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THE AUSTRALIAN MINERAL INDUSTRY

VOL. 15, No. 2

PART I — QUARTERLY REVIEW

DECEMBER 1962

Prepared in the MINERAL ECONOMICS SECTION

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Issued under the authority of
SENATOR the Hon. W. H. SPOONER, M.M.
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AUSTRALIAN MINERAL INDUSTRY

QUARTERLY REVIEW

DECEMBER 1962

SOME NOTES ON THE IMPORTANCE OF UNDERGROUND WATER

By J. F. Ivanac

Introduction

Water is one of the most widespread mineral constituents of the earth's crust and occurs in nature in the solid, liquid, and gaseous states. Because of its widespread distribution it has come to be regarded with familiarity—something that is obtained whenever a tap is turned on.

In recent years this attitude has changed, and in Australia there is a growing awareness of the importance of water because of the demands made by an expanding population for an increasing standard of living and the subsequent need to develop the low rainfall regions. An increasing population leads to greater industrial development with greater calls on water resources. Even in the more highly industrialised countries the problem of providing adequate water is becoming increasingly difficult.

The Australian Academy of Science, in stressing the importance of underground waters has noted that considerable exploitation of our water resources has taken place with little detailed study of the factors which control the movement and accumulation of these waters. It also noted that expansion of pastoral and agricultural industries, mineral prospecting and development, will ultimately depend upon conserving known water supplies and finding new ones.

The basic need in Australia is to determine the resources of usable water both underground and surface and when this has been done how they might best be developed and if necessary supplemented by desalinated supplies.

This paper draws attention to some of the needs before an assessment can be completed, comments on the interest of the States and the Commonwealth which has led to the formation of a Water Resources Council and notes some of the problems being considered and analysed at present. It will be seen that water supplies, both surface and underground, are of prime importance to Australia's future, and that the Commonwealth and States are working together to avoid duplication of effort and to ensure that the correct order of priority to development is given and maintained.

The Problems Stated. The water resources of Australia, surface and underground, have been assessed only in part and in many respects is is doubtful whether the assessment is adequate even in the qualitative sense.

With regard to surface supplies, river gaugings "have been recorded over considerable periods in some parts of Australia, in others records are intermittent, of short duration or non existent" (1960 Year Book). Thus it is impossible to estimate the total average annual flow of Australian streams and until this is known the volume of water which could be conserved must be guessed.

In the field of underground water a large amount of information has been accumulated but there is little factual data on available water resources — basically there is a need to know the rate at which water can be taken from the ground without diminishing the supply — in other words what is the safe yield?

Conversion of saline waters to fresh waters is being studied and several processes have been devised. The problem in desalination to be overcome is reduction of the high cost.

Assessment of Water Resources

The water resources of a country should be assessed under three headings, surface, underground and ocean supplies.

(a) Surface supplies are those obtained by harnessing the flow of rivers or flood run-off; run-off should be adequate and suitable sites for storage should be available within economic range of the place in which the supply is needed.

(b) Underground supplies are those won from artesian and non-artesian supplies including brackish water which may be used when treated. Artesian supplies may be divided, in addition to waters of suitable and unsuitable quality, into underground water basins. Non Artesian or non-pressure supplies may be divided, in addition to waters of suitable and unsuitable quality, on the basis of water provinces. Water provinces are defined as broad units based on the regional geology, geomorphology or any convenient and practical division.

(c) Ocean supplies include supplies within economic distance of the sea and are obtained by desalination of sea water and are feasible only when the requirement is within economic distance of the sea.

Notes on Geography

Australia is the world's driest landmass, the average rainfall being 16.5 inches per annum compared with 26 inches for all land areas in the world and 29 inches for the United States. Approximately 2/5ths of the Australian continent receives on the average less than 10 inches per annum. The average annual volume of run-off for the continent has been estimated at 200 million acre-feet representing an average depth of 1 1/3 inches compared with 9¾ inches for all land surfaces of the world.

Over much of the continent low rainfall and huge evaporation losses limit the flow of surface water in many areas to periods during and immediately after the wet season; it may be said that in catchment areas where rainfall is less than 20 to 25 inches annually there are no permanent streams and water supplies are seasonal, i.e., 2,034,614 square miles out of a total area of 2,974,581 square miles contain no permanent streams.

The Lake Eyre Basin covering an area of 500,000 square miles ranks as one of the world's major basins of internal drainage. The rivers of this system are dry for most of the year and rise in areas of low erratic rainfall, averaging 10 to 15 inches per annum, and are directed towards the most arid portion of the continent where the rainfall is less than 7 inches and potential evaporation more than 100 inches. Approximately one-third of the continent has uncoordinated drainage, an example being the Nullarbor Plain.

Underground Water

Underground water refers to all waters obtained from beneath the surface of the earth and can be divided into three categories, pressure and non-pressure water and soil moisture.

Pressure water is a term applied to artesian and sub-artesian water. In the former case water rises to the surface or flows when penetrated by a bore; in the latter case water rises part of the way up the bore or well and has to be pumped to the surface.

Non-pressure water does not rise in a bore or well when an aquifer is penetrated but flows into the bore and has to be pumped to the surface.

Although considerable use is made of underground water in Australia little is known of the actual resources of water available for development. Some systematic work has been done by various State and Commonwealth Authorities but as yet no figure has been obtained.

Artesian Water. Artesian basins in Australia occupy over half of the land surface area of Australia and yield substantial quantities of artesian and sub-artesian waters of variable quality. They coincide with and derive their names from sedimentary basins.

The principal water-bearing basins are as follows:

Name	State	Geological Age of Chief Aquifers	Approximate Area (sq. miles)	Depth to Pressure Water (feet)
Great Artesian	Queensland New South Wales South Australia Northern Territory	Mesozoic	678,000	Up to 7,000
Canning & Fitzroy	Western Australia	Mesozoic-Palaeozoic	160,000	100 to 1,500
Murray	Victoria New South Wales South Australia	Miocene-Eocene	107,250	100 to 900
Eucla	Western Australia	Pliocene-Eocene	68,000	300 to 2,000
Barkly-Georgina	Northern Territory Queensland	Mesozoic, Palaeozoic Upper Proterozoic(?)	57,000	150 to 1,000
Carnarvon	Western Australia	Cretaceous, Permian	40,000	230 to 4,000
Perth	Western Australia	Recent, Jurassic	10,000	200 to 2,500
Pirie-Torrens	South Australia	Recent-Pliocene	4,000	Up to 600
East Gippsland	Victoria	Pleistocene-Eocene	2,500	200 to 1,800
Adelaide	South Australia	Recent, Oligocene	1,100	10 to 850

The Great Artesian Basin deserves special mention because it is the largest basin of its kind in the world and is being investigated on a continuing basis by the States and the Commonwealth Bureau of Mineral Resources.

The Great Artesian Basin covers a land area of 678,000 square miles in Queensland, New South Wales, South Australia and the Northern Territory. Part of the Basin extends north beyond land limits and is found undersea in the Gulf of Carpentaria. Two-thirds of the area of the Basin is in Queensland.

In the early stages of exploration of the Great Artesian Basin the presence of mound springs directed attention to the possibility of obtaining artesian supplies. The first flowing bores were sunk beside these springs at Kallara in New South Wales in 1878 and near Anna Creek in South Australia in 1881. A drought year, 1885, focussed attention on the possibility of developing water supplies and R. L. Jack and J. B. Henderson were detailed to select sites for bores. Successful bores were drilled near Cunnamulla and Barcaldine in 1887 and Blackall in 1888. From that time onwards geological and hydrological studies of the Basin have been undertaken resulting in general acceptance of the hypothesis that water continually finds its way into the intake beds of the Basin; the intake beds being exposed in the Great Dividing Range and associated mountains and foothills.

The Great Artesian Basin is essentially a syncline modified by subsidiary folding and faulting, and consists of Permian, Mesozoic and Tertiary sediments.

The Mesozoic sediments alternate between non-calcareous, arenaceous beds containing the aquifers and the calcareous clay formations which are the main aquicludes (a formation which although porous and capable of absorbing water slowly will not transmit it fast enough to furnish an appreciable supply for a well or spring).

Water enters the intake beds in the Great Dividing Range and it has been shown that large quantities of water are absorbed at the head of the Flinders River and its tributaries and also in a larger region at the heads of the Barcoo, Nogoa, Warrego, and Maranoa Rivers.

The various formations making up the basins are aquifers, the most important supplies being derived from Mesozoic sediments. The Permian-Lower Triassic basins are quite distinct from the Jurassic-Cretaceous Basins.

The question of diminution of flow has been a subject of investigation for over 50 years and some remedial measures have been taken to conserve the flows. The volume of flowing artesian water used cannot, in the long term, exceed the replenishment. Thus as the existing excessive demand continues the potential will drop as it has in the past 50 years and an even annual rate of flow will take place.

Many of the early bores had large initial flows, some reported as being over 2 million gallons per day. The peak flow from all bores of 351 million gallons a day was reached about 1914 and flow had fallen to 230 million gallons a day in about 1945. After a further anticipated decline in water levels recharge and discharge will balance at a rate of 130 million gallons a day. It is estimated that 110 million gallons per day might be the final steady state discharge from flowing bores.

The quality of artesian water from the greater part of the Basin makes it unsuitable for irrigation and it is used to supply sheep and cattle industry.

The future of the Great Artesian Basin is not a gloomy one although some observers see in the diminuation of flow a threat to the pastoral industry. Water Supply Commissions are actively taking remedial measures and greater attention is being paid to better distribution methods.

The rapid expansion of oil exploration in the Great Artesian Basin is providing authorities with much new and accurate information on the stratigraphy of the Basin and should ultimately assist detailed planning for the use of the underground waters.

One of the important problems to be solved in the Artesian Basin is to determine the precise character, distribution, and yield from the various aquifers by both production and observation bores. When this is done the planners will have a valuable guide to assist them in their work. Regional geological mapping at a scale of 1:250,000 is in progress and from 24,000 to 36,000 square miles per year are mapped.

Very important supplies are won from other artesian basins in Australia but none of the yields are as spectacular as those of the Great Artesian Basin:—Figure 1 shows the main basins.

Non-Artesian Waters. Important non-pressure "pumping supplies" are widely distributed in Australia and are obtained at shallow depths from most parts of the continent. In many places this is the only source of supply. Geologists attached to Government regional mapping parties attend to many requests by pastoralists and others to assist in the location of suitable water supplies. These are most significant in times of drought when surface supplies may fail and the yields of bores are virtually unaffected. A familiar sight on the Australian landscape is the windmill used to drive the pump in these bores. Water is found in fractures and fissures in rocks, in shallow permeable aquifers such as sandstones, river gravel and allumiun, in seclian sands and weathered rock. Alluviated river valleys are probably the most important source.

The importance of non-artesian waters can best be illustrated by several examples of places where supplies are developed and where recent intensive work has located new or increased reserves.

Wangaratta, Victoria: In 1937 a supplementary supply for Wangaratta was developed from a series of 10 shallow (40 ft.) bores sunk to old river gravel formations. However, the high and variable iron content which at times reached 25 p.p.m. caused difficulties and the deposition of iron was such that it proved impracticable to maintain the bores. A deeper bore put down in 1943 to a depth of 140 ft. into old river gravel resting on the glacial bed rock yielded about 20,000 g.p.h. for a number of years. In 1946 a second bore was installed giving a comparable yield and in 1950 two more similar bores were installed and connected to the town supply. The iron content of this deeper water was 2 p.p.m. and necessitated aeration and filtration. The total safe yield of the four bores however is 50,000 g.p.h. due to interference and deterioration of output with deposits of iron at the bore casing. This supply is used as a supplementary source in times of drought when the Ovens and Kings Rivers which are normally used are inadequate.

Tomago Sands, New South Wales: Sands accumulated by wind action from many extensive dune and heathland areas along the New South Wales coast. Their main development is near the mouths of the major rivers where they show a characteristic

relationship to estuarine flats and to rock headland which, until they were "tied" to the coast by sand, were offshore islands. Although they offer the largest source of good quality water in the coastal regions only a few areas are being exploited. Of the areas being exploited the Tomago Sands in the Newcastle district are the most important. They cover an area about 20 miles long and 5-6 miles wide and have a potential yield of 15 million gallons per day; the water provides a large proportion of Newcastle's water supply. The Botany Sands in the Sydney area are an important source of water for many industries. The maximum thickness of sand is reported to be over 100 feet and average 49 feet. Safe yield is estimated to be of the order of $10\frac{1}{2}$ million gallons per day.

Alice Springs water supply comes from shallow aquifers in a sedimentary basin which is re-charged from time to time by the Todd River.

Wiluna. Of the many developments in the study of underground water in Australia in recent years, one of the most significant has been the recognition of the importance of the shallow Tertiary, Quaternary and Recent basins and their place in ground water storage. These basins, at least as known today, are small but many of them appear to be efficient storages of that part of the local rainfall which results in run-off and infiltration.

The Wiluna-Meekatharra area has very low relief with a generally un-coordinated drainage system. Most surface water flows over choked valleys which are relics of more vigorous drainage in a past era of greater rainfall. Large storms cause surface flow, generally in a wide shallow sheet, towards depressions which may form lakes, sometimes several miles in extent. In extreme floods the lakes overflow into other lakes at a lower level, sometimes forming a chain of storages which may follow the line of an old river course.

At Lorna Glen Station, floodwater flows from the east past the Homestead to join, at Corduroy Creek, flow from a large catchment extending to the north. The Creek flows into a depression called Lindsay Gordon Lagoon.

In the Wiluna area, flood water from catchments to the north and west flows into Lake Violet about a mile from the town. In extreme floods this lake overflows to the much larger Lake Way, a few miles to the south. The inflow into Lake Violet in the storms of March 1958 (? approximate frequency seven years) was 13,000 ac. feet.

In the Wiluna-Meekatharra area, ground water of varying quality generally occurs in the formations underlying the major flood channels, flows (at rates of the order of 1 mile in 5 years) towards a lake, and is lost by evaporation from the lake beds which have a shallow water table.

The area of the water-bearing basin at Wiluna is not known but apparently water is available beneath the fluviatile flats in an area at least 5 miles wide and 8 miles long. The deepest bore is 40 feet and the deepest well is 47 feet.

At Lorna Glen water is usually found below a depth of about 15 feet and the thickness of the buried valley fill ranges from 30 feet to 60 feet.

Commonwealth Interest in Water

In 1955 the Australian Academy of Science recommended to the Federal Government that the Interstate Artesian Conference last held in 1928 be revived with wider terms of reference to include the consideration of all underground water. The recommendation was contained in a report made to the Prime Minister on the subject of "Hydrology in Australia". The report drew attention to deficiencies in the study and assessment of Australian resources of underground water. It pointed out that there had been considerable exploitation of underground waters but very little detailed study of the factors which control the movement and accumulation of these waters. In many regions of a dry continent like Australia water stored in the ground — underground water — may be the only source of supply; the study of these resources is therefore vital to the development and well being of the nation. The expansion of pastoral and agricultural industries, mineral prospecting and development may ultimately depend upon finding new supplies and conserving known ones.

This recommendation was approved by the Commonwealth Government and a preliminary meeting of representatives from the States and Commonwealth bodies was held in Sydney on June 12th, 1959. Later that year letters were sent to the State Premiers asking them to nominate delegates to a permanent conference. In May 1961 the First Permanent Meeting of the Underground Water Conference of Australia was held in Canberra. Delegates attended from all States and Territories and from Commonwealth Government Departments concerned with underground water. This first meeting of the Conference was successful and a second meeting took place in Adelaide in May, 1962.

The Water Resources Conference brings together experts in the field of surface water resources and has made considerable progress in standardizing stream gauging techniques, analyses and publication of data. The first meeting was convened in 1951 and meetings have been held annually from 1953. It is attended by delegates from private and governmental organizations.

The establishment of the two Conferences has led to the next logical step of the formation of a Council at the highest level.

On 12th July, 1962 a meeting of Commonwealth and State Ministers was held in Canberra to discuss the proposal to establish a Water Resources Council, put forward by the Prime Minister in his policy speech for the 1961 Federal Elections.

The Ministers agreed that Australia's limited water resources could have considerable influence on the country's growth and future economy. While it is well known that Australia is the world's driest continent it is a matter of immediate practical concern that Australia *does not yet have a reliable estimate of how much water is available now, and how much will be available in future*. The Ministers were unanimous in their view that everything possible should be done to provide a comprehensive assessment of Australia's water resources and to extend measurements and research so that future planning could be carried out on a sound and scientific basis.

It was expected that an overall assessment of this nature would provide the background for consideration of the following questions:

1. As it is already apparent that in some areas water resources are likely to limit the economic growth of Australia in the foreseeable future, in which areas are these limitations likely to be most serious in the near future?

2. In which areas of Australia is information inadequate for the preparation of reliable assessments of water resources because of a lack of measurement of precipitation, stream flow and underground water?

3. What steps should be taken to initiate water resources measurement and assessment in cases where deficiencies in information are known to exist, and thereby to establish records of precipitation, run-off and underground water movement over a long period to be of value for future planning?

It was also agreed that there are several other subjects related to the measurement, assessment, and more efficient use, of water resources in which there is a need for collaboration or to which greater emphasis might be given. These are:

1. Procedures for promoting close and continuous liasion with overseas and international activities.

2. Collaboration in regard to local and overseas specialist investigations to minimize duplication.

3. Promotion of continuous collaboration between agencies dealing with the conservation of water (surface and sub-surface) and those agencies concerned with mapping, land use, forests and other natural resources having interrelated problems.

4. Increasing the availability of water through collaboration in research aimed at controlling run-off and decreasing evaporation, transpiration, seepage losses and promoting re-use of water. This involves the broad fields of hydrometeorological research, biological research and the efficiency of engineering structures and natural water courses as water conveyors.

5. Improvements and standardisation of hydrological measurement; standardisation of analysis and publication.

6. Education in hydrological research and engineering hydrology with the aims of increasing knowledge and particularly the availability of trained personnel.

Studies Contributing to an Assessment

Geological Mapping. The geologist in conjunction with geophysicists and engineers and others plays a leading role in the search for underground water which from his point of view is considered a mineral in every sense of the term.

One basic need in prosecuting the search for and study of underground water in Australia is an accurate and detailed knowledge of the geology. This knowledge is the cornerstone on which the whole search must pivot, and is one fundamental requirement before an assessment can be made.

Firstly regional geological maps of Australia at a scale of 1:250,000 must be compiled to provide geological data on which detailed surveys can be based. It follows then that we should look at the current status of regional mapping in Australia to see what the position is.

Approximately 540 1:250,000 sheet areas are shown on the map of Australia and of these about 100 are completed or are in various stages of completion. Currently geological parties of the States and Commonwealth are mapping about 30 1:250,000 sheet areas per year. This means that it will take some 14-15 years to compile the basic data needed to give a uniform geological picture of Australia.

Regional geological maps will enable the geologist to divide areas into various water provinces. But this solves only part of the problem because the hydrogeologist to assess underground water possibilities needs maps at smaller scales and as a consequence will use the 1:250,000 mapping as a base for more detailed work at scales of 1:50,000 and less.

The next step is to examine and map the various potential aquifers and predict their usefulness. This work is largely done on a small scale in Australia although much of the data provided by regional mapping parties direct their attention more to compiling the stratigraphic column and regional structure rather than assessment of aquifer potential. The latter information is obtained only as opportunity offers. In most cases areas will have to be re-examined by the hydrogeologist.

Once the regional geology is known and the country divided into underground water provinces the geologist is called on to predict quality of water in various areas. He can make a significant but generalised contribution on the basis of known data in some areas in Australia but his interpretation is inaccurate because of the incomplete status of geological knowledge. For example the Resident Geologists, Alice Springs, (Jones and Quinlan) have divided part of Central Australia into 15 water provinces. A description of a typical province is as follows—

Davenport Province

Aquifers — Fractured quartzites and volcanics of Lower Proterozoic age in complex structures.

Depth — Water table is at shallow to moderate depth below the local base level of erosion. The depth to water is in part dependent on geological structure.

Salinity — Generally good to moderate but may be saline in areas of sediments of the Warramunga Group.

Resources — Difficult to assess on available information, but may be moderate. Recharge for quartzite aquifers is probably efficient. Availability moderate but commonly confined to topographically inconvenient locations.

