

Australian Mineral Industry

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Part 1—Quarterly Review

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**Part 1—
Quarterly
Review**

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COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

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Information of interest to the mineral industry, corrections to published data, and suggestions will be welcomed.

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General Review

Z. KALIX, J. WARD, J. B. ALLEN, W. G. B. PHILLIPS, A. J. GOURLAY,
E. CLAYTON, R. Z. de FERRANTI

During the first half of 1969 activity in most sections of the mineral industry was at a very high level and indications are that production in terms of both volume and value will exceed the record levels achieved in 1968. This record mine production should be accompanied by a record level of mineral exports, reflecting expansion in physical shipments especially for iron ore, black coal, bauxite and alumina and nickel; and for some important export commodities, higher prices should prevail.

Although there has been a further expansion in production in nearly all sectors of the industry, increased prices for many mineral commodities have been an important factor in the increased value of output. Perhaps the most important development has been the marked increase in copper, lead, and zinc prices and the general upward trend in tin prices.

The recent announcement of a further expansion of alumina production capacity at Gladstone, Qld. and of aluminium smelters at Point Henry, Vic. and Kurri Kurri, N.S.W. are of great importance. Possibly of equal importance are new long-term contracts signed for the delivery of over 123 million tons of iron pellets and fines to Japan, the supply of coking coal between Queensland Coal Associates and Japanese steel mills, and re-negotiations of contracts for export of N.S.W. coals.

During the period, the eleventh meeting of the International Tin Council under the Third International Tin Agreement was held in London in March 1969. The Council declared the April-June Quarter, 1969 to be a third period of export control and invited the Australian Government to limit its exports in the same control period.

Z. K.

FUELS

Black Coal. Since announcement in January of the major coking coal export contract between Queensland Coal Associates and Japanese steel mills, there have been a number of new contracts and re-negotiated contracts, mainly for export of N.S.W. coals. Negotiations for coal shipments in Japanese fiscal 1969 (1 May 1969 to 30 April 1970) have been completed but negotiations are continuing on contracts for several projects which are to commence operation after 1969.

The second Japanese technical mission in ten months will visit Australia in June to inspect new coal projects in N.S.W. and Queensland. The mission will also examine coal mines in N.S.W. and Queensland where production and shipments have regularly fallen below contracted tonnages.

On 10 March, R. W. Miller (Holdings) Ltd announced a new contract for the export over 5 years commencing in April 1969 of 7.5 million tons of coking coal from the Maitland-Newcastle area. The value of the contract was stated to be "in excess of \$65 million", indicating a price of about \$8.67 per ton. The new contract replaces an expiring contract for shipment of 600,000 tons per annum. R. W. Miller also exports Huntley and Newstan-Borehole coal from the Port Kembla area on behalf of the N.S.W. State Electricity Commission.

Coal and Allied Industries Ltd announced new export contracts on 24 March. Existing contracts have been re-negotiated at higher tonnages and prices, and new contracts won. C.A.I.L. now holds contracts for export of 21.5 million tons of coking coal valued at more than \$200 million over periods of five years and longer. As a result of the new contracts, C.A.I.L. announced early in April that a new mine would be opened in the West Wallsend area, 15 miles from Newcastle. The new mine, to be known as West Wallsend No. 2, will have an output of 600,000 tons of coking coal per year, and will cost about \$9 million to develop. Current exports by C.A.I.L. of about 3 million tons per year are expected to increase to 4 million tons during the term of the new contracts.

Gollin Holdings Ltd entered the coal export market by announcing on 26 March, a contract for 5 million tons of coking coal to be delivered over five years, commencing in April 1969. The basic price is \$8.30 per ton with an escalation allowance of up to 20 cpts per ton per year. Shipments scheduled for fiscal 1969 are understood to be 550,000 tons.

The Bellambi Coal Co. finalised re-negotiation of former export contracts in May. The former five-year contract which was to have expired in March 1973 has been replaced by a new five-year contract totalling 6.3 million tons and commencing from April 1969. The new price is \$10.87 per ton and quantities for shipment are 0.88 million tons in fiscal 1969, 1.2 million tons in 1970 and 1.4 million tons in 1971, 1972, and 1973. It is intended that details of a further five-year contract (to commence in April 1974) will be settled by April 1972. In order to produce the new higher tonnages, Bellambi will install two more long wall mining units and expand haulage, preparation and service facilities at an estimated cost of \$9.6 million.

Contracts for export of coking coal from the western coalfields of N.S.W., worth at least \$2 million were announced early in May by Slater Walker Securities (Australia) Ltd. Austen and Butta are reported to be negotiating sales to Japan of coal from the western as well as the southern coalfields of N.S.W. The company is planning to develop new mines at Hartley in the western coalfields and at Dumbarton in the southern coalfields.

Contracts for the export of Newdell, Wollondilly, and Nattai-Bulli coal by Clutha Development Co. have been under review for several months. Clutha was seeking substantial price rises to be included in any new contracts but it appears that no agreement could be reached. Clutha is now reported to be seeking European markets for coal previously delivered on a spot basis to Japan, while sales based on existing contracts will continue.

Directors of Theiss Holdings Ltd reported on 17 April that a contract for export of 15 million tons of Blackwater coal had been ratified in Tokyo. Exports are to commence in April 1970 and will continue for 15 years, with an option of a further 5 million tons over 5 years after 1985. The initial price is \$11.87 per ton in the first year, decreasing to \$10.66 in the third and later years.

It was reported early in May that arrangements for development of the Mawson coal leases near Newcastle had reached final stages. It is proposed that a consortium led by the Hanwright iron ore group of Western Australia will operate the leases as a joint venture with the owners, Silver Valley Minerals N.L. Silver Valley have already arranged to sell steaming coal worth \$6 million to Formosa,

and it is hoped that the first shipment will leave by the end of 1969. As well as steaming coal, the Mawson leases are reported to contain substantial reserves of coking coal.

The Hanwright group was previously reported to be interested in a joint venture with Western Collieries to expand coal production in the Collie area of Western Australia. It was hoped that the Collie coal could be exported to the Pilbara area for use as a metallising fuel, and to overseas markets.

R. Z. de F.

METALS

Aluminium. Preliminary statistics enable an estimate to be made of the apparent consumption of primary aluminium during 1968, as in the table below. Information on stocks is not available, and hence actual consumption cannot be determined.

APPARENT CONSUMPTION OF ALUMINIUM (a)

	1965	1966	1967	1968
Refinery shapes—				
Domestic production	86,379	90,412	91,326	95,810
Imports	357	461	361	11,975
Total	86,736	90,873	91,687	107,785
Less exports	21,207	16,219	10,501	5,577
Apparent consumption	65,529	74,663	81,186	102,208
Wrought shapes (b)—				
Imports	1,806	1,362	1,174	950
Less exports	2,152	6,470	4,835	3,985
Net imports	—346	—5,108	—3,661	—3,035
Total apparent consumption	65,183	69,555	77,525	99,173
Scrap—				
Imports	797	937	1,468	856
Less exports	1,073	1,460	1,126	2,036
Net imports	—276	—523	342	—1,180

(a) Neglects stocks—n.a.p. Includes aluminium base alloy. (b) Excludes leaf and foil, wire and powder.

As mentioned previously, the unusually high level of apparent consumption in 1968 was no doubt in some measure the result of stockpiling by consumers in anticipation of a tight supply situation developing in 1969. Actual consumption figures would also need to take into account secondary smelter production, which is estimated to be running at about 15,000 tons yearly.

Statistics released in April 1969 by the Aluminium Development Council show that domestic shipments of wrought shapes in 1968 increased by 21 percent to a record level of 67,860 tons. The greatest increase was in extruded products, shipments of which rose by 27 percent to 29,500 tons; other increases were in sheet and plate (18 percent to 33,000 tons) and foil (10 percent to 5,360 tons).

It was announced in March 1969 that the annual production capacity of the Gladstone refinery of Queensland Alumina Ltd would be increased to 1,275,000 tons of alumina from mid-1971. A redistribution of equity participation will

accompany the expansion, with Conzinc Riotinto of Australia Ltd (CRA) and Alcan Aluminium Ltd increasing their shareholdings in the project. After the expansion, the respective interests will be:

Kaiser Aluminium and Chemical Corp'n. (U.S.A.)	43 percent
Alcan Aluminium Ltd (Canada)	22 percent
Pechiney Group (France)	20 percent
C.R.A. Ltd (Australia)	15 percent

The potential demand from the Anglesey smelter (North Wales), in which Rio Tinto-Zinc Corporation Ltd and Kaiser hold major interests, was reported to be one reason for the expansion at Gladstone.

The Chairman of Comalco Industries Pty Ltd announced on 29 April that the company planned to set up an alumina plant at Weipa, Queensland. The plant would have an initial capacity of 600,000 tons of alumina yearly, and provision would be made for trebling of this capacity when required. A consortium would be formed for the financing of the project, as in the case of the Gladstone plant; discussions with prospective participants in the consortium had already begun.

The expansion of Point Henry smelter to 90,000 tons yearly by 1970 (rather than in two stages as previously planned) was announced by Alcoa of Australia Ltd in April. The expansion to the larger capacity has been brought forward because of an increased requirement for aluminium ingot by Furukawa Aluminium Co. Ltd of Japan. Shipments to Furukawa will now commence at a rate of 30,000 tons per annum from 1970. In addition, the smelter's expanded capacity will provide a further 20,000 tons yearly to meet increasing domestic and export demand. The company's 150 megawatt power station at Anglesea, Victoria, was officially opened by the State Premier in March, 1969. Output from this station will need to be supplemented by supplies from the State Electricity Commission to meet the expanded requirements of the Point Henry smelter in 1970; nevertheless, the operation of the station should result in a substantial decrease in power costs.

It was also announced in April that Alcoa is investigating the feasibility of constructing a second alumina refinery near Pinjarra, 55 miles south of Perth. The studies are being undertaken in co-operation with the Western Australian Government and include the development of Bunbury as a port for the shipping of alumina exports.

The smelter of Alcan Australia Ltd at Kurri Kurri, New South Wales, will be expanded to 50,000 tons per annum; some of the new capacity will be commissioned by the middle of 1970. It is expected that preliminary manufacturing operations will commence early in the second half of 1969, with production building up to the full rated initial capacity of 30,000 tons yearly by the end of the year. Construction of the additional smelting facilities will begin during 1969; a reported additional expenditure of \$8 million on the expansion programme brings the total estimated cost of the smelter project to about \$36 million.

A. J. G.

Copper. Statistics released by the Commonwealth Statistician in April indicate that Australian copper production during the early months of 1969 was continuing at the relatively higher level evident in the latter part of 1968, reflecting chiefly increasing output from Mount Isa. Mine production for the period January-March 1969 was 28,945 tons, compared with 22,892 tons in the corresponding period of 1968; equivalent figures for the production of primary refined and primary blister copper during the period were 22,964 tons (13,902 tons) and 25,210 tons (17,655 tons), respectively.

The Australian copper price, which was 53 cents per pound on 1 March 1969, continued to increase until the end of April, when it reached its highest level since the record peak of \$1,350 per ton in early 1968. Increases in the price of wirebar, as announced by the Copper Producers' Association, are summarized in the following table:

Effective Date	Movement (cents per pound)	Price (cents per pound)	(\$A per ton)
3 April 1969	+1	54	1,209.60
11 April 1969	+1	55	1,232.00
16 April 1969	+1	56	1,254.40
22 April 1969	+1	57	1,276.80
29 April 1969	+1	58	1,299.20
16 May 1969	-1	57	1,276.80

The increases were in line with steadily rising prices on the London market, which resulted from several factors contributing to an increasingly tight world supply situation.

Conzinc Riotinto of Australia Ltd announced in March 1969 that its ore reserves on Bougainville Island, T.P.N.G., had been reassessed, and were now estimated at 760 million tons with an average grade of 0.47% copper and 4 dwt. gold per ton around which there are further tonnages of lower grade ore. The company hopes to be in a position to announce plans for the financing of full scale production at an early date; further details of the project appear in *AMI Quarterly Review*, Vol. 21, No. 3.

The London Metal Exchange daily cash price rose from £526½ on 3 March to a peak of £612½ on 28 April, and continued at a relatively high level through to 29 May 1969, when it was quoted at £605½. The continuing firmness of the market was attributed to such factors as an increase in United States domestic prices in early April, helped by supply shortages resulting from a Chilean dock strike, and towards the end of April, by uncertainty concerning the behaviour of sterling following the resignation of General de Gaulle. With returning confidence in the currency situation in early May, demand pressure was reported to have almost disappeared, and was eased further by copper bought during the period of high prices becoming available for resale, with no buyers until the market could be brought down to an acceptable level. According to reports, the short-term prospects of a significant fall in copper prices are not encouraging, as despite the relatively high levels of the recent past, world consumption continues to grow at an unforeseen high rate.

In the United States, the Copper Range company initiated an upward trend in the domestic wirebar price on 8 April 1969, with an increase of 5 cents to 44 cents per pound. Major domestic producers kept their wirebar price at 44-44½ cents per pound, to which level it had been raised early in January. Nevertheless, the effective establishment of brass mill product prices at 50 cents in April by all major producers could prove to be the harbinger of an increased primary metal price.

A. J. G.

Gold. The gold price fixed by the Australian Gold Producers Association has risen steadily in the past three months with minor fluctuations, reflecting prices on European markets. From \$38.12 on 12 February, the Gold Producers price rose to a record \$39.19 on 5 May following the resignation of President de Gaulle, and general monetary uncertainty in Europe. By 16 May however, the price had slipped back to \$38.99.

Total mine production of gold in the quarter to 31 March was 171,000 ounces compared to 190,000 ounces in the December quarter of 1968. The higher realised price for gold produced in Australia has stimulated interest in gold deposits, but has not changed the pattern of steadily decreasing production.

R. Z. de F.

Iron Ore and Steel. Iron ore production in 1968 amounted to about 25,980,000 tons, an increase of 8,944,000 tons on the 1967 production figure. Exports in 1968 were 16,384,071 tons valued at \$142.4 million.

Frances Creek Iron Mining Corporation Pty Ltd has completed a sales contract with Sumitomo Shoji Kaisha Ltd of Japan for the supply of 2 million tons of lump and fine ore. In addition, Frances Creek has reached an agreement for the supply of a further 2 million tons of fine ore provided its availability is proven in the next two years.

A contract valued at \$1,070 million for the supply of Robe River ore was signed by Cliffs West Australia and seven leading Japanese steel mills on 28 April. The contract calls for the supply of 87 million tons of pellets over 21 years starting in 1972 and 36.6 million tons of fines over 15 years starting in 1971. Within four months, from the signing of the contract, the full financing arrangements of the project will have to be presented to the Japanese steel mills. Partners in the Robe River venture are: National Bulk Carriers Inc. (Daniel K. Ludwig), 50 percent; Cleveland Cliffs Iron Co. of Ohio, Mitsui and Co. Ltd. and Garrick Agnew of Perth, 25 percent; other Australian participation 25 percent.

Goldsworthy Mining Ltd has begun examining the feasibility of increasing production at its existing mine and of opening up new ore bodies at Shay Gap and Kennedy Gap, about 40 miles inland from Mount Goldsworthy. Iron ore exports to Japan by this company during 1968 totalled 4,561,343 tons.

Broken Hill Proprietary Co. Ltd will spend more than \$150 million in the next three years on a major expansion programme at its Port Kembla Steelworks. A new blast furnace having an annual capacity of 1.5 million tons will be commissioned during 1971. This expansion programme will raise annual pig iron production to over 4 million tons and steelmaking capacity will then be increased from 31 million ingot tons to 53 million ingot tons. While most of the increase will be in flat products, there will also be additional tonnages of semi-finished steel and pig iron, some of which could be exported.

R. C.

Lead. The industrial disturbances that curtailed production of lead in 1968 have, unfortunately, continued into 1969 and two thousand miners at Zinc Corporation and New Broken Hill Consolidated were on strike for three weeks over night shift work in stopes. Partly because of these events and partly because producers' stocks had been run down in the previous year the British Metal Corporation announced that *force majeure* had been declared on deliveries of Broken Hill Associated Smelters' lead. Though it seems that consumers were caused only slight inconvenience, the news had some effect on the lead market prompting U.S. producers to raise their price again to 141¢ per pound (New York) at the beginning of April. Broken Hill Associated Smelters which increased the selling price of soft pig lead to \$250.00 per ton f.o.b. Port Pirie in March, has not changed up to the time of writing.

To alleviate the present shortage of lead a bill has been passed by the U.S. Congress to authorise the sale of 100,000 short tons of lead from the U.S.A. stockpile. At

present there are 1.2 million short tons of lead in the stockpile which is sufficient to support U.S. industry for about thirteen months. Since lead is no longer regarded as a strategic mineral the entire stock is available for disposal.

The next meeting of the International Lead and Zinc Study Group will take place in Geneva on 6 October, 1969. The Working Party's report on "Joint Production of Lead and Zinc" will be on the agenda.

Mt. Isa have announced plans to proceed with development of the Northern Leases where large lead-zinc-silver orebodies have been defined by diamond drilling. It appears that the size and grade of these deposits is of the same order as at the Mt. Isa mine itself. It is intended that production will begin in about seven years' time on the same scale and in addition to the present operations. This will make the whole mining complex the largest lead-zinc-silver mine in the world. As a first step a shaft is being sunk to facilitate underground exploration.

W. G. B. P.

Manganese. Exports of manganese ore increased by about 36 percent in 1968 to 427,515 tons. The largest producer, Groote Eylandt Mining Co. Ltd. was granted additional leases by the Government on the condition that beneficiation facilities are developed to achieve an annual capacity of 700,000 tons by 1971 and 1.1 million tons by 1974. Existing facilities have an annual capacity of 400,000 tons. Groote Eylandt supplies all of Australia's metallurgical manganese requirements and the balance of production is exported. Total shipments in 1967/68 amounted to 355,000 tons of which 114,000 tons were used domestically.

Longreach Manganese Pty Ltd acquired all the mining tenements of Mount Sydney Manganese Pty Ltd in September 1968. These comprise the operating mines at Woodie Woodie and major deposits at Ripon Hills, both of which are in the Pilbara region. The mines produce good metallurgical grade ore (48%-52% Mn) as well as siliceous grades (45% Mn, 15% SiO₂). Annual production at Woodie Woodie is about 60,000 to 80,000 tons.

Westralian Ores Pty Ltd produces metallurgical grade ore for export at Peak Hill and Mount Cooke in the Pilbara region.

E. C.

Nickel. Production of nickel concentrates at Kambalda in the four weeks to 29 April rose to a record 5,923 tons containing 750.4 tons of nickel and 96.5 tons of copper. Ore throughput at the mill in the same period was also a record at 24,391 tons compared to 14,583 tons in the previous period. The previous highest production of concentrates was 4,314 tons in the four weeks to 15 October 1968, but subsequent production has been restricted by continuing labour disputes. In addition to settlement of the disputes in mid-March, treatment has been increased by the commissioning of mill extensions which have raised capacity to 26,000 tons of ore per four week period (338,000 tons per year). Foundation work has also commenced for the crushing and screening plant section of further extensions designed to raise capacity to 66,000 tons of ore per four weeks (858,000 tons per year). Construction of the Kwinana refinery is reported to be progressing to schedule. In its Quarterly Report for the period to 1 April 1969, Western Mining Corporation Limited also announced results of further exploration drilling in the Kambalda area. The most significant results were obtained in five diamond drill holes at the Juan shoot (Kambalda North), although there was no addition made to stated reserves. At the Durkin shoot, shaft sinking and development work continued on W.M.C.'s second mine.

In the March Quarter, production of nickel in concentrates was 1,139 tons compared with 1,282 tons in the December Quarter of 1968. With increased capacity and the end of labour disputes, a significant increase can be expected in the June Quarter of 1969.

Conzinc Riotinto of Australia announced details of "Widgiemooltha" and "Redross" ore reserves, at the annual general meeting in March. Total indicated reserves at these prospects is 2.4 million tons averaging 2.35 percent nickel. The deposits were declared to be minable but no details of mining plans were announced, except that the Anaconda-C.R.A. partnership are negotiating special mining leases with the West Australian Government.

On 30 March, the Great Boulder-North Kalbarri partnership announced discovery of a new nickel copper prospect at Carr-Boyd Rocks, about 22 miles east of the Scotia mine. Assays of 0.77 to 4.43 percent nickel were recorded in two diamond drill holes, including a 66-foot intersection assaying 1.75 percent nickel and 0.36 percent copper.

