

# THE MINERAL INDUSTRY OF

# AUSTRALIA

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Australia is estimated to be the third largest producer of minerals and metals, excluding coal and petroleum, in the world, and its minerals industry is a leading catalyst in promoting the growth of the economy. The country's gross domestic product (GDP) in fiscal year 1996-97 (July-June) was A\$491.3 billion (about \$359 billion). The minerals industry represented \$23.3 billion, or 6.5% of the Australian economy (Minerals Council of Australia, 1998, Current economic impacts in Australia, accessed July 7, 1998, on the World Wide Web at URL <http://www.minmet.uq.au/ugrad/courses/5e103/aspin/notes18.html>). The real GDP growth rate for 1997 was 2.9% (U.S. Energy Information Agency, May 1998, Australia, accessed May 21, 1998, on the World Wide Web at URL <http://www.eia.doe.gov/emeu/cabs/australi.html>). In 1997, Australia was the world's leading producer of alumina, bauxite, chrysoprase, diamond, ilmenite, monazite, opal, rutile, sapphire, and zircon; second largest producer of lead and zinc; third largest producer of gold and iron ore; fourth largest producer of cobalt and uranium; and the fifth largest producer of aluminum, coal, copper, nickel, and silver. It was the premier exporter of alumina, coal, ilmenite, iron ore, refined lead, monazite, rutile, and zircon. The country's mineral wealth is so extraordinary that it is virtually self-sufficient in most mineral commodities. The only significant mineral resource in which Australia is not self-sufficient is petroleum (Digital Reflections, 1998, Mining and exploration—Australia and New Guinea, accessed April 17, 1998, on the World Wide Web at URL <http://www.reflections.com.au/MiningandExploration/>). Australia, nevertheless, produced more than 80% of its crude oil requirements domestically in 1997 (U.S. Energy Information Agency, May 1998, Australia, accessed May 21, 1998, on the World Wide Web at URL <http://www.eia.doe.gov/emeu/cabs/australi.html>). Australia also is endowed with abundant resources of other mineral fuels, including coal, natural gas, liquefied petroleum gas, and uranium and continues to be one of the few market economy countries that is a net exporter of mineral fuels.

## Government Policies and Programs

At yearend 1996, the Government announced that the foreign investment policy in relation to Australian uranium projects would be the same as that for any other mineral, meaning that although prior approval still is required, no special restrictions will apply unless the project appears to be contrary to national interest. Uranium export controls would continue to implement safeguards (UIC Newsletter, 1997b).

Attempts by the Government to reform native title legislation were stalemated at yearend. The Government's declared aim was to end the confusion resulting from the Wik ruling that was made by the High Court in the final days of 1996. Prior to the Wik ruling, the right of aboriginal people to claim land was restricted to vacant land

owned by the Government, about 36% of Australia, and then only if they had maintained a continuing association with the land being claimed. The Wik ruling threw the issue into confusion because it allowed the possibility of native title extending to land held under lease, thus increasing the proportion of land open to possible native title claim to about 78% of the country (Mining Journal, 1997c).

## Environmental Issues

In October, the Government set its goal to contain greenhouse gas emissions at an 18% increase from the 1990 levels by 2120 (instead of the projected 28% increase without restraint). Included with the \$130 million that will be spent to achieve this goal was a requirement that electricity retailers source an additional 2% of electricity from renewable sources by 2010 (UIC Newsletter, 1997a).

## Production

Of the total \$23.3 billion mineral and energy production in 1997, metallic minerals contributed an estimated 40%; petroleum (crude oil, natural gas, and natural gas liquids), 30%; coal, 25%; and industrial minerals (clays, construction materials, dimension stone, peat, and salt), 5%.

Australia remained the world's leading producer of alumina, bauxite, chrysoprase, diamond, ilmenite, monazite, opal, rutile, sapphire, and zircon. The country also continued to rank among the world's top producers of aluminum, antimony, coal, cobalt, copper, gold, iron ore, lead, manganese, nickel, salt, silver, tin, uranium, and zinc. (See table 1.)

## Trade

Australia continued to rely heavily on the export of the majority of its mineral production to bolster economic growth. Mineral exports were concentrated in just four commodity groups (in descending order)—coal, gold, alumina-aluminum-bauxite, and iron ore (U.S. Embassy, Canberra, Australia, 1998b). The mineral industry remained Australia's largest export earner, accounting for more than 60% of commodity export earnings (Minerals Council of Australia, 1998, Current economic impacts in Australia, accessed July 7, 1998, on the World Wide Web at URL <http://www.minmet.uq.au/ugrad/courses/5e103/aspin/notes18.html>). An estimated 80% of Australia's mineral production was exported. Australia remained the premier exporter of alumina, coal, ilmenite, iron ore, refined lead, monazite, rutile, and zircon. By using its plentiful resources of energy minerals (coal, liquefied natural gas, and uranium), Australia also continued to be a net exporter of mineral fuels.

## Structure of the Mineral Industry

The Australian mineral industry covers nearly the whole spectrum of minerals—major industrial minerals (ilmenite, rutile, and zircon), base metals (copper, lead, and zinc), ferrous metals (iron ore, manganese, and nickel), nonferrous metals (aluminum and tin), precious metals (gold and silver), fuel minerals (coal and uranium), and gemstones (diamond, opal, and sapphire). Australia is one of the world's principal producers and suppliers of ores, concentrates, and refined metals. Australia is estimated to rank third in the world in the value of its nonfuel mineral production. The value of its mineral production, including the fuels, is estimated to rank eighth in the world.

The Australian mining industry is based on a system of free enterprise in which private companies are involved in exploration, mine development, production, mineral processing, and marketing. A number of foreign companies in Australian mineral ventures are affiliates or subsidiaries of U.S. companies. Foreign companies control a majority of the mining, smelting, and refining sectors and a significant portion of the petroleum and natural gas sectors.

Many of Australia's mineral industries are fully integrated, producing ores, concentrates and other intermediate products (for example, alumina), and refined metal or other end products (for example, cut-and-polished gem diamond) within the country. In 1997, there were six alumina refineries and six smelters; three principal copper smelters and three principal refineries; one principal gold refinery; four principal lead-zinc smelters and/or refineries; one manganese ferroalloy plant; one nickel smelter and two nickel refineries; three principal crude steel plants; one primary tin smelter, one tin refinery, and two secondary tin refineries; two silver refineries; and eight principal petroleum refineries.

Ownership of mineral rights in Australia is divided between State ownership in State onshore areas and Commonwealth (Federal) ownership in Territories and in offshore areas beyond Australia's territorial limit. The Commonwealth's responsibility for minerals in the Northern Territory, except for uranium, has, however, been transferred to the Government of the Northern Territory. Thus, the individual States and Territories administer the mineral industries within their own borders, including registering land titles; issuing exploration and development permits; overseeing mining operations, including administration of inspections; assuring compliance with health, safety, and environmental regulations; and levying royalties and taxes.

The Federal Government may restrict mineral exports for the good of the country and, therefore, has de facto control over most mineral production. (See table 2.)

## Commodity Review

### Metals

**Bauxite, Alumina, and Aluminum.**—For the 27th successive year, Australia was the unchallenged world leader in bauxite production. Production was from the open-cut operations at Weipa on the western flank of the Cape York Peninsula in the far north of Queensland; the Gove operation across the Gulf of Carpentaria in northeastern Arnhem Land, Northern Territory; and the mines south of Perth in the Darling Ranges, Western Australia. Substantial bauxite deposits also border Admiralty Gulf at Cape Bougainville

and in the nearby Mitchell Plateau area of the Kimberley region of northern Western Australia, but their remoteness from energy supplies and infrastructure has prevented their development. Australia also was dominant in alumina production in 1997, with output coming from six refineries—four in Western Australia and one each in the Northern Territory and Queensland. Ranking fifth in the world in 1997, Australia also was a significant producer of aluminum. Aluminum was produced at six smelters, two each operating in New South Wales and Victoria and one each operating in Queensland and Tasmania.

In February, Alcan South Pacific Pty. Ltd., subsidiary of Canada's Alcan Aluminium Ltd. (Alcan), announced plans to develop a 2.5-million-metric-ton-per-year (Mt/yr) mine at its Ely bauxite deposit following a feasibility study that confirmed viability. First production was initially expected in 1999 with 1 million metric tons (Mt) of bauxite going to Alcan's Anghinish alumina refinery in Ireland (Mine Development Business Leads, 1997). Early in 1998, however, Alcan reached an agreement to take bauxite from Comalco Ltd. (Mining Journal, 1998a). The Ely deposit is adjacent to Comalco's Weipa Mine.

Alcoa of Australia Ltd.'s (Alcoa) Huntly Mine in Western Australia was scheduled to become the biggest bauxite mine in the world by the end of 1998, and to produce more bauxite each year (18 Mt) than any nation other than Australia itself and Guinea. Alcoa will compensate for the loss of 6.8 Mt/yr of bauxite production from the scheduled closing of the Jarrahdale Mine by expanding output from its nearby 11.9-Mt/yr Huntly Mine. Jarrahdale, in operation since 1963, was scheduled to close at the end of 1998 after reaching the end of its economic life. Construction to expand Huntly's operations began in August to enable commissioning of the required new facilities by yearend 1998 (Alcoa of Australia Ltd., 1997, p. 10). Eventually, Alcoa expects Huntly to supply all the bauxite requirements for its 1.9-Mt/yr Kwinana and 3.1-Mt/yr Pinjarra alumina refineries. The plans will not affect Alcoa's third bauxite mine at Willowdale (Mining Journal, 1997j).

In September, Worsley Alumina Pty. Ltd., operator of the Worsley Joint Venture, announced a \$600 million expansion at the Worsley alumina refinery and associated Mount Saddleback bauxite mine near Boddington, about 100 kilometers (km) south of Perth, Western Australia. Construction of a third reduction potline will increase alumina production from about 2.5 to 3.5 Mt/yr, making it the largest capacity refinery in Australia. Reynolds Australia Alumina Ltd. was the majority owner (56%) in the joint venture, the only bauxite-to-alumina project venture with Japanese shareholders (Metal Bulletin, 1997b).

In November, Alcoa began construction on the \$193 million expansion of its Wagerup Refinery. The expansion will increase operating capacity from 1.75 Mt/yr of alumina to 2.19 Mt/yr and is the first stage of a planned 3.3-Mt/yr expansion. Alumina output from the facility was scheduled to begin in mid-1999 (Alcoa of Australia Ltd., 1997, p. 3).

At yearend, Comalco was evaluating the siting of a \$975 million greenfield alumina refinery that would use bauxite from its Weipa deposits. Two sites were under consideration—Bintulu in Sarawak, Malaysia, and Gladstone, Queensland (Comalco Ltd., 1997, p. 14).

The proposed refinery would have a capacity of 1.4 to 1.6 Mt/yr (Resource Information Unit, 1998, p. 65).

In midyear, Comalco's majority-owned Boyne Island Smelters Ltd. completed the \$750 million expansion of its Boyne Island aluminum

smelter south of Gladstone. Capacity at the smelter was increased from 260,000 to 490,000 metric tons per year (t/yr) of aluminum through the addition of a third potline consisting of 264 cells. The expansion was commissioned in October, 6 months ahead of its original schedule and within budget (Comalco Ltd., 1997, p. 15).

In September, the State of Victoria announced that it planned to privatize its aluminum holding company, ALUVIC, in the first half of 1998. ALUVIC holds a 25% interest in the Portland aluminum smelter in Portland, Victoria, plus an indirect interest through its 16% share in Eastern Aluminium Ltd., which holds a 10% stake in the smelter (Mining Journal, 1997f).

**Chromium.**—In 1995, Danelagh Resources Pty. Ltd. secured a 3-year option to either mine, remove, and sell 200,000 metric tons (t) of chromite ore subject to the payment of a royalty to sole-owner Valiant Consolidated Ltd. or to purchase a 70% equity with the right to operate and manage all mining activities at the Coobina open-cut project in the Coobina Range, about 60 km east of Newman, Western Australia. Following trial mining operations in 1996 in which 6,000 t was shipped to China where it was smelted satisfactorily, Danelagh made two shipments totaling 31,000 t of ore in 1997—one to China and another to Japan (Resource Information Unit, 1998, p. 309). The ore was exported from Port Hedland, Western Australia.

**Cobalt.**—WMC Ltd. (WMC) processed cobalt-nickel sulfides from its Kambalda, Leinster, and Mount Keith Mines to produce cobalt-containing matte at its Hampden Smelter at Kalgoorlie and mixed cobalt-nickel sulfides at its Kwinana Refinery near Perth. The mines and plants were in Western Australia.

QNI Ltd. (QNI) continued to process lateritic cobalt-nickel ores at its Yabulu Refinery near Townsville, Queensland, producing cobalt-nickel sulfides. The refinery's feedstock was ore imported from P.T. Aneka Tambang's mine on Gebe Island, Indonesia, and four suppliers on La Grande Terre, the main island of New Caledonia—Nickel Mining Corp., Société des Mines de la Tontouta, Société Minière du Sud Pacifique, and J.C. Berton Mines. QNI's cobalt products mainly were sold to OMG Kokkola Chemicals Oy in Finland for the manufacture of cobalt chemicals and salts. In early 1997, QNI commissioned a cobalt refining facility at Yabulu to refine low-grade cobalt sulfides to manufacture pure cobalt oxide hydroxide used in the cobalt chemical market.

Finland's Outokumpu Mining Australia Pty. Ltd. mined byproduct cobalt from its nickel sulfide Forrestania underground mine in Western Australia and received byproduct cobalt concentrates from WMC's Mount Keith open-cut mine, as well as from the Silver Swan underground mine, an enterprise in which Outokumpu was in an equal joint venture with Mining Project Investors Pty. Ltd. The concentrates from the three mines were shipped from the southern Western Australia port at Esperance to Outokumpu's Harjavalta Smelter in Finland for processing (Matheson, 1998, p. 2-3).

Heavy rains disrupted throughput and production at the Yabulu Refinery during the March 1997 quarter. The refinery site was flooded, and power to the refinery was shut down. Normal operations resumed by the end of March, and production of cobalt and nickel increased during the subsequent quarter (Resource Information Unit, 1998, p. 349).

