

## CHAPTER XXV

### 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 mimeographed 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*.

Values of Australian oversea trade shown throughout this chapter are expressed as £A. f.o.b. port of shipment, except where otherwise indicated.

#### § 1. Introduction

1. **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 overlie 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 ..	Mount Isa
		Northern Territory	Tennant Creek
	Gold .. ..	Western Australia	Kalgoorlie and other localities
	Iron .. ..	South Australia ..	Middleback Ranges
		Western Australia	Yampi Sound
	Lead-Silver-Zinc	New South Wales	Broken Hill
		Queensland ..	Mount Isa
Palaeozoic (between 200 and 520 million years old)	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 ..	Mount Morgan
		Tasmania ..	Mount Lyell
	Lead-Silver-Zinc	Tasmania ..	Mount Read and Rosebery
	Tin (lode) ..	Queensland ..	Herberton
		Tasmania ..	North-east of State
	Tungsten ..	Tasmania ..	King Island and north-east of State

PRINCIPAL AUSTRALIAN MINERAL DEPOSITS—*continued*

Age of geological formation in which located	Metal or mineral	State or Territory	Locality
Mesozoic (between 75 and 200 million years old)	Black Coal ..	Queensland ..	Ipswich
		South Australia ..	Leigh Creek
		Tasmania ..	St. Marys
	Mineral Sands(a)	New South Wales	North coast
		Queensland ..	South coast
Cainozoic (less than 75 million years old)	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, from which production has now commenced, were formed during the early part of the Cainozoic Era.

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.

2. **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 salable 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.

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 1961, showing metal contents before and after differential flotation, are shown in the following table. It should be stressed that in both the ore and the concentrate, lead and zinc are contained in the form of 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) 1961

Particulars	Quantity	Proportion of weight of ore mined	Average assays			Proportion of metal distribution		
			Lead	Silver	Zinc	Lead	Silver	Zinc
	tons	per cent.	per cent.	f. oz.	per cent.	per cent.	per cent.	per cent.
Ore treated ..	1,894,679	100.0	10.9	3.9	12.1	100.0	100.0	100.0
Flotation products—								
Lead concentrate	264,209	13.9	75.4	25.5	4.1	96.4	92.3	4.7
Zinc concentrate	398,314	21.0	0.8	0.7	52.8	1.6	3.9	91.6
Residues(b) ..	1,232,156	65.1	0.3	0.2	0.7	2.0	3.8	3.7

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

### 3. Government Aid to Mining, and Mineral Control.—(i) *Aid to Mining—Commonwealth.*

(a) *Income Taxation Concessions.* One-fifth of the net income derived from mining for prescribed minerals in Australia or the Territory of Papua and New Guinea is exempt from tax. The metals or minerals to which this concession applies are as follows:—asbestos, bauxite, chromite, emery, fluorspar, graphite, ilmenite, kyanite, magnesite, manganese oxides, mica, monazite, pyrite, quartz crystals (piezo-electric quality), radio-active ores, rutile, sillimanite, vermiculite and zircon; and ores of antimony, arsenic, beryllium, bismuth, cobalt, columbium, copper, lithium, mercury, molybdenum, nickel, osmiridium, platinum, selenium, strontium, tantalum, tellurium, tin, tungsten and vanadium.

Income derived from mining principally for gold in Australia or the Territory of Papua and New Guinea is exempt from tax. The exemption is also available in respect of income derived from mining principally for gold and copper if the value of the gold obtained is not less than 40 per cent. of the value of total output.

Income attributable to uranium obtained from working a mining property in Australia or the Territory of Papua and New Guinea, or from the treatment of ore in Australia or the Territory to recover uranium concentrates, is exempt from tax for residents of Australia and the Territory of Papua and New Guinea. The exemption is, however, conditional upon the uranium recovered being owned by the Commonwealth or disposed of to a person approved by the Commonwealth.

Dividends paid wholly and exclusively out of exempt mining income are also exempt from tax.

Further information is given in a booklet entitled *Income Tax for the Mining Industry*, issued by the Commissioner of Taxation.

(b) *Assistance to the Gold-Mining Industry.* The assistance to the gold-mining industry by subsidy was introduced at a time of rising costs in the industry and a fixed official world price for gold. Because many producers were faced with the likelihood of closing down, the Government decided to subsidize marginal producers in Australia and the Territory of Papua and New Guinea. Under the *Gold-Mining Industry Assistance Act 1954*, a producer the value of whose gold output exceeded 50 per cent. of the total value of his mine output was eligible for assistance, subject to certain conditions, on the production of gold from 1st July, 1954. The rate of subsidy payable under the original Act was 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 or rate of profit. For large producers, subject to certain provisions, 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. A producer whose output during the year exceeds 500 fine oz. may elect to be treated as a small producer. In this case, the subsidy rate payable per fine ounce on total production is £2 8s. 0d. reduced by one penny for each fine ounce by which output exceeds 500 fine ounces. 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 overseas premium markets or otherwise, the subsidy payable is reduced by the amount of the excess. The subsidy is also limited, in the case of large producers, 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 used in the production and sale of gold. 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 apply to production until 30th June, 1965.

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 1958 to 1962 are shown in the table on page 1158.

The purpose of the *Gold Mines Development Assistance Act 1962* is to provide assistance to gold producers in Australia and the Territories of Papua and New Guinea not receiving subsidy under the *Gold-Mining Industry Assistance Act 1954–1962*, in order to increase the rate of their development work and so to add to their proved reserves of gold-bearing minerals. In recent years, these reserves had declined to the extent that the long-term prospects of the industry were jeopardized. The Act, which applies to 1962–63 and the next two financial years, provides that a development allowance is payable to a mine approved for the purposes of the scheme equal to the amount by which its allowable expenditure on development in a year, as defined in the Act, exceeds a defined base amount, which normally will be the average annual amount spent by the mine on development during the three years preceding 1962–63. The payment of allowance is also subject to a number of other conditions and limits provided for in the Act.

(c) *Assistance to the Copper Mining Industry.* After a Tariff Board investigation, assistance was accorded to the industry in 1958, partly by import duty and partly by bounty. The assistance to the industry was reviewed in 1960, and the present bounty assistance will continue until 31st December, 1963. Under the *Copper Bounty Act 1958-1960*, bounty is payable, subject to specified conditions, on refined copper sold for use in Australia. The rate of bounty is £35 per ton when the overseas price, as determined by the Minister for Customs and Excise, is £290 (£Stg.232) or less. When the overseas price rises above £290, the bounty falls by the same extent, so that no bounty is payable when the overseas price is £325 (£Stg.260) or more. A duty is imposed on imports of copper when the overseas price falls below £290 per ton, to the extent of £1 for each £1 that the price falls below £290. Including freight and other charges, the landed cost of imported copper is thus expected not to fall below about £305 per ton.

(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 Australia. In 1957, the Commonwealth Government introduced the *Petroleum Search Subsidy Act 1957*, whereby stratigraphic drilling operations were subsidized to the extent of 50 per cent. of cost. The *Petroleum Search Subsidy Act 1959* widened the scope of operations for which subsidy was offered to include all types of geophysical surveys and off-structure drilling operations. Another amendment in 1961 further widened the scope of the 1959 Act to provide subsidy for test drilling and detailed structure drilling operations. It also provided for the calculation of drilling subsidies on a footage basis as an alternative to the total cost basis. A sum of £5 million was allocated to the oil search subsidy scheme for 1962-63. This amount was almost double the allocation of £2.7 million provided in the previous year. In spite of the increased allocation, applications for subsidy increased to such an extent that the maximum rate of subsidy was reduced from 50 per cent. of the allowable cost of approved operations to 30 per cent. in 1962-63.

To the end of 1962, actual payments of subsidy totalling more than £5 million had been made in accordance with the terms of the subsidy Acts, and it is expected that this amount will be greatly increased during the next two years because of vigorous oil search activities. Further particulars of government assistance in oil exploration will be found in Official Year Book No. 48, pages 1095-6.

(e) *Assistance to Producers of Sulphuric Acid and Iron Pyrites.* Following recommendations of the Tariff Board, the *Sulphuric Acid Bounty Act* was extended for a period of five years from 1st July, 1960. Arising from these same recommendations, the *Pyrites Bounty Act 1960* was enacted on 15th December, 1960, to be operative for a period of four and a half years from 1st January, 1961. The Acts provide for bounties to be paid, subject to specified conditions, on sulphuric acid produced from prescribed materials of Australian origin and to producers of iron pyrites.

(f) *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.

(g) *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.

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

(ii) *Aid to Mining—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.

(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. This 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 and analytical and assay investigation, testing and treatment of ores and minerals, and 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 for the supply of some tools required for prospecting.

There are twenty State batteries operating intermittently throughout the goldfields 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 de-watering 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, through ore-dressing research into metallurgical recoveries, and the selection and design of treatment plant.

(h) *Northern Territory.* To encourage the development of the mining industry, the Northern Territory Administration has erected four government batteries for the treatment of miners' ores. Only two of these, at Tennant Creek and Mount Wells near Burrundie, are now in operation. The re-opening of the other two batteries will depend on the revival of small scale wolfram and tin mining in Hatches Creek and Maranboy where these batteries are located.

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.

(iii) *Controls on Minerals and Metals.* Export controls are maintained over certain minerals and metals. These controls are enforced by means of the Customs (Prohibited Exports) Regulations as amended from time to time by Statutory Rules. To export these materials, it is necessary to obtain a clearance from the following Commonwealth authorities:—

Department of National Development—mineral sands in all forms (including concentrates) containing zircon, rutile or ilmenite; lithium ores and concentrates; beryllium ores and concentrates; manganese ores; iron ores, beneficiated iron ores and iron concentrates;

Department of Trade—iron, steel and ferrous alloys;

Department of Primary Industry—phosphate rock, phosphate and superphosphate, and fertilizers containing phosphate or superphosphate;

Australian Atomic Energy Commission—all radio-active minerals, metals and compounds, including uranium, thorium and monazite; lithium metal and alloys; beryllium metal, alloys and compounds; zirconium metal, alloys and compounds.

Further information concerning the Atomic Energy Commission appears in Chapter XVIII. Education, Cultural Activities and Research.

## § 2. The Mineral Industry

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 Division of Minerals of the United States Bureau of Mines, 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 Mount Morgan and Mount Isa in Queensland and at Mount 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, and as tungsten 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. 55, 1960-61, 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.

Statistics of oil search operations have been excluded in accordance with the definition of the mining industry set out above, but a special article on developments in the search for oil, contributed by the Commonwealth Bureau of Mineral Resources, may be found in Official Year Book No. 48, pages 1094-9. More recent developments are outlined in § 13 of this chapter. Details of the activities of establishments engaged in the mining and treatment of uranium ore have been excluded because of the confidential nature of these operations.

(ii) *Mineral Product Data.* In the preparation of Australian mineral production statistics, the quantities and values of individual minerals produced are recorded 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 recorded. 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. In general, 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. Number of Mines and Quarries.—The following table shows the number of mines and quarries which operated in each State and Territory in 1961.

MINING AND QUARRYING: NUMBER OF MINES AND QUARRIES, 1961

Industry	N.S.W.	Vic.	Q'land	S.A.	W.A.	Tas.	N.T.	A.C.T.	Aust.
Metal mining—									
Gold mining ..	52	18	45	2	153	1	24	..	295
Lead-silver-zinc mining ..	14	..	5	1	4	2	1	..	27
Copper-gold mining ..	19	1	52	1	33	1	4	..	111
Tin mining ..	59	..	159	..	8	28	12	..	266
Mineral sands mining ..	13	..	4	..	4	..	..	..	21
Other metal mining ..	29	3	11	7	25	3	7	..	85
<i>Total, Metal Mining</i>	186	22	276	11	227	35	48	..	805
Fuel mining—									
Black coal mining—									
Underground ..	103	3	71	..	3	(a) 9	..	..	(a) 189
Opencut ..	4	..	7	1	1	..	..	..	13
<i>Total ..</i>	107	3	78	1	4	9	..	..	202
Brown coal mining ..	..	6	..	..	..	..	..	..	6
<i>Total, Fuel Mining ..</i>	107	9	78	1	4	9	..	..	208
Non-metal (excluding fuel) mining(b) ..	359	57	110	128	74	23	4	..	755
<i>Total, All Mining ..</i>	652	88	464	140	305	67	52	..	1,768
Construction material quarrying(c) ..	346	252	74	254	35	67	24	4	1,056
<i>Total, All Mining and Quarrying ..</i>	998	340	538	394	340	134	76	4	2,824

(a) Includes one mine operating both underground and open-cut workings. (b) Incomplete for some industries outside the normal administrative control of State Mines Departments (e.g. clays and salt). (c) Incomplete, owing to difficulties of coverage.

In the next table, the number of mines and quarries which operated in Australia in each of the years 1957 to 1961 are shown.

### MINING AND QUARRYING: NUMBER OF MINES AND QUARRIES, AUSTRALIA

Industry	1957	1958	1959	1960	1961
<b>Metal mining—</b>					
Gold mining .. .. .	294	285	306	296	295
Lead-silver-zinc mining .. .. .	82	50	35	28	27
Copper-gold mining .. .. .	100	81	81	90	111
Tin mining .. .. .	178	180	216	216	266
Mineral sands mining .. .. .	32	28	22	22	21
Other metal mining .. .. .	154	84	96	94	85
<i>Total, Metal Mining</i> .. .. .	<i>840</i>	<i>708</i>	<i>756</i>	<i>746</i>	<i>805</i>
<b>Fuel mining—</b>					
Black coal mining .. .. .	241	227	218	218	202
Brown coal mining .. .. .	7	7	8	7	6
<i>Total, Fuel Mining</i> .. .. .	<i>248</i>	<i>234</i>	<i>226</i>	<i>225</i>	<i>208</i>
Non-metal (excluding fuel) mining(a) .. .. .	641	645	687	698	755
<i>Total, All Mining</i> .. .. .	<i>1,729</i>	<i>1,587</i>	<i>1,669</i>	<i>1,669</i>	<i>1,768</i>
Construction material quarrying(a) .. .. .	780	746	862	892	(b)1,056
<i>Total, All Mining and Quarrying</i> .. .. .	<i>2,509</i>	<i>2,333</i>	<i>2,531</i>	<i>2,561</i>	<i>(b)2,824</i>

(a) Incomplete.  
in Victoria.

(b) Not strictly comparable with previous years, owing to extension of coverage

4. **Employment in Mining and Quarrying.**—(i) *Persons Engaged.* Statistics of persons employed in the mining and quarrying industry are derived mainly from the annual census of that industry.

Data on the work force employed in the industry are also obtained from the Population Censuses of Australia. The Population Census figure for mining and quarrying includes a number of persons excluded by definition from the mining and quarrying census employment figure, e.g. prospectors, head office employees, etc.

In the following table, which shows particulars collected in the Population Censuses of Australia at 30th June, 1947, 1954, and 1961, 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 IN MINING AND QUARRYING, AUSTRALIA

Particulars	Census, 30th June—		
	1947	1954	1961
<b>Persons engaged in—</b>			
Mining and quarrying .. .. .	57,574	62,107	52,941
All primary industries .. .. .	563,697	560,100	472,670
<b>Total work force</b> .. .. .	<b>3,196,431</b>	<b>3,702,022</b>	<b>4,225,098</b>
<b>Persons engaged in mining and quarrying as a proportion of—</b>			
All primary industries .. .. . %	10.2	11.1	11.2
<b>Total work force</b> .. .. . %	<b>1.8</b>	<b>1.7</b>	<b>1.3</b>

The following table is derived from mining census data and shows the average numbers engaged in the various mining industries in each State or Territory in 1961.



## MINING AND QUARRYING: EMPLOYMENT(a), 1961

Industry	N.S.W.	Vic.	Q'land	S.A.	W.A.	Tas.	N.T.	A.C.T.	Aust.
Metal mining—									
Gold mining ..	20	205	(b)	(b)	4,909	(b)	140	..	5,438
Lead-silver-zinc mining ..	5,164	..	(b)	(b)	21	(b)	1	..	8,158
Copper-gold mining ..	72	2	(b)	(b)	219	(b)	226	..	2,322
Tin mining ..	104	..	(b)	..	49	(b)	5	..	1,131
Mineral sands mining ..	669	..	(b)	..	(b)	..	..	..	1,141
Other metal mining ..	33	10	(b)	(b)	396	(b)	5	..	1,097
<i>Total, Metal Mining</i>	<i>6,062</i>	<i>217</i>	<i>4,233</i>	<i>(b)</i>	<i>(b)</i>	<i>2,247</i>	<i>377</i>	<i>..</i>	<i>19,287</i>
Fuel mining—									
Black coal mining—									
Underground ..	12,360	340	2,806	..	(b)	} c 257 {	..	..	(b)
Opencut ..	152	..	184	(b)	(b)		..	..	(b)
<i>Total ..</i>	<i>12,512</i>	<i>340</i>	<i>2,990</i>	<i>(b)</i>	<i>(b)</i>	<i>257</i>	<i>..</i>	<i>..</i>	<i>16,957</i>
Brown coal mining ..	..	1,441	..	..	..	..	..	..	1,441
<i>Total, Fuel Mining..</i>	<i>12,512</i>	<i>1,781</i>	<i>2,990</i>	<i>(b)</i>	<i>(b)</i>	<i>257</i>	<i>..</i>	<i>..</i>	<i>18,398</i>
Non-metal (excluding fuel) mining(d) ..	1,167	261	285	590	535	100	4	..	2,942
<i>Total, All Mining ..</i>	<i>19,741</i>	<i>2,259</i>	<i>7,508</i>	<i>1,250</i>	<i>6,884</i>	<i>2,604</i>	<i>381</i>	<i>..</i>	<i>40,627</i>
Construction material quarrying(e) ..	1,755	2,022	425	777	233	222	(f) 64	(g)	5,498
<i>Total, All Mining and Quarrying ..</i>	<i>21,496</i>	<i>4,281</i>	<i>7,933</i>	<i>2,027</i>	<i>7,117</i>	<i>2,826</i>	<i>(f) 445</i>	<i>(g)</i>	<i>46,125</i>

(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) Incomplete, owing to difficulties of coverage. (f) Includes Australian Capital Territory. (g) Not available for publication; included with Northern Territory.

The following table shows particulars of mining employment in Australia for the years 1957 to 1961. The figures show the average number of persons employed during the whole year, including working proprietors.