Recent spectacular rises in the free market prices for nickel reflect a continuing world shortage of the metal. In London, the free market price of nickel has risen from £1,580-1,680 at the beginning of February to £2,550-2,750 at the beginning of May. Other important factors contributing to the rise of the free market are suggestions that the United States strategic stockpile might be increased and fears of labour troubles at the mines of International Nickel Co. Mine workers are currently negotiating wage increases with International Nickel, and these are expected to raise the company's producer price of 0.94 cents per pound when the extent of new labour service and supply costs are known. Labour disputes and a rise in the U.S. stockpile could affect the major producers' ability to supply customers.

R. Z. de F.

Silver. In 1968 the mine production of silver in the western world was about 250 million ounces which is 110 million ounces less than the industrial consumption of 360 million ounces. Against this background it is not surprising that speculation in silver has reached large proportions. The market has been partly stabilised by the knowledge that production is growing faster than consumption and by the sales from the G.S.A. which, it was thought, would continue at the rate of 2 million ounces per week for at least three years. However, in May the U.S. Treasury Department announced that sales would be reduced to 1.5 million ounces per week and have lifted the ban on melting silver coins. Legislation will be introduced to authorize the minting of dollar and half-dollar coins composed of metals other than silver. These moves suggest that the U.S. Treasury does not expect the shortage of silver to disappear in the near future. Though very large stocks of silver are being held as a currency hedge it seems unlikely that these will be available for industry until doubts about the rates of exchange of several important currencies are resolved. At present the G.S.A. has a surplus of about 150 million ounces which at the announced rate of disposal will last about two years.

W. G. B. P.

Tin. Domestic mine production of tin which reached a 55-year high of 6,698 tons in 1968 was expanded still further in early 1969 to an annual rate of about 7,200 tons. Mine production is expected to be increased to higher levels in the latter part of the year. Although the mining targets of major expansion programmes undertaken in connection with hard-rock mines in recent years are now being achieved, anticipated milling results are, in some cases, below expectations. Increased recovery rates of fine tin from these operations could boost output significantly. Again, production of alluvial tin in recent months has been at a

reduced level because of adverse weather conditions and the retreatment of low-grade tailings. With the resumption of operations on virgin ground and new production from recently-commissioned alluvial operations, output of alluvial tin should at least recover to levels achieved in 1968.

In contrast to expanded mine production, domestic production of primary, refined tin during the March quarter, 1969 was reduced to an annual rate of about 3,100 tons (3,700 tons in 1968) mainly as the result of a shortage of concentrates amenable to economic refining with the facilities available to the domestic smelter. Domestic consumption of primary refined tin which was reduced to 3,846 tons in 1968 compared with 4,396 tons in 1967, following a slump in domestic tinplate production in mid-1968, has improved in recent months and should reach about 4,000 tons during the current year.

Overseas, the eleventh meeting of the International Tin Council under the Third International Tin Agreement was held in London on 11-13 March 1969. The Council declared the quarter 1 April-30 June 1969 to be a third period of export control. The total permissible export tonnage for the period of 91 days for the six producing countries in the Agreement is 38,750 tons which compares with 38,000 tons for the previous control period of 90 days (1 January-31 March 1969). The Council invited the Australian Government, and the invitation was accepted, to limit its exports in the same third control period. The Council agreed to authorize the Buffer Stock Manager to operate within the middle sector of the price range (£1,400-£1,515) during the three months' period beginning 1 April 1969. This authorization increases the flexibility of market operations by the Buffer Stock Manager who previously was restricted to buying in the lower range (£1,280-£1,400) and to selling in the upper range (£1,515-£1,630). As at 31 December 1968 the buffer stock of the International Tin Council held 11,290 tons of tin metal.

On 27 March 1969 it was officially announced in Washington that the United States Office of Emergency Planning (O.E.P.) had increased the United States national stockpile objective for tin from 200,000 long tons to 232,000 tons. This in effect reduced the stockpile surplus of tin available for disposal by the General Services Administration to 25,121 tons. Although commercial sales by the G.S.A. were suspended until further notice on 1 July 1968, tin was included in a list of forty materials announced by the G.S.A. on 17 January 1969 as available for barter in exchange for certain products sought by the agency for the national stockpile. Tin was subsequently excluded from this list on 21 April 1969.

Although tin prices on the London Metal Exchange have fluctuated significantly since early 1969, in general, the price trend has been upwards. From a low of £1,348½ per ton which followed the United States' announcement that stockpile tin would be released on a barter basis, the L.M.E. cash price for tin recovered to £1,387 in mid-February, eased to £1,367½ in mid-March and recovered to £1,381½ on the announcement concerning the reduction of the U.S. national stockpile surplus. Aided by firm demand on both the London and Penang markets and purchases of tin as a hedge against currency uncertainties, cash tin broke through the £1,400 barrier on 9 April. As at 8 May, cash tin stood at £1,427½, and with a small, continuing contango, forward tin was quoted at £1,435½.

J. W.

Tungsten. During the early part of 1969 domestic production of scheelite concentrates was maintained at the 1968 level of about 1,600 tons (65% WO₃ basis) per annum. However, production of wolfram concentrates has increased significantly and should rise to about 800 tons in 1969, an increase of about 30 percent over the 1968 level of production. Although tungsten production is now recorded from Queensland, Northern Territory, New South Wales, and Western Australia,

operations in Tasmania continue to supply the bulk of domestic output, and any large-scale increase in production, at least in the short term, will be dependent on expanded production in Tasmania.

The cyclical pattern of the world tungsten market which has become an accepted feature of the bi-annual Canton Fair was again in evidence during the early part of 1969. The London *Metal Bulletin* quotation for standard-grade wolfram which reached a peak of stg. 4374-450 shillings per long ton unit WO_3 in mid-January 1969 declined progressively throughout February and March, until by the time of the Canton Fair (mid-April), the quotation was reduced to the range of 365-380 shillings. Although the level of offerings of Chinese ore is reported to have increased, price discounts have been to a large extent eliminated. By mid-May, the L.M.B. quotation for wolfram had been readjusted to the range of 375-400 shillings per l.t.u. WO_3 .

J. W.

Zinc. The strong demand for zinc continued during the second quarter of 1969 and the recent price increases in the U.S. were followed by the Australian refineries who raised the price of g.o.b. zinc from \$264 per ton to \$278 per ton in May. These world price changes suggest that the supply of zinc may be rather inelastic in the short run and that the excess capacity that was suggested by the statistics was due to an over-optimistic estimate of plant performance.

The significance of the Beltana, S.A. zinc silicate orebody has been enhanced by the discovery of zinc mineralization at Aroona, seven miles to the north-west. The deposit has been traced 800 feet along the strike and has an average width of 20 feet. Electrolytic Zinc have begun a diamond drilling programme to evaluate the discovery in depth.

Exports of zinc in zinc concentrates from Australia have fluctuated widely from year to year but on average there has been little sign of growth. This picture may change in the coming year in view of Mt. Isa's expansion programme. This company has no zinc refinery and ships nearly all the zinc produced in the form of concentrate. New Broken Hill and Zinc Corporation also export a proportion of their zinc concentrates but the Read-Rosebery mines, Broken Hill South and North Broken Hill deliver nearly all of their concentrate to E.Z. Industries' refinery at Risdon. Domestic refining has the advantage of additional revenue from by-products and from a national point of view there is a greater contribution to G.N.P. However, concentrates find a ready market overseas from electrolytic refineries and I.S.F. smelters. There seems to be a tendency to install new plant in the industrialised countries close to the market provided that there is an adequate power supply. The refinery sometimes forms part of an industrial complex which uses the refined zinc in its own manufactures (e.g. Hachihoe, Japan). This trend may make the sale of refined metal more difficult than concentrates and inhibit the establishment of secondary industries on the basis of domestic raw materials. A case in point is Goldfields of South Africa's subsidiary Zincor which has constructed an electrolytic refinery with a capacity of 33,000 tons per year at Vogelstruhsbult. The South African Government is pursuing a policy of import replacement and as soon as the refinery was commissioned, an embargo was placed on imports of refined zinc. Due to technical problems, this was later relaxed but it seems that a traditional outlet for Australian zinc will be closed by the end of 1969.

At E.Z. Industries' Rosebery mine exploratory drilling has established ore reserves of 7.5 million tons. To exploit these resources, the mine will sink a new shaft and duplicate the concentration plant. It is intended that production will be doubled to 600,000 tons of ore per annum within two years. Output from the company's Farrell mine will also be increased from 5,000 to 15,000 tons per annum.

G. B. P.

MINERAL SANDS

Following on the results of 1968 when all sectors of the domestic mineral sands industry operated at record levels, preliminary statistics available for the early months of 1969 indicate that the industry will achieve even higher levels of production and sales during the current year. In addition to expanded output by long-established mineral-sand operators and manufacturers of TiO_2 pigments, two recent developments are worthy of special note. On King Island in Bass Strait, mineral sand operations have been brought to commercial production by Naracoopa Rutile Ltd. and at Port Pirie, the processing plant of Rare Earth Corporation of Australia Pty Ltd was officially commissioned on 2 May 1969. The plant is currently producing individual rare earths from locally-produced monazite concentrates and scandium from residues accumulated from the treatment of davite ore from Radium Hill in the period 1955-1962.

Ilmenite. During the first quarter of 1969, production of ilmenite concentrate in Western Australia was running at an annual rate of about 650,000 tons. This compares with domestic output of 550,117 tons in 1968. In recent months, the domestic ilmenite industry has been marked by an increase in the tempo of exploration, particularly in Western Australia, and by further developments in the beneficiation of ilmenite. At least four Australian mining companies are actively engaged on research and pilot-plant investigations aimed at developing an upgraded TiO_2 product competitive with natural rutile in both quality and price. Western Titanium, N.L., operating at Capel, W.A. is well advanced in achieving production on a commercial scale. The company produced approximately 1,600 tons of upgraded ilmenite during the year ended 31 January 1969 but as the TiO_2 content was slightly below that desired, no deliveries were made to potential consumers. Throughout the early part of 1969, the company's semi-commercial plant has operated continuously at the designed rate of throughput of 10,000-15,000 tons per annum. Although the grade of the end product is still slightly below that aimed for, some improvement in grade is being achieved. It is now hoped that the necessary large test parcels will be made available for processing by potential consumers during the current year.

Further details have been released of the beneficiation process developed jointly by Murphysore Incorporated Pty Ltd and the C.S.I.R.O. Division of Mineral Chemistry. Briefly, the process involves the reduction of ilmenite with hydrogen and subsequent leaching with dilute hydrochloric acid to give an upgraded product assaying 96-97 percent TiO_2 . Commercial output is planned for 1971-1972, and will depend on progress made in pilot-plant investigations. Meanwhile, the company is producing a mixed ilmenite-zircon-rutile concentrate at Rodd's Peninsula, about 20 miles south of Gladstone. Dry plant facilities are being commissioned at Barney Point, Gladstone.

Rutile. The steady firming in rutile prices, a feature of the world rutile market in recent months, was accelerated sharply in April when the United Kingdom quotation for rutile concentrates, 95-97% TiO_2 , was increased in one adjustment from £stg52-54 per ton c.i.f. to the range £59-63 per ton. Such an adjustment highlights the increasing pressure to which immediate supplies of rutile are being subjected. An increasing proportion of future domestic production is now covered by long-term contracts held by pigment producers, and spot material, for use mainly by the electric welding-rod industry, is now commanding premium prices. Shipments of rutile for prompt delivery are reported in the general range of \$110-120 per ton f.o.b.

The increased strength of the rutile market has resulted in the full utilization of installed capacity on the east coast and has stimulated the development of new deposits formerly regarded as sub-marginal. Preliminary statistics indicate that domestic output of rutile concentrates is currently running at about 320,000 tons per annum.

Zircon. Domestic output of zircon concentrates has increased progressively since early 1968 and in the March quarter 1969, production was running at an annual rate of almost 330,000 tons. Despite a statistical surplus, zircon prices remain firm, except for isolated shipments of low-priced material, as major producers build up stocks and concentrate more on the production of premium-grade zircon.

J. W.

SULPHUR

Increase in the production of sulphuric acid was not maintained in 1968 and fell from the peak of 1,987,190 mono-tons in 1967 to 1,842,787 mono-tons in 1968. Of the total production 68.1 percent was produced from elemental sulphur, 12.0 percent from pyrites, 14.7 percent from zinc concentrates, 3.9 percent from lead concentrates and the remaining 1.3 percent from other materials.

Of the total sulphuric acid consumption of 1,846,610 mono-tons, 77.5 percent was used in the manufacture of superphosphate, 3.4 percent in the manufacture of sulphate of ammonia, 16.9 percent in general chemicals and the remaining 2.2 percent in mining and metallurgy.

Total imports of elemental sulphur in 1968 were a record 548,558 tons valued at \$21,632,484; of this total 548,382 tons valued at \$21,602,022 was sulphur in bulk and 176 tons valued at \$30,462 was sulphur bagged or packaged. Increased imports from Canada accounted for 57.5 percent of the total exports, while the United States, the chief source of supply for many years and Mexico supplied 21.7 percent and 16.5 percent respectively. Poland and France supplied the rest.

There were some variations in import values of elemental sulphur during the year. The average f.o.b. values of sulphur from Canada, the United States, Mexico, Poland and France in 1968 were \$38.52 per ton, \$38.24 per ton, \$42.59 per ton, \$39.26 per ton and \$54.46 per ton respectively; comparable figures in 1967 were \$34.40, \$32.80, \$32.40 and \$53.40 per ton respectively. No exports were recorded from Poland in that year.

For the first time since 1962 output of the non-Communist world's elemental sulphur producers exceeded sales and the short supply of sulphur is over.

The non-Communist world production of sulphur in all forms of 27.3 million tons was up 1.8 million tons over 1967. About three-quarters of this gain was accounted for by increased elemental sulphur production, the major part of which represented an increase in output in Western Canada and to a lesser degree, higher production of U.S.A.

The non-Communist world consumption of sulphur in all forms established a new record of 26.9 million tons in 1968, an increase of more than a million tons over 1967. Elemental sulphur consumption reached 16 million tons, an increase of 550,000 tons as compared with 1967. The largest gains were in the Far East and Latin America with more moderate improvements in Africa, the Middle East, Oceania and Europe.

Regarding outlook, both consumption and production of sulphur in the non-Communist world are expected to set new records in 1969. The increase in consumption is expected to exceed the increase achieved in 1968; continued rising demand for fertilizer throughout the world will increase sulphur requirements for this major consuming industry.

Z. K.

Prospects for Australian Zinc

J. B. ALLEN

INTRODUCTION

Despite mid-year industrial stoppages that seriously affected the output from Broken Hill, mine production of zinc in Australia rose for the fourth successive year in 1968 to exceed 412,000 tons of zinc in all mine products. In the period since statistics became available in 1889, the total amount of zinc mined in Australia had exceeded 13 million tons by early 1969. Australia produced roughly 8 percent of the world's total mine output of zinc in 1967 and was ranked fourth in order of decreasing importance to Canada (23 percent), U.S.A. (11 percent) and U.S.S.R. (10 percent). Australia is long established as having the highest actual consumption per head of population in the world, amounting to 19.8 pounds of zinc per capita in 1968. In this connection, the ease with which sheet galvanized products can be transported in a rolled form over the long distances and poor roads of the Australian outback has been an important factor in promoting a high consumption of zinc for constructional purposes in the rural industries.

The present decade in the Australian mineral industry has been marked by rapid growth accompanied by an increasing diversification that has focussed world attention on such comparative newcomers to the list of Australian mineral exports as alumina, salt, manganese, and nickel concentrates, in addition to the burgeoning exports of iron ore, black coal, and bauxite. In this situation, there is a tendency to overlook the expansion and diversification that is taking place concurrently in the lead-zinc sector as its proportionate contribution to total export earnings begins to decline. In 1965, exports of the lead and zinc industry accounted for 44 percent of the total value of mineral exports (excluding shipments of gold, alumina and uranium oxide). However, in 1966, when the value of exports from the lead-zinc sector rose to a record level of \$127.9 million, its proportionate contribution to mineral export earnings declined to 38.5 percent. This trend was accentuated in 1967 when world prices for lead and zinc were depressed and export earnings from this sector declined by 2.0 percent to \$125.5 million which represented only 30 percent of mineral export earnings.

Any discussion of the Australian zinc industry must also consider the domestic lead industry as these base metals occur in close association, together with silver, cobalt, cadmium, and other co-products, in the three main centres of mine production, viz. Broken Hill, N.S.W., Mt Isa, Qld. and Read-Rosebery, Tas. Overseas earnings from the lead-zinc sector have been the mainstay of Australian mineral trade in earlier decades and it would be hard to exaggerate their contribution to the economic growth of the nation. In particular since the commencement of mining at Broken Hill in 1885, these world-famous mines have conferred immense financial benefits on the states of Victoria, South Australia, and New South Wales. Thus company dividends and capital gains have accrued to shareholders and speculators in Victoria; rail freight, treatment and handling charges have benefited South Australia; while mining royalties have been levied by New South Wales. The smelting and subsequent treatment of the Broken Hill concentrates led to the formation of three major companies in chronological order—Sulphide

Corporation Pty Ltd, Broken Hill Associated Smelters Pty Ltd, and Electrolytic Zinc Company of Australasia Ltd (now part of E.Z. Industries Ltd). These companies account for the entire domestic production of refined zinc and refined lead, and also produce a varied range of by-products such as fertilizers, sulphuric acid, refined silver and other metals, that are in turn the basis of secondary industries.

AUSTRALIAN RESOURCES OF ZINC

Before reviewing the domestic zinc industry on a company basis, it is relevant to consider the Australian supply position in relation to zinc-bearing ores and other domestic sources of raw material from which zinc metal can be extracted. In the case of ores, figures of "proved" reserves are published annually by the mining companies for the three most important centres of current mine production, viz. Broken Hill, Mount Isa, and Read-Rosebery. However, the summation of these figures understates considerably the total reserve position. The delineation of "proved" reserves by the blocking out of ore on three sides is an expensive procedure that companies normally restrict to a few years ahead in the working life of the mine. If the Beltana prospect is excluded from Table 1, "proved" reserves at current mining centres of production amount to only 5.4 million tons of zinc (associated with 4.8 million tons of lead and 280 million ounces of silver) and this amount would be exhausted within fourteen years at the present rate of mine production. The companies do not normally release estimates of their reserves of "indicated" and "inferred" ore, but some useful data on Broken Hill is contained in the Annual Report for 1967 of Conzinc Riotinto of Australia Ltd. In this report, the "ore expectancy" of the mine operated by The Zinc Corporation Ltd, on 31 December 1967 amounted to 25.1 million tons assaying 10.5% zinc, 10% lead and 2.5 oz. silver per ton. Although 6 million tons of "proved" ore was included in this total, there was an additional 3.8 million tons of material assaying 8% zinc, 2.5% lead and 0.5 oz. silver that was excluded as it was

TABLE 1. "PROVED" ORE RESERVES OF MAIN AUSTRALIAN PRODUCERS

Company	Location	Date	"Proved" reserves ('000 tons)	Assay values			Zinc content ('000 tons)
				% Zinc	% Lead	oz/ton Silver	
North Broken Hill	Broken Hill, N.S.W.	30. 6.68	4,463	*10.7	13.0	7.4	477.5
Broken Hill South	Broken Hill, N.S.W.	30. 6.68	770	*11.0	11.6	6.5	84.7
Zinc Corporation	Broken Hill, N.S.W.	31.12.68	6,000	9.9	11.9	2.5	594.0
New B.H. Consolidated	Broken Hill, N.S.W.	31.12.68	6,000	13.8	9.9	2.6	828.0
Mt. Isa Mines	Mt. Isa, Qld.	30. 6.68	32,000	5.6	7.2	5.2	1,792.0
E.Z. Industries Ltd.	Rosebery-Hercules, Tas.	30. 6.68	8,650	18.6	5.6	5.1	1,608.9
E.Z. Industries Ltd.	Farrell, Tas.	30. 6.68	60	7.3	12.8	14.1	4.4
E.Z. Industries Ltd.	Beltana, S.A.	30. 6.68	730	37	2.9	—	270.1
E.Z. Industries Ltd.	Beltana, S.A.	30. 6.68	97	24	12	—	23.3
TOTAL							5,682.9

*Based on recent production assays where not stated for reserves.

uncertain that all sections of this lower-grade material could be mined economically under the conditions prevailing at Broken Hill. The "ore expectancy" of the mine operated by New Broken Hill Consolidated Ltd, on 31 December 1967 amounted to 33.3 million tons assaying 15.5% zinc, 9% lead and 2.5 oz. silver per ton. This total included 6 million tons of proved ore but did not include a further 10.8 million tons of material assaying 9% zinc, 4% lead, and 1 oz. silver per ton. If the foregoing data are used to calculate total reserves of metal contained in ore and lower-grade material on 31 December 1967 at both mines: The Zinc Corporation Ltd had total reserves of 2.94 million tons of zinc, 2.61 million tons of lead and 64.65 million ounces of silver.

