	253,108	260,100	281,310
Opencut mines ..	15,478	18,381	15,032	16,168	18,058
AUSTRALIA.					
Semi-anthracite ..	82,206	81,143	70,720	57,196	54,066
Bituminous ..	17,610,156	17,681,258	18,229,181	18,615,606	18,576,508
Sub-bituminous ..	1,582,388	1,511,433	1,619,195	1,769,050	1,667,868
Total ..	19,274,750	19,273,834	19,919,096	20,441,852	20,298,442
Underground mines ..	16,959,182	17,123,882	17,887,693	18,376,516	18,593,068
Opencut mines ..	2,315,568	2,149,952	2,031,403	2,065,336	1,705,374

(b) Sub-bituminous coal from an opencut mine.

(c) Sub-bituminous coal.

The principal producing centres during 1959 were as follows:—

- (i) *New South Wales.* The principal deposits worked were in the vicinity of Newcastle, Cessnock and Singleton (northern field), Lithgow (western field) and Wollongong (southern field). Tonnages mined in 1959 were: northern field, 9,338,280 tons; southern field, 4,811,754 tons and western field, 1,562,406 tons. All opencut coal was from the northern field.
The coal fields of New South Wales, predominantly bituminous, are the most important in Australia, in respect of the magnitude, quality and accessibility of reserves and the extent to which the deposits are being worked. Coal from the various seams differs in properties, coal from the Greta seam worked in the vicinity of Cessnock being particularly suitable for gas making, while coal from the Victoria tunnel, Dudley, Young Wallsend and Borehole seams, all of which are mined near Newcastle, have coking properties and are used in the steelworks. Coking coal is also obtained from the Bulli seam which is mined near Wollongong and in the Burragorang Valley. A multi-purpose coal is available in the Singleton area and steaming coals are mined around Newcastle, Lithgow, Cessnock and Wollongong.
- (ii) *Victoria.* Production of black coal in Victoria was restricted to the Gippsland district. The State Coal Mine at Wonthaggi was the main producer, and the remaining production came from small privately-owned mines.
- (iii) *Queensland.* The principal producing centres were Ipswich, 1,520,521 tons; Collinsville, 478,509 tons; Blair Athol, 175,573 tons; and Callide, 67,720 tons. Opencut coal was mined at Blair Athol, Callide, and Collinsville and the total coal won by this means was 17 per cent. of total production.
- (iv) *South Australia.* Coal was mined only at Leigh Creek, 377 miles north of Adelaide.
- (v) *Western Australia.* The only coal deposits which have been developed on a commercial scale are at Collie in the south-west of the State and all production during 1959 was from this source.
- (vi) *Tasmania.* Of the total production, 290,692 tons were produced from the Avoca and Mt. Nicholas-Fingal-Dalmaine fields in the north-east of the State. Of the remainder, 2,217 tons of semi-anthracite were produced at the Sandfly mine, near Hobart.

3. *Mine Production of Brown Coal.*—Brown coal is mined only in Victoria and production in recent years has been as follows:—1955, 10,112,206 tons; 1956, 10,559,801 tons; 1957, 10,740,989 tons; 1958, 11,643,629 tons; and 1959, 13,034,605 tons. In the past ten years, the output of brown coal has nearly doubled.

4. *Australia's Coal Reserves.*—The latest available estimate of the measured and indicated coal reserves of Australia is that prepared by the Coal and Lignites Panel of the Power Survey Sectional Committee of the Standards Association of Australia, and is shown in the following table. It should be noted that reserves can only be included in the "measured and indicated" categories when sufficient exploratory and testing work has been completed.

ESTIMATED COAL RESERVES OF AUSTRALIA, 1959.
(Million Tons.)

State.	Bituminous Coal.(a)	Sub-bituminous Coal.	Brown Coal. (Lignite).
New South Wales	8,650	800	..
Victoria	12	..	56,100
Queensland	749	..	..
South Australia .. .. .	..	144	230
Western Australia .. .. .	..	274	..
Tasmania	240	..	..
Australia	9,651	1,218	56,330

(a) Includes reserves of a small quantity of semi-anthracitic coal.

5. *Production in Principal Countries.*—The following table shows the production of the principal countries in 1958 and 1959 as published by the Mineral Resources Division of the United Kingdom Overseas Geological Surveys.

COAL : PRODUCTION IN PRINCIPAL COUNTRIES.
(⁰000 Tons.)

Country.	Black Coal.		Brown Coal and Lignite.	
	1958.	1959.	1958.	1959.
United States of America ..	383,205	383,837	2,167	2,482
U.S.S.R.	347,000	359,600	141,000	138,900
China	270,000	342,300	..	..
United Kingdom	215,825	206,114	..	..
Germany, Federal Republic ..	133,221	126,205	92,285	92,230
Poland	93,481	97,500	7,422	9,200
France	56,809	56,696	2,281	2,141
India	(a) 45,340	(a) 47,000	(b)	(b)
Japan	48,884	44,977	1,557	1,537
Union of South Africa	36,499	35,876	..	..
Czechoslovakia	23,554	24,727	55,940	52,855
Belgium	26,635	22,397	..	..
Australia	20,442	20,298	11,644	13,035
Saar	16,164	15,972	..	..
Spain	14,216	13,327	2,629	2,069
Netherlands	11,692	11,823	251	196
Canada	8,423	7,749	2,012	1,739
Germany, Eastern	2,858	2,796	211,574	211,391
Hungary	2,585	2,691	21,273	22,256
Yugoslavia	1,188	1,276	17,598	19,498
<i>Estimated World Total</i> ..	<i>1,800,000</i>	<i>1,860,000</i>	<i>600,000</i>	<i>620,000</i>

(a) Includes lignite.

(b) Included with black coal.

6. *Consumption of Coal in Australia.*—(i) *Black Coal.* Details of the production of black coal in Australia and its disposal are shown in the following table for the years 1955–56 to 1959–60.

BLACK COAL : PRODUCTION AND CONSUMPTION.
(⁰000 Tons.)