A further step in the assessment of underground water is drilling and the setting up of recorder stations to measure the water resources and the variation in resources with development. Until the reaction of aquifers are known to usage and recharge is known, it will be virtually impossible to determine the safe yield in any specified area. The question might well be asked "How can continued agricultural development etc. take place in an area dependent on underground water if the safe yield is not known?" Planning must be based on calculated resources, and to know these the rate of recharge must be known.

Geophysics. Fundamentally, problems except renewal problems met in the search for water do not differ from those met in the search for other minerals; therefore the geophysical methods used in one may be applied equally well to the other.

Broadly, hydrological problems of the distribution type which can be solved by geophysical tools may be arranged into three groups:

(a) Large-scale structures (such as deep artesian basins)

The methods used for investigation are the same as those used in oil exploration; that is, gravity and seismic methods. Usually no detailed information about the rock types is obtained but drilling targets are chosen according to structure (synclines, faults, rock contacts).

(b) Shallow basins, sub-surface valleys or deep leads

The requirements for a suitable groundwater supply include:

(a) Suitable thickness of saturated sediments;

(b) Reasonable porosity of these sediments;

(c) Suitable permeability of sediments;

(d) Low salinity of the pore solutions;

(e) Sufficient replenishment of water.

To solve some of the questions associated with the above requirements the first necessity is to make a bedrock contour plan, which makes it possible to say whether the basin is partly or completely closed and where regular flushing out by surface water takes place. Further, it is desirable to know the distribution of fresh and salt water, to obtain some indication of the rock types and if possible, to locate the water table.

Most of this information can be obtained by using a combination of resistivity traversing, resistivity depth probing, seismic refraction, and magnetic surveys. The gravity method can often be used but it should be avoided on account of the costly and time consuming amount of topographical surveying and computing required.

(c) Logging

Logging of bores gives the following information:

(a) qualitative information of the rock types;

(b) inter-correlation of drill holes in an area;

(c) with suitable equipment quantitative estimates can be made of the porosities and permeabilities of the rocks and the salinity of the pore solutions.

Methods used include single-point resistance logging, self-potential and radiometric (gamma ray) logging.

Geophysics is not widely used in Australia in the search for underground water and there is much room for expansion. It is fortunate that, in the extensive oil exploration programme at present under way, one of the main tools in the search is geophysics. Indirectly much valuable information is being gathered and will be of value to the underground water authorities.

Hydrological Studies. Studies of the movement of pressure and non-pressure waters, the rates of flow and recharge are an integral part of the assessment of water resources. The application of engineering services to the assessment is not discussed in detail here but broadly this consists of supervision of test drilling pump tests, and recommendations on the best methods of utilisation of proved resources.

Evaporation Control. Evaporation is the great enemy of surface water conservation particularly in the low rainfall regions where up to 100 inches per annum may be lost from water storages. Over 70 per cent of the continent comprising most inland districts and extending to the coast in the North-West and Eucla divisions of Western Australia the average rainfall does not exceed evaporation during any one month of the year.

For some years now the Commonwealth Scientific and Industrial Research Organisation (C.S.I.R.O.) has conducted research on evaporation control. The use of the hexadecanol method has proved successful at Broken Hill where a reduction of evaporation by 37 per cent has been achieved. On larger water areas subject to the effects of strong prevailing winds results are not so successful and alternative approaches to problems are being studied.

De-salination. In some areas of the world supplies of fresh water from rivers and from underground have been totally exploited or are not available. To overcome this difficulty intensive research is being conducted into the processes for desalting of saline waters. Some techniques have been investigated in the laboratory whilst others have been proved in pilot scale and large scale operation. It is now generally accepted that the following are the most promising:—

(a) Thermal distillation—fossil or nuclear fuel is used as a source of heat to distil water.

(i) Multi-effect evaporation — water is boiled and resulting steam is used to evaporate further water at a low pressure. Plants are in operation at Bahamas (1,000,000 gallons per day) and Freeport, Texas (800,000 gallons per day); feed is sea water.

(ii) Multi-flash evaporation — water is heated and the pressure is then reduced in stages to cause it to flash into steam. Plants are established at Curacao (2,800,000 gallons per day), San Diego, California (800,000 gallons per day, approximate cost per thousand gallons in U.S. $1.3) and Guernsey (500,000 gallons per day); feed is sea water.

In both cases the cost depends on the salt content of feed water: prevention of scale formation is a problem to be solved.

(b) Vapour compression distillation. The steam produced on boiling water is compressed and used as a heating medium. Plants are in operation at Gibraltar (160,000 gallons per day) and Bermuda (200,000 gallons per day) using sea water.

(c) Solar Distillation. Application appears to be limited to areas of favourable climate conditions. It could be suitable as domestic units.

(d) Electrodialysis. In this process salt water is caused to pass through special membranes under the influence of an electric current. Cost is too prohibitive using water feed containing more than 10,000 p.p.m. salts. A 200,000 gallons per day plant using brackish water feed at Freeport, Texas, commenced proving trials in October, 1961.

(e) Freezing Processes. Considerable progress has been made in this field and freezing may offer the best prospects for economic desalting particularly in the 50,000-100,000 gallons per day range.

The United States Office of Saline Water has proceeded with a demonstration plant programme. Five large plants to investigate each of the processes have been built. Capital cost is around $10 million and operating cost about $1.20 per 100 imperial gallons; it is anticipated cost will be reduced to $0.50 per 1000 imperial gallons.

The Chemical Engineering Section of C.S.I.R.O. is studying various aspects of desalination ,and are investigating heat transfer and scaling characteristics in tubular evaporators, developing a simple domestic vapour compression still, and experimenting on electrodialysis and freezing processes.

The cost of desalted water is likely to become acceptable for domestic and some industrial purposes; it would be prohibitive for large scale irrigation unless agricultural economics undergo a radical change.

The Underground Water Conference of Australia. The Underground Water Conference has held two meetings since its inception. A brief review of some of the comments made at the Conference will show some factors considered important in making an assessment of water reserves.

(a) Inventory of Data. The Conference noted the vast amount of data already compiled but little was being done to study it and assess it. This must proceed hand in hand with any planning to assess water resources. A committee has been formed, the task of which is to examine and report on the availability of all ground water information throughout Australia as regards its character, form and accessibility. One of the ultimate objectives is the publication of a comprehensive inventory of Australian underground water data.

(b) Education. The Conference found that there is a need for academic training at University level in the field of underground water. It is aware that an increase in the demand for hydrologists is imminent, and suggests that Universities be urged to consider ways and means of establishing a special course.
The Conference considered that, if carefully ordered studies and surveys of underground water resources are to be made it is essential that drilling and recording must be of satisfactory standard. Talks should be arranged over country radio and television services to bring before the public the importance of underground water in our economy. Perhaps education authorities in the States might include projects on Australia's water resources at a suitable place in the curricula of their schools.

To impress upon various authorities and universities the importance of underground water, the Conference proposes to sponsor a special training course in groundwater hydrology. Emphasis will be placed on practical methods employed in the search for underground water, including drilling, cementing, test pumping, use of screens and also geophysical equipment and methods.
An Education Committee is giving close attention to the need for education in the Underground Water Field.

State Committees on Underground Water. Following on a recommendation of the 1961 Conference Committees have been set up in each State to provide liaison between the Conference and interested State bodies in any groundwater matters which may arise in the time intervening between annual Conferences.

Committee to Study Great Artesian Basin. The Conference recommended that a Committee be established to investigate and report on:

(i) the present status of knowledge of the Great Artesian Basin; and

(ii) the need for, and nature of, further work in relation to the occurrence, use and conservation of the waters of the Basin.

The scope of the Committee could be widened to include Basins, such as the Barkly and Georgina, lying on the "fringe" of the Great Artesian Basin.

The need for a study of all Basins in Australia was recognized.

Water Supplies other than Artesian: The study of the underground water potential in alluviated river valleys which may contain artesian supplies, in fractures in crystalline rocks, in coastal dune and heathland is of great importance to Australia. Much work has already been done in some States. It is proposed to assess the amount of work done and papers setting out the status of the investigation in each State and Territory will be written to provide a convenient starting point for further studies.

Mineralized Waters: In many parts of Australia opportunity exists for conversion of saline and brackish waters to fresh. However, before the size of the problem can be properly assessed an accurate map showing the distribution of mineralized waters must be compiled.

In some areas the quality of water suitable for agricultural and pastoral industries differs widely. Data on this subject will be compiled and distributed.

Facts on quantity and distribution of harmful elements in underground waters are to be compiled to provide a suitable starting point for study on an Australia-wide basis.

Conclusion

Basic steps to further the study of the water resources of Australia have now been taken and it can be expected that the problem of assessing these water resources will be tackled systematically on a coordinated national basis.

GENERAL REVIEW

At the end of 1962 approached, indications were that the Australian mineral industry would have the record year that had been foreshadowed by production rates at mid-year. It was expected that production of copper, lead, zinc, silver and beach sand minerals in particular would be at high levels and that this would be satisfactorily reflected in high export income.

Although lead and zinc have been suffering depressed prices in recent months, their contribution to the value of Australian production and exports is still very significant. Mine production of lead in the second and third quarters of 1962 was at the very high rate of 400,000 tons per annum, so that production for 1962 is likely to be 370,000 tons, well ahead of the 1957 record of 334,000 tons. Because of restrictions on 1962 production of refined lead at Port Pirie much of the increase in mine production will be reflected in increased exports of lead concentrates; there will also be increased production of lead bullion at Cockle Creek and with uninterrupted production at Mt. Isa this will give a total of about 77,000 tons of bullion for the year. With no restrictions on refined metal production planned for 1963, production and exports should be much higher than in 1962.

Mine production of zinc in zinc concentrates in 1962 is also expected to be a record, at 300,000 tons. Zinc metal production should exceed 160,000 tons in 1962, and an increase to 170,000 tons is likely in 1963. With domestic consumption at about 80,000 tons, a considerable tonnage will be available for export; diversification of export sales will assist in disposing of this metal.

With the return to full-scale production at Broken Hill, mine production of silver will be up in 1962, and refinery production should exceed the 1961 output of 7.1 million ounces. Exports of refined silver have fallen away in recent years owing to increased purchases by the Commonwealth Treasury, but actual silver exports will rise again by virtue of the fact that a substantial proportion of the increased production of base metals will be exported as concentrates also carrying silver.

Although mine production of copper in 1962 is not expected to exceed the record of 109,000 tons established in 1960, at 105,000 tons it will be highly satisfactory. With increased smelting and refining capacity available since early in the year, production of both blister and refined copper in 1962 should exceed 80,000 tons, new record levels. Domestic consumption of primary copper in late 1962 was at the high rate of 65,000 tons per annum.

Another contract for the supply of Australian rutile for titanium pigment manufacture was announced during the period under review; the contract is for the supply of 50,000 tons over a period of 5 years. (In this connection it is interesting to note that the 5-year period appears to be favoured in the negotiation of these contracts.) It is regarded as not unlikely that demand for Australian rutile will rise to 200,000 tons per annum within the next few years. Major expansion plans are also in hand in Western Australian ilmenite, and these will lift production capacity from 240,000 tons per annum to 375,000 tons per annum, of which at least 250,000 tons will be firmly contracted for. Although there will be some increase in zircon production, it is unlikely that this will be of the same magnitude as the increase in rutile production, and it should be readily taken up by the market.

Production of pig iron, ingot steel and tinplate in the first 9 months of 1962 were all higher than in the same period in 1961, and by October tinplate production was running at an annual rate of 200,000 tons. In November the first cut in domestic steel prices since World War II (for hot rolled products) was announced, to take effect from 1st January 1963.

In recent years the export market, particularly Japan, has become increasingly important to the Australian black coal industry. As a result of revision of Japanese iron and steel production targets and consequent curtailment of coal imports, coal production in New South Wales showed a marked downturn in the second half of 1962. The daily production rate in New South Wales fell by over 3 per cent from June to September, and stocks rose by 500,000 tons in the period June to October. Revised estimates of production now put the 1962 figure at just over 24 million tons. Exports declined sharply in the second half of 1962, falling by nearly 25 per cent from the 1961/62 rate in the period June to October. Exports in 1962 are expected to total 2.8 million tons, about the same level as in 1961.

The situation of Australian tungsten producers continued to be serious towards the end of 1962, although prices were slightly better than the very low quotations of August. For some time Australian mines had been producing at a cost above current world prices, and with theexpiration of contracts and no apparent prospect of price improvement some had to reduce production or resort to stockpiling towards the end of the year.

The Moonie field continued to provide an encouraging note in oil exploration. By early December 1962 ten wells had been drilled in the Moonie structure and all had struck oil. Plans were in hand for the construction of a pipeline from the Moonie field to Brisbane.

D.F.L.

ALUMINIUM

Details of production of aluminium by Comalco Aluminium (Bell Bay) Ltd. are no longer available for publication. The rate of output in mid-1962 was 15,000 tons per annum. It was announced by the company in November 1962 that production capacity at Bell Bay had been increased to 35,000 tons per annum, and would be further increased to 52,000 tons per annum in 1963.

Imports of primary aluminium in the first half of 1962 were 12,407 tons, valued at £2,995,741, compared with 16,141 tons, valued at £3,882,554, in the whole of 1961. Apparent consumption of primary aluminium in 1962 will be of the order of 40,000 tons. Imports of bauxite in the first half of 1961 were 44,951 tons, compared with 51,799 tons for the whole of 1961.

During November 1962 uncertainty was expressed in some quarters regarding the plans for the Comalco group to erect a 120,000-ton smelter at Bluff (New Zealand) using power from Lakes Manapouri and Te Anau.

It was reported that the New Zealand Government and Comalco were likely to experience difficulty in raising the capital required for the Manapouri power scheme. However, no official announcement to clarify the issue had been made up to the end of November.

Prices of aluminium were unchanged throughout the period under review. At the end of November 1962 prices were: Canadian export price, 24.00 Can. cents per lb.; United States, domestic and Canadian imported ingot, 24.00 U.S. cents per lb.; United Kingdom, £stg. 180 per ton; Australia, domestic ingot £271 per ton, imported ingot £225/18/- per ton c.i.f.

D.F.L.

ASBESTOS

Production of crocidolite asbestos in the first six months of 1962 was 7,195 short tons, compared with 6,246 short tons for the same period in 1961. However, this production was well below the 9,531 short tons produced in the second half of 1961. The total production for 1962 is expected to be about 15,000 short tons ,slightly below that of 1961 (15,777 short tons). All of this production continues to come from the Wittenoom Gorge mine (W.A.) operated by Australian Blue Asbestos Pty. Ltd. Production was interrupted during October following a rock collapse in part of a newly-developed section of the mine; company officials have attributed the collapse to an earth tremor which was recorded in the area at that time.

Production of chrysotile asbestos continues to decline and was only 382 short tons for the first two quarters of 1962. This production was from Baryulgil (N.S.W.); no production had been recorded in Western Australia up to June, 1962.

Domestic consumption of asbestos in recent months has not changed significantly and it is estimated that consumption is still well below the record level of 1960. Production of asbestos cement sheets for the eight months ending August 1962 was 17.84 million square yards, indicating that the total production for 1962 should be slightly higher than that for 1961.

Total imports of all varieties of asbestos for the first two quarters of 1962 were 16,309 short tons, valued at £1,057,921. The bulk of these imports were of chrysotile, and Canada was the main source of imports.

Recorded exports of blue asbestos from Australia in the first half of 1962 were 4,952 short tons, valued at £481,734, which was an increase of more than 50 per cent over exports for the same period in 1961. This increase reflects the sale in late 1961 of crocidolite to the United States stockpile. However, sales of this nature are not expected to be repeated in the near future, and with increased competition in world markets exports of blue asbestos are expected to decline unless there is an unexpected change in the pattern of overseas demand.

D.J.I.

COAL (BLACK)

Production of black coal in Australia in the June quarter of 1962 was 5,833,937 tons, compared with 5,875,958 tons in the same period in 1961. Total production for the first six months of 1962 was 11,406,325 tons, slightly higher than for the first half of 1961. The decline in demand from Japan in recent months necessitated a decrease in production in New South Wales and the average daily production rate fell from 81,500 tons in June to 78,900 tons in September. Stocks held in New South Wales increased by almost 500,000 tons in the period June to October and a further decrease in the production rate may be necessary. It is now expected that total Australian production of black coal in 1962 will be about 24 million tons.

Total exports of black coal in the first six months of 1962 were 1,635,506 tons, valued at £6,397,049. Of this, 1,505,477 tons, valued at £5,870,913, were consigned to Japan. Total Australian exports during 1961/62 were 3,507,784 tons, valued at £13,851,654 (preliminary figures). Exports have, however, declined in the second half of the current year owing to the lessened Japanese demand for Australian coal. Shipments from New South Wales to Japan, which had averaged about 57,000 tons per week

during 1961/62, decreased to a weekly average of about 43,000 tons for the period June to October. As a result of this decreased demand total Australian exports for 1962 are expected to be about 2.8 million tons.

In the last twelve months several trial shipments of semi-anthracite coal have been despatched to Japan and the Netherlands from Baralaba in the Dawson Valley in Queensland, but large sales of this coal are not anticipated at present. There are quite extensive reserves of semi-anthracite in the Dawson Valley, but development would require considerable capital expenditure and long-term contracts would be necessary to allow a suitable rate of amortization.

The Joint Coal Board presented its report for the year 1961/62 to Federal Parliament in October. The year reviewed was a most prosperous one for the New South Wales industry and new records were established for production, exports and total disposals. However, domestic consumption of black coal fell slightly and interstate shipments continued to decline. With the recent decline in export demand the year closed with a generally dull market and the Board's immediate forecast was that this would continue with, however, some prospect of an improvement in export conditions in 1963.

The Annual Report of the Queensland Coal Board states that coal production for 1961/62 exceeded three million tons for the first time; production was 3,208,948 tons, an increase of 305,359 tons on the previous year. Domestic consumption of coal was slightly higher than for the previous year, the electricity generating industry being the largest single consumer.

Early in November the Queensland Government announced its intention to build a £18,760,000 thermal power station on the Collinsville coalfield to supply power to Mackay, Townsville and Cairns. The station, which will ultimately be capable of generating 180 megawatts, is to be built in two stages, the first of which is planned to go into operation in 1967/68. Consumption of coal when the station is completed will be of the order of 500,000 tons annually.

This station is the third developmental work of this kind announced by the Queensland Government in the past eighteen months. The two other stations are to be built at Swanbank on the West Moreton field and at Calcap on the Callide field. Total outlay on the three stations and related projects will be in excess of £80 million. Total annual consumption of coal by these power stations when they are in full operation is expected to be of the order of 2 million tons, which would represent a considerable uplift for the Queensland coal mining industry.

D.J.I.

COAL (BROWN)

Production of brown coal in the year 1961/62 was 16,728,029 tons, compared with 15,740,637 tons in 1960/61. Total production for the calendar year 1962 is expected to be about 17 million tons.

Briquette production from the Victorian State Electricity Commission's two briquette factories at Yallourn and Morwell amounted to 1,821,000 tons in 1961/62, compared with 1,807,000 tons in 1960/61 and 975,000 tons in 1959/60. The opening of the Morwell briquette works in late 1960 has permitted the previous annual production rate to be almost doubled.

The greater availability of briquettes has meant a slight change in the pattern of fuel consumption at the State Electricity Commission's power stations. In 1960/61 these stations consumed 9,390,361 tons of brown coal and 902,950 tons of briquettes, compared with 9,817,869 tons of brown coal and only 311,301 tons of briquettes in 1959/60. The power stations consumed almost 50 per cent of the total briquette production in 1960/61, compared with 32 per cent in 1959/60.

The State Electricity Commission of Victoria is planning to spend about 32 million in capital works in 1962/63. Over half of this sum will be spent in the Latrobe Valley, principally at Hazelwood, where work continues on the first 400,000-kw stage of the new 1.2 million kw power station. The first of Hazelwood's 200,000-kw generators will be commissioned in 1964, and the second in 1965. The second stage of the project ,also of 400,000 kw, is due for completion in 1968, and the major contracts have already been placed.

Work is also in progress on the large new coal dredger which has been ordered, at a cost of about £900,000, to increase brown coal production from the Morwell open cut to supply fuel for Hazelwood. The new dredger has a capacity of 1,500 tons per hour and is expected to be in operation in 1964, by which time the first generator will be commissioned. Work on ancillary developments for this project is well advanced.

D.J.I.