## MINING AND QUARRYING: EMPLOYMENT, AUSTRALIA

Industry	1957	1958	1959	1960	1961
Metal mining—					
Gold mining ..	6,205	5,901	5,948	5,544	5,438
Lead-silver-zinc mining ..	10,354	9,461	9,031	8,731	8,158
Copper-gold mining ..	2,151	2,057	2,301	2,364	2,322
Tin mining ..	856	944	926	946	1,131
Mineral sands mining ..	2,062	1,102	1,019	1,127	1,141
Other metal mining ..	1,300	1,030	1,031	1,177	1,097
<i>Total, Metal Mining ..</i>	<i>22,928</i>	<i>20,495</i>	<i>20,256</i>	<i>19,889</i>	<i>19,287</i>
Fuel mining—					
Black coal mining ..	22,345	20,795	18,678	18,529	16,957
Brown coal mining ..	1,579	1,540	1,519	1,399	1,441
<i>Total, Fuel Mining ..</i>	<i>23,924</i>	<i>22,335</i>	<i>20,197</i>	<i>19,928</i>	<i>18,398</i>
Non-metal (excluding fuel) mining (a) ..	2,749	2,728	2,975	2,925	2,942
<i>Total, All Mining ..</i>	<i>49,601</i>	<i>45,558</i>	<i>43,428</i>	<i>42,742</i>	<i>40,627</i>
Construction material quarrying (a) ..	4,640	4,581	4,116	5,016	5,498
<i>Total, All Mining and Quarrying ..</i>	<i>54,241</i>	<i>50,139</i>	<i>47,544</i>	<i>47,758</i>	<i>46,125</i>

(a) Incomplete.

(ii) *Size Classification of Mines and Quarries.* Most of the mines and quarries worked during 1961 employed less than four persons, including working proprietors. However, more than half of the persons engaged in mining and quarrying were in the 48 mines each employing 200 persons or more. The following table shows the distribution of the total number of mines into various size groups according to the average number of persons employed during the period worked by each mine in 1961. For particulars of the method of compiling these industry statistics, see para. 2 (i), pages 1144-5.

#### MINING AND QUARRYING: SIZE CLASSIFICATION OF ESTABLISHMENTS, 1961

Mines and quarries employing on the average(a)—	N.S.W.	Vic.	Q'land	S.A.	W.A.	Tas.	N.T. and A.C.T.	Aust.
Less than 4 persons—								
Establishments ..	704	150	376	285	233	78	69	1,895
Persons ..	1,092	255	678	502	617	154	113	3,411
From 4 to 20 persons—								
Establishments ..	175	152	84	95	78	41	7	632
Persons ..	1,421	1,241	859	721	622	305	50	5,219
From 21 to 200 per- sons—								
Establishments ..	93	35	74	12	20	12	3	249
Persons ..	7,103	1,293	3,356	578	1,619	742	158	14,849
More than 200 per- sons—								
Establishments ..	26	3	4	2	9	3	1	48
Persons ..	12,182	1,907	4,041	566	4,539	1,744	221	25,200
Total—								
Establishments ..	998	340	538	394	340	134	80	2,824
Persons ..	21,798	4,696	8,934	2,367	7,397	2,945	542	48,679

(a) Average during period worked. Includes working proprietors.

(iii) *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. In 1961, 28 persons were recorded as killed and 1,394 as injured in mining (excluding quarrying) accidents. Recorded deaths and injuries in that year were highest in black coal mines (11 and 368, respectively), lead-silver-zinc mines (4 and 359), gold mines (5 and 322), and copper-gold mines (4 and 142). Persons killed and injured in the construction material quarrying industry numbered 10 and 74, respectively, in 1961.

5. *Production Costs in Mining and Quarrying.*—(i) *Salaries and Wages Paid.* Salaries and wages paid in the mining and quarrying industries in Australia during each year 1957 to 1961 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.469) and also in the *Labour Report*.

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

(£'000)

Industry	1957	1958	1959	1960	1961
<b>Metal mining—</b>					
Gold mining .. ..	6,422	6,492	6,504	6,655	6,591
Lead-silver-zinc mining .. ..	16,241	13,462	13,944	13,555	13,261
Copper-gold mining .. ..	2,289	2,362	2,710	2,938	2,915
Tin mining .. ..	753	737	814	905	927
Mineral sands mining .. ..	2,177	1,327	1,188	1,336	1,474
Other metal mining .. ..	1,402	1,108	1,058	1,338	1,263
<i>Total, Metal Mining</i> .. ..	<i>29,284</i>	<i>25,488</i>	<i>26,218</i>	<i>26,727</i>	<i>26,431</i>
<b>Fuel mining—</b>					
Black coal mining .. ..	25,105	24,501	23,437	25,918	25,460
Brown coal mining .. ..	1,640	1,694	1,710	1,785	1,923
<i>Total, Fuel Mining</i> .. ..	<i>26,745</i>	<i>26,195</i>	<i>25,147</i>	<i>27,703</i>	<i>27,383</i>
<b>Non-metal (excluding fuel) mining(b)</b> .. ..	<b>2,400</b>	<b>2,384</b>	<b>2,631</b>	<b>2,664</b>	<b>2,875</b>
<i>Total, All Mining</i> .. ..	<i>58,429</i>	<i>54,067</i>	<i>53,996</i>	<i>57,094</i>	<i>56,689</i>
<b>Construction material quarrying(b)</b> .. ..	<b>3,219</b>	<b>3,241</b>	<b>3,490</b>	<b>3,628</b>	<b>4,018</b>
<b>Total, All Mining and Quarrying</b> .. ..	<b>61,648</b>	<b>57,308</b>	<b>57,486</b>	<b>60,722</b>	<b>60,707</b>

(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.

(ii) *Power, Fuel, Light and Materials, etc., used.* The following table contains details of the value of power, fuel, materials and stores used by the mining and quarrying industry during each year 1957 to 1961.

## MINING AND QUARRYING: VALUE OF POWER, FUEL, LIGHT AND MATERIALS, ETC., USED, AUSTRALIA

(£'000)

Industry	1957	1958	1959	1960	1961
<b>Metal mining—</b>					
Gold mining .. ..	5,076	4,970	5,069	4,909	4,979
Lead-silver-zinc mining .. ..	10,419	10,025	10,367	12,106	10,303
Copper-gold mining .. ..	2,549	2,969	3,325	3,288	3,503
Tin mining .. ..	428	521	512	530	601
Mineral sands mining .. ..	1,977	1,281	1,348	1,562	1,797
Other metal mining .. ..	1,399	1,004	924	1,109	1,258
<i>Total, Metal Mining</i> .. ..	<i>21,848</i>	<i>20,770</i>	<i>21,545</i>	<i>23,504</i>	<i>22,441</i>
<b>Fuel mining—</b>					
Black coal mining .. ..	10,233	10,536	10,166	11,319	12,409
Brown coal mining .. ..	635	612	593	623	622
<i>Total, Fuel Mining</i> .. ..	<i>10,868</i>	<i>11,148</i>	<i>10,759</i>	<i>11,942</i>	<i>13,031</i>
<b>Non-metal (excluding fuel) mining(a)</b> .. ..	<b>2,146</b>	<b>2,389</b>	<b>2,359</b>	<b>2,340</b>	<b>2,508</b>
<i>Total, All Mining</i> .. ..	<i>34,862</i>	<i>34,307</i>	<i>34,663</i>	<i>37,786</i>	<i>37,980</i>
<b>Construction material quarrying(a)</b> .. ..	<b>3,447</b>	<b>3,312</b>	<b>4,167</b>	<b>4,427</b>	<b>(b) 5,346</b>
<b>Total, All Mining and Quarrying</b> .. ..	<b>38,309</b>	<b>37,619</b>	<b>38,830</b>	<b>42,213</b>	<b>(b) 43,326</b>

(a) Incomplete.  
in Victoria.

(b) Not strictly comparable with previous years owing to extension of coverage

6. Value of Additions and Replacements to Fixed Assets in Mining and Quarrying.—The following table shows details for Australia of the value of additions and replacements to fixed assets during the years 1957 to 1961.

**MINING AND QUARRYING: VALUE OF ADDITIONS AND REPLACEMENTS TO FIXED ASSETS(a), AUSTRALIA**  
(£'000)

Industry	1957	1958	1959	1960	1961
<b>Metal mining—</b>					
Gold mining .. .. .	1,385	1,334	1,446	789	778
Lead-silver-zinc mining .. .. .	5,641	3,692	6,566	3,548	3,425
Copper-gold mining .. .. .	926	540	651	451	845
Tin mining .. .. .	117	75	66	185	261
Mineral sands mining .. .. .	2,155	894	787	481	728
Other metal mining .. .. .	510	624	713	1,369	1,138
<i>Total, Metal Mining</i> .. .. .	<i>10,734</i>	<i>7,159</i>	<i>10,229</i>	<i>6,823</i>	<i>7,175</i>
<b>Fuel mining—</b>					
Black coal mining .. .. .	9,229	7,912	7,707	10,947	11,535
Brown coal mining .. .. .	2,706	2,309	3,654	1,914	2,723
<i>Total, Fuel Mining</i> .. .. .	<i>11,935</i>	<i>10,221</i>	<i>11,361</i>	<i>12,861</i>	<i>14,258</i>
Non-metal (excluding fuel) mining(b) .. .. .	1,575	1,283	1,454	588	1,274
<i>Total, All Mining</i> .. .. .	<i>24,244</i>	<i>18,663</i>	<i>23,044</i>	<i>20,272</i>	<i>22,707</i>
Construction material quarrying(b) .. .. .	874	825	1,408	1,624	2,281
<b>Total, All Mining and Quarrying</b> .. .. .	<b>25,118</b>	<b>19,488</b>	<b>24,452</b>	<b>21,896</b>	<b>24,988</b>

(a) Excludes mines and quarries employing less than four persons.

(b) Incomplete.

7. Mineral Production.—(i) *Quantity of Principal Minerals Produced.* In the following table, particulars of the quantity of the principal minerals produced during 1961 are shown for each State and the Northern Territory.

**QUANTITY OF PRINCIPAL MINERALS PRODUCED, 1961**

Mineral	Unit	N.S.W.	Vic.	Q'land	S.A.	W.A.	Tas.	N.T.	Aust.
<b>METALLIC MINERALS</b>									
Antimony ore and concentrate .. .. .	ton	188	2	..	..	..	..	..	190
Bauxite .. .. .	..	2,437	(a)	(a)	..	..	..	..	15,976
Beryllium ore .. .. .	..	36	..	..	9	261	..	..	306
Copper ore(b) .. .. .	..	222	52	59,901	8	7,384	7,619	29	75,215
Copper concentrate .. .. .	..	4,642	..	272,854	..	6,291	48,976	41,007	373,770
Copper precipitate .. .. .	..	84	..	9	..	..	16	716	825
Gold concentrate .. .. .	..	1	..	..	..	..	..	..	1
Gold—other forms(c) .. .. .	oz.	—586	(d)	(d)	(d)	(d)	(d)	(d)	(d)
Ilmenite concentrate .. .. .	ton	2,012	..	4	..	164,384	..	..	166,400
Iron ore(e) .. .. .	'000 tons	..	..	..	3,982	1,360	..	..	5,342
Lead ore(f) .. .. .	ton	245	..	7,482	..	..	..	16	7,743
Lead concentrate .. .. .	..	277,910	..	91,440	..	597	12,345	..	382,292
Lead-copper concentrate .. .. .	..	..	..	..	..	8,057	..	..	8,057
Manganese ore .. .. .	..	883	..	2,465	295	83,660	..	108	87,411
Pyrite concentrate .. .. .	..	31,138	..	9,375	69,493	52,397	51,020	..	213,423
Rutile concentrate .. .. .	..	66,607	..	33,908	..	916	..	..	101,431
Tantalite-columbite concentrate .. .. .	..	..	..	..	..	..	..	..	..
Tin concentrate .. .. .	lb.	..	..	..	..	31,808	..	..	31,808
Tin concentrate .. .. .	ton	238	..	1,887	..	341	1,390	14	3,870
<b>Tungsten concentrates—</b>									
Scheelite concentrate .. .. .	..	(g)	..	..	..	1,017	..	..	1,017
Wolfram concentrate .. .. .	..	(g)	..	2	..	1,117	..	23	1,142
Zinc concentrate .. .. .	..	425,442	..	49,021	..	..	68,177	..	542,640
Zircon concentrate .. .. .	..	100,085	..	29,016	..	7,361	..	..	136,462

NOTE.—See next page for footnotes.

QUANTITY OF PRINCIPAL MINERALS PRODUCED, 1961—*continued*

Mineral	Unit	N.S.W.	Vic.	Q'land	S.A.	W.A.	Tas.	N.T.	Aust.
<b>FUEL MINERALS</b>									
Coal, black—									
Semi-anthracite ..	'000 tons	..	..	57	..	..	2	..	59
Bituminous ..	"	19,021	66	2,650	..	..	254	..	21,991
Sub-bituminous ..	"	..	..	75	1,115	766	..	..	1,956
<i>Total</i> ..	"	19,021	66	2,782	1,115	766	256	..	24,006
Coal, brown (lignite) ..	"	..	16,279	..	..	..	..	..	16,279

## NON-METALLIC (EXCLUDING FUEL) MINERALS

Asbestos ..	short ton	794	..	..	..	15,952	..	..	16,746
Barite ..	ton	60	..	..	19,157	..	..	..	19,217
Clays—									
Brick clay and shale ..	'000 tons	2,006	(h) 1,089	300	311	485	153	..	4,344
Other(i) ..	"	567	176	14	87	46	22	..	912
Diatomite ..	ton	4,331	507	579	..	..	..	..	5,417
Dolomite(j) ..	"	4,796	..	2,132	183,214	374	1,108	..	191,624
Felspar ..	"	5,378	..	..	1,641	1,190	..	..	8,209
Gypsum ..	"	97,250	80,223	..	387,289	45,145	..	..	609,907
Limestone(j) ..	'000 tons	2,576	1,243	(a)	1,105	(a)	204	(g)	6,146
Magnesite ..	ton	88,511	..	..	659	9,625	..	..	98,795
Phosphate rock ..	"	..	..	..	4,759	115	..	..	4,874
Salt, crude ..	"	..	(a)	(a)	387,433	(a)	..	807	508,657
Silica (glass, chemical, etc.)(i) ..	"	150,891	..	29,226	22,769	8,274	1,415	..	212,575
Talc ..	"	825	..	..	7,571	5,149	..	..	13,545

## CONSTRUCTION MATERIALS(k)

Sand ..	'000 tons	2,937	2,528	(l)	1,863	(l)	34	(m) 65	7,427
River gravel and gravel boulders ..	"	1,450	3,040	(l)	911	(l)	612	(m) 5	6,018
Dimension stone ..	"	354	7	2	40	130	(g)	(g)	533
Crushed and broken stone ..	"	3,794	11,297	1,870	8,609	949	571	(m) 213	27,303
Other (decomposed rock, etc.) ..	"	14,798	1,659	(l)	(l)	(l)	25	(l)	16,482

(a) Not available for publication. (b) Includes cupreous ore for fertilizer. (c) Bullion, alluvial, retorted gold, etc. (d) Gross weight not available. (e) Iron oxide for metal extraction. (f) Includes lead-silver ore. (g) Less than half the unit of quantity shown. (h) Estimated. (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. (l) Not available. (m) Includes Australian Capital Territory which is not available for separate publication.

NOTE.—Particulars of uranium concentrate produced are not available for publication and are excluded.

(ii) *Quantities of Principal Minerals Produced, Australia.* The following table shows the quantities of the principal minerals produced in Australia during the years 1957 to 1961.

## QUANTITIES OF PRINCIPAL MINERALS PRODUCED: AUSTRALIA

Mineral	Unit	1957	1958	1959	1960	1961
METALLIC MINERALS						
Antimony ore and concentrate ..	ton	852	1,116	1,022	256	190
Bauxite .. .. .	"	7,707	6,909	14,985	69,435	15,976
Beryllium ore .. .. .	"	395	247	317	190	306
Chromite .. .. .	"	3,049	776	120	529	..
Copper ore(a) .. .. .	"	56,447	58,109	77,738	68,321	75,215
Copper concentrate .. .. .	"	222,168	279,976	358,774	432,758	373,770
Copper precipitate .. .. .	"	557	1,536	1,379	1,301	825
Gold concentrate .. .. .	"	(b) 959	1,855	1,487	43	1
Gold—other forms(c) .. .. .	oz.	(d)	(d)	(d)	(d)	(d)
Ilmenite concentrate .. .. .	ton	71,155	69,948	83,577	106,586	166,400
Iron ore(e) .. .. .	'000 tons	3,801	3,917	4,141	4,355	5,342
Lead ore(f) .. .. .	ton	20,758	21,854	12,693	13,716	7,743
Lead concentrate .. .. .	"	497,404	492,908	461,055	449,590	382,292
Lead-copper concentrate .. .. .	"	7,366	7,630	6,010	6,797	8,057
Manganese ore .. .. .	"	77,010	59,683	89,971	60,646	87,411
Pyrite concentrate .. .. .	"	229,125	226,744	223,004	238,630	213,423
Rutile concentrate .. .. .	"	128,903	83,328	81,905	88,637	101,431
Tantalite-columbite concentrate .. .. .	lb.	50,038	13,507	18,950	23,677	31,808
Tin concentrate .. .. .	ton	2,867	3,128	3,304	3,099	3,870
Tungsten concentrates—						
Scheelite concentrate .. .. .	"	1,449	733	1	420	1,017
Wolfram concentrate .. .. .	"	656	517	903	1,131	1,142
Zinc concentrate .. .. .	"	556,763	503,752	473,276	549,000	542,640
Zircon concentrate .. .. .	"	88,561	59,269	113,356	102,362	136,462

## FUEL MINERALS

Coal, black—						
Semi-anthracite .. .. .	'000 tons	71	57	54	50	59
Bituminous .. .. .	"	18,229	18,616	18,576	20,641	21,991
Sub-bituminous .. .. .	"	1,619	1,769	1,668	1,878	1,956
<i>Total</i> .. .. .	"	19,919	20,442	20,298	22,569	24,006
Coal, brown (lignite) .. .. .	"	10,741	11,644	13,035	14,967	16,279

## NON-METALLIC (EXCLUDING FUEL) MINERALS

Asbestos .. .. .	short ton	14,670	15,568	17,875	15,613	16,746
Barite .. .. .	ton	9,778	6,802	6,214	11,417	19,217
Clays—						
Brick clay and shale .. .. .	'000 tons	3,531	3,829	4,299	4,636	4,344
Other(g) .. .. .	"	748	775	823	880	912
Diatomite .. .. .	ton	6,221	4,240	5,089	4,659	5,417
Dolomite(h) .. .. .	"	192,103	138,832	160,084	190,868	191,624
Felspar .. .. .	"	8,819	7,016	6,750	8,414	8,209
Gypsum .. .. .	"	478,436	504,938	516,791	580,878	609,907
Limestone(h) .. .. .	'000 tons	4,572	5,324	5,305	5,669	6,146
Magnesite .. .. .	ton	83,473	69,391	60,586	62,166	98,795
Mica—muscovite, trimmed .. .. .	lb.	36,713	42,479	44,665	9,500	..
Phosphate rock .. .. .	ton	11,430	7,421	4,775	2,321	4,874
Salt, crude .. .. .	"	427,600	429,534	467,532	463,296	508,657
Silica (glass, chemical, etc.)(g) .. .. .	"	149,339	145,483	154,778	210,100	212,575
Talc .. .. .	"	14,441	15,393	16,376	15,670	13,545

NOTE.—See next page for footnotes.