Particulars.	1955–56.	1956–57.	1957–58.	1958–59.	1959–60.
Production(a)	19,033	19,711	20,362	20,459	21,209
Imports	4	6	9	8	8
Total	19,037	19,717	20,371	20,467	21,217
<i>Consumption as Fuel—</i>					
Electricity Generation ..	5,922	6,363	6,941	7,131	7,398
Factories	3,101	2,977	2,991	3,122	3,169
Railway Locomotives(b) ..	2,963	2,690	2,217	2,050	2,002
<i>Bunker Coal—</i>					
Oversea Vessels	39	9	12	8	8
Interstate Vessels(c) ..	198	181	171	172	148
Total	12,223	12,220	12,332	12,483	12,725
<i>Consumption as raw material—</i>					
Gas works	2,031	1,946	1,779	1,761	1,727
Coke works	3,258	3,665	3,841	3,846	4,216
Total	5,289	5,611	5,620	5,607	5,943
Exports (Oversea)	194	545	836	645	1,088
Mine Washery Refuse and Dump Losses(c)	233	274	495	660	982
Balance—Unrecorded consumption, other purposes(d)	1,098	1,067	1,088	1,072	479
Grand Total	19,037	19,717	20,371	20,467	21,217

(a) Includes miners' and colliery coal.

(b) Government railways only.

(c) Only New South Wales available.

(d) Includes net change in stocks.

After the 1939-45 War, it was found necessary to augment local supplies of black coal in Australia by increasing imports. The quantity imported reached a post-war peak of 597,866 tons in 1950-51, but has since declined as production has expanded considerably. Since 1952-53, exports have exceeded imports by a wide margin; in 1959-60, exports of black coal were 1,087,844 tons and imports were 7,678 tons. These imports were of black coal for special purposes only.

(ii) *Brown Coal.* The table following shows the production and utilization of brown coal and the production of briquettes in Victoria for the years 1955-56 to 1959-60:—

BROWN COAL: PRODUCTION AND UTILIZATION, VICTORIA.
(’000 Tons.)

Year.	Production.	Consumption as Fuel.			Consumption as Raw Material in Briquette Manufacture.	Briquettes Manufactured.
		Electricity Generation.	Briquette Factory.	Other Factories. (a)		
1955-56	10,383	6,517	843	1,191	1,686	634
1956-57	10,772	6,943	806	1,309	1,613	618
1957-58	10,869	7,020	810	1,297	1,619	626
1958-59	12,243	8,470	819	1,293	1,639	643
1959-60(b)	14,101	9,300	1,198	1,248	2,396	975

(a) Recorded consumption.

(b) Subject to revision.

The briquetting plant of the State Electricity Commission at Yallourn started operations in November, 1924, and the output, which in 1926 was 95,477 tons, had increased to 180,905 tons in 1930 and to 1,513,727 tons in 1960. Approximately two and a half tons of brown coal are required to make one ton of briquettes. In December, 1956, the Lurgi high pressure brown coal gasification plant at Morwell was opened. This plant is operated by the Gas and Fuel Corporation of Victoria and produces town gas which is sent to Melbourne through 103 miles of pipeline.

7. *Exports.*—The quantities and values of the overseas exports of Australian coal and of bunker coal for overseas vessels for the five years 1955-56 to 1959-60 are shown in the following table. These shipments were made mainly from New South Wales.

COAL: OVERSEA EXPORTS AND BUNKER, AUSTRALIA.

Year.	Oversea Exports.(a)		Bunker Coal for Oversea Vessels.	
	Quantity.	Value.	Quantity.	Value.
	Tons.	£A f.o.b.	Tons.	£A f.o.b.
1955-56	193,813	780,284	38,749	165,224
1956-57	545,101	2,196,044	9,065	44,116
1957-58	836,336	3,390,628	11,608	50,656
1958-59	645,249	2,676,042	8,187	37,808
1959-60	1,087,844	4,326,810	8,117	25,380

(a) Excludes bunker coal.

New South Wales, in addition to meeting requirements within the State, supplies considerable quantities of coal to other States and for export overseas. Of the total of 17,076,000 tons produced in 1959-60, 1,951,000 tons (11.4 per cent.) were exported interstate and 1,088,000 tons (6.4 per cent.) were exported overseas. The demand for bunker coal continues to decline and in 1959-60 a total of 149,000 tons (0.9 per cent.) of New South Wales production was supplied for interstate and overseas vessels.

8. Value at the Mine in New South Wales.—Particulars of the average values at the mine (or at screens or mine washeries where these are at a distance from the mine) of saleable coal for each district and for New South Wales as a whole are shown in the following table for the years 1955 to 1959. Saleable coal excludes miners' coal, coal consumed at the mines and refuse, etc., removed by the use of hand picking belts or at mine washeries. In calculating these values, coal won by producer consumers is also excluded, and in respect of stocks of coal held at grass by the Commonwealth Government only actual sales have been taken into account. No deduction has been made in respect of excise duty operative from 1st November, 1949.

**AVERAGE SELLING VALUE AT THE MINE PER TON OF SALEABLE COAL:
NEW SOUTH WALES.**

(s. d.)

Year.	Northern District.	Southern District.	Western District.	Average for State.
1955.. ..	59 11	58 10	55 9	59 2
1956.. ..	59 3	58 1	55 1	58 6
1957.. ..	58 3	55 7	50 7	56 9
1958.. ..	56 1	55 0	47 5	54 10
1959.. ..	52 5	54 4	47 6	52 7

9. Values in New South Wales, United Kingdom and the United States of America.—The following table shows, for the years 1955 to 1959, average values of coal produced in New South Wales, Great Britain and the United States of America. The figures give an indication of changes in average value or price within each country but they do not necessarily show the relative levels as between the countries concerned.

PRODUCTION VALUES OF COAL PER TON: NEW SOUTH WALES, UNITED KINGDOM AND UNITED STATES OF AMERICA.

Country.	1955.	1956.	1957.	1958.	1959.
	s. d.	s. d.	s. d.	s. d.	s. d.
New South Wales—Bituminous(a)	59 2	58 6	56 9	54 10	52 7
United Kingdom—Deep mined(b)	68 0½	77 0	82 1	85 7	83 5½
United States of America—Bituminous and lignite(c) ..	\$ 4.50	\$ 4.82	\$ 5.08	\$ 4.86	\$ 4.77

(a) Average selling value at the mine per ton of 2,240 lb.; the figures relate to saleable coal and include excise duty. (b) Average value in sterling at the mine per ton of 2,240 lb. (c) Average value in United States currency at the mine per ton of 2,000 lb.

10. Employment in Coal-mines.—The number of persons employed, both above and below ground, in coal-mines in each State for each of the years 1955 to 1959 is shown in the following table:—

COAL-MINES: PERSONS EMPLOYED.(a)

Year.	New South Wales.	Victoria.		Queensland.	South Australia.	Western Australia.	Tasmania.	Australia.
		Black.	Brown.					
1955	19,260	687	1,502	3,634	280	1,432	367	27,162
1956	17,918	610	1,566	3,568	260	1,190	349	25,461
1957	16,622	561	1,579	3,493	223	1,145	301	23,924
1958	15,463	516	1,540	3,295	230	999	292	22,335
1959	13,445	401	1,519	3,172	251	1,095	314	20,197

(a) Average number of persons employed (including working proprietors) during whole year.