**Copper.**—Mine production of copper in Australia either was the primary product or a coproduct mainly from mines that produce other metals. The most notable copper-producing operations in Australia are at Mount Isa, Queensland (Hilton copper-lead-zinc mine), and Roxby Downs Station, South Australia (Olympic Dam

copper-gold-uranium mine). In 1997, Australian copper production ranked fifth highest in the world, with only Chile, the United States, Canada, and Indonesia producing more.

In June, Aberfoyle Ltd. announced a \$125 million expansion of its Gunpowder-Mammoth open-cut mine, 125 km north of Mount Isa, following completion of a 12-month feasibility study. The expansion, to be completed during September quarter 1998, will increase output to the equivalent of about 44,000 t/yr of copper cathode for 6 years, then decrease to the equivalent of 35,000 t/yr copper cathode during the subsequent 4 years (Mining Journal 1997a).

Following a successful pilot-scale bacterial oxidation plant at its Mount Lyell copper mine in Tasmania, Copper Mines of Tasmania Pty. Ltd., a wholly owned subsidiary of Mount Lyell Mining Co. Ltd. (formerly Gold Mines of Australia Ltd.), started the second phase of its feasibility study into the use of bacterial oxidation to extract copper from copper concentrate; the second phase was to determine the commercial viability of the process (Mining Journal, 1997g).

In October, demolition and redevelopment work began on the 80,000-t/yr Port Kembla copper smelter near Wollongong, New South Wales, that was placed on care-and-maintenance in 1995 by the former owner, CRA Ltd. (now Rio Tinto Ltd.), rather than invest \$150 million in substantial environmental and technical improvements. The new owners, a consortium of Japanese firms led by Furukawa Co. Ltd., planned to spend about the same amount to install an MIM Holdings Ltd.-designed tank house along with converting equipment and to carry out an environmental upgrade of an accompanying sulfuric acid plant. One-half of the smelter's 400,000-t/yr copper concentrate feed was expected to come from domestic mines (Mining Journal, 1997k). Reconstruction of the smelter was made possible when legislation passed in midyear by the New South Wales Government eased the burden of environmental compliances (Mining Journal, 1997e).

The Ernest Henry open-cast copper-gold mine was commissioned in October after construction was completed 2 months ahead of schedule and more than \$26 million under budget. Ernest Henry, 30 km northeast of Cloncurry, Queensland, was designed to produce 95,000 t/yr of copper at full capacity during the fourth production year. All the concentrates will be processed at MIM's Mount Isa Smelter and the Townsville Refinery (van Os, 1997). An injunction to restrain Ernest Henry Mining Pty. Ltd., the mine's operator-manager, from mining was sought by the Mitakoodi-Juhnjar aboriginal people in their challenge of the validity of the mining leases granted by the Queensland Government in 1974 and renewed in 1995. The basis of their claim was that the Queensland Government had not followed the correct process established under the Native Title Act. The matter was still pending at yearend (Resource Information Unit, 1998, p. 101).

In December, environmental clearance was granted for the \$1.1 billion extension to WMC's huge Olympic Dam polymetallic operation at Roxby Downs Station. The clearance applied to any production increase up to 200,000 t/yr of copper plus associated products. WMC began the expansion in the latter part of 1996 to boost copper output from 85,000 to 200,000 t/yr, originally to be completed by 2001 but later rescheduled forward to mid-1999. WMC also applied for environmental approval for eventual production of 350,000 t/yr of copper (Mining Journal, 1997i). Olympic Dam was the sixth largest copper ore body in the world (Minerals Gazette, 1996a).

**Gold.**—Gold is mined in all six States and the Northern Territory. Australia remained the world's third largest gold producer after South Africa and the United States. Western Australia remained the premier gold mining State in Australia, producing more than 75% of the country's output (Australian Bureau of Agricultural and Resource Economics, 1998, p. 15). Gold is the second largest export earner after coal (Mining Journal, 1997o). The Kalgoorlie Super Pit in Western Australia was the largest single producer with production capacity of more than 21,000 kilograms per year (kg/yr) of gold (Metal Bulletin, 1998c). Total gold production in 1997 was a record-high 311 t, nearly an 8% increase from that of 1996 (Mining Journal, 1998b).

Development of Acacia Resources Ltd.'s \$35 million Sunrise Dam surface mine and plant was completed ahead of schedule and under budget, and the mine began commercial production in April after a successful commissioning phase. Since then, the plant has operated at 120% of design capacity, resulting in higher-than-forecast gold recovery. The waste-to-ore ratio in the pit was less than one-half that projected, resulting in a significant increase in the amount of ore fed to the plant. As a result, production by yearend was more than double the 4,500 kilograms (kg) originally forecast (Resource Information Unit, 1998, p. 291).

In June, the Reserve Bank of Australia, an agency of the Federal Government, announced that it had secretly sold 167 t of gold, two-thirds of its total holdings, during the previous 6 months, setting off a drop in the gold index of more than 10% and a decrease in the value of Australian gold shares by almost \$2 billion. Although the price of gold continued to drop to a 12-year low later in the year, it was uncertain whether the Reserve Bank's gold sale was ultimately responsible for the decrease in prices (van Os, 1998).

The Western Australia Government introduced a gold royalty effective July 1. The 1.25% initial royalty, assessed on production of more than 2,500 ounces (Mining Journal, 1997q), equivalent to approximately 77.76 kg, will increase to 2.5% in July 2000 if the average spot price for gold increases above A\$450 per ounce, equivalent to approximately \$331 per ounce; by 2005, no matter what the price of gold may be, the present royalty arrangements will be extinguished, and a flat rate of 2.5% will be imposed (Mining Journal, 1997p).

The Ernest Henry copper-gold project was officially opened in October, ahead of schedule and under budget. The mine near Cloncurry was to produce 120,000 ounces per year of gold when mining reaches full optimization of 1.5 Mt/yr of ore during the fourth year of production (Mining Journal, 1997n).

In November, Pegasus Gold Australia Pty. Ltd. placed its Mount Todd Mine in the Northern Territory on care-and-maintenance, owing, primarily, to low metal prices and high operating costs. Originally begun as a heap-leaching operation, the mine was progressively transformed after the addition of a crushing and milling plant in 1996. A second expansion program to increase nominal throughput capacity to 8 Mt/yr included flotation, regrinding, leaching, and a four-stage crushing circuit. A new 35-megawatt gas turbine powerplant also was included in the expansion, and first gold from the new complex was poured in January 1997 (Resource Information Unit, 1998, p. 147).

**Iron Ore and Steel.**—Australia was the world's largest exporter of iron ore for the fourth (revised) successive year, with shipments totaling 152 Mt valued at about \$2.6 billion. The country supplied 15% of the world iron ore market, representing 36% of global

seaborne trade, and 77% of its shipments were destined for integrated steelmakers in Asia (Mining Journal, 1998d). As a world producer, Australia ranked third behind China and Brazil. Iron ore production continued to be concentrated in the Hamersley Range of the Pilbara region, Western Australia, which accounted for more than 97% of the country's production. Iron ore also was produced by BHP Steel Pty. Ltd. at its Iron Baron, Iron Duke, and Iron Knob Mines in the Middleback Range near Whyalla, South Australia.

BHP Iron Ore Pty. Ltd. was Australia's largest producer of iron ore, with major mines at Goldsworthy, Jimblebar, Mount Newman, and Yandi, all in the Pilbara region. Iron ore from BHP Iron Ore's mines is railed to Nelson Point and Finucane Island, on opposite sides of the harbor at Port Hedland. BHP Iron Ore is the second largest iron ore producer in the world after Brazil's Cia. Vale do Rio Doce (Metal Bulletin Monthly, 1998).

Hamersley Iron Pty. Ltd., a part of the international mining giant Rio Tinto, operates the mines Brockman No. 2 Detrital, Channar (60% Hamersley), Marandoo, Mount Tom Price, and Paraburdoo in the Hamersley region of the Pilbara. The company, Australia's second largest iron ore producer, owned and operated railway links from Paraburdoo through Tom Price to the port of Dampier, Western Australia, 386 km away, where Hamersley shipped to steel mills in China, Japan, the Republic of Korea, Taiwan, and Europe. Spur lines connect the Brockman No. 2 (44 km) and the Marandoo (59 km) Mines; the Channar Mine is linked to Paraburdoo by overland conveyor. Hamersley shipped a record 60 Mt of iron ore in 1997, 80% going to Asia (Metal Bulletin, 1998a). In September, Hamersley committed to the development of its \$510 million Yandicoogina operation. Capacity at the mine was expected to increase to 15 Mt/yr from initial production of 5 Mt/yr in 1999 (Resource Information Unit, 1998, p. 315).

Robe River Iron Associates, with a capacity of 27 Mt/yr, was Australia's third largest iron ore producer and the fourth largest in the world. The principal iron ore deposits are located in mesas stretching about 100 km along the Robe River valley near the company town of Pannawonica in Western Australia. Robe River's processing and port facilities are at Cape Lambert, Western Australia, about 200 km to the northeast. The Mesa J iron ore deposit was the company's production base, providing sinter fines for export (Bachman, 1997, p. 30).

Koolyanobbing Iron Pty. Ltd., a 60-40 joint venture of Portman Mining Ltd. and China's Anshan Iron and Steel Corp., operated the Koolyanobbing iron ore mine, 50 km north of Southern Cross, Western Australia. The mine produced lump and fines ore in about equal quantities. All fines were shipped from Koolyanobbing Iron's port at Esperance to Anshan Iron under a 20-year sales contract approved in 1994. The lump ore was shipped to Anshan Iron and other Chinese steelmakers, as well as to Japanese integrated steelmakers. Koolyanobbing Iron also operated the iron ore-beneficiation plant on Cockatoo Island off the northern coast of Western Australia, 140 km north of Derby (Bachman, 1997, p. 32).

The contribution of BHP Steel, the only integrated steel producer in Australia, to total world steel output is small, ranking 20th in the world and producing about 1% of world production (Metal Bulletin, 1998b). BHP Steel's steelworks are at Newcastle, Port Kembla, and Whyalla. BHP Steel announced the closing of the Newcastle plant but is conducting a \$90 million feasibility study for constructing a new facility (Stewart, 1998, p. 13).

Near yearend, the Government awarded a \$4.7 million research

and development grant to the South Australian Steel and Energy (SASE) Project. The grant will enable construction of a demonstration plant at Whyalla that will use Ausmelt Ltd.'s patented AusIron furnace technology to produce pig iron. Although this technology has been used on a commercial scale, the demonstration plant will allow more measurement of operating parameters, thus paving the way for the \$700 million SASE Project to produce 2.5 Mt/yr of low-cost pig iron for export to Southeast Asia (Mining Journal, 1997d).

Brisbane-based Goldamere Pty. Ltd., trading as Australian Bulk Minerals (ABM), reopened the Savage River iron ore mine and pellet plant in Tasmania in November (Resource Information Unit, 1998, p. 316). ABM acquired the mine in March 1997 after it was closed by the former owner-operator, Pickands Mather and Co. International of the United States, after almost 30 years of production. ABM was planning to produce 500,000 t/yr of pig iron by using new technology and constructing a ministeelworks.

**Lead and Zinc.**—Most lead and zinc mined in Australia was from operations that produced both because the two metals commonly occur in the same deposits. Zinc, however, was the main product in most of Australia's lead-zinc mining operations. In 1997, Australia ranked second in the production of lead concentrates and zinc concentrates; China produced slightly more lead, and Canada produced more zinc. In refined production, Australia was estimated to rank eighth in lead and seventh in zinc.

In March, mining began at BHP Ltd.'s Cannington underground lead-zinc-silver mine in Queensland. Ore processing began in August and the mine was commissioned in October. Cannington was completed on schedule and under budget. At full production, it was to produce 50,000 t/yr of lead and 11,000 t/yr of zinc.

Following proclamation of the Queensland Government's Century Zinc Project Bill, Pasmaenco Ltd. obtained the leases and licenses necessary for development to begin at the Century zinc-lead mine (Pasmaenco Ltd., 1997).

At yearend, construction of the Republic of Korea's Korea Zinc Co. Ltd.'s new greenfield smelter in Queensland was on schedule for commissioning in late 1999. The 170,000-t/yr-capacity plant was designed so that output could be doubled to 350,000 t/yr in a second stage, depending on market conditions (Metal Bulletin, 1997a).

**Mineral Sands.**—Australia's mineral sands industry comprises the mining and processing of high concentrations of such titanium minerals as ilmenite, leucosene, and rutile; monazite, a rare-earth phosphate; and zircon, an ore of zirconium. Australia was the world's leading producer and exporter of mineral sands. The mineral sands industry produced about 40% of the world's ilmenite, 25% of the rutile, 50% of the zircon, and a substantial portion of the monazite (A.C.T.E.D. Pty. Ltd., 1998, Titanium dioxide pigment (and titanium metal), accessed June 26, 1998, on the World Wide Web at URL <http://jimi.vianet.net.au/~acted/titanium.htm>).

**Platinum-Group Metals.**—No Australian mines are primary producers of platinum-group metals (PGM), although minor production continued in Western Australia's Eastern Goldfields at Kalgoorlie-Boulder and Kambalda as a byproduct of nickel operations. PGM, mainly platinum and palladium, were recovered at the Port Kembla refinery-smelter complex from byproduct copper sulfide residues produced at the Kwinana nickel refinery. PGM also were contained in nickel matte produced for export at the Kalgoorlie smelter.

**Silver.**—Australia was a major silver producer in 1997, ranking

fifth largest in the world after Mexico, Peru, the United States, and Canada. Most of the country's production, however, continued to be a byproduct of copper-gold, gold, or lead-zinc mining.

Production of byproduct silver from the Olympic Dam Mine will increase from about 12,500 to about 30,000 kg/yr as a result of a progressive expansion program scheduled to be completed in mid-1999, 18 months earlier than originally planned (Resource Information Unit, 1998, p. 108).

The first lead and zinc concentrates, containing 3,000 grams per ton (g/t) and 300 g/t silver, respectively, were produced in October at the Cannington lead-zinc-silver mine 200 km southeast of Cloncurry (Resource Information Unit, 1998, p. 326). The lead-silver and zinc-silver concentrates were to be railed to Townsville for further shipment to Pasmaenco's and other smelters to yield a maximum of 750 t/yr silver (Mining Journal, 1997b). At the full production rate of 1.5 Mt/yr of ore, expected to be achieved by mid-1998, the Cannington Mine will account for about 6% of the world's mine output of silver (Mining Journal, 1997n).