New Broken Hill Consolidated Ltd had total reserves of 6.13 million tons of zinc, 3.43 million tons of lead, and 11.63 million ounces of silver.

The above summations suggest that total reserves at all producing mines would be several times greater than the figure given in Table 1.

In respect of current mining operations, no recent estimates of reserves at the Cobar, N.S.W. copper-lead-zinc mine nor at the Mount Hebbard residue dump in Broken Hill have been released by Broken Hill South Ltd. Estimates are also lacking for the Mount Evelyn, N.T. lead-zinc-silver mine operated by United Uranium N.L. where reserves are understood to be limited.

The discovery of another occurrence of willemite seven miles to the northwest of the Beltana deposit, was reported by E.Z. Industries Ltd in April 1969. At the time of writing, no details of reserves are available for the new ore-body which is to be termed the Aroona deposit. In respect of other potential producers, reserves are not available for the Mount Bulga deposit, N.S.W., which is under investigation by Kamilaroi Oil Co. Ltd, nor at Woodcutters', N.T., which is being investigated by Peko-Wallsend Investments Ltd and E.Z. Industries Ltd. However, these and other occurrences would appear to be of minor importance compared with the large lead-zinc-silver orebody under investigation by Mount Isa Mines Ltd at McArthur River, N.T., where reserves have been "guestimated" at 200 million tons of ore assaying 4% lead and 9% zinc.

Despite the paucity of published data, there can be little doubt that Australian reserves of zinc are sufficient to maintain the present rate of mine extraction well into the next century. In the case of Broken Hill where ore is being extracted from greater depths with some reduction in grade, mining costs are bound to influence the reserve position and are in turn dependent on the degree to which restrictive practices are followed by the labour force. Reservations on development costs also apply to the more remotely situated deposits such as McArthur River where transportation problems are as important as the metallurgical problems presented by the ore.

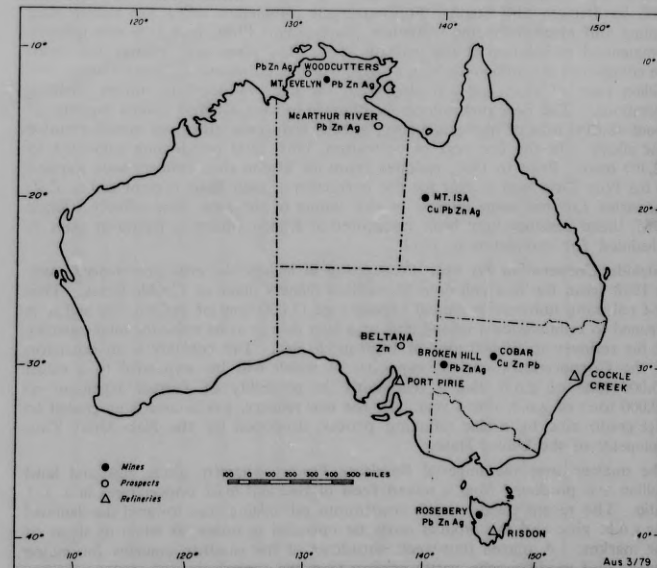


Fig. 1. Principal localities for zinc.

RECENT DEVELOPMENTS IN THE AUSTRALIAN ZINC INDUSTRY

It is convenient to review recent developments in mining and metal extraction in the Australian zinc industry on a company basis. Some of the more important projects are tabulated in Table 2.

North Broken Hill Ltd. Work commenced at Broken Hill in June 1967 on extending the No. 3 shaft from 4,320 feet down to 5,300 feet in order to assess the potential of the orebody at depth.

Broken Hill South Ltd. The re-treatment of the large Mount Hebbard residue dump at Broken Hill commenced in September 1966. In the twelve months ending 30 June 1968, 246,886 tons of residue assaying 3.0% lead, 3.1 oz. silver and 4.6% zinc were treated for the production of 7,188 tons of zinc in zinc concentrate and 4,279 tons of lead and 507,882 ounces of silver in lead concentrate. This re-treatment programme is planned to continue at an annual rate of 250,000 tons of residue. Rising production has been reported from the copper-lead-zinc mine at Cobar by a subsidiary company, Cobar Mines Proprietary Ltd, which produced 12,285 tons of zinc concentrate containing 6,108 tons of zinc in the calendar year 1968, in addition to separate concentrates of lead and copper.

The Zinc Corporation Ltd. A computer installation for control and accounting purposes is expected to be completed in 1970. A new type of flotation cell has been developed by the company and was introduced into the mill circuit in 1968. The introduction of automated milling techniques is a continuing development in the C.R.A. mines at Broken Hill.

New Broken Hill Consolidated Ltd. The productive capacity of the mine was raised to 1 million tons per annum in 1967 and raised further to 1.2 million t.p.a. early in 1969 in the company's expansion programme. In recent years, increased tonnages of ore have been treated from the predominantly zinc-bearing "B" lode.

The Broken Hill Associated Smelters Pty Ltd. The company is owned as to 50 percent by Conzinc Riotinto of Australia, 30% by North Broken Hill and 20% by Broken Hill South. Following the completion of a \$16 million slag fuming and electrolytic zinc reduction plant at Port Pirie, S.A., the new refinery commenced production at the end of 1967. The plant will recover zinc from the company's six-million-ton slag dump, which is estimated to contain about one million tons of zinc, and will also treat the slag produced in current smelting operations. The new zinc refinery is planned to have a rated annual capacity of about 40,000 tons of high-grade zinc, special high-grade zinc and special purpose zinc alloys. In the first year of operation, 1968, total production amounted to 22,967 tons. Prior to 1965, residues from the Risdon zinc refinery were shipped to the Port Pirie lead smelter for the extraction of their lead content and so E.Z. Industries Ltd has some interest in the output of the new zinc refinery. Since 1965, these residues have been stockpiled at Risdon where a treatment plant is scheduled for completion in 1971.

Sulphide Corporation Pty Ltd. Production of high-grade zinc commenced early in 1968 from the first unit of a \$3 million refinery plant at Cockle Creek. This first refluxing unit has an annual capacity of 17,000 tons of refined zinc and it is planned to commission a second unit at a later date so as to raise the total capacity of the refinery to 35,000 tons of high-grade zinc. The refinery is an extension of the Corporation's smelter, capacity of which will be expanded to a rated 55,000 tons of g.o.b. zinc a year with the possibility of further expansion to 70,000 tons of g.o.b. zinc a year. In the new refinery, g.o.b. zinc is up-graded to high-grade zinc by a zinc refluxing process developed by the New Jersey Zinc Company of the United States.

The smelter uses the Imperial Smelting Process wherein g.o.b. zinc and lead bullion are produced from a mixed feed of zinc and lead concentrates in a 3:1 ratio. The recent trend towards continuous galvanizing has lowered the demand for g.o.b. zinc and this product must be upgraded in order to retain its share of the market. A planned four-week shutdown of the smelter complex for major repairs and modifications, partly arising from the commissioning of the refluxing

TABLE 2. RECENT DEVELOPMENTS IN THE AUSTRALIAN ZINC INDUSTRY

<i>Company</i>	<i>Location</i>	<i>Project</i>	<i>Expenditure</i>	<i>Completion Date</i>
North Broken Hill Ltd	Broken Hill (N.S.W.)	Deepening of No. 3 Shaft and related mine development	\$2.3 million	1971
Broken Hill South Ltd	Broken Hill (N.S.W.)	Re-treatment of 250,000 t.p.a. of residues from Mt. Hebbard dump	\$1 million	1966
Cobar Mines Pty Ltd	Cobar (N.S.W.)	Deepening of No. 1 shaft, C.S.A. mine and general development of the Cobar field		? early 1970's
The Zinc Corporation Ltd	Broken Hill (N.S.W.)	Introduction of automated milling techniques		
New B.H. Consolidated Ltd	Broken Hill (N.S.W.)	Expansion in mine capacity to 1 million t.p.a. of ore	\$10 million	1967
		Further expansion to 1.2 million t.p.a. of ore	\$3 million	1969
Mount Isa Mines Ltd	Mt. Isa (Qld.)	Expansion in mine capacity to exceed 5.5 million t.p.a. of ore	\$130 million	1969
	Mt. Isa (Qld.)	Treatment plant for production of 31,000 t.p.a. of zinc oxide from lead smelter slag	\$6.5 million	1971-72
	Mt. Isa (Qld.)	Commencement of production from the Northern leases	Very large	1976
E.Z. Industries Ltd	Rosebery (Tas.)	Sinking of No. 2 mine shaft	\$4 million	1971
	Rosebery (Tas.)	Expansion in mill capacity, company housing, etc.	\$6 million	1971
	Risdon (Tas.)	New casting plant and "fluidised roaster" unit	\$5.5 million	1969
	Risdon (Tas.)	New electrolytic cell unit, etc.	\$3.6 million	1970
	Risdon (Tas.)	Treatment plant for production of 22,000 t.p.a. of zinc from refinery residues	\$6.3 million	1970
B.H. Assoc. Smelters Pty Ltd	Port Pirie (S.A.)	Slag fuming and electrolytic plant with eventual capacity of 40,000 t.p.a. of zinc	\$16 million	1967
Sulphide Corp. Pty Ltd	Cockle Creek (N.S.W.)	Smelter expansion and installation of zinc refluxing unit with eventual capacity of 35,000 t.p.a. of H.G. zinc	\$3 million	1969 (1st unit completed)

unit, occurred in 1968 and was responsible for the lowered metal output of 48,581 tons.

Mount Isa Mines Ltd. An expansion programme entailing an expenditure of \$130 million which was initiated by the company in the previous decade is expected to be completed in 1969. The daily throughput of ore which averaged 13,376 tons in 1968 is then intended to reach a target of 16,000 tons of ore per day. In terms of metal, the company should be able to produce each year 100,000 tons of copper, 140,000 tons of lead, 160,000 tons of zinc concentrate averaging around 52 percent of zinc, and 11.5 million ounces of silver.

New projects announced in November 1968 that are additional to this programme include the sinking of a new shaft in the copper-productive area at an anticipated cost of \$4.5 million on which work commenced in March 1969, and the building of a zinc oxide plant which will involve an expenditure of \$6.5 million. The company has no facilities for the smelting of zinc concentrates but will base the zinc oxide plant on spent slag from the Mount Isa lead smelter. It will be recalled that the slag from the lead smelter at Port Pirie is converted to zinc oxide before being processed in the new electrolytic zinc refinery operated by Broken Hill Associated Smelters Pty Ltd. The zinc oxide plant at Mount Isa is expected to be commissioned in 1971 or 1972 and will have an annual output of about 31,000 tons of zinc oxide containing 23,000 tons of zinc.

In May 1969, plans were announced by the company for bringing its Northern leases into production by about 1976. The leases are situated some twelve miles to the north of the present town and it is anticipated that the deposit would support a production operation of the same magnitude as the present lead-silver-zinc operations at Mount Isa. No details were disclosed in the company's announcement of the cost of this new project but it will involve many millions of dollars spread over a number of years in the development of mines, the building of a concentrating plant and smelter and the provision of additional transport facilities.

E.Z. Industries Ltd. Although a group of mining companies from Broken Hill founded the Electrolytic Zinc Company of Australasia Ltd. in 1916 for the refining of zinc concentrates, only 10 percent of the shareholdings in E.Z. Industries Ltd is now held by some of the original founders, viz. North Broken Hill and Broken Hill South. In the early years of its operations at Risdon, Tas., the company depended upon the Broken Hill mines for supplies of zinc concentrates but since 1921 has obtained about one-third of its requirements from its own mines near Rosebery on the west coast of Tasmania, and this proportion is rising under the company's current expansion programme. Occasional shipments of zinc concentrates are also made from Mount Isa to Risdon.

In 1968, the E.Z. Industries group initiated a major programme of expansion that will involve a capital investment of some \$50 million over five years. Two major facilities involving an expenditure of some \$5.5 million at the Risdon refinery include a new zinc melting and casting plant, which has been introduced to satisfy market requirements for a variety of shapes and specifications of zinc and zinc alloys, and a new concentrate "fluid bed" roaster. The new roasting unit, which was commissioned in March 1969, will replace two of the existing hearth roasters and also increase the capacity of the plant. The company has embarked on a \$6.3 million project for the annual treatment of 115,000 tons of primary residue from the refinery. The proposed plant will process residue from current production together with material from a 900,000 ton residue dump at Risdon. The residue dump assays 22.8% zinc, 5.2% lead, 0.22% cadmium and 6.6 oz. of silver per ton. Zinc in solution for the production of 22,000 tons of zinc a year will be provided from the treatment plant which is scheduled for completion at the end of 1970. In addition to zinc, the treatment plant is expected to yield annually 230 tons of copper residue, 220 tons of cadmium, 13 tons of cobalt oxide and 35,000 tons of a silver-lead residue containing 18-22% lead, 6-9% zinc, and 23-24 oz. of silver per ton.

Partly in order to meet the additional electrolytic cell capacity that will be needed to extract the zinc in solution from the treatment plant, a new cell unit with auxiliary plant and equipment will be constructed at Risdon for an estimated expenditure of some \$3.6 million. Other improvements at the Risdon works include the installation on the foreshore of a conveyor system which can handle zinc concentrate at rates of up to 1,000 tons per hour and will transfer it directly from ship to stockpile.

At the Company's mines on the west coast of Tasmania, work commenced at the end of 1967 on the Rosebery No. 2 mine shaft project of which the capital cost is estimated at \$4 million. The new shaft will service mining operations below the level of the existing shaft and is scheduled for completion in 1971 when the mine capacity should have doubled to 600,000 tons of ore a year. The mill capacity at Rosebery will be raised to match the increased mine capacity and this expansion, together with additional housing for the enlarged work force, will involve an expenditure of some \$5 million.

In September 1968, the Company announced that a drilling programme at the Beltana zinc prospect in South Australia had demonstrated ore reserves of 730,000 tons averaging 37% zinc and 2.9% lead, and 97,000 tons averaging 24% zinc and 12% lead. The zinc mineralization is willemite (zinc silicate) and, to date, no sulphides have been located. Open-cut mining feasibility studies have been made on the Beltana orebody and pilot plant scale metallurgical tests on a trial shipment of Beltana ore were in progress at Risdon early in 1969. In April 1969 a further occurrence of willemite was located at the Aroona deposit, seven miles to the northwest of the Beltana deposit. Diamond-drilling was then progressing to establish reserves for the new orebody.

In addition to its exploration programme in the Flinders Range, the company is actively engaged in exploration for a variety of metals throughout Australia and a large number of these ventures are joint projects with other companies. In September 1968, the Commonwealth Government announced the acceptance of a joint proposal submitted by Peko-Wallsend Investments Ltd and the Electrolytic Zinc Company of Australasia Ltd to carry out further exploration and development work on the Woodcutters' lead-zinc prospect in the Northern Territory. The companies were expected to spend at least \$150,000 in the initial stage of exploration and assessment at Woodcutters'.

TRENDS IN MINE PRODUCTION

Provided that production plans are not disrupted by labour difficulties or by events on the international scene, a continuing upward trend in domestic mine production is assured for the next decade and beyond. This expectation is based upon the increased mine capacities achieved at the southern end of the Broken Hill orebody in 1967, the present programme of expansion at Read-Rosebery, and the completion of a massive expansion at Mount Isa in 1969. In addition at Mount Isa, the announcement in May 1969 of a further massive expansion which will bring the Northern leases into production by 1976 could lead eventually to a doubling in output from this remarkable mining centre. Apart from these main areas of current mine production and an increasing output from the Cobar field, significant contributions could also be made by Beltana, Aroona, Woodcutters', and other prospects. In the long term, a substantial output should be forthcoming from the extensive deposit at McArthur River provided that metallurgical and other development problems can be overcome.

Mine production statistics of zinc in zinc concentrates for the calendar years 1967 and 1968 are given in Table 3. The effects of industrial unrest at Broken Hill during 1968 is demonstrated by a fall in output of 20,000 tons from the Broken Hill mines; however, rising output from Mount Isa more than compensated for this temporary decline. On the basis that the expansion at Mount Isa is completed in 1969 and the Read-Rosebery expansion is completed in 1972, projected mine capacities for 1970 and 1972 are also included in Table 3. However, it should be noted that actual production could fall well below the projected

tonnages due to the intervention of a variety of factors. Apart from industrial difficulties, the mining companies might decide on a temporary curtailment of output if the world supply of zinc concentrates were to move into a position of pronounced surplus, while prevailing metal prices might cause a producer who was working a mixed orebody as at Mount Isa to extract a higher proportion of ore with a lower zinc content. Bearing in mind these qualifications, it would appear that total domestic mine capacity of zinc in zinc concentrates will rise to 425,000 tons in 1970 and will attain 470,000 tons in 1972.

TABLE 3. MINE PRODUCTION ZINC IN ZINC CONCENTRATES (tons)

	1967	1968		
North Broken Hill	49,718	45,593	<i>Projected Mine Capacities Zinc in Zinc Concentrates (tons)</i>	
Broken Hill South	25,541	24,634		
The Zinc Corporation	76,038	64,352		
New Broken Hill Consolidated	126,585	122,936		
			1970	1972
Broken Hill total	277,882	257,515	280,000	285,000
Mount Isa	40,104	66,597	83,000	83,000
Read-Rosebery	45,204	45,012	50,000	90,000
Cobar	3,573	6,108	8,000	8,000
Others	2,276	4,844	4,000	4,000
Total	369,039	380,076	425,000	470,000

If these projections prove to be borne out by the pattern of mine production in 1970 and 1972, the implied decline in the relative importance of Broken Hill as the dominant supplier of zinc concentrates in Australia is worthy of comment. Thus from supplying 75 percent of the total output of zinc concentrates in 1967, Broken Hill's proportionate contribution would be reduced to 60 percent in 1972, and can be anticipated to decline further after 1976 when the Northern leases at Mount Isa are brought into production.

TRENDS IN METAL PRODUCTION

In the important area of refined metal production, 1968 was an eventful year during which continued progress was made by E.Z. Industries toward upgrading the capacity of its Risdon refinery while production of high-grade zinc was established at two new centres in Australia, viz. Port Pirie and Cockle Creek.

Power restrictions which were imposed in the Risdon works as a result of drought conditions in Tasmania during 1967 and 1968 served to depress metal production during this period below the level of plant capacity which would have been around 150,000 tons. The easing of power restrictions in mid-1968 enabled a return to normal working conditions and Risdon was producing refined zinc at an annual rate of 155,000 tons at the end of the first quarter of 1969. In the present programme of expansion, it is anticipated that the capacity of the refinery will be raised to around 175,000 tons by 1970 and to 200,000 tons by 1972. At the end of this period, a substantial change will have occurred in the relative proportions of concentrates and other processed raw materials in addition to their increased volume. Thus, a doubling in output from the west coast mines should cause the contribution of zinc concentrates treated from this source to rise from roughly 30 percent in 1968 to exceed 50 percent in 1972, while treatment of the Risdon residues should be yielding zinc in solution for the annual production of 22,000 tons of zinc by 1971. Present indications are that the Beltana ore will be treated at Risdon, where presumably it will be blended for processing with sulphide concentrates from Broken Hill and Rosebery. However, the chemistry of zinc silicate ore renders it unlikely that the electrolytic extraction unit at Risdon would be able to cope annually with more than 20,000 tons of Beltana ore in a mixed feed. Current expansion at Risdon will raise the throughput of all the various processing units in the refinery to an optimum level. After the completion of this programme, the capacity of the refinery should be approaching the attainable maximum on the present site and further increases beyond a "suggested ceiling" capacity limit of 230,000 tons would seem unlikely.

Australian statistics of refined zinc production in 1967 and 1968 are presented in Table 4 together with projected refinery capacities for 1970 and 1972. It is assumed in these projections that expansion at Risdon proceeds at the rate indicated below, that full capacity is not achieved at Port Pirie until after 1970 and that the capacity at Cockle Creek has not exceeded 60,000 tons by 1972. As expansion would proceed at a faster rate at both Port Pirie and Cockle Creek, these projections could seem to be minimal estimates. Furthermore, the production at Mount Isa of 31,000 tons of zinc oxide annually from 1971 or 1972 has been omitted from these estimates as the company has not announced whether it intends to refine the zinc oxide in Australia.