The year of maximum employment was 1926 when 31,774 persons were engaged in the coal-mines of Australia. Shortly after that year, the industrial depression and a prolonged stoppage of work on one of the principal fields of New South Wales during 1929 and 1930 seriously affected the figures of employment. After 1933, there was a gradual increase up to a level of about 23,000 which was maintained during the war years. There was a further increase after the war to 28,303 in 1952, but since then the number in employment has fallen again. In 1959, it was 20,197.

In New South Wales, during 1959, 13,483,000 tons of coal or 88.2 per cent. of the total output of underground coal, were loaded by machinery as compared with 1,101,000 tons (9.8 per cent.) in 1939, 3,089,000 tons (32.9 per cent.) in 1949, and 12,354,000 tons (81.6 per cent.) in 1958. Similar details for other States are not available, but machinery is used to a considerable extent in Western Australian mines and to a lesser extent in Queensland.

11. Production of Black Coal per Man-shift.—(i) *Underground Mines.* The following table shows particulars of estimated black coal output per man-shift worked, (a) at the coal face, and (b) by all employees, in respect of underground mines for each State concerned and for Australia for the years 1955 to 1959. These estimates have been calculated by the Joint Coal Board from data collected fortnightly in respect of coal production and the number of man-shifts actually worked. In South Australia, black coal is won only by opencut mining.

PRODUCTION OF BLACK COAL PER MAN-SHIFT: UNDERGROUND MINES.
(Tons.)

Year.	N.S.W.	Vic.	Q'land.	W. Aust.	Tas.	Australia.
PRODUCTION PER MAN-SHIFT WORKED AT COAL FACE.						
1955	10.76	2.13	6.61	4.74	6.54	9.24
1956	11.43	2.05	6.79	5.14	7.04	9.77
1957	13.19	2.01	7.13	5.88	7.60	11.02
1958	14.48	2.04	7.28	6.67	8.01	11.96
1959	18.07	2.10	7.53	7.60	7.34	14.13
PRODUCTION PER MAN-SHIFT WORKED BY ALL EMPLOYEES.						
1955	3.29	0.86	2.66	2.06	3.08	3.14
1956	3.55	0.83	2.65	2.35	3.41	3.28
1957	3.99	0.85	2.82	2.77	3.76	3.65
1958	4.35	0.89	2.90	3.02	3.91	3.95
1959	4.90	0.93	2.95	3.35	3.72	4.37

(ii) *Opencut Mines.* In the next table, the Joint Coal Board's estimates of production of black coal per man-shift worked by all employees in opencut mines are shown for the years 1955 to 1959. There are no opencuts producing black coal in Victoria.

PRODUCTION OF BLACK COAL PER MAN-SHIFT: OPENCUT MINES.
(Tons.)

Year.	N.S.W.	Q'land.	S. Aust.	W. Aust.	Tas.	Australia.
1955	9.18	11.42	6.02	5.77	7.78	8.11
1956	10.36	13.06	6.72	6.37	8.56	9.19
1957	11.11	12.17	9.89	6.04	7.68	10.25
1958	11.31	13.63	11.46	6.78	10.42	11.47
1959	12.47	12.50	10.36	7.64	10.47	11.08

12. **Joint Coal Board.**—After the 1939–45 War, the Governments of the Commonwealth and New South Wales agreed to create jointly a coal authority with powers similar to, and in some respects wider than, those possessed under Commonwealth war-time legislation. Following this agreement, the Joint Coal Board was created and has functioned as from 1st March, 1947. Briefly, it is the responsibility of the Board to ensure that the coal of the State is conserved, developed, worked, distributed and used to the best advantage in the public interest, and to promote the welfare of the workers in the industry. Further details of the powers and functions of the Board are contained in Official Year Book No. 39, page 887.

§ 14. Coke and Other By-products from Coal.

1. **Coke.**—The production of metallurgical coke in Australia was limited to about 250,000 tons per annum prior to the 1914–18 War. This was below local requirements and necessitated an annual import of about 27,000 tons. By 1920, production had risen to more than 500,000 tons, by 1938–39 to 1,164,873 tons, and in 1959–60 it reached the record level of 2,376,097 tons. Imports exceeded exports prior to 1952–53, but in 1952–53 and later years there has been a net export surplus. In 1959–60, exports amounted to 75,502 tons while imports were 8,802 tons. Most of the tonnage imported is petroleum coke for use in the production of aluminium.

In addition to metallurgical coke referred to above (which is produced by specialized coke works), considerable quantities of coke are produced in gas works as a by-product of the manufacture of gas. Production in gas works in 1959–60 was 758,668 tons. To date, there has been no production of petroleum coke at Australian oil refineries.

In order to avoid duplication with coal values, the figures for coke have not been included in the general tables of mineral production in the early part of this chapter.

In the following table, particulars of the production of coke in coke works and gas works in Australia are shown for the years 1955–56 to 1959–60. The figures exclude output of coke breeze, which amounted to 343,808 tons in 1958–59 and 316,549 tons in 1959–60.

COKE PRODUCTION: AUSTRALIA.
(Tons.)

Industry..	1955–56.	1956–57.	1957–58.	1958–59.	1959–60.
Coke Works	2,058,426	2,234,458	2,295,737	2,210,621	2,376,097
Gas Works	1,031,135	954,756	831,615	815,464	758,668
Total	3,089,561	3,189,214	3,127,352	3,026,085	3,134,765

2. **Other By-products from Coal.**—In addition to coke, other products are obtained from the treatment of coal by coke and gas works. Some of the main items produced, principally in coke and gas works, during 1959–60 (1958–59 in parentheses) were: crude tar, 43,474,814 gallons (49,799,660 gallons); refined tar, 29,647,990 gallons (28,696,302 gallons); and ammonium sulphate, 104,861 tons (117,489 tons).

§ 15. Mineral Oils.

In 1960, the search for oil continued throughout the Australian mainland and in Papua-New Guinea. Some significant discoveries of gas were made. In two instances, some oil was associated with gas shows.

In the Roma area, Queensland, Pickanjinne No. 1 well tested a flow of 6.2 million cubic feet of gas per day. Cabawin No. 1 well, near Tara, Queensland, blew out while drilling below 9,000 feet, and some oil was observed in association with gas. The well was quickly brought under control and drilling is continuing.