### *Industrial Minerals*

**Cement.**—Five industrial conglomerates accounted for most of the country's cement capacity and they held large-share percentages of a multitude of plants around the country—Adelaide Brighton Cement Ltd. held the most, about 2.1 Mt/yr of capacity, or a 29% share; Blue Circle Southern Cement Ltd. approximately 2 Mt/yr, or 28%; Australian Cement Holdings Ltd., about 1.4 Mt/yr, or 20%; Queensland Cement Ltd., about 1.3 Mt/yr, or 18%; and Cockburn Cement Ltd., 0.3 Mt, or about 4%.

**Diamond.**—Since 1986, Australia has been the largest volume producer of natural diamond in the world, supplying about one-third of the annual world diamond production. Because only a small portion of its output is of gem quality, the country ranks fifth in terms of value for world diamond production. The only commercial production of diamond in Australia since the closure of the Bow River Mine in 1995 was from the AK-1 lamproite pipe and alluvial operations at the Argyle Mine in the Kimberley region of Western Australia. About 5% of Argyles' production was of gem quality, including a small proportion of the highly valued intensely pink stones that generate about 50% of revenues but represent only about 0.1% of production; 45% was near-gem quality, producing about 45% of revenues; and 50% was industrial grade that contributed just 5% of revenues (Gemstone Forecaster, 1997, International market updates—Diamonds, accessed July 9, 1998, on the World Wide Web at URL <http://www.preciousgemstones.com/gfwin97two.html>).

Argyle Diamond Mines Pty. Ltd. was the management company and operator of Argyle Diamond Mines Joint Venture's (ADMJV) Argyle Mine. In 1997, following the mid-1996 expiry of the sales contract with De Beer's Central Selling Organization, ADMJV marketed all its rough diamond production through its European sales office in Antwerp, Belgium. The majority of Argyle's production was cut and polished in India (Ashton Mining Ltd., 1997a, p. 10). ADMJV continued to sell at its annual Argyle Pink Tenders, as it has since production startup, the few handfuls of the very rare, intensely pink "Argyle Pink" fancy diamonds unique to the Argyle Mine, as well as the slightly more common yellow-to-brown stones that were marketed as "Argyle Champagne" or "Argyle Cognac" depending upon the specific color. These diamonds were cut and polished by using traditional techniques and automated laser-

cutting machines at Argyle Diamond Sales Pty. Ltd.'s small facility in West Perth.

Feasibility studies that began in 1993 continued through 1997 into the economic and operational aspects of future mining of the AK-1 pipe, focusing on large-scale block caving and major expansion of the open cut as the mining methods of choice. Ore reserves within the current AK-1 pit design will sustain the operation through 2003 (Ashton Mining Ltd., 1997c).

The Stage I feasibility study for the Merlin diamond project in the Coanjula area of the Northern Territory near the Gulf of Carpentaria was completed in May, and the subsequent Stage I mine development plan was approved by the joint-venture partners, Ashton Mining Ltd. (77.4%), manager, and Aberfoyle (22.6%), in September. Stage I included trial mining by open-cut methods of the four diamond-bearing kimberlite pipes already bulk sampled—diamond valuation tested and bulk sampling from several of the remaining eight known pipes during a 2.5-year period (Ashton Mining Ltd., 1997a, p. 11). Construction for Stage I was scheduled to begin by mid-1998, and commissioning of the 700,000-t/yr processing plant was planned for December 1998 pending grant of valid title and resolution of Native Title issues. The plant can be expected to process 1.4 Mt/yr of ore during subsequent stages. When commissioned, Merlin will become Australia's second hardrock diamond mine (Ashton Mining Ltd., 1997b).

**Garnet Sand.**—At yearend, GMA Garnet Pty. Ltd. (GMA) was nearing completion of a new garnet sand plant near Port Gregory, Western Australia, to process ore from a newly developed alluvial resource about 10 km from GMA's existing open-cut mine and processing plant. The new wet separation plant will produce almandine garnet concentrate for processing to final product at GMA's dry separation plant at Geraldton, 100 km to the south. GMA was the world's largest single garnet producer, with total garnet production capacity of 200,000 t/yr. GMA was jointly owned by Australia's Hancock and Gore Ltd. and Barton Mines Corp. of the United States (Industrial Minerals, 1998c).

**Gemstones.**—Australia was the leading producer of precious opal, accounting for about 90% of world production. About one-half of Australia's annual production was mined in South Australia's three major fields at Andamooka, Coober Pedy, and Mintabie as well as many smaller fields stretching from Andamooka to the Northern Territory border along the southwestern margin of the Great Artesian Basin. Most opal was hand mined either from open cuts or underground drives, and all grades were produced from milky pinfire through crystal up to high-grade black (Mines and Energy South Australia, 1997, p. 2). Opal in New South Wales was mined at Lightning Ridge, the world's major source of the highly prized and valuable black opal, although a small amount was still produced at White Cliffs, the site of the first opal discovery in 1889. A small quantity of opal also was produced in western Queensland.

Redfire Resources NL conducted large-diameter exploratory drilling and underground mining at selected sites on its Queensland licenses along a northern extension of the Lightning Ridge trend just north of the New South Wales border in search of large opal-bearing deposits suitable for large-scale open-cut mining. In April, draft mining lease applications were under review by the Queensland Government, but because a decision to grant title was not to be made until the Federal Government had cleared Native Title claims, Redfire suspended exploration until yearend (Resource Information Unit, 1998, p. 126).

Australia also continued to be the world's leading producer of natural sapphire. Commercial sapphire production was mined from alluvial deposits in the Inverell-Glen Innes (New England) region of northern New South Wales and the Rubyvale-Anakie region of central Queensland. Australia was supplying as much as 30% by volume of the world's rough sapphire output. Most of the uncut gems were exported to Thailand, the recognized world leader for cutting and marketing.

Jade was discovered in the form of nephrite, one of the two recognized jade minerals, the other being jadeite, near Cowell on the Eyre Peninsula in South Australia. The deposits near Cowell, the world's largest known resource of nephrite jade, are mined every 2 years for enough nephrite to satisfy the market. Australia produced most of the world's chrysoprase, which is known as Australian Jade outside of Australia (Mines and Energy South Australia, 1997, p. 3).

Australia produced other gemstones, including agate, amethyst, chiolite, emerald (aquamarine), garnet, rhodonite, topaz, tourmaline, turquoise, and zircon.

**Gypsum.**—In August, Lake MacLeod Gypsum, a division of Rio Tinto controlled by its subsidiary Dampier Salt Ltd., began shipments of processed gypsum to Asian markets from its Lake MacLeod deposit near Carnarvon, Western Australia. Dampier Salt began mining the deposit in November 1996. The gypsum was dredged and then heap leached with water for several months to remove salt and other impurities, producing high-quality gypsum (chloride levels below 100 parts per million, gypsum purity of 96%, and 3.0% maximum moisture content) for use in the plasterboard and cement markets (Industrial Minerals, 1997c). Lake MacLeod Gypsum, Australia's largest producer of gypsum, was 68.49% owned by Rio Tinto; the remainder was held by Marubeni Corp., Nissho-Iwai Corp., and Itochu Corp., all of Japan (Industrial Minerals, 1998a).

**Kaolin.**—Early in the year, Comalco ended kaolin production permanently at its Weipa operations in northern Queensland after placing the kaolin plant on care-and-maintenance towards the end of 1996 as part of a larger restructuring and rationalization plan to overhaul its Weipa bauxite operations (Industrial Minerals, 1997b).

In November, Australian Kaolin Ltd. (AKL), formerly Venture Exploration NL, purchased the Elsmore kaolin deposit and associated infrastructure near Inverell, New South Wales, from Ironwork (Elsmore) Pty. Ltd. for \$1.1 million. The purchase included the kaolin deposit itself, all developmental and environmental approvals, technical data, a calcining kiln, bagging plant, and excavator. AKL will produce 24,000 t/yr of calcined kaolin for the paint, plastic, and rubber markets when full production is reached in 2000 (Industrial Minerals, 1998b).

AKL was developing the Skardon River kaolin deposit on Cape York Peninsula, 100 km north of Weipa, at a capital cost of \$46 million. Construction of the kaolin-processing plant began late in the year, and its commissioning was scheduled for mid-1998. Mine production was to be 75,000 t/yr of premium-grade calcined kaolin and 100,000 t/yr of hydrous kaolin for a minimum of 13 years. By midyear, AKL had signed marketing and distribution agreements with Austral Imex of Taiwan, Chemag AG of Germany, Hanwha Corp. of the Republic of Korea, Lomas International of the United States, and Nissho-Iwai (Industrial Minerals, 1997e).

**Lithium and Tantalum.**—Gwalia Consolidated Ltd. was the world's largest producer of lithium minerals (spodumene), which were mined from the southern end of the Greenbushes Mine, the

world's largest, highest grade spodumene resource, 300 km south of Perth. Gwalia Consolidated also was the world's largest producer of tantalum, supplying approximately 50% of primary tantalum produced in the world and 25% of total world tantalum demand incorporating other sources of supply, such as recycling and slag treatment. Both commodities were extracted from two separate open cuts, spaced about 300 meters (m) apart, within the Greenbushes pegmatite ore body, one of the largest zoned rare metal pegmatites in the world. Additionally, Gwalia Consolidated produces tantalum from the Mount Cassiterite ore body at its Wodgina Mine, 100 km south of Port Hedland. Wodgina was the second largest hardrock tantalum mine in the world, second only to the Greenbushes Mine (Gwalia Consolidated Ltd., 1997, p. 14).

In June, Gwalia Consolidated placed the lithium carbonate plant at Greenbushes on care-and-maintenance owing to increased supplies of lithium carbonate from new sources at prices significantly below historical levels, as well as on-going commissioning problems with the plant itself. The lithium carbonate plant, originally commissioned in the first quarter of 1996 was recommissioned in March 1997 following design changes and upgrades (Industrial Minerals, 1997f).

**Magnesia.**—Cryptocrystalline magnesite has been mined since 1992 by Queensland Metals Corp. (QMC) at the Kunwarara Mine, 70 km northwest of Rockhampton in Queensland, through the Queensland Magnesia (QMAG) project for the production of deadburned and electrofused magnesia used as feedstock for refractory materials. QMAG also is a research organization focusing on refractory applications and the research and development of calcined building materials.

The Magnesium Metal Project, a 50-50 joint venture of QMC and Commercial Minerals Ltd., a wholly owned Normandy Mining Ltd. subsidiary, was formed early in the year to develop process technology for producing magnesium metal and alloys from magnesite ore. In February, construction began on a 1,000-t/yr pilot plant at Gladstone, 160 km from the Kunwarara Mine. A full-scale feasibility study of a commercial-scale operation was to follow. The cost of this first phase of the project, expected to take 2½ years to complete, was estimated to be \$56 million. This work was expected to result in a decision as to whether or not to construct a plant to produce 90,000 t/yr at an estimated cost of \$539 million (Mining Journal, 1997m).

**Phosphate Rock.**—By November, WMC Fertilizers Ltd., a wholly owned subsidiary of WMC, had awarded all construction contracts for its phosphate rock mine at Phosphate Hill and high-analysis ammonium phosphate fertilizer plants at Phosphate Hill and Mount Isa in northwestern Queensland. Construction of the chemical facilities were expected to start early in 1998 and to be on-stream by late 1999. Capital cost for refurbishing the phosphate rock mine, idle since 1983, and building the chemical facilities was estimated to be \$539 million. The 1-Mt/yr operation will produce diammonium phosphate (DAP) and monoammonium phosphate (MAP).

The DAP and MAP produced at Phosphate Hill will be railed to Townsville where it will be shipped to Australian and offshore markets. WMC Fertilizers expected that more than one-half of its production would be used in Australia, replacing imported fertilizers (Fertilizer Week, 1997).

**Salt.**—Australia ranked sixth in world salt production, most of which was produced from solar salt plants. Significant quantities also were produced from salt from inland lakes, coastal lagoons, and

ancient buried evaporites.

Dampier Salt supplied more than one-half of Australia's annual salt production from its solar operations at Dampier Field on Mistaken Island near Dampier in the Pilbara area and Lake MacLeod Field near Carnarvon. Following an expansion completed at yearend, the Dampier Field has about 3½ times more production capacity (4 Mt/yr) than the Lake MacLeod Field (Industrial Minerals, 1997a).

Salt from the Dampier Field was produced by evaporation of seawater; the evaporating ponds cover more than 9,000 hectares (ha). At Lake MacLeod, natural brine was recovered from the subsurface Lake MacLeod Aquifer through shallow wells from depths of 4 to 6 m and circulated by gravity through an evaporating pan system where salt crystals were grown for harvest and processing. Dampier Salt produced mainly industrial-grade salt for chemical and industrial uses, but the product also is approved as a food-grade salt.

Dampier Salt supplied more than one-half of Australia's salt exports. Japan remained Dampier Salt's main market, with Indonesia, the Republic of Korea, and Taiwan receiving the bulk of remaining export sales.

The Cargill, formerly the Leslie, salt project, at Port Hedland, owned by the Cargill Salt department of Cargill Australia Ltd., a wholly owned subsidiary of Cargill Inc. of the United States, was the second largest Australian solar salt producer. Salt was produced by a process of evaporation and concentration in which salt water was pumped into a series of concentration and crystallizer ponds covering an area of about 8,000 ha. The Cargill operation has a capacity of about 3 Mt/yr. Cargill exported high-quality salt throughout Asia mainly to the chemical industry. (Resource Information Unit, 1998, p. 366).

**Silica.**—Gwalia Consolidated produced high-quality silica sand containing aluminum and potassium suitable for the container and sheet glass markets at its Kemerton Mine, about 25 km northeast of Bunbury, Western Australia. Production was exported to Japan. Owing to successful marketing by its Japanese joint-venture partners, Itochu Corp. and Tochu Co. Ltd., demand exceeded production capacity, and, at yearend, Gwalia Consolidated was considering increasing production capacity from 400,000 to 700,000 t/yr (Industrial Minerals, 1997d).

