

THE MINERAL INDUSTRY OF

AUSTRALIA

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Australia was the third largest producer of minerals and metals (excluding coal and petroleum) in the world in 1994, and its minerals industry was a leading catalyst in promoting growth of the country. In 1994, Australia remained the world's leading producer of alumina, bauxite, diamond, ilmenite, lead, monazite, opal, rutile, sapphire, and zircon. It was the second largest producer of mined zinc, the third largest gold producer, and the fourth largest producer of cobalt, iron ore, refined nickel, and uranium.² Australia was the fifth largest producer of black coal and mined nickel in the world. It was the premier exporter of alumina, coal, ilmenite, iron ore, refined lead, monazite, rutile, and zircon. The country's mineral wealth was so extraordinary that it was virtually self-sufficient in most mineral commodities. The only significant mineral resource in which Australia was not self-sufficient was petroleum. Nevertheless, Australia still produced about 75% of its crude oil requirements domestically. However, the country was endowed with abundant other mineral fuel resources including coal, natural gas, liquefied petroleum gas, and uranium, and continued to be one of the few market economy countries that was a net exporter of mineral fuels.

Although the Australian mineral industry dates back to coal and copper mining shortly after the first European settlements in 1788, the country's mining industry did not come into its own until the gold rushes of the 1850's in New South Wales (NSW), Queensland (QLD), Victoria (VIC), and Western Australia (WA); the lead-silver-zinc discoveries at Broken Hill, NSW, in 1883; and the Mount Isa, QLD, lead-silver-zinc and copper finds 50 years later. Further discoveries followed, and since the mid-1960's, Australia has become a major world producer of a number of minerals.

The minerals industry, the largest primary sector of the economy, remained heavily export-oriented, with about 80% of the value of its mineral production destined for international markets. Mineral exports were heavily concentrated into just four commodity groups: alumina, aluminum, and bauxite; coal; gold; and iron ore.

Government Policies and Programs

The ruling by the Australian High Court in its landmark *Mabo v. Queensland* decision in 1992 recognized that the common law of Australia had not automatically extinguished

native title under the principle of *Terra Nullius*, or unoccupied land. Although the judgment overturned established law, the Court's decision did not evaluate the acquisition of sovereignty by the Crown. Thus, titles issued by the State governments, including mining tenements and leases, potentially became subject to native claims where the Aboriginal people had maintained their connection with the land continuously through the years of European settlement; such title had not been terminated by valid acts of Imperial, Colonial, State, Territory, or Commonwealth governments; and the content of native title could be determined according to the traditional laws and customs of the Aboriginal people involved.

The *Mabo* decision created a new form of property law for the country, which was applicable retroactively, overturning more than 200 years of established property law in Australia. Consequently, uncertainty resulted, encouraging the filing of suits dealing with native title claims in all six States and both Territories.

Because of the potentially serious impact of the *Mabo* decision throughout Australia, especially on the minerals industry, the Government introduced in November 1993 the Native Title Act 1993. The act was to confirm recognition of the High Court's decision on native title and provide the mechanism to maintain a system of land management to make it work through clear and predictable rules.

On January 1, 1994, the Native Title Act 1993 came into force, providing four main objectives:

1. Validation—The Act validated the legality of past grants of rights to use or own land that might have been invalid because the land was native title land at the time of the grant. This meant that people, other than native title owners, who owned or had a legal interest in an area of land, did not need to apply to any court or tribunal in order to protect their interests.

2. National Native Title Tribunal—The Act set up a system to decide where native title still existed. If people wanted to know whether native title existed over a particular area of land, they would have to apply to the National Native Title Tribunal created by the Act for a decision.

3. Compensation—The Act provided for compensation where native title was lost because of validation (discussed above) and where it would be lost or affected by new acts.

4. Negotiation—The Act provided negotiation rights to native title holders, or people who have claimed native title, where others want to mine on their lands, or where Governments want to buy their land for others to use.

The Native Title Act 1993 also provided for the States and Territories to propose their own tribunals and arrangements for, first, determining native title claims and, second, deciding whether proposed grants affecting native title may be made.

The Native Title Act 1993 legislation was a compromise. Aboriginal groups do not have "veto rights" on mining and pastoral (farming and ranching) uses of land, but they do have the right to be consulted on land uses when leases expire. Similarly, mining interests do not have automatic renewal of their leases.