COPPER

Mine production of copper in the January-September period of 1962 was 76,053 tons. It appears likely that 1962 mine production will be about 105,000 tons.

Increased production from expanded domestic smelting and refining capacity will result in record production figures for blister and refined copper in 1962. The copper content of copper concentrates despatched to domestic smelters in the first nine months of 1962 was 61,556 tons. Production of primary blister copper in the period was 63,886 tons and primary refined copper production was 57,087 tons.

Copper ore reserves at Mt. Isa increased by 2.5 million tons during the year ended 30th June 1962. The underground drilling programme also indicated substantial orebodies which have yet to be proved before inclusion in reserves. At Townsville, Copper Refineries Pty. Ltd. produced a broader range of products in the year 1961/62 and increased its refining rate from 45,000 tons per annum in mid-1961 to 75,000 tons per annum in June 1962.

Statistics released by the Copper Institute showed that world stocks of refined copper reached a record 508,000 short tons at the end of October. The increase in stocks of blister and refined copper during October was 17,800 short tons, compared with increases of 23,200 short tons in September and 60,500 short tons in August; this may indicate greater success in restricting output by those producers involved in price stabilization operations.

The price of 3 months forward copper edged up steadily from £stg. 229 a ton in early June and in November was running only slightly below the producers' support price of £stg. 234. The narrowing backwardation is considered to reflect market confidence in the long-term chances of success for the producers' price stabilization operation, which began in September 1961.

It is particularly noteworthy that the London price held at the stabilized level of £stg. 234 in spite of scare buying during the Cuban crisis and the threat of strikes at Chilean mines, indicating that the producers are prepared to hold the price down in bullish conditions as well as support it in conditions of potential over-supply.

The United States price of refined copper remained at 31.00 cents per lb., delivered, to the end of November 1962, despite a considerable volume of discount sales in recent weeks. Some anxiety was expressed by United States producers that the trend towards rising stocks outside the United States might indicate that foreign producers were not cutting production to the extent planned but merely supporting the price by withholding offerings or by buying.

G.B.R.

GOLD

Mine production of gold in the first 8 months of 1962 was 697,993 ounces, an increase of 2,965 ounces on output for the corresponding period in 1961. Production was down in the Northern Territory, Queensland and New South Wales.

Total refined gold production in the January-August period was 785,041 ounces, comprising 681,121 ounces from newly-won gold of Australian origin, 89,343 ounces from imported newly-won gold and 14,577 ounces from scrap.

Exports of refined gold were 117,369 ounces during the eight months to August 1962; of this 112,030 ounces were shipped to Hong Kong and 4,817 ounces to New Zealand. August sales of Australian gold on overseas premium markets realized £15/13/1 per ounce.

Payments of subsidy to gold producers in Australia and Papua and New Guinea under the Gold Mining Industry Assistance Act were £316,666 in the January-August period of 1962. Payments under the Act commenced in March 1955 and the progressive total to August was £4,794,406. The Act will operate until 30th June 1965.

Notwithstanding the slightly increased rate of production of gold in 1962, some established producers have either ceased operations following the depletion of reserves that can be worked economically, or are likely to cease operations in the near future.

Production by Great Western Consolidated N.L. at the Copperhead, Nevoria, and Frasers mines near Bullfinch (W.A.) will cease toward the end of December 1962. Two other mines near Bullfinch operated by Great Western Consolidated N.L., the Corinthian and the Pilot, shut down at the end of 1961. In their annual report the directors of the Sons of Gwala Ltd. mine at Leonora (W.A.) stated that although geological reports indicated a short remaining life for the mine, in their opinion there was little prospect of profitable operations. In November the State Government granted a subsidy of £40,000 for further development in an effort to prolong the life of this mine. Production from these six mines in 1960 was approximately 110,000 ounces.

The approximate total of gold sales in international markets for the first 10 months of 1962 was reported to amount to SU.S. 3,265 million against a figure of SU.S. 2,840 million for the corresponding period of 1961. After quiet trading during September there was an upsurge in the demand for gold in October, to a reported level of SU.S. 475 million; although this was reminiscent of the buying rush of October 1960, it was considered to be tied largely to recent international tension rather than to pure speculation on a revaluation of the price of gold as in 1960. On 24th October the price of gold in London rose to its highest point for the year, £stg. 251/3¼. No

9-months or 12-months contracts for gold for future delivery were reported to have been offered during the second half of October, notwithstanding an increase in the volume of forward sales.

The total of Communist gold sales on the London market was reported to be SU.S. 80 million to the end of October. This represents an annual rate of shipments of some 2.75 million ounces, less than half the level of sales in recent years.

G.B.R.

GYPSUM

Production of gypsum in the first six months of 1962 was 286,719 tons, compared with 307,734 tons for the same period in 1961. The decrease was accounted for by lower production in South Australia and New South Wales.

Exports of gypsum for the first six months of 1962 were 49,747 tons, valued at £156,976, compared with 46,864 tons, valued at £143,061, for the same period in 1961. The bulk of the exports so far in 1962 gave gone to New Zealand, Malaya and Japan.

Production of fibrous plaster sheets in the first eight months of 1962 was 10,102,000 sq. yards compared with 14,825,000 sq. yards for the whole of 1961. Peak production of these sheets in recent years was 18,438,000 sq. yards in the boom year of 1960. It is unlikely that production of fibrous plaster sheets will regain this high level in the foreseeable future as chipboard-covered plaster board continues to increase its share of the total market for plaster wallboard. Statistics for production of this latter form of wallboard are not available, but it is estimated that about one-third of plaster wallboard now used is of the chipboard-covered type.

Increased activity in industries which consume gypsum—mainly the plaster wallboard industry and to a lesser extent the cement industry—together with the increase in exports, indicate, in the face of decreased production, that stocks which had been built up during 1961 are now being reduced. It is thought that the bulk of the stocks are held by exporters to cover possible overseas requirements, but some of the domestic demand in recent months must have been satisfied from stocks.

D.J.I.

IRON AND STEEL

During the first half of 1962 domestic production of iron ore was 2,495,591 tons, comprising 1,776,014 tons from the Middleback Range area (S.A.), 660,163 tons from Yampi Sound (W.A.) and 39,414 tons from Koolyanobbing (W.A.). Not included in this total are 31,244 tons of jaspilite with an estimated iron content of 30 per cent produced from the Middleback Range area. Domestic production of iron ore for the comparable period of 1961 was 2,613,660 tons, including 1,963 tons of jaspilite.

Imports of iron ore from New Caledonia in the first half of 1962 were 126,241 tons, valued at £141,478.

The Broken Hill Proprietary Company Ltd. and Australian Iron and Steel Pty. Ltd. recorded increased outputs of almost all major products in the first three quarters of 1962 compared with the same period of 1961. Pig iron production rose by 205,793 tons to 2,547,781 tons. This increase was largely due to increased output from No. 4 blast furnace at Port Kembla, which is currently producing at a rate of about 82,750 tons per month. Ingot steel production rose by 199,881 tons to 3,029,940 tons, while tinplate production increased from 78,255 tons to 116,939 tons. Tinplate production in October was running at a rate of 200,000 tons per annum.

As a result of increased steel-making capacity, exports of steel rose substantially in the first half of 1962 compared with the first half of 1961, while correspondingly exports of pig iron fell. Exports of steel ingots, blooms and slabs in the first half of 1962 were 71,163 tons, compared with 1,831 tons in the first half of 1961. Exports of pig iron were only 77,558 tons in the first half of 1962, compared with 147,082 tons in the first half of 1961.

Early in November 1962 John Lysaght (Australia) Ltd., a leading steel manufacturing company, announced the first reduction in domestic steel prices since World War II; it would reduce the price of hot-rolled steel products by 5 per cent as from 1st January 1963.

Western Mining Corporation Ltd. reported in October 1962 that it will be joined by two major United States mining companies in the development of the Tallering Peak, Koolanooka Hills and Blue Hills iron ore deposits in Western Australia. The two companies, Hanna Mining Company of Ohio and Homestake Mining Company of California, will each acquire a 25 per cent interest in the joint enterprise, with Western Mining Corporation Ltd. holding the remaining 50 per cent interest.

R.H.M.

LEAD

As from 1st April 1962 there have been no curtailments on the rate of lead mine production in Australia. During the second and third quarters of the year production was at an annual rate slightly in excess of 400,000 tons compared with a rate of 280,000 tons in the first quarter. Actual production in the ten months ending October was 307,000 tons; the total production for the year is likely to be about 370,000 tons, compared with the previous record of 334,000 tons established in 1957.

At Port Pirie (S.A.) production of primary refined lead in the January-October period of 1962 was 160,624 tons; production for the whole of 1962 will be held to 190,000 tons; total lead metal production including the lead content of antimonial lead but excluding lead bullion will be about 207,000 tons, compared with 179,000 tons in 1961. Production of lead bullion from Mt. Isa and Cockle Creek in 1962 is estimated to be 77,000 tons compared with 48,000 tons in 1961; production in 1961 was affected by the strike at Mt. Isa in the last quarter of the year.

The return to full scale mining operations contemporaneously with the limitations on refined metal production at Port Pirie has meant that the quantity of concentrate available for export has risen sharply. The lead content of lead concentrates shipped abroad in the first ten months of 1962 was 58,650 tons compared with 57,000 tons in 1961 and 49,000 tons in 1960. The final position for 1963 will depend on the ultimate level of metal production at Port Pirie and requirements of the Cockle Creek smelter. At this stage it appears that mine production for 1963 will be well ahead of the 1962 level.

Exports of refined lead and lead bullion in the January-October period were 178,249 tons and 60,383 tons respectively. The very high level of refined lead exports reflects the finalization of barter shipments to the United States in the first half of 1962.

With no restrictions on metal production programmed for 1963 both production and exports of refined metal should be substantially higher than the current rate. Exports of bullion in 1963 will probably be slightly higher than in 1962.

The domestic lead price was reduced from £85 to £75 per ton, f.o.b. Port Pirie in August and was unchanged to the end of November. On the London Metal Exchange the price, which had fallen to as low as £stg. 50 per ton towards the end of August, firmed slightly in September, and this trend was maintained to the end of November when the price had risen to £stg. 55⅞ per ton. In the United States the domestic producers' price was lifted from 9.50 cents to 10.00 cents per lb. on 1st November; this was the first adjustment to this quotation since February. The improvement in the United States price reflected a further downturn in producers' stocks in that country, a situation which was in part accounted for by the protracted strike affecting the operations of St. Joseph Lead Company. However, stocks in the United States still remain relatively high.

The Sixth Session of the International Lead and Zinc Study Group was held in Geneva in October; the session was proceeded by a meeting of the Special Working Group. Information available to the Study Group indicated that the overall position was better than had been predicted at the May meeting and that a shortfall of new supplies of 75,000 tons was expected in 1962; this confirmed the recent trend in stock movements. With respect to the first half of 1963 the Study Group indicated that supply and demand would be approximately in balance with new records being set in both production and consumption. For the first time since mid-1959 no proposals for curtailments in lead production were considered. However, an important development was the decision for work to proceed in the Special Working Group on outlining principles on which an intergovernmental agreement might be framed.

J.W.M.

MANGANESE

Domestic production of manganese ore in the first half of 1962 was 43,656 tons, compared with 22,529 tons in the first half of 1961. Of the total output, 43,219 tons represented shipments of metallurgical grade ore from Western Australia; 37,348 tons were exported to Japan, and the remainder was sold to domestic consumers. The balance, 437 tons, was all battery grade—359 tons from New South Wales and 78 tons from Western Australia.

Imports of manganese ore in the first half of 1962 comprised 10,901 tons of metallurgical grade, valued at £82,798 and 40 tons of battery grade, valued at £8,055. Imports of ferro-manganese continue to fall, and in the January-June period of 1962 were 6,997 tons, valued at £403,354.

During the current year increased competition in the international manganese market, particularly with the advent of low-priced ore from Gabon, has created further problems for some of the major producing countries. India, traditionally one of the world's largest producers and exporters of manganese ore, has been affected substantially

due to competition from other sources of supply nearer to her traditional markets, particularly the United States. In an attempt to counteract this competition, the Indian Government has abolished duty on all grades of manganese ore and reduced rail freights by almost 50 per cent. The price of Indian manganese ore in overseas countries was reduced in August 1962. In the United States the nominal quotation for 46%-48% ore, c.i.f., was reduced from $0.87 - 0.90 per long ton unit. In the United Kingdom the price for 46%-48% ore, c.i.f., was reduced from stg. 5/6-5/9 per unit to stg. 5/4-5/6 per unit.

R.H.M.

MICA

The termination of the Commonwealth Mica Pool's buying activities in December 1960 has been followed by the cessation of mica mining in Australia. This was not unexpected, as mine production of mica had declined markedly in the previous six years, and under the less remunerative terms which private buyers offered little incentive remained for the few miners to continue production.

Stocks held by the Pool will be liquidated by early 1963 and this organization will become defunct when all sales have been finalized. Because of the Pool's slightly reduced prices, demand from Australian consumers has been quite strong in recent months and shipments on consignment to London ceased after the March quarter. Details of the Pool's sales for the nine months ended 30th September are given below:

March quarter:	domestic sales	18,723 lb.	(£8,612)
	overseas sales	8,800 lb.	(£3,692)
June quarter:	domestic sales	12,385 lb.	(£9,599)
	overseas sales	10,100 lb.	(£4,902)
September quarter:	domestic sales	10,519 lb.	(£8,970)
	overseas sales	4,500 lb.	(£1,232)

These sales by the Pool are already greater than the sales for the whole of 1961.

Imports of the various forms of mica for the first six months of 1962 were valued at £37,987, compared with £42,261 for the same period in 1961. There was a considerable fall in the quantity of splittings imported from India but this is expected to be offset by increased shipments in the second half of the year. Apart from this variation the pattern of imports was almost the same as for the corresponding period in 1961. Exports for the first six months of the year were valued at £6,901, considerably lower than for the same period in 1961. Exports can be expected to become negligible in the near future while imports will increase once accumulated stocks are run down.

With the cessation of mica mining and the imminent closure of the Mica Pool the production of micanite in Australia may become of more importance to local consumers of mica. Micanite is a built-up mica produced from imported Indian splittings. This material is suitable for many applications where block mica is used and in addition different forms of micanite can be manufactured to precise specifications as regards electrical characteristics and elastic properties.

Australian production of the various forms of micanite in the first nine months of 1962 was about 97,000 lb., indicating an annual production rate of about £130,000. A minor overseas trade exists in this material. Exports for 1961/62 were valued at £16,952 (preliminary) compared with 29,499 and £17,191 respectively in the two previous financial years. The bulk of the exports were consigned to New Zealand. Imports of micanite in 1961/62 were valued at £10,729 (preliminary) compared with £18,818 and £5,352 respectively in the two previous financial years. New South Wales is the major importing State and India the major supplier of these imports.

D.J.I.

PETROLEUM

By Petroleum Technology Section

The total number of active rigs operating in Australia increased by one from 17 to 18, over the three months period ending 30th November 1962. A breakdown of rig activity is given in Table 1.

Table 1. Drilling Rig Activity in the 3-month Period Commencing 1/9/62

Date	Active Rotary Rigs								Idle Rotary Rigs
	Q'ld.	N.S.W.	Vic.	S.A.	W.A.	P-N.G.	N.T.	Total	
1/9/62	10	2	1	2	2	—	—	17	5
30/11/62	8	4	2	0	2	1	1	18	9

This table is based on the latest information available to the Bureau of Mineral Resources. There are a number of small rotary and diamond drilling units and cable tool rigs in operation but they have not been included as these units are primarily engaged in drilling seismic shot holes, water wells or shallow scout holes.

There has been no known drilling activity by private enterprise during the period under review in Tasmania. The Bureau of Mineral Resources has a shallow core hole drilling programme in progress in the Northern Territory (Georgina Basin).

A number of new oil exploration companies were formed, including Alliance Oil N.L., formed with Oil Development N.L. and Bitumen & Oil Refineries (Aust.) Ltd., and Lincoln Oil Ltd. In addition it was announced that the Amerada-Continental-Marathon group of the U.S.A. has taken over Permit 22 in Papua from The Papuan Apinaipi Petroleum Company Ltd.

The drilling activities of the companies and groups engaged in the search for petroleum from 1st September to 30th November 1962 are summarized in Table 2. Much of this information has been compiled from published reports and press statements.

Table 3 shows the work done by the Bureau of Mineral Resources in the search for petroleum in the period under review.

Table 4 shows the latest availability of final reports on subsidized operations. This table is supplementary to tables which have appeared in previous issues of this Review.

Table 2. Wells Drilling at 30/11/62 or Completed in the 3-month Period Commencing 1/9/62

Operating Company	Well Name & Number	Approximate Location	Progress, Status at 30/11/62 or Last Reported Depth
Queensland			
Associated Australian Oilfields N.L.	Penrith No. 1*	23°10'20"S. 143°26'00"E.	Entered basement at 3,886 ft. TD 4,073 ft. Abandoned as dry well.
	Pleasant Hills No. 1*	26°25'10"S. 149°00'10"E.	Abandoned in basement at 3,485 ft. on 19/9/62.
	Westgrove No. 3*	25°34'00"S. 148°26'00"E.	Drilling at 10,811 ft. (28/11/62). D.S.T. 2748-2,800 ft.; 0.5 MMcf/D gas; D.S.T. 2,855-2,911 ft. 0.8 MMcf/D gas; D.S.T. 8,269--8,304 ft. negative.
	Sunnybank No. 1*	26°56'25"S. 149°13'20"E.	Spudded in on 15th Nov. drilling at 4,840 ft. (28/11/62).
Phillips Petroleum Company	Black Mountain No. 1*	22°33'00"S. 147°17'00"E.	Plugged and abandoned at 5,511 ft. on 25/10/62.
	Canary No. 1*	23°15'30"S. 140°22'00"E.	Abandoned at 3,046 ft. in quartzite and tuff on 22/11/62.
	Kogan No. 1*	27°05'18"S. 150°50'49"E.	Plugged and abandoned at 3,437 ft. on 1/9/62.
	Kogan South No. 1*	27°08'40"S. 150°48'08"E.	Plugged and abandoned at 3,519 ft. on 9/10/62.
	Gumbardo No. 1*	25°59'00"S. 144°42'00"E.	Abandoned in basement at 12,940 ft. on 1/11/62.
Union Oil Development Corporation (Kern & A.O.G.)	Moonie No. 7	0.5 miles W. of Moonie No. 4	Completed as producer 25/9/62. Flowed 1,032 B/D of clean 44° API gravity oil on ¼" choke.
	Moonie No. 8	0.5 miles N. of Moonie No. 1	Completed as producer 19/10/62. Flowed 360 B/D of clean 45° API gravity oil on ¼" choke.
	Moonie No. 9	0.5 miles S. of Moonie No. 7	Completed as producer 20/11/62. Flowed 840 B/D of 44° API gravity oil on ½" choke with 100 Mcf/D gas.
	Moonie No. 10	0.75 miles N.E. of Moonie No. 1	Drilling at 5,500 ft. (30/11/62).
	Yarrill Creek No. 1*	28°S. + 5.4 miles E. + 26.7 miles E. 150°	Abandoned at 4,420 ft. Completed as water well from 1,550 ft.
	Burunga No. 1*	26°00'00"S. 150°04'43"E.	Plugged and abandoned at 10,242 ft. on 4/10/62.
	Cockatoo Creek No. 1	25°30'S. + 5 miles S. 150°E. + 6.5 miles E.	Drilling at 3,678 ft. (30/11/62).
	Tara No. 1	27°20'50"S. 150°29'26"E.	Drilling at 4,908 ft. (30/11/62).
	Minima No. 1*	28°S. + 24.5 miles S. 150°E. + 7 miles E.	Plugged and abandoned in volcanics at 7,142 ft. on 12/11/62.
Condamine Oil Ltd.	Speculation No. 1	P.E.P. 708	Suspended at 2,540 ft.
Oil Development N.L.	Maranda No. 1*	23°12'14"S. 145°26'30"E.	Drilling at 4,888 ft. (23/11/62).
Delhi Australian Petroleum Ltd.	Orientos No. 1*	28°03'00"S. 141°25'00"E.	Drilling at 9,503 ft. (28/11/62).
Exoil N.L.	Brookwood No. 1*	22°28'55"S. 141°19'58"E.	Abandoned as dry hole in granite basement at 4,806 ft. on 6/11/62.