In Papua, Ichi No. 11 well was drilled to a total depth of 10,042 feet. A gas flow of about 31 million cubic feet per day was tested from an interval in the Mesozoic section. No oil shows were recorded.

The Petroleum Search Subsidy Act 1959 continues to attract applications for subsidy for stratigraphic drilling and geophysical surveys. For particulars of the subsidy, see paragraph (d), *Search for Oil*, page 1088.

Drilling programmes were undertaken in all States and Territories with the exception of South Australia and Tasmania.

In the following table, details are given of the footage drilled in the search for oil in the Commonwealth of Australia and the Territories of Papua and New Guinea during the years 1956 to 1960:—

FOOTAGE DRILLED IN THE SEARCH FOR OIL.

Source: Bureau of Mineral Resources.(a)

State or Territory..	1956.	1957.	1958.	1959.	1960.
	Feet.	Feet.	Feet.	Feet.	Feet.
New South Wales	4,608	8,729	16,357	17,422	6,169
Victoria	22,660	12,244	2,439	8,395	14,682
Queensland	92	15,343	5,081	30,328	54,841
South Australia	16,966	13,995	6,239	12,637	..
Western Australia	61,271	26,961	30,383	36,020	17,193
Northern Territory .. ..	..	..	..	2,458	1,373
Australia	105,597	77,272	60,499	107,260	94,258
Territories of Papua and New Guinea	17,500	25,636	29,350	13,389	10,042

(a) Based on figures obtained from State Departments of Mines and the Northern Territory Mines Branch.

§ 16. Sulphur.

1. **Mine Production of Sulphur.**—There is no production of elemental sulphur (brimstone) in Australia but, although sulphur is itself non-metallic, considerable quantities are contained in certain metallic minerals produced.

It should be noted that large quantities of the lead and zinc concentrates produced are exported and the sulphur they contain is not available for utilization in Australia.

The following table shows the sulphur content of the metallic minerals produced during 1959 from which sulphur was subsequently recovered:—

SULPHUR: CONTENT OF METALLIC MINERALS PRODUCED, 1959.

(Tons.)

Mineral in which contained.	N.S.W.	Q'land.	S. Aust.	W. Aust.	Tas.	Australia.
Lead Concentrate	48,042	..	..	(a) 266	(a) 2,160	50,468
Lead-copper Concentrate ..	..	..	..	..	(a) 841	(a) 841
Pyrite Concentrate	16,577	8,946	(a) 27,616	24,207	29,535	106,881
Zinc Concentrate ..	124,273	(a) 8,518	..	..	19,564	152,355
Total ..	188,892	17,464	(a) 27,616	24,473	52,100	310,545

(a) Estimated.

The principal producing centres during 1959 were:—

(i) *New South Wales.* All the sulphur produced in New South Wales was contained in lead and zinc concentrates produced at Broken Hill and in lead, zinc and pyrite concentrates produced at Captain's Flat.

(ii) *Queensland.* In Queensland, sulphur was contained in zinc concentrate milled at Mt. Isa and in pyrite concentrate produced at Mt. Morgan. No sulphur was recovered in Australia from the zinc concentrate.

(iii) *South Australia.* A pyrite concentrate containing sulphur was produced from ore mined at Nairne, 22 miles east of Adelaide.

(iv) *Western Australia.* Sulphur was recovered from pyrite concentrates produced at Norseman and at Kalgoorlie. Although both these concentrates are auriferous, gold was recovered only from that produced at Kalgoorlie. A small quantity of sulphur was contained in lead concentrates produced in the Northampton mineral field.

(v) *Tasmania.* A pyrite concentrate was recovered at Mt. Lyell after the prior separation of the copper sulphide mineral. Recoverable sulphur was also contained in lead, lead-copper and zinc concentrates milled at Rosebery, but only that contained in zinc concentrate was recovered in Australia.

The following table shows for the years 1955 to 1959 the sulphur content of minerals from which sulphur was subsequently recovered:—

SULPHUR: CONTENT OF METALLIC MINERALS PRODUCED.

(Tons.)

State.	1955.	1956.	1957.	1958.	1959.
New South Wales	140,120	187,087	207,604	197,736	188,892
Queensland	47,515	(a) 15,103	24,544	(a) 14,647	17,464
South Australia (b) ..	13,790	31,248	32,721	32,129	27,616
Western Australia	23,892	25,295	25,420	22,635	24,473
Tasmania	39,066	47,339	52,185	54,472	52,100
Australia ..	264,383	306,072	342,474	322,619	310,545

(a) Partly estimated. (b) Estimated.

2. **Production of Sulphuric Acid.**—The principal use of sulphur is in the manufacture of sulphuric acid, which is produced in all States and in the Northern Territory. Most of this is used for fertilizer manufacture, although small quantities are used in the rubber and chemical industries and in the preparation of uranium concentrates. Sulphur contained in lead concentrate is used for acid manufacture at Port Pirie and sulphur in zinc concentrates is used at Risdon. Pyrite concentrate is used as a source of sulphur for acid manufacture at Cockle Creek, near Newcastle, and at Port Kembla in New South Wales, and at Melbourne, Brisbane, Adelaide, Perth and Fremantle. However, half the sulphuric acid produced in Australia is made from imported elemental sulphur. The next table shows, for the years 1956 to 1960, the Australian production of sulphuric acid and the quantity of sulphur in the acid produced from various sources.

SULPHUR USED IN SULPHURIC ACID PRODUCTION: AUSTRALIA.

(Tons.)

Item.	1956.	1957.	1958.	1959.	1960.
<i>Production of Sulphuric Acid (Mono.)</i>	<i>841,225</i>	<i>971,976</i>	<i>1,009,064</i>	<i>1,000,458</i>	<i>1,109,751</i>
<i>Sulphur in Sulphuric Acid (Mono.) produced from—</i>					
Sulphur (Elemental)(a) ..	146,816	156,413	162,881	153,195	179,752
Zinc Concentrate	29,061	35,025	38,524	39,933	42,946
Lead Concentrate	16,090	18,272	21,339	19,619	21,573
Pyrite	76,780	100,111	99,216	103,596	104,406
Spent Oxide	4,643	4,744	4,301	3,655	3,814
Other Materials	1,694	3,271	3,702	7,151	10,396
Total Sulphur Content..	275,084	317,836	329,963	327,149	362,887

(a) All imported.

§ 17. Non-metallic Minerals.