The Government claimed in December 1994 almost 15 million square kilometers of additional territory under the United Nations Convention on the Law of the Sea, which entered into force November 16. The Convention added the weight of international law to Australia's declaration on August 1 of an Exclusive Economic Zone (EEZ). The addition of the EEZ to Australia's territory included access to any natural resources, including minerals and petroleum.³

Environmental Issues

At the urging of the Australian mining industry, the Australian Center for Minesite Rehabilitation Research (ACMRR) was established in September 1994, with an initial funding of \$600,000. The ACMRR was a joint venture of the University of QLD, the Commonwealth Scientific and Industrial Research Organization, Curtin University of Technology, the University of WA, and the Australian Mineral Industries Research Association. The primary objective of the ACMRR was to conduct strategic research into mine-site rehabilitation, which would lead to significant improvements in rehabilitation processes for the mutual benefit of Australia and its mining industry.⁴

Production

The value of minerals produced in Australia in fiscal year (FY) 1994,⁵ the latest period for which official data were available, increased to \$21.2 billion,⁶ 2% above that of FY 1993 and almost 8% of the gross domestic product (GDP), estimated at \$281 billion. This increase followed a similar 2% increase in FY 1993. Metallic mineral production contributed an estimated 40% of the total, followed by petroleum production (crude oil, natural gas, and natural gas liquids), 30%; coal, 25%; and industrial minerals, including clays, construction materials, dimension stone, peat, and salt, 5%. The value of downstream production, including smelting and refining, decreased about 6% in FY 1994 from

that of FY 1993.

Australia remained the world's leading producer of alumina, bauxite, diamond, ilmenite, mined lead, monazite, opal, rutile, sapphire, and zircon in calendar year 1994. The country also continued to rank among the world's top producers of aluminum, mined antimony, coal, cobalt, mined copper, gold, iron ore, manganese, mined and refined nickel, salt, silver, mined tin, uranium, and mined zinc. (*See table 1.*)

Trade

Australia continued to rely heavily on the export of the majority of its mineral production to bolster economic growth. Although the value in FY 1994 of its mineral exports decreased 4%, to \$20.8 billion, from the record high \$21.7 billion set in FY 1993, the minerals industry remained Australia's largest export earner, accounting for about 60% of commodity export earnings. 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. While using its plentiful resources of energy minerals (coal, liquefied natural gas, and uranium), Australia also continued to be a net exporter of mineral fuels, thus enabling the country to retain a favorable trade balance in energy products.

Coal remained Australia's largest mineral export earner in 1994, followed by gold, iron ore, and bauxite, respectively. Annually, Australia exports about 70% of its coal production, accounting for about 30% of world coal trade; more than 90% of the gold it produces; about 90% of its iron ore production, also representing about 30% of world trade; and 80% of its aluminum production, composing more than 10% of world trade. The richness and diversity of the Australian minerals sector provided a significant portion of the GDP, contributing an estimated 50% of the country's export earnings in FY 1994.

Structure of the Mineral Industry

The Australian minerals industry covers nearly the whole spectrum of minerals, from 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), to gemstones (diamond, opal, and sapphire). Australia was one of the world's principal producers and suppliers of ores, concentrates, and refined metals. Australia was estimated to rank third in the world in the value of nonfuel mineral production. The value of mineral production, including fuels, was estimated to rank eighth in the world.

The Australian mining industry was based on a system of free enterprise, with private companies involved in exploration, mine development, production, mineral

processing, and marketing. A number of foreign companies in mineral ventures in Australia were affiliates or subsidiaries of U.S. companies. Foreign companies controlled 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 were fully integrated, producing ores, concentrates and other intermediate products (e.g., alumina), and refined metal or other end products (e.g., cut-and-polished gem diamond) within the country. In 1994, there were six alumina refineries and aluminum smelters each; three principal copper smelters and refineries each; two principal gold refineries; four principal lead-zinc smelters and/or refineries; one manganese ferroalloys plant; one nickel smelter and two nickel refineries; three principal crude steel plants; one primary tin smelter and refinery each and two secondary tin refineries; and two silver refineries. Australia had eight principal petroleum refineries.

Ownership of mineral rights in Australia was divided between State ownership in State onshore areas and Commonwealth ownership in Territories and in offshore areas beyond the territorial limit. However, the Commonwealth's responsibility for minerals in the Northern Territory (NT), except for uranium, has been transferred to the Government of the NT. Thus, the individual States and Territories administered the minerals industries within their own borders, including registering of 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 had de facto control over most mineral production. (*See table 2.*)

Commodity Review

Metals

Antimony.—The only antimony mine operating in Australia was Hillgrove Gold Ltd.'s Garibaldi-Eleanora underground mine at Hillgrove, an old gold mining area in northern NSW. Hillgrove Gold, formerly Vam Ltd., was considering the installation of a small on-site smelter for the production of antimony trioxide, which had about twice the value of concentrate. The mine was producing about 3,000 metric tons per year (mt/a) of antimony concentrate and minor amounts of gold.