Table 2. Wells Drilling at 30/11/62 or Completed in the 3-month Period Commencing 1/9/62—(continued)

Operating Company	Well Name & Number	Approximate Location	Progress, Status at 31/8/62 or Last Reported Depth
New South Wales			
Australian Oil and Gas Corporation Ltd.	Jerilderie No. 1*	35°15'00"S. 145°58'00"E.	Drilling at 4,346 ft. (24/11/62).
Exoil N.L.	Kurrajong Heights No. 1*	33°31'45"S. 150°37'15"E.	Abandoned as dry hole at 9,132 ft. in volcanics 22/11/62.
Farmout Drillers	Stockyard Mountain No. 1*	34°36'05"S. 150°47'10"E.	Abandoned as dry hole at 3,516 ft. on 6/10/62.
Planet Exploration Co. Pty. Ltd.	East Maitland No. 1*	32°45'46"S. 151°36'58"E.	Drilling at 2,569 ft.
Amalgamated Petroleum	Urana No. 1	35°15'40"S. 146°00'40"E.	Abandoned as dry hole at 2,216 ft. basemen 2,202 ft.
Mid-Eastern Oil N.L.	Mt. Jack No. 1	30°45'00"S. 143°45'00"E.	Spudding in early December.
B.O.C. (Aust.) Ltd., & Clarence River Basin	Clifdon No. 3	29°34'08"S. 152°54'57"E.	Spudding in on 29th November.
Victoria			
Oil Development N.L.	Anglesea No. 1*	38°09'00"S. 144°02'00"E.	Plugged and abandoned as dry hole at 10,065 ft. on 8/11/62.
Frome-Broken Hill Co. Pty. Ltd.	Pretty Hills No. 1*	38°13'30"S. 142°07'30"E.	Plugged and abandoned in basement at 7,872ft. on 16/10/62.
	Eumeralla No. 1	38°12'43"S. 151°36'58"E.	Drilling at 6,410 ft., D.S.T. at 5,880 ft. negative.
Woodside (Lakes Entrance) Oil Co.- Arco	North Seaspray No. 1	38°17'38"S. 147°12'13"E.	Drilling at 3,380 ft. (28/11/62).
	East Nowra No. 1	Same general area.	Abandoned at 930 ft. on 27/10/62.
	East Lake Tyers No. 1	Same general area.	Abandoned at 1,541 ft.
South Australia			
Beach Petroleum N.L.	Geltwood Beach Wells	37°41'00"S. 140°15'00"E.	Ten shallow stratigraphic wells programmed. Nos. 1 to 7 drilled.
Delhi Australian Petroleum Ltd.	Dullingari No. 1*	28°08'00"S. 140°52'00"E.	Plugged and abandoned as dry hole in basement at 11,588 ft.
Oil Development N.L.	Mount Salt No. 1*	37°57'27"S. 140°37'45"E.	Plugged and abandoned as dry hole at 10,040 ft. on 11/9/62.
Western Australia			
West Australian Petroleum Pty. Ltd.	Hill River Wells*	30°17'—"S. 115°14'—"E.	9-hole programme completed, total footage 7,805 ft.
	Langoora No. 1*	17°18'07"S. 124°06'48"E.	Plugged and abandoned in basement at 5,198 ft. on 3/10/62.
	Hawkstone Peak No. 1*	17°14'45"S. 124°24'26"E.	Drilling stopped at 3,897 ft.; attempting to test.
	Woolmulla No. 1	30°01'24"S. 115°11'28"E.	Drilling at 2,586 ft. (30/11/62).
Northern Territory			
Amalgamated Petroleum N.L.	Lake Nash No. 1	21°54'18"S. 137°53'20"E.	Spudded in 25/11/62; drilling at 100 ft.
Bureau of Mineral Resources	Georgina Basin Core Holes Nos. 1 to 16	Georgina Basin	A 16-hole programme of shallow core holes is nearing completion.
Papua-New Guinea			
Australasian Petroleum Co. Pty. Ltd.	Iamara No .1*	8°27'00"S. 142°57'30"E.	Drilling at 3,382 ft. (27/11/62).

* This operation has been approved for Government subsidy prior to 30/11/62.

Table 3. Bureau of Mineral Resources Activity in Oil Search in the 3-Month Period Commencing 1/9/62

State	Basin	Type	Duration (crew-months)	Status 30/11/62
Queensland	Bowen	Geological	5	Completed 23/10/62
	Bowen	Geological	5	Completed 23/10/62
	Bowen	Aeromagnetic	4	In progress
	Great Artesian	Geological	5	Completed 23/10/62
	Great Artesian	Seismic	4	Completed 30/11/62
	Great Artesian	Well logging	2½	In progress
New South Wales	Great Artesian	Detailed gravity	1½	In progress
Western Australia	Amadeus-Canning	Seismic	3	In progress
	Canning	Contract seismic	5	Completed 3/11/62
Northern Territory	Amadeus	Geological	6	Completed 23/10/62
	Amadeus	Geological	5	Completed 28/9/62
	Amadeus	Seismic	5	Completed 3/9/62
	Amadeus-Canning	Helicopter gravity	½	Completed 6/9/62
	Georgina-Great Artesian	Helicopter gravity	1	Completed 28/9/62
	Georgina	Geological	5	Completed 23/10/62
	Georgina	Geological	4	Completed 20/9/62
	Georgina	Core drilling	14	In progress

Table 4. Availability of Final Reports on Subsidized Operations
(Supplementary to Vol. 15, No. 1, p. 16)

Name	Operation Type	Company*	Availability of Final Reports
Amadeus Basin			
Mereenie Anticline	Gravity	Magellan	27/4/63
Hale River	Gravity	Beach	12/5/63
Bonaparte Basin			
Spirit Hill	Seismic	Oil Development	8/3/63
Keep River	Seismic	A.A.O.	24/3/63
Carnarvon Basin			
Whaleback	Seismic	Wapet	9/5/63
Carpentaria Basin			
Gulf of Carpentaria	Aeromagnetic	Delhi-Santos	16/2/63
Coonamble Basin			
Narrabri-Coonamble	Seismic	Woodside	28/3/63
Drummond Basin			
Lake Galilee	Seismic	Exoil	29/4/63
Fitzroy Basin			
Hawkstone Peak	Seismic & Gravity	Wapet	8/1/63
Sisters	Seismic	A.F.O.	27/1/63
Hawkstone Peak No. 1	Stratigraphic drilling	Wapet	2/6/63
Langoora No. 1	Test drilling	Wapet	6/4/63
Napier Downs	Gravity	Oil Development	13/4/63
Great Artesian Basin			
Quilberry Creek	Seismic	Phillips	17/2/63
Mt. Jack	Seismic	Mid-Eastern	25/3/63
Dullingari No. 1	Stratigraphic drilling	Delhi	29/3/63
Penrith No. 1	Stratigraphic drilling	A.A.O.	29/3/63
Yantabulla	Aeromagnetic	Mid-Eastern	1/4/63
Lagoon Creek	Seismic	Farmout	6/4/63
Etonvale No. 1	Stratigraphic drilling	Phillips	10/4/63
Orient No. 2	Stratigraphic drilling	Smart	16/8/63
Laura Basin			
Marina No. 1	Off-structure drilling	Cabot-Blueberry	7/2/63
Murray Basin			
Balranald No. 1	Off-structure drilling	Woodside	10/1/63
Bundy Lake Boga	Seismic	Woodside	17/1/63
Magenta	Seismic	Planet	18/2/63
Loxton	Seismic & Gravity	Beach	7/3/63
Officer Basin			
Mabel Creek	Seismic	Exoil	1/3/63

* The following abbreviations are additional to those already published—
Cabot-Blueberry — Cabot Corporation and Blueberry Oil Corporation
Farmout — Farmout Drillers N.L.
Mid-Eastern — Mid-Eastern Oil N.L.

SILVER

Mine production of silver in the first half of 1962 was 8,373,817 oz. There was a substantial improvement in the rate of production in the second quarter following the resumption of full-scale production of lead and zinc at Broken Hill. Production for 1962 will be well ahead of that in recent years when reduced production reflected cuts in lead mine production.

Production of refined silver in 1962 will exceed the 7.1 million ounces recorded in 1961. However, operations at the Port Pirie lead refinery remain on a restricted basis until the end of 1962, although at a higher level than in 1961. With a return to full-scale operations in 1963 production of silver will be further increased.

The silver content of concentrates and bullion exported will be higher in 1962 than in immediately preceding years, as a substantial proportion of the increased mine production will be exported. Exports of refined silver have fallen away sharply in recent years owing to increased purchases by the Treasury.

During the third quarter of 1962 the price of silver on the London market showed a marked upturn and with minor fluctuations moved steadily from stg. 84⅜d. per oz. in mid-June to stg. 104d. per oz. in mid-October, subsequently falling to stg. 101d. per oz. on 16th November. In the same period the New York price rose from 101¼ cents per oz. to 122 cents but fell in early November to 120¼ cents. Compared with the November 1961 "fixed" price of 91 cents per oz. the rise over the 11 months represents a gain of about 35 per cent in the market valuation of refined silver.

Mocatta and Goldschmidt Limited reported a strong industrial demand for silver during August and September on the Continent and in the U.K. with a small demand for coinage and speculative purposes.

During September the rise in New York steadied as a result of sales by the Bank of Mexico to supplement normal producers sales. These sales were apparently intended to restrain the rise at a time when the silver content of Mexican coin approximated its mint value. When the Bank of Mexico ceased selling on 24th September the market reacted sharply and with little prospect of immediate Chinese sales future price increases were to be expected. However, further price rises may be expected to bring out some hoarders' stocks.

G.B.R.

TIN

Domestic mine production of tin during the second quarter of 1962 was 625 tons. Production for the first half of 1962 was 1,267 tons, compared with 2,745 tons for the whole of 1961, when the highest level of output since 1942 was achieved.

Smelter production of tin up to the end of October was 2,178 tons, representing an annual rate of just over 2,600 tons, compared with 2,546 tons recorded in 1961.

Following the commissioning of the new electrolytic tinplate plant of Australian Iron and Steel Pty. Ltd. at Port Kembla (N.S.W.) at the end of April 1962 domestic consumption of primary tin rose sharply in the second quarter of 1962; consumption for

the year is expected to exceed 4,000 tons, compared with 3,366 tons in 1961. Consumption may be expected to level out at 4,500-5,000 tons per annum within the next few years. In line with increased consumption, imports of tin have risen appreciably in recent months and are expected to reach 1,900-2,000 tons for the year.

A recent announcement by the Aberfoyle Tin Development Partnership has given plans for properties being tested by the partnership. Results to date are said to indicate that profitable tin mining operations could be established at Mt. Cleveland (Tas.) and Greenbushes (W.A.).

The company reports that diamond drilling of sulphide ore-bodies at Mt. Cleveland, near Waratah (Tas.), has indicated substantial widths of lode carrying about 1% Sn. Test boring of the alluvial prospect at the Greenbushes field in the south-west of Western Australia is reported to have indicated approximately 20 million cubic yards of ground carrying payable tin and tantalite and apparently suitable for bucket dredging.

Mine output at Aberfoyle (Tas.) will be maintained or even increased as a result of the location of additional reserves about half a mile north of the present mine and the re-treatment of 500,000-600,000 tons of accumulated coarse jig tailings. The latter will be treated in a heavy media separation plant due to be in operation in 1963.

These developments, together with planned production from the Ardlethan deposit (see Vol. 15, No. 1 of this Review), and possibly increased production from the New England area (N.S.W.) should do much within the next few years to reduce the domestic shortfall of tin, which it is estimated will be about 2,000 tons in 1963. Of the developments listed above, none are expected to make any appreciable impact on the level of production before the latter part of 1963, by which time they may serve only to offset a temporary decrease in production from the North Queensland dredges.

Towards the end of August, the United States General Services Administration announced plans for the disposal of surplus pig tin from the national stockpile during the remainder of 1962. It was announced that the surplus tin would be offered at a maximum rate of 200 tons per week through market sales on the basis of competitive bidding, utilization in foreign aid programmes and transfers to other agencies of the Government for their direct use. An average of approximately 30 tons per week would be used in foreign aid programmes and approximately 10 tons per week would be for direct use by United States Government agencies. The quantity to be actually sold on commercial markets would be reduced accordingly. It was also announced that the weekly limitation would not be cumulative as far as commercial sales were concerned, but that unsold portions might be made available in following weeks in the other two categories.

During the eight weeks from 12th September to 31st October, the G.S.A. offered for sale 1,150 tons of A grade tin, 350 tons of B grade, 50 tons of D grade and 50 tons of E grade. Bids were accepted for 450 tons of A grade, 100 tons of B grade and 20 tons of E grade.

The disposals by the G.S.A. had no visible effect on the market; however, it would appear that the intention of the Buffer Stock Manager is to hold the price, so far as he is able, at the top of the lower range, i.e. £stg.850. With spot metal readily available, and an apparent unwillingness of consumers to cover more than their immediate requirements, the L.M.E. price did drop marginally below £stg. 850 late in September. The market reacted sharply to the Cuban crisis and at the end of October the price had risen to £stg. 875. By mid-November it had firmed at £stg. 888½, but with lessening of tension over the Sino-Indian dispute the spot price drifted down to £stg. 870 late in November.

J.W.

TITANIUM

Rutile. Production of rutile concentrates from the east coast during the second quarter of 1962 was 27,804 tons, bringing production for the first half of the year to more than 54,000 tons. Recorded exports of rutile concentrates from Australia during the second quarter were 27,055 tons, valued at £884,729. Exports of rutile concentrates are expected to increase substantially in the latter half of 1962, as a result of shipments in connection with the du Pont contract. The first shipmnet of some 10,000 tons under this contract was bulk-loaded for despatch from Newcastle early in November 1962.

Long-term contracts for the supply of Australian rutile concentrates to United States pigment manufacturers continue to be announced, the latest being that between N.S.W. Rutile Mining Company Pty. Ltd. and Godfrey Cabot Corporation of Boston. This is a five-year contract and will involve the supply of 50,000 tons of rutile. It is understood that the rutile will be used in the company's new plant at Ashtabula (Ohio).

This new contract, combined with those of Rutile and Zircon Mines (Newcastle) Ltd. with E. I. du Pont de Nemours, and Associated Minerals Consolidated Ltd. with American Potash and Chemical Corporation could result in an increase in demand of up to 80,000 tons per annum by the end of 1963. This estimate takes no account of possible increased demand in the traditional outlets for rutile, viz. welding rod coatings and metal production, nor of the likelihood of at least a partial switch by other pigment manufacturers from ilmenite to rutile as the raw material for pigment production. Overall, it is not unlikely that world demand for Australian rutile will rise to about 200,000 tons per annum within the next few years. Despite the recent closing down of a limited amount of east-coast production units and the loss through deterioration of some plant which has been in operation during the best part of a decade, expansion programmes currently in hand are such that there seems little doubt that east-coast producers will be in a position to satisfy increased demand when called upon to do so.

Notwithstanding efforts by some domestic producers to stabilize rutile prices, there are indications that prices will harden appreciably in the near future. As from 1st October 1962, the conference freight rate for rutile from Australia to the United Kingdom and the Continent was increased by stg. 5/6 to stg. 131/- per ton, and it is reported that following recent meetings in Sydney domestic rutile producers have agreed on a minimum price of rutile at £39, f.o.b., to consumers buying less than 2,000 tons and £38, f.o.b., to merchants and to consumers buying 2,000 tons or more. It seems unlikely that contract prices for rutile for use in pigment manufacture will exceed £40 per ton, but it is interesting to speculate what level the price of spot material may rise to with the pressure of increased demand on the market. Indeed, it would now be difficult to predict the price ceiling of contract rutile for metal manufacture and for use in the welding rod industry, in as much as it is understood that the price of raw materials for these industries is not as crucial as for pigment manufacture.

Ilmenite. Shipments of ilmenite concentrates from Western Australia (including those for domestic consumption) were 41,013 tons in the second quarter of 1962, bringing shipments for the first half of the year to about 84,000 tons. Ilmenite shipments from Western Australia are expected to rise considerably in the second half of 1962.

Plans are in hand to expand considerably ilmenite production capacity in Western Australia during 1963. Mining and treatment facilities at the Bunbury plant of Cable (1956) Ltd. are to be extended, and Western Mineral Sands Pty. Ltd., controlled by Australian Titan Products Pty. Ltd. and Westralian Oil Ltd., is to erect a 100,000 t.p.a. ilmenite plant at Capel. It is estimated that this expansion will lift total production capacity from the present level of about 240,000 tons per annum to 375,000 tons per annum. Of this total, it is expected that about 250,000 tons per annum will be firmly contracted for.

It is reported that ilmenite exports from India, formerly one of Australia's chief competitors, have virtually ceased. It is understood that contracts covering the supply of Indian ilmenite to Glidden Corporation (U.S.A.) and to British Titan Products will not be renewed when the contracts expire in late 1963 and mid-1964 respectively. On the other hand, negotiations are in hand for the supply of ilmenite to Japanese pigment manufacturers from Ceylon; it is reported that a small shipment of ilmenite has been made to Japan by the Ceylon Mineral Sands Corporation from its plant at Pulmoddai, near Trincomalee, the first shipment made from this plant since its inauguration in 1957.

Titanium. According to Business and Defence Services Administration, production and shipments of titanium mill products in the United States are currently running at the highest level achieved. At the present rate, the peak of 5,650 short tons achieved in 1957 should be exceeded in 1962. Production and shipments of titanium mill products increased in the first half of 1962 to a total of 3,032 short tons compared with 2,666 short tons in the first half of 1961. Output of titanium ingot during the two periods was 5,318 short tons and 4,840 short tons, respectively. Shipments of titanium mill products in the first eight months of 1962 were 3,961 short tons compared with 3,510 short tons for the similar period of 1961.

Titanium continues to find increasing use in anti-corrosion equipment in the chemical industry and in aerospace fabrications. In particular, titanium tubing is finding wider applications.

J.W.

TUNGSTEN

During the second quarter of 1962, production of wolfram concentrates at Storeys Creek (Tas.) was restricted still further and total production of tungsten concentrates for the quarter was only 350 tons — 229 tons of scheelite concentrates and 121 tons of wolfram concentrates. Virtually all production of scheelite was from King Island, although the shipment of a small parcel of some 7 tons of scheelite concentrates from the North Coolgardie mineral field in Western Australia was finalized during the quarter. Production of wolfram concentrates consisted of 69 tons from Storeys Creek and 52 tons from Aberfoyle.

Recorded exports of tungsten concentrates during the second quarter of 1962 were 350 tons, valued at £148,389, and consisted of 195 tons of scheelite concentrates (£81,050) and 155 tons of wolfram concentrates (£67,339).

In common with most non-Communist producers, the Australian industry has been producing concentrates at a cost above recent world prices. With the expiration of contracts, and with no indications of any worthwhile improvement in the tungsten market some domestic producers have resorted to reduced production or stockpiling.

Overseas, the price of tungsten ore, which fell to a twenty-year low of stg. 57/6-60/- per long ton unit, c.i.f. Europe, early in August 1962, has recovered somewhat in recent months and at the end of October was quoted at stg. 75/- - 85/-. Subsequently, there was some weakening of the upper limit of the range which had receded to stg. 75/- - 83/- by mid-November. At this time, Korean scheelite, c.i.f. Europe, was quoted at stg. 75/- per long ton unit. There was a transient recovery in the market under pressure from the Cuban crisis and some limited business for top quality ore was reported at stg. 90/-. Nevertheless, Chinese material is still being offered at stg. 7/6 per long ton unit under the lower limit of the price range and with Russian contracts in force, there is only limited demand for Western ore. Most of the current demand for Western ore stems from the need by consumers to blend in ferberite ore to offset the relatively high manganese content of the Russian hubnerite ore.

J.W.

ZINC

Mine production of zinc (zinc content of zinc concentrates) in 1962 is expected to be close to 300,000 tons, which would be above the 1957 record level of 292,000 tons; production in the ten months ending October was 259,119 tons. A further increase in mine production is likely in 1963.

Refined zinc production was 139,148 tons in the January-October period and is likely to exceed 160,000 tons for the full year, which would also be a new record; a further increase in production to 170,000 tons is likely in 1963.