### *Mineral Fuels*

**Coal.**—In 1997, the coal industry was Australia's largest foreign-exchange earner (U.S. Embassy, Canberra, Australia, 1997c), accounting for an estimated 25% of export revenues from the minerals sector and about 15% of the country's export earnings (Mining Journal, 1998c). Australia was the sixth largest coal producer (all grades) in the world (Coal Age, 1997b). New South Wales and Queensland accounted for more than 98% of the country's black coal production and virtually all its exports. The principal areas of coal production were the Bowen Basin, Queensland; Hunter Valley, Western Coalfield, and South Coast Coalfield, New South Wales; Leigh Creek, South Australia; Fingal, Tasmania; Latrobe Valley Coalfield (all brown coal), Victoria; and near Bunbury, Western Australia. The Northern Territory had no coal production.

In 1997, Australia retained its position, held since 1984, as the world's largest exporter of coal (Edwards, 1997). Coal exports were shipped from nine terminals at seven ports along the country's eastern coast. Australia controlled an estimated 35% to 40% of the

world's seaborne coal trade by exporting more than 70% of its salable coal production of more than 215 Mt in 1997. The major market for Australia's coal exports was Japan and other Asian countries. Significant amounts of coal also were exported to Europe, the Indian subcontinent, the Middle East, and South America (Australian Bureau of Agricultural and Resource Economics, 1998, p. 11-12).

BHP Coal Pty. Ltd.'s Mount Owen Mine in New South Wales officially opened in March. BHP Coal, which acquired the mine when it purchased the assets of Hunter Valley Coal Corp. in 1995, upgraded it from 1 to 3.55 Mt/yr to meet the demand from the growing Asian thermal coal markets. Thiess Contractors Pty. Ltd., which constructed a 7-km rail spur and a washing plant, also operated the mine, and Mount Owen became the first coal mine in Australia to operate under a partnering agreement (Resource Information Unit, 1998, p. 75).

In June, the joint-venture partners of the Central Queensland Coal Associates announced plans to spend \$375 million on expansion of the Peak Downs and the Saraji open-cut coking coal mines and the Hay Point port facilities. The expansion will increase output at Peak Downs by 3 Mt/yr, to 10 Mt/yr, by the last semester of 2001 through the addition of a new large dragline and added stripping, hauling, and processing capacity. Capacity at the Saraji Mine will increase from 5 to 7 Mt/yr. The ongoing expansion of Hay Point will increase shipping capacity from 24 to 28 Mt/yr (Mining Journal, 1997i).

Majority owner Portman (95%) approved plans in October that will nearly double production from 2 to 4 Mt/yr of salable coal at its Burton Mine. The mine began commercial production in January. Construction was scheduled to start in early 1998 with expansion to be completed near yearend (Coal Age, 1997c).

The Gordonstone Mine, Australia's highest-capacity longwall mine with output exceeding 4.6 Mt in 1996, was placed on care-and-maintenance in October. The majority owners, two subsidiaries of the fourth largest U.S. coal producer, Atlantic Richfield Co. (ARCO), closed the mine following higher production costs, lower output, and poorer profit margins (Resource Information Unit, 1998, p. 83). ARCO was considering the disposal of all its Australian and U.S. coal mining operations and withdrawing from the worldwide coal business (Coal Age, 1997a).

In December, majority-owner MIM announced it would develop a new underground longwall section at its Oaky Creek Mine in Bowen Basin. The expansion will nearly double mine output to 6 Mt/yr of coking coal. Improved dragline efficiencies at the open-cut operations were expected to maintain their 1.8-Mt/yr capacity (Mining Journal, 1997h).

**Petroleum and Natural Gas.**—In 1997, Australia produced more than 80% of its crude oil requirements, with about 90% of total production coming from offshore wells. About 44% of the oil and gas condensate was produced in the Gippsland Shelf Fields in Bass Strait between Victoria and Tasmania. The Carnarvon Basin off the northwestern coast of Western Australia was Australia's next largest producer, providing about 41% of total production. The Gippsland Basin in Victoria was the largest producer of natural gas (a 33% share) and liquefied petroleum gas (69%). The North West Shelf Project on the Continental Shelf, about 140 km offshore Dampier, Western Australia, was the source of the country's liquid natural gas production (Australian Institute of Petroleum, 1997, Frequently asked questions—Where does our oil and gas come from and how long will it last?, accessed July 23, 1998, on the World Wide Web at

URL <http://www.aip.com.au/education/faq/index.html>).

In December, BHP Petroleum Pty. Ltd. and Esso Australia Ltd. announced phased development of the deep water Blackback Oilfield in Bass Strait. The field is on the steep continental slope in 400 m of water. The first phase of development, costing \$80 million, comprises three subsea wells connected back to the existing Mackerel Field production platform, 18 km distant. This was expected to access about 13.5 million barrels of reserves with production scheduled to begin in mid-1999. Peak production will reach 18,000 barrels per day during the first year (Reuters, December 17, 1997, BHP, Esso to start new oilfield, accessed December 17, 1997, on the World Wide Web at URL [http://biz.yahoo.com/finance/971217/bhp\\_bhp\\_ax\\_esso\\_x\\_1.html](http://biz.yahoo.com/finance/971217/bhp_bhp_ax_esso_x_1.html)).

In November, Chevron Asiatic Ltd., developer of the proposed \$1.48 billion, 2,500-km gas pipeline from Papua New Guinea to Townsville and Gladstone, signed a Heads of Agreement with indigenous landholders over the proposed route through Queensland. The agreement covered eight aboriginal landholder groups along the proposed pipeline corridor from Cape York to Gladstone (Petroleum Gazette, 1998).

The total number of petroleum exploration and development wells drilled during 1997 (319) was 87 more than that of 1996 (232). The number of onshore exploration wells drilled in 1997 (118) was 22 more than that of 1996 (96). During 1997, the number of offshore exploration wells drilled increased to 58 compared with that of 1996 when 47 wells were drilled. The total number of exploration wells drilled in 1997 (176) increased by 23% from the number drilled in 1996 (143). The total number of development wells drilled (143) was 54 more than the 1996 figure (89); 79 wells were drilled onshore, an increase of 10 wells from the 1996 figure and the highest level since 1985; and 64 were drilled offshore compared with 20 wells drilled in 1996. In 1997, the total meters drilled for exploration and development wells (718,716) was about 40% more than that drilled in 1996 (510,702). The 431,589 line kilometers of seismic survey activity during 1997 was the highest ever achieved for the second consecutive year, easily surpassing 1996's record of 390,167 (revised) line kilometers. The higher level of line-kilometer acquisition is mainly the result of rising offshore activity (Bureau of Resource Sciences, 1998).

**Uranium.**—The existence of uranium in Australia has been known since the 1890's. In the 1930's, ores were mined at Radium Hill and Mount Painter in South Australia to recover minute amounts of radium for medical purposes. As a result, a few hundred kilograms of uranium also were produced and used as a bright yellow pigment in glass and ceramics. Uranium ores as such were mined and treated in Australia from the 1950's until 1971. Radium Hill, Rum Jungle in Northern Territory, and Mary Kathleen in Queensland were the largest producers of uranium (as yellowcake). The uranium was intended primarily for export to the United Kingdom and the United States for use in their weapons programs of the period, but much also was used in the production of electricity. With resumption of the mining and exporting of Australia's uranium in 1981, it has been sold strictly for electrical power generation with adequate safeguards in place to ensure this policy. Australia's uranium reserves are the world's largest, having about 40% of the western world (Minerals Gazette, 1996b) and about 25% of the world total (Uranium Information Center Ltd., June 1998, Australia's uranium and who buys it—Nuclear issues briefing paper 1, accessed July 24, 1998, on the World Wide Web at URL <http://www.uic.com.au/nip01.htm>).

In October, the Government granted approval for Energy Resources of Australia (ERA) to develop its Jabiluka Mine site on the edge of the World heritage-listed Kakadu National Park. The Jabiluka Mine was projected to produce 90,400 t of uranium oxide from 19.5 Mt of ore during a mine life of 28 years (U.S. Embassy, Canberra, Australia, 1997a). ERA's preferred option for development of the deposit was to have facilities occupying about 20 ha within an operating area of 80 ha, with the ore trucked to ERA's Ranger operation, 22 km away, for processing. The haul road would be completely within ERA's leases, not within the boundaries of Kakadu National Park, and tailings would be placed in the completed Ranger pits (Resource Information Unit, 1998, p. 372).

## Reserves

Australia has a significant resource base of a diverse range of minerals and is self-sufficient in most minerals of economic importance. The country, however, still appears to be deficient (import reliant) in chromite, mercury, mica, PGM, petroleum, and sulfur. Major minerals with reserves adequate for domestic demand and exports included bauxite, clays, coal, copper, diamond, gold, iron ore, lead, manganese, mineral sands, natural gas, nickel, salt, silver, tin, uranium, and zinc. (*See table 3.*)

## Infrastructure

The transportation infrastructure of Australia is well developed. There are 895,030 km of roads, including 345,482 km paved (1,330 km are expressways) and 549,548 km unpaved. Inland waterways, of which there are 8,368 km usable for mainly small, shallow-draft craft, are of little importance to the transportation industry.

The public sector railway system consisted of 38,563 km of track, of which 16,752 km was standard (1.435-m) gauge, 15,728 km is narrow (1.067-m) gauge, and 6,083 km is broad (1.600-m) gauge. There were 2,914 km of electrified rail. A few hundred kilometers of rail was privately owned, most of which served the iron ore industry in Western Australia. Of 443 airports, 275 were principal with permanent-surface runways. International shipping ports included Adelaide, Brisbane, Cairns, Darwin, Devonport, Fremantle, Geelong, Hobart, Launceston, Mackay, Melbourne, Sydney, and Townsville. The merchant marine fleet included 14 petroleum-oil-lubricant tankers; 3 chemical tankers; 4 liquefied gas tankers; 1 combination ore-oil tanker; and 30 bulk ore freighters.

Pipelines included 5,600 km for natural gas, 2,500 km for crude oil, and 500 km for refined oil products. Electric generating capacity was 38.83 gigawatts (Central Intelligence Agency, 1997, 1997 World Factbook—Australia, accessed July 7, 1998, on the World Wide Web at URL <http://www.odci.gov/cia/publications/factbook/as.htm>).

In remote areas where mines, mills, and smelters are usually located, an individual mining company or joint venture must provide supporting infrastructure, such as housing, roads, railways, port facilities, electric power and water facilities, and various community services, including schools, shopping centers, and recreation facilities.

## Outlook

Because of a growing worldwide need for mineral and energy

supplies, with particular demand for those mineral commodities in which Australia is abundantly endowed and for which Australia was among the leaders in world supply—bauxite, coal, copper, diamond, gold, iron ore, lead, manganese, mineral sands, natural gas, and zinc—the country probably will continue to be a significant world mineral supplier well into the 21st century.

Asia was an important export market for Australia's mineral resources. The Asian financial and economic crisis that manifested itself during 1997's last quarter was expected to slow Australia's economy, although the economy was still expected to grow at about a rate of 3.7% during 1998 (Far Eastern Economic Review, 1998).

## References Cited

- Alcoa of Australia Ltd., 1997, Annual report: Alcoa of Australia Ltd., 41 p.
- Ashton Mining Ltd., 1997a, Annual report: Ashton Mining Ltd., 58 p.
- 1997b, Attachment to Preliminary final statement for year ended 31 December 1997: Ashton Mining Ltd., p. 1-4.
- 1997c, Quarterly report to 31 December 1997: Ashton Mining Ltd., p. 1
- Australian Bureau of Agricultural and Resource Economics, 1998, Australian mineral statistics—March quarter: Australian Bureau of Agricultural and Resource Economics, 32 p.
- Bachman, David, 1997, Western Australian iron ore industry review—An overview of iron ore industry developments: Perth, Western Australia Department of Resources Development, 64 p.
- Bureau of Resource Sciences, 1998, Australian petroleum exploration and development activity 1 October to 31 December 1997: Canberra, Bureau of Resource Sciences, 4 p.
- Coal Age, 1997a, Arco considers a withdrawal from coal business: Coal Age, v. 102, no. 5, p. 10.
- 1997b, International Longwall—Australia: Coal Age, v. 102, no. 9, p. 29.
- 1997c, News—Australia: Coal Age, v. 102, no. 10, p. 13.
- Comalco Ltd., 1997, Annual report: Comalco Ltd., 80 p.
- Edwards, G.E., 1997, Australia—Responding to the Asian challenge: Coaltrans 97 Conference, Istanbul, October 13-15, 1997, p. 93-108.
- Far Eastern Economic Review, 1998, Economic indicators—Selected Asian countries: Far Eastern Economic Review, v. 161, no. 4, January 22, p. 58.
- Fertilizer Week, 1997, Queensland fert project moves forward: Fertilizer Week, v. 11, no. 25, November 3, p. 1-2.
- Gwalia Consolidated Ltd., 1997, Annual report: Gwalia Consolidated Ltd., 72 p.
- Industrial Minerals, 1997a, Asia—Dampier Salt expands salt capacity: Industrial Minerals, no. 362, November, p. 9.
- 1997b, Australia—Comalco closes Weipa kaolin: Industrial Minerals, no. 353, February, p. 9.
- 1997c, Australia—Lake MacLeod Gypsum secures Asian exports: Industrial Minerals, no. 364, August, p. 9.
- 1997d, Australia—Silica sand capacity to increase at Kemerton: Industrial Minerals, no. 363, December, p. 9.
- 1997e, Australia—Skardon kaolin to go into production: Industrial Minerals, no. 358, July, p. 9.
- 1997f, World of minerals—Headline news: Industrial Minerals, no. 359, August, p. 8.
- 1998a, Australia—The Asia connection: Industrial Minerals, no. 364, January, p. 39.
- 1998b, Australia—Australian Kaolin buys Elsmore project: Industrial Minerals, no. 365, February, p. 9.
- 1998c, Australia—GMA commissioning A\$4.5m garnet plant: Industrial Minerals, no. 367, April, p. 23.
- Matheson, P., 1998, Cobalt in Australia 1993 to 2003—A review and forecast: Cobalt Conference, Toronto, May 27-28, 1998, Proceedings, 11 p.
- Metal Bulletin, 1997a, Construction of Townsville smelter on schedule: Metals Bulletin, no. 8239, December 22, p. 7.
- 1997b, Worsley to expand alumina refinery: Metals Bulletin, no. 8210, September 11, p. 5.
- 1998a, Hamersley remains optimistic about Asia: Metals Bulletin, no. 8167, April 6, p. 24.
- 1998b, Iron and steel—China still world's largest producer: Metals Bulletin, no. 8246, January 22, p. 21.
- 1998c, Plutonic shareholders approve merger with Homestake—Gold: Metals Bulletin, no. 8274, May 4, p. 10.
- Metal Bulletin Monthly, 1998, More BHP iron ore on the way: Metal Bulletin Monthly, no. 330, June, p. 89.