Bauxite, Alumina, and Aluminum.—Australia continued to be the unchallenged world leader in bauxite production for the 24th consecutive year, producing more than 40% of the production of market economy countries. All mining continued to be from the open cut operations at Weipa on the western flank of the Cape York Peninsula in

the far north of QLD; the Gove operation across the Gulf of Carpentaria in northeastern Arnhem Land, NT; and from the mines south of Perth in the Darling Ranges, WA. Although substantial bauxite deposits also were known to occur bordering the Admiralty Gulf at Cape Bougainville and in the nearby Mitchell Plateau area of the Kimberley region of northern WA, their remoteness from energy supplies and infrastructure has thus far blocked development.

Australia also continued to dominate in 1994 the world alumina market, producing from six refineries more than one-third of Western World production. The NT and QLD each had one refinery; the remaining four were in WA.

Australia was a significant supplier of aluminum as well. Aluminum was produced at six smelters, two each operating in NSW and VIC, and one each operating in QLD and Tasmania (TAS).

Comalco Ltd. finalized in March the \$550 million purchase of the Gladstone power station from the QLD Electricity Commission, enabling Comalco to proceed with construction of a third potline at its 50%-owned Boyne Island aluminum smelter near Gladstone. The \$660 million potline, scheduled for commissioning in 1997, would expand the capacity of the facility from 230,000 mt/a to 475,000 mt/a, making it one of the largest aluminum plants in the world.⁷ Each of the joint-venture partners was to finance its share of the project according to their respective equity share holdings.

Comalco was unable to successfully resolve during the year a long-term power supply arrangement with the TAS Hydro-Electric Commission for power to operate the Bell Bay, TAS, smelter. Comalco previously announced that it would close the Bell Bay facility when its power contract with the Commission expired in 2001, if it has not secured a competitively priced source of electricity. In March, economic conditions forced Comalco temporarily to shut down three potlines at Bell Bay, reducing annual production 30%, from 120,000 mt to 84,000 mt.⁸

A major expansion program was completed in September at Alcoa of Australia Ltd.'s Wagerup alumina refinery, WA, adding 200,000 mt to the annual capacity. The upgrade included the installation of a 550-mt-per-hour capacity mill and a 2,000-mt bauxite storage bin, enabling a more uniform flow of ore to the mill.⁹

Alcoa sought environmental approval from the Government of WA to facilitate future expansion of its Wagerup refinery to 3.3 million metric tons per year (Mmt/a), almost doubling its present capacity of 1.7 Mmt/a. Although there was no firm date for expansion, Alcoa continued detailed planning and a feasibility study for installation of a \$440 million third potline and associated facilities.¹⁰

Chromium.—Dragon Mining NL was developing Australia's largest known chromium deposit, a lateritic ore body at Range Well in WA. Dragon Mining planned to use

the high-iron content ore to manufacture high-chromium cast grinding balls by a direct smelting and casting route.¹¹

Cobalt.—Australia remained the fourth largest producer of cobalt in the world, with output principally produced as a byproduct of nickel mining and processing. Australia's leading producer was the Queensland Nickel Joint Venture (QNJV), which processed laterite nickel-cobalt ores at its Yabulu nickel refinery near Townsville, QLD. The QNJV comprised QNI Ltd., 80%; and Nickel Resources North Queensland Pty. Ltd., an agency of the QLD Government and also a QNI shareholder, holding a 20% interest in the QNJV. The refinery's feedstock was ore imported from Gebe Island, Indonesia, and La Grande Terre, the main island of New Caledonia, that was blended with domestically produced ores mined at QNJV's Brolga Mine and from stockpiled ore from the Greenvale Mine, both in QLD. The Greenvale Mine, 225 kilometers (km) west of Townsville at Marlborough, was depleted in 1992, and the facilities and equipment not necessary for the operation of the adjacent Brolga Mine were sold in May 1993.

Copper.—Mine production of copper in Australia continued to be from operations that produced other metals, either as the primary product or as a coproduct. The most notable copper-producing operations were at Mount Isa (Hilton copper-lead-zinc mine), QLD, and Roxby Downs Station (Olympic Dam copper-gold-uranium mine), South Australia (SA).

Renison Goldfields Consolidated Ltd. (RGC) announced in March its intention to close on December 15, 1994, about 6 months ahead of the originally planned mid-1995 target, the Mount Lyell Mine. RGC claimed that the mine, on the west coast of TAS near Queenstown and operated by its wholly owned subsidiary, The Mount Lyell Mining and Railway Co. Ltd., could not retain long-term viability and was approaching the end of its productive life.¹² RGC operated the 101-year-old-mine since 1984 under lease agreements with the Tasmanian State government.