TABLE 4. PRODUCTION OF REFINED ZINC (tons)

	1967	1968		
E.Z. Industries Ltd			<i>Projected Refinery Capacities (tons)</i>	
Special high grade	25,842	24,025		
High grade	81,892	68,242		
Debased	31,441	38,120		
Zinc dust	3,148	3,057	1970	1972
E.Z. total	142,323	133,444	175,000	200,000
Sulphide Corp'n Pty Ltd	52,148	48,581	55,000	60,000
B.H.A.S. Pty Ltd	—	22,967	35,000	40,000
Total	194,471	204,992	265,000	300,000

TRENDS IN METAL CONSUMPTION

As with some other metals, comprehensive statistics relating to the domestic consumption of zinc are not available. This situation is due partly to a lack of data concerning the consumption of scrap, particularly when the metal is not recovered, e.g. remelted brasses, but statistics for the consumption of primary zinc are also incomplete. Regular returns for the sale of primary metal in Australia are released by the Australian Zinc Development Association—see Table 5; however, excluded from these returns are some inter-company despatches that are not reported as sales. More complete estimates of domestic consumption are provided by the summation of all domestic despatches and imports as presented in the tabulation accompanying Fig. 2 and it will be noted that these estimates are upwards of several thousand tons higher than the totals derived from sales returns in Table 5. Although most of the zinc in these inter-company "sales" is believed to go to die-casting, no attempt has been made to adjust the A.Z.D.A. die-casting return as a variable amount of die-casting alloy is exported each year but is not differentiated from refined zinc in Australian trade returns.

Domestic consumption has always followed an erratic course due to the influence of such variables as the level of personal disposable income, the state of the domestic automobile industry—which affects die-casting consumption—and the weather, e.g. a prolonged drought will depress the demand for galvanized products in the rural industries. Thus, domestic consumption of refined zinc in 1967 rose more than 15 percent above the level of 1966, although the overall growth rate in domestic consumption for the decade 1958-1967 was 3.1 percent per annum. Consumption rose by roughly this amount from 1967 to 1968 and an annual growth rate of 3.1 percent applied to the level of 1968 consumption would give projected estimates of consumption levels in 1970 of 113,000 tons and in 1972 of 120,000 tons. These estimates have been plotted in Fig. 2 together with the projected capacities of mine and refinery production in 1970 and 1972.

The trend towards refining an increasing proportion of domestic mine production within Australia is somewhat exaggerated in Fig. 2 as the zinc refinery at Port Pirie is based on slag obtained from past and present smelting operations on lead concentrates (and formerly from Risdon residues also), while a useful contribution to the Risdon output will be made by extracting zinc from old and current residues produced in the zinc refinery.

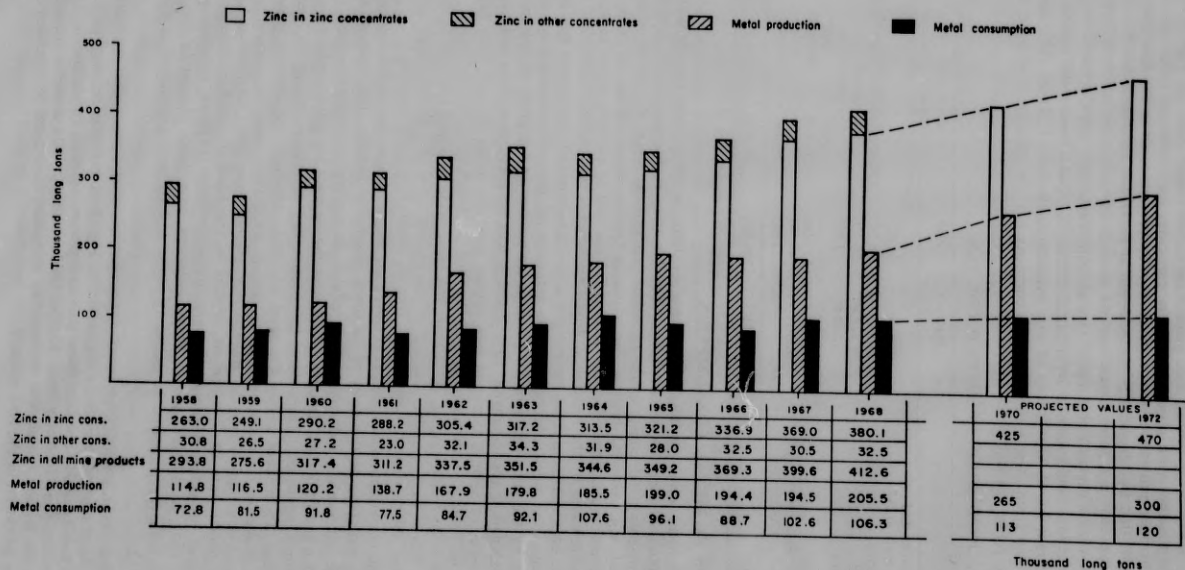


Fig.2 Australian zinc production and consumption(1958 - 1968),and projections for 1970 and 1972

OUTLETS FOR ZINC

Although Belgium is credited with a higher level of per capita consumption, much of this zinc enters into the Belgium export trade and in terms of actual consumption, Australia has the highest per capita consumption of zinc in the world. However, the consumption pattern of zinc in Australia shows marked differences from the overall pattern of world consumption. Expressed in rough proportions, about 35 percent of the total world consumption of zinc (including scrap) is used in the form of protective coatings for iron and steelwork. Die-casting accounts for 25 percent, brassmaking for 20 percent, rolled zinc for 10 percent, with miscellaneous uses, notably in the pigments zinc oxide, zinc dust and lithopone accounting for a further 10 percent. In Australia, the proportion of metal used in galvanizing is around 70 percent which is double the level of world consumption. Using sales data for primary zinc provided by the Australian Zinc Development Association, a break-down of domestic consumption by end-uses for the five-year period 1964-68 is presented in Table 5, and can be summarized as follows: galvanizing 69 percent, die-casting 12 percent, brassmaking 10 percent, rolled zinc 4 percent, and miscellaneous 5 percent. Variations in particular years from these proportions have been marginal and the consumption pattern appears to have been fairly uniform over the period. However, it should be noted that the statistics in Table 5 are restricted to actual sales of primary zinc and are not comprehensive.

TABLE 5. SALES DISTRIBUTION OF PRIMARY ZINC IN AUSTRALIA (tons)

	1964 %	1965 %	1966 %	1967 %	1968 %	1964-1968 %
Galvanizing						
General	9,008 8.8	9,070 9.9	9,472 11.2	9,328 9.6	8,947 9.5	45,825 9.8
Sheet	44,842 43.8	38,752 42.4	33,092 39.0	43,779 45.2	39,261 41.7	199,726 42.5
Wire	3,678 3.6	3,541 3.9	2,657 3.1	3,709 3.8	3,510 3.7	17,095 3.6
Pipe and Tube	12,260 12.0	11,980 13.1	11,529 13.6	12,534 12.9	11,909 12.7	60,212 12.8
Total	69,788 68.1	63,343 69.3	56,750 66.8	69,350 71.6	63,627 67.7	322,858 68.7
Die-casting	11,694 11.4	10,692 11.7	9,493 11.2	11,441 11.8	11,640 12.4	54,960 11.7
Brass and bronze	9,764 9.5	8,793 9.6	10,266 12.0	8,661 8.9	9,331 9.9	46,815 10.0
Rolled zinc	6,327 6.2	3,776 4.1	3,516 4.2	2,431 2.5	3,587 3.8	19,637 4.2
Zinc oxide	2,609 2.6	2,418 2.6	2,511 3.0	2,855 3.0	3,043 3.2	13,436 2.9
Zinc dust	1,057 1.0	1,115 1.2	793 0.9	1,003 1.0	1,695 1.8	5,663 1.2
Miscellaneous	1,178 1.2	1,242 1.4	1,612 1.9	1,151 1.2	1,129 1.2	6,312 1.3
Grand Total	102,417	91,379	84,941	96,892	94,052	469,681

*Source: Australian Zinc Development Association.

The purity of slab zinc varies with the method of production and the level of the main impurity—lead—generally determines the uses for which the various grades of zinc are suitable. The main categories of zinc are Special High Grade (>99.99 percent zinc), High Grade or Electrolytic (>99.95 percent), and Prime Western, g.o.b. or debased electrolytic (>98.0 percent). Special High Grade zinc is necessary to make die-casting alloys and High Grade zinc is needed for certain brasses and for rolled zinc sheet. With the exception of some continuous galvanizing processes, g.o.b. zinc is generally adequate for most other applications.

In the post-war period, growth in world zinc consumption has been most marked in the area of protective zinc coatings. Various methods are used to apply the coatings, viz. hot dip galvanizing, zinc spraying, plating or electro-galvanizing, sherardizing, and the use of zinc-rich paints containing a suspension of fine zinc dust. In 1963, the first hot dip galvanized steel bridge in North America was built at Pont Lizotte in Quebec and three additional bridges have been built subsequently in Quebec containing a total of 1,271 tons of galvanized steel. In the

United States, the first hot dip galvanized bridge was the 420 feet long Stearns Bayou bridge in Michigan which was completed in 1967. The company responsible for galvanizing the Stearns Bayou bridge reported in 1967 that it had received orders for an additional twenty-five galvanized bridges. This growing use of galvanized steel in bridges and other large structures in North America reflects the drastic economies in maintenance costs that can be effected with galvanized steel *vis-a-vis* painted steel and other structural materials.

Alloys based on S.H.G. zinc are used for pressure die-casting, a fast mass production process for making strong accurate components with excellent corrosion resistance and able to take a variety of decorative finishes. It is estimated that over half the total weight of die-castings made is used in car manufacture, mostly in plated exterior components and trim. The alloy most commonly used in die-casting contains 4 percent aluminium and 0.04 percent magnesium; a slightly harder alloy being obtained by adding copper.

Brasses are copper-zinc alloys with a zinc content ranging from 20-45 percent. Brasses are characterized by their ease of working, high corrosion resistance and good electrical conductivity, which cause them to be widely used for plumbing and electrical components. A range of alloys containing zinc, aluminium, copper, and other metals are used for special purposes.

Rolled zinc sheet and strip is used mainly in dry batteries and in the printing and building industries. The major outlet for zinc oxide is in natural and synthetic rubber compositions where it serves to accelerate the vulcanizing process and strengthens the product. Car tyres contain up to 5 percent zinc oxide. The oxide is also used in paints and a technique has been developed recently whereby zinc oxide can be incorporated into exterior latex paint formulations. Developments in the use of zinc oxide in electrographic copying and magnetic data storage equipment are other outlets that are increasing in importance. The discovery* by an American company in April 1969 of a silverless electrophotographic process, which is claimed to be cheaper and have other advantages over conventional processes, may represent a further outlet for zinc oxide which is used in the new photographic paper.

"Blue Powder" is a fine partially oxidized zinc dust obtained as a by-product of horizontal retort zinc production and is used for sherardizing and as a chemical reducing agent. Pigment grades of zinc dust are generally made from galvanizers' dross and old die castings, while coarser dusts suitable for metal spraying, are made by the atomization of a jet of molten zinc. The biggest single outlet for zinc dust is in paper making, and it is also used in gold recovery and electrolytic zinc refining.

Perhaps the most interesting new outlet for zinc where a rapid growth rate might be expected is presented by a superplastic alloy containing 78 percent zinc and 22 percent aluminium. In the United Kingdom, research is being conducted into the use of this alloy, termed "Prestal", as a substitute for sheet steel by Pressed Steel Fisher, the body-making subsidiary of the Leyland motor manufacturing group, in conjunction with the Imperial Smelting Corporation. At temperatures of around 260-270° C. "Prestal" is claimed to show as much as 1,000 percent elongation under suitably low rates of strain; whereas at normal temperatures, the alloy reverts to metal-like characteristics with a tensile strength of up to 20 tons a square inch along with acceptable elongation. Apart from the economies in die-making that "Prestal" offers, its superior resistance to corrosion eliminates many of the rust-proofing steps that are necessary for sheet steel applications. Similar research on the alloy has also been reported from the United States by the General Motors Corporation in conjunction with New Jersey

*Metals Week, 14 April 1969, Vol. 40 no. 15, p. 29.

Zinc. Although zinc and aluminium are more expensive basic materials than steel, it has been suggested that a large amount of the sheet steel now used in the motor industry could be replaced with "Prestal" because of the resultant savings in production and labour costs. In the event of economic viability being achieved for this superplastic alloy, a complete car body might contain around 350 pounds of zinc which could add up to a formidable demand for zinc over the whole automobile industry.

Statistics are difficult to obtain for the consumption of scrap zinc in Australia; however, if remelted brasses and bronzes are excluded, the level of scrap consumption would appear to be low and is probably of the order of 5,000 tons of metal annually. It has been estimated that around 4,500 tons of zinc is recovered annually from galvanizing residues with some 300 tons from rolled sheet zinc and 250 tons from old die castings. Some zinc dust or pigment grade is made by the controlled condensation of zinc vaporized from galvanizer's dross, a zinc-iron alloy containing excess zinc which collects at the bottom of galvanizing baths, or from die caster's ash. These materials also provide a source of low-grade zinc oxide that is suitable for the vulcanizing of rubber.

TRENDS IN OVERSEAS TRADE

It is not within the scope of the present article to discuss the international commodity market for zinc and zinc concentrates, nor to attempt a review of the important developments that have occurred since the end of World War II. It was recognized by producers in the post-war period that pronounced fluctuations in lead and zinc prices were increasing the dangers of substitution from alternative materials such as plastics and aluminium. When the United States Government discontinued its stockpile purchases of lead and zinc in 1958 and imposed import quotas on both concentrates and metals, the resulting imbalance between supply and demand led to the formation of the International Lead and Zinc Study Group in 1960. In addition to facilitating inter-governmental consultations and international trade in these metals, the Group has done valuable work in extending the statistical coverage of the industry as a first requisite for bringing the supply of these metals into line with their demand and thereby stabilizing prices. A period of excess supply of metal accompanied by low prices in 1960-62 was followed by a period of relative scarcity and high prices in 1963-64. In July 1964, an official Producer Basis price was established by zinc producers outside the United States; since then Australian zinc has been priced on this basis.

Following the United States Government's removal of import quotas on lead and zinc in October 1965, the resulting upsurge in imported metal has caused protectionist interests in the United States to press for a re-imposition of such controls and the problem was presumably under consideration by the new Administration in mid-1969. In this connection, it is relevant to mention the system of tariff-free quotas on lead and zinc that is in operation in the European Economic Community.

In common with other base metals, so many variables affect the world supply of and demand for zinc that forecasts made even in the short term of a year ahead have been found to provide only an approximation due to subsequent events. Variations in the net exports of zinc from the centrally planned economies, and disposals from the United States stockpiles are but two of the factors that cannot be anticipated in such forecasts. At the end of 1969, the national and supplemental stockpiles in the United States still contained more than 1 million tons of zinc classified as surplus to strategic requirements. Recent stockpile disposals of zinc have been administered mainly under an overseas aid programme by the Agency for International Development (AID), and in 1968, zinc disposals amounted to some 22,000 tons of which a large proportion is understood to have been allocated to India. Australian export statistics in the period 1965-68 for zinc in zinc concentrates, and refined zinc and zinc alloy are presented in Table 6.

The companies do not make a practice of publishing their export returns, however in the case of zinc concentrates—(a) all the Mount Isa output is exported apart from an occasional shipment to Risdon and Cockle Creek, (b) all the Read-Rosebery output goes to Risdon, (c) all the Cobar output is exported, (d) Broken Hill despatches in 1968 were distributed thus: 43 percent to export, 38 percent to Risdon and 19 percent to Cockle Creek.

In regard to metal exports, E.Z. Industries Ltd reported that shipments of zinc and zinc alloys in the fiscal years 1966/67 and 1967/68 amounted to 150,202 tons and 127,660 tons respectively, of which 60,338 tons and 62,557 tons respectively were sold in Australia and 89,814 tons and 65,103 tons respectively were shipped to overseas markets.

TABLE 6. AUSTRALIAN EXPORTS OF ZINC BY DESTINATION 1965-68 (tons)

	1965	1966	1967	1968
Zinc in Zinc Concentrates:—				
Belgium	5,565	4,737	12,028	8,667
India	—	—	4,527	8,253
Japan	13,446	22,916	47,472	40,543
Norway	7,226	8,369	11,310	11,665
South Africa	—	—	—	6,906
United Kingdom	76,842	79,892	73,984	85,118
Other	414	364	—	28
Total	103,493	116,278	149,321	161,180
Refined Zinc and Zinc Alloys:—				
Belgium	1,902	2,400	—	599
China (Formosa)	915	2,802	3,693	3,609
Hong Kong	2,133	2,620	1,667	2,199
India	28,225	12,444	21,525	16,361
Italy	3,084	5,346	7,948	1,650
Japan	137	65	1,068	193
Malaysia	1,991	1,505	2,523	2,531
Netherlands	6,001	5,052	6,898	5,877
New Zealand	3,407	4,910	3,184	5,818
Pakistan	1,573	4,620	4,468	2,412
Philippines	4,107	9,107	7,684	7,906
South Africa	—	2,393	3,083	7,261
Thailand	6,182	9,208	11,692	11,260
United Kingdom	22,167	19,050	10,150	6,926
U.S.A.	1,000	29,123	3,992	18,609
Other	4,227	9,344	6,896	3,966
Total	87,051	119,989	96,471	97,177

A consideration of the projections made in Fig. 2 suggests that the amount of metal surplus to domestic requirements and available for export in 1972 could rise to 180,000 tons and this would represent almost a doubling of the level exported in 1968. While domestic consumption could increase at a higher rate than the projected rate of 3.1 percent, it would seem unlikely that the domestic market could absorb more than a small proportion of this surplus as Australian per capita consumption is already the highest in the world.

Apart from any restrictions that overseas governments may decide to impose on imports of refined metals, the marketing of this surplus zinc could be attended with some difficulty in view of the world-wide trend towards additional refinery capacity, particularly in areas such as the United Kingdom, Europe, and India where Australian exports of zinc have been substantial in the past. However, Australia is favourably situated in relation to the populous countries of South-East Asia which are regarded generally as possessing considerable potential for growth in the consumption of zinc and other metals. It is thus opportune that a new Zinc and Lead International Service (ZALIS) became established in February 1969 with the object of stimulating the consumption of lead and zinc products

in the developing countries. In this regard, a comprehensive technical service on behalf of ZALIS will be provided to the countries of South-East Asia by the Australian associations AZDA and ALDA with the help of Japan.

Export outlets for surplus zinc concentrates should present fewer problems as many refineries overseas are based upon imported raw materials, e.g. the Avonmouth refinery of the Imperial Smelting Corporation in the U.K. As it may be possible to market zinc concentrates where no market exists for the metal, it can be anticipated that domestic producers will balance their exports of both concentrates and metal in accordance with world market requirements.

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Metal and Mineral Prices

Compiled by D. A. de SMET

MONTHLY AVERAGE BASE METAL PRICES

Australia (per long ton)—	Copper	Lead	Zinc	Tin
March	\$1,187.20	\$238.60	\$264.00	\$3,111.70
April	\$1,233.12	\$250.00	\$264.00	\$3,160.70
May	\$1,290.16	\$250.00	\$274.80	\$3,205.59
U.K. (L.M.E., per long ton)—				
March	£540.18. 1	£110.10. 8	£114.13. 8	£1,372.18. 7
April	£589. 5. 9	£113. 9.10	£115. 7.11	£1,398.16. 3
May	£588.17.10	£117.14. 4	£117.18.10	£1,420.17.10
U.S.A. (US cents per lb)—				
March	44.250	14.00	14.00	156.63
April	46.625	14.43	14.25	157.39
May	48.000	14.50	14.50	156.94

MAXIMUM AND MINIMUM BASE METAL PRICES, 1 MARCH 1969 TO 30 MAY 1969

Australia (per long ton)—	Copper	Lead	Zinc	Tin
Maximum	\$1,299.20	\$250	\$278	\$3,246
Minimum	\$1,187.20	\$230	\$264	\$3,038
U.K. (stg. L.M.E., per long ton)—				
Maximum	£615.10. 0	£119.12. 7	£119.11. 5	£1,432.10. 0
Minimum	£525.10. 0	£108.16. 3	£113. 7. 7	£1,366.10. 0
U.S.A. (cents per lb)—				
Maximum	50	14.5	14.5	165
Minimum	44	14	14	152.5

METAL PRICES AS AT 2 JUNE 1969

Metal	Australia \$A per long ton (a)	United Kingdom £ per long ton (a)	United States of America US cents per lb (a)
Aluminium	(b) \$538	£247½ delivered	(c) 27.00
Antimony	(d) \$1,350	£412.10.0	48.5
Bismuth	\$5.20 lb	33/4 lb	\$4.00 delivered
Cadmium	\$2.68 lb	25/- lb (U.K. & Cwlth)	\$3.00
Cobalt	(u) \$1.46 lb	16/9 lb	(r) \$1.85
Copper	(e) \$1,299.20	(f) £610-£611	46-50 ex-refinery
		(g) £611	
Gold	\$38.61 fine oz	£42.95 troy oz	\$42.95 troy oz
Lead	(h) \$250	£117½-£117½	14.5
Mercury	—	(i) £223 per flask	\$505-\$515 (20 plus flasks)
Nickel	(k) \$0.94 per lb	£986 delivered	(l) \$1.03
Pig Iron	(s) \$51.25	(m) £21.15.0	(m) \$63.00
Platinum	—	(n) £50 to £52 troy oz (del'd)	\$120-\$125 troy oz
Silver	140.7c troy oz f.o.b.	178d troy oz	177c troy oz
Tin	\$3,252	£1,434½-£1,435	(r) 160
Zinc	(o) \$278	(p) £117½-£117½	(p) 14.5
		(q) £121	

(a) Unless otherwise stated. (b) Domestic, 1-20 K ingots, 99.5% c.i.f. (c) U.S. domestic price and Canadian export price, delivered U.S. buyer, U.S. currency. (d) 1 ton lots, delivered capital cities. (e) Price electrolytic ex-smelter, Port Kembla. (f) L.M.E. quotation spot. (g) Producers' price c.i.f. Europe. (h) Price, f.o.b. Port Pirie. (i) Ex-warehouse. (k) Lots over 1 ton, Metropolitan area. (l) Ex-refinery, Port Colborne, Canada. (m) Basic price per long ton Birmingham, U.K. and f.o.b. Buffalo, U.S. respectively. (n) U.K. and Empire refined c.i.f. (o) g.o.b., delivered Melbourne, Sydney, Port Kembla and Adelaide. (p) g.o.b.; Prime Western. (q) g.o.b. Producers' price. (r) Shot: 99%+; 500 lb. lots, f.o.b., N.Y., Chicago. (s) Basic price State capitals. (t) Straits, New York. (u) Delivered Melbourne. (v) Australian Gold Producers' Association price.