QUANTITIES OF PRINCIPAL MINERALS PRODUCED: AUSTRALIA—*continued*

Mineral	Unit	1957	1958	1959	1960	1961
CONSTRUCTION MATERIALS(i)						
Sand .. .. .	'000 tons	4,125	4,118	4,623	5,934	7,427
River gravel and gravel boulders .. .. .	"	1,759	2,265	2,524	2,932	6,018
Dimension stone .. .. .	"	230	272	283	318	533
Crushed and broken stone .. .. .	"	15,587	15,543	19,822	22,843	27,303
Other (decomposed rock, etc.) .. .. .	"	12,546	12,722	13,699	15,264	16,482

(a) Includes cupreous ore for fertilizer. (b) Includes a small quantity of gold ore.  
 (c) Bullion, alluvial, retorted gold, etc. (d) Gross weight not available. (e) Iron oxide for metal extraction.  
 (f) Includes lead-silver, lead-silver-zinc and lead-zinc ores. (g) Incomplete; figures relate only to production reported by Mines Departments. (h) Excludes quantities used directly as a building or road material. (i) Incomplete owing to difficulties of coverage; 1961 figures are not strictly comparable with previous years owing to extension of coverage in Victoria.

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

(iii) *Contents of Metallic Minerals Produced.* The following table shows the contents of metallic minerals produced in 1961 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, 1961

Content of metallic minerals produced	Unit	N.S.W.	Vic.	Q'land	S. Aust.	W. Aust.	Tas.	N.T.	Aust.
Alumina (Al <sub>2</sub> O <sub>3</sub> ) .. .. .	ton	929	(a)	(a)	..	..	..	..	(b) 7,464
Antimony .. .. .	"	679	1	..	..	..	..	..	680
Beryllium oxide (BeO) .. .. .	unit(c)	490	..	..	(d) 120	2,975	..	..	3,585
Bismuth .. .. .	lb.	..	..	..	..	602	..	..	602
Cadmium .. .. .	ton	845	..	..	..	..	62	..	907
Cobalt .. .. .	"	65	..	..	..	..	(e)	..	65
Copper .. .. .	"	3,510	8	66,505	..	2,206	12,743	10,652	95,626
Gold .. .. .	fine oz.	12,034	26,229	64,786	55	870,658	26,885	75,645	1,076,292
Iron(f) .. .. .	'000 tons	..	..	(d) 2,581	853	..	..	..	(b) 3,434
Lead .. .. .	ton	211,679	..	45,280	433	12,253	..	11	269,656
Manganese(g) .. .. .	"	..	..	(d) 1,109	..	39,880	..	..	40,989
Manganese di-oxide (MnO <sub>2</sub> )h .. .. .	"	632	..	..	(d) 192	204	..	76	1,104
Molybdenum di-sulphide(MoS <sub>2</sub> ) .. .. .	lb.	2,070	..	(d) 560	..	..	..	..	2,630
Monazite .. .. .	ton	144	..	127	..	(d) 1,192	..	..	(b) 1,463
Platinum .. .. .	oz.	2	..	..	..	..	..	..	2
Silver .. .. .	'000	..	..	..	..	..	..	..	..
Sulphur(i) .. .. .	fine oz.	7,448	1	3,883	..	209	1,436	82	13,059
Tantalite-columbite (Ta <sub>2</sub> O <sub>5</sub> + Nb <sub>2</sub> O <sub>5</sub> ) .. .. .	ton	194,659	..	(b)20,515	(d)33,357	24,046	52,289	..	324,866
Tin .. .. .	lb.	..	..	..	..	13,814	..	..	13,814
Titanium dioxide (TiO <sub>2</sub> ) .. .. .	ton	173	..	(d) 1,350	..	231	986	5	2,745
Tungstic oxide (WO <sub>3</sub> ) .. .. .	"	65,189	..	33,058	..	93,718	..	..	191,965
Zinc .. .. .	"	(e)	..	1	..	..	1,519	16	1,536
Zircon .. .. .	"	237,834	..	33,219	(d) 12	..	40,106	(e)	311,171
	"	98,421	..	28,775	..	(d) 7,287	..	..	134,483

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

NOTE.—Particulars of production of uranium oxide (U<sub>3</sub>O<sub>8</sub>) are not available for publication and are excluded.

(iv) *Contents of Metallic Minerals Produced in Australia.* Particulars of the contents of metallic minerals produced in Australia in the years 1957 to 1961 are shown in the following table. Graphs showing details of the mine production of principal metals and coal from 1935 to 1962 may be found on pages 1159-60.

### CONTENTS OF METALLIC MINERALS PRODUCED: AUSTRALIA

Content of metallic minerals produced	Unit	1957	1958	1959	1960	1961
Alumina ( $\text{Al}_2\text{O}_3$ ) ..	ton	3,758	3,533	6,914	(a) 31,393	(a) 7,464
Antimony ..	"	1,209	1,356	1,280	786	680
Beryllium oxide (BeO) ..	unit(b)	4,570	2,900	3,587	2,221	3,585
Bismuth ..	lb.	1,344	2,328	..	..	602
Cadmium ..	ton	979	872	860	949	907
Chromic oxide ( $\text{Cr}_2\text{O}_3$ ) ..	"	(a) 1,420	(a) 386	(c) 60	(c) 265	..
Cobalt ..	"	68	71	60	65	65
Copper ..	"	59,255	75,715	94,950	109,435	95,626
Gold ..	fine oz.	1,083,941	1,103,980	1,085,104	1,086,709	1,076,292
Iron(d) ..	'000 tons	2,463	2,539	2,700	2,814	3,434
Lead ..	ton	333,753	328,347	316,293	308,163	269,656
Manganese(e) ..	"	34,904	25,623	40,966	28,585	40,989
Manganese dioxide ( $\text{MnO}_2$ )(f) ..	"	1,239	2,819	2,475	1,617	1,104
Molybdenum disulphide ( $\text{MoS}_2$ ) ..	lb.	(c) 5,236	(c) 8,568	..	..	2,630
Monazite ..	ton	132	423	331	(a) 344	(a) 1,463
Osmiridium ..	oz.	69	43	3	..	..
Platinum ..	"	17	22	..	4	2
Silver ..	'000 fine oz.	15,811	16,340	15,161	15,216	13,059
Sulphur(g) ..	ton	342,474	322,619	310,545	340,000	324,866
Tantalite-columbite ( $\text{Ta}_2\text{O}_5 + \text{Nb}_2\text{O}_5$ ) ..	lb.	23,499	6,736	8,499	11,500	13,814
Tin ..	ton	1,952	2,237	2,351	2,202	2,745
Titanium dioxide ( $\text{TiO}_2$ ) ..	"	163,751	119,233	125,301	144,744	191,965
Tungstic oxide ( $\text{WO}_3$ ) ..	"	1,409	850	653	1,111	1,536
Zinc ..	"	318,962	293,763	275,547	317,408	311,171
Zircon ..	"	87,703	58,745	112,352	101,494	134,483

(a) Partly estimated. (b) 1 unit = 22.4 lb. (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 ( $\text{U}_3\text{O}_8$ ) are not available for publication and are excluded.

### § 3. Gold

1. *Historical.*—A brief history of gold-mining in Australia may be found in previous issues of the Year Book (see No. 48, p. 1059).

2. *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 following table shows the mine production of gold (gold content of minerals produced) during 1961 according to the mineral in which it was contained and the State or Territory of origin. A small quantity of gold recovered from pyrite concentrate produced at Kalgoorlie, Western Australia, for sulphuric acid manufacture is included with gold ore, concentrate, etc.

### GOLD: MINE PRODUCTION, 1961

(Fine oz.)

Mineral in which contained	N.S.W.	Vic.	Q'land	S.A.	W.A.	Tas.	N.T.	Aust.
Copper ore, concentrate, etc. ..	2,556	..	49,690	..	2,983	7,242	18,354	80,825
Gold ore, concentrate, etc. ..	753	26,229	15,096	55	867,675	446	57,291	967,545
Lead concentrate ..	7,088	..	..	..	..	3,889	..	10,977
Lead-copper concentrate ..	..	..	..	..	..	12,572	..	12,572
Zinc concentrate ..	1,637	..	..	..	..	2,736	..	4,373
<b>Total Gold ..</b>	<b>12,034</b>	<b>26,229</b>	<b>64,786</b>	<b>55</b>	<b>870,658</b>	<b>26,885</b>	<b>75,645</b>	<b>1,076,292</b>

The principal sources of production during 1961 were as follows.

(i) *New South Wales.* There was only one mine employing four or more persons engaged solely in gold-mining. Most of the gold produced during 1961 was contained in lead and zinc concentrates produced at Broken Hill and copper, lead, and zinc concentrates milled at Captain's Flat.

(ii) *Victoria.* At Chewton, near Castlemaine, one mine produced more than half of the State's production. Only one other gold mine, located in the north-east of the State, produced more than 1,000 fine oz. during the year.

(iii) *Queensland.* The copper concentrate produced at Mount 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 the total production came from the East Coolgardie goldfield, 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 166,031 fine oz. during 1961, and two other mines each produced over 100,000 fine oz. in the same period.

(vi) *Tasmania.* Lead-copper, lead and zinc concentrates milled at Rosebery contained more than two-thirds of the gold produced in Tasmania during 1961, nearly all the remaining production being contained in copper concentrate produced at Mount Lyell.

(vii) *Northern Territory.* Gold production 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 year 1958 to 1962 and total output since the first major discovery of gold in 1851. Owing to defective information in the earlier years, it is likely that the total production figures fall considerably short of the actual totals.

## GOLD: MINE PRODUCTION(a)

State or Territory	1958	1959	1960	1961	1962(b)	Total(b) 1851-1962
	f. oz.	f. oz.	f. oz.	f. oz.	f. oz.	'000 f. oz.
New South Wales ..	18,709	13,275	13,628	12,034	11,712	16,447
Victoria ..	41,476	34,662	28,566	26,229	28,134	73,732
Queensland ..	74,568	91,687	78,267	64,786	67,841	22,821
South Australia ..	48	16	36	55	48	451
Western Australia ..	874,819	860,969	869,966	870,658	860,040	63,357
Tasmania ..	21,744	21,353	23,994	26,885	32,075	2,459
Northern Territory ..	72,616	63,142	72,252	75,645	73,297	1,532
<b>Australia ..</b>	<b>1,103,980</b>	<b>1,085,104</b>	<b>1,086,709</b>	<b>1,076,292</b>	<b>1,073,147</b>	<b>180,799</b>

(a) Gold content of minerals produced.

(b) Subject to revision.

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 1958 to 1962. The value of the refined newly-won gold is based on the price fixed by the Reserve 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	1958	1959	1960	1961	1962
QUANTITY (FINE Oz.)					
Australian origin—					
Newly-won gold ..	1,069,774	1,067,129	1,045,139	1,036,947	1,024,623
From scrap ..	17,350	20,617	22,699	22,593	21,806
Oversea origin—					
Newly-won gold ..	136,998	141,624	142,526	155,598	138,455
From scrap ..	888	1,075	1,164	1,277	188
<b>Total ..</b>	<b>1,225,010</b>	<b>1,230,445</b>	<b>1,211,528</b>	<b>1,216,415</b>	<b>1,185,072</b>

## VALUE (£'000)

<i>Newly-won gold of Australian origin ..</i>	16,720	16,677	16,396	16,241	16,021
---	--------	--------	--------	--------	--------

5. **Changes in Stocks of Gold held in Australia.**—The following table shows particulars of production and consumption, imports and exports of gold and changes in stocks of gold held in Australia for each of the years 1958 to 1962.

**CHANGES IN STOCKS OF GOLD HELD IN AUSTRALIA**  
(Fine oz.)

Particulars	1958	1959	1960	1961	1962 (a)
Mine production of gold(b) ..	1,103,980	1,085,104	1,086,709	1,076,292	1,073,147
Imports of gold(c)(d) ..	160,232	136,674	144,033	146,279	135,087
<i>Total</i> .. ..	<i>1,264,212</i>	<i>1,221,778</i>	<i>1,230,742</i>	<i>1,222,571</i>	<i>1,208,234</i>
Exports of gold(c) .. ..	128,550	128,052	2,513,906	1,099,701	314,971
Gold content of ores and concentrates exported ..	22,453	17,941	25,803	39,835	44,166
Net industrial consumption of gold .. ..	29,135	33,938	40,972	35,429	47,881
<i>Total</i> .. ..	<i>180,138</i>	<i>179,931</i>	<i>2,580,681</i>	<i>1,174,965</i>	<i>407,018</i>
Changes in stocks of gold held in Australia(e) .. ..	+ 1,084,074	+ 1,041,847	- 1,349,939	+ 47,606	+ 801,216

(a) Subject to revision. (b) Gold content of minerals produced in Australia. (c) Includes gold contained in matte. Excludes specie, leaf and foil and gold in unrefined forms other than the gold content of unrefined gold and silver bullion. (d) Excludes gold imported in some minor minerals. (e) Includes changes in holdings in Australia by Official and Banking Institutions both on their own behalf and that of non-residents, together with the gold content of change in stocks of minerals awaiting refining. The sign near the figure indicates increase (+) or decrease (-) in stocks during the period shown.

6. **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. On 1st May, 1954, it was raised from £15 9s. 10d. to £15 12s. 6d. per fine oz. and has remained unchanged since that date. The current price reflects the "parity" value of Australian currency established by the *International Monetary Agreement Act 1947*. Prior to 1947, the price of gold was based on the price for which it could be sold abroad in official markets, less cost of movement.

Average prices of gold per fine oz. at mints in Australia and on the London gold market are shown in the following table for the years 1958 to 1962.

**PRICES OF GOLD: AUSTRALIA AND LONDON**  
(per fine oz.)

Place of sale	1958	1959	1960	1961	1962
At mints in Australia £A. s. d.	15 12 6	15 12 6	15 12 6	15 12 6	15 12 6
London .. .. £stg. s. d.	12 9 9½	12 9 10½	12 11 2½	12 11 0	12 10 1

7. **Sales of Gold on Oversea Premium Markets.**—In November, 1951, the Commonwealth Government decided to allow Australian gold producers to benefit from the higher prices then being paid for gold on some overseas markets. To implement this decision, producers formed the Gold Producers' Association Limited 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.

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 1958 to 1962.

### GOLD SOLD ON OVERSEA PREMIUM MARKETS

Particulars	Unit	1958	1959	1960	1961	1962
Quantity ..	fine oz.	189,537	37,346	320,151	733,217	320,323
Value ..	£A. f.o.b.	2,964,637	584,129	5,049,183	11,513,571	5,016,625
Average price ..	£A. s. d.	15 12 10	15 12 10	15 15 5	15 14 1	15 13 3

8. *Gold Subsidy*.—Details of amounts paid under the provisions of the *Gold Mining Industry Assistance Act* 1954–1962 for the years 1958 to 1962 are shown in the following table. Particulars of this Act and other legislation are given in para. 3 (i) (b) on page 1141.

### 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
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
1961 ..	145	63,036	1,325	..	585,306	..	4,930	44,758	699,500
1962 ..	61	50,579	2,134	97	621,573	18	1,235	72,812	748,509

9. *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 1957 to 1961 are shown in the following table.

### GOLD: PRODUCTION IN PRINCIPAL COUNTRIES

(Source: Division of Minerals, United States Bureau of Mines)

('000 fine oz.)