Consumption of refined zinc in 1962 has been running at a slightly higher level than in 1961 and should again rise above 80,000 tons. With the very substantial increase in production the export availability of zinc metal has also increased. Actual shipments of refined zinc in the first ten months of 1962 were 70,465 tons, compared with the 1961 record level of exports of 46,500 tons; exports of zinc in zinc concentrates in the same period amounted to 114,006 tons.

The domestic price for refined zinc continues unchanged at £100 per ton, f.o.b. Risdon, and £98¾ per ton, f.o.r. Cockle Creek. After falling to £stg. 62⅜ per ton in August the price of zinc on the London Metal Exchange has firmed in recent months and at the end of November stood at £stg. 68¾ per ton. In the United States the domestic producers' official quotation for prime western grade was unchanged at 11.50 cents per lb. from the beginning of April to the end of November. The improvement in the L.M.E. price follows some easing of pressure on L.M.E. stocks and the continued good demand for higher grades; stocks on the Continent, however, continue to be somewhat higher than in recent months. In the United States there has been a strong demand for special high grade zinc for die-casting and some improvement in demand for prime western; overall the immediate outlook is for the price to remain at about recent levels.

At the Sixth Session of the International Lead and Zinc Study Group, held in Geneva in October, no proposals were considered for curtailments of zinc production in 1963.

The Study Group indicated that mine and metal production and also consumption were expected to be at new record levels in 1962; however, a small statistical surplus was predicted for the second half of 1962. The forecast for the first half of 1963 showed little change in the situation. As mentioned in the Lead chapter interested Governments have been asked to forward their views on the principles and objectives of a commodity agreement for consideration of the Special Working Group which will meet in March 1962.

J.W.M.

ZIRCONIUM

During the second quarter of 1962 production of zircon concentrates from the east coast was 31,851 tons, and 774 tons of zircon concentrates were shipped from Western Australia; total production for the half year was 67,341 tons. Exports of zircon concentrates during the second quarter were 36,725 tons, valued at £451,074. Recorded exports of zircon concentrates for the first half of the year were about 69,000 tons, and it seems likely that exports in 1962 will at least reach the record level of 140,333 tons achieved in 1961.

Notwithstanding the large increase in rutile production which will result from increased demand by the pigment industry, no excessive increase in output of zircon is expected at least in the short term. Production of zircon from stockpiled material has virtually ceased and it is felt that in meeting commitments to the pigment industry emphasis in plant expansion will be on increased rutile production. There will of course be some increased zircon production from ilmenite operations in Western Australia, both from the reworking of zircon dumps and from plant installed to treat secondary minerals.

Despite predictions from some quarters of oversupply, the market for zircon remains buoyant and it is encouraging to note the apparent ease with which world demand is absorbing the current high level of output. The price of standard grade zircon concentrates is being maintained at the very satisfactory level of about £12 per ton.

It is reported that domestic producers have agreed to maintain production of zircon at a level commensurate with world demand. Concentrates are now standardized into two distinct grades — a standard grade containing a minimum of 98% zircon (65.2% ZrO_2) and a maximum of 0.3% TiO_2 and a premium grade, minimum 66% ZrO_2 and a maximum of 0.1% TiO_2 and 0.05% Fe_2O_3. Minimum prices for the standard and premium grades have been fixed at £12 per ton, f.o.b., and £14 per ton, f.o.b., respectively.

J.W.

METAL AND MINERAL PRICES

MONTHLY AVERAGE BASE METAL PRICES

		COPPER	LEAD	ZINC	TIN
Australia (per long ton)	Sept.	£305	£75	£100	£1107/1/-
	Oct.	£305	£75	£100	£1104/13/1
	Nov.	£305	£75	£100	£1118/11/10
U.K. (stg. per long ton)	Sept.	£234/2/8	£51/18/-	£64/1/9	£851/6/-
	Oct.	£234/5/-	£52/19/1	£66/0/7	£855/13/11
	Nov.	£234/2/6	£54/ 5/8	£68/8/10	£873/10/8
U.S.A. (cents per lb.)	Sept.	31.00	9.50	11.50	108.480
	Oct.	31.00	9.50	11.50	108.750
	Nov.	31.00	9.951	11.50	110.868

MAXIMUM AND MINIMUM BASE METAL PRICES, 1st SEPT.-31st NOV. 1962

		COPPER	LEAD	ZINC	TIN
Australia (per long ton)	Max.	£305	£75	£100	£1128
	Min.	£305	£75	£100	£1094
U.K. (stg., per long ton)	Max.	£235/12/6	£56/12/6	£70/6/3	£888/10/-
	Min.	£234/2/6	£50/ 6/3	£63/16/3	£849/15/-
U.S.A. (cents per lb.)	Max.	31.00	10	11.50	112.000
	Min.	31.00	9.50	11.50	107.375

METAL PRICES AS AT 3rd DECEMBER 1962

	Australia (per long ton) (a)	U.K. (stg., per long ton) (a)	U.S.A. (U.S. cents per lb.) (a)
Aluminium	(b) £271 (c) £225/18/- (d) £257/10/-	£180	22.50 (e) 22.50
Antimony	(f) £290	£237/10/-	32.50
Bismuth	£1/10/3 per lb.	16/- per lb.	$2.25
Cadmium	16/10 per lb.	13/6 per lb.	$1.70-1.80
Cobalt	—	12/- per lb.	$1.50
Copper	(g) £305	£234/2/6	31.0
Gold	£15/12/6 per fine oz.	£12/10/3¼ per fine oz.	$35 per fine oz.
Lead	(h) £80	£56/6/3	10.00
Mercury	—	£61/10/- per flask	$192-193 per flask
Nickel	(i) 7/7 per lb.	£642	(j) 79.00
Pig iron	(k) £21/3/-	(l) £22/1/-	(m) $63.00 per ton
Platinum	—	(n) £30/5/- per fine oz.	$80-85 per fine oz.
Silver	10/9¼ per fine oz.	8/7 per fine oz.	119 c. per fine oz.
Tin	£1,118	£868/5/-	110.500
Zinc	(o) £98/15/- (p) £100	(q) £66/13/9	(r) 11.50

(a) Unless otherwise stated. (b) Domestic, 1-20K ingots, 99.5%, c.i.f. capital cities. (c) Imported, c.i.f. capital cities. (d) Australian weighted average price on import licensing basis, current ratio being 70.30, local to imported ingot. (e) Canadian export price, delivered U.S. buyer, U.S. currency. (f) 1 tons lots, delivered capital cities. (g) Electrolytic, ex smelter, Port Kembla. (m) F.o.b., Port Pirie. (i) Lots over 1 ton, ex Sydney. (j) Ex refinery, Port Colborne, Canada, including 1.25 cents U.S. import duty, U.S. currency. (k) Basic price State capitals. (l) Basic price, Birmingham. (m) Basic price, Cleveland. (n) U.K. and Empire refined, c.i.f. (o) G.o.b., f.o.r. Cockle Creek. (p) Electrolytic, f.o.b., Risdon. (q) G.o.b. (r) Prime Western.

ORE AND CONCENTRATE PRICES AS AT 3rd DECEMBER 1962

	Australia	U.K. (stg.)	U.S.A.
Antimony—ore	Nominal	26/- - 28/- per unit contained metal, 60% Sb min., c.i.f.	$4.00-4.25 per s.t.u. contained metal, 60% Sb min., c.i.f.
Beryllium—beryl	Nominal	190/- - 200/- per unit of ore, 10% BeO, f.o.b.	$29-32 per s.t.u. of ore, 10-12% BeO, imported, c.i.f.
Bismuth—ore		8/6 per lb contained metal, 65% Bi min., c.i.f.	
Chromium—chromite	Nominal	£15/5/- per ton, 48% Rhodesian ore, 3:1 ratio, c.i.f.	$35.75-36.25 per long ton, nom. 48% Rhodesian ore, 3:1 ratio, f.o.b. cars N.Y.
Columbium—columbite		135/- - 145/- per unit 65% combined oxides, 10:1 ratio, c.i.f.	$0.90-1.00 per lb., 65% combined oxides, 10:1 ratio, c.i.f. U.S. ports.
Manganese—ore	£30 per ton 75% MnO_2, f.o.b. N.S.W. railway siding. £35 per ton, 75-80% MnO_2 Queensland ore, c.i.f. Sydney.	5/4 - 5/6 per unit contained metal, 46-48% Mn. c.i.f. European ports.	$0.80-0.85 per l.t.u. contained metal, 46-48% Mn. c.i.f. U.S. ports. Import duty extra.
Molybdenum—molybdenite	Nominal	10/- per lb. contained metal, 85% MoS_2, f.o.b. Climax, Colorado.	$1.40 per lb. contained metal, 95% MoS_2, f.o.b. Climax, Colorado.
Tantalum—tantalite	Nominal	£44-52 per unit, 60% Ta_2O_5, c.i.f.	
Tin—cassiterite	£9/10/- per unit contained metal, delivered Sydney.		
Titanium—ilmenite	£4 per ton, nom., 52-54% TiO_2 cons. f.o.b., Bunbury.	£7-7/5/- per ton, Malayan 52-54% TiO_2 cons., c.i.f.	$21-21.50 per long ton, 54% TiO_2 cons., f.o.b. cars Atlantic ports.
rutile	£35-36 per ton, nominal, f.o.b.	£37 per ton, Australian 95-97% TiO_2 cons., c.i.f.	$102 per short ton of 94% TiO_2 cons., delivered within 12 months.
Tungsten—wolfram	77/6-90/- per unit of 65% WO_3.	66/- - 76/- per unit, 65% WO_3, c.i.f. Europe.	$8.50-9.50 per s.t.u. 65% WO_3, c.i.f. Import duty $7.93 per s.t.u. extra.
scheelite	do	66/- per unit, Korean c.i.f. Europe.	do
Zirconium—zircon	£12 per ton standard grade, min. 65.2% ZrO_2 cons. £14 per ton premium grade, min. 66% ZrO_2 cons.	£15/10/- - 17 per ton of 66-67% ZrO_2 cons., c.i.f.	$50 per long ton, 65% ZrO_2 cons., c.i.f. Atlantic ports.

Commonwealth Bureau of Census and Statistics,
Canberra, Australia

THE
AUSTRALIAN MINERAL INDUSTRY

VOL. 15, No. 2

PART 2 — QUARTERLY STATISTICS

QUARTER ENDED 30th JUNE, 1962

Prepared under instructions from the Right Honourable the Treasurer
by

K. M. ARCHER
Commonwealth Statistician

PREFACE

Statistics included in this Part relate to Australian production of and oversea trade in minerals and mineral products. In the main, the data relating to mineral production consist of official statistics of Mines Departments of the several States and the Northern Territory Mines Branch. These statistics have been supplemented as necessary by data obtained from the Bureau of Mineral Resources, including information collected by that Bureau from mines and treatment plants.

The fundamental provision of the uniform plan evolved in 1950 for standardization of Australian mineral production statistics is that quantities and values of individual minerals produced should be reported in terms of the products in the form in which they are dispatched from the locality of each mine. This involves the inclusion in the mining industry of ore-dressing and elementary smelting of metallic minerals (e.g. ,in the case of gold) and miscellaneous treatment of non-metallic minerals where these operations are carried out in an associated plant at or near the 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.

The particulars of quantities of minerals produced shown in Table 4 have been compiled on this basis as far as practicable. This has involved some re-arrangement of official statistics published by Mines Departments for certain States. Actual output of the mineral product (as defined in the preceding paragraph) has generally been reported, but in some cases it has been necessary to include dispatches from the mine (or sales) as distinct from production in deriving the total for Australia. In addition to the basic quantity data, particulars of contents of metallic minerals have been shown in detail in Tables 4 and 5 and in summary form in Table 6. In general, the particulars of content of metallic minerals represent total contents (as determined by assay) for each metal which is a "pay metal" or "refiners' prize" when present in the particular mineral. The data in Table 4 exclude construction materials (sand, gravel, building stone, etc.), and some particulars for non-metallic minerals which are not at present available. In Table 6 particulars of producing States as well as totals for Australia are shown.

Principally because of time lags in treatment of a number of important metallic minerals, it has been found impracticable, under Australian conditions, to obtain satisfactory information as to the value of minerals produced, on a **quarterly basis.** Statistics of (i) value of output and of production of the mining and quarrying industries (ii) value of individual minerals produced, (iii) value of imports and of exports of principal minerals and mineral products on a **calendar year basis,** and (iv) value of smelter and refinery production on a **fiscal year basis,** appear as a supplement to the first issue of this Bulletin each year.

In the presentation of the tables the following terms and symbols have been used:

ton: long ton of 2,240 lb.
short ton: ton of 2,000 lb.
unit: 22.4 lb.
* subject to revision.

(—): nil
(. .): less than half the unit shown.
(n.a.): not available.
(†): estimated or partly estimated.

All tables in this publication omit particulars relating to uranium bearing minerals.

I extend my thanks to State Departments of Mines, Statisticians of the several States, and the Bureau of Mineral Resources who have supplied information used in the preparation of this Bulletin.

K. M. ARCHER,
Commonwealth Statistician

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I. SUMMARY TABLES

TABLE 1 — MINE PRODUCTION OF PRINCIPAL MINERALS: AUSTRALIA

Mineral	Unit of Quantity	1958	1959	1960	1961*	1962* Apr.-June	1962* Jan.-June
Metallic contents—							
Copper	ton	75,715	94,950	109,435	95,690	26,304	50,580
Lead	,,	328,347	316,293	308,163	269,656	101,958	174,504
Zinc	,,	293,763	275,547	317,408	311,171	88,843	160,585
Tin	,,	2,237	2,351	2,202	2,745	625	1,268
Gold	'000 f. oz.	1,104	1,085	1,087	1,069	256	509
Silver	,,	16,340	15,161	15,216	13,062	4,713	8,374
Iron (a)	'000 tons	†2,539	†2,700	†2,814	†3,434	†833	†1,613
Manganese ore—							
Metallurgical (Mn. content)	ton	25,623	40,966	28,585	40,240	10,326	20,970
Battery and other (MnO_2 content)	ton	2,819	2,475	1,617	1,104	337	496
Rutile (TiO_2 content)	,,	80,955	79,624	86,015	98,217	26,991	52,792
Ilmenite (TiO_2 content)	,,	38,278	45,677	58,729	92,898	23,209	47,487
Tungsten concentrates (WO_3 content)	ton	850	653	1,111	1,536	250	521
Black coal	'000 tons	20,442	20,298	22,569	23,979	5,834	11,406
Brown coal	,,	11,644	13,035	14,967	16,280	4,381	8,321

(a) Excludes iron content of iron oxide not intended for metal extraction.

TABLE 2 — SMELTER AND REFINERY PRODUCTION OF PRINCIPAL METALS: AUSTRALIA

(Excludes secondary metal (i.e., metal recovered from scrap) unless otherwise specified).

Metal	Unit of Quantity	1958	1959	1960	1961*	1962* Apr.-June	1962* Jan.-June
Aluminium (refined)	ton	10,869	11,370	11,655	13,294	n.a.	n.a.
Cadmium (refined)	,,	353	341	300	311	93	176
Copper (blister) (a)	,,	64,608	68,494	71,037	62,497	22,022	37,710
Copper (refined)	,,	43,276	51,593	70,652	63,723	18,099	33,025
Gold (refined)—							
Australian origin	'000 f. oz.	1,070	1,067	1,045	1,037	281	525
Total	,,	1,207	1,209	1,188	1,193	320	596
Lead—							
Refined (b)	ton	191,474	185,805	189,823	162,264	51,477	92,269
Lead cont. of lead-silver bullion for export	ton	57,171	50,310	52,723	48,090	16,178	33,761
Total	,,	248,645	236,115	242,546	210,354	67,655	126,030
Pig iron (c)	'000 tons	2,279	2,507	2,882	3,159	870	1,740
Steel ingots (c)	,,	3,133	3,395	3,687	3,873	1,040	2,033
Silver (refined)	'000 f. oz.	9,101	7,805	8,085	7,099	1,739	3,201
Tin (refined)	ton	2,121	2,226	2,254	2,546	566	1,207
Zinc (refined slab) (d)	,,	114,773	116,461	120,230	138,694	42,418	78,716

(a) Total production for refining in Australia and overseas. (b) Includes lead content of antimonial lead. (c) Includes recovery from scrap. (d) Includes small quantities of metal recovered from zinc dust used in works.

Note: Particulars of refined aluminium, cadmium, copper, lead, silver, tin and zinc in Table 2 were collected by the Bureau of Mineral Resources.

TABLE 3 — SUMMARY OF PRODUCTION, IMPORTS AND EXPORTS OF PRINCIPAL MINERALS AND MINERAL PRODUCTS: AUSTRALIA

(Note: Particulars of production of refined metals exclude secondary metal (i.e., metal recovered from scrap) unless otherwise specified)

Particulars	1958	1959	1960	1961*	1962* Apr.-June	1962* Jan.-June
ALUMINIUM (Tons)						
Production—						
Bauxite (Al_2O_3 content)	3,533	6,914	†31,393	†11,964	1,071	2,805
Alumina	22,490	26,900	29,801	29,468	n.a.	n.a.
Refined aluminium	10,869	11,370	11,655	13,204	n.a.	n.a.
Imports—						
Bauxite (Al_2O_3 content)	†38,419	†36,910	†53,199	†28,645	†11,697	†24,858
Refined aluminium (a)						
Ingots	14,813	19,268	26,432	16,141	7,900	12,407
Rolled, drawn and extruded shapes (b)	2,827	2,719	6,259	2,282	593	1,273
Foil	2,409	2,788	3,909	2,002	544	1,050
Powder	486	670	678	396	61	128
Exports—						
Bauxite (Al_2O_3 content)	—	—	†13,400	†13,720	—	—
Refined aluminium (a)—						
Ingots	—	78	20	7	12	16
Rolled, drawn and extruded shapes (b)	135	162	282	325	50	88
COPPER (Tons)						
Production—						
Copper cont. of minerals produced	75,715	94,950	109,435	95,690	26,304	50,580
Blister copper (c)	64,608	68,494	71,037	62,497	22,022	37,710
Refined copper	43,276	51,593	70,652	63,723	18,099	†3,025
Imports of refined copper—						
Ingots	659	3,470	4,750	3,761	195	4,409
Rolled, drawn and extruded shapes (b)	2,289	1,189	2,445	2,939	341	1,879
Exports—						
Copper cont. of ores concentrates, matte, etc.	7,272	20,095	36,210	28,012	7,167	15,143
Blister copper	14,421	16,225	502	1,022	—	—
Refined copper—						
Ingots	—	2,749	13,577	23,073	999	4,096
Rolled, drawn and extruded shapes (b)	1,365	1,011	2,051	2,029	940	1,899
GOLD (Fine oz.)						
Production—						
Gold content of minerals produced	1,103,980	1,085,104	1,086,709	1,068,690	255,920	509,099
Refined gold—						
Australian origin	1,069,774	1,067,129	1,045,139	1,036,947	281,425	524,970
Overseas origin	136,998	141,624	142,526	155,598	38,997	71,346
Total refined gold	1,206,772	1,208,753	1,187,665	1,192,545	320,422	596,316
Imports—						
Bullion, other crude forms	160,232	136,674	144,029	146,420	48,971	69,944
Refined gold	—	—	4	3	1	1
Exports—						
Gold content of ores & concentrates	22,453	17,941	25,803	39,377	8,818	19,550
Bullion, other crude forms	—	—	323	—	—	—
Refined gold	128,550	128,052	2,513,583	1,099,701	2,821	116,322
Net industrial consumption	37,568	33,938	40,972	40,103	12,057	23,159
Change in stocks of gold held in Australia (d)	+1,075,641	+1,041,847	−1,349,939	−35,932	+281,196	+420,013

(a) Includes aluminium-base alloys. (b) Excludes wire. (c) Total production for refining in Australia and overseas. (d) Excludes specie; includes gold content of change in stocks of minerals awaiting refining.