Mine Development Business Leads, 1997, Alcan on track with bauxite mine: *Mine Development Business Leads*, no. 1, April, p. 3.

Minerals Gazette, 1996a, The monster to get bigger: *Minerals Gazette*, v. 1, no. 91, August, p. 7.

———1996b, Uranium coming in from the cold: *Minerals Gazette*, v. 1, no. 86, March, p. 8.

Mines and Energy South Australia, 1997, South Australia—The jewel in the crown: Eastwood, South Australia, Australia, Mines and Energy South Australia, 4 p.

Mining Journal, 1997a, Aberfoyle approval: *Mining Journal*, v. 329, no. 8439, July 25, p. 66.

———1997b, Cannington ramps up: *Mining Journal*, v. 329, no. 8450, October, 10, p. 301.

———1997c, Election over land reform?: *Mining Journal*, v. 329, no. 8459, December 12, p. 481.

———1997d, ...government support for SASE: *Mining Journal*, v. 329, no. 8459, December 12, p. 483.

———1997e, Legislative change to help Kembla: *Mining Journal*, v. 328, no. 8432, June 6, p. 445.

———1997f, Market news: *Mining Journal*, v. 329, no. 8445, September 5, p. 203.

———1997g, Mt. Lyell study: *Mining Journal*, v. 329, no. 8441, August 8, p. 119.

———1997h, Oaky Creek expansion: *Mining Journal*, v. 329, no. 8458, December 5, p. 461-462.

———1997i, Olympic Dam extension: *Mining Journal*, v. 329, no. 8459, December 12, p. 487.

———1997j, Production—Alcoa's bauxite compensation: *Mining Journal*, v. 328, no. 8435, June 27, p. 509.

———1997k, Production—Australian copper boost: *Mining Journal*, v. 329, no. 8453, October 31, p. 365.

———1997l, Production—BHP expansion: *Mining Journal*, v. 328, no. 8435, June 27, p. 509.

———1997m, Queensland magnesium venture: *Mining Journal*, v. 328, no. 8412, January 17, p. 34.

———1997n, Queensland mines commissioned: *Mining Journal*, v. 329, no. 8452, October 24, p. 337.

———1997o, Record Australia gold output: *Mining Journal*, v. 328, no. 8417, February 21, p. 150.

———1997p, Western Australia's gold miners struggle: *Mining Journal*, v. 329, no. 8455, November 14, p. 402.

———1997q, Western Australia softens gold royalty: *Mining Journal*, v. 329, no. 8440, August 1, p. 82.

———1998a, Alumina and bauxite: *Supplement to Mining Journal*, v. 330, no. 8483, June 5, p. 11.

———1998b, Australia: *Supplement to Mining Journal*, v. 330, no. 8481, May 22, p. 4.

———1998c, Australian coal verdict: *Mining Journal*, v. 330, no. 8476, April 17, p. 297-298.

———1998d, Iron ore Australia's Asian hopes: *Mining Journal*, v. 330, no. 8477, April 24, p. 322.

Pasminco Ltd., 1997, Pasminco welcomes issuing of Century leases: Pasminco Ltd. press release, September 19, 1 p.

Petroleum Gazette, 1998, The quarter at a glance—Native title deal: *Petroleum Gazette*, v. 33, no. 1, first quarter, p. 42.

Resource Information Unit, 1998, Register of Australian Mining 1998-99: Resource Information Unit, 652 p.

Stewart, N., 1998, Asia and Australia—Annual review supplement: *Supplement to Mining Journal*, v. 331, no. 8489, July 17, p. 5-15.

UIC Newsletter, 1997a, Australia announces greenhouse measures: Uranium Information Center Newsletter, no. 6, November-December, p. 5.

———1997b, Foreign investment policy change for uranium: Uranium Information Center Newsletter, no. 1, January-February, p. 4.

U.S. Embassy, Canberra, Australia, 1997a, Mining—Jabiluka uranium mine to go ahead: U.S. State Department Telegram 002953, October 20, p. 3.

———1998b, Prospects good for iron ore exports despite Asian troubles: U.S. State Department Telegram 000829, March 4, p. 3.

———1997c, Truce in coal strikes—National strike looms: U.S. State Department Telegram 002429, September 1, p. 1.

van Os, J., 1997, Australia's new copper mine: *Metal Bulletin Monthly*, no. 320, August, p. 31-33.

———1998, Australia still glitters—For now: *Metal Bulletin Monthly*, no. 330, June, p. 61.

## Major Sources of Information

### *Commonwealth Departments and Enterprises*

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**Major Publications**

Australian Bureau of Agricultural and Resource Economics,  
Canberra: Quarterly Mineral Statistics, quarterly.

Australian Bureau of Statistics, Belconnen: Mineral Production,  
Australia, fiscal year.

Australian Bureau of Statistics, Belconnen: Production Statistics,  
Preliminary, monthly.

TABLE 1  
AUSTRALIA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity	1993	1994	1995	1996	1997 e/	
<b>METALS</b>						
<b>Aluminum:</b>						
Bauxite, gross weight	thousand tons	41,320	41,733	42,655	43,063 r/	44,465 2/
Alumina	do.	12,598	12,892	13,147	13,348 r/	13,385 2/
<b>Metal, refined:</b>						
Primary	do.	1,381	1,317	1,297 r/	1,372 r/	1,495 2/
Secondary		34,800	55,000	55,000	95,000 r/	100,000 2/
Antimony, Sb content of ores and concentrates		2,300 r/	1,300 r/	900	1,800 r/	1,900 2/
<b>Cadmium:</b>						
Mine output, Cd content		2,375	2,275	1,900 e/	1,900	1,900
Metal, smelter (refined)		951	910	838 r/	639 r/	632 2/
<b>Cobalt: e/</b>						
Mine output, Co content		1,300 r/	1,200 r/	1,300 r/	1,400 r/	1,600
Recovered cobalt, including that from imported source material		1,900 r/	2,300 r/	2,500 r/	2,800 r/	3,000
Columbium-tantalum concentrate, gross weight		495	700	900	920	1,010 2/
<b>Copper:</b>						
Mine output, Cu content	thousand tons	402	415	420	525	560 2/
<b>Metal:</b>						
<b>Smelter:</b>						
Primary	do.	323	315	215	289	208 2/
Secondary e/		10,000	9,600	1,200	1,200	1,000
<b>Refined:</b>						
Primary	thousand tons	285	312	242	314	271 2/
Secondary e/	do.	24	24	18	24	24
<b>Gold:</b>						
Mine output, Au content	kilograms	247,196	256,188	253,504	289,530 r/	311,740 2/
<b>Metal:</b>						
<b>Refined:</b>						
Primary	do.	283,726	302,612	289,004	329,000	303,410 2/
Secondary	do.	8,345	8,500 e/	8,747	3,620	780 2/
<b>Iron and steel:</b>						
<b>Iron ore:</b>						
Gross weight	thousand tons	120,534	128,493	142,936	147,100	157,766 2/
Fe content	do.	74,767	80,900 e/	88,653	93,000	97,901 2/
<b>Metal:</b>						
Pig iron	do.	7,414	7,466	7,476	7,774 r/	7,884 2/
<b>Ferrous alloys: e/</b>						
Ferromanganese		75,000	100,000	110,000	110,000	95,000
Silicomanganese		75,000	100,000	100,000	95,000	95,000
Total		150,000	200,000	210,000	205,000	190,000
Steel, crude	thousand tons	7,853	8,424	8,447	8,415	8,769 2/
Semimanufactures e/		1,788 2/	4,000	4,000	4,000	5,000
<b>Lead:</b>						
Mine output, Pb content	thousand tons	519	537	455	522	531 2/
<b>Metal:</b>						
<b>Primary:</b>						
Bullion, for export	do.	224	197	164	191	178 2/
Refined	do.	221	212	215	204	204 2/
Total	do.	445	409	379	395	382 2/
Secondary excluding remelt	do.	22	21	20	20	20
<b>Manganese ore (metallurgical):</b>						
Gross weight	do.	2,092	1,924	2,176	2,109	2,136 2/
Mn content	do.	1,043	944	1,066	1,023	1,024 2/
<b>Nickel:</b>						
Mine output, Ni content	do.	65	79	98	113	124 2/
Metal, smelter (refined Ni and Ni content of oxide)	do.	55	67	77	74	74 2/
<b>Platinum-group metals: e/</b>						
Palladium, Pd content	kilograms	400	400	400	400	400
Platinum, Pt content	do.	100	100	100	100	100
Total	do.	500	500	500	500	500

See footnotes at end of table.

TABLE 1--Continued  
 AUSTRALIA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity	1993	1994	1995	1996	1997 e/
METALS--Continued					
Rare-earth metals, monazite concentrate: e/					
Gross weight	3,000	--	200	--	--
Monazite content	1,650	--	110	--	--
Silver:					
Mine output, Ag content	1,092	1,045	939	1,013 r/	1,106 2/
Metal, refined	345	362	346	356	280 2/
Tin:					
Mine output, Sn content 3/	8,057	7,495 r/	8,656	8,828	10,168 2/
Metal, refined:					
Primary	222	315	570	460	605
Secondary e/	250	260	300	300	300
Titanium concentrates, gross weight:					
Ilmenite thousand tons	1,804	1,782	1,980	2,028	2,233 2/
Leucoxene	21,000	35,000	31,000	33,000 r/	32,000 2/
Rutile	186,000	233,000	195,000	180,000	235,000 2/
Tungsten, mine output, W content	23	11 e/	--	--	--
Zinc:					
Mine output, Zn content thousand tons	1,010	995	937	1,071	1,035 2/
Metal, smelter:					
Primary do.	316	323	320	326	307 2/
Secondary e/	4,500	4,975 2/	4,500	4,500	10,000
Zirconium concentrates, gross weight thousand tons	414	511 r/	518 r/	502 r/	424 2/
INDUSTRIAL MINERALS					
Abrasives, natural: e/					
Beach pebble	2,000	2,000	2,000	2,000	2,000
Garnet	25,000	25,000	25,000	25,000	25,000
Barite e/	11,000	11,000	11,729 r/ 2/	12,000 r/	15,000
Cement, hydraulic e/ thousand tons	5,500	6,500	6,500	6,500	6,500
Clays: e/					
Bentonite and bentonitic clay	35,000	35,000	35,000	35,000	35,000
Brick clay and shale thousand tons	8,000	8,000	8,000	8,000	8,000
Cement clay and shale do.	500	500	500	500	500
Damourite clay	100	100	100	100	100
Fire clay	25,000	25,000	25,000	25,000	25,000
Fuller's earth (attapulgit)	15,000	15,000	15,000	15,000	15,000
Kaolin and ball clay	180,000	200,000	210,000	210,000	220,000
Other thousand tons	1,000	1,000	1,000	1,000	1,000
Diamond:					
Gem thousand carats	18,844	19,485	18,312	18,897	18,079
Industrial do.	23,032	23,815	22,381	23,096	22,096
Total do.	41,876	43,300	40,693	41,993	40,175 2/
Diatomite e/	11,000	11,000	11,000	11,000	11,000
Feldspar including nepheline syenite e/	15,000	16,000	16,000	17,000	20,000
Gemstones, other than diamond: e/					
Opal value, thousands	\$90,000	\$100,000	\$100,000	\$100,000	\$110,000
Sapphire do.	\$40,000	\$50,000	\$50,000	\$50,000	\$60,000
Other do.	\$1,000	\$1,500	\$1,500	\$1,500	\$12,000
Total do.	\$131,000	\$151,500	\$151,500	\$151,500	\$182,000
Gypsum e/ thousand tons	2,000	2,000	2,000	2,000	2,000
Kyanite e/	800	800	800	800	800
Lime e/	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000
Magnesite	260,600 e/	285,610	263,249	237,707 r/	245,127 2/
Nitrogen, N content of ammonia	398,000	412,600	432,900	446,400 r/	450,000
Perlite, crude e/	5,000	5,000	5,000	5,000	5,000
Phosphate rock e/	1,700	1,500	5,000	17,000	15,000
Salt thousand tons	7,737	7,685	8,148	7,905	8,749 2/
Sillimanite e/ 4/	100	100	100	100	100
Spodumene, concentrate	52,900 e/	45,987	81,841	117,094	88,399 2/

See footnotes at end of table.