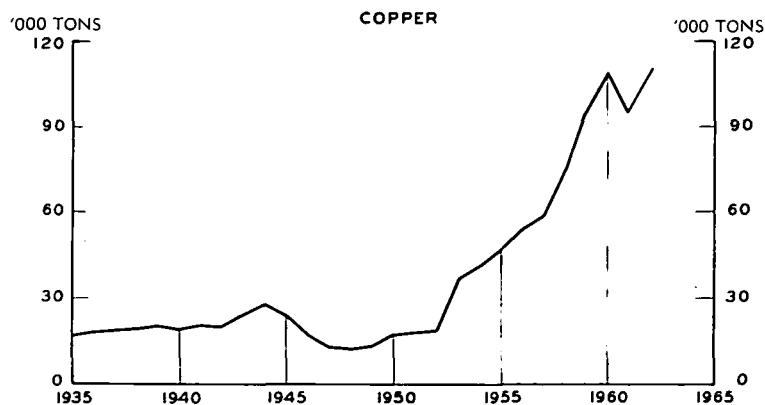
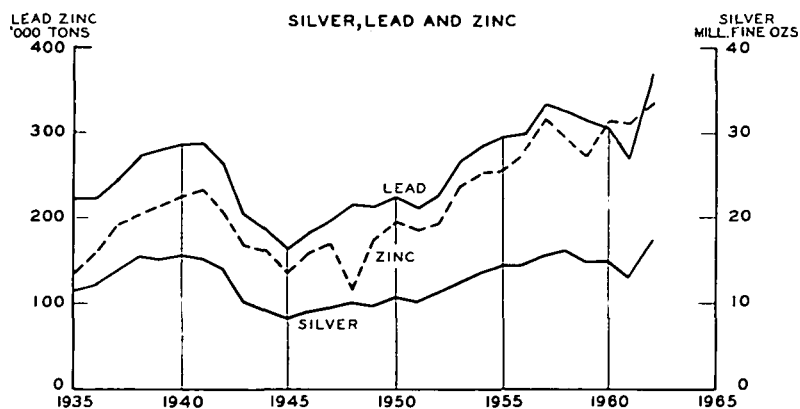
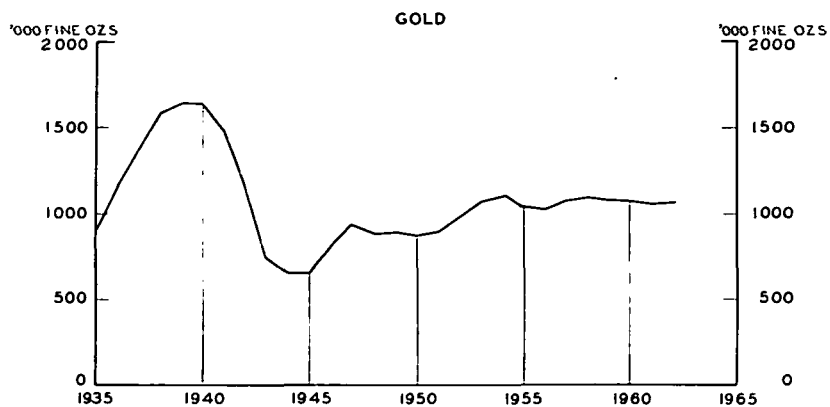
Country	1957	1958	1959	1960	1961
South Africa ..	17,031	17,656	20,066	21,383	22,942
U.S.S.R.(a) ..	10,000	10,000	10,000	11,000	12,000
Canada ..	4,434	4,571	4,483	4,629	4,442
United States of America ..	1,800	1,759	1,635	1,680	1,567
Australia ..	1,084	1,104	1,085	1,087	1,076
Ghana ..	790	853	913	893	970
Rhodesia and Nyasaland ..	540	559	572	568	574
Philippines ..	380	423	403	411	424
Colombia ..	325	372	398	434	400
Japan ..	253	261	262	261	294
<i>Estimated World Total</i> ..	39,500	40,600	42,800	45,400	47,700

(a) Estimated.

## MINE PRODUCTION OF PRINCIPAL METALS

(METALLIC CONTENT OF MINERALS)

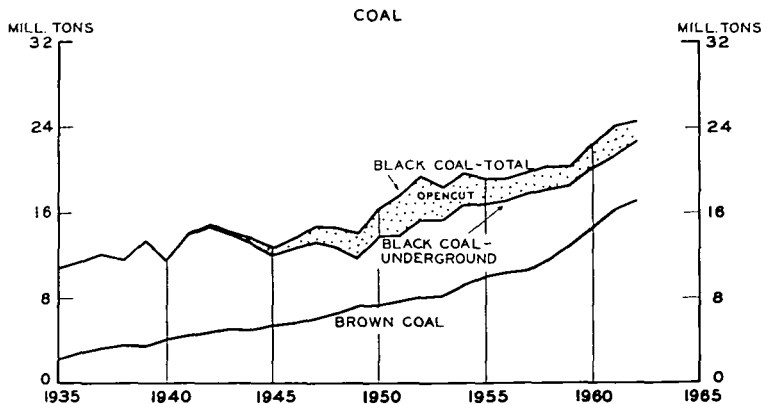
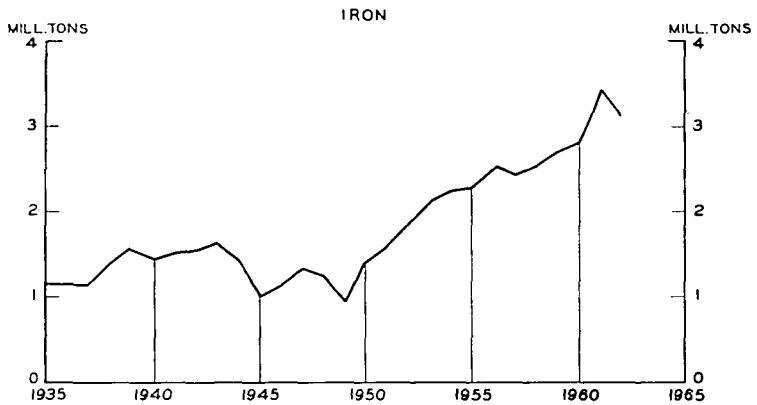
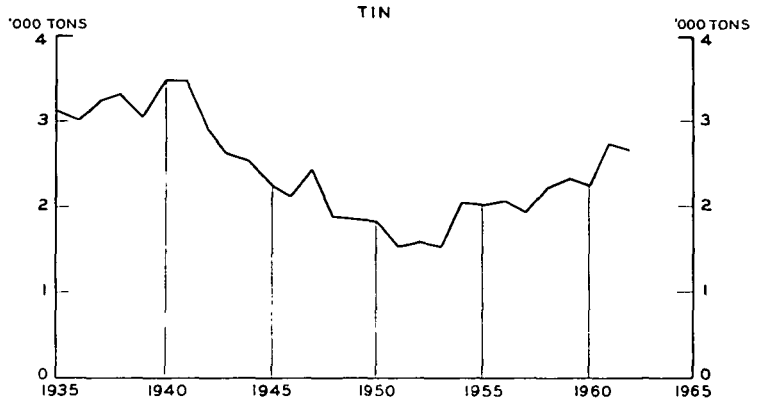
AUSTRALIA, 1935 TO 1962



# MINE PRODUCTION OF PRINCIPAL METALS AND PRODUCTION OF COAL

(METALLIC CONTENT OF MINERALS)

AUSTRALIA, 1935 TO 1962



## § 4. Lead, Silver and Zinc

1. **Historical.**—A brief history of silver-lead-zinc mining in Australia may be found in previous issues of the Year Book (see No. 48, p. 1065).

2. **Lead-Zinc Study Group.**—With the cessation of stock-pile buying of lead and zinc by the United States Government in 1958, world producers were faced with the prospect of a serious unbalance between world supply and demand for these metals. To meet this problem, a series of meetings of interested governments was held, at which Australia was represented. The meeting culminated in the formation of the Lead-Zinc Study Group in mid-1959. This group has met on several occasions and embarked on basic studies of productive capacity of lead and zinc, prices, and consumption trends. Since the group was established, it has recommended reduced production and sales (mainly lead) from time to time which have meant curtailments in both mine and metal production in Australia. No reduction was planned for 1963.

3. **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.

Particulars of representative Broken Hill lead and zinc concentrates are shown in para. 2, page 1140.

4. **Mine Production.**—The following table shows 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, 1961**

Mineral in which contained	N.S.W.	Vic.	Q'land	S.A.	W. Aust.	Tas.	N.T.	Aust.
<b>LEAD (tons)</b>								
Lead ore(a) ..	42	..	686	..	..	..	11	739
Lead concentrate ..	207,716	..	43,631	..	433	7,230	..	259,010
Lead-copper concentrate ..	..	..	..	..	..	2,733	..	2,733
Zinc concentrate ..	3,921	..	963	..	..	2,290	..	7,174
<i>Total Lead</i> ..	<i>211,679</i>	<i>..</i>	<i>45,280</i>	<i>..</i>	<i>433</i>	<i>12,253</i>	<i>11</i>	<i>269,656</i>

<b>SILVER (fine oz.)</b>								
Copper ore ..	582	..	11	..	..	9,151	..	9,744
Copper concentrate ..	82,179	..	442,070	..	8,785	43,304	82,124	658,462
Gold concentrate, etc. ..	141	573	17,133	..	200,573	..	9	218,429
Lead ore(a) ..	4,465	..	26,585	..	..	..	49	31,099
Lead concentrate ..	7,050,980	..	3,255,043	..	289	357,156	..	10,663,468
Lead-copper concentrate ..	..	..	..	..	..	799,031	..	799,031
Zinc concentrate ..	309,610	..	141,942	..	..	227,381	..	678,933
<i>Total Silver</i> ..	<i>7,447,957</i>	<i>573</i>	<i>3,882,784</i>	<i>..</i>	<i>209,647</i>	<i>1,436,023</i>	<i>82,182</i>	<i>13,059,166</i>

<b>ZINC (tons)</b>								
Lead ore(a) ..	..	..	..	..	..	(b)	(b)	
Lead concentrate ..	12,256	..	7,590	..	..	3,116	..	22,962
Zinc ore ..	..	..	..	(c) 12	..	..	(c)	12
Zinc concentrate ..	225,578	..	25,629	..	..	36,990	..	288,197
<i>Total Zinc</i> ..	<i>237,834</i>	<i>..</i>	<i>33,219</i>	<i>(c) 12</i>	<i>..</i>	<i>40,106</i>	<i>(b)</i>	<i>311,171</i>

(a) Includes lead-silver and lead-silver-zinc ore.

(b) Less than half a ton.

(c) Estimated.

The principal sources of production of lead, silver and zinc during 1961, 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 the zinc. During 1961, New South Wales mines produced (in terms of the content of all ores and concentrates produced) more than three-quarters of Australia's lead and zinc and more than half of the silver.

(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.* Mount Isa produced all the lead and zinc concentrates in Queensland during 1961. These contained most of the State's production of lead and silver and all the zinc. Nearly all the remaining silver was contained in copper concentrate produced at Mount Morgan.

(iv) *South Australia.* A small quantity of zinc ore for fertilizer was mined during 1961; there was no mine production of lead or silver during the year.

(v) *Western Australia.* Most of the silver produced was obtained from gold bullion produced by the gold-mining industry. All the lead produced was contained in lead concentrate. No zinc was produced during 1961.

(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 Williamsford and milled at Rosebery to produce separate lead, zinc, and lead-copper concentrates.

(vii) *Northern Territory.* Almost all the silver was contained in copper concentrates produced from Tennant Creek and Rum Jungle. In addition, a small quantity of lead ore containing silver, lead and zinc was produced.

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 1957 to 1961.

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

State or Territory	1957	1958	1959	1960	1961
LEAD (tons)					
New South Wales .. ..	266,928	246,896	246,449	235,868	211,679
Victoria .. ..	4	..	..	..	..
Queensland .. ..	51,269	65,799	54,415	57,518	45,280
South Australia .. ..	20	13	8	..	..
Western Australia .. ..	3,087	1,854	1,382	1,739	433
Tasmania .. ..	12,445	13,785	14,039	13,038	12,253
Northern Territory .. ..	..	..	..	..	11
<i>Australia</i> .. ..	<i>333,753</i>	<i>328,347</i>	<i>316,293</i>	<i>308,163</i>	<i>269,656</i>
SILVER (fine oz.)					
New South Wales .. ..	9,969,102	8,992,293	8,555,203	8,397,889	7,447,957
Victoria .. ..	3,157	3,018	2,016	576	573
Queensland .. ..	4,305,886	5,710,031	4,953,209	5,121,700	3,882,784
South Australia .. ..	975	613	394	..	..
Western Australia .. ..	187,530	189,375	179,601	196,756	209,647
Tasmania .. ..	1,299,062	1,394,818	1,369,070	1,398,424	1,436,023
Northern Territory .. ..	45,417	49,664	101,138	100,611	82,182
<i>Australia</i> .. ..	<i>15,811,129</i>	<i>16,339,812</i>	<i>15,160,631</i>	<i>15,215,956</i>	<i>13,059,166</i>



LEAD, SILVER AND ZINC: CONTENT OF ORES AND CONCENTRATES  
PRODUCED—*continued*

State or Territory	1957	1958	1959	1960	1961
ZINC (tons)					
New South Wales .. ..	256,276	227,440	216,993	248,164	237,834
Queensland .. ..	29,507	29,538	23,468	34,775	33,219
South Australia(a) .. ..	97	113	..	35	12
Western Australia .. ..	..	20	..	..	..
Tasmania .. ..	33,082	36,652	35,086	34,434	40,106
Northern Territory .. ..	..	..	..	..	(b)
<i>Australia</i> .. ..	<i>318,962</i>	<i>293,763</i>	<i>275,547</i>	<i>317,408</i>	<i>311,171</i>

(a) Estimated.

(b) Less than half a ton.

5. *Smelter and Refinery Production.*—(i) *Lead Concentrate.* The bulk of 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 recovered in various products which are sent to copper refineries for copper extraction. Because of the continued low price of lead, production of refined metal at Port Pirie was below capacity in 1961.

In 1961, a new smelter was commissioned at Cockle Creek, New South Wales. It draws its supplies of lead and zinc concentrates from Broken Hill. This plant is unique in Australia in that the zinc content of lead concentrate is recovered. Previously this zinc content had accumulated in lead smelter slags. The bullion produced at this plant is exported for treatment while the refined zinc is used domestically. Sulphuric acid and cadmium are recovered as by-products. Some of the Broken Hill concentrate not treated at Port Pirie and Cockle Creek 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 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 in Western Australia are exported.

(ii) *Zinc Concentrate.* A large proportion of the zinc concentrate produced at Broken Hill is exported, and the remainder is either shipped from Port Pirie to Risdon, near Hobart, or railed to Cockle Creek for smelting and 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 concentrate produced at Mount Isa is refined overseas.

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	1957	1958	1959	1960	1961
<b>LEAD (tons)</b>					
Refined lead— Production(a) .. .. .	192,161	191,474	185,805	189,823	162,264
Sold to Australian consumers(b) ..	37,291	39,928	33,563	32,985	26,289
Sold for export(b) .. .. .	152,432	158,075	133,340	132,957	142,166
Silver-lead bullion— Produced for export (lead content)(a) ..	46,891	57,171	50,310	52,723	48,090

<b>SILVER ('000 fine oz.)</b>					
Production(a) .. .. .	8,011	9,101	7,805	8,085	7,099
Sold to Australian consumers(b) ..	4,410	4,184	4,775	5,284	6,362
Sold for export(b) .. .. .	3,397	5,074	2,722	2,740	912

<b>ZINC (tons)</b>					
Production(a) .. .. .	110,348	114,773	116,461	120,230	138,694
Sold to Australian consumers(b) ..	78,874	72,844	78,753	90,240	85,499
Sold for export(b) .. .. .	37,316	37,989	40,950	29,335	42,675

(a) Source: Bureau of Mineral Resources.

(b) Source: Australian Mines and Metals Association.

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 1958 to 1962.

## PRICES OF LEAD, SILVER AND ZINC

Particulars	1958	1959	1960	1961	1962
<b>Australian prices, in Australian currency—</b>					
Lead, per ton(a) .. £	87	100	100	99	82
Silver, per fine oz.(b) s. d.	7 11½	8 2½	8 3½	8 4½	9 6½
Zinc, per ton(c) .. £	51	105	113	102	103
<b>London Metal Exchange prices, in sterling—</b>					
Lead, per ton .. £	73	72	72	65	57
Silver, per fine oz. s. d.	6 4½	6 7	6 7½	6 7½	7 7½
Zinc, per ton .. £	65	80	88	78	68

(a) The minimum price was fixed at £100 per ton on 23rd December, 1958. This was reduced to £95 per ton on 14th November, 1961, £85 per ton on 30th January, 1962, and £75 per ton on 10th August, 1962. On 1st December, 1962, the price was increased to £80 per ton. (b) Silver prices shown represent export parity calculated from London Metal Exchange prices. (c) Average market price was used subsequent to 30th June, 1959. On 1st January, 1958, a minimum price was fixed at £90 and this minimum was raised to £100 on 22nd December, 1958. The minimum price was abolished on 1st July, 1959.

7. Production in Principal Countries.—The following table shows, for the years 1957 to 1961, particulars of lead, silver and zinc production (mine basis) in principal producing countries, together with the estimated world total.

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

(Source: Division of Minerals, United States Bureau of Mines)

Country	1957	1958	1959	1960	1961
LEAD ('000 tons)					
U.S.S.R.(a) .. .. .	277	295	304	304	348
Australia .. .. .	334	328	316	308	270
United States of America .. .. .	302	239	228	220	234
Canada .. .. .	162	167	167	184	208
Mexico .. .. .	211	199	188	188	178
Peru .. .. .	135	132	113	130	132
<i>Estimated World Total</i> .. .. .	<i>2,360</i>	<i>2,310</i>	<i>2,290</i>	<i>2,330</i>	<i>2,375</i>

SILVER ('000 fine oz.)					
Mexico .. .. .	47,150	47,592	44,075	44,526	40,342
United States of America .. .. .	38,165	34,111	31,194	30,766	34,794
Peru .. .. .	24,845	25,918	27,225	30,755	33,582
Canada .. .. .	28,823	31,163	31,924	34,017	31,168
U.S.S.R.(a) .. .. .	25,000	25,000	25,000	25,000	25,000
Australia .. .. .	15,811	16,340	15,161	15,216	13,059
Japan .. .. .	6,544	6,552	6,651	6,913	7,947
Germany, Eastern(a) .. .. .	4,800	4,800	4,800	4,800	4,800
Bolivia .. .. .	5,375	6,051	4,504	4,887	3,900
Congo .. .. .	3,045	3,794	4,768	3,963	3,470
<i>Estimated World Total</i> .. .. .	<i>231,100</i>	<i>239,000</i>	<i>221,900</i>	<i>240,200</i>	<i>231,800</i>

ZINC ('000 tons)					
United States of America .. .. .	475	368	380	389	415
U.S.S.R.(a)(b) .. .. .	295	321	330	339	397
Canada .. .. .	369	380	354	363	371
Australia .. .. .	319	294	276	317	311
Mexico .. .. .	239	221	260	258	265
Peru .. .. .	152	133	141	175	173
Japan .. .. .	134	141	140	154	165
Poland .. .. .	129	121	127	142	137
<i>Estimated World Total</i> .. .. .	<i>3,100</i>	<i>3,000</i>	<i>3,020</i>	<i>3,200</i>	<i>3,320</i>

(a) Estimated.

(b) Smelter production.

## § 5. Copper

1. **Historical.**—A brief history of copper-mining in Australia may be found in previous issues of the Year Book (see No. 48, p. 1070).

2. **Assistance to the Copper Mining Industry.**—For particulars, see para. 3(i)(c), page 1142.