In July 1994, the State announced that the leases for the Mount Lyell Mine would be awarded to Gold Mines of Australia Ltd. (GMA) following RGC's withdrawal at yearend. (GMA was formed early in 1994 by the merger of Eastmet Ltd., Metana Minerals NL, and Paragon Resources NL.) In October, RGC and GMA agreed that all plant, equipment, buildings, and infrastructure, except for some heritage items, would be sold on December 30, 1994, to GMA's wholly owned subsidiary, Copper Mines of Tasmania, for nearly \$3 million.¹³

At yearend, GMA announced its plans to restart mining and processing operations at Mount Lyell, beginning late in 1995 or early in 1996, at a rate of 1.5 Mmt/a of ore. This was to be increased to 2.0 Mmt/a in the second year, and to 3.5 Mmt/a by 1998.¹⁴ In an agreement with the China National Nonferrous Metal Industry Corp. (CNNC), all of

Mount Lyell's production would be sold to CNNC during the 4-year period beginning January 1, 1996, at London Metal Exchange prices, along with a guarantee of a minimum price of \$1.98 per kilogram (kg) (\$0.90 per pound) for 77% of Mount Lyell's output. CNNC also would be allowed to purchase up to a 20% interest in the mine for \$19.4 million prior to the mine's startup.¹⁵

Western Mining Corp. Holdings Ltd. (WMC) announced in August its plans to conduct a \$5 million feasibility study for a major expansion at its Olympic Dam polymetallic mine at Roxby Downs Station. The study was expected to be completed by mid-1995, with a final decision made by February 1996.¹⁶ The \$55 million production optimization program, started in 1993, was scheduled for completion during 1995, increasing copper output from 66,000 mt/a to 84,000 mt/a. The program included installation of a new autogenous grinding mill and additional thickening and leaching equipment.¹⁷

North Broken Hill Peko Ltd. (NBHP), 80% majority shareholder and operator, opened in August the Northparkes copper-gold mine in NSW, although only gold was mined during 1994. The Northparkes Mine would be the second largest underground base metal mine ever in Australia, after Mount Isa Mines Ltd.'s (MIM) Mount Isa Mine in QLD. It was to produce 65,000 mt/a of copper in concentrate, including production from its two open pits.¹⁸

WMC brought into operation its 60,000-mt/a opencut Nifty Mine in the Great Sandy Desert of WA. The operation was to produce about 16,500 mt of copper cathode using a combination of heap leaching and solvent extraction-electrowinning (SX-EW) methods, although difficulties in the SX-EW section limited copper output to about 50% of potential capacity during the year.¹⁹

The shareholders of Southern Copper Ltd., manager of the smelter-refinery complex at Port Kembla, NSW, announced near yearend they would close and place the facility on care-and-maintenance. Smelting operations were to cease early in 1995, with other activities at the site phasing out progressively over the ensuing weeks. The closure was precipitated by several factors, including a projected \$169 million capital cost to upgrade the plant's environmental control facilities and expand production to improve economic performance. CRA Ltd., the majority shareholder with 60%, also was seeking to reduce its equity in the facility with the introduction of another investment partner. The shareholders previously had discussed the terms under which the plant would be on care-and-maintenance status, and the arrangements that would apply for its recommissioning when an investor was found.²⁰

Gold.—Despite the gold industry's predictions of dire consequences, the removal of the tax-exempt status on gold mining profits had little or no adverse impact during the 4-year period of production since the tax was implemented January 1, 1991. Indeed, production again reached a new

record high in 1994, preserving Australia's ranking as the third largest producer, after South Africa and the United States, in the world. Australia produced in 1994 more than 10% of the world's gold production.

WA remained the premier gold-producing State, again producing about 75% of the country's production, followed by the NT and QLD. Gold was mined in all States and Territories except the Australian Capital Territory (ACT).

NBHP opened in August its Northparkes copper-gold mine in NSW. Production consisted only of gold during 1994, although copper production was to commence during the second quarter, 1995. When completely on-stream, the Northparkes Mine was expected to produce more than 2,100 kilograms of gold from oxide copper-gold and sulfide copper-gold ores mined from two open pits, and from sulfide copper-gold ore mined from the underground operation.²¹

Great Central Mines NL commissioned in November its Bronzewing surface mine, 65 km northeast of Leinster, WA. Underground mining was scheduled to begin by June 1995, with higher grade material expected to be recovered.²²

Equal partners Delta Gold NL and Peko Gold Ltd. gave in December the go-ahead to develop the underground portion of the ore body at the Kanowna Bell Mine, WA, which would increase gold production to more than 6,200 kilograms per year (kg/a). Open pit mining began in 1993. Decline development was to begin in midyear 1995, with first production scheduled for mid-1998.²³