TABLE 3 — SUMMARY OF PRODUCTION, IMPORTS AND EXPORTS OF PRINCIPAL MINERALS AND MINERAL PRODUCTS: AUSTRALIA — (Continued)

Particulars	1958	1959	1960	1961*	1962* Apr.-June	1962* Jan.-June
IRON AND STEEL (Tons)						
Production—						
Iron content of iron ore (a)	†2,539,197	†2,699,615	†2,813,955	†3,433,976	†832,620	†1,612,700
Pig iron (b)	2,279,282	2,506,514	2,881,951	3,159,393	869,695	1,739,941
Ingot steel (b)	3,133,081	3,395,261	3,687,183	3,872,682	1,039,970	2,032,976
Blooms and slabs	2,668,571	2,910,865	3,186,129	3,282,782	859,283	1,719,339
Tinplate	69,066	80,256	101,624	101,594	36,733	66,192
Imports—						
Iron content of iron ore	†162,886	†144,047	†153,176	†148,732	†38,012	†69,432
Ferro-alloys	13,335	23,989	41,612	55,959	3,625	11,284
Tinplate	66,059	50,348	63,741	38,355	5,656	17,298
Exports—						
Pig iron	19,321	44,038	97,847	296,050	33,339	77,558
Ingots, blooms and slabs	728	12,061	9,619	86,869	12,886	71,163
Tinplate	n.a.	1,671	8,080	16,644	6,353	9,269
Scrap	156,978	182,985	205,747	223,320	49,689	72,927
LEAD (Tons)						
Production—						
Lead content of minerals produced	328,347	316,293	308,163	269,656	101,958	174,504
Smelter production—						
Refined lead (c)	191,474	185,805	189,823	162,264	51,477	92,269
Lead cont. of lead-silver bullion for export	57,171	50,310	52,723	48,090	16,178	33,761
Total lead cont.	248,645	236,115	242,546	210,354	67,655	126,030
Exports—						
Lead content of ores, concentrates, etc.	64,606	67,692	54,927	61,813	20,223	29,171
Lead content of lead-silver bullion	57,661	52,650	49,305	45,767	10,784	16,937
Refined lead						
Pigs	155,730	138,448	125,265	145,174	67,417	116,728
Rolled and extruded shapes (except wire, leaf and foil)	99	86	93	130	203	211
Antimonial lead	109	597	503	676	282	585
Scrap	5,152	1,390	891	100	—	—
MANGANESE ORE (Tons)						
Production—						
Metallurgical grade ore	55,536	86,556	58,292	86,452	21,676	43,219
Battery (incl. other) grade ore	4,147	3,415	2,354	1,572	523	749
Imports—						
Metallurgical grade ore	5	3	51	250	2,142	10,901
Battery grade ore	1,183	1,304	177	2,379	30	40
Exports—						
All grades of ore	18,399	31,812	45,639	52,283	19,863	51,897

(a) Excludes iron content of iron oxide not intended for metal extraction. (b) Includes recovery from scrap. (c) Includes lead content of antimonial lead.

TABLE 3 — SUMMARY OF PRODUCTION, IMPORTS AND EXPORTS OF PRINCIPAL MINERALS AND MINERAL PRODUCTS: AUSTRALIA — (Continued)

Particulars	1958	1959	1960	1961*	1962* Apr.-June	1962* Jan.-June
SILVER ('000 fine oz.)						
Production—						
Silver content of minerals produced	16,340	15,161	15,216	13,062	4,713	8,374
Refined silver	9,101	7,805	8,085	7,099	1,739	3,201
Imports—						
Bullion and other crude forms	75	78	69	70	23	34
Exports—						
Silver content of ores and concentrates	2,564	2,366	2,429	2,867	784	1,298
Silver content of lead-silver bullion produced for export	4,696	4,242	3,972	3,594	762	1,870
Refined silver	4,876	3,001	2,800	1,055	101	272
TIN (Tons)						
Production—						
Tin content of minerals produced	2,237	2,351	2,202	2,745	625	1,268
Refined tin	2,121	2,226	2,254	2,546	566	1,207
Imports—						
Refined tin, excl. leaf and foil	1,070	1,294	1,708	778	708	986
Exports—						
Tin content of ores, concentrates, etc.	29	43	2	178	6	11
Refined tin, excl. leaf and foil	11	9	14	1	—	—
TITANIUM (in terms of TiO_2) (Tons)						
Ilmenite—						
Production	38,278	45,677	58,729	92,898	23,209	47,487
Exports	†30,717	†37,468	†41,463	†79,083	†26,112	†35,065
Rutile—						
Production	80,955	79,624	86,015	98,217	26,991	52,792
Exports	†73,462	†78,688	†91,082	†96,668	†26,243	†51,049
TUNGSTEN (WO_3 content) (Tons)						
Scheelite—						
Production	478	. .	291	709	162	323
Exports	341	103	351	701	137	305
Wolfram—						
Production	372	653	820	827	88	198
Exports	319	717	655	761	114	265
ZINC (Tons)						
Production—						
Zinc content of minerals produced	293,763	275,547	317,408	311,171	88,843	160,585
Refined slab zinc (a)	114,773	116,461	120,230	138,694	42,418	78,716
Exports—						
Zinc content of ores, concentrates, etc.	146,234	114,124	178,091	155,289	35,541	70,725
Refined zinc—						
Ingots and other refinery shapes	37,938	41,606	27,443	46,472	21,112	45,345
Plates, sheets, circles and strips	1,090	1,096	1,148	1,416	232	474
Scrap	269	344	1,183	554	—	85

(a) Includes small quantities of metal recovered from zinc dust used in works.

TABLE 3 — SUMMARY OF PRODUCTION, IMPORTS AND EXPORTS OF PRINCIPAL MINERALS AND MINERAL PRODUCTS: AUSTRALIA — (Continued)

Particulars	1958	1959	1960	1961*	1962* Apr.-June	1962* Jan.-June
COAL ('000 Tons)						
Production—						
Black coal—						
Semi-anthracite	57	54	50	57	16	29
Bituminous	18,616	18,576	20,641	21,958	5,230	10,273
Sub-bituminous	1,769	1,668	1,878	1,964	588	1,104
Total black coal	20,442	20,298	22,569	23,979	5,834	11,406
Underground	18,377	18,593	20,408	21,152	5,035	9,857
Open cut	2,065	1,705	2,161	2,827	799	1,549
Brown coal (lignite)	11,644	13,035	14,967	16,280	4,381	8,321
Imports—						
Coal	6	8	5	8	3	3
Coke (incl. petroleum coke)	9	7	12	. .	—	. .
Exports—						
Coal	824	794	1,577	2,850	910	1,636
Coke	52	21	95	98	2	32
SULPHURIC ACID AND SULPHUR (Tons)						
Production of sulphuric acid (mono-tons)	1,009,064	1,000,458	1,109,751	1,137,501	324,634	629,937
Sulphur in sulphuric acid (mono-) from—						
Sulphur (elemental)	162,881	153,195	179,752	182,554	55,509	107,781
Zinc concentrate	38,524	39,933	42,946	52,423	16,432	31,583
Lead concentrate	21,339	19,619	21,573	22,440	5,146	9,612
Pyrite	99,216	103,596	104,406	100,520	25,946	50,186
Spent oxide	4,301	3,655	3,814	2,277	620	1,323
Other materials	3,702	7,151	10,396	11,749	2,502	5,504
Total sulphur cont.	329,963	327,149	362,887	371,963	106,155	205,989
Imports—						
Sulphur (elemental)	202,421	170,770	221,778	182,052	35,610	90,703
ASBESTOS (Short tons of 2,000 lb.)						
Production—						
Chrysotile	2,255	1,433	1,141	969	202	382
Crocidolite	13,313	16,442	14,472	15,777	3,707	7,195
Imports—						
Chrysotile	23,408	24,316	28,832	27,210	5,231	12,997
Crocidolite	311	328	74	84	3	8
Amosite	13,984	12,019	10,138	8,705	1,046	2,658
Other	1,185	1,667	1,958	902	524	646
Exports—						
Chrysotile	264	197	25	6	—	—
Crocidolite	10,049	12,684	8,177	7,981	3,942	4,952
Other	120	93	97	73	6	6

II. DETAILED TABLES

TABLE 4 — QUANTITIES AND CONTENTS (OR GRADE) OF MINERALS PRODUCED: AUSTRALIA

Mineral	Unit of Quantity	1958	1959	1960	1961*	1962* Apr.-June	1962* Jan.-June
METALLIC MINERALS							
Antimony ore	ton	54	3	6	2	. .	. .
Antimony content	,,	31	2	3	1	. .	. .
Antimony concentrate	,,	1,062	1,019	250	188	—	94
Antimony content	,,	661	626	151	116	—	62
Bauxite	,,	6,909	14,985	69,435	25,976	2,506	6,047
Al_2O_3 content	,,	3,533	6,914	†31,393	†11,964	1,071	2,805
Beryllium ore	,,	247	317	190	306	99	117
BeO content	unit	2,900	3,587	2,221	3,585	1,144	†1,364
Bismuth concentrate	lb.	3,310	—	—	911	181	181
Bismuth content	,,	2,328	—	—	602	97	97
Chromite	ton	776	120	529	—	—	—
Cr_2O_3 content	,,	†386	†60	†265	—	—	—
Copper ore (a)	,,	58,109	77,738	68,321	77,198	6,894	14,026
Copper content	,,	3,897	4,420	3,702	4,633	423	758
Gold content	f. oz.	37	2	—	153	86	118
Silver content	,,	1,037	198	18	9,733	4,548	6,509
Copper concentrate	ton	279,976	358,774	432,726	373,381	100,090	194,513
Copper content	,,	66,219	85,165	100,667	86,398	24,257	46,968
Gold content	f. oz.	77,506	97,660	88,334	78,774	20,754	33,505
Silver content	,,	411,304	579,004	712,940	657,503	248,467	422,446
Copper precipitate	ton	1,536	1,379	1,301	816	69	73
Copper content	,,	998	935	915	525	53	55
Gold content	f. oz.	310	—	—	—	195	195
Silver content	,,	38	—	—	—	16	16
Gold concentrate	ton	1,855	1,487	75	249	85	85
Gold content	f. oz.	4,109	3,534	493	1,645	455	455
Silver content	,,	492	4	453	1,111	786	786
Copper content	ton	. .	—	5	36	15	15
Gold other forms (b)	oz.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Gold content	f. oz.	995,925	959,413	971,988	960,196	225,225	457,752
Silver content	,,	196,778	194,601	206,702	220,671	49,315	103,774
Ilmenite concentrate	ton	69,948	83,577	106,586	167,374	42,092	85,940
TiO_2 content	,,	38,278	45,677	58,729	92,898	23,209	47,487
Iron ore (c)	,,	3,917,424	4,140,693	4,355,464	5,342,041	1,295,742	2,495,591
Iron content	,,	†2,539,197	†2,699,615	†2,813,955	†3,433,976	†832,620	†1,612,700
Iron oxide							
For gas purification	ton	2,864	4,355	2,970	1,255	206	336
For cement manufacture	ton	6,093	9,485	15,776	21,977	3,200	7,898
For coal washing	,,	25	30	386	1,260	—	—
For fluxing	,,	8,100	9,600	9,600	8,850	†2,000	†4,000
Lead ore (d)	,,	21,854	12,693	13,716	7,652	3,000	6,320
Lead content	,,	2,301	1,115	1,300	739	150	332
Zinc content	,,	20	—	—	—	—	—
Silver content	f. oz.	94,757	36,611	52,864	31,099	6,195	18,547
Gold content	,,	15	—	—	—	—	—
Lead concentrate	ton	492,908	461,055	449,590	382,292	144,057	246,308
Lead content	,,	316,048	306,395	297,868	259,010	98,820	168,467
Silver content	f. oz.	14,200,130	13,073,288	12,861,302	10,663,468	3,979,227	7,001,807
Gold content	,,	11,590	12,065	11,076	10,977	3,242	5,986
Antimony content	ton	664	652	632	563	229	375
Cadmium content	,,	74	72	68	55	19	32
Copper content	,,	3,270	3,320	2,810	2,646	1,128	1,977
Zinc content	,,	30,719	26,414	27,184	22,962	8,799	14,934
Sulphur content	,,	51,939	50,468	49,102	45,282	17,118	28,738
Lead-copper concentrate	,,	7,630	6,010	6,797	8,057	3,025	5,628
Lead content	,,	2,843	2,521	2,204	2,733	1,134	2,109
Copper content	,,	666	487	598	731	248	470
Silver content	f. oz.	761,360	671,412	716,940	799,031	250,319	484,068
Gold content	,,	10,091	8,436	10,978	12,572	4,863	8,924
Sulphur content	ton	1,068	941	952	2,135	691	1,365
Lithium	,,	—	—	15	24	—	0
Lithium Oxide content	,,	—	—	1	2	—	1

(a) Includes cupreous ore for fertilizer. (b) Bullion, alluvial, retorted gold, etc. (c) Iron oxide for metal extraction. (d) Includes lead-silver and lead-zinc ores.

TABLE 4 — QUANTITIES AND CONTENTS (OR GRADE) OF MINERALS PRODUCED: AUSTRALIA—(Continued)

Mineral	Unit of Quantity	1958	1959	1960	1961*	1962* Apr.-June	1962* Jan.-June
METALLIC MINERALS—(Continued)							
Manganese ore—							
Metallurgical grade	ton	55,536	86,556	58,292	86,452	21,676	43,219
Manganese content	,,	25,623	40,966	28,585	40,240	10,326	20,970
Battery grade	,,	974	1,409	849	1,169	211	437
MnO_2 content	,,	706	1,060	625	836	149	308
Other grades	,,	3,173	2,006	1,505	403	312	312
MnO_2 content	,,	2,113	1,415	992	268	188	188
Molybdenite concentrate	lb.	10,080	—	—	2,972	—	2,240
MoS_2 content	,,	†8,568	—	—	†2,630	—	†1,904
Monazite concentrate	ton	454	358	362	1,642	200	529
Monazite content	,,	423	331	344	1,553	190	503
Osmiridium, native	oz.	42	3	—	—	—	—
Platinum concentrate	,,	28	—	7	3	—	—
Platinum content	,,	22	—	4	2	—	—
Osmiridium content	,,	1	—	—	—	—	—
Pyrite concentrate	ton	226,744	223,004	238,630	213,423	44,885	85,829
Sulphur content	,,	108,636	106,881	114,549	102,149	21,699	40,022
Gold content	f. oz.	(a)	(a)	(a)	(a)	(a)	(a)
Rutile concentrate	ton	83,328	81,905	88,637	101,428	27,879	54,678
TiO_2 content	,,	80,955	79,624	86,015	98,217	26,991	52,792
Silver ore	ton	19	25	15	—	—	—
Silver content	f. oz.	35,242	29,175	16,919	—	—	—
Tantalite-columbite concentrate	lb.	13,507	18,950	23,677	31,808	10,909	17,315
Ta_2O_5 + Nb_2O_5 content	,,	6,736	8,499	11,500	13,814	5,066	7,450
Tin concentrate	ton	3,128	3,304	3,099	3,870	889	1,799
Tin content	,,	2,237	2,351	2,202	2,745	625	1,268
Tungsten concentrates—							
Scheelite	ton	733	1	420	1,017	229	459
WO_3 content	,,	478	. .	291	709	162	323
Wolfram	,,	517	903	1,131	1,142	121	279
WO_3 content	,,	372	653	820	827	88	198
Zinc ore, for fertilizer	ton	—	—	219	70	70	70
Zinc content	,,	—	—	35	12	12	12
Zinc concentrate	,,	503,752	473,276	549,000	542,640	150,273	272,769
Zinc content	,,	263,024	249,133	290,189	288,197	79,642	145,249
Lead content	,,	7,155	6,262	6,791	7,174	1,854	3,596
Silver content	f. oz.	638,674	576,338	647,818	678,933	174,257	335,864
Gold content	,,	4,487	3,994	3,840	4,373	1,100	2,164
Cadmium content	ton	798	788	881	852	245	428
Cobalt content	,,	71	60	65	65	18	31
Copper content	,,	695	623	738	721	180	537
Manganese content	,,	5,680	5,763	5,379	4,292	1,238	2,127
Sulphur content	,,	160,976	152,355	175,397	175,299	48,520	88,098
Zircon concentrate	,,	59,269	113,356	102,362	136,481	32,625	67,341
Zircon content	,,	58,745	112,352	101,494	134,502	32,216	66,431

(a) Included with gold — other forms.

Mineral	Unit of Quantity	1958	1959	1960	1961*	1962* Apr.-June	1962* Jan.-June
FUEL MINERALS							
Black coal—							
Semi-anthracite	'000 tons	57	54	50	57	16	29
Bituminous	,,	18,616	18,576	20,641	21,958	5,230	10,273
Sub-bituminous	,,	1,769	1,668	1,878	1,964	588	1,104
Total black coal	,,	20,442	20,298	22,569	23,979	5,834	11,406
Brown coal (lignite)	,,	11,644	13,035	14,967	16,280	4,381	8,321

Note:—Small quantities of natural gas and oil condensate have been produced in Queensland since the December quarter 1961.

TABLE 4 — QUANTITIES AND CONTENTS (OR GRADE) OF MINERALS PRODUCED: AUSTRALIA—(Continued)

Mineral	Unit of Quantity	1958	1959	1960	1961*	1962* Apr.-June	1962* Jan.-June
NON-METALLIC (Excluding Fuel) MINERALS							
Asbestos—							
Chrysotile, fibre and fines	short ton	2,255	1,433	1,141	969	202	382
Crocidolite, fibre	,,	13,313	16,442	14,472	15,777	3,707	7,195
Barite	ton	6,802	6,214	11,417	19,217	3,430	6,099
Clays—							
Bentonite	ton	37	133	382	587	280	485
Bentonitic clay	,,	116	152	190	307	—	—
Brick clay and shale	,,	†3,829,263	†4,298,605	†4,545,804	†4,271,686	†1,105,055	†2,062,916
Cement clay and shale (a)	ton	149,745	172,946	208,729	188,042	n.a.	n.a.
Damouritic clay	,,	482	491	559	508	n.a.	n.a.
Fireclay, n.e.i.	,,	160,308	175,202	157,297	202,149	n.a.	n.a.
Fuller's earth	,,	120	136	90	192	n.a.	n.a.
Kaolin (incl. ball clay)	,,	37,099	36,974	48,195	47,181	n.a.	n.a.
Stoneware clay	,,	119,680	101,186	128,825	156,578	n.a.	n.a.
Tile clay (a)	,,	143,780	143,150	125,326	150,630	n.a.	n.a.
Other clays (a)	,,	163,514	192,265	210,399	159,372	n.a.	n.a.
Diamonds, industrial	carat	158	37	6	n.a.	n.a.	n.a.
Diatomite	ton	4,240	5,089	4,659	5,461	n.a.	n.a.
Dolomite	,,	138,832	160,084	190,868	191,624	39,880	76,894
Felspar (inc. Cornish stone)	ton	7,016	6,750	8,414	8,209	1,392	3,707
Fluorspar (fluorite)	,,	930	471	7	. .	—	—
Average grade	% CaF_2	85	85	85	85	—	—
Garnet concentrate	ton	36	65	97	63	20	46
Gems—							
Opal	Value £A	216,266	446,020	637,493	830,052	n.a.	n.a.
Sapphire	,,	1,813	2,792	5,311	8,047	n.a.	n.a.
Glauconite	ton	112	102	111	—	—	—
Gypsum	,,	504,938	516,791	580,878	608,109	152,706	286,719
Limestone (incl. shell & coral)	'000 tons	5,324	5,305	5,669	6,121	1,481	3,050
Loam, for foundry moulding (a)	ton	21,505	15,410	16,206	19,306	n.a.	n.a.
Magnesite, crude	,,	69,391	60,586	62,166	98,795	12,851	26,764
Mica, muscovite—							
Trimmed	lb.	42,479	44,665	9,500	—	—	—
Crude and film	,,	35,840	170,000	649,600	185,920	—	—
Scrap	,,	37,408	7,000	—	—	—	—
Mineral pigments—							
Red ochre	ton	252	163	150	192	28	32
Yellow ochre	,,	31	15	15	177	—	—
Pebbles, for grinding	,,	970	900	671	617	n.a.	n.a.
Perlite	,,	300	708	796	394	—	—
Petalite	ton	68	—	—	101	—	54
Li_2O content	unit	285	—	—	442	—	231
Phosphate rock	ton	7,421	4,775	2,321	4,874	n.a.	2,177
Pyrophyllite	,,	267	347	501	1,288	250	544
Salt	,,	429,534	467,532	463,296	494,898	n.a.	n.a.
Serpentine, for refractories	ton	965	920	1,057	909	302	605
Silica (glass, chemical, etc.) (a)	ton	145,483	154,778	210,100	212,574	n.a.	n.a.
Sillimanite	,,	1,696	3,633	1,524	1,787	754	1,267
Slate, for filler	,,	15	—	—	—	—	—
Talc (incl. steatite)	,,	15,393	16,376	15,670	13,545	3,424	5,895

(a) Incomplete; figures relate only to production reported by Mines Departments.