3. **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 open-cut methods at Mount Morgan, Mount Isa and Mount Lyell and by underground methods at Mount Isa and Ravensthorpe (Western Australia). Oxidized copper ore is mined at Mount 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 Mount Lyell and Mount Morgan, the tailings from the copper flotation are subjected to a further flotation and a pyrite concentrate is produced. The oxidized ore mined at Mount Isa is not concentrated and is fed direct to the smelters.

4. **Mine Production.**—The following table shows for 1961 the copper content of all minerals produced in the several States and the Northern Territory.

**COPPER: CONTENT OF ORES AND CONCENTRATES PRODUCED, 1961**  
(Tons)

Mineral in which contained	N.S.W.	Vic.	Q'land	S. Aust.	W. Aust.	Tas.	N.T.	Aust.
Copper ore, concentrate, etc. ..	983	8	65,983	2	2,206	11,694	10,652	91,528
Lead concentrate ..	2,045	..	522	..	..	79	..	2,646
Lead-copper concentrate ..	..	..	..	..	..	731	..	731
Zinc concentrate ..	482	..	..	..	..	239	..	721
<b>Total .. ..</b>	<b>3,510</b>	<b>8</b>	<b>66,505</b>	<b>2</b>	<b>2,206</b>	<b>12,743</b>	<b>10,652</b>	<b>95,626</b>

The following were the principal sources of copper during 1961.

- (i) *New South Wales.* Most of the copper produced was contained in lead concentrate milled at Broken Hill. At Captain's Flat, nearly all the copper was contained in copper concentrate, but reserves were nearly exhausted. (The mine has since closed down.)
- (ii) *Victoria.* One mine produced a small quantity of copper ore during 1961.
- (iii) *Queensland.* Mount Isa was the most important copper producing centre in Australia, its 1961 output being 60 per cent. of the Australian total. The copper produced at Mount Isa is contained in copper sulphide concentrate, oxidized copper ore and lead concentrate. Copper concentrate produced at Mount Morgan contained most of the remainder.
- (iv) *South Australia.* Only a small quantity of copper ore for fertilizer was produced during 1961.
- (v) *Western Australia.* Two-thirds 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 Mount Lyell, where copper was contained in copper concentrate, ore and precipitate. Lead-copper concentrate, lead concentrate and zinc concentrate milled at Rosebery made up most of the remainder of Tasmania's production.
- (vii) *Northern Territory.* Copper concentrate from Tennant Creek and copper concentrate and precipitate from Rum Jungle contained almost all of the Territory's output of copper.

The table hereunder shows the quantities of copper contained in minerals produced in the several States and the Northern Territory during the years 1957 to 1961.

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

State or Territory	1957	1958	1959	1960	1961
New South Wales .. ..	4,382	4,023	3,728	3,572	3,510
Victoria .. ..	..	..	14	..	8
Queensland .. ..	35,786	50,511	66,798	82,753	66,505
South Australia .. ..	2	1	16	5	2
Western Australia .. ..	788	1,107	2,197	1,661	2,206
Tasmania .. ..	10,984	11,413	12,244	11,680	12,743
Northern Territory .. ..	7,313	8,660	9,953	9,764	10,652
<b>Australia .. ..</b>	<b>59,255</b>	<b>75,715</b>	<b>94,950</b>	<b>109,435</b>	<b>95,626</b>

In New South Wales, the search for ore in the Cobar mining field was continued during 1961. The prospecting methods employed included geological mapping, geophysical and geochemical surveys and diamond drilling from the surface and from underground shafts. In 1962, development work started on the site of an old mine, 7 miles north of Cobar. This mine is expected to produce about 80,000 tons of copper annually after 1965.

**5. Smelter and Refinery Production of Copper.**—Most of the copper concentrate milled in Australia is smelted locally, blister copper being produced at Mount Isa, Mount Morgan, Mount Lyell and Port Kembla.

Blister copper smelted at Mount Isa is railed to Townsville for electrolytic refining. Mount Lyell blister copper is electrolytically refined at Mount Lyell and the bulk is re-melted and cast into primary shapes at Port Kembla. Mount 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. Fire refining, which is a cheaper process and undertaken when there are no other metals to be recovered, has been used to a lesser extent. Copper by-products from lead smelting operations at Port Pirie are also treated at Port Kembla.

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

In the following table, details are given of the production of blister copper, and the production and exports of refined copper for the years 1957 to 1961.

#### METALLIC COPPER: PRODUCTION AND EXPORTS, AUSTRALIA

(Source: Bureau of Mineral Resources)

(Tons)

Particulars	1957	1958	1959	1960	1961
Blister copper production ..	50,403	64,608	68,494	71,037	62,497
Refined copper production ..	32,880	43,276	51,593	70,652	63,723
Exports of blister and refinery shapes .. .. .	19,079	14,421	18,974	14,079	24,095

**6. Prices.**—Details of average market prices for the years 1958 to 1962 are given in terms of Australian currency and sterling in the following table.

#### AVERAGE PRICES OF ELECTROLYTIC COPPER IN AUSTRALIA AND THE UNITED KINGDOM

(£ per ton)

Country	1958	1959	1960	1961	1962
Australia — in Australian currency(a) .. ..	284	312	324	307	305
United Kingdom—in sterling	193	235	239	228	232

(a) Ex-works Port Kembla.

**7. Production in Principal Countries.**—The following table shows the mine production of copper for the years 1957 to 1961 in the principal producing countries and the estimated world production in those years.

**COPPER: MINE PRODUCTION IN PRINCIPAL COUNTRIES**

(Source: Division of Minerals of the United States Bureau of Mines)

('000 tons)

Country	1957	1958	1959	1960	1961
United States of America ..	970	874	736	964	1,040
Rhodesia and Nyasaland ..	432	401	545	581	579
Chile .. .. .	478	460	538	524	539
U.S.S.R.(a) .. .. .	402	420	429	491	536
Canada .. .. .	321	308	353	392	402
Congo(b) .. .. .	238	234	278	297	291
Peru .. .. .	56	53	49	179	195
Australia .. .. .	59	76	95	109	96
Japan .. .. .	80	80	84	88	95
South Africa .. .. .	46	49	48	45	52
Philippines .. .. .	40	46	49	43	51
Mexico .. .. .	60	64	56	59	49
<i>Estimated World Total ..</i>	<i>3,473</i>	<i>3,375</i>	<i>3,598</i>	<i>4,143</i>	<i>4,330</i>

(a) Estimated.

(b) Smelter production.

**§ 6. Tin**

1. **Historical.**—A brief history of tin-mining in Australia may be found in previous issues of the Year Book (see No. 48, p. 1073).

2. **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 1957 to 1961. No tin is recorded from minerals other than tin concentrate.

**TIN: CONTENT OF TIN CONCENTRATES PRODUCED**

(Tons)

State or Territory	1957	1958	1959	1960	1961
New South Wales .. ..	211	239	174	223	173
Victoria .. .. .	(a)	..	..	..	..
Queensland .. .. .	772	1,019	(b) 1,104	(b) 885	(b) 1,350
Western Australia .. ..	182	94	174	190	231
Tasmania .. .. .	777	883	890	884	986
Northern Territory .. ..	10	2	9	20	5
<b>Australia .. .. .</b>	<b>1,952</b>	<b>2,237</b>	<b>2,351</b>	<b>2,202</b>	<b>2,745</b>

(a) Less than half a ton.

(b) Estimated.

The following were the principal sources of production in 1961.

- (i) *New South Wales.* Virtually all production was from alluvial deposits. The New England region, mainly around Tingha, Deepwater, Emmaville and Tenterfield, produced over 80 per cent. of the total production.
- (ii) *Queensland.* Most of the tin concentrate produced was from the Herberton field, principally alluvial tin concentrate being produced. Tin concentrate was also produced in the Chillagoe, Kangaroo Hills and Cooktown districts.
- (iii) *Western Australia.* Nearly all the tin concentrate produced was alluvial tin won from the Pilbara field.
- (iv) *Tasmania.* Most of the tin concentrate produced was won in the north-east part of the State, from both lode and alluvial deposits. Wolfram concentrate, as well as tin concentrate, was produced.
- (v) *Northern Territory.* Almost the whole output of tin came from a single mine at Moun! Masson.

4. **Smelter and Refinery Production.**—Except for occasional small parcels of concentrate shipped to oversea smelters, all local production is treated by the two tin smelters located in Sydney.

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:—1958, 2,121 tons; 1959, 2,226 tons; 1960, 2,254 tons; 1961, 2,546 tons; and 1962, 2,704 tons.

Consumption of refined tin has increased substantially in recent years following the introduction of tin-plate production in Australia; hot-dip plating began in 1957 and the electrolytic plant at Port Kembla, New South Wales, commenced operations early in 1962.

5. **Prices.**—Details of the movement in average market prices of tin for the years 1958 to 1962 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	1958	1959	1960	1961	1962
Australia — in Australian currency	995	1,058	1,042	1,169	1,163
United Kingdom—in sterling	735	786	794	895	898

6. **Production in Principal Countries.**—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 slightly above 1 per cent.

The mine production of tin for the principal producing countries and the estimated world totals in 1960 and 1961 were as follows.

## TIN: PRODUCTION IN PRINCIPAL COUNTRIES

(Source: Division of Minerals of the United States Bureau of Mines)

(Tons)

Country	Production		Country	Production	
	1960	1961		1960	1961
Malaya, Federation of	51,979	56,028	Australia .. ..	2,202	2,745
China(a) .. ..	28,000	30,000	South Africa ..	1,276	1,450
Bolivia .. ..	19,406	20,408	United Kingdom ..	1,192	1,210
Indonesia .. ..	22,599	18,574	Burma(b) .. ..	1,100	1,100
Thailand .. ..	12,080	13,270	Japan .. ..	842	852
Nigeria .. ..	7,675	7,779	<i>Estimated World</i>		
Congo(b) .. ..	8,934	6,601	<i>Total</i> ..	181,500	188,000

(a) Estimated smelter production.

(b) Estimated.

## § 7. 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. The Koolyanobbing deposits will be worked on a very much larger scale eventually and will supply the ore for an iron and steel industry to be established at Kwinana, south of Perth. A blast furnace is expected to be in operation in 1968.

In December, 1960, the Commonwealth Government announced a partial relaxation of the embargo on the export of iron ore which had been in force since 1938. Permission has been granted for the export of iron ore from Talling Peak-Koolanooka and of pelletized ore from the Scott River area, both in Western Australia, and from small deposits in New South Wales and Queensland.

The modification of the export embargo has greatly increased exploration for iron ore. Of particular importance was the discovery of extensive deposits in the Pilbara district, in the north-west of Western Australia. An extensive testing programme is in hand to determine the size and grade of these deposits. Early in 1963, the Western Australian Government announced that reserves in that State were conservatively estimated at 8,000 million tons, the bulk of which was in the Pilbara region.

Recent work at Mount Goldsworthy, Western Australia, and Savage River, Tasmania, has indicated that reserves are substantially greater than originally estimated. Further testing was made of other ore deposits located at Roper River (Northern Territory) and at Constance Range (Queensland).



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.**—Currently 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. Some concentration of lower grade ore from the Iron Knob area in South Australia is now carried out. Early in 1963, a scree treatment plant began operating at Iron Knob. Concentrates produced had an iron content of over 60 per cent. and recovery was of the order of 85 per cent. Sintering is now carried out at both Newcastle and Port Kembla to provide an improved blast furnace feed.

**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 1957 to 1961.

#### IRON: ESTIMATED IRON CONTENT OF IRON ORE PRODUCED

(Tons)

State	1957	1958	1959	1960	1961
South Australia .. ..	2,199,981	2,173,922	2,218,846	2,227,551	2,581,313
Western Australia .. ..	262,519	365,275	480,769	586,404	852,663
<b>Australia .. ..</b>	<b>2,462,500</b>	<b>2,539,197</b>	<b>2,699,615</b>	<b>2,813,955</b>	<b>3,433,976</b>

The producing centres during 1961, were as follows.

- (i) *South Australia.* 3,982,493 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. Production of beneficiated iron ore commenced at Iron Knob in the latter part of 1962.
- (ii) *Western Australia.* Ore shipped from Yampi Sound, north of Derby, to New South Wales for sintering and smelting amounted to 1,284,768 tons. A quantity of 74,780 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 1961, according to end use, is shown in the following table.

#### IRON OXIDE PRODUCTION, 1961

(Tons)

Use	New South Wales	Victoria	Queensland	South Australia	Tasmania	Australia
For gas purification ..	565	690	..	..	191	1,446
For cement manufacture ..	17,922	..	1,746	..	2,118	21,786
For coal washing ..	1,260	..	..	..	..	1,260
For fluxing .. ..	..	..	..	8,850	..	8,850
<b>Total .. ..</b>	<b>19,747</b>	<b>690</b>	<b>1,746</b>	<b>8,850</b>	<b>2,309</b>	<b>33,342</b>

The principal sources of iron oxide production during 1961 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 Lithgow, Mudgee and Rylstone mining divisions. Magnetite, used in coal washing, was produced in the Copmanhurst mining division and also 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 8,850 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 according to end use are shown in the following table.

#### IRON OXIDE PRODUCTION: AUSTRALIA

(Tons)

Use	1957	1958	1959	1960	1961
For gas purification ..	5,338	2,864	4,355	2,970	1,446
For cement manufacture ..	9,759	6,093	9,485	15,776	21,786
For coal washing ..	4	25	30	386	1,260
For fluxing ..	4,650	8,100	9,600	9,600	8,850
<b>Total ..</b>	<b>19,751</b>	<b>17,082</b>	<b>23,470</b>	<b>28,732</b>	<b>33,342</b>

5. **Iron and Steel Production.**—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.

#### 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)
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
1956 ..	1,910,521	2,320,289	1961 ..	3,001,800	3,748,037
1957 ..	2,098,352	2,773,995	1962 ..	3,380,334	4,075,699

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

(b) Includes recovery from scrap.

In 1962, ten blast furnaces were operating in Australia; four at Port Kembla and three at Newcastle, in New South Wales, two at Wundowie in Western Australia, and one at Whyalla, South Australia. Production of pig-iron throughout 1962 was at a record level and during October, 1962, the No. 4 blast furnace at Port Kembla produced 92,680 short tons of pig-iron, claimed to be a new world production record for a single unit. A fourth blast furnace with a daily capacity of 1,400 tons of pig-iron was commissioned at Newcastle in July, 1963.

During 1962, the bulk of Australia's ingot steel production was obtained from 27 open hearth furnaces (13 at Port Kembla and 14 at Newcastle). In addition, 3 other open hearth furnaces and 14 electric furnaces were in operation during 1962 for the production of special steels and ferro-alloys. In March, 1962, the fifth and largest furnace of the No. 2 open hearth shop at Port Kembla was commissioned. By the end of 1962, all furnaces in this shop were using oxygen lancing equipment, thereby increasing capacity at Port Kembla from 2.9 million tons to 3.25 million tons of ingot steel per annum. In December, 1962, the first basic oxygen steelmaking furnace was commissioned at Newcastle, and a second unit was commissioned in January, 1963. Although these two units will eventually replace ten of the open-hearth furnaces, the net capacity of the Newcastle steelworks will be increased from 1.3 million tons to 1.6 million tons per annum.

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 1960 and 1961 are shown in the following table.

#### IRON AND STEEL: PRODUCTION IN PRINCIPAL COUNTRIES

(Source: Division of Minerals of the United States Bureau of Mines)

('000 Tons)

Country	Pig-iron and ferro-alloys		Steel ingots and castings	
	1960	1961	1960	1961
United States of America ..	61,268	59,569	88,645	87,513
U.S.S.R. ..	46,018	50,089	64,262	69,583
Germany, Federal Republic ..	25,332	25,019	33,562	32,930
Japan ..	12,147	16,126	21,788	27,822
United Kingdom ..	15,763	14,768	24,305	22,100
France ..	14,138	14,613	17,008	17,322
China (Mainland) ..	27,054	21,696	18,161	14,768
Italy ..	2,779	3,150	8,099	8,979
Poland ..	4,491	4,695	6,772	7,120
Czechoslovakia ..	4,621	4,893	6,661	6,932
Belgium ..	6,449	6,343	7,074	6,900
Canada ..	3,943	4,503	5,170	5,773
Luxembourg ..	3,726	3,773	4,020	4,048
India ..	4,126	4,616	3,235	4,007
Australia ..	2,876	3,155	3,694	3,877
Sweden ..	1,604	1,733	3,167	3,501
Germany, Eastern ..	1,963	1,997	3,284	3,389
Austria ..	2,196	2,226	3,113	3,052
<i>Estimated World Total ..</i>	<i>254,500</i>	<i>258,000</i>	<i>340,500</i>	<i>350,400</i>

## § 8. Mineral Sands

1. **Historical.**—Since the war, the growing world demand for rutile as a coating for electric welding rods and as a source of titanium metal, and for ilmenite in the production of titanium pigments, 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 on 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 pigment production. Operators produce separate concentrates of rutile, zircon and ilmenite and, in addition, a few companies produce high-grade monazite concentrate.

Following the record post-war output of rutile in 1957, production was on a reduced scale during the period 1958–60, mainly because of greatly reduced prices offering on world markets. However, during the second half of 1961 and throughout 1962, the price of rutile improved and production increased. Strengthening of the rutile market was due in part to the rationalization of the Australian industry and also to increased demand for rutile.

2. **Methods of Mining and Treatment.**—Mining on the east coast of Australia is mainly by suction dredging. In Western Australia, ilmenite is mined hydraulically or by earth-moving equipment. Heavy mineral concentrates are recovered by wet gravity concentration, using a combination of concentrating spirals and shaking tables. The constituent minerals of the heavy-mineral concentrates, mainly rutile, zircon, ilmenite and monazite are separated by electromagnetic and electrostatic methods.

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 1957 to 1961.

## TITANIUM DIOXIDE: CONTENT OF CONCENTRATES PRODUCED

(Tons)

State	1957	1958	1959	1960	1961
-------	------	------	------	------	------

## CONTAINED IN RUTILE CONCENTRATE

New South Wales .. ..	83,363	44,915	44,792	52,262	64,284
Queensland .. ..	41,500	35,755	34,736	33,260	33,056
Western Australia .. ..	..	285	96	493	880
<i>Australia</i> .. ..	<i>124,863</i>	<i>80,955</i>	<i>79,624</i>	<i>86,015</i>	<i>98,220</i>

## CONTAINED IN ILMENITE CONCENTRATE

New South Wales .. ..	485	59	111	537	905
Queensland .. ..	78	..	..	21	2
Western Australia .. ..	38,325	38,219	45,566	58,171	92,838
<i>Australia</i> .. ..	<i>38,888</i>	<i>38,278</i>	<i>45,677</i>	<i>58,729</i>	<i>93,745</i>

(ii) *Zircon.* The quantities of zircon mineral contained in zircon concentrate produced during the years 1957 to 1961 are shown in the following table.