GMA produced early in October its first bar of gold from its Youanmi underground mine. This marked the first commercial use of the BacTech bacterial oxidation process owned by BacTech (Australia) Pty. Ltd., itself owned 45% by GMA. The plant operated for the remainder of the year at planned oxidation and recovery levels, but operation testing at full capacity was not scheduled to be done until production from the mine had increased. The Youanmi Mine had sufficient reserves to sustain production for 7 years at more than 2,300 kg/a gold.²⁴

Kalgoorlie Consolidated Mines Pty. Ltd., manager of the Kalgoorlie Super Pit at Kalgoorlie, WA, announced an expansion of the Fimiston mill's annual capacity from 5 million metric tons (Mmt) to 9.1 Mmt. The upgrade was to be completed by August 1995 and cost an estimated \$84 million. The upgrade was to ensure that the present capacity of the mining and milling complex at the Super Pit was maintained when the Mount Percy and the Oroya treatment facilities were closed to make room for expansion of the pit. The Super Pit, Australia's largest gold mine in terms of gold production and quantity of ore mined and processed, ultimately will merge into a single pit all of the previous open pits and shallower workings of Kalgoorlie's Golden Mile. The Super Pit was expected to attain a size of about 4.2 km long, 1.5 km wide, and 500 meters (m) deep.²⁵

Iron Ore.—Australia retained its position in 1994 as the world's leading iron ore exporter, beating out Brazil for the

fourth consecutive year. As a world producer, Australia ranked fourth after the former U.S.S.R., China, and Brazil. Australian iron ore production continued to be heavily concentrated in the Hamersley Range of the Pilbara District, WA, which accounted for more than 96% of the country's production. Iron ore also was produced at the Iron Duke and Iron Knob Mines by BHP Steel Ltd. in the South Middleback Ranges near Whyalla, SA, and at the Savage River Mine in northwestern TAS.

BHP Minerals Ltd. announced in midyear plans for a major iron ore processing plant for the Pilbara iron ore region. Construction of the proposed \$550 million facility, a 2-Mmt/a direct-reduced iron/hot-briquetted iron plant sited near Port Hedland, WA, was scheduled to be started by mid-1995 and completed during 1997.²⁶

The results of a feasibility study at Pickands Mather and Co. International's Savage River opencut mine may defer for as many as 10 years the company's planned 1997 closure of the mine. The study was being conducted at the North Pit, where it was known from previous drilling that the ore body extended to considerable depth. The drilling program for the feasibility study was being done to confirm the grade and delineate the ore block at depth. Open cut mining at Savage River was scheduled to conclude at yearend 1996, with final processing of stockpiled materials completed by the end of the first quarter of 1997. A decision whether to continue mining using underground methods was expected early in 1995.²⁷

Lead and Zinc.—Most lead and zinc mined in Australia continued to be from operations that produced both because the two metals commonly occur in associated minerals. Zinc was the main product of all the lead-zinc mines in operation during the year.

Australia was the most important lead concentrate producer in the industrialized world, with about 20% of the total, and was second in the production of zinc concentrate, with about 15% of the total, in 1994. In refined production, Australia ranked fifth in zinc and eighth in lead, excluding lead bullion.

Development of the McArthur River underground mining project, begun in midyear 1993, continued on schedule during 1994 for commissioning by May 1995 and startup of commercial production shortly thereafter. The McArthur River deposit, in the northeast corner of the NT, was about 100 km inland from the Gulf of Carpentaria and 230 km west of the QLD border. It was considered to be one of the largest zinc-lead-silver deposits in the world. McArthur River production was to be a high-grade bulk concentrate containing 160,000 mt of zinc and 45,000 mt of lead. The concentrate was to be transported 120 km by road to Bing Bong on the Gulf of Carpentaria coast, and barged to ships moored 30 km offshore for export to overseas smelters. The mine would employ about 200 people in its permanent work force. Employees were to commute on a fly in-fly out basis

from Darwin, NT, except for those who would be employed locally.²⁸ McArthur River Mining Pty. Ltd. was to be the operator of the joint-venture project, 70% owned by MIM Holdings Ltd. and 30% owned by Japanese interests.