1. **Asbestos.**—The production of asbestos in Australia at present is only sufficient to meet about one-sixth of domestic requirements. Production in recent years has been of two types, chrysotile (white) and crocidolite (blue). The deposits of chrysotile, however, are relatively small and widely scattered, and during 1959, it was produced mainly at Nunyerry and Lionel in Western Australia and at Baryulgil in New South Wales. Production of crocidolite, which is confined to the Hammersley Ranges in Western Australia, about 200 miles south-east of Roebourne, has expanded greatly in recent years. Large scale operations were commenced there in 1943 at Wittenoom Gorge, and reserves are estimated at two million tons.

The production of chrysotile and crocidolite in Australia during the five years 1955 to 1959 is shown in the following table:—

PRODUCTION OF ASBESTOS : STATES.
(Short Tons of 2,000 lb.)

Year.	Chrysotile.			Crocidolite.
	New South Wales.	Western Australia.	Australia.	Australia.(a)
1955	661	308	969	5,025
1956	697	852	1,549	8,160
1957	676	1,556	2,232	12,438
1958	712	1,543	2,255	13,313
1959	726	707	1,433	16,442

(a) Produced in Western Australia only.

2. **Clays.**—Statistics of clay production in Australia are not entirely satisfactory, mainly because of differences between States in the classification of the various types of clays. In addition, the statistics are incomplete as some clays are outside the normal administrative control of some State Mines Departments. In the following table, the recorded production of the main types of clays produced in each State of Australia is shown for the year 1959.

PRODUCTION OF CLAYS : STATES, 1959.
(Tons.)

Type.	New South Wales.	Victoria.	Queensland	South Australia.	Western Australia.	Tasmania.	Australia.
Bentonite and Bentonitic Clay ..	56	..	96	..	133	..	285
Brick Clay and Shale ..	1,893,440	21,122,000	289,931	441,354	(a) 398,000	153,880	4,298,605
Cement Clay and Shale ..	121,460	(b)	(b)	29,165	22,321	(b)	(c) 172,946
Damouritic Clay ..	..	..	..	491	..	..	491
Fireclay, n.e.i. ..	89,988	29,803	8,443	20,766	26,202	..	175,202
Fuller's Earth ..	136	..	..	..	..	..	136
Kaolin ..	23,888	6,088	20	4,593	1,190	1,195	36,974
Stoneware Clay ..	64,345	..	116	36,725	..	..	101,186
Tile Clay ..	132,111	(b)	(b)	(b)	(b)	11,039	(c) 143,150
Other Clays ..	9,259	159,682	(b)	(b)	(b)	23,324	(c) 192,265

(a) Estimated.

(b) Not available.

(c) Incomplete.

3. **Gypsum.**—There are very extensive deposits of gypsum in Australia, but only the more accessible and easily worked deposits have been exploited. These deposits lie in four main regions, (a) in New South Wales stretching from around Griffith to near Broken Hill, (b) in the north-west corner of Victoria, the south-west corner of New South Wales and adjoining parts of South Australia, (c) in South Australia on both sides of St. Vincent Gulf and extending to Lake MacDonnell in the west, and (d) between Perth and Kalgoorlie in Western Australia. The South Australian deposits are the most important and more than half the total Australian production of gypsum in 1959 came from that State, where the main centres of production are Stenhouse Bay on Yorke Peninsula and Lake MacDonnell.

The building industry is the main user of the gypsum produced in Australia. The greatest part is used in the manufacture of plaster and most of the remainder in cement manufacture. A small amount is also used as fertilizer. A considerable quantity is exported, mainly to New Zealand for use in the plaster industry, and to New Caledonia for use in nickel smelting operations.

The production of gypsum in Australia is set out in the following table for the five years 1955 to 1959.

PRODUCTION OF GYPSUM : STATES.

(Tons.)

Year.	New South Wales.	Victoria.	South Australia.	Western Australia.	Australia.
1955	136,356	83,190	204,522	39,946	470,014
1956	94,203	78,895	263,136	27,121	463,355
1957	101,491	68,647	274,945	33,353	478,436
1958	90,664	72,010	306,749	35,515	504,938
1959	101,143	81,101	296,816	37,731	516,791

4. **Limestone.**—Limestone is quarried in all States, being used mainly for the manufacture of cement. Other uses are in agriculture, in the steel industry as a metallurgical flux, and in the chemical industry.

The recorded statistics of limestone production in each State of Australia for the years 1955 to 1959 are shown in the following table. Details of limestone produced for use as building or road material are not included.

PRODUCTION OF LIMESTONE(a) : STATES.

('000 Tons.)

Year.	New South Wales.	Victoria.	Queensland.	South Australia.	Western Australia.	Tasmania.	Australia.
1955 ..	1,690	714	(b)	987	(b)	206	3,998
1956 ..	1,700	813	(b)	1,076	(b)	179	4,264
1957 ..	1,897	846	(b)	1,135	(b)	205	4,572
1958 ..	2,061	859	(b)	1,220	(b)	235	5,324
1959 ..	2,056	1,120	(b)	1,017	(b)	230	5,305

(a) Includes shell and coral.

(b) Not available for publication, included in total for Australia.

5. **Magnesite.**—The major sources of magnesite at present are deposits at Fifield and Thuddungra in central New South Wales. Most of the output of magnesite in Australia is used for refractory purposes, particularly in the steel industry, and small amounts are used in chemical, paper, glass, rubber, and ceramic industries. Particulars of the production of magnesite in each State for the years 1955 to 1959 are set out in the table below.

PRODUCTION OF MAGNESITE : STATES.

(Tons.)

Year.	New South Wales.	Queensland.	South Australia.	Western Australia.	Australia.
1955	57,262	..	412	..	57,674
1956	63 050	..	831	804	64,685
1957	83,271	..	202	..	83,473
1958	69,030	20	341	..	69,391
1959	59,777	..	790	19	60,586

6. *Mica*.—Almost all Australian production of muscovite mica comes from the Northern Territory, though small quantities of inferior grades have been obtained from most of the States. The centre of mica production in the Northern Territory is the Harts Range area, about 130 miles north-east of Alice Springs, where mining has been carried on intermittently since 1892, and the Plenty River field, 50 miles north-east of Harts Range.

The Commonwealth Mica Pool, details of which are given on page 1094 of Official Year Book No. 46, purchased, prior to 31st December, 1960, all mica which was in accordance with certain specifications. The following table shows the quantity of muscovite mica produced in Australia during the five years 1955 to 1959:—

MUSCOVITE MICA PRODUCTION.

(lb.)