## ZIRCON: CONTENT OF ZIRCON CONCENTRATE PRODUCED

(Tons)

State	1957	1958	1959	1960	1961
New South Wales .. ..	58,747	32,230	71,156	65,764	98,421
Queensland .. ..	28,956	26,412	34,504	31,752	28,775
Western Australia .. ..	..	103	6,692	(a) 3,978	(a) 7,287
<b>Australia .. ..</b>	<b>87,703</b>	<b>58,745</b>	<b>112,352</b>	<b>101,494</b>	<b>134,483</b>

(a) Estimated.

(iii) *Other Products.* During 1961, small quantities of monazite concentrate, magnetite and garnet concentrate were also recovered from mineral sands.

(iv) *Sources of Production.* The principal sources of mineral sands treated during 1961 were as follows.

(a) *New South Wales and Queensland.* The main deposits of mineral sands occur along the eastern Australian coast from Wyong in New South Wales to Curtis Island, Queensland. At present, the principal mining operations are located between Lake Munmorah and Newcastle in the south, between Laurieton and Crescent Head on the central coast, and between Byron Bay and North Stradbroke Island in the north. Most mining operations are now confined to dunes and swampy areas lying behind beaches where high-grade deposits are now exhausted.

(b) *Western Australia.* The chief deposits of mineral sands occur in the south-west corner of the State, between Bunbury and Wonnerup. During 1961, the bulk of production was from inland deposits in the Capel-Yoganup area.

## § 9. Aluminium

1. *Mine Production.*—The source of aluminium is bauxite. Until recent years, the only bauxite production in Australia was from small deposits in Queensland, New South Wales and Victoria. Production from these deposits has been used mainly by the chemical and steel industries.

Large deposits of bauxite exist at Weipa (North Queensland), Gove (Northern Territory) and Darling Range (Western Australia). The deposits at Weipa and the Darling Range are now being developed, and trial shipments from both deposits have been sent to Japan for smelting. There have also been some shipments from Weipa to the Bell Bay alumina plant. The Weipa deposit is being developed for the production of alumina (plant capacity 360,000 tons annually) at that centre and also for the export of bauxite. This plant will supply the requirements of an aluminium smelter (plant capacity 120,000 tons annually) to be installed at Invercargill (New Zealand) and at least part of the requirement of the Bell Bay smelter in Tasmania. At Kwinana (Western Australia), an alumina plant (capacity 200,000 tons annually) is being constructed to use Darling Range bauxite. The alumina will be shipped to Geelong (Victoria) for the production of metal. In addition, some alumina is likely to be exported from Kwinana. Deposits at Gove are to be developed in the first instance for the export of bauxite to Japan. It is envisaged that 10 million tons will be shipped over a period of eighteen years. Investigations are to be made into the possibility of establishing an alumina plant at Gove. The alumina content of bauxite produced in Australia during the years 1957 to 1961 is shown in the following table.

**ALUMINA: CONTENT OF BAUXITE PRODUCED**  
(Tons)

State	1957	1958	1959	1960	1961
New South Wales .. ..	1,354	633	1,648	1,386	929
Victoria .. ..	1,910	2,304	1,991	2,306	(a)
Queensland(b) .. ..	494	596	..	14,442	(a)
Western Australia(b) .. ..	..	..	3,275	13,259	..
<b>Australia .. ..</b>	<b>3,758</b>	<b>3,533</b>	<b>6,914</b>	<b>(c) 31,393</b>	<b>(c) 7,464</b>

(a) Not available for publication.

(b) Estimated.

(c) Partly estimated.

2. **Refinery Production.**—There is a refinery for the production of alumina and refined aluminium at Bell Bay on the River Tamar 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 capacity of the Bell Bay plant was increased to 35,000 tons in 1962 and will be further increased to 52,000 tons in 1963. A new smelter with an ultimate capacity of 40,000 tons is under construction at Geelong (Victoria). The plant is expected to come into production in 1963. The following table shows the production of alumina and refined aluminium in Australia during the years 1957 to 1961. Details of production in 1962 are not available for publication.

**ALUMINA AND REFINED ALUMINIUM: PRODUCTION, AUSTRALIA**  
(Source: Bureau of Mineral Resources)  
(Tons)

Refinery product	1957	1958	1959	1960	1961
Alumina .. ..	20,116	22,490	26,900	29,801	29,468
Refined aluminium .. ..	10,624	10,869	11,370	11,655	13,204

### § 10. 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 1962, the principal producing centres were as follows.

- (i) *Queensland.* Uranium ore was mined by opencut methods at Mary Kathleen, 33 miles east of Mount Isa.
- (ii) *South Australia.* The Radium Hill mine closed down in December, 1961, and the Port Pirie plant ceased production of uranium oxide late in February, 1962.
- (iii) *Northern Territory.* At Rum Jungle, uranium-copper and copper ores were treated to produce  $U_3O_8$  concentrate, copper concentrate and copper precipitate. Production of concentrates was from ore stockpiled when mining operations at Rum Jungle ceased late in 1958. Shipments of uranium oxide from the Rum Jungle plant to the Combined Development Agency were expected to be completed early in 1963. After this, ore from the Rum Jungle Creek South deposit will be treated at the Rum Jungle plant.

In the South Alligator River area, the El Sherana mine was operated to supply ore to a concentrating plant at Moline.

The contract for the supply of uranium oxide to the United Kingdom Atomic Energy Authority from Mary Kathleen was expected to be completed by the end of 1963. Domestic production from then on will be confined to Rum Jungle and Moline. Existing contracts with the U.K. Atomic Energy Authority are expected to keep the Moline plant operating until 1965. Operations at Rum Jungle will be maintained at current levels and the uranium oxide produced will be available for sale overseas.

## § 11. 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 in 1960. Low prices have persisted and production during 1962 was on a limited scale.

Particulars of the production of tungstic oxide contained in scheelite and wolfram concentrates produced during the years 1957 to 1961 are shown in the following table.

**TUNGSTIC OXIDE (WO<sub>3</sub>): CONTENT OF CONCENTRATES PRODUCED**  
(Tons)

State	1957	1958	1959	1960	1961
<b>CONTAINED IN SCHEELITE CONCENTRATE</b>					
New South Wales .. ..	1	1	(a)	(a)	(a)
Queensland .. ..	1	..	..	..	..
Tasmania .. ..	948	477	..	291	709
<i>Australia</i> .. ..	950	478	(a)	291	709
<b>CONTAINED IN WOLFRAM CONCENTRATE</b>					
New South Wales .. ..	(a)	..	..	..	(a)
Queensland .. ..	19	5	..	..	1
Tasmania .. ..	391	360	645	804	810
Northern Territory .. ..	49	7	8	16	16
<i>Australia</i> .. ..	459	372	653	820	827

(a) Less than half a ton.

2. **Manganese.**—In recent years, Western Australia has been the principal State producing manganese ore, mined mainly from the Pilbara goldfield.

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 1957 to 1961.

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

Year	Metallurgical grade In terms of manganese (Mn) content				Battery and other grades In terms of manganese dioxide (MnO <sub>2</sub> ) content				
	N.S.W.	Q'land (a)	W. Aust.	Aust.	N.S.W.	S. Aust.	W. Aust.	N. Terr.	Aust.
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
1960 ..	342	1,670	26,561	28,585	623	45	9	940	1,617
1961 ..	..	1,109	39,880	40,989	632	(a) 192	204	76	1,104

(a) Estimated.

(b) Includes Victoria (12 tons).

The quantity of manganese dioxide recovered at the Risdon, Tasmania, refinery during 1961 amounted to 3,073 tons, of which 372 tons were sold for chemical processing and trace element fertilizer.

3. **Other.**—Production in 1961 (1960 shown in parentheses) of other metallic minerals are listed in the following paragraphs.

(i) *Antimony.* The antimony content of antimony-bearing minerals produced was 680 tons (786 tons). Of this amount, 563 tons (632 tons) were in lead concentrate and 117 tons (154 tons) in 190 tons (256 tons) of antimony ore and concentrate.

(ii) *Beryllium.* Production of beryllium ore was 306 tons (190 tons), which came mainly from Western Australia where the Pilbara and Gascoyne goldfields were the main producing areas. The beryllium oxide content of the ore was 3,585 units of 22.4 lb. (2,221 units).

(iii) *Chromite.* No chromite was produced in 1961. In the previous year, 529 tons were produced with an estimated chromic oxide content of 265 tons.

(iv) *Tantalite-columbite.* The production of tantalite-columbite concentrate was 31,808 lb. (23,677 lb.) and the whole of this output came from Western Australia. The tantalum pentoxide and columbium pentoxide content of the concentrates was 13,814 lb. (11,500 lb.).

(v) *Other.* Three ounces of platinum concentrate containing 2 oz. of platinum were obtained in New South Wales as a by-product of gold refining.

## § 12. Coal

1. **Historical.**—A brief history of coal-mining in Australia may be found in previous issues of the Year Book (*see* No. 48, p. 1086).

2. **Joint Coal Board.**—For details of the powers and functions of this Board, which has functioned since 1947, *see* page 887 of Official Year Book No. 39.

3. **Australia's Coal Reserves.**—The latest available estimates of the measured and indicated coal reserves of Australia are those prepared by the Mines Departments in the various States for the Coal Utilization Research Advisory Committee whose report was issued by the Department of National Development in 1962. This information 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

(Source: State Mines Departments)

(Million Tons)

State	Type of coal	Measured and indicated	Inferred
New South Wales .. ..	Bituminous.. ..	(a) 3,050	(b)
Victoria .. ..	" .. ..	20	10
" .. ..	Brown .. ..	54,700	43,000
Queensland .. ..	Bituminous, sub-bituminous ..	950	(c)
South Australia .. ..	Sub-bituminous .. ..	130	..
" .. ..	Lignite .. ..	530	..
Western Australia .. ..	Sub-bituminous .. ..	274	1,603
Tasmania .. ..	Bituminous.. ..	(d)	(e) 137

(a) Recoverable reserves. (b) In excess of 30,000 million tons. (c) In excess of 10,000 million tons. (d) Very small; measured reserves in Tasmania amount to only several thousand tons. (e) Includes both indicated and inferred reserves.



4. Mine Production of Black Coal.—Production of black coal according to rank in the several States during the years 1957 to 1961 is set out in the following table. The tonnages produced by underground mining and opencut mining are also shown.

**BLACK COAL: PRODUCTION**  
(Tons)

Particulars	1958	1959	1960	1961	1962
<b>NEW SOUTH WALES</b>					
Bituminous .. ..	15,840,550	15,712,440	17,736,994	19,020,805	19,030,418
Sub-bituminous ..	10,398	..	..	..	..
<i>Total</i> .. ..	<i>15,850,948</i>	<i>15,712,440</i>	<i>17,736,994</i>	<i>19,020,805</i>	<i>19,030,418</i>
Underground mines	15,130,633	15,278,162	16,981,561	18,188,613	18,195,881
Opencut mines ..	720,315	434,278	755,433	832,192	834,537
<b>VICTORIA</b>					
<i>Total(a)</i> .. ..	<i>108,359</i>	<i>90,438</i>	<i>76,972</i>	<i>66,363</i>	<i>56,721</i>
<b>QUEENSLAND</b>					
Semi-anthracite ..	55,190	51,849	47,762	56,437	68,363
Bituminous .. ..	2,392,435	2,476,479	2,531,581	2,650,367	2,654,313
Sub-bituminous ..	132,748	66,059	70,769	75,362	87,969
<i>Total</i> .. ..	<i>2,580,373</i>	<i>2,594,387</i>	<i>2,650,112</i>	<i>2,782,166</i>	<i>2,810,645</i>
Underground mines	2,098,030	2,142,302	2,269,564	2,157,790	2,196,872
Opencut mines ..	482,343	452,085	380,548	624,376	613,773
<b>SOUTH AUSTRALIA</b>					
<i>Total(b)</i> .. ..	<i>755,022</i>	<i>690,374</i>	<i>884,819</i>	<i>1,115,156</i>	<i>1,392,085</i>
<b>WESTERN AUSTRALIA</b>					
<i>Total(c)</i> .. ..	<i>870,882</i>	<i>911,435</i>	<i>922,393</i>	<i>765,740</i>	<i>919,112</i>
Underground mines	779,394	800,856	798,185	506,306	598,502
Opencut mines ..	91,488	110,579	124,208	259,434	320,610

NOTE.—See next page for footnotes.

**BLACK COAL: PRODUCTION—continued**  
(Tons)

Particulars	1958	1959	1960	1961	1962
<b>TASMANIA</b>					
Semi-anthracite ..	2,006	2,217	2,333	2,142	1,649
Bituminous ..	274,262	297,151	295,337	253,686	270,693
<b>Total</b> ..	<b>276,268</b>	<b>299,368</b>	<b>297,670</b>	<b>255,828</b>	<b>272,342</b>
Underground mines	260,100	281,310	281,662	241,812	262,137
Opencut mines ..	16,168	18,058	16,008	14,016	10,205
<b>AUSTRALIA</b>					
Semi-anthracite ..	57,196	54,066	50,095	58,579	70,012
Bituminous ..	18,615,606	18,576,508	20,640,884	21,991,221	22,012,145
Sub-bituminous ..	1,769,050	1,667,868	1,877,981	1,956,258	2,399,166
<b>Total</b> ..	<b>20,441,852</b>	<b>20,298,442</b>	<b>22,568,960</b>	<b>24,006,058</b>	<b>24,481,323</b>
Underground mines	18,376,516	18,593,068	20,407,944	21,160,884	22,702,198
Opencut mines ..	2,065,336	1,705,374	2,161,016	2,845,174	1,779,125

(a) Bituminous coal from underground mines. (b) Sub-bituminous coal from an opencut mine.  
(c) Sub-bituminous coal.

The principal producing centres during 1961 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 1961 were: northern field, 10,378,000 tons; southern field, 7,057,000 tons; and western field, 1,586,000 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 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, 1,666,243 tons; Mount Morgan, 325,111 tons; Bowen, 297,642 tons; and Clermont, 155,859 tons. Opencut methods were used on the Bowen, Clermont and Mount Morgan fields, and the total coal won by this means was 22 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 1961 was from this source.
- (vi) *Tasmania.* Most of the coal produced was won in the north-east of the State, the principal producing centres in 1961 being Fingal, 111,272 tons; St. Mary's, 91,046 tons; and Avoca, 44,182 tons.

5. **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 1957 to 1961. 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
<b>PRODUCTION PER MAN-SHIFT WORKED AT COAL FACE</b>						
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
1960 .. ..	20.64	2.16	8.37	8.12	7.64	16.08
1961 .. ..	24.61	2.15	8.69	8.09	8.77	19.04

**PRODUCTION PER MAN-SHIFT WORKED BY ALL EMPLOYEES**

Year	N.S.W.	Vic.	Q'land	W. Aust.	Tas.	Australia
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
1960 .. ..	5.39	0.94	3.19	3.62	3.87	4.81
1961 .. ..	6.23	0.83	3.46	4.00	4.09	5.55

(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. 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
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
1960 .. ..	22.15	10.96	12.46	8.01	9.38	13.79
1961 .. ..	22.29	11.43	14.91	9.63	10.79	14.60

6. **Mine Production of Brown Coal.**—Brown coal is mined only in Victoria, and production in recent years has been as follows:—1958, 11,643,629 tons; 1959, 13,034,605 tons; 1960, 14,967,202 tons; 1961, 16,279,168 tons; and 1962, 17,137,436 tons. In the past ten years, the output of brown coal has nearly doubled.

7. **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 salable coal for each district and for New South Wales as a whole are shown in the following table for the years 1957 to 1961. Salable 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, most 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 SALABLE COAL:  
NEW SOUTH WALES**

(s. d.)

Year	Northern District	Southern District	Western District	Average for State
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
1960.. ..	51 11	55 1	48 1	52 8
1961.. ..	51 5	55 11	46 9	52 3

8. **Values in New South Wales, United Kingdom and the United States of America.**—The following table shows for the years 1957 to 1961 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	1957	1958	1959	1960	1961
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
New South Wales—bituminous(a) ..	56 9	54 10	52 7	52 8	52 3
United Kingdom—deep-mined(b) ..	82 1	85 7	83 5½	86 1½	90 10½
United States of America— bituminous and lignite(c) ..	\$ 5.08	\$ 4.86	\$ 4.77	\$ 4.69	\$ 4.58

(a) Average selling value at the mine per ton of 2,240 lb.; the figures relate to salable 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.

9. **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 1957–58 to 1961–62.

**BLACK COAL: PRODUCTION AND CONSUMPTION**  
(<sup>'000</sup> Tons)

Particulars	1957-58	1958-59	1959-60	1960-61	1961-62
Production(a) .. ..	20,362	20,459	21,223	22,947	24,432
Imports .. ..	9	8	8	7	5
Total .. ..	20,371	20,467	21,231	22,954	24,437
Consumption as fuel—					
Electricity generation ..	6,941	7,131	7,398	7,420	7,869
Factories .. ..	2,991	3,122	3,166	3,103	2,844
Railway locomotives(b) ..	2,217	2,050	2,002	1,847	1,627
Bunker coal(c) .. ..	229	203	169	136	101
Total .. ..	12,378	12,506	12,735	12,506	12,441
Consumption as raw material—					
Gas works .. ..	1,779	1,761	1,744	1,726	1,634
Coke works .. ..	3,841	3,846	4,216	4,910	5,039
Total .. ..	5,620	5,607	5,960	6,636	6,673
Exports (oversea) .. ..	836	645	1,088	1,888	3,470
Mine washery refuse and dump losses(d) .. ..	496	660	982	1,072	1,341
Balance—unrecorded consumption, other purposes(e) ..	1,041	1,049	466	852	512
Grand Total .. ..	20,371	20,467	21,231	22,954	24,437

(a) Includes miners' and colliery coal. (b) Government railways only. (c) Figures refer only to New South Wales consumption by oversea, interstate and intrastate vessels. (d) Prior to 1959-60, figures refer only to New South Wales. Later figures include Tasmania. (e) 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 1961-62, exports of black coal were 3,469,552 tons and imports were 4,792 tons. These imports were of black coal only for special purposes.