MIM closed the smaller of its two lead smelters at its Mount Isa lead-zinc mine site in QLD. The newer 60,000-mt/a capacity Isasmelt plant was shut down in response to continued low metal prices and exhaustion of the lead concentrate stockpile. The 170,000-mt/a capacity conventional lead smelter remained in operation.²⁹

Pasminco Ltd. unveiled in midyear plans to double the mine life and output of its Rosebery lead-zinc mine in TAS through a \$33 million, 4-year exploration and development program. The proposal consisted of delineating an additional 10 Mmt of ore reserves below the current mine working levels to add to the 4.5 Mmt of existing reserves prior to almost doubling the mining capacity to 1 Mmt/a from the present 550,000 mt/a.³⁰

CRA began development of its Century lead-zinc deposit, 250 km northwest of Mount Isa, QLD. Production was to be 670,000 mt/a lead concentrate and 780,000 mt/a zinc concentrate, which would be transported by pipeline 300 km to Kurumba on the Gulf of Carpentaria. Relatively high silica levels in the ore and efforts to surmount the problem have pushed back the original startup date of 1995 to at least until late 1997 or early 1998.³¹

Manganese.—Groote Eylandt Mining Co. Pty. Ltd.'s (GEMCO) mine on the northwest portion of Groote Eylandt, in the west of the Gulf of Carpentaria, was the second biggest mining operation in the NT, after the Gove bauxite mine, and was the world's third largest manganese producer, representing about 10% of production. GEMCO ships annually about one-quarter of its approximate 2 Mmt of concentrate to the ferromanganese plant operated by Tasmanian Electro Metallurgical Co. Pty. Ltd. (TEMCO) at Bell Bay, TAS. Both GEMCO and TEMCO were wholly owned subsidiaries of BHP Minerals. Smaller quantities were used in BHP Minerals' electrolytic manganese dioxide plant at Newcastle, NSW, for the production of high-grade material used in long-life batteries.

Portman Mining Ltd. previously had been Australia's only other manganese miner, producing from its Woodie Woodie operation near Nullagine, in the Pilbara region of WA. Portman placed the operation on care-and-maintenance in May, citing adverse manganese ore prices. In September 1994, Portman successfully concluded its dispute with its former joint-venture partners in the Woodie Woodie project, Gayna Park Pty. Ltd., 27.5%, and Alsace Pty. Ltd., 22.5%, acquiring full ownership and control of the mine. Near yearend, Portman negotiated the sale of 200,000 mt of metallurgical grade manganese to the Japanese market for delivery commencing in April 1995, the beginning of Japan's fiscal year.³² In contrast with Portman's shutdown, Valiant Consolidated Ltd. brought its Mike deposit at Pearana Rock

Hole, also in the Woodie Woodie area, into production. Valiant exported in October a 33,000-mt shipment of high-grade ore to Japan's Nippon Steel Corp. and was expected to ship a further 65,000 mt early in 1995.³³

Mineral Sands.—Australia's mineral sands industry included the mining and processing of high concentrations of the heavy minerals ilmenite, leucoxene, monazite, rutile, and zircon. Australia was the world's leading producer and exporter of mineral sands. In 1994, Australia's mineral sands industry produced about 40% of the ilmenite, 35% of the rutile, 50% of the zircon, and a substantial portion of the world's monazite.

Rutile was an important titanium dioxide (TiO₂) material, and ilmenite was an important feed material for the production of synthetic rutile, or TiO₂ slag. Ilmenite and rutile were valued for their TiO₂ content, which was used as white pigment in the paint, paper, plastics, printing, and rubber industries, and as the source for titanium metal used in the aerospace and medical industries. Monazite was a source of rare-earth oxides that were used in electronics and other high-technology products. Zircon was widely used in ceramics, refractories, and foundry applications.

Nickel.—The Australian nickel mining industry in 1994 consisted of several mines operating near the communities of Forrestania, Kambalda, and Leinster in WA, and an operation near Marlborough, QLD, that supplanted the depleted Greenvale Mine. Downstream processing occurred at the Kalgoorlie Smelter in WA, and at refineries at Kwinana, WA, and Yabulu, near Townsville, QLD. In 1994, Australia was the world's fifth largest producer behind Russia, Canada, New Caledonia, and Indonesia of mined nickel in the world. It was the world's fourth largest producer, behind Russia, Canada, and Japan, of nickel metal and nickel matte.

WMC remained the country's dominant nickel miner and main nickel metal producer. WMC operated nickel sulfide mines and mills centering on the Kambalda and Leinster regions of WA; the nickel smelter at Kalgoorlie, WA; and the refinery at Kwinana, WA. Kambalda Nickel Operations (KNO), a division of WMC, operated several mines in the Kambalda area, and Leinster Nickel Operations (LNO), also a division of WMC, operated the Rocky's Reward and Perseverance Mines near Leinster. The inactive Leinster Mine, an underground mine originally named Agnew, and mothballed in 1986, was the LNO's namesake.