ORE AND CONCENTRATE PRICES AS AT 2 JUNE 1969

Note: Some ore and concentrate prices are nominal, the prices quoted being subject to negotiation between the producer and purchaser. The ore and concentrate prices quoted below will also vary according to grade and possible impurities, and in many cases with size of the ore parcel.

Ore or Concentrate	Australia \$A	United Kingdom £ stg	United States of America \$U.S.
Antimony	Nominal	73s to 78s l.t.u. Sb for cons 60% Sb, c.i.f.	\$8.80 to \$9.00 s.t.u. Sb for cons min. 60% Sb, c.i.f.
Beryllium	Nominal	397s. 6d. to 444s. s.t.u. BeO for ore, 10% BeO, f.o.b.	Nominal
Bismuth	Nominal	24s. to 26s. per lb. metal content concentrate oxide min. 60% Bi c.i.f.	\$4
Chromium	Nominal	Nominal	\$31 to \$35 long ton 48-50% Cr ₂ O ₃ Rhodesian 34-1 ratio, f.o.b. Atlantic ports
Columbium	—	165s. to 175s. l.t.u. (Nb ₂ O ₅ + Ta ₂ O ₅) 65% combined oxides, 10:1 ratio, c.i.f.	87c to 94c per lb. of 65% combined oxides, 10:1 ratio, c.i.f.
Manganese	Nominal	51d. to 56d. l.t.u. Mn for 46- 48% Mn cons max. 0.1% P, c.i.f. (nominal)	Nominal per l.t.u. of con- tained metal min. 48% Mn c.i.f., U.S. ports Import duty extra
Molybdenum	Nominal	14s. 4d. per lb. of contained metal cons, 85% MoS ₂ f.o.b. Climax, Colorado	\$1.72 per lb. of contained metal cons, 95% MoS ₂ , f.o.b. Climax, Colorado
Monazite	Nominal	£75 to £85 per ton, 60% min. REO + Thoria, c.i.f. (Aus- tralian)	Sand. \$180 to \$200 per long ton, 55-60% REO excl. Thoria (nominal)
Tantalum	Nominal	\$6.26 to \$7.25 per l.t.u. Ta ₂ O ₅ ore 60% Ta ₂ O ₅ c.i.f.	Nominal
Tin (cassiterite)	\$27.91 per l.t.u. Sn for 70% Sn cons delivered Sydney on 31.5.69	—	—
Titanium cons— Ilmenite	\$8 to \$10 ton f.o.b. Bunbury (nominal)	£7.10.0 to £9.10.0 per ton 52-54% TiO ₂ (Malayan) c.i.f.	\$20 to \$21 long ton 54% TiO ₂ f.o.b. cars Atlantic ports
Rutile	\$92 to \$96 per ton f.o.b. (nominal)	£61 to £66 per ton 95-97% TiO ₂ (Australian) c.i.f.	\$145 short ton f.o.r. Atlantic ports 96% TiO ₂ delivered within 12 months
Tungsten cons— Wolfram	\$44.76 to \$51.78 per unit WO ₃ (nominal)	420s. to 435s. per l.t.u. WO ₃ cons. c.i.f. Europe. Standard quality (spec. com- position)	\$43 per s.t.u. WO ₃ cons 65% WO ₃ c.i.f. import duty \$7.14 per s.t.u. WO ₃ As above
Scheelite Zircon	Nominal \$46 to \$50 per ton min. 65.2% ZrO ₂ (nominal)	Nominal £26.5.0 to £27.15.0 per ton 66-67% ZrO ₂ c.i.f.	\$70 per long ton 65% ZrO ₂ c.i.f. Atlantic ports

Copper Ore—
Australia: The price paid for ores is related to the market price of copper, less charges listed below.
The basis of price determination is variable; details are obtainable from individual smelters.

Company	Draftage deduction or copper content deduction	Receiving sampling assaying and smelting charge per ton of ore	Converting refining realising charge per unit of copper paid for	Gold refining charge per oz per gold paid for	Silver refining charge per oz of silver paid for
E.R.S.(a)	1.3 unit of copper per ton of ore	14.75	1.15	1.50	0.44
Mount Isa(b)	1.3 unit of copper per ton of ore	10.50	1.50	No payment for gold	0.45
Mount Morgan(c)(d)	1% of weight of ore plus 1.3 units of copper per ton of ore	12.00	2.00	1.70	0.50

(a) The Electrolytic Refining and Smelting Company of Australia Pty Ltd, Port Kembla, New South Wales.
(b) Mount Isa Mines Ltd, Mount Isa, Queensland. (c) Mount Morgan Ltd, Mount Morgan, Queensland.
(d) Mount Morgan gold and silver deductions—Gold, deductions range from 1 dwt/ton for 10 dwt/ton and lower grade ore to 1 dwt/ton plus 5 percent of the balance for 12 dwt/ton and over ore; silver, 1 oz/ton plus 10 percent of the balance.

Publications

RECENT PUBLICATIONS

BULLETINS

- No. 80—Palaeontological papers, 1965
(Separates of individual papers—\$0.50) \$3.25
- No. 97—Upper Palaeozoic rocks, Bonapare Gulf Basin of northwestern Australia; by J. J. Veevers and J. Roberts \$3.25
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- No. 103—Ordian (Cambrian) crustacea Bradoriida of Australia; by A. A. Opik \$1.00

REPORTS

- No. 45—Geology of the gold prospects at Union Reefs, Northern Territory; by J. W. Shields, D. A. White, and J. F. Ivanac \$1.75
- No. 105—Geology and mineral deposits Port Moresby/Kemp Welch area, Papua; by K. R. Yates and R. Z. de Ferranti \$3.50
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- No. 125—Reconnaissance geology and petrography of the Ngalia Basin, N.T.; by P. J. Cook and I. F. Scott \$0.75

PSSA PUBLICATIONS

- No. 80—Summary of data and results, Canning Basin, Western Australia: Sahara No. 1 well of Western Australia Petroleum Pty Ltd \$1.50

GEOLOGICAL MAPS

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Enquiries relating to publications should be sent to:

The Director
Bureau of Mineral Resources
P.O. Box 378
Canberra City, A.C.T. 2601

**Part 2—
Quarterly
Statistics**

Australian Mineral Industry

VOLUME 21 No. 4 QUARTER ENDED 31 DECEMBER 1968

*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 overseas 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 Fuel Branch of the Department of National Development and the Bureau of Mineral Resources, including information collected by that Bureau from mines and treatment plants.

The presentation of data in this Part has been revised to assemble under the one heading all statistics in respect of each particular mineral. However, summary tables showing production of selected major minerals and metals have been retained and are shown on page 23, and include details where available for the March quarter 1969.

The fundamental concept of Australian mineral production statistics is that quantities and values of individual minerals are 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 certain 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 an associated plant in the locality of the mine.

The particulars of quantities of minerals produced shown 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 reported sales) as distinct from production in deriving the total for Australia. In addition to the basic quantity data, particulars of contents of metallic minerals are shown and in general 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 exclude construction materials (sand, gravel, building stone, etc.) and some particulars for non-metallic minerals which are not at present available.

Quarterly value of output statistics are not available because of delays in realization of values of several important minerals. Calendar year statistics of the value of output of the mining and quarrying industries and values of individual minerals are published in the annual statistical bulletins *Minerals and Mineral Products* and *Minerals and Mineral Products (Preliminary)*.

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 Department of National Development who have supplied information used in the preparation of this Bulletin.

K. M. ARCHER
Commonwealth Statistician

Summary Tables: Production of Principal Minerals and Smelter and Refinery Production of Principal Metals 23

(References are to page numbers)

The following terms and symbols, where shown in tables, mean:

ton: long ton of 2,240 lb.
short ton: ton of 2,000 lb.
unit: 22.4 lb.
f oz: fine content, troy ounce
*: subject to revision

(—): nil
(. .): less than half the unit shown
(n.a.): not available
(n.e.l.): not elsewhere included.

Statistics of smelter and refinery production exclude secondary metal (i.e. metal recovered from scrap) unless otherwise specified.

All import and export values are expressed in Australian currency and are generally f.o.b. port of shipment. A more detailed description of the method of valuation is quoted in the *Overseas Trade Bulletin*.

Any discrepancies between totals and sums of components in the tables are due to rounding.

Other Publications of the Commonwealth Bureau of Census and Statistics relating to the Australian mineral industry

Reference Title, Frequency and Price

- 10.4 Construction Material Quarrying, A.C.T., **Annually, Free**
- 10.18 Minerals and Mineral Products, **Annually, Free**
- 10.19 Minerals and Mineral Products, **Monthly, Free**
- 10.20 Mining and Quarrying, **Annually, Free**
- 10.21 Mining and Quarrying (Preliminary), **Annually, Free**
- 10.23 Non-Rural Primary Industries, **Annually, \$1.17 Including Postage †**
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Enquiries regarding free publications should be made to:

Commonwealth Bureau of Census and Statistics
The Treasury Building
Newlands Street
Canberra. A.C.T. 2600

† The Non-Rural Primary Industries Bulletin may be purchased from either The Director of Publications, Commonwealth Government Printing Office, Canberra, A.C.T. 2600 or the Office of the Deputy Commonwealth Statistician in each State capital.

ALUMINIUM

Quarters—1968*

1967 1968* March June September December

PRODUCTION

Mine production						
Minerals produced						
Bauxite	ton	4,176,474	4,882,620	986,441	1,332,234	1,258,190
Alumina (Al ₂ O ₃) content	"	2,258,164	2,635,655	531,280	733,451	675,659
Production: States (Al ₂ O ₃ content)						
New South Wales	"	4,026	6,723	1,407	3,769	479
Victoria	"	1,050	—	—	—	—
Queensland	"	1,643,787	1,805,342	379,759	533,389	474,764
Western Australia	"	603,291	223,590	150,114	146,293	200,416
Total contained alumina	"	2,258,164	2,635,655	531,280	733,451	675,659
Smelter and refinery production						
Alumina	"	840,923	1,288,776	286,548	299,556	322,654
Refined aluminium	"	91,326	95,810	21,310	21,323	25,039

IMPORTS (a)

Aluminium and aluminium base alloys						
Alumina	ton	37,047	2,964	853	423	910
Value	\$'000	2,543	551	172	83	126
Unworked shapes	ton	361	11,975	180	962	5,835
Canada	"	1	3,782	—	—	1,782
Other	"	360	8,193	180	962	4,053
Value	\$'000	232	5,822	111	513	2,765
Plates, sheets, strips and circles	ton	544	349	101	66	68
Value	\$'000	585	432	126	96	90
Pipes and tubes	ton	27	48	4	2	23
Value	\$'000	44	108	9	9	43
Bars, rods and angles	ton	603	553	139	21	168
Value	\$'000	524	560	130	45	164
Foil	ton	516	511	161	119	85
Value	\$'000	776	698	220	168	119
Powder	ton	365	418	137	152	36
Value	\$'000	235	282	84	91	28
Wire, single strand, uncovered	ton	122	289	37	66	120
Value	\$'000	260	481	73	125	175
Scrap (including re-melt)	ton	1,468	856	261	171	183
Value	\$'000	426	260	84	52	45

EXPORTS (a)

Aluminium and aluminium base alloys						
Unworked shapes	ton	10,501	5,577	1,326	2,421	834
Hong Kong	"	1,505	2,155	311	1,371	372
Philippines	"	1,640	1,481	399	772	167
New Zealand	"	1,169	1,002	195	172	193
Israel	"	180	360	141	20	36
Other	"	6,027	579	280	66	66
Value	\$'000	4,926	2,745	627	1,176	416
Plates, sheets, strips and circles	ton	3,470	3,580	652	972	1,491
Value	\$'000	2,253	2,109	383	562	891
Pipes and tubes	ton	63	119	9	8	32
Value	\$'000	83	187	11	8	36
Bars, rods and angles	ton	1,302	286	10	162	49
Value	\$'000	968	153	15	65	27
Foil	ton	436	704	132	179	251
Value	\$'000	371	487	85	126	171
Powder	ton	232	40	30	10	—
Value	\$'000	24	4	2	1	—
Wire, single strand, uncovered	ton	35	24	8	6	4
Value	\$'000	53	37	14	8	7
Scrap (including re-melt)	ton	1,126	2,036	414	465	717
Value	\$'000	236	606	112	143	213

(a) Details of imports of bauxite, and exports of bauxite and alumina are not available for publication.

ANTIMONY

			Quarters—1968*			
	1967	1968*	March	June	September	December
IMPORTS						
Mine production						
Minerals produced						
Antimony ore	ton	2	5	—	—	5
Antimony content	11	1	—	—	—	1
Antimony concentrate	11	152	235	—	50	58
Antimony content	11	91	158	—	34	39
Antimony content of minerals produced						
Antimony ore	11	1	—	—	—	1
Antimony concentrate	11	91	158	34	65	39
Lead concentrate	11	810	672	166	150	194
Lead-zinc concentrate	11	29	—	—	—	—
New South Wales	11	930	831	166	184	234
Queensland	11	—	—	—	—	—
Total contained antimony	11	930	831	166	184	234
IMPORTS						
Antimony metal						
Value	\$'000	6	2	—	4	—
		5	2	—	3	—

ASBESTOS

			Quarters—1968*				
	1967	1968*	March	June	September	December	
PRODUCTION							
Mine production							
Chrysotile	short ton	600	895	204	281	234	176
New South Wales	..	515	820	173	237	234	176
Western Australia	..	85	75	31	44	—	—
IMPORTS							
Chrysotile	short ton	39,752	51,797	11,300	12,281	12,638	15,578
Canada	..	39,078	51,133	10,984	11,936	12,638	15,575
Others	..	674	664	316	345	—	3
Value	\$'000	4,970	6,750	1,401	1,669	1,657	2,024
Amosite	short ton	10,345	10,108	2,803	3,029	2,054	2,222
South Africa	..	9,950	9,838	2,628	3,029	2,054	2,202
Others	..	395	270	175	—	75	20
Value	\$'000	1,237	1,229	345	372	249	263
Other types	short ton	2,487	4,836	996	1,389	813	1,638
Value	\$'000	229	339	60	99	71	106
EXPORTS							
All types and grades	short ton	3,524	804	338	179	145	142
Value	\$'000	438	186	73	43	35	35

CADMIUM

	1967	1968*	Quarters—1968*			
			March	June	September	December
PRODUCTION						
Mine production						
Cadmium content of minerals produced						
Lead concentrate	66	52	12	11	13	16
Lead-zinc concentrate	11	—	—	—	—	—
Zinc concentrate	1,247	1,288	291	284	321	392
New South Wales	1,079	992	235	214	238	305
Queensland	160	256	47	58	71	80
Tasmania	73	74	17	18	20	19
Northern Territory	12	18	4	5	5	4
Total contained cadmium	1,324	1,340	303	295	334	408
Refinery production						
Refined cadmium	516	452	104	97	113	133
EXPORTS						
Refined cadmium and cadmium alloys—						
Ingot and blocks	63	97	7	1	51	38
Value	316	475	30	5	243	197
Bars and rods	404	448	151	191	85	21
Value	1,639	1,388	524	544	218	101

COAL

	1967	1968*	Quarters—1968*			
			March	June	September	December
PRODUCTION						
Mine production						
Black coal						
Semi-anthracite	'000 ton	38	30	8	7	7
Bituminous		31,299	36,755	7,890	8,949	10,107
Sub-bituminous		3,370	3,486	802	880	917
New South Wales		26,813	30,346	6,559	7,327	8,237
Victoria		32	27	7	7	6
Queensland		4,679	6,639	1,385	1,677	1,914
South Australia		2,045	2,079	491	529	560
Western Australia		1,062	1,087	241	273	286
Tasmania		77	90	17	23	26
Underground		29,267	32,232	7,113	7,858	8,625
Opencut		5,440	8,038	1,587	1,979	2,406
Total		34,707	40,270	8,700	9,836	11,031
Brown coal (lignite)		23,384	22,974	4,836	6,056	6,717
Victoria		23,384	22,974	4,896	6,056	6,717
Coal products						
Metallurgical coke		3,637	3,893	910	913	1,018
Brown coal briquettes		1,844	1,552	370	417	446
IMPORTS						
Coal	ton	7,710	9,278	978	102	7,945
Value	\$'000	96	119	24	3	79
Coke (incl. petroleum coke)	ton	27,961	47,726	8,943	14,483	9,196
Value	\$'000	875	1,430	257	417	322
EXPORTS						
Coal	'000 ton	9,250	12,066	2,437	2,975	3,268
Japan		8,874	11,783	2,391	2,827	3,236
Other		376	303	46	148	32
Value	\$'000	76,202	103,745	20,578	27,069	27,464
Coke	ton	208,580	202,167	49,764	70,117	59,246
Value	\$'000	2,527	2,428	634	748	666

COPPER

		Quarters—1968*					
		1967	1968*	March	June	September	December
PRODUCTION							
Mine production							
Minerals produced							
Copper ore (a)	ton	31,453	40,018	9,500	9,547	9,873	11,098
Copper content	ton	1,945	2,066	503	493	511	559
Gold content	oz	157	88	23	15	24	26
Silver content	'000 foz	10	4	1	1	1	1
Copper concentrate	ton	391,954	452,117	94,136	111,406	122,004	124,571
Copper content	ton	81,927	97,891	20,603	23,210	26,575	27,503
Gold content	oz	111,481	94,561	22,463	25,075	22,695	24,328
Silver content	'000 foz	891	878	207	198	237	236
Lead content	ton	—	954	—	309	346	299
Copper precipitate	ton	725	566	64	108	205	196
Copper content	ton	472	318	39	45	117	117
Gold content	oz	—	378	—	378	—	—
Silver content	'000 foz	—	—	—	—	—	—
Copper contents of minerals produced							
Bismuth concentrate	ton	6	106	9	26	34	37
Copper ore (a)	ton	1,945	2,066	503	493	511	559
Copper concentrate	ton	81,927	97,891	20,603	23,210	26,575	27,503
Copper precipitate	ton	472	318	39	45	117	117
Copper-iron concentrate	ton	39	169	—	44	55	70
Lead ore	ton	3,624	3,596	1,023	865	780	828
Lead concentrate	ton	1,246	1,333	343	311	378	301
Lead-copper concentrate	ton	84	—	—	—	—	—
Lead-zinc concentrate	ton	264	551	134	114	165	138
Nickel concentrate	ton	754	840	188	169	221	262
Zinc concentrate	ton	—	—	—	—	—	—
New South Wales							
Victoria	ton	11,393	12,052	2,595	2,828	3,168	3,461
Queensland	ton	5	—	—	—	—	—
South Australia	ton	51,457	68,871	14,461	16,140	18,753	19,517
Western Australia	ton	85	29	—	11	—	18
Tasmania	ton	1,027	1,377	301	274	425	377
Northern Territory	ton	17,468	16,601	4,028	3,785	4,464	4,324
Total contained copper	ton	90,381	106,870	22,842	25,277	28,636	29,815
Smelter and refinery production							
Blister copper (b)	ton	70,826	91,536	17,655	19,941	27,777	26,163
Refined copper	ton	66,093	83,795	13,902	23,922	21,763	24,208
IMPORTS							
Copper—							
Unrefined copper	ton	—	4,529	—	4,524	5	—
Value	\$'000	1	5,233	—	5,231	3	—
Refinery shapes	ton	3,061	397	—	310	77	10
Chile	ton	—	300	—	300	—	—
South Africa	ton	—	50	—	50	—	—
Others	ton	3,061	47	—	10	27	10
Value	\$'000	3,667	380	—	291	78	10
Bars, rods, angles and tees	ton	13	1	1	—	—	—
Value	\$'000	19	2	1	—	—	—
Plates, sheets and strips	ton	22	11	—	—	5	6
Value	\$'000	29	15	—	—	8	7
Pipes and tubes	ton	297	524	115	125	130	154
Value	\$'000	476	819	183	201	204	231
Wire	ton	26	25	8	10	1	6
Value	\$'000	74	68	24	26	5	13
Powder	ton	172	240	63	24	51	102
Value	\$'000	241	348	84	39	81	145
Scrap	ton	729	1,471	182	492	582	215
Value	\$'000	459	1,247	140	491	479	136
Copper-base alloys—							
Pigs, ingots and blocks	ton	63	48	13	19	11	5
Value	\$'000	49	45	11	18	8	8