(ii) *Brown Coal.* The table following shows the production and consumption of brown coal and the production of briquettes in Victoria for the years 1957-58 to 1961-62.

**BROWN COAL: PRODUCTION AND CONSUMPTION, VICTORIA**  
(<sup>'000</sup> Tons)

Particulars	1957-58	1958-59	1959-60	1960-61	1961-62
Production .. ..	10,866	12,243	14,101	15,723	16,729
Consumption as fuel—					
Electricity generation ..	7,830	9,289	10,498	9,970	10,981
Briquette factory .. ..					
Other factories .. ..					
Total .. ..	1,297	1,293	1,248	951	860
Consumption as raw material—					
Briquette manufacture ..	1,619	1,639	2,396	4,764	5,457
Balance(a) .. ..	+ 120	+ 22	- 41	+ 38	- 569
Briquettes manufactured ..	626	643	975	1,807	1,820

(a) The sign (+) indicates that the balance shown is available for other consumption and accumulation of stocks; the sign (-) indicates a reduction in stocks.

The State Electricity Commission of Victoria produces brown coal briquettes at Yallourn and Morwell, both situated on the brown coal deposits in Gippsland. The former commenced commercial production of briquettes in 1925, and initial output of the Morwell plant was in 1960. Output of briquettes (Yallourn and Morwell combined) was 1,806,619 tons in 1960-61, and 1,819,954 tons in 1961-62.

In December, 1956, the Lurgi high pressure brown coal gasification plant at Morwell was opened by the Gas and Fuel Corporation of Victoria. This plant operates on briquettes supplied by belt conveyor from the State Electricity Commission's Morwell works, and produces town gas which is sent to Melbourne through 103 miles of pipeline.

10. **Exports.**—The quantities and values of the overseas exports of Australian coal and of bunker coal for overseas vessels for the five years 1957-58 to 1961-62 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 overseas vessels	
	Quantity	Value	Quantity	Value
	Tons	£	Tons	£
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
1960-61 .. ..	1,888,415	7,682,223	179	1,716
1961-62 .. ..	3,469,552	13,611,122	37	410

(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 19,083,000 tons produced in 1961-62, 1,315,000 tons (6.9 per cent.) were exported interstate and 3,180,000 tons (16.7 per cent.) were exported overseas. The demand for bunker coal continues to decline, and in 1961-62 a total of 101,000 tons (0.5 per cent.) of New South Wales production was supplied for interstate, intrastate and overseas vessels.

11. **Production in Principal Countries.**—The following table shows the production of coal in the principal countries and estimated world totals in 1960 and 1961.

**COAL: PRODUCTION IN PRINCIPAL COUNTRIES**

(Source: Division of Minerals, United States Bureau of Mines.)

('000 Tons)

Country	Black Coal		Brown Coal and Lignite	
	1960	1961	1960	1961
China .. ..	(a) 413,000	(a) 375,000	(b)	(b)
United States of America ..	385,343	372,684	2,452	2,695
U.S.S.R. .. ..	369,012	370,968	136,077	127,435
United Kingdom .. ..	193,606	190,466	..	..
Germany, Federal Republic of ..	140,992	141,348	94,620	95,661
Poland .. ..	102,789	104,923	9,179	10,175
India .. ..	(a) 51,848	(a) 55,243	(b)	(b)
Japan .. ..	50,261	53,620	1,386	1,279
France .. ..	55,076	51,531	2,240	2,860
South Africa .. ..	37,571	38,940	..	..
Czechoslovakia .. ..	25,800	25,774	57,481	64,271
Australia .. ..	22,569	24,006	14,967	16,279
Belgium .. ..	22,111	21,198	..	..
Spain .. ..	13,566	13,558	1,734	2,055
Netherlands .. ..	12,301	12,421	4	..
Korea (North) .. ..	(a) 10,452	(a) 11,604	(b)	(b)
Canada .. ..	7,893	7,312	1,938	1,972
Turkey .. ..	6,207	6,281	3,357	3,713
Korea (South) .. ..	5,266	5,791	..	..
Formosa .. ..	3,899	4,170	..	..
Hungary .. ..	2,802	3,024	23,302	24,707
New Zealand(c) .. ..	2,852	2,768	160	157
Germany, Eastern .. ..	2,678	2,634	221,840	232,666
Colombia .. ..	2,559	2,461	..	..
<i>Estimated World Total ..</i>	<i>1,962,639</i>	<i>1,919,493</i>	<i>628,496</i>	<i>647,339</i>

(a) Includes lignite.  
Department Report, 1961.

(b) Included with black coal.

(c) Source: New Zealand Mines

12. **Coke and Other By-products from Coal.**—(i) *Coke.* The production of metallurgical coke in Australia during 1961–62 was 2,716,894 tons, compared with the record production of 2,738,505 tons during 1960–61.

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 1961–62 was 761,355 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 1957–58 to 1961–62. The figures exclude output of coke breeze, which amounted to 376,123 tons in 1960–61 and 456,719 tons in 1961–62.

### COKE PRODUCTION: AUSTRALIA

(Tons)

Industry			1957–58	1958–59	1959–60	1960–61	1961–62
Coke works	..	..	2,295,737	2,210,621	2,376,097	2,738,505	2,716,894
Gas works	..	..	831,615	815,464	758,668	764,626	761,355
Total	..	..	3,127,352	3,026,085	3,134,765	3,503,131	3,478,249

(ii) *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 1961–62 (1960–61 in parentheses) were: crude tar, 56,883,264 gallons (57,132,117 gallons); refined tar, 24,070,783 gallons (29,672,825 gallons); and ammonium sulphate, 105,754 tons (98,988 tons).

## § 13. Oil Exploration in Australia

1. **Introduction.**—A comprehensive survey of developments in the search for oil was presented on pages 1094–8 of Year Book No. 48. A summary of later developments is given below.

2. **Developments in 1962.**—The effort in the search for oil increased considerably during 1962, following the success obtained at the Moonie field in southern Queensland. The greatest concentration of effort in 1962 was in Queensland. The development of the Moonie field continued, and of the ten wells drilled to the end of 1962, nine were productive: in one well the sand was found to contain water. The field has proven to cover an area of at least eight square miles. In December, 1962, an encouraging show of oil was found in Sunnybank No. 1, which is about 90 miles northwest of Moonie. However, later testing of this well did not match early production rates. The same company also found gas at a depth of over 12,300 feet in Westgrove No. 3, about 100 miles north of Roma.

Although attention during 1962 has been focussed on Queensland, encouraging signs of oil and/or gas were also found near Grafton (Clifden No. 3) in New South Wales, and at North Seaspray No. 1 near Bairnsdale in south-east Victoria. Drilling in the Perth Basin of Western Australia has also yielded encouraging results.

During the year, a contract was let for the construction of a 10-inch pipe line from the Moonie field to Brisbane, a distance of nearly 200 miles. The cost of the line was estimated at about £5 million, and it is envisaged that the line will be in use by the end of 1963. The line will be a common carrier and oil from any other area can be fed into it.

During 1962, expenditure by private enterprise was of the order of £13.5 million, excluding Commonwealth subsidies totalling £2,965,400 paid under the *Petroleum Search Subsidy Acts*. In addition, £1,013,200 was spent by the Bureau of Mineral Resources on regional geological and geophysical surveys. The total expenditure to date by both government and private enterprise is of the order of £100 million. Further information regarding Government assistance in the search for oil is given in para. 3 (i) (d) on page 1142.

3. **Footage Drilled in the Search for Oil.**—The following table shows details of footage drilled in the search for oil in Australia, Papua and New Guinea during the years 1958 to 1962.

#### FOOTAGE DRILLED IN THE SEARCH FOR OIL

(Source: Bureau of Mineral Resources(a) )

(Feet)

State or Territory	1958	1959	1960	1961	1962
New South Wales .. ..	16,357	17,422	6,169	7,779	34,031
Victoria .. ..	2,439	8,395	14,682	22,439	42,635
Queensland .. ..	5,081	30,328	54,841	74,931	237,380
South Australia .. ..	6,239	12,637	..	8,945	40,836
Western Australia .. ..	30,383	36,020	17,193	13,712	38,400
Northern Territory .. ..	..	2,458	1,373	1,024	9,347
<b>Australia .. ..</b>	<b>60,499</b>	<b>107,260</b>	<b>94,258</b>	<b>128,830</b>	<b>402,629</b>
<b>Papua and New Guinea ..</b>	<b>29,350</b>	<b>13,389</b>	<b>10,042</b>	<b>..</b>	<b>5,947</b>

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

### § 14. Sulphur

1. **Mine Production.**—There is no production of elemental sulphur (brimstone) in Australia. However, while sulphur is itself non-metallic, considerable quantities are contained in certain metallic minerals produced. 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 1961 from which sulphur was subsequently recovered.

#### SULPHUR: CONTENT OF METALLIC MINERALS PRODUCED, 1961

(Tons)

Mineral in which contained	N.S.W.	Q'land	S. Aust.	W. Aust.	Tas.	Australia
Lead concentrate..	42,667	..	..	(a) 84	2,531	45,282
Lead-copper concentrate ..	..	..	..	..	2,135	2,135
Pyrite concentrate	14,949	4,829	(a) 33,357	23,962	25,053	102,150
Zinc concentrate ..	137,043	(a) 15,686	..	..	22,570	175,299
<b>Total ..</b>	<b>194,659</b>	<b>(b) 20,515</b>	<b>(a) 33,357</b>	<b>24,046</b>	<b>52,289</b>	<b>324,866</b>

(a) Estimated.

(b) Partly estimated.



The principal producing centres during 1961 were as follows.

(i) *New South Wales.* All the sulphur produced 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.* Sulphur was contained in zinc concentrate milled at Mount Isa and in pyrite concentrate produced at Mount Morgan. Zinc concentrate produced at Mount Isa was exported.

(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.

(v) *Tasmania.* A pyrite concentrate was recovered at Mount Lyell after the separation of the copper sulphide mineral. Recoverable sulphur was contained also 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 1957 to 1961 the sulphur content of minerals from which sulphur was recovered.

#### SULPHUR: CONTENT OF METALLIC MINERALS PRODUCED

(Tons)

State	1957	1958	1959	1960	1961
New South Wales .. ..	207,604	197,736	188,892	204,358	194,659
Queensland(a) .. ..	24,544	14,647	17,464	24,612	20,515
South Australia(b) .. ..	32,721	32,129	27,616	31,717	33,357
Western Australia .. ..	25,420	22,635	24,473	24,556	24,046
Tasmania .. ..	52,185	55,472	52,100	54,757	52,289
<b>Australia .. ..</b>	<b>342,474</b>	<b>322,619</b>	<b>310,545</b>	<b>340,000</b>	<b>324,866</b>

(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 concentrate is used at Risdon. In June, 1961, acid production from lead-zinc sinter gases commenced at Cockle Creek, near Newcastle, New South Wales. Pyrite concentrate is used as a source of sulphur for acid manufacture at Cockle Creek and at Port Kembla in New South Wales, and at Melbourne, Brisbane, Adelaide, Perth and Fremantle. However, about half the sulphuric acid produced in Australia is made from imported elemental sulphur. The next table shows, for the years 1958 to 1962, 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	1958	1959	1960	1961	1962
Production of sulphuric acid (mono) .. .. .	1,009,064	1,000,458	1,109,751	1,137,501	1,229,256
Sulphur in sulphuric acid (mono) produced from—					
Sulphur (elemental)(a) ..	162,881	153,195	179,752	182,554	202,659
Zinc concentrate ..	38,524	39,933	42,946	52,423	65,342
Lead concentrate ..	21,339	19,619	21,573	22,440	20,247
Pyrite ..	99,216	103,596	104,406	100,520	97,927
Spent oxide ..	4,301	3,655	3,814	2,277	2,381
Other materials ..	3,702	7,151	10,396	11,749	13,410
<b>Total Sulphur Content</b>	<b>329,963</b>	<b>327,149</b>	<b>362,887</b>	<b>371,963</b>	<b>401,966</b>

(a) All imported.

## § 15. Non-metallic Minerals

1. **Asbestos.**—Production of asbestos has been confined mainly to crocidolite in Western Australia, principally at Wittenoom Gorge in the north-western part of the State. The only deposits of chrysotile, located mainly at Nunyerry in Western Australia and at Baryulgil in New South Wales, are relatively small and widely scattered.

The production of chrysotile and crocidolite in Australia during the five years 1957 to 1961 is shown in the following table.

## PRODUCTION OF ASBESTOS

(Short tons of 2,000 lb.)

Year	Chrysotile			Crocidolite
	New South Wales	Western Australia	Australia	Australia(a)
1957 .. .. .	676	1,556	2,232	12,438
1958 .. .. .	712	1,543	2,255	13,313
1959 .. .. .	726	707	1,433	16,442
1960 .. .. .	1,072	69	1,141	14,472
1961 .. .. .	794	175	969	15,777

(a) Produced in Western Australia.

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 1961.

### PRODUCTION OF CLAYS, 1961 (Tons)

Type	New South Wales	Victoria	Queensland	South Australia	Western Australia	Tasmania	Australia
Bentonite and bentonitic clay ..			307		587		894
Brick clay and shale ..	2,005,679	1,089,000	299,594	311,257	484,996	153,156	4,343,682
Cement clay and shale ..	158,527	(b)	(b)	11,651	17,864	(b)	(c) 188,042
Damouritic clay ..				508			508
Fireclay, n.e.i. ..	113,055	25,584	11,587	25,576	26,384		202,186
Fuller's earth ..	151				41		192
Kaolin ..	37,866	9,016	60	2,142	772	1,232	51,088
Stoneware clay ..	107,614		2,135	46,829			156,578
Tile clay ..	144,555	(b)	(b)	(b)	(b)	6,075	(c) 150,630
Other clays ..	5,169	(a) 142,083	(b)	(b)	(b)	14,553	(c) 161,805

(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 1961 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. Substantial quantities of gypsum are also exported to Malaya and the Philippines.

The production of gypsum in Australia is set out in the following table for the five years 1957 to 1961.

### PRODUCTION OF GYPSUM (Tons)

Year	New South Wales	Victoria	South Australia	Western Australia	Australia
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
1960 .. ..	95,514	100,386	340,762	44,216	580,878
1961 .. ..	97,250	80,223	387,289	45,145	609,907

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 are shown in the following table. Details of limestone produced for use as building or road material are not included.

### PRODUCTION OF LIMESTONE(a) (\*000 Tons)

Year	N.S.W.	Vic.	Q'land	S.A.	W.A.	Tas.	Aust.
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
1960 .. ..	2,400	1,157	(b)	1,064	(b)	215	5,669
1961 .. ..	2,576	1,243	(b)	1,105	(b)	204	6,146

(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, Thuddungra and Lake Cargelligo in central New South Wales, and at Ravensthorpe in Western Australia. Production at Ravensthorpe is expected to increase substantially in the near future. 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 1957 to 1961 are set out in the table below.

#### PRODUCTION OF MAGNESITE

(Tons)

Year				New South Wales	Queensland	South Australia	Western Australia	Australia
1957	..	..	..	83,271	..	202	..	83,473
1958	..	..	..	69,030	20	341	..	69,391
1959	..	..	..	59,777	..	790	19	60,586
1960	..	..	..	61,668	..	498	..	62,166
1961	..	..	..	88,511	..	659	9,625	98,795

6. **Mica.**—Production during 1961 was confined to the Northern Territory, where 185,920 tons of crude and film mica were produced during the year. Mining in the Northern Territory came to a standstill in 1962, and the Commonwealth Mica Pool has ceased operations.

The following table shows the quantity of muscovite mica produced in Australia during the five years 1957 to 1961.

#### MUSCOVITE MICA PRODUCTION

(lb.)

Particulars				1957	1958	1959	1960	1961
New South Wales—								
Scrap	..	..	..	..	15,680	7,000	..	..
Queensland—								
Scrap	..	..	..	..	21,728	..	..	..
Northern Territory—								
Trimmed	..	..	..	36,713	42,479	44,665	9,500	..
Crude and film	..	..	..	..	35,840	170,000	649,600	185,920
Scrap	..	..	..	40,600	..	..	..	..

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 1957 to 1961. Estimates of total Australian production are also shown.

#### SALT PRODUCTION

('000 Tons)

Particulars				1957	1958	1959	1960	1961
South Australia				339	336	358	359	387
Estimated Australian total				428	430	468	463	509

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 Oraparinna in the North Flinders Range in South Australia. The production of barite in Australia during 1961 was 19,217 tons, of which 19,157 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 1961, 5,417 tons were produced, of which New South Wales produced 4,331 tons, mainly at Coonabarabran and Barraba. The remaining 1,086 tons were produced in Queensland (579 tons) and Victoria (507 tons).

(iv) *Dolomite.* In 1961, South Australia continued to supply the bulk of the requirements of the iron and steel industry from quarries at Ardrossan. During the year, production in the various States was South Australia, 183,214 tons; New South Wales, 4,796 tons; Queensland, 2,132 tons; Tasmania, 1,108 tons; and Western Australia, 374 tons; making an Australian total of 191,624 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 5,378 tons of the Australian total of 8,209 tons in 1961. Of the remainder, 1,641 tons came from South Australia and 1,190 tons from Western 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 £765,000 in 1961. Other production in 1961 was from Lightning Ridge in New South Wales, valued at £65,000.

(b) *Sapphires.* In 1961, sapphires produced in the Inverell District of New South Wales were valued at £3,000 and production from the Anakie field in Central Queensland was valued at £5,000.

(vii) *Phosphate Rock.* During 1961, 4,874 tons of phosphate rock were produced, of which 4,759 tons came from South Australia and the remaining 115 tons from Western Australia. In the course of a search for deposits of uranium ore near Rum Jungle in 1961, the Bureau of Mineral Resources discovered phosphate rock deposits in the area. A programme was conducted in 1962 to make a preliminary assessment of the extent and grade of the new deposits.

(viii) *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 150,891 tons in New South Wales; 29,226 tons in Queensland; 22,769 tons in South Australia; 8,274 tons in Western Australia; and 1,415 tons in Tasmania; making a total of 212,575 tons recorded for those States during 1961.

(ix) *Sillimanite.* In 1961, 1,787 tons of sillimanite were produced in Australia, 1,533 tons of which came from South Australia and 254 tons from New South Wales.