TABLE 1--Continued  
 AUSTRALIA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity	1993	1994	1995	1996	1997 e/
<b>INDUSTRIAL MINERALS--Continued</b>					
Stone, sand and gravel: e/					
Construction sand thousand tons	30,000	30,000	30,000	30,000	30,000
Gravel do.	15,000	15,000	15,000	15,000	15,000
Dolomite do.	10,000	10,000	10,000	10,000	10,000
Limestone:					
For cement do.	6,000	6,000	6,000	6,000	6,000
For other uses do.	6,000	6,000	6,000	6,000	6,000
Silica in the form of quartz, quartzite, glass sand do.	2,000	2,500	2,500	2,500	2,500
Other:					
Crushed and broken stone do.	65,000	65,000	65,000	65,000	65,000
Dimension stone do.	100	100	100	100	100
Unspecified do.	30,000	30,000	30,000	30,000	30,000
Sulfur, byproduct:					
Metallurgy do.	299	275	263	327	350
Petroleum do.	85	115	27	27	30
Total do.	384	390	290	354	380
Talc, chlorite, pyrophyllite, steatite e/	215,000	215,000	215,000	215,000	215,000
<b>MINERAL FUELS AND RELATED MATERIALS</b>					
Coal:					
Bituminous and subbituminous thousand tons	226,330	227,772	193,500	199,800	216,490 2/
Lignite do.	48,458	48,582	50,700	53,600	60,100
Total do.	274,788	276,354	244,200	253,400	276,590
Coke, metallurgical e/ do.	300	300	322	325	325
Fuel briquets e/ do.	750	750	750	750	750
Gas, natural, marketed million cubic meters	24,519	28,146	29,798	29,802	29,950 2/
Natural gas liquids thousand 42-gallon barrels	23,050	23,342	56,614	63,062	48,924 2/
Peat e/ do.	11,000	15,000	15,000	15,000	20,000
Petroleum:					
Crude thousand 42-gallon barrels	181,387	196,539	204,765 r/	219,000 r/	209,784 2/
Refinery products:					
Gasoline:					
Aviation do.	1,011	955	944	981	899 2/
Motor do.	112,408	112,877	113,115	114,550	116,210 2/
Jet fuel do.	27,225	27,008	29,502	31,679	34,082 2/
Kerosene do.	282	514	169	338	540 2/
Distillate fuel oil do.	71,263	72,155	74,291	78,983	84,849 2/
Residual fuel oil do.	14,890	14,022	15,594	10,574	11,421 2/
Lubricants do.	4,261	4,903	4,881	4,806	5,327 2/
Liquefied petroleum gas do.	6,287	7,162	8,083	9,687	10,333 2/
Bitumen do.	4,252	4,129	3,818	3,938	4,346 2/
Unspecified do.	6,125	5,976	7,146	6,441	6,830 2/
Refinery fuel and losses do.	8,946	6,242	13,713	13,638	8,863 2/
Total do.	256,950	255,943	271,256	275,615	283,700 2/
Uranium, mine output, U content	2,256	2,208	3,712	4,945	5,489 2/

e/ Estimated. r/ Revised.

1/ Includes data available through August 5, 1998.

2/ Reported figure.

3/ Excludes tin content of copper-tin and tin-tungsten concentrates.

4/ In addition, about 7,000 metric tons per year of sillimanite clay, also known as kaolinized sillimanite, containing 40% to 48% aluminum oxide, is produced.

TABLE 2  
AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 1997

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities 1/	Annual capacity e/
Alumina	Queensland Alumina Ltd., operator. [Comalco Ltd., 30.3%; Kaiser Aluminum and Chemical Corp. (Australia) Ltd., 28.3%; Alcan Australia Ltd., 21.4%; and Pechiney Australia Pty. Ltd., 20%]	Gladstone Refinery, QLD	3,000
Do.	Nabalco Pty. Ltd., operator. (Swiss Aluminium Australia Ltd., 70%; and Gove Aluminium Ltd., 30%)	Gove Refinery, NT	1,600
Do.	Alcoa of Australia Ltd., 100%	Kwinana Refinery, WA	1,900
Do.	do.	Pinjarra Refinery, WA	3,000
Do.	do.	Wagerup Refinery, WA	1,700
Do.	Worsley Alumina Pty. Ltd., operator. [Reynolds Australia Alumina Ltd., 56%; Billiton Australia Pty. Ltd., 30%; Kobe Alumina Associates (Australia) Pty. Ltd., 10%; and Nissho Iwai Alumina, 4.0%]	Worsley Refinery, WA	1,600
Aluminum	Comalco Aluminium (Bell Bay) Ltd., 100%	Bell Bay Smelter, TAS	120
Do.	Boyne Island Smelters Ltd., operator. (Comalco Ltd., 59.25%; Marubeni Corp., Sumitomo Corp., and Light Metal Industries, 17% collectively; Mitsubishi Corp. and Mitsubishi Materials Corp., 14.25% jointly; and Yoshida Kogyo KK, 9.5%)	Boyne Island Smelter, QLD	230
Do.	Capral Aluminium Ltd., 100%	Kurri Kurri Smelter, NSW	150
Do.	Alcoa of Australia Ltd., 100%	Point Henry Smelter, VIC	182
Do.	Alcoa of Australia Ltd., 45% and manager; ALUVIC (State of VIC agency), 25%; First National Resources Trust, 10%; China International Trust Investment Co., 10%; and Marubeni, 10%	Portland Island Smelter, VIC	327
Do.	Tomago Aluminium Co. Pty. Ltd., operator. (Gove Aluminium Finance Ltd., 35%; Pechiney Australia Pty. Ltd., 35%; Australian Mutual Provident Society, 15%; VAW Australia Pty. Ltd., 12%; and Hunter Douglas Ltd., 3%)	Tomago Smelter, NSW	380
Antimony	Hillgrove Gold Ltd., 100%	Hillgrove open-cut/underground mine, NSW	4
Bauxite	Nabalco Pty. Ltd., manager. (Swiss Aluminium Australia Ltd., 70%; and Gove Aluminium Ltd., 30%)	Gove surface mine, NT	7,000
Do.	Alcoa of Australia Ltd., 100%	Huntly, Jarrahdale, and Williwdale surface mines, WA	24,000 2/
Do.	Worsley Alumina Pty. Ltd., manager. [Reynolds Australia Alumina Ltd., 56%; Billiton Australia Pty. Ltd., 30%; Kobe Alumina Associates (Australia) Pty. Ltd., 10%; and Nissho Iwai Australia Ltd., 4.0%]	Mount Saddleback and Worsley surface mines, WA	5,000
Do.	Comalco Aluminium Ltd., 100%	Weipa surface mine, QLD	11,000
Cement	Blue Circle Southern Cement Ltd., 100%	Berrima Plant, NSW	1,200
Do.	Adelaide Brighton Cement Ltd., 100%	Birkenhead Plant, SA	1,000
Do.	Queensland Cement Ltd., 100%	Darra Plant, QLD	700
Do.	Adelaide Brighton Cement Ltd., 100%	Geelong Plant, VIC	800
Do.	Goliath Cement Holdings Ltd., 100%	Railton Plant, TAS	1,000
Do.	Cockburn Cement Ltd., 100%	South Coogee Plant, WA	1,000
Coal, black	Powercoal Pty. Ltd., 100%	Angus Place underground mine, NSW	2,000
Do.	BHP Steel (AIS) Pty. Ltd., 100%	Appin underground mine, NSW	2,400
Do.	Coalex Pty. Ltd., 95% and manager; and Sumisho Coal Development Pty. Ltd., 5%	Baal Bone underground mine, NSW	3,500
Do.	Coal Operations Australia Ltd., 78.3% and manager; Nippon Oil (Australia) Pty. Ltd., 8.7%; Nippon Steel Australia Pty. Ltd., 8%; and KEPSCO Resources Australia Pty. Ltd., 5%	Baywater No. 2 open cut, NSW	4,000
Do.	do.	Baywater No. 3 open cut, NSW	4,000
Do.	Central Queensland Coal Associates, 100%. (BHP Coal Pty. Ltd., 52.1%; QCT Resources Ltd., 32.37%; and Mitsubishi Development Pty. Ltd., 15.53%)	Blackwater open cut, QLD	5,000
Do.	Queensland Coal Pty. Ltd., 57.195% and manager; ARCO Coal Australia Inc., 17.527%; ARCO Resources Ltd., 13.89%; EPDC (Australia) Pty. Ltd., 7.972%; and Japan Coal Development Co. Ltd., 3.416%	Blair Athol open cut, QLD	8,500

See footnotes at end of table.

TABLE 2--Continued  
 AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 1997

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities 1/	Annual capacity e/
Coal, black--Continued:	Bloomfield Collieries Pty. Ltd., 100%	Bloomfield open cut, NSW	2,000
Do.	Shell Coal (Callide) Pty. Ltd., 66.7% and manager; and AMP Society Ltd., 33.3%	Boundary Hill open cut, QLD	3,500
Do.	do.	Callide open cut, QLD	3,500
Do.	Thiess Contractors Pty. Ltd, 5% and operator, and Portman Mining Ltd., 95%	Burton open-cut, QLD	4,000
Do.	Camberwell Coal Pty. Ltd., manager. [Navidale Pty. Ltd., 50%; Toyota Tsusho Mining (Australia), 40%; and Dia Coal Mining (Australia) Pty. Ltd., 10%]	Camberwell open cut, NSW	4,000
Do.	Coalex Pty. Ltd., 80% and manager; Japan Energy (Australia) (Pty. Ltd., 10%; and Yukong Ltd. (Republic of Korea), 10%	Clarence underground mine, NSW	2,500
Do.	Collinsville Coal Co. Pty. Ltd., 75% and manager; and Itochu Coal Resources of Australia Pty. Ltd., 25%	Collinsville open-cut/underground mine, QLD	2,000
Do.	Powercoal Pty. Ltd., 100%	Cooranbong underground mine, NSW	1,600
Do.	BHP Steel (AIS) Pty. Ltd., 100%	Cordeaux underground mine, NSW	2,800
Do.	Cumnock No. 1 Colliery Pty. Ltd., 100%	Cumnock No. 1 underground mine, NSW	2,500
Do.	ARCO Coal Australia Inc., 87% and manager; and Mitsui Coal Development Australia Pty. Ltd., 13%	Curragh open cut, QLD	6,600
Do.	Shell Coal (Drayton) Pty. Ltd., 74.8% and manager; AMP Society Ltd., 13.4%; Mitsui Coal Development Australia Pty. Ltd., 3.8%; Mitsui Mining (Australia) Pty. Ltd., 3%; Daesung (Australia) Pty. Ltd., 2.5%; and Hyundai (Australia) Pty. Ltd., 2.5%	Drayton open cut, NSW	4,000
Do.	Ebenezer Mining Co., 100%	Ebenezer open cut, QLD	3,000
Do.	BHP Steel (AIS) Pty. Ltd., 100%	Elouera underground mine, NSW	2,500
Do.	Capricorn Coal Management Pty. Ltd., 100%. [Shell Coal Holdings (Australia) Ltd., 46.75%; Tigor Ltd., 26.06; British British Coal Corp., 14.81%; and Ruhrkohle Australia Pty. Ltd., 12.38%]	German Creek open-cut/underground mine, QLD	3,500
Do.	Capricorn Coal Management Pty. Ltd., 100%. [Shell Coal (German Creek) Pty. Ltd., 59.47%; Tigor Energy Pty. Ltd., 31.14%; and Marubeni Australia Pty. Ltd., 9.39%]	German Creek East open-cut/underground mine, QLD	3,500
Do.	Central Queensland Coal Associates, 100%. (BHP Coal Pty. Ltd., 52.1%; QCT Resources Ltd., 32.37%; and Mitsubishi Development Pty. Ltd., 15.53%	Goonyella open cut, QLD	9,250
Do.	Gordonstone Coal Management Pty. Ltd., 100%. (ARCO Coal Australia Inc., 50%; ARCO Resources Ltd., 30%; Mitsui Gordonstone Investment Pty. Ltd., 15%; and MCL Coal Investment Pty. Ltd., 5%	Gordonstone underground mine, QLD	4,600
Do.	BHP Minerals Ltd., 64.14% and manager; QCT Resources Ltd., 32.37%; and Mitsubishi Development Pty. Ltd., 3.49%	Gregory open cut, QLD	3,500
Do.	Newcastle Wallsend Coal Co. Pty. Ltd., 100%	Gretley underground mine, NSW	1,500
Do.	Novacoal Australia Pty. Ltd., 60% and manager and Mitsubishi Coal Development Pty. Ltd., 40%	Howick open cut, NSW	5,000
Do.	Coal and Allied Industries Ltd., 100%	Hunter Valley No. 1 open cut, NSW	6,300
Do.	Optima Energy, 100%	Leigh Creek open cut, SA	3,000
Do.	Exxon Coal and Minerals Australia Ltd., 100%	Lemington open cut, NSW	4,000
Do.	Liddell Coal Operations Pty. Ltd., manager. (Savage Resources Ltd., 67.5%; and Mitsui Matsushima Australia Pty. Ltd., 32.5%)	Liddell open cut, NSW	4,000
Do.	Rio Tinto Coal (NSW) Pty. Ltd., manager. Coal and Allied Industries Ltd., 80%, and Pohang Steel Australia Pty. Ltd., 20%	Mount Thorley open cut, NSW	6,500
Do.	BHP Coal Pty. Ltd., 80%, and BHP Mitsui Coal Pty. Ltd., 20%	Moura open cut, QLD	5,000
Do.	Muswellbrook Coal Co. Ltd., 100%	Muswellbrook No. 2 open-cut/underground mine, NSW	1,850
Do.	The Griffin Coal Mining Co. Pty. Ltd., 100%	Muja open cut, WA	2,500
Do.	Powercoal Pty. Ltd., 100%	Myuna underground mine, NSW	1,500
Do.	Newlands Coal Pty. Ltd., 75% and manager; and Itochu Resources of Australia Pty. Ltd., 25%	Newlands open-cut/underground mine, QLD	5,000

See footnotes at end of table.