Queensland Nickel Pty. Ltd., MIM Holdings, and the Townsville Port Authority signed in August agreements for the development of a long-term dedicated facility for the importation of Queensland Nickel's ore through the Townsville port. Construction of the ore importation facility, including a new ore unloader, wharf hoppers, conveyor system, train loader, stockpile, and associated infrastructure, began during the December 1994 quarter at an estimated cost

of \$35 million. The facility was scheduled to be operational late in 1996.

WMC's Mount Keith Mine, 90 km from Leinster and regarded as the world's largest low-grade sulfide nickel deposit, commenced commissioning in October. Mining was to produce about 6.6 Mmt/a of ore, producing about 28,000 mt/a of nickel concentrate. The first shipments of concentrate were scheduled to be made early in January 1995 to the Kalgoorlie smelter and to Outokumpu Metals and Resources Oy's Harjavlta smelter/refinery in Finland.

At yearend, Defiance Mining NL was preparing a development plan to bring back into operation, by the end of 1995, the Carr Boyd nickel mine. The mine, 75 km north of Kalgoorlie, was to be reopened, in part, because of a dramatic increase in nickel prices, as well as the increased resource potential of the area. Defiance was planning to construct a decline at Carr Boyd, relocate the Paringa treatment plant from Kalgoorlie, and establish associated infrastructure to process an initial 150,000 mt/a of ore to produce 2,000 mt of contained nickel; this was to increase to 5,000 mt/a within 5 years.³⁴

Platinum-Group Metals.—No Australian mines were primary producers of platinum-group metals (PGM) in 1994, although minor production continued in WA's Eastern Goldfields at Kalgoorlie-Boulder and Kambalda as a byproduct of the nickel operations. PGM, mainly platinum and palladium, were recovered at the Port Kembla, NSW, refinery-smelter complex from byproduct copper sulfide residue produced at the Kwinana nickel refinery. PGM also were contained in nickel matte produced for export at the Kalgoorlie smelter.

Steel.—BHP Steel was the only integrated steel producer in Australia during the year. BHP Steel's contribution to total world steel output was relatively small, having just three integrated steelworks that produced less than 1% of world production. BHP Steel's plants were at Newcastle and Port Kembla in NSW and Whyalla in SA.

Tantalum.—Australia was a major producer of tantalum concentrates. Production was from Gwalia Consolidated Ltd.'s Greenbushes Mine, about 250 km south of Perth in WA and the largest producer of tantalite in the world, and from the Mount Cassiterite Mine, 100 km south of Port Hedland, WA. Mount Cassiterite, managed by Pan West Tantalum Pty. Ltd., a subsidiary of Pancontinental Mining Ltd., in equal joint-venture with Goldrim Mining Australia Ltd., replaced the joint venture's depleted Wodgina Mine, about 1 km to the north. A mill upgrade increasing ore throughput capacity by 60%, in anticipation of lower grades of ore than at Wodgina, was completed in January 1994, bringing the capacity to 144,000 mt/a to produce almost 400 mt/a of tantalum oxide (Ta₂O₅) in salable concentrates.³⁵

Tin.—RGC's Renison Bell Mine near Zeehan, TAS, remained the world's largest hard-rock underground tin mine and Australia's main tin producer. Gwalia Consolidated's Greenbushes Mine in southwestern WA also produced tin as a coproduct of its spodumene and tantalite mining.

RGC was preparing at yearend to embark on a 5-year, \$25 million development of its Rendeep high-grade ore resource, existing beneath the present workings at the northern end of the Renison Bell underground mine. The expansion would enable RGC to extend the life of the mine beyond its planned 1996-97 closure, extending the mine's life another 6 years to at least 13 years. RGC was drilling a shaft 575 m underground near existing shafts and tunnels to access the Rendeep deposit, which occurs 600 m to 800 m below the surface.³⁶

Industrial Minerals

Diamond.—Australia has been the world's largest producer of natural diamond since 1986, but only a relatively small portion of its output has been of gem quality, reflecting the country's sixth ranking in terms of value of world diamond production. The majority of production was derived from operations at the mammoth Argyle Mine in the Kimberley region of WA, which again retained its position, for the ninth consecutive year, as the world's biggest single-mine producer of diamond with output equivalent to about 40% of world production. About 5% of production was of gem quality, including a small proportion of the highly valued intensely pink stones that generated about 50% of revenues; 40% was near-gem quality that produced about 45% of revenues; and 55% was industrial quality that contributed just 5% of revenues.³⁷