(x) *Talc.* The Australian output of talc (including steatite) was 13,545 tons in 1961, South Australia produced 7,571 tons, Western Australia 5,149 tons, and New South Wales 825 tons.

(xi) *Other.* Other non-metallic minerals produced in Australia in small quantities during 1961 were fluorspar, garnet concentrate, foundry loam, lithium ores, mineral pigments, pebbles for grinding, perlite, pyrophyllite, rhodonite and serpentine.

## § 16. Value of Production

1. **Local Value of Mining and Quarrying Production, 1961.**—The following table shows particulars of the local value of production for individual mining industry groups and quarrying for the year 1961. It should be stressed 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), pages 1144–5. A more detailed reference to the value of production of mining and quarrying and other industries together with a brief explanation of terms used will be found in Chapter XXIX. Miscellaneous.

## MINING AND QUARRYING: LOCAL VALUE OF PRODUCTION(a), 1961

(£'000)

Industry	N.S.W.	Vic.	Q land	S.A.	W.A.	Tas.	N.T.	A.C.T.	Aust.
<b>Metal mining—</b>									
Gold mining ..	12	470	(b)	1	14,311	(b)	917	..	15,952
Lead-silver-zinc mining ..	17,706	..	(b)	1	24	(b)	1	..	35,633
Copper-gold mining ..	19	2	(b)	1	458	(b)	2,041	..	8,051
Tin mining ..	170	..	1,370	..	233	1,163	4	..	2,940
Mineral sands mining ..	2,933	..	1,588	..	644	..	..	..	5,165
Other metal mining ..	95	19	(b)	5,177	2,122	(b)	12	..	8,348
<b>Total, Metal Mining</b>	<b>20,935</b>	<b>491</b>	<b>22,207</b>	<b>5,180</b>	<b>17,792</b>	<b>6,509</b>	<b>2,975</b>	<b>..</b>	<b>76,089</b>
<b>Fuel mining—</b>									
Black coal mining ..	45,112	359	8,008	1,338	1,680	584	..	..	57,081
Brown coal mining ..	..	7,722	..	..	..	..	..	..	7,722
<b>Total, Fuel Mining ..</b>	<b>45,112</b>	<b>8,081</b>	<b>8,008</b>	<b>1,338</b>	<b>1,680</b>	<b>584</b>	<b>..</b>	<b>..</b>	<b>64,803</b>
<b>Non-metal (excluding fuel) mining—</b>									
Clays(c) ..	1,098	993	107	283	157	49	..	..	2,687
Gypsum ..	199	80	..	457	30	..	..	..	766
Limestone ..	1,296	594	(b)	756	(b)	212	(d)	..	3,609
Salt(c) ..	..	(b)	(b)	775	(b)	..	11	..	999
Other non-metal (excluding fuel) mining ..	765	(b)	(b)	1,110	1,487	5	1	..	3,433
<b>Total, Non-metal (excluding Fuel) Mining</b>	<b>3,358</b>	<b>1,794</b>	<b>866</b>	<b>3,381</b>	<b>1,817</b>	<b>266</b>	<b>12</b>	<b>..</b>	<b>11,494</b>
<b>Total, All Mining ..</b>	<b>69,405</b>	<b>10,366</b>	<b>31,081</b>	<b>9,899</b>	<b>21,289</b>	<b>7,359</b>	<b>2,987</b>	<b>..</b>	<b>152,386</b>
<b>Construction material quarrying(c) ..</b>	<b>8,766</b>	<b>10,888</b>	<b>1,139</b>	<b>6,013</b>	<b>1,207</b>	<b>600</b> (e)	<b>379</b>	<b>(f)</b>	<b>28,992</b>
<b>Total, All Mining and Quarrying ..</b>	<b>78,171</b>	<b>21,254</b>	<b>32,220</b>	<b>15,912</b>	<b>22,496</b>	<b>7,959</b> (e)	<b>3,366</b>	<b>(f)</b>	<b>181,378</b>

(a) Value of output or selling value of products at the mine or quarry. (b) Not available for publication. (c) Incomplete. (d) Less than £500. (e) Includes Australian Capital Territory. (f) Not available for publication; included with Northern Territory.

2. Local Values, 1957 to 1961.—In the following table, the local value of mining and quarrying production is shown by States and Territories.

## MINING AND QUARRYING: LOCAL VALUE OF PRODUCTION(a)

(£'000)

Year	N.S.W.	Vic.	Q'land	S. Aust.	W. Aust.	Tas.	N.T.(b)	Aust.
1957 ..	83,170	12,728	25,576	11,872	20,979	8,421	2,365	165,111
1958 ..	71,414	13,694	27,632	12,308	20,777	7,358	2,772	155,955
1959 ..	71,090	14,935	33,329	13,209	21,787	7,639	2,996	164,985
1960 ..	79,641	16,267	37,608	13,952	22,166	8,067	3,539	181,240
1961 ..	78,171	c 21,254	32,220	15,912	22,496	7,959	3,366	181,378

(a) Value of output or selling value of products at the mine or quarry. (b) Includes Australian Capital Territory. (c) Not strictly comparable with previous years owing to extension of coverage of quarrying activities.

3. Net Value of Mining and Quarrying Production.—The following table shows particulars of net value of production for individual mining industry groups and construction material quarrying for the year 1961.

## MINING AND QUARRYING: NET VALUE OF PRODUCTION(a), 1961

(£'000)

Industry	N.S.W.	Vic.	Q'land	S.A.	W.A.	Tas.	N.T.	A.C.T.	Aust.
Metal mining—									
Gold mining ..	11	304	(b)	(b)	9,662	(b)	808	..	10,973
Lead-silver-zinc mining ..	12,337	..	(b)	(b)	9	(b)	(c) 1	..	d 25,330
Copper-gold mining ..	(e) -89	1	(b)	(b)	237	(b)	1,698	..	4,548
Tin mining ..	148	..	(b)	..	153	(b)	1	..	2,339
Mineral sands mining ..	2,028	..	(b)	..	(b)	..	..	..	3,368
Other metal mining ..	82	18	(b)	(b)	1,701	(b)	(c) 12	..	(d) 7,090
<i>Total, Metal Mining</i>	<i>14,517</i>	<i>323</i>	<i>15,403</i>	<i>(b)</i>	<i>(b)</i>	<i>4,104</i>	<i>2,520</i>	<i>..</i>	<i>53,648</i>
Fuel mining—									
Black coal mining ..	34,784	241	6,704	(b)	(b)	464	..	..	44,672
Brown coal mining ..	..	7,100	..	..	..	..	..	..	7,100
<i>Total, Fuel Mining ..</i>	<i>34,784</i>	<i>7,341</i>	<i>6,704</i>	<i>(b)</i>	<i>(b)</i>	<i>464</i>	<i>..</i>	<i>..</i>	<i>51,772</i>
Non-metal (excluding fuel) mining—									
Clays(f) ..	885	936	(c) 107	251	110	42	..	..	(d) 2,331
Gypsum ..	163	61	(b)	(b)	(b)	..	..	..	614
Limestone ..	940	367	(b)	622	(b)	(b)	(g)	..	2,531
Salt(f) ..	..	(b)	(b)	(b)	(b)	..	(c) 11	..	(d) 849
Other non-metal (excluding fuel) mining ..	629	(b)	(b)	1,063	(b)	(b)	(c) 1	..	2,661
<i>Total, Non-metal (excluding Fuel) Mining ..</i>	<i>2,617</i>	<i>1,491</i>	<i>591</i>	<i>2,948</i>	<i>1,155</i>	<i>172</i>	<i>12</i>	<i>..</i>	<i>8,986</i>
<i>Total, All Mining ..</i>	<i>51,918</i>	<i>9,155</i>	<i>22,698</i>	<i>8,669</i>	<i>14,694</i>	<i>4,740</i>	<i>2,532</i>	<i>..</i>	<i>114,406</i>
Construction material quarrying(f) ..	(r) 8,766	8,131	736	4,434	859	463	(h) 257	(i)	d 23,646
<i>Total, All Mining and Quarrying ..</i>	<i>60,684</i>	<i>17,286</i>	<i>23,434</i>	<i>13,103</i>	<i>15,553</i>	<i>5,203</i>	<i>(h) 2,789</i>	<i>(i)</i>	<i>138,052</i>

(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) Not available for publication. (c) No allowance has been made for costs of power, fuel, light and other materials and stores used, particulars of which are not available. (d) See footnote (c). (e) Cost of materials used, etc., exceeded value of output. (f) Incomplete. (g) Less than £500.

(h) Includes Australian Capital Territory. (i) Not available for publication; included with Northern Territory.

4. Net Value of Production, 1957 to 1961.—In the following table, the net value of mining and quarrying production and the value per head of population are shown by States and Territories.

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

Year	N.S.W.	Vic.	Q'land	S.A.	W.A.	Tas.	N.T. and A.C.T.	Aust.
NET VALUE OF PRODUCTION(a) (£'000)								
1957 ..	66,091	9,944	18,810	9,320	14,889	5,897	1,851	126,802
1958 ..	55,801	10,987	19,796	9,999	14,454	5,168	2,131	118,336
1959 ..	56,331	12,101	24,481	10,698	14,765	5,398	2,381	126,155
1960 ..	63,214	13,158	27,460	11,404	15,444	5,476	2,871	139,027
1961 ..	60,684	(b)17,286	23,434	13,103	15,553	5,203	2,789	138,052

NET VALUE OF PRODUCTION(a) PER HEAD OF POPULATION  
(£)

1957 ..	18.2	3.7	13.2	10.5	21.5	17.8	30.6	13.0
1958 ..	15.0	4.0	13.6	11.0	20.5	15.3	32.3	11.9
1959 ..	14.8	4.3	16.6	11.5	20.6	15.7	31.9	12.4
1960 ..	16.3	4.5	18.3	11.9	21.2	15.6	35.5	13.4
1961 ..	15.4	(b) 5.9	15.4	13.4	20.9	14.6	31.4	13.0

(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. (b) Not strictly comparable with previous years owing to extension of coverage of quarrying activities.

5. Local Value of Minerals Produced, 1957 to 1961.—Particulars of the estimated values of minerals (mine and quarry products) produced 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	1957	1958	1959	1960	1961
METALLIC MINERALS					
Copper ore, concentrate, etc.(a) ..	12,345	14,770	21,165	25,439	21,249
Gold ore, concentrate, other forms, etc. ..	16,090	16,251	15,853	15,870	15,859
Iron ore ..	(b) 4,295	(b) 4,393	4,633	4,844	5,899
Lead and lead-silver ore and concentrate, lead-copper concentrate, etc.(a) ..	28,810	22,493	21,477	20,396	16,933
Manganese ore ..	589	460	626	329	427
Pyritic concentrate ..	1,166	1,112	1,068	1,136	1,252
Rutile concentrate ..	8,577	4,524	3,838	3,639	3,314
Tin concentrate ..	1,612	1,739	2,043	1,940	2,786
Tungsten concentrates ..	2,167	871	410	940	1,033
Zinc ore and concentrate ..	3,655	2,565	4,888	7,730	5,295
Zircon concentrate ..	854	487	1,008	972	1,267
Other metallic minerals ..	602	525	512	575	769
<i>Total, Metallic Minerals</i> ..	<i>80,762</i>	<i>70,190</i>	<i>77,521</i>	<i>83,810</i>	<i>76,083</i>
FUEL MINERALS					
Coal, black ..	52,279	51,658	49,211	55,201	57,081
Coal, brown ..	5,228	5,418	6,123	6,845	7,722
<i>Total, Fuel Minerals</i> ..	<i>57,507</i>	<i>57,076</i>	<i>55,334</i>	<i>62,046</i>	<i>64,803</i>
NON-METALLIC (EXCLUDING FUEL) MINERALS					
<i>Total, Non-metallic (excluding Fuel) Minerals</i> ..	<i>(c) 9,002</i>	<i>(c) 10,192</i>	<i>(c) 10,533</i>	<i>10,843</i>	<i>11,494</i>

NOTE.—See next page for footnotes.



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

Mineral	1957	1958	1959	1960	1961
<b>CONSTRUCTION MATERIALS(d)</b>					
Total, Construction Materials .. ..	17,840	18,497	21,597	24,541	(e) 28,998
<b>TOTAL</b>					
Total, All Minerals and Construction Materials(d) .. ..	165,111	155,955	164,985	181,240	181,378

(a) In 1957, 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.  
 (e) Not strictly comparable with previous years, owing to extension of coverage in Victoria.

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

Owing to the necessity of classifying individual mines according to the principal mineral produced, the values in the tables on pages 1192 and for mining industry groups differ slightly in some cases from totals of the corresponding groups of mine products shown in the table above.

## § 17. Oversea Trade in Minerals and Mineral Products

Particulars of the quantity and value (£A. f.o.b. port of shipment) of the principal mineral and mineral product items imported into and exported from Australia during the years 1959 to 1961 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.)		
		1959	1960	1961	1959	1960	1961
IMPORTS							
Aluminium, refined—							
Ingots .. ..	ton	19,268	26,432	16,141	3,883	6,448	3,883
Plates, sheets and strips .. ..	"	2,555	5,770	1,953	1,068	2,432	802
Foil .. ..	"	2,788	3,909	2,002	1,803	2,560	1,343
Asbestos .. ..	short ton	38,330	41,002	36,901	2,502	2,508	2,310
Gold, unrefined bullion(a) .. ..	fine oz.	136,674	144,029	146,420	2,136	2,238	2,283
Iron and steel—							
Iron ore .. ..	ton	261,904	278,502	270,422	303	310	321
Ferro-alloys .. ..	"	23,989	41,612	54,369	1,859	3,391	4,018
Tinplate .. ..	"	50,348	63,741	38,355	4,774	6,039	3,661
Petroleum oils—							
Crude .. ..	'000 gals.	2,603,377	2,705,989	2,833,256	69,347	67,743	66,630
Enriched crude .. ..	"	35,559	237,336	404,863	802	6,923	11,831
Kerosenes .. ..	"	109,649	102,965	111,199	6,002	5,368	5,688
Lubricating oil .. ..	"	49,619	49,837	55,866	6,582	6,809	7,337
Gasolenes and solvents .. ..	"	243,910	238,208	191,728	13,228	13,247	10,353
Phosphate rock .. ..	'000 tons	1,327	1,491	1,766	3,689	4,075	4,768
Sulphur .. ..	ton	170,770	221,778	182,052	1,855	2,285	1,920
Titanium oxide (pigments) .. ..	"	5,472	5,054	5,139	1,016	971	1,017

NOTE.—See next page for footnotes.

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

Item	Unit of quantity	Quantity			Value (£A.'000 f.o.b.)		
		1959	1960	1961	1959	1960	1961
EXPORTS(b)							
Asbestos .. ..	short ton	12,974	8,299	8,060	1,225	784	800
Coal .. ..	ton	794,190	1,577,140	2,850,307	3,178	6,327	11,505
Copper, blister .. ..	"	16,225	502	1,022	4,375	162	395
Gold, refined .. ..	fine oz.	128,052	2,513,583	1,099,701	2,007	39,275	17,265
Iron and steel—							
Iron ore .. ..	ton	293	10	43	1	(c)	(c)
Pig iron .. ..	"	44,038	99,847	296,050	963	2,199	6,588
Ingots, blooms and slabs ..	"	12,061	9,619	86,860	397	380	3,102
Tinplate .. ..	"	1,671	8,080	16,644	134	699	1,338
Scrap .. ..	"	182,985	205,747	223,320	3,404	3,431	3,957
Lead—							
Ore and concentrate(d) ..	"	90,797	74,696	86,268	5,034	4,172	4,590
Lead-silver bullion .. ..	"	53,021	49,653	46,089	5,498	5,268	4,476
Pig .. ..	"	138,448	125,265	145,174	12,025	10,970	11,382
Petroleum oils—							
Gasolenes and solvents ..	'000 gals.	32,682	37,312	63,233	2,140	2,586	3,639
Automotive distillate ..	"	93,008	179,490	140,331	5,305	10,232	6,855
Residuals and heavy distil- lates .. ..	"	146,869	175,330	238,318	6,484	7,346	8,096
Rutile concentrate .. ..	ton	80,938	93,706	99,652	3,609	4,064	3,207
Silver, refined .. ..	'000 fine oz.	3,001	2,800	1,055	1,224	1,150	437
Zinc—							
Ore and concentrate ..	ton	193,254	321,930	276,109	2,472	5,395	5,056
Refinery type shapes ..	"	41,606	27,443	46,472	3,962	3,066	4,482

(a) Includes gold contained in matte. (b) Includes re-exports. (c) Less than £500.  
(d) 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 1961 and their principal metallic content as estimated by assay.

**PRINCIPAL METALLIC CONTENTS OF SPECIFIED ORES AND CONCENTRATES,  
ETC., EXPORTED FROM AUSTRALIA DURING 1961**

Ores and concentrates, etc.	Quantity exported	Metallic contents—estimated from assay						
		Copper	Gold	Lead	Silver	Tin	Tungstic oxide	Zinc
	tons	tons	fine oz.	tons	fine oz.	tons	tons	tons
Copper—								
Ore and concentrate ..	107,234	26,342	16,923	..	395,458	1	..	..
Copper-lead dross and speiss ..	3,286	495	..	2,286	180,785	..	..	..
Other slags and residues ..	671	150	..	..	..	..	..	..
Blister .. ..	1,022	1,014	3,415	..	7,280	..	..	..
Lead—								
Ore and concentrate(a) ..	86,268	955	19,489	56,764	2,197,118	..	..	6,593
Slags and residues ..	1,575	22	8	699	2,368	33	..	83
Lead-silver bullion ..	46,089	3	..	45,767	3,593,740	..	..	..
Tungsten—								
Scheelite ore and concentrate ..	940	..	..	..	..	..	701	..
Wolfram ore and concentrate ..	1,046	..	..	..	..	..	761	..
Zinc—								
Ore and concentrate ..	276,109	..	..	2,064	83,655	..	..	143,437
Slags and residues ..	7,782	44	..	..	..	..	..	5,176
<b>Total Metallic Contents ..</b>	<b>..</b>	<b>29,025</b>	<b>39,835</b>	<b>107,580</b>	<b>6,460,404</b>	<b>34</b>	<b>1,462</b>	<b>155,289</b>

(a) Includes lead-copper concentrate.