COPPER

		Quarters—1968*					
		1967	1968*	March	June	September	December
IMPORTS (continued)							
Copper-base alloys—Continued							
Roller, drawn and extruded shapes	ton	714	585	94	193	62	236
Value	\$'000	998	941	150	292	117	382
Wire	ton	216	161	41	33	44	43
Value	\$'000	368	294	80	54	77	83
Scrap	ton	721	1,188	470	233	350	135
Value	\$'000	397	859	411	174	210	65
EXPORTS							
Copper—							
Copper concentrate	ton	44,830	36,494	6,611	7,997	10,675	11,211
Japan	ton	44,830	36,494	6,611	7,997	10,675	11,211
Other	ton	—	—	—	—	—	—
Value	\$'000	9,526	8,657	1,754	1,791	2,399	2,713
Copper precipitate	ton	499	222	—	88	—	134
Value	\$'000	305	140	—	68	—	72
Copper matte	ton	3,892	6,925	1,500	3,144	500	1,781
Belgium-Luxembourg	ton	3,892	6,925	1,500	3,144	500	1,781
Value	\$'000	1,914	3,008	926	1,232	222	629
Copper-lead dross	ton	2,111	4,927	1,203	2,053	1,133	538
Value	\$'000	593	1,567	465	632	303	167
Slags and residues	ton	102	855	99	505	150	101
Value	\$'000	2	21	2	14	3	2
Bilister copper	ton	6,893	7,063	1,472	1,648	1,871	2,072
Japan	ton	6,893	7,063	1,472	1,648	1,871	2,072
Value	\$'000	8,627	10,459	2,036	2,524	3,328	2,572
Refinery shapes	ton	9,325	16,518	2,146	3,297	9,327	1,748
E.E.C.	ton	2,257	6,786	300	200	5,935	351
Japan	ton	2,010	4,330	995	496	1,992	847
Other	ton	5,058	5,402	851	2,601	1,400	550
Value	\$'000	8,975	16,518	2,596	3,587	8,905	1,721
Bars and rods	ton	5,129	5,733	567	1,705	1,726	1,735
Value	\$'000	5,317	6,296	661	2,027	1,804	1,803
Angles, shapes and sections	ton	22	5	1	1	1	2
Value	\$'000	27	7	1	2	1	3
Plates, sheets and strips	ton	974	768	127	211	220	210
Value	\$'000	1,364	1,100	186	326	307	281
Tubes and pipes	ton	918	658	129	103	171	255
Value	\$'000	1,394	978	193	166	253	366
Wire	ton	155	41	3	14	17	7
Value	\$'000	197	58	7	20	23	9
Scrap	ton	16	—	—	—	—	—
Value	\$'000	13	—	—	—	—	—
Copper-base alloys—							
Refinery shapes	ton	5	7	—	6	1	1
Value	\$'000	8	7	1	1	5	1
Bars and rods	ton	1,810	2,966	456	410	1,033	1,067
Value	\$'000	1,389	2,299	342	337	782	838
Angles, shapes and sections	ton	123	105	5	36	31	33
Value	\$'000	136	104	10	34	30	30
Plates, sheets and strips	ton	203	248	16	44	98	90
Value	\$'000	266	305	24	58	112	111
Tubes and pipes	ton	38	24	9	3	1	11
Value	\$'000	64	34	10	4	1	18
Wire	ton	82	69	15	15	17	22
Value	\$'000	68	72	16	13	15	28
Scrap	ton	207	32	5	7	5	15
Value	\$'000	143	39	9	6	7	17
Copper and copper-base alloys—							
Foil	ton	3	4	—	2	2	—
Value	\$'000	6	3	—	1	2	—
Powders and flakes	ton	1	—	—	—	—	—
Value	\$'000	1	—	—	—	—	—
Copper content of concentrates, matte, etc. exported (c)	ton	14,184	13,988	2,721	4,082	3,195	3,990

(a) Includes cupreous ore for fertilizer. (b) Total production for refining in Australia and overseas. (c) Excludes copper

(a) Includes cupreous ore for fertilizer. (b) Total production for refining in Australia and overseas. (c) Excludes copper in bilister.

GEMS

			Quarters--1968*					
			1967	1968*	March	June	September	December
PRODUCTION								
Opals		\$'000	3,993	5,745	n.a.	n.a.	n.a.	n.a.
New South Wales			1,150	1,725	n.a.	n.a.	n.a.	n.a.
Queensland			8	5	n.a.	n.a.	n.a.	n.a.
South Australia			2,835	4,015	n.a.	n.a.	n.a.	n.a.
Sapphires			432	556	n.a.	n.a.	n.a.	n.a.
New South Wales			304	410	n.a.	n.a.	n.a.	n.a.
Queensland			128	146	n.a.	n.a.	n.a.	n.a.
Other gems			180	159	n.a.	n.a.	n.a.	n.a.
New South Wales			19	19	n.a.	n.a.	n.a.	n.a.
Queensland			140	119	n.a.	n.a.	n.a.	n.a.
Western Australia			8	11	n.a.	n.a.	n.a.	n.a.
South Australia			13	10	n.a.	n.a.	n.a.	n.a.

IMPORTS

Diamonds, gem	metric carat	27,520	32,500	7,251	6,986	10,530	7,733
Value	\$'000	4,301	4,727	1,121	1,054	1,453	1,099

EXPORTS

Opals—							
Rough, not cut nor polished	\$'000	6,996	7,501	1,355	1,764	1,892	2,490
Cut and polished		1,624	3,152	667	644	812	1,028

GOLD

			Quarters—1968*					
			1967	1968*	March	June	September	December
PRODUCTION								
Mine production								
Minerals produced								
Gold ore	ton	6	—	—	—	—	—	—
Gold content	oz	3	—	—	—	—	—	—
Silver content		5	—	—	—	—	—	—
Gold bullion (a)		997,793	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Gold content		653,073	622,652	156,576	171,552	144,866	149,658	149,658
Silver content		253,016	211,135	18,251	32,379	29,159	33,785	33,785
Gold contents of minerals produced								
Bismuth concentrate		1,578	33,535	3,508	16,587	7,624	5,816	5,816
Copper ore		157	88	23	15	24	26	26
Copper concentrate		111,481	94,561	22,463	25,075	22,695	24,328	24,328
Copper precipitate		—	378	—	378	—	—	—
Gold ore		3	—	—	—	—	—	—
Gold bullion (a)		653,073	622,652	156,576	171,552	144,866	149,658	149,658
Lead ore		71	—	—	—	—	—	—
Lead concentrate		10,480	9,935	2,714	2,232	2,155	2,834	2,834
Lead-copper concentrate		23,162	21,552	4,551	5,053	6,272	5,676	5,676
Lead-zinc concentrate		681	—	—	—	—	—	—
Zinc concentrate		4,670	4,341	1,057	1,002	1,081	1,201	1,201
New South Wales								
Victoria		10,716	8,435	2,172	1,958	1,942	2,365	2,365
Queensland		10,996	10,791	2,515	3,096	3,069	2,111	2,111
South Australia		95,601	82,854	20,631	21,347	20,622	20,254	20,254
Western Australia		—	1	—	10	—	28	28
Tasmania		573,755	516,888	137,077	131,746	121,620	126,445	126,445
Northern Territory		37,528	36,497	8,410	8,454	9,726	9,907	9,907
Total contained gold		76,739	131,539	20,087	55,285	27,738	28,429	28,429
		805,336	787,042	190,892	221,894	184,717	188,539	188,539
Refinery production								
Newly-won gold								
Australian origin		672,171	639,327	140,902	170,737	165,323	162,365	162,365
Overseas origin		136,389	126,178	32,047	30,678	27,005	36,448	36,448
Scrap								
Australian origin		27,276	13,460	3,524	2,593	4,011	3,332	3,332
Overseas origin		727	349	—	—	66	283	283
Total		838,563	770,314	176,473	204,008	196,406	202,428	202,428

GOLD

		Quarters—1968*					
		1967	1968*	March	June	September	December
IMPORTS							
Gold							
Refined forms (excl. specie, leaf and foil)	foz	5,505	4,869	1,154	1,309	1,260	1,146
Value	\$'000	184	165	37	47	42	39
Unrefined bullion (gold content)	foz	128,127	122,758	37,574	24,843	28,186	32,155
Fiji	"	104,896	102,601	32,347	21,090	22,126	27,038
Papua and New Guinea	"	23,211	20,157	5,227	3,753	6,060	5,177
Other	"	20	—	—	—	—	—
Value	\$'000	4,019	4,133	1,183	865	971	1,115

EXPORTS

Unrefined bullion (gold content)	oz	1,183	1,450	615	—	835 —
Value	\$'000	37	54	25	—	30 —
Refined forms (excl. specie, leaf and foil)	oz	537,922	385,761	58,105	118,222	62,223 147,211
Hong Kong		528,292	358,279	57,738	117,199	43,293 140,049
New Zealand		9,399	3,951	242	964	2,065 680
Other		231	23,531	125	59	16,865 6,482
Value	\$'000	16,942	13,118	1,827	3,773	2,155 5,363
Gold contents of concentrates, blister copper, etc. exported	oz	131,749	113,574	19,251	32,379	29,159 33,785

CHANGES IN STOCKS OF GOLD HELD IN AUSTRALIA

Supplies						
Refinery production	oz	672,171	639,327	140,902	170,737	165,323 162,365
Imports		133,832	127,657	38,723	26,152	29,446 33,301
Total supplies		805,603	766,984	179,630	196,889	194,769 195,666
Disposals						
Exports		539,105	387,211	58,720	118,222	63,058 147,211
Net industrial consumption		125,658	177,072	30,622	29,114	46,875 70,451
Total disposals		664,763	564,283	89,342	147,336	109,933 217,672
Changes in stocks held in Australia (b)		141,040	202,671	90,288	49,553	84,836 —22,006

(a) Mine bullion, alluvial, retorted gold etc. Includes production from auriferous pyrites. (b) Excludes specie; includes changes in holdings in Australia by Official and Banking Institutions both on their own behalf and that of non-residents.

GYPSUM

		Quarters—1968*					
		1967	1968*	March	June	September	December
PRODUCTION							
Mine production	ton	914,084	817,229	182,443	181,344	199,895	253,547
New South Wales	11	42,504	32,145	9,953	8,807	7,890	5,485
Victoria	11	224,065	48,842	11,137	13,956	12,079	11,674
South Australia	11	607,437	631,220	152,029	145,706	166,753	166,732
Western Australia	11	40,078	105,018	9,324	12,875	13,173	69,946
EXPORTS							
Gypsum and anhydrite	ton	207,674	247,078	73,034	38,812	48,232	87,000
New Zealand	11	86,334	84,317	15,309	22,419	24,971	21,618
Philippines	11	26,182	52,317	18,028	8,429	17,460	8,400
China, Formosa	11	62,007	38,515	17,011	—	—	21,504
Other	11	33,151	71,929	22,686	7,964	5,801	35,478
Value	\$'000	679	1,104	269	197	213	426

IRON

		Quarters—1968*					
		1967	1968*	March	June	September	December
PRODUCTION							
Mine production							
Minerals produced							
Iron ore and concentrate (a)	'000 tons	16,887	25,977	4,917	6,130	7,193	7,737
Iron content	"	10,831	16,767	3,180	3,951	4,636	5,000
Production: States, iron content							
South Australia	"	2,906	3,505	794	811	752	1,148
Western Australia	"	7,725	12,176	2,257	2,884	3,562	3,473
Tasmania	"	—	(b)	(b)	114	155	225
Northern Territory	"	201	(b)	(b)	142	166	154
Total contained iron	"	10,831	16,767	3,180	3,951	4,636	5,000
Iron and steel							
Iron ore pellets	"	—	2,951	(b)	(b)	971	1,382
Pig iron	"	4,977	5,483	1,326	1,343	1,317	1,498
Steel ingot (c)	"	6,167	6,599	1,547	1,581	1,690	1,690
Blooms and slabs	"	5,360	5,369	1,341	1,372	1,414	1,462
Tinplate	"	271	234	58	47	60	68
IMPORTS							
Iron							
Iron ore	'000 tons	171	244	58	70	57	59
New Caledonia	"	171	244	58	70	57	59
Other	"	—	—	—	—	—	—
Value	\$'000	382	547	121	160	130	135
Iron and steel							
Ferro-alloys (excl. powders)							
Ferro-chromium	ton	3,430	3,487	1,353	995	927	212
Value	\$'000	880	977	453	250	224	51
Ferro-manganese	ton	4,855	10,482	1,485	3,820	2,089	3,088
Value	\$'000	1,008	2,631	322	836	624	849
Ferro-molybdenum	ton	131	163	91	37	20	15
Value	\$'000	523	464	228	123	60	53
Ferro-nickel	ton	3,746	1,103	436	157	510	—
Value	\$'000	2,056	517	215	75	226	—
Ferro-silicon	ton	5,291	6,227	1,644	1,340	1,429	1,814
Value	\$'000	1,379	923	252	208	205	257
Other	ton	1,938	1,956	473	430	757	296
Value	\$'000	843	889	245	203	378	63
Tinplate	ton	10,731	7,214	6,036	659	276	243
Value	\$'000	2,108	1,449	1,225	119	53	52
EXPORTS							
Iron							
Iron ore and pellets	'000 tons	8,017	16,107	3,456	3,593	4,206	4,852
Japan	"	8,229	13,792	2,912	3,177	3,551	4,152
Other	"	788	2,316	544	416	655	700
Value	\$'000	75,372	139,559	28,590	31,018	36,343	43,607
Iron and steel							
Pig iron	ton	149,557	241,869	50,248	43,545	78,288	69,788
Japan	"	109,393	200,370	42,700	32,324	63,838	61,508
Philippines	"	12,060	14,130	2,199	3,942	5,724	2,265
Other	"	28,134	27,369	5,349	7,279	8,726	6,015
Value	\$'000	6,169	8,925	2,050	1,662	2,704	2,509
Ingots, blooms and slabs	ton	338,637	350,669	83,912	93,461	95,862	77,444
Value	\$'000	19,353	18,773	4,342	5,013	5,157	4,261
Scrap	ton	475,056	401,801	75,481	106,350	122,922	97,068
Value	\$'000	14,226	10,389	2,149	3,017	2,855	2,369
Tinplate	ton	56,252	42,576	10,104	11,353	7,622	13,497
Value	\$'000	7,452	5,359	1,290	1,477	907	1,715
Iron content of iron ore exported	'000 tons	5,893	10,859	2,307	2,593	2,719	3,240

(a) Iron oxide for metal extraction. (b) Not available for publication. (c) Includes recovery from scrap.

LEAD

		Quarters—1968*					
		1967	1968*	March	June	September	December
PRODUCTION							
Mine production							
Minerals produced							
Lead ore (a)	ton	18,224	40,759	4,000	6,759	7,979	22,021
Lead content	"	1,544	2,524	232	459	576	1,257
Silver content	'000 foz	150	118	8	21	31	58
Zinc content	ton	1,073	452	—	105	172	175
Copper content	"	39	—	—	—	—	—
Gold content	f oz	71	—	—	—	—	—
Lead concentrate							
Lead content	ton	537,193	601,297	132,076	141,970	155,420	171,831
Silver content	'000 foz	356,219	361,254	82,904	84,297	91,684	102,369
Antimony content	ton	15,985	17,738	3,856	4,214	4,787	4,881
Cadmium content	"	810	672	168	150	162	194
Copper content	"	66	52	12	11	13	16
Gold content	f oz	3,824	3,596	1,023	865	780	929
Zinc content	ton	10,480	9,935	2,714	2,232	2,155	2,834
Sulphur content	"	27,754	32,986	7,166	8,284	8,852	8,684
Lead-copper concentrate	"	56,490	50,251	12,712	11,797	11,797	14,007
Lead contents of minerals produced							
Copper concentrate	"	12,227	12,558	3,298	2,792	3,504	2,964
Lead content	"	4,605	4,682	1,270	990	1,272	1,150
Copper content	"	1,246	1,333	343	311	378	301
Silver content	'000 foz	1,114	1,053	253	247	289	264
Gold content	f oz	23,162	21,552	4,551	5,053	6,272	5,676
Zinc content	ton	1,342	1,414	353	318	396	347
Sulphur content	"	3,081	3,260	851	740	916	753
Lead-zinc concentrate (b)							
Lead content	"	14,885	5,373	4,532	—	456	385
Zinc content	"	5,195	1,788	1,503	—	212	73
Silver content	'000 foz	1,325	441	353	—	34	54
Antimony content	ton	476	167	139	—	24	4
Cadmium content	"	29	—	—	—	—	—
Copper content	"	11	—	—	—	—	—
Gold content	f oz	84	—	—	—	—	—
Sulphur content	ton	881	—	—	—	—	—
Lead contents of minerals produced							
Copper concentrate	"	—	954	—	309	346	299
Lead ore	"	1,644	2,524	232	459	576	1,257
Lead concentrate	"	356,219	361,254	82,904	84,297	91,684	102,369
Lead-copper concentrate	"	4,605	4,682	1,270	990	1,272	1,150
Lead-zinc concentrate	"	5,195	1,788	1,503	—	212	73
Zinc concentrate	"	8,117	10,048	2,487	2,361	2,469	2,731
New South Wales							
Queensland	"	282,173	248,675	63,832	57,013	58,358	69,472
South Australia	"	76,439	115,959	20,638	27,369	33,936	34,016
Western Australia	"	—	—	7	—	36	—
Tasmania	"	688	442	88	41	107	206
Northern Territory	"	15,134	14,913	3,562	3,662	3,969	3,820
Total contained lead	"	1,345	1,218	276	324	289	329
Value	\$'000	375,779	381,250	88,396	88,416	96,559	107,879
Smelter and refinery production							
Refined lead (c)	"	190,863	175,232	45,678	44,269	39,345	45,940
Lead content of lead bullion for export	"	101,167	116,638	22,826	26,285	32,826	32,701
EXPORTS							
Lead concentrate							
U.S.A.	ton	124,016	121,122	34,761	21,711	33,921	30,729
Japan	"	36,395	36,362	8,571	5,533	13,635	8,623
United Kingdom	"	25,416	29,006	11,056	8,173	4,118	5,659
Germany F.R.	"	22,599	26,749	7,512	8,005	6,750	4,462
Other	"	33	16,632	—	—	4,667	11,965
Value	\$'000	39,573	12,373	7,622	—	4,751	—
Value	\$'000	23,166	23,636	6,763	4,368	6,542	5,962

Continued over page

LEAD

			Quarters—1968*					
			1967	1968*	March	June	September	December
EXPORTS (continued)								
Lead bullion	ton		100,394	107,325	22,374	23,003	31,996	29,952
United Kingdom	"		80,995	83,168	19,218	18,003	28,996	26,951
Netherlands	"		9,500	8,001	1,000	2,000	1,000	2,001
Belgium-Luxembourg	"		3,899	3,420	920	1,500	500	500
Germany F.R.	"		4,200	2,736	1,236	500	500	500
Other	"		2,000	2,000	—	1,000	1,000	—
Value	\$'000		26,901	34,457	6,711	7,332	10,728	9,687
Refined lead, unworked	ton		147,558	137,542	37,414	37,296	23,559	39,273
United Kingdom	"		57,913	60,975	15,801	13,250	15,920	16,004
U.S.A.	"		48,720	40,618	10,971	13,190	550	15,905
India	"		19,224	16,029	4,680	5,143	2,945	3,361
Philippines	"		3,017	4,204	861	1,393	606	1,344
Netherlands	"		4,803	3,449	1,349	—	2,100	—
New Zealand	"		2,885	2,163	620	314	702	527
Italy	"		1,206	2,001	1,001	1,000	—	—
Other	"		10,010	8,105	2,131	3,006	836	2,132
Value	\$'000		30,282	28,419	7,562	7,654	4,980	8,223
Rolled and extruded shapes	ton		429	883	149	216	167	331
Value	\$'000		129	242	40	57	58	87
Antimonial lead	ton		3,246	3,132	280	729	704	1,419
Value	\$'000		797	797	69	177	182	370
Scrap	ton		955	1,927	164	586	472	705
Value	\$'000		176	240	18	73	58	91
Slags and residues	ton		3,062	2,547	313	787	944	503
Value	\$'000		421	618	40	204	176	198
Lead content of concentrates, residues, etc. exported	ton		93,787	91,793	26,307	17,413	25,987	22,106
Lead content of lead bullion exported	"		99,822	106,547	22,162	22,856	31,779	29,750

(a) Includes lead-silver and lead-zinc ores. (b) Product of dump re-treatment. (c) Includes lead content of lead alloys from primary sources.