TABLE 5 — CONTENTS OF METALLIC MINERALS PRODUCED: AUSTRALIA

Mineral in which contained	Contents of Metallic Minerals Produced					
	1958	1959	1960	1961*	1962* Apr.-June	1962* Jan.-June
ALUMINA (Al_2O_3) (Tons)						
Bauxite	3,533	6,914	†31,393	†11,964	1,071	2,805
ANTIMONY						
Antimony ore	31	2	3	1	. .	. .
Antimony concentrate	661	626	151	116	—	62
Lead concentrate	664	652	632	563	229	375
Total	1,356	1,280	786	680	229	437
BERYLLIUM OXIDE (BeO) (Units of 22.4 lb.)						
Beryllium ore	2,900	3,587	2,221	3,585	1,144	1,364
BISMUTH (lb.)						
Bismuth concentrate	2,328	—	—	602	97	97
CADMIUM (Tons)						
Lead concentrate	74	72	68	55	19	32
Zinc concentrate	798	788	881	852	245	428
Total	872	860	949	907	264	460
CHROMIC OXIDE (Cr_2O_3) (Tons)						
Chromite	†386	†60	†265	—	—	—
COBALT (Tons)						
Zinc concentrate	71	60	65	65	18	31

TABLE 5 — CONTENTS OF METALLIC MINERALS PRODUCED: AUSTRALIA (Continued)

Mineral in which contained	Contents of Metallic Minerals Produced					
	1958	1959	1960	1961*	1962* Apr.-June	1962* Jan.-June
COPPER (Tons)						
Copper ore (a)	3,897	4,420	3,702	4,633	423	758
Copper concentrate	66,219	85,165	100,667	86,398	24,257	46,968
Copper precipitate	908	935	915	525	53	55
Gold concentrate	—	—	5	36	15	15
Lead concentrate	3,270	3,320	2,810	2,646	1,128	1,977
Lead-copper concentrate	666	487	598	731	248	470
Zinc concentrate	665	623	738	721	180	337
Total	75,715	94,950	109,435	95,690	26,304	50,580
GOLD (Fine oz.)						
Copper ore	37	2	—	153	86	118
Copper concentrate	77,506	97,660	88,334	78,774	20,754	33,505
Copper precipitate	310	—	—	—	195	195
Gold concentrate	4,109	3,534	493	1,645	455	455
Gold—other forms (b)	995,925	959,413	971,988	960,196	225,225	457,752
Lead ore (c)	15	—	—	—	—	—
Lead concentrate	11,590	12,065	11,076	10,977	3,242	5,986
Lead-copper concentrate	10,001	8,436	10,978	12,572	4,863	8,924
Pyrite concentrate	(d)	(d)	(d)	(d)	(d)	(d)
Zinc concentrate	4,487	3,994	3,840	4,373	1,100	2,164
Total	1,103,980	1,085,104	1,086,709	1,068,690	255,920	509,099
IRON (Tons) (e)						
Iron Ore	†2,539,197	†2,699,615	†2,813,955	†3,433,976	†832,620	†1,612,700
LEAD (Tons)						
Lead ore (f)	2,301	1,115	1,300	739	150	332
Lead concentrate	316,048	306,395	297,868	259,010	98,820	168,467
Lead-copper concentrate	2,843	2,521	2,204	2,733	1,134	2,109
Zinc concentrate	7,155	6,262	6,791	7,174	1,854	3,596
Total	328,347	316,293	308,163	269,656	101,958	174,504
MANGANESE (Tons)						
Manganese ore—metallurgical grade	25,623	40,966	28,585	40,240	10,326	20,970
Zinc concentrate	5,680	5,763	5,379	4,292	1,238	2,127
Total	31,303	46,729	33,964	44,532	11,564	23,097

(a) Includes cupreous ore for fertilizer. (b) Bullion, alluvial, retorted gold, etc. (c) Includes lead-silver ore. (d) Included with gold—other forms. (e) Excludes iron content of iron oxide not intended for metal extraction. (f) Includes lead-silver and lead-zinc ores.

TABLE 5 — CONTENTS OF METALLIC MINERALS PRODUCED: AUSTRALIA (Continued)

Mineral in which contained	Contents of Metallic Minerals Produced					
	1958	1959	1960	1961*	1962* Apr.-June	1962* Jan.-June
MANGANESE DIOXIDE (MnO_2) (Tons)						
Manganese ore—						
Battery grade	706	1,060	625	836	149	308
Other grades	2,113	1,415	992	268	188	188
Total	2,819	2,475	1,617	1,104	337	496
MOLYBDENUM DISULPHIDE (MoS_2) (lb.)						
Molybdenite concentrate	†8,568	—	—	†2,630	—	†1,904
MONAZITE (Tons)						
Monazite concentrate	423	331	344	1,553	190	503
OSMIRIDIUM (oz.)						
Osmiridium, native	42	3	—	—	—	—
Platinum concentrate	1	—	..	—	—	—
Total	43	3	..	—	—	—
PLATINUM (oz.)						
Platinum concentrate	22	—	4	2	—	—
SILVER (Fine oz.)						
Copper ore	1,037	198	18	9,733	4,548	6,509
Copper concentrate	411,304	579,004	712,940	657,503	248,467	422,446
Copper precipitate	38	—	—	—	16	16
Gold concentrate	492	4	453	1,111	786	786
Gold—other forms (a)	196,778	194,601	206,702	220,671	49,315	103,774
Lead ore (b)	94,757	36,611	52,864	31,099	6,195	18,547
Lead concentrate	14,200,130	13,073,288	12,861,302	10,663,468	3,979,227	7,001,807
Lead-copper concentrate	761,360	671,412	716,940	799,031	250,319	484,068
Silver ore	35,242	29,175	16,919	—	—	—
Zinc concentrate	638,674	576,338	647,818	678,933	174,257	335,864
Total	16,339,812	15,160,631	15,215,956	13,061,549	4,713,130	8,373,817
SULPHUR (Tons)						
Lead concentrate	51,939	50,468	49,102	45,282	17,118	28,738
Lead-copper concentrate	1,068	841	952	2,135	780	1,454
Pyrite concentrate	108,636	106,881	114,549	102,149	21,699	40,022
Zinc concentrate	160,976	152,355	175,397	175,299	48,520	88,098
Total	322,619	310,545	340,000	324,865	88,117	158,312

(a) Bullion, alluvial, retorted gold, etc. (b) Includes lead-silver ore.

TABLE 5 — CONTENTS OF METALLIC MINERALS PRODUCED: AUSTRALIA (Continued)

Mineral in which contained	Contents of Metallic Minerals Produced					
	1958	1959	1960	1961*	1962* Apr.-June	1962* Jan.-June
TANTALITE-COLUMBITE (Ta_2O_5 + Nb_2O_5) (lb.)						
Tantalite-columbite concentrate	6,736	8,499	11,500	13,814	5,066	7,450
TIN (Tons)						
Tin concentrate	2,237	2,351	2,202	2,745	625	1,268
TITANIUM DIOXIDE (TiO_2) (Tons)						
Ilmenite concentrate	38,278	45,677	58,729	92,898	23,209	47,487
Rutile concentrate	80,955	79,624	86,015	98,217	26,991	52,792
Total	119,233	125,301	144,744	191,115	50,200	100,279
TUNGSTIC OXIDE (WO_3) (Tons)						
Scheelite concentrate	478	. .	291	709	162	323
Wolfram concentrate	372	653	820	827	88	198
Total	850	653	1,111	1,536	250	521
ZINC (Tons)						
Lead ore (a)	20	—	—	—	—	—
Lead Concentrate	30,719	26,414	27,184	22,962	9,189	15,324
Zinc ore, for fertilizer	—	—	35	12	12	12
Zinc concentrate	263,024	249,133	290,189	288,197	79,642	145,249
Total	293,763	275,547	317,408	311,171	88,843	160,585
ZIRCON (Tons)						
Zircon concentrate	58,745	112,352	101,494	134,502	32,216	66,431

(a) Includes lead-zinc ore.

TABLE 6 — PRINCIPAL CONTENTS OF METALLIC MINERALS AND QUANTITIES OF ASBESTOS AND COAL PRODUCED: STATES AND AUSTRALIA

Content and States	Unit of Quantity	1958	1959	1960	1961*	1962* Apr.-June	1962* Jan.-June
PRINCIPAL CONTENTS OF METALLIC MINERALS PRODUCED							
Antimony	ton	**1,356**	**1,280**	**786**	**680**	**229**	**437**
N.S.W.		1,355	1,279	784	679	229	437
Victoria		1	1	2	1	—	—
Copper	ton	**75,715**	**94,950**	**109,435**	**95,690**	**26,304**	**50,580**
N.S.W.		4,023	3,728	3,572	3,510	1,059	1,859
Victoria		—	14	—	—	5	10
Q'land		50,511	66,798	82,753	66,592	17,869	36,838
S. Aust.		1	16	5	2	—	—
W. Aust.		1,107	2,197	1,661	2,206	442	790
Tasmania		11,413	12,244	11,680	12,743	4,436	6,594
N. Territory		8,660	9,953	9,764	10,637	2,493	4,489
Gold	'000 f. oz.	**1,104**	**1,085**	**1,087**	**1,069**	**256**	**509**
N.S.W.		19	13	14	12	3	5
Victoria		41	35	29	26	7	13
Q'land		74	92	78	64	18	30
S. Aust.		. .	. .	. .	. .	. .	. .
W. Aust.		875	861	870	871	204	411
Tasmania		22	21	24	27	8	15
N. Territory		73	63	72	69	16	35
Iron (a)	'000 tons	**†2,539**	**†2,700**	**†2,814**	**†3,434**	**†833**	**†1,613**
S. Aust.		†2,174	†2,219	†2,228	†2,581	†598	†1,156
W. Aust.		365	481	586	853	235	457
Lead	ton	**328,347**	**316,293**	**308,163**	**269,656**	**101,958**	**174,504**
N.S.W.		246,896	246,449	235,868	211,679	82,752	137,354
Q'land		65,799	54,415	57,518	45,280	15,306	29,492
S. Aust.		13	8	—	—	—	—
W. Aust.		1,854	1,382	1,739	433	136	278
Tasmania		13,785	14,039	13,038	12,253	3,764	7,380
N. Territory		—	—	—	11	—	—
Silver	'000 f. oz.	**16,340**	**15,161**	**15,216**	**13,062**	**4,713**	**8,374**
N.S.W.		8,992	8,555	8,398	7,448	2,760	4,696
Victoria		3	2	1	1	. .	. .
Q'land		5,710	4,954	5,122	3,883	1,401	2,650
S. Aust.		1	. .	—	—	—	—
W. Aust.		189	180	196	212	51	106
Tasmania		1,395	1,369	1,398	1,436	451	852
N. Territory		50	101	101	82	50	70
Tin	ton	**2,237**	**2,351**	**2,202**	**2,745**	**625**	**1,268**
N.S.W.		239	174	223	173	44	97
Victoria		—	—	—	—	4	5
Q'land		1,019	1,104	885	1,350	234	547
W. Aust.		94	174	190	231	66	119
Tasmania		883	890	884	986	277	499
N. Territory		2	9	20	5	. .	1
Titanium (in terms of TiO_2)—							
In Rutile Concentrate	ton	**80,955**	**79,624**	**86,015**	**98,217**	**26,991**	**52,792**
N.S.W.		44,915	44,792	52,262	64,284	17,364	33,560
Q'land		35,755	34,736	33,260	33,056	9,555	19,064
W. Aust.		285	96	493	877	72	168
In Ilmenite Concentrate	ton	**38,278**	**45,677**	**58,729**	**92,898**	**23,209**	**47,487**
N.S.W.		59	111	537	905	481	847
Q'land		—	—	21	2	—	—
W. Aust.		38,219	45,566	58,171	91,991	22,728	46,640

(a) Excludes iron content of iron oxide not intended for metal extraction.

TABLE 6 — PRINCIPAL CONTENTS OF METALLIC MINERALS AND QUANTITIES OF ASBESTOS AND COAL PRODUCED: STATES AND AUSTRALIA—(Continued)

Content and States	Unit of Quantity	1958	1959	1960	1961*	1962* Apr.-June	1962* Jan.-June
PRINCIPAL CONTENTS OF METALLIC MINERALS PRODUCED—(Continued)							
Tungsten (in terms of WO_3)	ton	**850**	**653**	**1,111**	**1,536**	**250**	**521**
In Scheelite Concentrate	ton	**478**	. .	**291**	**709**	**162**	**323**
N.S.W. ..		1	. .	. .	. .	—	—
W. Aust.		—	—	—	—	5	5
Tasmania		477	—	291	709	157	318
In Wolfram Concentrate	ton	**372**	**653**	**820**	**827**	**88**	**198**
Q'land		5	—	—	1	—	—
Tasmania		360	645	804	810	88	198
N. Terr. ..		7	8	16	16	—	—
Zinc	ton	**293,763**	**275,547**	**317,408**	**311,171**	**88,843**	**160,585**
N.S.W.		227,440	216,993	248,164	237,834	67,407	116,874
Q'land		29,538	23,468	34,775	33,219	9,554	19,841
S. Aust		113	—	35	12	12	12
W. Aust.		20	—	—	—	—	—
Tasmania		36,652	35,086	34,434	40,106	11,870	23,858
QUANTITIES OF ASBESTOS AND COAL PRODUCED							
Asbestos							
Chrysotile	short ton	**2,255**	**1,433**	**1,141**	**969**	**202**	**382**
N.S.W. ..		712	726	1,072	794	202	382
W. Aust. ..		1,543	707	69	175	—	—
Crocidolite	short ton	**13,313**	**16,442**	**14,472**	**15,777**	**3,707**	**7,195**
W. Aust.		13,313	16,442	14,472	15,777	3,707	7,195
Black coal	'000 tons	**20,442**	**20,298**	**22,569**	**23,979**	**5,834**	**11,406**
Semi-anthracite	'000 tons	**57**	**54**	**50**	**57**	**16**	**29**
Q'land		55	52	48	55	16	29
Tasmania		2	2	2	2	. .	. .
Bituminous	'000 tons	**18,616**	**18,576**	**20,641**	**21,958**	**5,230**	**10,273**
N.S.W. ..		15,841	15,712	17,737	19,021	4,481	8,858
Victoria ..		108	90	77	67	11	24
Q'land		2,393	2,477	2,532	2,616	677	1,265
Tasmania		274	297	295	254	61	126
Sub-bituminous	'000 tons	**1,769**	**1,668**	**1,878**	**1,964**	**588**	**1,104**
N.S.W. ..		10	—	—	—	—	—
Q'land		133	66	71	83	20	37
S. Aust. ..		755	690	885	1,115	332	631
W. Aust.		871	912	922	766	236	436
Brown coal	'000 tons	**11,644**	**13,035**	**14,967**	**16,280**	**4,381**	**8,321**
Victoria		11,644	13,035	14,967	16,280	4,381	8,321

TABLE 7 — IMPORTS OF MINERALS AND MINERAL PRODUCTS: AUSTRALIA

Commodity & Country of Origin	Unit of Quantity	1958	1959	1960	1961*	1962* Apr.-June	1962* Jan.-June
METALLIC GROUP							
Aluminium & aluminium base alloys—							
Ore (bauxite)	ton	69,473	66,746	96,200	51,799	21,152	44,951
Indonesia		69,473	49,466	—	—	—	—
Other		—	17,280	96,200	51,799	21,152	44,951
Ingots (refined)	ton	14,813	19,268	26,432	16,141	7,900	12,407
Canada		13,948	17,985	21,814	11,142	4,031	6,679
Other		865	1,283	4,618	4,999	3,869	5,728
Rods and bars	ton	423	80	80	147	66	106
Plates, sheets & strips	,,	2,317	2,555	5,770	1,953	502	1,018
United Kingdom		1,335	1,744	4,322	858	452	944
Other		982	811	1,448	1,095	50	74
Angles, circles, pipes and tubes	ton	87	84	409	182	25	149
Foil	,,	2,409	2,788	3,909	2,002	544	1,050
United Kingdom		2,078	2,476	3,146	1,285	300	508
Other		331	312	763	717	244	542
Powder	ton	486	670	678	396	61	128
Wire, single strand, uncovered	ton	94	70	138	50	5	11
Scrap (incl. re-melt)	,,	102	24	231	282	134	254
Antimony—							
Ore & concentrate	ton	10	37	363	22	—	12
Metal, incl. antimonial and lead compounds	ton	69	174	201	180	52	77
Arsenic trioxide	,,	2,699	2,402	2,779	1,439	285	909
Bismuth metal	lb.	37,530	36,445	34,378	36,660	8,624	9,340
Chromium ore & conc. ..	ton	8,772	6,381	21,259	17,049	—	5,500
Copper—							
Pigs, ingots & blocks (refined)	ton	659	3,479	4,750	3,761	195	4,409
Canada		50	250	1,099	1,649	50	1,050
Rhodesia and Nyasaland ..		—	1,002	—	500	—	—
Other		609	2,227	3,651	1,612	145	3,359
Bars, rods, angles and tees	ton	1,330	227	508	2,226	10	1,331
Plates, sheets & strips	,,	939	940	1,911	646	304	493
Pipes and tubes	,,	20	22	26	67	27	55
Wire, single strand, uncovered	ton	34	18	15	40	—	1
Powder	,,	72	105	161	63	45	82
Scrap (incl. re-melt) ..	,,	17	27	97	24	1	8
Copper-base alloys—							
Pigs, ingots and blocks	ton	7	46	18	30	18	23
Rolled, drawn and extruded shapes	ton	627	671	1,049	850	323	523
Wire, single strand, uncovered	ton	187	126	152	93	24	42
Scrap	,,	101	64	113	91	42	61
Gold—							
Refined forms (excl. specie, leaf and foil)	f. oz.	—	—	4	3	1	1
Unrefined bullion	,,	160,232	136,674	144,029	146,420	48,971	69,944
New Guinea		45,999	44,636	43,181	37,366	11,771	19,961
Fiji		92,925	66,035	71,763	80,179	32,832	43,063
Other		21,308	26,003	29,085	28,875	4,368	6,920
Iron ore	ton	296,157	261,904	278,502	270,422	69,113	126,241
New Caledonia		296,157	261,894	271,474	270,422	69,113	126,241
Other		—	10	7,028	—	—	—

TABLE 7 — IMPORTS OF MINERALS AND MINERAL PRODUCTS: AUSTRALIA—(Contd.)

Commodity & Country of Origin	Unit of Quantity	1958	1959	1960	1961*	1962* Apr.-June	1962* Jan.-June
METALLIC GROUP—(Continued)							
Iron and Steel—							
Ferro-alloys (excl. powder)—							
Ferro-chromium	ton	1,892	2,824	5,714	4,133	641	990
Norway		961	24	705	14	26	36
Other		931	2,800	5,009	4,119	615	954
Ferro-manganese	ton	3,060	9,910	30,340	40,276	1,243	6,997
Norway		51	57	5	1	—	—
Other		3,009	9,853	30,335	40,275	1,243	6,997
Ferro-molybdenum	ton	164	108	219	283	20	37
Sweden		138	72	99	67	—	—
Other		26	36	120	216	20	37
Ferro-silicon	ton	7,482	10,463	3,905	9,677	1,257	2,594
South Africa		6,217	10,369	2,852	1,306	726	1,078
Norway		1,146	38	69	55	368	4,349
Other		119	56	984	8,316	163	167
Other	ton	737	684	1,434	1,590	464	666
Tinplate	ton	66,059	50,348	63,741	38,355	5,656	17,298
United Kingdom		57,449	41,838	39,296	19,159	1,532	5,484
Other		8,610	8,510	24,445	19,196	4,124	11,814
Manganese—							
Metallurgical ore	ton	5	3	51	250	2,142	10,901
Battery grade ore	,,	1,183	1,304	177	2,379	30	40
Metal and powder	,,	85	95	70	116	51	74
Mercury	lb.	65,398	109,778	149,532	120,139	19,757	39,048
Italy		19,690	42,734	26,995	14,412	—	—
Spain		23,864	28,122	56,863	24,248	12,321	15,513
Other		21,844	38,922	65,674	81,479	7,436	23,535
Nickel—							
Pigs, ingots & blocks	ton	674	806	1,518	368	56	128
Rolled, drawn and extruded shapes	ton	16	22	14	23	4	39
Nickel-base alloys—							
Rolled, drawn and extruded shapes	ton	269	372	362	238	36	78
Wire, single strand, uncovered	ton	78	140	100	101	20	38
Platinum and Platinum Group Metals—							
Platinum (excl. wire)	oz.	1,385	994	1,433	1,483	723	948
Other (excl. wire)	,,	1,108	1,478	1,917	821	12	20
Wire	,,	1,567	1,769	2,047	1,281	108	280
Silver, unrefined bullion	'000 f. oz.	75	78	69	70	23	34
New Guinea		28	35	32	26	8	14
Fiji		36	28	22	23	8	10
Other		11	15	15	21	7	10
Tin (refined)	ton	1,070	1,294	1,708	778	708	986
Titanium oxide	,,	6,996	5,472	5,054	5,139	1,471	3,178

TABLE 7 — IMPORTS OF MINERALS AND MINERAL PRODUCTS: AUSTRALIA—(Contd.)