Particulars.	1955.	1956.	1957.	1958.	1959.
New South Wales—					
Scrap	20,160	..	..	15,680	7,000
Queensland—					
Scrap .. ..	..	..	..	21,728	..
Northern Territory—					
Trimmed	56,649	28,837	36,713	31,391	33,665
Crude and Film .. ..	..	..	..	35,840	170,000
Scrap .. ..	..	..	40,600	11,088	11,000

7. *Salt*.—Salt is obtained in Australia by evaporation of saline lakes and clay pans. Production satisfies local requirements and provides a considerable surplus for export. Recorded production in South Australia (the chief producing State) is shown in the following table for the years 1955 to 1959. Estimates of total Australian production are also shown.

SALT PRODUCTION.

('000 Tons.)

Particulars.	1955.	1956.	1957.	1958.	1959.
South Australia	291	332	339	336	358
Estimated Australian Total ..	369	409	428	430	468

8. *Other Non-metallic Minerals*.—(i) *General*. Many other non-metallic minerals are produced in Australia in considerable quantities, and are listed separately in the following paragraphs.

(ii) *Barite*. The principal centre producing first-grade barite is at Orparinna in the North Flinders Range in South Australia. The production of barite in Australia during 1959 was 6,214 tons, of which 6,145 tons came from South Australia and 60 tons from New South Wales.

(iii) *Diatomite*. Production of diatomite is carried on mainly in the eastern States of Australia. In 1959, 5,089 tons were produced, of which New South Wales produced 4,409 tons, mainly at Coonabarabran and Barraba.

(iv) *Dolomite*. Up to 1950, New South Wales was the main producer of dolomite, but in that year a large deposit at Ardrossan in South Australia, which now produces over 90 per cent. of the total output, was opened up. In 1959, South Australia produced 151,401 tons; New South Wales, 3,776 tons; Tasmania, 2,907 tons; and Queensland, 2,000 tons, making an Australian total of 160,084 tons.

(v) *Felspar*. The main demand for felspar comes from the glass and ceramic industries. Most of the Australian production of felspar comes from New South Wales, which produced 4,700 tons out of the Australian total of 6,750 tons in 1959. Of the remainder, 1,396 tons came from Western Australia and 654 tons from South Australia.

(vi) *Gemstones.* (a) *Opals.* Most of the opals won in recent years came from the Coober Pedy and Andamooka fields in South Australia which produced opals worth £422,000 in 1959. Other production in 1959 was from Lightning Ridge in New South Wales, valued at £23,000, and the Quilpie district in Queensland, valued at £1,000.

(b) *Sapphires.* In 1959, sapphires produced in the Inverell District of New South Wales were valued at £2,000 and production from the Anakie Field in Central Queensland was valued at £1,000.

(vii) *Silica.* The production of silica is not recorded in Victoria and production recorded in all other States may not be complete. The output of silica, which includes glass sand, quartz, quartzite, sand, sandstone, and silicious abrasives, but does not include production for use as building or road material, was 125,918 tons in New South Wales; 13,607 tons in South Australia; 7,140 tons in Western Australia; 6,519 tons in Tasmania; and 1,594 tons in Queensland; giving a total of 154,788 tons recorded for those States during 1959.

(viii) *Sillimanite.* In 1959, 3,633 tons of sillimanite were produced in Australia, of which 3,587 tons came from South Australia.

(ix) *Talc.* The Australian output of talc (including steatite) was 16,376 tons in 1959. South Australia produced 11,239 tons, Western Australia 4,048 tons, and New South Wales 1,089 tons.

(x) *Other.* Other non-metallic minerals produced in Australia in small quantities during 1959 were fluorspar, garnet concentrate, glauconite, industrial diamonds, foundry loam, mineral pigments, pebbles for grinding, perlite, phosphate rock, pyrophyllite, and serpentine.

§ 18. Oversea Trade in Minerals and Mineral Products.

Particulars of the quantity and value of the principal mineral and mineral product items imported into and exported from Australia during the years 1957 to 1959 are shown in the following table:—

IMPORTS AND EXPORTS OF PRINCIPAL MINERALS AND MINERAL PRODUCTS: AUSTRALIA.

Item.	Unit of Quantity.	Quantity.			Value. (£A'000 f.o.b. Port of Shipment.)		
		1957.	1958.	1959.	1957.	1958.	1959.
IMPORTS.							
Aluminium, Refined—							
Ingots	ton	8,374	14,813	19,268	2,199	3,356	3,883
Plates, Sheets and Strips	"	1,881	2,317	2,555	907	1,026	1,068
Foil	"	2,193	2,409	2,788	1,512	1,711	1,803
Asbestos	short ton	33,888	38,888	38,330	2,377	2,493	2,502
Gold, Unrefined Bullion	fine oz.	159,998	160,232	136,674	2,479	2,502	2,136
Iron and Steel—							
Bars and Rods	ton	17,860	24,798	9,035	2,394	2,750	1,940
Ferro-alloys	"	14,579	13,335	23,989	2,061	1,486	1,859
Plate and Sheet (Plain)	"	15,404	15,918	9,119	2,860	3,354	2,919
Tinplate	"	144,199	66,059	50,348	14,991	6,699	4,774
Petroleum Oils—							
Crude	'000 gals.	2,118,236	2,441,916	2,603,377	57,574	67,778	69,391
Enriched Crude	"	142,908	95,302	35,559	6,156	4,079	802
Kerosene	"	112,789	97,403	109,649	6,280	5,337	6,002
Lubricating Oil	"	40,165	41,665	49,391	5,831	5,759	6,582
Spirit	"	183,132	207,500	223,405	11,940	12,565	13,228
Phosphate Rock	'000 tons	1,035	1,501	1,327	2,622	-3,894	3,689
Sulphur	ton	120,277	202,421	170,770	1,459	2,254	1,855
Titanium Oxide	"	6,172	6,996	5,472	1,383	1,482	1,016