LIMESTONE

			Quarters—1968*					
			1967	1968*	March	June	September	December
PRODUCTION								
Mine production (a)		'000 tons	8,355	8,292	1,756	1,832	2,172	2,432
New South Wales	....	..	2,706	2,853	677	647	640	689
Victoria	....	..	1,992	1,805	368	424	486	527
Queensland	....	..	(b)	(b)	(b)	(b)	(b)	(b)
South Australia	....	..	1,591	1,557	349	319	415	474
Western Australia	....	..	(b)	(b)	(b)	(b)	(b)	(b)
Tasmania	....	..	345	(b)	(b)	(b)	(b)	(b)
Cement, Portland	....	..	3,769	3,868	891	957	1,030	1,000
IMPORTS								
Limestone and calcareous stone	....	ton	265,422	416,619	73,540	109,220	125,568	108,291
Japan	....	..	265,420	416,611	73,540	109,220	125,561	108,290
Other	....	..	2	8	—	7	—	1
Value	....	\$'000	368	581	103	152	175	151
Calcium carbide	....	ton	21,737	10,298	1,879	2,810	2,170	3,439
Norway	....	..	6,975	5,604	1,421	1,380	1,363	1,440
South Africa	....	..	7,807	4,894	458	1,430	807	1,999
Other	....	..	7,155	—	—	—	—	—
Value	....	\$'000	1,659	813	143	215	179	276
Cement, Portland	....	ton	44,406	54,160	12,320	8,618	19,374	13,848
Japan	....	..	28,553	36,212	6,314	4,744	15,535	9,619
United Kingdom	....	..	4,771	5,830	1,914	613	1,404	1,669
Other	....	..	11,082	12,308	4,082	3,267	2,435	2,530
Value	....	\$'000	945	1,104	288	191	341	285
EXPORTS								
Cement, constructional	....	tons	13,324	4,739	683	3,575	220	261
Value	....	\$'000	120	67	17	36	6	8

(a) Including shell and coral. (b) Not available for publication.

MAGNESITE

			Quarters—1968*					
			1967	1968*	March	June	September	December
PRODUCTION								
Mine production	ton		23,653	23,821	4,878	5,679	6,462	6,902
New South Wales	..		22,207	23,336	4,422	5,661	6,462	6,791
South Australia	..		188	319	301	18	—	—
Western Australia	..		1,258	166	155	—	—	11
IMPORTS								
Magnesite calcined, dead burned	ton		23,657	24,308	4,686	7,166	12,001	455
Value	\$'000		1,241	1,260	231	386	615	29
Magnesite calcined, other	ton		168	141	49	53	19	20
Value	\$'000		47	61	21	23	8	8
Magnesite, other	ton		3	2	—	1	—	—
Value	\$'000		1	1	—	—	—	—
EXPORTS								
Magnesite	ton		2,185	1,571	236	340	275	720
Value	\$'000		163	126	19	25	20	62

MANGANESE

			Quarters—1968*					
			1967	1968*	March	June	September	December
PRODUCTION								
Mine production								
Minerals produced								
Metallurgical grade ore	ton		559,600	737,532	79,890	211,385	211,621	234,636
Manganese content	"		256,325	342,703	36,368	98,341	99,441	108,553
Battery grade ore	"		—	—	—	—	—	—
Manganese dioxide content	"		—	—	—	—	—	—
Other grades	"		367	210	—	143	57	10
Manganese dioxide content	"		228	133	—	91	36	6
Manganese content of minerals produced								
Manganese contained in								
Metallurgical grade ore	"		258,325	342,703	36,368	98,341	99,441	108,553
Zinc concentrate	"		6,335	5,970	1,441	1,325	1,426	1,778
Total contained manganese	"		264,660	348,673	37,809	99,666	100,867	110,331
Production, States: metallurgical grade ore:								
Western Australia	"		195,065	149,798	10,527	42,396	46,430	50,445
Northern Territory	"		364,535	587,734	69,363	168,989	165,191	184,191
Total	"		559,600	737,532	79,890	211,385	211,621	234,636
Manganese dioxide content of minerals produced								
Manganese dioxide contained in:								
Battery grade ore	"		—	—	—	—	—	—
Other grades	"		228	133	—	91	36	6
Total contained manganese dioxide	"		228	133	—	91	36	6
Production, States: battery and other grades								
New South Wales	"		29	—	—	—	—	—
South Australia	"		—	24	—	14	—	10
Northern Territory	"		338	188	—	129	57	—
Total	"		367	210	—	143	57	10
IMPORTS (a)								
Metallurgical grade ore	ton		6,551	9,322	3,599	925	414	4,384
Value	\$'000		242	342	134	27	23	158
Battery grade ore	ton		49	2,191	1,527	39	625	—
Value	\$'000		19	147	74	11	62	—
Metal and powder	ton		494	392	80	92	92	128
Value	\$'000		235	173	34	40	43	58
EXPORTS								
Manganese ore	ton		314,782	555,743	96,663	119,985	136,750	200,465
Japan	"		286,883	316,921	60,068	89,019	87,066	100,771
Other	"		27,899	238,822	36,595	50,966	49,684	99,694
Value	\$'000		6,933	10,827	2,020	2,364	2,654	3,769

(a) Imports of ferro-manganese are shown on page 8.

MONAZITE

		Quarters—1968*					
		1967	1968*	March	June	September	December
PRODUCTION							
Mine production							
Monazite concentrate	ton	2,313	3,044	544	516	1,120	864
Monazite content	"	2,163	2,793	517	491	1,007	778
Production: States							
New South Wales	"	434	476	—	—	475	1
Queensland	"	237	272	114	52	76	30
Western Australia	"	1,492	2,045	403	439	456	747
Total	"	2,163	2,793	517	491	1,007	778

EXPORTS

Monazite concentrate	ton	1,858	2,575	688	486	450	951
U.S.A.	"	1,750	2,505	618	486	450	951
Other	"	708	70	70	—	—	—
Value	\$'000	443	348	96	62	58	132

NICKEL

		Quarters—1968*					
		1967	1968*	March	June	September	December
PRODUCTION							
Mine production							
Nickel concentrate	ton	15,753	36,699	7,833	7,739	10,470	10,857
Nickel content	"	2,061	4,573	1,038	996	1,267	1,282
Cobalt content	"	45	98	22	22	26	28
Copper content	"	264	551	134	114	165	138

IMPORTS (a)

Nickel—							
Pigs, ingot and blocks	ton	968	1,477	503	337	346	291
Value	\$'000	1,681	2,879	990	663	679	547
Pellets, shot, granulated	ton	269	261	129	60	60	12
Value	\$'000	486	489	233	116	116	24
Electroplating anodes	ton	299	176	53	35	49	39
Value	\$'000	901	480	149	100	133	98
Bars, rods, angles, shapes and sections	ton	15	238	48	58	80	52
Value	\$'000	28	484	94	125	161	104
Plates, sheets and strips	ton	313	19	4	5	4	6
Value	\$'000	569	64	15	16	14	19
Pipes and tubes	ton		1		1		
Value	\$'000	4	7	1	4	1	1
Wire	ton	23	31	15	11	5	
Value	\$'000	69	105	46	42	17	1
Powder	ton	10	10	4	4	1	1
Value	\$'000	24	24	9	9	4	2
Nickel-base alloys—							
Unworked shapes	ton	769	628	293	164	102	69
Value	\$'000	1,111	940	429	248	158	106
Bars, rods, angles, shapes and sections	ton	106	108	16	41	27	24
Value	\$'000	292	247	48	74	54	70
Plates, sheets and strips	ton	125	154	60	35	19	40
Value	\$'000	479	476	190	121	63	93
Pipes and tubes	ton	36	64	10	11	6	37
Value	\$'000	157	203	47	36	28	92
Wire	ton	226	218	58	74	29	57
Value	\$'000	761	713	192	230	107	184
Powder	ton	53	27	9	8	5	5
Value	\$'000	278	128	32	26	31	39

(a) Imports of ferro-nickel are shown on page 8.

Note: Details of exports of nickel concentrate are not available for publication.

PETROLEUM

	1967	1968*	Quarters—1968*				
			March	June	September	December	
PRODUCTION (Source: Fuel Branch, Department of National Development)							
Petroleum production							
Crude oil	'000 bbls	7,600	13,877	3,303	3,478	3,602	3,494
Natural gas	'000 cu ft	152,360	215,805	34,515	57,201	63,122	60,967
Refinery operations							
Input of feedstock	'000 bbls	150,936	163,589	37,964	40,781	41,998	42,846
Products							
Refinery gas (a) (b) (c)	"	1,186	1,249	253	341	384	271
Liquefied petroleum gas	"	2,170	2,887	526	712	905	744
Aviation gasoline	"	339	312	116	102	46	46
Motor spirit	"	52,487	56,085	13,932	13,277	14,022	14,854
Power kerosene	"	609	551	155	120	124	152
Aviation turbine fuel	"	5,471	6,374	1,541	1,606	1,489	1,738
Lighting kerosene	"	1,152	1,323	222	345	435	321
Heating oil	"	17,035	19,105	314	652	931	304
Automotive distillate	"	1,619	2,201	4,892	4,884	4,525	5,204
Industrial diesel fuel	"	7,190	7,543	1,510	1,834	2,154	2,045
Furnace fuel (b)	"	40,737	44,729	10,371	10,921	12,007	11,430
Solvents	"	931	1,107	242	307	292	266
Lubricating oil base stock	"	2,291	2,402	612	657	485	648
Bitumen	"	2,514	2,540	683	602	455	800
Other marketable products	"	1,790	2,657	572	608	757	720
Refinery fuel—							
Liquid	"	5,194	5,685	1,201	1,559	1,640	1,285
Gas and coke (a)	"	8,983	9,610	2,445	2,262	2,173	2,730

IMPORTS

Natural crude	'000 bbls	115 485	120,142	28,075	30,067	30,578	31,422
Value	\$'000	167,008	170,000	39,987	42,935	42,488	44,590
Enriched crude and other refinery feedstock	'000 bbls	28,575	27,396	7,307	7,748	6,271	6,070
Value	\$'000	43,976	42,727	11,509	12,093	9,582	9,543
Gasoline, solvents and other petroleum spirits	'000 bbls	4,057	4,563	1,098	1,364	733	1,368
Value	\$'000	13,949	15,470	3,288	5,133	2,363	4,686
Kerosene and aviation turbine fuel	'000 bbls	960	838	245	168	163	262
Value	\$'000	3,515	3,165	938	629	794	804
Automotive distillate, industrial and marine diesel fuels and heavy distillates n.e.s.	'000 bbls	525	1,219	351	142	475	251
Value	\$'000	1,578	3,484	974	447	1,323	740
Residual oils	'000 bbls	685	894	43	202	356	293
Value	\$'000	1,149	1,485	77	355	585	468
Lubricating oil	'000 bbls	325	346	64	123	62	91
Value	\$'000	3,365	3,663	752	1,224	803	884

EXPORTS

Natural crude	'000 bbls	145	—	—	—	—	—
Value	\$'000	221	—	—	—	—	—
Gasoline, solvents and other petroleum spirits	'000 bbls	1,590	2,488	609	576	1,063	238
Value	\$'000	6,582	9,669	2,561	2,299	3,792	1,037
Kerosene and aviation turbine fuel	'000 bbls	619	959	189	433	131	206
Value	\$'000	2,553	3,916	763	1,733	557	863
Automotive distillate, industrial and marine diesel fuels and heavy distillates n.e.s.	'000 bbls	1,800	2,064	670	756	179	479
Value	\$'000	5,310	6,269	2,007	2,177	549	1,536
Residual oils	'000 bbls	3,530	2,518	730	608	538	644
Value	\$'000	5,851	5,471	1,651	1,122	1,085	1,613
Lubricating oils	'000 bbls	820	690	100	216	110	264
Value	\$'000	8,577	6,918	1,141	1,847	1,344	2,586

(a) Fuel oil equivalent. (b) Excluding refinery fuel. (c) For sale as fuel.

PHOSPHATE

		Quarters—1968*					
		1967	1968*	March	June	September	December
PRODUCTION							
Mine production							
Phosphate rock	ton	11,770	5,744	n.a.	n.a.	n.a.	n.a.
South Australia	"	11,770	5,744	n.a.	n.a.	n.a.	n.a.
Production of superphosphate (a)	'000 tons	4,566	4,174	1,200	1,030	957	967
IMPORTS							
Phosphate rock	'000 tons	3,665	3,431	728	865	1,022	815
Nauru	"	1,304	1,520	267	415	494	345
Christmas Island (Indian Ocean)	"	781	901	210	185	300	206
U.S.A.	"	611	511	136	105	148	122
Other	"	969	499	115	160	80	142
Value	\$'000	30,355	34,140	7,179	8,523	10,279	8,160

(a) Source: Department of Primary Industry. Includes double and triple superphosphate and ammonium phosphate expressed in terms of single superphosphate, i.e. 22% P₂O₅ equivalent.

SALT

		Quarters—1968*					
		1967	1968*	March	June	September	December
PRODUCTION							
Mine production	ton	703,157	895,000	n.a.	n.a.	n.a.	n.a.
Victoria	"	(a)	(a)	n.a.	n.a.	n.a.	n.a.
Queensland	"	(a)	(a)	n.a.	n.a.	n.a.	n.a.
South Australia	"	516,166	610,827	n.a.	n.a.	n.a.	n.a.
Western Australia	"	(a)	(a)	n.a.	n.a.	n.a.	n.a.
IMPORTS							
Salt, common	ton	13,690	7,910	2,690	1,841	1,615	1,764
Value	\$'000	182	118	41	27	24	26
EXPORTS							
Salt	ton	87,977	224,854	35,474	59,718	74,834	54,828
Value	\$'000	463	854	147	273	249	186

(a) Not suitable for publication.

SILLIMANITE

		Quarters—1968*					
		1967	1968*	March	June	September	December
PRODUCTION							
Mine production	ton	1,183	2,125	790	370	248	718
New South Wales	"	479	1,780	662	257	181	660
South Australia	"	704	365	128	113	68	56
IMPORTS							
Sillimanite	ton	572	758	225	129	322	82
Value	\$'000	26	36	11	6	15	4

SILVER

		Quarters—1968*					
		1967	1968*	March	June	September	December
PRODUCTION							
Mine production							
Silver contents of minerals produced							
Bismuth concentrate	'000 foz		3	1	1	1	1
Copper ore	"	10	4	1	1	1	1
Copper concentrate	"	891	878	207	198	237	236
Gold ore	"						
Gold bullion	"	253	211	49	61	49	53
Lead ore	"	150	118	8	21	31	58
Lead concentrate	"	15,985	17,738	3,856	4,214	4,787	4,881
Lead-copper concentrate	"	1,114	1,053	253	247	289	264
Lead-zinc concentrate	"	476	167	139	—	24	4
Zinc concentrate	"	962	1,110	226	262	295	327
New South Wales	"	10,714	9,441	2,434	2,153	2,209	2,645
Victoria	"						
Queensland	"	6,832	9,603	1,782	2,304	2,910	2,607
South Australia	"						
Western Australia	"	224	192	50	51	44	47
Tasmania	"	1,798	1,750	412	419	475	444
Northern Territory	"	274	296	62	78	76	80
Total contained silver	"	19,842	21,281	4,739	5,005	5,713	5,824
Refinery production							
Refined silver	"	9,917	9,426	2,226	2,635	2,171	2,394
IMPORTS							
Silver							
Unrefined bullion	'000 foz	76	65	14	14	15	22
Fiji	"	59	53	14	12	13	14
New Zealand	"	13	4	—	1	1	2
Other	"	4	8	—	1	1	6
Value	\$'000	91	137	23	29	37	48
EXPORTS							
Silver, refined							
Mint bullion	'000 foz	4,168	14,542	1,470	6,752	4,125	2,195
Value	\$'000	5,705	29,339	2,656	14,173	8,639	3,871
Refined, other	'000 foz	1,081	1,270	259	201	406	405
Value	\$'000	1,468	2,366	495	357	720	794
Silver content of concentrate, matte etc. exported	'000 foz	3,063	3,437	896	875	682	885
Silver content of lead bullion exported	"	7,043	7,873	1,622	1,569	2,529	1,954

SULPHUR

		Quarters—1988*					
		1987	1988*	March	June	September	December
PRODUCTION							
Mine production							
Pyrite concentrate (a)	tons	252,748	164,720	45,665	47,678	33,529	37,848
Sulphur content	"	111,202	71,835	20,157	20,817	14,124	16,737
Sulphur content of minerals produced	"	56,490	50,251	12,712	11,735	11,797	14,007
Lead concentrate	"	3,081	3,260	851	740	916	753
Lead-copper concentrate	"	2,206	—	—	—	—	—
Pyrite concentrate	"	111,202	71,835	20,157	20,817	14,124	16,737
Zinc concentrate	"	219,392	223,681	51,995	51,212	54,723	65,751
New South Wales	"	223,338	202,401	49,953	45,811	47,173	59,464
Queensland	"	30,851	41,721	8,240	9,337	11,354	12,790
South Australia	"	42,275	36,119	7,960	10,512	10,560	7,087
Western Australia	"	34,359	14,434	5,171	5,638	2,046	1,579
Tasmania	"	61,548	53,074	14,013	12,778	10,070	16,213
Northern Territory	"	—	1,278	378	428	357	115
Total contained sulphur	"	392,371	349,027	85,715	84,504	81,560	97,248
Sulphuric acid production	'000 tons	1,993	1,860	485	462	443	469
IMPORTS							
Sulphur, elemental	ton	513,962	548,563	144,648	168,098	154,823	80,794
Canada	"	178,566	315,400	61,285	118,874	80,133	55,108
United States	"	210,645	119,342	39,169	15,041	54,257	10,875
Mexico	"	116,631	90,654	44,364	34,157	12,133	—
Other	"	8,120	23,167	30	26	8,300	14,811
Value	\$'000	17,296	21,632	5,234	6,766	6,364	3,268

(a) Gold content not recorded separately, included in gold content of gold bullion.

TALC (a)

		Quarters—1988*					
		1987	1988*	March	June	September	December
PRODUCTION							
Mine production							
New South Wales	ton	17,779	36,681	5,982	11,090	12,718	9,791
South Australia	"	2,690	2,988	773	971	659	585
Western Australia	"	7,180	10,419	1,601	2,222	2,200	4,396
Other	"	7,901	25,274	2,708	7,897	9,859	4,810
IMPORTS							
Talc	ton	2,164	3,533	557	737	806	1,433
China (Mainland)	"	1,393	2,403	344	394	484	1,181
U.S.A.	"	975	462	56	161	142	103
India	"	169	425	146	140	140	137
Other	"	227	243	157	34	40	12
Value	\$'000	74	117	16	28	29	44
EXPORTS							
Talc	ton	8,648	24,982	6,673	8,070	4,776	5,463
Netherlands	"	6,861	18,725	3,025	7,043	3,684	4,773
Belgium-Luxembourg	"	—	3,024	3,024	—	—	—
Other	"	1,787	3,233	624	1,027	892	690
Value	\$'000	277	661	178	224	113	146

(a) Includes steatite, chlorite, etc

TIN

		Quarters—1988*					
		1987	1988*	March	June	September	December
PRODUCTION							
Mine production							
Minerals produced							
Copper-tin concentrate	ton	—	877	—	217	303	357
Copper content	"	—	169	—	44	55	70
Tin content	"	—	60	—	15	20	25
Tantalite-tin concentrate	"	—	387	—	—	—	387
Tantalite content	lb	—	18,985	—	—	—	18,985
Tin content	ton	—	11	—	—	—	11
Tin concentrate	"	8,557	11,169	2,720	2,558	2,786	3,105
Tin content	"	5,586	6,663	1,317	1,547	1,768	2,031
Production: States, tin content							
New South Wales	"	1,569	1,440	359	339	325	417
Victoria	"	33	65	7	17	20	21
Queensland	"	1,649	1,230	229	234	405	362
Western Australia	"	747	828	168	351	123	186
Tasmania	"	1,528	1,144	552	612	900	1,080
Northern Territory	"	60	27	2	9	15	—
Total contained tin	"	5,586	6,734	1,317	1,562	1,788	2,067
Smelter and refinery production							
Refined tin	"	3,594	3,692	878	857	912	1,045
IMPORTS (a)							
Refined tin	ton	693	156	50	27	43	36
Value	\$'000	2,066	448	142	76	119	111
EXPORTS (a)							
Tin concentrate	ton	3,330	5,366	733	1,065	1,351	2,217
Value	\$'000	4,387	7,574	1,008	1,627	1,793	3,147
Tin and alloys, unworked	ton	28	214	51	94	37	32
Value	\$'000	78	557	144	240	85	88
Tin content of concentrates exported	ton	1,601	3,004	395	601	733	1,275

(a) Production and overseas trade details for tinplate are shown on Page 8.