Commodity & Country of Origin	Unit of Quantity	1958	1959	1960	1961*	1962* Apr.-June	1962* Jan.-June
FUEL GROUP							
Coal	ton	6,315	7,577	5,156	7,988	2,896	2,896
Coke (incl. petroleum coke)	ton	8,697	7,046	11,639	15	—	28
Petroleum oils—							
Crude	'000 gals.	2,441,916	2,603,377	2,705,989	2,833,256	744,697	1,437,295
Enriched crude	,,	95,302	35,559	237,336	404,863	91,043	193,597
Gasolines and Solvents	,,	207,500	243,910	238,208	191,728	61,578	119,809
Kerosines	,,	97,403	109,649	102,965	111,199	34,773	49,475
Automotive Distillate	,,	11,724	9,983	12,473	26,746	7,751	19,094
Residuals and Heavy Distillates	,,	7,617	10,224	12,085	12,076	12,455	19,786
Lubricating Oil	,,	41,665	49,619	49,837	55,866	8,406	23,198
NON-METALLIC (Excluding Fuel) GROUP							
Asbestos—							
Chrysotile	short ton	23,408	24,316	28,832	27,210	5,231	12,997
Canada		20,323	20,941	24,099	22,706	4,042	10,888
Other		3,085	3,375	4,733	4,504	1,189	2,109
Crocidolite	short ton	311	328	74	84	3	8
Amosite	,,	13,984	12,019	10,138	8,705	1,046	2,658
South Africa		13,417	11,956	9,995	8,616	1,046	2,634
Other		567	63	143	89	—	24
Other	short ton	1,185	1,667	1,958	902	524	646
Calcium carbide	,,	12,413	13,286	21,340	16,791	2,012	3,510
South Africa		7,396	8,953	14,738	11,473	1,701	2,739
Norway		4,439	3,335	4,002	739	311	524
Other		578	998	2,600	4,579	—	247
Cement, Portland	ton	5,744	12,957	14,861	16,998	4,222	9,065
United Kingdom		2,564	3,205	3,788	4,917	959	1,855
Japan		—	2,508	8,709	8,139	50	2,114
Other		3,180	7,244	2,364	3,942	3,213	5,096
Clays—							
Ball clay	ton	407	798	653	650	186	396
Bentonite	,,	4,952	6,330	7,270	6,895	2,917	4,665
Fire clay	,,	594	698	1,048	293	320	558
White clay	,,	2,502	14,654	9,093	14,890	3,889	4,838
Clays, n.e.i.	,,	2,585	4,764	6,434	5,594	1,356	2,607
Cryolite	,,	1,597	858	1,123	1,141	508	1,569
Diamonds, Industrial	carat	191,335	320,294	372,668	314,844	54,016	113,479
South Africa		127,649	184,860	242,639	145,366	36,391	67,404
Other		63,686	135,434	130,029	169,478	17,625	46,075
Diatomite	ton	3,736	4,502	4,150	4,071	980	2,122
Fluorspar (fluorite)	,,	975	2,080	2,186	2,482	1,052	1,659
Graphite—							
Colloidal	ton	52	44	92	129	37	40
Flake	,,	280	278	209	187	8	80
Crystalline	,,	40	163	112	67	6	8
Amorphous	,,	542	488	511	352	296	368
Kyanite	,,	500	15	546	1,045	—	—
Magnesite	,,	6,555	2,680	13,946	15,711	122	3,524
Mica—							
Block or sheet, trimmed	lb.	21,368	24,184	43,455	21,437	9,786	14,286
cut or stamped)	,,	2,594	2,775	2,589	3,837	1,265	1,869
Condenser film (not cut of stamped)	lb.	—	44	748	1,223	—	—
Splittings (not cut or stamped)	lb.	149,450	166,975	229,775	226,970	26,448	39,396
Ground or pulverised	,,	217,104	270,966	341,042	282,348	104,202	133,122
Scrap	,,	558,940	484,996	802,320	302,400	475,101	564,701

TABLE 7 — IMPORTS OF MINERALS AND MINERAL PRODUCTS: AUSTRALIA—(Contd.)

Commodity & Country of Origin	Unit of Quantity	1958	1959	1960	1961*	1962* Apr.-June	1962* Jan.-June
NON-METALLIC (Excluding Fuel) GROUP—(Continued)							
Phosphate rock	'000 tons	1,501	1,327	1,491	1,766	575	922
Nauru		833	690	789	905	384	605
Christmas Is. (Indian Ocean)		361	434	411	533	127	206
Gilbert and Ellis Is.		298	191	284	316	64	111
Other		9	12	7	12	—	—
Potassium chloride (fertiliser grade)	ton	47,942	43,259	41,541	51,881	2,618	22,200
Potassium sulphate (fertiliser grade)	ton	7,389	5,951	5,785	7,523	111	3,395
Salt—							
Rock	ton	1,879	2,083	5	—	—	—
Other	"	7,178	7,210	19,463	11,822	1,991	3,966
Sodium nitrate (fertiliser grade)	ton	12,804	3,458	5,818	7,217	—	3,110
Sillimanite	"	131	135	259	191	11	21
Sulphur	"	202,421	170,770	221,778	182,052	35,610	90,703
U.S.A.		146,831	110,519	146,278	115,580	35,466	75,582
Mexico		42,840	59,846	71,077	66,018	—	8,648
Other		12,750	405	4,423	454	144	6,473
Talc	ton	307	264	496	1,465	682	739

TABLE 8 — EXPORTS OF MINERALS AND MINERAL PRODUCTS: AUSTRALIA

Commodity & Country of Destination	Unit of Quantity	1958	1959	1960	1961*	1962* Apr.-June	1962* Jan.-June
METALLIC GROUP							
Aluminium & aluminium base alloys—							
Ore (bauxite)	ton	—	—	29,778	30,489	—	—
Ingots (refined)	"	—	78	20	7	12	16
Rolled, drawn & extruded shapes (excl. wire)	ton	135	162	282	345	50	88
Scrap (incl. re-melt)	"	123	587	659	564	61	180
Beryllium ore and concentrate	ton	146	—	148	167	15	135
Cadmium—							
Ingots and blocks	ton	48	17	7	36	38	48
Bars and rods	"	178	126	53	120	25	57
Copper—							
Ore and concentrate	ton	14,951	73,286	137,897	107,234	26,010	57,043
Japan		14,951	63,717	137,815	105,526	25,956	56,896
Other		—	9,569	82	1,708	54	147
Blister copper	ton	14,421	16,225	502	1,022	—	—
Belgium-Luxembourg		6,805	7,203	502	—	—	—
Germany, Fed. Rep.		2,060	5,019	—	—	—	—
U.S.A.		3,983	4,003	—	1,022	—	—
Other		1,573	—	—	—	—	—
Pigs, ingots & blocks (refined)	ton	—	2,749	13,577	23,073	999	4,096

TABLE 8 — EXPORTS OF MINERALS AND MINERAL PRODUCTS: AUSTRALIA—(Contd.)

Commodity & Country of Destination	Unit of Quantity	1958	1959	1960	1961*	1962* Apr.-June	1962* Jan.-June
METALLIC GROUP—(Continued)							
Copper—(Continued)							
Rolled, drawn & extruded shapes	ton	1,365	1,011	2,051	2,029	940	1,899
Wire, single strand, uncovered	ton	308	314	302	553	2	19
Scrap (incl. re-melt)	"	279	547	329	834	56	269
Slags and residues	"	1,332	45	139	671	111	143
Copper-base alloys—							
Pigs, ingots & blocks	ton	18	100	45	77	5	113
Rolled, drawn & extruded shapes	ton	283	508	977	2,063	656	892
Wire, single strand, uncovered	ton	11	12	4	61	70	96
Scrap	"	279	4,936	4,866	12,066	1,676	3,289
Copper-lead dross	"	7,709	6,006	5,333	3,286	2,058	2,058
U.S.A.		5,035	6,006	4,718	3,286	2,058	2,058
Other		2,674	—	615	—	—	—
Gold—							
Refined forms (excl. specie, leaf & foil)	f. oz.	128,550	128,052	2,513,583	1,099,701	2,821	116,322
United Kingdom		205	—	2,300,211	348,711	—	—
Hong Kong		122,520	124,363	184,905	610,812	—	112,030
Other		5,825	3,704	28,467	140,178	2,821	4,292
Unrefined bullion	f. oz.	—	—	323	—	—	—
Ilmenite concentrate	ton	56,243	68,649	75,319	144,009	47,133	63,295
Iron and steel—							
Iron ore	ton	6	293	10	43	34	57
Pig iron	"	19,321	44,038	99,847	296,050	33,339	77,558
New Zealand		9,556	8,504	8,863	8,724	1,991	5,020
Other		9,765	35,534	88,984	287,326	31,348	72,538
Ingots, blooms and slabs	ton	728	12,061	9,619	86,860	12,886	71,163
New Zealand		203	29	205	2,617	1,501	4,282
Other		525	12,032	9,414	84,243	11,385	66,881
Tinplate	ton	n.a.	1,671	8,080	16,644	6,353	9,269
Scrap	ton	156,978	182,985	205,747	223,320	49,689	72,927
Japan		134,457	167,645	179,875	209,841	42,765	61,654
Other		22,521	15,340	25,872	13,479	6,924	11,273
Lead—							
Ore and concentrate	ton	83,984	90,797	74,696	86,268	26,899	40,694
Belgium-Luxembourg		21,822	8,816	8,362	6	—	—
Japan		18,029	23,100	26,028	24,672	134	435
U.S.A.		37,552	38,283	24,136	38,234	7,796	18,311
Other		6,581	20,649	16,170	23,356	18,969	21,948
Bullion	ton	58,068	53,021	49,653	46,089	10,856	27,912
United Kingdom		58,068	53,021	49,653	44,339	9,006	21,062
Other		—	—	—	1,750	1,850	6,850
Pig	ton	155,730	138,448	125,265	145,174	67,417	116,728
United Kingdom		53,407	76,045	66,500	60,616	21,137	39,061
India		6,126	1,839	2,182	145	2,241	3,270
New Zealand		5,350	3,580	4,469	4,790	624	1,605
Japan		1,799	1,282	7,409	13,814	5,768	8,229
U.S.A.		75,542	46,780	37,634	60,698	21,895	43,675
Other		13,506	8,922	7,071	5,111	15,752	20,888
Rolled and extruded shapes	ton	99	86	93	130	203	211
Antimonial lead	"	109	597	503	676	282	585
Scrap	"	5,152	1,390	891	100	—	—
Slags and residues	"	2,604	1,014	808	1,575	22	573

TABLE 8 — EXPORTS OF MINERALS AND MINERAL PRODUCTS: AUSTRALIA—(Contd.)

Commodity & Country of Destination	Unit of Quantity	1958	1959	1960	1961*	1962* Apr.-June	1962* Jan.-June
METALLIC GROUP—(Continued)							
Manganese ore	ton	18,399	31,812	45,639	52,283	19,863	51,897
U.S.A.		7,794	4,165	21	—	—	—
Other		10,605	27,647	45,618	52,283	19,863	51,897
Monazite concentrate	ton	102	150	158	1,802	399	616
Nickel and nickel-base alloys	ton	31	139	104	97	27	51
Platinum and platinum group metals—							
Ore and concentrate	lb.	48	3	7	11	3	3
Metal and powder	oz.	854	197	578	494	60	84
Rutile concentrate	ton	75,615	80,938	93,706	99,652	27,055	52,628
United Kingdom		11,630	8,652	12,717	14,276	3,552	6,328
Netherlands		9,446	10,931	9,903	12,134	4,641	9,149
U.S.A.		26,219	22,537	26,214	23,533	3,456	8,649
Other		28,320	38,818	44,872	49,709	15,406	28,502
Silver—							
Refined ingot or bar	'000 f. oz.	4,875	2,958	2,770	1,002	99	270
Refined other	,,	1	43	30	53	2	2
Tantalum & columbium ore and concentrate	ton	8	8	16	12	31	33
Tin—							
Concentrate	ton	25	42	—	197	—	—
Refined	,,	11	9	14	1	—	—
Tin-base alloys	,,	50	21	24	1	—	2
Tungsten—							
Scheelite concentrate	ton	506	145	505	940	195	435
United Kingdom		134	114	235	199	78	166
U.S.A.		276	—	—	—	—	—
Other		96	31	270	741	117	269
Wolfram concentrate	ton	442	993	913	1,046	155	361
United Kingdom		66	80	57	153	30	70
U.S.A.		163	722	761	330	20	45
Other		213	191	95	543	105	246
Zinc—							
Concentrate	ton	261,279	193,254	321,930	276,109	63,794	126,751
United Kingdom		115,825	87,002	153,894	142,287	26,796	50,340
Belgium-Luxembourg		115,558	49,372	58,829	23,868	12,955	16,380
Other		29,896	56,880	109,207	109,954	24,043	60,031
Refinery-type shapes	ton	37,938	41,606	27,443	46,472	21,112	45,345
United Kingdom		7,727	9,857	2,820	11,446	2,857	6,759
India		21,940	17,279	16,375	16,195	4,316	9,094
U.S.A.		2,001	6,911	401	501	—	1,501
Other		6,270	7,559	7,847	18,330	13,939	27,991
Plates and sheets	ton	86	22	43	3	1	1
Circles and strips	,,	1,004	1,074	1,105	1,413	231	473
Slags and residues	,,	3,476	9,046	6,443	7,782	1,561	2,751
Scrap	,,	269	344	1,183	554	—	85
Zircon concentrate	,,	60,895	108,820	104,630	140,333	36,725	69,227
United Kingdom		21,043	26,635	31,236	29,888	9,192	15,862
U.S.A.		19,017	46,135	28,714	32,112	8,851	17,309
Other		20,835	36,050	44,680	78,333	18,682	36,056

TABLE 8 — EXPORTS OF MINERALS AND MINERAL PRODUCTS: AUSTRALIA—(Contd.)

Commodity & Country of Destination	Unit of Quantity	1958	1959	1960	1961*	1962* Apr.-June	1962* Jan.-June
FUEL GROUP							
Coal	ton	823,925	794,190	1,577,140	2,850,307	910,204	1,635,506
Argentine		88,891	109,673	—	—	—	—
New Caledonia		171,561	143,580	135,199	77,256	21,100	31,050
Japan		360,709	480,613	1,382,317	2,669,045	799,309	1,505,477
Korea, Republic of		173,243	15,813	49,769	27,915	9,132	18,104
Other		29,521	44,511	9,855	76,091	80,663	80,875
Coke	ton	52,460	20,899	94,550	98,485	2,351	31,573
New Caledonia		51,848	19,396	92,741	67,998	—	15,896
Other		612	1,503	1,809	30,487	2,351	15,677
Petroleum oils—							
Gasolines and Solvents	'000 gals.	80,171	32,823	37,312	63,233	7,470	13,563
Kerosines	,,	9,915	16,044	17,182	43,484	5,056	13,379
Automotive Distillate	,,	43,081	89,589	179,490	140,331	43,112	82,849
Residuals and Heavy Distillates	,,	202,052	146,867	175,330	238,318	100,725	177,157
Lubricating oil	,,	1,050	1,326	1,659	1,576	381	816
NON-METALLIC (Excluding Fuel) GROUP							
Asbestos—							
Chrysotile	short ton	264	197	25	6	—	—
Crocidolite	,,	10,049	12,684	8,177	7,981	3,942	4,952
U.S.A.		6,020	9,655	2,518	2,566	2,363	2,776
Other		4,029	3,029	5,659	5,415	1,579	2,176
Other	short ton	120	93	97	73	6	6
Barite (ground)	ton	2,494	1,108	7,650	5,902	516	1,109
Cement, constructional	,,	20,401	13,324	7,607	5,085	1,016	1,365
New Guinea		4,732	2,124	680	130	50	75
Fiji		8,659	4,725	59	38	4	5
Christmas Is. (Indian Ocean)		1,098	703	1,475	1,200	—	—
Other		5,912	5,772	5,393	3,717	962	1,285
Clays	ton	646	1,110	1,008	827	154	522
Diamonds, industrial	carat	41,529	57,478	31,684	60,840	6,181	16,101
Graphite	ton	8	5	11	3	2	2
Gypsum	,,	68,138	77,876	85,634	88,613	22,529	49,747
New Zealand		62,128	66,665	71,231	69,178	16,492	41,259
Other		6,010	11,211	14,403	19,435	6,037	8,488
Magnesite	ton	31	64	106	2,719	43	59
Mica	lb.	28,748	90,248	43,898	112,262	21,722	32,301
Opals	value £A	351,342	674,948	1,036,298	1,403,740	477,570	905,848
Salt	ton	20,346	17,826	18,346	59,618	13,219	46,182
New Zealand		16,982	15,547	15,771	23,875	5,386	10,483
Other		3,364	2,279	2,575	35,743	7,833	35,699
Superphosphate	ton	1,607	1,619	40	26	—	1
Talc	,,	3,256	2,620	3,905	4,191	1,945	2,685

III. APPENDIX

The following later information has become available since compilation of statistical tables for periods up to 30th June, 1962. The figures are preliminary and subject to revision.

TABLE 9 — SMELTER AND REFINERY PRODUCTION OF PRINCIPAL METALS: AUSTRALIA

(Excludes secondary metal (i.e., metal recovered from scrap) unless otherwise specified)

Metal	Production*				
	Unit of Quantity	July 1962	August 1962	Sept. 1962	July-Sept. 1962
Cadmium (refined)	ton	n.a.	n.a.	n.a.	90
Copper (blister) (a)	"	7,785	8,880	9,641	26,306
Copper (refined)	"	7,324	8,740	7,794	23,858
Gold (refined)—					
Australian origin	f. oz.	77,551	78,600	74,661	230,812
Oversea origin	"	8,406	9,591	9,113	27,110
Total refined gold	"	85,957	88,191	83,774	257,922
Lead—					
Refined (b)	ton	18,519	15,132	17,240	50,891
Lead content of lead-silver bullion produced for export	ton	6,136	6,563	6,735	19,434
Total lead content	"	24,655	21,695	23,975	70,325
Pig iron (c)	"	292,601	286,328	262,769	841,698
Steel ingots (c)	"	357,814	352,876	339,664	1,050,354
Silver (refined)	'000 f. oz.	452	710	714	1,876
Tin (refined)	ton	170	253	304	727
Zinc (refined slab) (d)	"	14,423	15,685	14,924	45,032

(a) Total production for refining in Australia and overseas. (b) Includes lead content of antimonial lead. (c) Includes recovery from scrap. (d) Includes small quantities of metal recovered from zinc dust used in works.

Note: Particulars of refined aluminium, cadmium, copper, lead, silver, tin and zinc in Table 9 were collected by the Bureau of Mineral Resources.

TABLE 10 — MINE PRODUCTION OF GOLD AND COAL: AUSTRALIA

Item	Production*				
	Unit of Quantity	July 1962	August 1962	Sept. 1962	July-Sept. 1962
Gold (a)	f. oz.	95,465	95,898	95,894	287,257
Coal—					
Black	'000 tons	2,320,172	2,385,722	2,051,794	6,757,688
Brown	"	1,635,983	1,658,697	1,473,495	4,768,175

(a) Gold content of minerals produced.