IMPORTS AND EXPORTS OF PRINCIPAL MINERALS AND MINERAL PRODUCTS: AUSTRALIA—*continued.*

Item.	Unit of Quantity.	Quantity.			Value. (£A'000 f.o.b. Port of Shipment.)		
		1957.	1958.	1959.	1957.	1958.	1959.
EXPORTS.							
Asbestos	short ton	11,329	10,433	12,974	1,212	933	1,245
Coal	ton	759,095	823,925	794,190	3,056	3,408	3,178
Copper, Blister	"	19,131	14,471	16,225	5,004	3,156	4,375
Gold, Refined	fine oz.	783,814	128,550	128,052	12,275	2,111	2,004
Iron and Steel—							
Bars and Rods	ton	21,595	28,588	39,198	1,094	1,420	1,895
Plate and Sheet, Plain	"	143,629	85,444	141,313	8,008	5,169	8,468
Plate and Sheet, Galvanized	"	86,378	58,938	58,488	6,961	4,911	4,975
Scrap	"	178,255	156,978	182,985	5,010	2,800	3,404
Lead—							
Ore and Concentrate(a)	"	91,236	83,984	90,797	5,813	4,776	5,034
Lead-Silver Bullion	"	47,618	58,068	53,021	7,085	6,104	5,498
Pig	"	160,589	155,730	138,448	19,368	13,729	12,025
Petroleum Oils—							
Spirit	'000 gals.	36,133	80,171	32,682	2,857	4,814	2,140
Diesel Oil	"	21,294	43,081	93,008	1,465	2,511	5,305
Residual and Furnace Oil	"	156,027	202,052	146,869	8,258	9,131	6,484
Rutile Concentrate	ton	119,052	75,615	80,938	8,617	4,630	3,609
Silver, Refined	'000 fine oz.	3,672	4,876	3,001	1,505	1,911	1,224
Zinc—							
Ore and Concentrate	ton	323,654	261,279	193,254	5,201	2,749	2,472
Refinery Type Shapes	"	37,092	37,938	41,606	4,033	3,165	3,962

(a) Includes lead-copper concentrate.

Considerable quantities of metallic ores, concentrates, slags and residues are exported from Australia for refining overseas. The following table shows the quantities of such items exported during 1959 and their principal metallic content as estimated by assay:—

PRINCIPAL METALLIC CONTENTS OF SPECIFIED ORES AND CONCENTRATES, ETC., EXPORTED FROM AUSTRALIA DURING 1959.

Ores and Concentrates, etc.	Quantity Exported. ton.	Metallic Contents—Estimated from Assay.						
		Copper.	Gold.	Lead.	Silver.	Tin.	Tungstic Oxide.	Zinc.
		ton.	fine oz.	ton.	fine oz.	ton.	ton.	ton.
Copper—								
Ore and Concentrate	73,286	18,209	5,523	..	187,326	3	..	..
Copper—Lead Dross and Speiss	6,006	1,278	11	3,591	330,930	..	..	..
Other Slags and Residues	45	31	..	..	..	..	..	..
Blister	16,225	16,091	..	..	..	..	..	..
Lead—								
Ore and Concentrate(a)	90,797	570	12,407	62,228	1,791,962	..	..	6,109
Slags and Residues	1,014	..	..	489	301	8	..	..
Lead-Silver Bullion	53,021	..	..	52,650	4,241,700	..	..	..
Tin Ore and Concentrate	42	..	..	..	..	32	..	..
Tungsten—								
Scheelite Ore and Concentrate	145	..	..	..	..	..	103	..
Wolfram Ore and Concentrate	993	..	..	..	..	..	717	..
Zinc—								
Ore and Concentrate	193,254	..	..	1,383	55,300	..	..	101,738
Slags and Residues	9,046	7	..	1	..	..	..	6,277
Total Metallic Contents .. ..	..	36,186	17,941	120,342	6,607,519	43	820	114,124

(a) Includes lead-copper concentrate.

§ 19. Government Aid to Mining, and Mineral Control.

1. *Aid to Mining.*—(i) *Commonwealth.* (a) *Assistance to the Gold Mining Industry.* For particulars, see para. 9, page 1052.

(b) *Assistance to the Copper Mining Industry.* For particulars, see para. 8, page 1061.

(c) *Income Taxation Concessions.* For particulars of income taxation concessions to the gold, copper and uranium mining industries, see pages 1053, 1061 and 1071 respectively. Further information is given in a booklet entitled *Income Tax for the Mining Industry*, issued by the Commissioner of Taxation.

(d) *Search for Oil.* The Commonwealth Government has encouraged the search for oil in Australia, Papua and New Guinea and considerable sums have been spent during recent years in geological and geophysical surveys and in drilling operations.

The Bureau of Mineral Resources, in close co-operation with the Mines Departments of the States, has continued regional geological and geophysical surveys throughout the Commonwealth. In 1957, the Commonwealth introduced the Petroleum Search Subsidy Act 1957, whereby stratigraphic drilling operations were subsidised to the extent of 50 per cent. of cost. In 1959, the Petroleum Search Subsidy Act 1959 increased the nature of operations for which subsidy was offered, to include all types of geophysical surveys and off-structure drilling operations. Under the 1957 Act, £500,000 was set aside each year for a period of four years, and under the 1959 Act, £1,000,000 was set aside for each of three years, ending in 1962.

Under these Acts, 49 operations had been approved for subsidy to the end of 1960. For particulars of oil search operations in 1960, see § 15, Mineral Oils, page 1080.

(e) *Rewards for Discovery of Uranium Ore.* The Commonwealth Government's offer to pay rewards up to a maximum of £25,000 for the discovery of any one deposit of uranium ore was withdrawn as from 31st March, 1961.

(f) *Mica Pool.* The Commonwealth Mica Pool ceased purchasing mica on 31st December, 1960, and the Committee of Management was abolished on the same day. The Pool will continue to sell mica while stocks last.

(g) *Bureau of Mineral Resources, Geology and Geophysics.* The Bureau of Mineral Resources, Geology and Geophysics has sections dealing with geology, geophysics, mining engineering, petroleum technology and mineral economics. The geological section provides geologists to conduct all surveys required in Commonwealth Territories, and makes detailed and regional surveys in conjunction with or by arrangement with the State Mines Departments, surveys of possible oil-fields in Australia and New Guinea, surveys of mines for which financial assistance is sought, and investigations of deposits of radio-active minerals. The geophysical section conducts investigations throughout Australia and New Guinea connected with the search for metalliferous radio-active and other mineral deposits; investigations connected with exploration for coal, oil and water; regional magnetic and gravity surveys; engineering and military geophysics; and the operation of geophysical (magnetic and seismic) observatories. The Bureau works in close co-operation with the Mines Departments of the States. It has assumed full responsibility for geological and geophysical surveys in Commonwealth Territories, but suitable arrangements have been made to ensure that the local Administrations have the necessary technical advice directly available to them.

(h) *Ore-dressing and Mineragraphic Investigations.* These investigations are conducted by the Commonwealth Scientific and Industrial Research Organization as required by the industry. Ore-dressing investigations are carried out at the Ore-Dressing Laboratory, situated in the Department of Mining, University of Melbourne, and at the Ore-Dressing Laboratory, Kalgoorlie, situated at the School of Mines. The Mineragraphic Investigations Section is located in the Geology Department, University of Melbourne.