TABLE 2--Continued  
 AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 1997

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities 1/	Annual capacity e/
Coal, black--Continued:	Muswellbrook Coal Co. Ltd., 100%	Muswellbrook No. 2 open-cut/underground mine, NSW	1,850
Do.	The Griffin Coal Mining Co. Pty. Ltd., 100%	Muja open cut, WA	2,500
Do.	Powercoal Pty. Ltd., 100%	Myuna underground mine, NSW	1,500
Do.	Newlands Coal Pty. Ltd., 75% and manager; and Itochu Resources of Australia Pty. Ltd., 25%	Newlands open-cut/underground mine, QLD	5,000
Do.	Powercoal Pty. Ltd., 100%	Newstan underground mine, NSW	2,500
Do.	White Mining Ltd., 51% and manager; and Sumisho Coal Development Pty. Ltd., 49%	North Goonyella underground mine, QLD	3,000
Do.	Central Queensland Coal Associates, 100%. (BHP Coal Pty. Ltd., 52.1%; QCT Resources Ltd., 32.37%; and Mitsubishi Development Pty. Ltd., 15.53%)	Norwich Park open cut, QLD	4,500
Do.	Oaky Creek Coal Pty. Ltd., 75%, operator and manager, Sumitomo Coal Australia Pty. Ltd., 15%, and Itochi Coal Resources of Australia Pty. Ltd., 10%	Oaky Creek open-cut/underground mine, QLD	3,500
Do.	Central Queensland Coal Associates, 100%. (BHP Coal Pty. Ltd., 52.1%; QCT Resources Ltd., 32.37%; and Mitsubishi Development Pty. Ltd., 15.53%)	Peak Downs open cut, QLD	7,000
Do.	Wesfarmers Coal Ltd., 100%	Premier open cut, WA	3,000
Do.	Peabody Resources Ltd., 100% at Ravensworth and 50% at Narama. RGC Ltd., 50% at Narama	Ravensworth-Narama open cut, NSW	6,200
Do.	BHP Coal Pty. Ltd., 80%, and BHP Mitsui Coal Pty. Ltd., 20%	Riverside open cut, QLD	6,000
Do.	Central Queensland Coal Associates, 100%. (BHP Coal Pty. Ltd., 52.1%; QCT Resources Ltd., 32.37%; and Mitsubishi Development Pty. Ltd., 15.53%)	Saraji open cut, QLD	5,000
Do.	Bulga Coal Management Pty. Ltd., 90% and manager; and Nippon Steel Australia Pty. Ltd., 10%	Saxonville-Bulga open-cut/underground mine, NSW	9,000
Do.	Cyprus Springvale Ltd., 50% and manager; and Samsung Development (Australia) Pty. Ltd., 50%	Springvale underground mine, NSW	2,000
Do.	Austral Coal Ltd., 100%	Tahmoor underground mine, NSW	4,100
Do.	Oceanic Coal Australia Ltd., 80% and manager; Marubeni Coal Pty. Ltd., 14%; Chelsea Coal Pty. Ltd., 3%; and Kokan Kogyo (Australia) Pty. Ltd., 3%	Teralba underground mine, NSW	1,700
Do.	BHP Steel (AIS) Pty. Ltd., 100%	Tower underground mine, NSW	1,600
Do.	Ulan Coal Mines Ltd., manager. (Mitsubishi Development Pty. Ltd., 49%; Exxon Coal Australia Ltd., 36%; and Axiom Funds Management Ltd., 15%)	Ulan open cut-underground mine, NSW	5,500
Do.	Wambo Mining Corp. Pty. Ltd., 100%	Wambo open-cut/underground mine, NSW	4,000
Do.	Peabody Resources Ltd., 28.75% and manager. (Mitsubishi Coal Development Pty. Ltd., 22.75%; Tigor Energy Pty. Ltd., 20%; Peabody Australia Pty. Ltd., 15%; Nippon Steel Australia Pty. Ltd., 7.5%; and Mitsubishi Materials (Australia) Pty. Ltd., 6%)	Warkworth open cut, NSW	5,000
Do.	BHP Steel (AIS) Pty. Ltd., 100%	West Cliff underground mine, NSW	3,000
Do.	Oceanic Coal Australia Ltd., 80% and manager; Marubeni Coal Pty. Ltd., 14%; Chelsea Coal Pty. Ltd., 3%; and Kokan Kogyo (Australia) Pty. Ltd., 3%	West Wallsend underground mine, NSW	2,400
Do.	Powercoal Pty. Ltd., 100%	Wyee underground mine, NSW	1,800
Coal, brown	Hazelwood Power Corp., 100%	Hazelwood open cut, VIC	13,000
Do.	Loy Yang Power Ltd., 100%	Loy Yang open cut, VIC	27,000
Do.	Yallourn Energy Pty. Ltd., manager. (Powergen International, 49.9%; AMP Society Ltd., 26%; Itochu Australia Ltd., 10.4%; Axiom Funds Management Ltd., 8%; and Hastings Fund Management, 5.7%)	Yallourn open cut, VIC	18,000
Cobalt	QNI Ltd., 100%	Yabulu Refinery, QLD	1
Copper	Worsley Alumina Pty. Ltd., manager. (Normandy Gold Ltd., 44.45%; Acacia Resources Ltd., 33.33%; and Newcrest Mining Ltd., 22.22%)	Boddington open-cut/underground mine, WA	10

See footnotes at end of table.

TABLE 2--Continued  
 AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 1997

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities 1/	Annual capacity e/	
Copper--Continued:	Ernest Henry Mining Pty. Ltd., operator and manager. (MIM Holdings Ltd., 51%, and Savage Resources Ltd., 49%)	Ernest Henry open-cut, Queensland	95	
Do.	Girilambone Copper Co. Pty. Ltd., manager. Straits Resources Ltd., 60%; and Nord Pacific Ltd., 40%	Girilambone open cut, NSW	15	
Do.	Murchison Zinc Co. Pty. Ltd., 100%	Golden Grove (includes Gossan Hill and Scuddles) underground mine	50	
Do.	Aberfoyle Ltd., 100%	Gunpowder-Mammoth open cut mine, QLD	45	
Do.	do.	Hellyer underground mine, TAS	4	
Do.	MIM Holdings Ltd., 100%	Hilton underground mine, QLD	180	
Do.	Murchison United NL, 60% and manager; and Brancote Australia NL, 40%	Mount Cuthbert open cut mine, QLD	8	
Do.	MIM Holdings Ltd., 100%	Mount Isa underground mine, QLD	150	
Do.	do.	Mount Isa Smelter, QLD	175	
Do.	Copper Mines of Tasmania Pty. Ltd., 100%	Mount Lyell underground mine, TAS	20	
Do.	WMC Ltd., 100%	Nifty open cut, WA	10	
Do.	North Ltd., 80% and operator; Sumitomo Metal Mining Oceania Pty. Ltd., 13.3%; and SC Mineral Resources Pty. Ltd., 6.7%	Northparkes open-cut/underground mine, NSW	40	
Do.	Olympic Dam Operations Pty. Ltd., manager. (WMC Ltd., 100%)	Olympic Dam underground mine, SA	85	
Do.	do.	Olympic Dam Refinery, SA	50	
Do.	do.	Olympic Dam Smelter, SA	70	
Do.	Placer Pacific Ltd., 100%	Osborne underground mine, QLD	50	
Do.	Peak Gold Mines Pty. Ltd., 100%	Peak underground mine, NSW	3	
Do.	Furukawa Co. Ltd., 52.5%; Nittetsu Mining Co., 20%; Nissho Iwai Corp., 17.5%; Itochu Corp., 10%	Port Kembla Refinery, NSW	80	
Do.	do.	Port Kembla Smelter, NSW	80	
Do.	Pasminco Ltd., 100%	Rosebery underground mine, TAS	4	
Do.	Australian Resources Ltd., 100%	Selwyn open-cut/underground mine, QLD	16	
Do.	Normandy Gold Ltd., 100%	Tennant Creek open-cut/underground mines, NT	17	
Do.	RGC Ltd., 100%	Thalanga underground mine, QLD	28	
Do.	Copper Refineries Pty. Ltd., operator. (MIM Ltd., 100%)	Townsville Refinery, QLD	175	
Do.	Denehurst Ltd., 100%	Woodlawn underground mine, NSW	8	
Diamond	Argyle Diamond Mines Pty. Ltd., manager. (RTZ Corp. PLC.-CRA Ltd. Group, 59.9%; and Ashton Mining Ltd., 40.1%)	Argyle Mine (AK-1 lamproite pipe and alluvial deposits), WA	42,000	
Gas, condensate	Woodside Petroleum Pty. Ltd., manager. [BHP Petroleum Pty. Ltd.; BP Australia Holdings Ltd.; Chevron Asiatic Ltd.; Japan Australia LNG (MIMI) Pty. Ltd.; Shell Development (Australia) (Australia) Pty. Ltd.; and Woodside Petroleum Ltd., 16.67% each]	North West Shelf operations, 130 kilometers offshore from Dampier, WA	60	
Gas, natural	do.	North West Shelf operations, 130 kilometers offshore from Dampier, WA	20	
million cubic meters per day				
Gold	WMC Ltd., 100%	Agnew open cut-underground mine, WA	4,000	
Do.	do.	Normandy Mining Ltd., 70% and manager; Saint Barbara Mines Ltd., 30%)	Big Bell Consolidated (includes former Golden Crown) open-cut/underground mine, WA	7,000
Do.	do.	Saint Barbara Mines Ltd., 100%	Bluebird open cut, WA	4,000
Do.	do.	Worsley Alumina Pty. Ltd., manager. (Normandy Gold Ltd., 44.45%; Acacia Resources Ltd., 33.33%; and Newcrest Mining Ltd., 22.22%)	Boddington open-cut/underground mine, WA	12,000
Do.	do.	Great Central Mines Ltd., 100%	Bronzewing open-cut/underground mine, WA	6,200
Do.	do.	Herald Resources Ltd., 100%	Coolgardie open-cut/underground operations, WA	4,000
Do.	Ernest Henry Mining Pty. Ltd., operator and manager. (MIM Holdings Ltd., 51%, and Savage Resources Ltd., 49%)	Ernest Henry open cut, Queensland	4,000	
Do.	do.	Normandy NFM Ltd., 100%	Granites-Dead Bullock Soak open-cut/underground mines, NT	7,000

See footnotes at end of table.

TABLE 2--Continued  
 AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 1997

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities 1/	Annual capacity e/
Gold--Continued:		Placer (Granny Smith) Pty. Ltd., manager. (Placer Pacific Ltd., 60%; and Delta Gold NL, 40%)	Granny Smith open cut, WA	4,800
	kilograms			
Do.	do.	Alcoa of Australia Ltd., 100%	Hedges open cut, WA	4,900
Do.	do.	Goldfields Ltd., 100%	Henty underground mine, TAS	2,800
Do.	do.	Hill 50 Gold NL, 100%	Hill 50 open-cut/underground mine, WA	4,000
Do.	do.	Great Central Mines Ltd., 100%	Jundee open cut, WA	6,600
Do.	do.	Australian Gold Refineries, 100% (State of WA agency)	Kalgoorlie Refinery, WA	46,000
Do.	do.	North Ltd., manager, 50%; and Delta Gold NL, 50%	Kanowna Belle open-cut/underground mine, WA	5,300
Do.	do.	Kidston Gold Mines Ltd., 100%	Kidston open cut, QLD	6,500
Do.	do.	Sons of Gwalia Ltd., 100%	Marvel Loch-Southern Cross open-cut/underground mines, WA	3,000
Do.	do.	Kalgoorlie Consolidated Gold Mines Pty. Ltd., manager. (Homestake Gold of Australia Ltd., 50%; and Gold Mines of Kalgoorlie Ltd., 50%)	Mount Charlotte underground mine, WA	4,300
Do.	do.	Normandy Mount Leyshon Ltd., 100%	Mount Leyshon open cut, QLD	7,500
Do.	do.	Australian Resources Ltd., 100%	Mount McClure open-cut/underground mine, WA	3,100
Do.	do.	Eagle Mining Corp. NL, 100%	Nimary open cut, WA	3,600
Do.	do.	Central Norseman Gold Corp. Ltd., 100%	Norseman open-cut/underground mine, WA	3,700
Do.	do.	North Ltd., 80% and operator; Sumitomo Metal Mining Oceania Pty. Ltd., 13.3%; and SC Mineral Resources Pty. Ltd., 6.7%	Northparkes open-cut/underground mine, NSW	2,500
Do.	do.	Olympic Dam Operations Pty. Ltd., manager. (WMC Ltd., 100%)	Olympic Dam underground mine, SA	1,500
Do.	do.	MIM Ltd., 100%	Pacific precious metals refinery, NSW	1,900
Do.	do.	Goldfields Kalgoorlie Ltd., 100% and manager	Paddington open cut, WA	4,100
Do.	do.	Peak Gold Mines Pty. Ltd., 100%	Peak underground mine, NSW	4,700
Do.	do.	Australian Gold Refineries, 100% (State of WA agency)	Perth Refinery (Newburn), WA	95,000
Do.	do.	Plutonic Resources Ltd., 100%	Plutonic open-cut/underground mine, WA	5,800
Do.	do.	Carpentaria Gold Pty. Ltd., 50.1% and manager; and Haoma Mining NL, 49.9%	Ravenswood open cut, QLD	
Do.	do.	WMC Ltd., 100%	Saint Ives open-cut/underground mine, WA	7,500
Do.	do.	Sons of Gwalia Ltd., 100%	Sons of Gwalia open cut, WA	4,000
Do.	do.	MPI Gold Pty. Ltd., 50% and Stawell Gold Mines Pty. Ltd., 50%	Stawell underground mine, VIC	2,700
Do.	do.	Kalgoorlie Consolidated Gold Mines Pty. Ltd., manager. (Homestake Gold of Australia Ltd., 50%; and Gold Mines of Kalgoorlie Ltd., 50%)	Super Pit (includes Fimiston) operation, WA	22,000
Do.	do.	Otter Gold Mines Ltd., 60% and manager; and Acacia Resources Ltd., 40%	Tanami open cut, NT	4,000
Do.	do.	Newcrest Mining Ltd., 100%	Telfer open-cut/underground mine, WA	12,000
Do.	do.	Normandy Gold Ltd., 100%	Tennant Creek open-cut/underground mines, NT	4,000
Do.	do.	Wiluna Mines Ltd., 100%	Wiluna open-cut/underground mine, WA	3,300
Do.	do.	Sons of Gwalia Ltd., 70% and manager; Coeur D'alene Mines Corp. 25%; and Gemini Mining Pty. Ltd., 5%	Yilgarn Star open-cut/underground mine, WA	3,400
Ilmenite		BHP Titanium Minerals Pty. Ltd., 100%	Beenup Dredge, WA	600
Do.		RGC Mineral Sands Ltd., 100%	Capel South Dredge, WA	450
Do.		Tiwest Joint Venture, operator. (KMCC Western Australia Pty. Ltd., 50%, and Ticor Resources Pty. Ltd., 50%)	Cooljarloo Dredge, WA	480
Do.		RGC Mineral Sands Ltd., 100%	Eneabba Dredge, WA	600
Do.		BHP Titanium Minerals Pty. Ltd., 100%	Hawks Nest (Fullerton, Viney Creek, and Stockton) Dredges, NSW	10
Do.		Cable Sands (WA) Pty. Ltd., 100%	Jangardup Dredge, WA	100
Do.		do.	Maidment Dredge, WA	50
Do.		Westralian Sands Ltd., 100%	North Capel, Yoganup Extended, and Yoganup North Dredges, WA	300

See footnotes at end of table.