TITANIUM

		Quarters—1988*					
		1987	1988*	March	June	September	December
PRODUCTION							
Mine production							
Minerals produced							
Ilmenite concentrate	ton	544,216	550,167	116,663	132,123	149,749	151,632
Titanium dioxide content	"	297,385	299,018	63,212	71,523	81,327	82,956
Leucoxene concentrate	"	696	5,797	1,163	1,399	1,589	1,686
Titanium dioxide content	"	617	5,226	1,062	1,278	1,393	1,493
Rutile concentrate	"	265,514	288,987	71,084	74,263	72,580	71,060
Titanium dioxide content	"	254,892	277,482	68,239	71,325	69,697	68,221
Titanium dioxide content of minerals produced							
Titanium dioxide contained in:							
Ilmenite concentrate	"	297,385	299,018	63,212	71,523	81,327	82,956
Leucoxene concentrate	"	617	5,226	1,062	1,278	1,393	1,493
Rutile concentrate	"	254,892	277,482	68,239	71,325	69,697	68,221
Total contained titanium dioxide	"	552,894	581,726	132,513	144,126	152,417	152,670
Production: States							
In ilmenite concentrate (a)							
New South Wales	ton	5,109	5,324	1,282	1,330	1,724	988
Queensland	"	1,385	2,529	302	561	804	862
Western Australia	"	291,508	296,391	62,690	70,910	80,192	82,699
Total	"	298,002	304,244	64,274	72,801	82,720	84,449
In rutile concentrate							
New South Wales	ton	177,013	187,806	48,270	49,154	46,906	43,476
Queensland	"	77,495	88,943	19,822	22,010	22,563	24,548
Western Australia	"	384	733	147	161	228	197
Total	"	254,892	277,482	68,239	71,325	69,697	68,221

Continued over page

TITANIUM (continued)

		Quarters—1988*					
		1987	1988*	March	June	September	December
IMPORTS							
Titanium oxide pigments—							
Anatase	ton	446	480	129	142	98	111
Value	\$'000	167	180	47	52	38	44
Rutile	ton	469	832	224	234	135	239
Value	\$'000	192	329	95	88	53	93
Titanium, white	ton	195	215	71	3	52	89
Value	\$'000	90	95	31	2	24	37

EXPORTS

Ilmenite concentrate (a)	ton	384,300	395,911	57,102	147,781	90,860	100,138
United Kingdom	"	186,700	154,593	31,775	62,613	31,012	29,193
France	"	80,859	120,210	17,541	43,588	32,434	26,647
Japan	"	61,850	67,412	7,467	13,831	16,878	29,236
U.S.A.	"	48,617	29,599	—	17,277	313	12,409
Other	"	26,174	23,697	319	10,472	10,253	2,653
Value	\$'000	3,896	4,090	610	1,533	914	1,033
Rutile concentrate	ton	258,791	284,995	62,401	66,433	83,097	73,064
U.S.A.	"	130,378	146,900	34,587	34,072	40,051	38,190
Japan	"	29,387	30,613	8,294	6,375	11,033	4,911
Canada	"	4,838	23,794	208	5,171	11,506	6,900
United Kingdom	"	15,948	16,582	1,871	4,463	4,199	6,049
Other	"	78,242	87,106	17,441	16,352	16,308	17,005
Value	\$'000	19,692	21,865	4,735	5,374	5,988	5,769

(a) Includes leucocene concentrate

TUNGSTEN

			Quarters—1988*			
			1987	1988*	March	June September December

PRODUCTION

Mine production							
Minerals produced							
Scheelite concentrate	ton	1,202	1,465	325	340	355	445
Tungstic oxide (WO ₃) content	unit	86,406	105,432	23,599	24,614	25,619	31,600
Wolfram concentrate	ton	448	526	108	107	129	182
Tungstic oxide (WO ₃) content	unit	32,804	37,991	7,925	7,747	9,492	12,827
Tungstic oxide (WO ₃) content of minerals produced							
Tungstic oxide contained in:							
Scheelite concentrate							
New South Wales	unit	37	—	—	—	—	—
Western Australia	"	89	—	—	—	—	—
Tasmania	"	86,280	105,432	23,599	24,614	25,619	31,600
Total contained in scheelite	"	86,406	105,432	23,599	24,614	25,619	31,600
Wolfram concentrate							
New South Wales	"	312	—	—	—	—	—
Queensland	"	195	2,322	12	—	—	2,310
Western Australia	"	54	34	—	—	—	34
Tasmania	"	31,973	34,615	7,913	7,747	9,012	9,943
Northern Territory	"	270	1,020	—	—	480	540
Total contained in wolfram	"	32,804	37,991	7,925	7,747	9,492	12,827
Total contained in tungsten							
minerals	"	119,210	143,423	31,524	32,361	35,111	44,427

EXPORTS

Scheelite concentrate	ton	1,239	1,434	225	313	416	480
Value	\$'000	3,316	3,532	617	714	958	1,244
Wolfram concentrate	ton	399	497	84	108	189	136
Value	\$'000	1,096	1,287	154	257	529	346
Tungstic oxide (WO ₃) content of concentrates exported							
in scheelite concentrate	unit	113,120	132,181	19,236	28,899	41,898	42,151
in wolfram concentrate	"	84,290	97,505	15,300	21,285	26,280	32,940
	"	26,830	34,678	3,936	7,813	13,618	9,511

ZINC

			Quarters—1988*			
			1987	1988*	March	June September December

PRODUCTION

Mine production						
Minerals produced						
Zinc ore	ton	198	2,700	—	—	2,700
Zinc content	"	34	810	—	—	810
Zinc concentrate	ton	702,792	718,311	165,961	163,820	177,493
Zinc content	ton	368,999	377,391	87,218	85,711	93,041
Lead content	"	8,117	10,048	2,487	2,361	2,469
Silver content	0001 oz	862	1,110	226	282	295
Gold content	oz	4,670	4,341	1,057	1,002	1,081
Cadmium content	ton	1,247	1,288	291	284	321
Cobalt content	"	101	112	24	22	29
Copper content	"	754	838	186	169	221
Manganese content	"	6,335	5,970	1,441	1,325	1,426
Sulphur content	"	219,392	223,684	51,995	51,212	54,726
Zinc content of minerals produced						
Lead ore	"	1,073	459	—	105	179
Lead-concentrate	"	27,754	32,986	7,166	8,284	8,852
Lead-copper concentrate	"	1,342	1,414	353	318	396
Lead-zinc concentrate	"	1,325	441	353	—	34
Zinc ore	"	34	810	—	—	810
Zinc concentrate	"	368,999	377,391	87,218	85,711	93,041
New South Wales	"	298,672	278,012	67,624	62,610	65,687
Queensland	"	51,034	84,062	15,678	19,389	23,506
South Australia	"	34	810	—	—	810
Tasmania	"	48,850	48,729	11,309	11,897	12,885
Northern Territory	"	1,837	1,868	479	522	444
Total contained zinc	"	400,527	413,501	95,090	94,418	102,502
Smelter and refinery production						
Refined zinc	"	194,471	205,482	44,497	45,877	57,432

EXPORTS

Zinc							
Zinc concentrate	ton	297,927	312,643	74,913	101,758	54,595	81,377
United Kingdom	"	147,615	165,105	45,082	60,935	17,781	41,327
Japan	"	94,717	78,642	24,808	17,197	14,579	22,058
Norway	"	22,585	22,627	—	12,931	—	9,606
Other	"	33,030	46,269	5,023	10,695	22,255	8,296
Value	\$'000	19,873	21,164	5,140	7,123	3,478	5,422
Refinery-type shapes	ton	96,471	97,177	22,199	21,352	21,841	31,785
U.S.A.	"	3,992	18,609	5,666	3,838	1,550	7,555
India	"	21,525	16,361	5,689	4,781	3,487	2,404
Thailand	"	11,692	11,290	1,240	3,280	2,275	4,485
Other	"	59,262	50,947	9,604	9,453	14,529	17,361
Value	\$'000	23,562	22,597	4,949	4,984	5,175	7,490
Plates, circles and strips	ton	247	245	30	28	101	86
Value	\$'000	141	133	17	17	53	46
Slags and residues	ton	6,543	8,353	1,725	1,821	2,590	2,217
Value	\$'000	470	394	108	122	71	92
Zinc content of ores and concentrates, slags, residues, etc. exported	ton	165,640	172,993	41,613	55,588	31,029	44,780

ZIRCONIUM

			Quarters—1968*					
			1967	1968*	March	June	September	December
PRODUCTION								
Mine production								
Minerals produced								
Zircon concentrate	ton		283,682	309,910	72,895	77,124	79,268	80,623
Zircon content	"		280,324	306,230	72,029	76,274	78,306	79,621
Production: States, zircon content								
New South Wales	"		174,502	186,807	43,322	46,605	50,241	46,639
Queensland	"		74,460	79,734	20,464	20,321	17,891	21,058
Western Australia	"		31,362	39,689	8,243	9,348	10,174	11,924
Total contained zircon	"		280,324	306,230	72,029	76,274	78,306	79,621
EXPORTS								
Zircon concentrate	ton		247,179	266,121	53,025	71,598	76,448	65,050
Japan	"		55,986	59,136	15,330	17,320	14,532	11,954
U.S.A.	"		63,276	57,446	11,135	10,441	17,019	18,851
United Kingdom	"		30,917	39,779	4,693	14,829	13,691	6,566
France	"		14,553	25,406	6,989	4,354	9,182	4,881
Other	"		82,447	84,354	14,878	24,654	22,024	22,799
Value	\$'000		10,720	11,013	2,188	2,980	3,152	2,691

MINOR MINERALS

			Quarters—1968*					
			1967	1968*	March	June	September	December
BARITE								
Mine production	ton		15,666	39,197	5,673	8,420	8,606	16,498
Imports			1,345	1,544	788	192	64	500
Value	\$'000		64	48	26	7	2	14
Exports	ton		4,174	19,564	4,508	5,010	5,788	4,258
Value	\$'000		139	789	182	193	226	188
BERYLLIUM								
Mine production	ton		55	15	3	2	10	—
BeO content	unit		675	183	31	30	122	—
Exports	ton		637	135	10	—	104	21
Value	\$'000		222	53	3	—	40	10
BISMUTH								
Mine production	ton		106	1,556	237	561	415	343
Bismuth concentrate	lb		25,536	388,416	56,000	126,784	104,832	100,800
Gold content	oz		1,578	33,535	3,508	16,587	7,624	5,816
Copper content	ton		6	106	9	26	34	37
Silver content	'000 l oz		—	3	—	1	1	1
Imports	lb		14,614	31,997	6,030	13,526	3,510	8,931
Bismuth metal	\$'000		59	118	22	49	13	33

MINOR MINERALS

		1967	1968*	Quarters—1968*			
				March	June	September	December
CLAYS							
Mine production							
Brick clay and shale	'000 tons	5,696	6,388	1,431	1,612	1,668	1,677
Imports							
Bentonite and bentonitic clay	ton	20,927	43,839	10,700	4,405	22,286	5,448
Value	\$'000	615	1,014	228	139	426	221
Clay, ball	ton	11,112	18,349	5,498	2,849	5,565	4,437
Value	\$'000	282	410	133	69	112	96
Clays and earths, activated	ton	5,498	5,461	1,304	1,163	1,654	1,340
Value	\$'000	399	419	104	83	130	102
Clay, white	ton	26,197	25,549	5,935	2,330	6,066	11,218
Value	\$'000	596	620	137	85	140	258
Fireclay	ton	2,353	4,991	2,394	336	604	1,657
Value	\$'000	101	173	70	10	24	70
Clays, n.e.i.	ton	14,045	12,379	2,920	2,821	3,853	2,785
Value	\$'000	519	548	114	123	183	128
Exports							
Clays (except activated)	ton	3,987	3,714	1,012	1,129	599	674
Value	\$'000	135	158	31	66	28	34
COBALT							
Mine production							
Cobalt content of minerals produced							
Cobalt contained in							
Nickel concentrate	ton	45	98	22	22	26	26
Zinc concentrate	"	101	112	24	22	29	37
Total	"	146	210	46	44	55	63
Imports							
Cobalt oxide and hydroxide	ton	37	31	9	10	5	7
Value	\$'000	113	101	29	32	17	23
Cobalt and cobalt base metal alloys	ton	51	73	28	7	27	11
Value	\$'000	188	285	108	27	105	45
CRYOLITE, NATURAL							
Imports	ton	237	201	67	55	25	54
Value	\$'000	49	38	12	11	5	10
DIAMONDS, INDUSTRIAL							
Imports	carats	525,053	669,931	113,417	158,539	191,671	206,304
Value	\$'000	1,990	2,725	484	640	797	805
Exports	carats	39,983	60,097	6,247	7,361	8,258	38,231
Value	\$'000	210	340	33	47	59	203
DIATOMITE							
Mine production	ton	11,103	2,280	293	323	874	790
Imports	"	4,331	5,126	1,152	1,309	1,198	1,487
Value	\$'000	281	334	76	74	81	103
DOLOMITE							
Mine production	ton	290,659	309,023	69,460	73,886	93,821	72,056

MINOR MINERALS

		Quarters—1968*					
		1967	1968*	March	June	September	December
FELSPAR							
Mine production	ton	4,450	4,473	763	1,156	1,614	940
FLUORSPAR							
Imports	ton	22,431	14,921	5,230	2,673	4,213	2,805
Value	\$'000	474	518	190	86	144	98
KYANITE							
Imports	ton	1,714	1,776	103	237	796	638
Value	\$'000	119	75	7	13	23	32
LITHIUM							
Mine production	ton	667	738	156	89	407	86
Lithium ore Li_2O content	unit	2,906	3,111	655	374	1,721	361
MERCURY							
Refinery production	lb	4,204	2,147	92	678	462	915
Imports	lb	132,904	104,549	32,804	21,631	23,099	27,015
Italy		45,402	68,144	19,067	12,169	19,799	17,109
Mexico		7,803	9,925	803	2,662	—	6,460
Other		79,899	26,480	12,934	6,800	3,300	3,446
Value	\$'000	847	714	244	143	150	177
MICA							
Imports							
Slab, bloc. or sheet	'000 lb	49	37	9	9	5	15
Value	\$'000	119	83	33	22	12	17
Splittings (not cut or stamped)	'000 lb	228	172	57	29	54	31
Value	\$'000	97	91	29	14	23	24
Ground or pulverised	'000 lb	583	859	301	127	137	294
Value	\$'000	43	60	22	9	9	20
Scrap	'000 lb	1,155	1,422	350	391	284	397
Value	\$'000	26	31	7	8	6	10
PLATINUM and PLATINUM GROUP METALS							
Imports							
Ingots, blocks, pigs, etc.	oz	5,389	6,426	704	1,424	2,065	2,213
Value	\$'000	293	436	50	112	113	161
Powder	oz	7,599	11,001	516	1,665	8,537	263
Value	\$'000	71	155	32	73	35	15
Wire	oz	1,626	1,841	461	382	379	619
Value	\$'000	149	205	53	39	44	69
POTASSIUM							
Imports							
Potassium chloride (fertilizer grade)	ton	102,294	121,834	32,425	25,652	32,544	31,213
Value	\$'000	3,230	3,044	927	830	763	724
Potassium sulphate (fertilizer grade)	ton	11,774	14,046	6,129	710	4,767	2,440
Value	\$'000	513	527	170	30	231	96
TANTALUM AND COLUMBIUM							
Mine production							
Tantalite-columbite concentrate	lb	79,587	238,115	97,978	82,860	23,050	34,227
$\text{Ta}_2\text{O}_5 + \text{Nb}_2\text{O}_5$ content	"	32,906	56,196	16,999	17,227	6,039	15,927
Exports							
Tantalite-columbite concentrate	ton	39	59	16	14	19	10
Value	\$'000	158	212	71	34	62	25

Summary Tables

MINE PRODUCTION OF PRINCIPAL MINERALS: AUSTRALIA

		Quarters—1968*					
		1967	1968*	June	September	December	1969*
Mineral	Unit of Quantity						March
Bauxite	'000 tons	4,176	4,883	1,332	1,258	1,306	1,793
Black coal	"	34,707	40,270	9,836	11,031	10,703	9,808
Brown coal	"	23,384	22,974	6,056	6,717	5,305	4,815
Copper (a)	ton	90,361	106,870	25,277	28,836	29,915	28,945
Gold (a)	'000 f oz	805	767	222	185	190	171
Iron ore and concentrate (b)	'000 tons	16,887	25,977	6,130	7,193	7,737	7,866
Lead (a)	ton	375,779	381,250	88,416	96,559	107,879	80,924
Manganese ore, metallurgical	"	559,600	737,532	211,385	211,621	234,636	241,968
Nickel (a)	"	2,061	4,573	966	1,267	1,262	1,139
Petroleum—							
Crude oil	'000 bbls	7,600	13,677	3,478	3,602	3,494	3,406
Natural gas	'000 cu ft	152,350	215,805	57,201	63,122	60,967	66,093
Silver (a)	'000 f oz	19,842	21,281	5,005	5,713	5,824	5,127
Tin (a)	ton	5,586	6,734	1,552	1,766	2,067	1,765
Titanium—							
Ilmenite concentrate (c)	"	544,216	550,167	132,123	149,749	151,632	170,772
Rutile concentrate	"	265,514	288,967	74,263	72,580	71,060	75,494
Tungsten concentrates (d)	unit	116,210	143,423	32,361	35,111	44,427	38,532
Zinc (a)	ton	400,527	413,501	94,418	102,502	121,491	94,448

(a) Total metallic content of minerals produced. (b) Excludes iron oxide not intended for metal extraction. (c) Excludes leucocene. (d) Tungstic oxide content.

SMELTER AND REFINERY PRODUCTION OF PRINCIPAL METALS: AUSTRALIA

		Quarters—1968*					
		1967	1968*	June	September	December	1969*
Metal	Unit of Quantity						March
Alumina	ton	840,923	1,286,776	299,556	322,654	380,018	418,301
Aluminium (refined)	"	91,326	95,810	21,323	26,039	26,138	27,915
Cadmium (refined)	"	516	452	97	113	138	112
Copper (blister) (a)	"	70,626	91,536	19,941	27,777	26,163	26,210
Copper (refined)	"	66,093	83,795	23,922	21,763	24,208	22,964
Gold (refined)—							
Australian origin	'000 f oz	672	639	171	165	162	134
Total	"	809	766	201	192	199	164
Lead—							
Refined (b)	ton	190,863	175,232	44,219	39,345	45,940	40,957
Lead content of lead bullion for export	"	101,167	116,636	28,285	32,826	32,701	28,556
Pig iron	'000 ton	4,677	5,463	1,343	1,517	1,498	1,460
Steel ingots (c)	"	6,167	6,399	1,581	1,581	1,680	1,704
Silver (refined)	'000 f oz	9,817	9,426	2,636	2,171	2,394	2,207
Tin (refined)	ton	3,594	3,692	857	912	1,046	783
Zinc (refined)	"	194,471	205,482	45,677	57,432	57,676	54,637

(a) Total production for refining in Australia and overseas. (b) Includes lead content of lead alloys from primary sources. (c) Includes recovery from scrap.

Note: Particulars of crude oil and natural gas were collected by Fuel Branch, Department of National Development and refined aluminium, cadmium, copper, lead, nickel, silver, tin and zinc were collected by the Bureau of Mineral Resources.