These two groups of laboratories perform complementary services—the Mineragraphic Investigations Section assesses microscopically the state of dispersion and the mineral association of ore bodies, while the Ore-Dressing Laboratories investigate the composition of ores and provide advice on suitable methods for their full-scale treatment. Much of this research is carried out on a co-operative research basis with the mining industry.

(i) *Department of Territories.* For particulars of the Northern Territory Administration, see paragraph (h) under section. (ii). *States* following.

(ii) *States. (a) General.* In addition to free assays and determinations of rocks and minerals carried out for prospectors by the Mines Departments of the States and Territories, technical officers of these departments provide advice to the mining and allied industries where required, carry out field examinations of mining prospects, advise on exploration and development, select sites for water supply, and in general give a free technical service to the mining industry.

(b) *New South Wales.* State aid to assist metalliferous mining may consist of grants to assist the prospecting and/or mining for gold and minerals, and for the purchase, removal and installation of mining plant or equipment. A quantity of mechanical equipment is also available in several localities for hire at reasonable rentals to prospectors and small mine operators, and District Inspectors have geiger counters and scheelite detectors which are loaned to approved persons.

(c) *Victoria.* Loans may be granted to assist prospecting and development or the purchase of machinery for gold mining. The Mines Department has stamp batteries in different parts of the State to crush ore for prospectors at nominal rates. Small mining companies may avail themselves of these facilities. Drilling with diamond, rotary and percussion drills is carried out by the Mines Department for mining companies and for general mineral exploration. A survey of the State's underground water reserves is in progress, in conjunction with the opening up of town water supplies from underground sources.

(d) *Queensland.* Various forms of assistance to mining are made available by the Queensland Department of Development and Mines. Grants are made from the Consolidated Revenue Fund for use on construction and maintenance of roads in mining areas. Advances are made from the Gold Mining Encouragement Fund for mining development work. This assistance is restricted to gold mines and advances are repayable from proceeds of the mine, if any. From the Assistance to Metalliferous Mining Fund, plant, such as jackhammers, compressors and pumps, is purchased and maintained. Such plant is made available on hire, the rental payments being credited back to the fund. Prospecting assistance is made available in approved cases, the rates being £2 10s. a week for a single man and £3 10s. a week for a married man with dependants. This is not repayable. From the Advances to Mining Fund, assistance by way of subsidy is advanced for mine development. Such is repayable from proceeds of the mine. The Department also maintains a treatment works for tin ores, etc., at Irvinebank, an assay office at Cloncurry, and diamond-drilling plants in several parts of the State. The Venus State mill at Charters Towers is available for the treatment of gold-bearing ores.

(e) *South Australia.* The Department of Mines provides the following services and facilities to the mineral industry:—(i) Hire of boring plant and mining equipment, boring and testing of mineral deposits, financial subsidies in approved cases for prospecting and mining development, development of sub-surface water supplies for farming pastoral, irrigation and mining purposes, and purchase of basic metal ores from prospectors; (ii) geological examination of mineral deposits, water supply, dam foundation and drainage problems, guidance on mining legislation, and publication and issue of geological bulletins and maps. It also provides, through the Australian Mineral Development Laboratories, chemical and metallurgical analytical and assay investigation, testing and treatment of ores and minerals, petrographic, mineragraphic and radiometric determinations. Pilot scale metallurgical and chemical treatment plants are maintained and operated for the development of mineral extraction processes.

(f) *Western Australia.* Assistance is given to prospectors to the extent of £5 a week south of the 26th parallel of latitude, and of £6 a week north of that parallel; also provision is made of some tools required for prospecting.

There are twenty State batteries operating throughout the gold-fields for the treatment of ore from prospectors and small mine-owners, at a nominal charge. A cartage subsidy is also granted to such operators sending ore to State batteries for treatment.

Provision is made for loans to mine-owners who require assistance to develop mines. The Government also has a drilling scheme, financing mine-owners on a £1 for £1 basis.

(g) *Tasmania.* The Department of Mines provides financial assistance to mining lessees for the purchase of plant and machinery, for sinking, repairing or dewatering of shafts, for construction of dams and water races, for testing and proving a deposit of any mining product, for developmental work and for diamond and other types of drilling. The Department has available for hire percussion and diamond drills for exploration, as well

as a complete plant for small shaft sinking and tunnelling. Other assistance is rendered to the industry by geological and engineering advice and through ore-dressing research into metallurgical recoveries and the selection and design of treatment plant.

(h) *Northern Territory.* In order to encourage the development of the mining industry, the Northern Territory Administration has erected Government batteries at Tennant Creek, Hatches Creek, and Maranboy for the treatment of miners' ores. The Tennant Creek battery is the only one now in operation. After reconstruction, it was re-opened for public crushing in October, 1958, and has been fully employed since that date. The re-opening of the Hatches Creek and Maranboy batteries will depend on the revival of small scale wolfram and tin mining, respectively, in these areas. The Administration is erecting another battery at Mount Wells, near Burrundie, to treat tin, gold and lead ores. It is expected that this battery will commence crushing towards the end of 1961. The crushing charges are subsidized by Government grants. In addition, the Administration provides cartage subsidies and financial advances to encourage miners to carry out developmental work. Roads and water supply services are provided and maintained for mines under active development throughout the Territory.

2. *Control of Minerals.*—(i) *Control of Exports of Metals and Minerals.* Certain metals and minerals produced in Australia are subject to export control for one or more of the following reasons:—

- (a) the necessity of conserving resources;
- (b) the inadequacy of local production to fulfil domestic demand;
- (c) the strategic importance of the minerals;
- (d) to encourage processing of the minerals in Australia prior to export.

Minerals and metals subject to export control include iron ores and concentrates; pig-iron; manganese ores; beryllium ores and concentrates; lithium ores and concentrates; minerals containing uranium; and minerals, including monazite, containing thorium. Mixed concentrates of beach sand minerals are prohibited exports but the major constituent minerals (rutile, zircon and ilmenite) may be exported.

(ii) *Radio-active Minerals.* During 1953, Commonwealth Legislation was enacted to set up an Atomic Energy Commission which is responsible, in an overall sense, for the production and utilization of uranium in Australia. This Act, the Atomic Energy Act 1953–1958, supersedes the Atomic Energy (Control of Materials) Act of 1946, but retains a provision of that Act which provides for control of substances which could be used for production or use of atomic energy. It gives the Commonwealth power to acquire such substances in their natural state and in waste materials from mining operations, to carry on mining and other operations necessary for the recovery of such substances, and to pay compensation for such acquisition. It also gives the Commonwealth power to obtain possession of such substances held by any person.

Further information concerning the Atomic Energy Commission appears in Chapter XXX.—Miscellaneous.