TABLE 2--Continued  
 AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 1997

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities 1/	Annual capacity e/
Ilmenite--Continued	Consolidated Rutile Ltd., 100%	North Stradbroke Island (Amity, Bayside, and Gordon) Dredges, QLD	200
Iron ore	Hamersley Iron Pty. Ltd., 100%	Brockman No. 2 Detrital open cut, WA	4,500
Do.	Hamersley Iron Pty. Ltd., 60% and manager, and China Iron and Steel Industry and Trade Group Corp., 40%, a People's Republic of China Government Agency	Channar open cut, WA	8,000
Do.	BHP Iron Ore Pty. Ltd., 85% and manager; CI Minerals Australia Pty. Ltd., 8%; and Mitsui Iron Ore Corp. Pty. Ltd., 7%	Goldsworthy open cut (formerly Nimingarra, Shay Gap, and Sunrise Hill), WA	8,000
Do.	BHP Iron Ore Pty. Ltd., 100%	Jimblebar open cut, WA	3,000
Do.	Koolyanobbing Iron Pty. Ltd., manager. (Portman Resources NL, 60%, and Angang Australia Pty. Ltd., 40%)	Koolyanobbing open cut, WA	2,000
Do.	Hamersley Iron Pty. Ltd., 100%	Marandoo open cut, WA	12,000
Do.	BHP Iron Ore Pty. Ltd., 85% and manager; Mitsui Itochu Iron Pty. Ltd., 10%; and CI Minerals Australia Pty. Ltd., 5%	Mount Newman (includes Whaleback, Orebody 23-25, Orebody 29, and Yarrie) open cut, WA	35,000
Do.	Hamersley Iron Pty. Ltd., 100%	Mount Tom Price open cut, WA	28,000
Do.	Robe River Iron Associates, manager. (Robe River Mining Co. Pty. Ltd., 53%; Mitsui Iron Ore Development Pty. Ltd., 33%; Nippon Steel Australia Pty. Ltd., 10.5%; and Sumitomo Metal Australia Pty. Ltd., 3.5%)	Pannawonica-Deepdale (includes Mesa J) open cut, WA	32,000
Do.	Hamersley Iron Pty. Ltd., 100%	Paraburdoo open cut, WA	15,000
Do.	Goldamere Pty. Ltd., 100%	Savage River open cut, TAS	1,500
Do.	BHP Iron Ore Pty. Ltd., manager. (BHP Minerals Pty. Ltd., 55%; Pilbara Iron Pty. Ltd., 30%; CI Minerals Australia Pty. Ltd., 8%; and Mitsui Iron Ore Corp. Pty. Ltd., 7%)	Yandi open cut, WA	25,000
Lead	Pasminco Ltd., 100%	Broken Hill open-cut/underground (South) mine, NSW	200
Do.	Western Metals Ltd., 100%	Cadjebut underground mine, WA	105
Do.	BHP Minerals Ltd., 100%	Cannington underground mine, Queensland	205
Do.	Pasminco Ltd., 100%	Cockle Creek Smelter, NSW	30
Do.	Pasminco Ltd., 100%	Elura underground mine, NSW	85
Do.	Aberfoyle Ltd., 100%	Hellyer underground mine, TAS	50
Do.	McArthur River Mining Pty. Ltd., operator. (Mount Isa Mines Ltd., 70%; and ANT Minerals Pty. Ltd.)	McArthur River underground mine, NT	15
Do.	Mount Isa Mines Ltd., 100%	Mount Isa underground mine, QLD	190
Do.	do.	Mount Isa Smelter, QLD	240
Do.	Peak Gold Mines Pty. Ltd., 100%	Peak underground mine, NSW	4
Do.	Pasminco Ltd., 100%	Port Pirie Refinery-Smelter, SA	220
Do.	do.	Rosebery underground mine, TAS	15
Do.	RGC Ltd., 100%	Thalanga underground mine, QLD	25
Do.	Normandy Mining Ltd., 100%	Woodcutters underground mine, NT	10
Do.	Denehurst Ltd., 100%	Woodlawn underground mine, NSW	30
Leucosene	Tiwest Joint Venture, operator. (KMCC Western Australia Pty. Ltd., 50%, and Ticor Resources Pty. Ltd., 50%)	Cooljarloo Dredge, WA	10
Manganese	Groote Eylandt Mining Co. Pty. Ltd., 100%	Groote Eylandt open cut, NT	2,300
Manganese alloys	Tasmanian Electro Metallurgical Co. Pty. Ltd., 100%	Bell Bay Smelter, TAS	260
Nickel	Outokumpu Mining Australia Pty. Ltd., 100%	Forrestania underground mines (2), 375 kilometers southeast of Perth, WA	10
Do.	WMC Ltd., 100%	Kalgoorlie Smelter, WA	80
Do.	do.	Kambalda Nickel Operations, WA	35
Do.	do.	Kwinana Refinery, WA	42
Do.	do.	Leinster Nickel Operations, WA	30
Do.	do.	Mount Keith Mine, WA	37
Do.	QNI Ltd., 100%	Yabulu Refinery, QLD	30
Opal	Many small producers	Andamooka and Coober Pedy areas, SA; Lightning Ridge area, NSW	NA

See footnotes at end of table.

TABLE 2--Continued  
 AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 1997

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities 1/	Annual capacity e/
Petroleum thousand 42-gallon barrels per day		Petroleum Refineries (Australia) Pty. Ltd., manager. (Mobile Refining Australia Pty. Ltd., 100%)	Altona Refinery, VIC	108
Do.	do.	BP Refinery (Bulwer Island) Pty. Ltd., 100%	Bulwer Island Refinery, QLD	74
Do.	do.	Shell Refining (Australia) Pty. Ltd., 100%	Clyde Refinery, NSW	80
Do.	do.	do.	Geelong Refinery, VIC	110
Do.	do.	Caltex Refining Co. Pty. Ltd., 100%	Kurnell Refinery, NSW	110
Do.	do.	BP Refinery (Kwinana) Pty. Ltd., 100%	Kwinana Refinery, WA	120
Do.	do.	Mobile Refining Australia Pty. Ltd., 100%	Lytton Refinery, QLD	85
Do.	do.	Petroleum Refineries (Australia) Pty. Ltd., manager. (Mobile Refining Australia Pty. Ltd., 100%)	Port Stanvac Refinery, SA	72
Rutile		RGC Mineral Sands Ltd., 100%	Capel South Dredge, WA	120
Do.		Tiwest Joint Venture, operator. (KMCC Western Australia Pty. Ltd., 50%, and Ticor Resources Pty. Ltd., 50%)	Cooljarloo Dredge, WA	35
Do.		RGC Mineral Sands Ltd., 100%	Eneabba Dredge, WA	120
Do.		BHP Titanium Minerals Pty. Ltd., 100%	Hawks Nest (Fullerton, Viney Creek, and Stockton) Dredges, NSW	35
Do.		Cable Sands (WA) Pty. Ltd., 100%	Jangardup Dredge, WA	100
Do.		do.	Maidment Dredge, WA	50
Do.		Consolidated Rutile Ltd., 100%	North Stradbroke Island (Amity, Bayside, and Gordon) Dredges, QLD	80
Do.		Pacific Mining Ltd., 100%	Tomago Dredge, NSW	35
Salt		Dampier Salt Ltd., 100%	Dampier and Lake Macleod salt fields, WA	4,500
Do.		Cargill Salt, 100%	Leslie Salt operations, WA	2,750
Silver	kilograms	Pasminco Ltd., 100%	Broken Hill open-cut/underground (South) mine, NSW	120,000
Do.	do.	BHP Minerals Ltd., 100%	Cannington underground mine, Queensland	750,000
Do.	do.	Cobar Mines Pty. Ltd., 100%	Cobar (GSM) underground mine, NSW	15,000
Do.	do.	Pasminco Ltd., 100%	Elura underground mine, NSW	45,000
Do.	do.	McArthur River Mining Pty. Ltd., operator. (Mount Isa Mines Ltd., 70%; and ANT Minerals Pty. Ltd. holding the combined Japanese interests of Nippon Mining and Metals Co. Ltd., 15%; Mitsubishi Materials Corp., 5%; Mitsui & Co. Ltd., 5%; and Marubeni Corp., 5%)	McArthur River underground mine, NT	18,000
Do.	do.	Mount Isa Mines Ltd., 100%	Mount Isa underground mine, QLD	375,000
Do.	do.	Olympic Dam Operations Pty. Ltd., manager. (WMC Ltd., 100%)	Olympic Dam underground mine, SA	12,900
Do.	do.	Peak Gold Mines Pty. Ltd., 100%	Peak underground mine, NSW	20,000
Do.	do.	Pasminco Ltd., 100%	Rosebery underground mine, TAS	20,000
Do.	do.	Normandy Mining Co. Ltd., 100%	Woodcutters underground mine, NT	55,000
Do.	do.	Denehurst Ltd., 100%	Woodlawn underground mine, NSW	4,500
Spodumene	do.	Gwalia Consolidated. Ltd., 100%	Greenbushes open cut, WA	100
Steel		BHP Steel Ltd., 100%	Newcastle steelworks, NSW	1,800
Do.		do.	Port Kembla steelworks, NSW	4,000
Do.		do.	Sydney (Rooty Hill) minimill, NSW	250
Do.		do.	Whyalla steelworks, SA	1,200
Talc		Three Springs Talc Pty. Ltd., 100%	Three Springs open cut, WA	200
Tantalite	pounds Ta <sub>2</sub> O <sub>5</sub>	Gwalia Consolidated Ltd., 100%	Greenbushes open cut, WA	600,000
Tin		do.	Greenbushes open cut, WA	1
Do.		do.	Greenbushes Smelter, WA	1
Do.		RGC Ltd., 100%	Renison Bell underground mine, TAS	6
Uranium	tons U <sub>3</sub> O <sub>8</sub>	Olympic Dam Operations Pty. Ltd., manager. (WMC Ltd., 100%)	Olympic Dam underground mine, SA	1,500
Do.	do.	Energy Resources of Australia Ltd., 100%	Ranger open cut, NT	4,500
Zinc		Pasminco Ltd., 100%	Broken Hill open-cut/underground (South) mine, NSW	350
Do.		Western Metals Ltd., 100%	Cadjebut underground mine, WA	25
Do.		BHP Minerals Ltd., 100%	Cannington underground mine, Queensland	95
Do.		Pasminco Ltd., 100%	Cockle Creek Refinery-Smelter, NSW	85
Do.		do.	Elura underground mine, NSW	125
Do.		Aberfoyle Ltd., 100%	Hellyer underground mine, TAS	250

See footnotes at end of table.

TABLE 2--Continued  
 AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 1997

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities 1/	Annual capacity e/
Zinc--Continued	McArthur River Mining Pty. Ltd., operator. (Mount Isa Mines Ltd., 70%; and ANT Minerals Pty. Ltd.)	McArthur River underground mine, NT	60
Do.	Mount Isa Mines Ltd., 100%	Mount Isa underground mine, QLD	250
Do.	Pasminco Ltd., 100%	Port Pirie Refinery-Smelter, SA	45
Do.	do.	Ridson Refinery, TAS	220
Do.	do.	Rosebery underground mine, TAS	45
Do.	Normandy Mining Ltd., manager. (Murchison Zinc Co. Pty. Ltd., 100%)	Scuddles (includes Golden Grove and Gossan Hill) underground mine	150
Do.	RGC Ltd., 100%	Thalanga underground mine, QLD	75
Do.	Normandy Mining Co. Ltd., 100%	Woodcutters underground mine, NT	45
Do.	Denehurst Ltd., 100%	Woodlawn underground mine, NSW	55
Zircon	RGC Mineral Sands Ltd., 100%	Capel South Dredge, WA	300
Do.	Tiwest Joint Venture, operator. (Kerr-McGee Chemical Chemical Corp. Western Australia Pty. Ltd., 50%, and Tigor Resources Pty. Ltd., 50%)	Cooljarloo Dredge, WA	67
Do.	RGC Mineral Sands Ltd., 100%	Eneabba Dredge, WA	300
Do.	BHP Titanium Minerals Pty. Ltd., 100%	Hawks Nest (Fullerton, Viney Creek, and Stockton) Dredges, NSW	25
Do.	Westralian Sands Ltd., 100%	North Capel, Yoganup Extended, and Yoganup North Dredges, WA	60
Do.	Consolidated Rutile Ltd., 100%	North Stradbroke Island (Amity, Bayside, and Gordon) Dredges, QLD	50
Do.	RZM Pty. Ltd., 100%	Tomago Dredge, NSW	30

e/ Estimated.

1/ NSW New South Wales; NT Northern Territory; QLD Queensland; SA South Australia; TAS Tasmania; VIC Victoria; WA Western Australia.

2/ The Jarrahdale Mine is scheduled to close in 1998.

TABLE 3  
AUSTRALIA: RESERVES OF MAJOR MINERAL COMMODITIES

Commodity	Reserves
Antimony	89.9
Bauxite	3,024.0
Black coal:	
In situ	68.0
Recoverable	49.0
Brown coal:	
In situ	46.0
Recoverable	41.0
Cadmium	132.1
Cobalt	414.1
Columbium (Niobium)	4.0
Copper	23.6
Diamond:	
Gem and near gem	85.0
Industrial	90.0
Gold	4,454.0
Iron ore	17.8
Lead	18.7
Lithium	166.0
Magnesite (MgCO <sub>3</sub> )	179.9
Manganese ore	118.0
Mineral sands:	
Ilmenite	135.0
Rutile	14.9
Zircon	21.4
Nickel	6.4
Petroleum, recoverable:	
Condensate	183.0
Crude	277.0
Liquefied petroleum gas	144.0
Natural gas	1,264.0
Platinum-group metals (Pd, Pt)	19.1
Rare earths (REO plus Y <sub>2</sub> O <sub>3</sub> )	1.0
Silver	43.3
Tantalum	8.1
Tin	119.5
Tungsten	0.9
Uranium, recoverable	622.0
Vanadium	15.0
Zinc	39.9

REO: rare-earth oxides

Source: Mineral Resources Branch, Bureau of Resource Sciences, Canberra, Australia.