Argyle Diamond Mines Pty. Ltd. (ADM), a wholly owned subsidiary of CRA, was the management company and operator of Argyle Diamond Mines Joint Venture's (ADMJV) Argyle Mine. ADMJV itself comprised CRA, 59.7%, and Ashton Mining Ltd., 40.3%. ADMJV continued to sell most of its gem quality and about 80% of its near-gem quality white diamonds to De Beers' Central Selling Organization (CSO) under a 5-year marketing contract signed in mid-1991 through Argyle Diamond Sales Pty. Ltd. (ADS), a company jointly owned on the same basis as the mine by CRA and Ashton. ADMJV retained the right to sell the few handfuls of the very rare, intensely pink *Argyle Pink* diamonds unique to the Argyle Mine, as well as the more common yellow to brown stones, which were marketed as *Argyle Champagne* or *Argyle Cognac* diamonds, depending upon the specific color. These diamonds were cut and polished using traditional techniques and automated laser cutting machines at ADS's small facility in West Perth. Most of the remaining portion of the near-gem quality and all of the industrial-grade stones were sold on the open market through ADS's Antwerp, Belgium, office. A small proportion of the near-gem quality material was toll

processed overseas through ADS before being sold on the open market.

ADM's second major upgrade of the processing plant, the first since 1990, to increase capacity was commissioned in March, 6 weeks ahead of schedule. The \$70 million upgrade increased the capacity of the plant a further 2 Mmt/a to 8 Mmt/a, ensuring that the level of diamond production would be maintained, offsetting the gradual decline in ore grade with depth of the AK-1 lamproite pipe and increasing distance of the alluvials away from the AK-1 source.³⁸

Australia's only other commercial diamond operation was Poseidon Bow River Diamond Mine Ltd.'s Bow River Mine, 25 km northeast of the Argyle Mine. All of Bow River's output was marketed under a sales agreement with the CSO. About 20% of the Bow River production was gem quality, with a consistent percentage of the intensely pink diamonds, and 80% was industrial grade. Bow River diamonds were recovered from buried diamondiferous gravels that originated from the AK-1 pipe.

Gemstones.—Australia again was the world's leading producer of precious opal in 1994, accounting for about 90% of the world's production. About one-half of Australia's opal was produced from fields at Andamooka, Coober Pedy, and Mintabie in SA. Most was hand-mined, either from an open cut or an underground drive. Opal in NSW mostly was mined at Lightning Ridge, the world's major source of the highly prized and valuable black opal, although a small amount still was produced at White Cliffs, the site of opal discovery in 1889. A small quantity of opal also was produced in western QLD.

Before 1994, opal mining leases in NSW were limited to 50 square meters, effectively limiting mining to individuals. Licensing changes presently permit miners to obtain leases up to two hectares, meaning that mining can be done using open-cut mining techniques, providing that the leaseholder can demonstrate that the ground is unstable.³⁹

Australia also continued to be the world's leading producer of natural sapphire. Australia's commercial sapphire production was mined from alluvial deposits in the Inverell-Glen Innes (New England) region of northern NSW and the Rubyvale-Anakie region of central QLD. Australia was supplying up to about 70% by volume of the world's sapphire until 1987 when the Thai Government lifted restrictions on mechanized mining of Thailand's sapphire, and production was increased substantially in China and Nigeria. Consequently, Australia's share of world supply gradually has declined so that in 1994 it was producing only about 25% to 30% by volume of the world's rough sapphire output. Most of the uncut gems still were exported to Thailand, the recognized world leader for cutting and marketing.

Australia again continued to produce almost all the world's chrysoprase from the Marlborough, QLD, deposit and has the world's largest known resource of nephrite jade at

Cowell, on the Eyre Peninsula in SA. In addition, Australia also produced other gemstones, including agate, amethyst, chialstolite, emerald (aquamarine), garnet, rhodonite, topaz, tourmaline, turquoise, and zircon.

Lithium.—Following successful pilot plant studies, Gwalia Consolidated began construction of a lithium carbonate plant at its Greenbushes Mine, south of Perth, WA. The plant would provide significant value-added lithium chemical products to supplement its spodumene concentrate production.

The plant was to have a production capacity of 5,000 mt/a lithium carbonate, although initially it would not operate at full capacity; production would be increased as markets were established. The almost \$13 million plant was expected to be commissioned by September 1995.⁴⁰

Salt.—Dampier Salt (Operations) Pty. Ltd. continued to supply more than one-half of Australia's salt exports, 70% of which went to Japan, from its solar operations at Dampier Field, on Mistaken Island near Dampier in the Pilbara area, and Lake Macleod Field, near Carnarvon, both in WA. Indonesia, South Korea, and Taiwan received the bulk of the remaining exports.

Mineral Fuels

Coal.—Australia retained in 1994 its position as the world's largest exporter of coal, a position it has held since 1984, shipping more than 131 Mmt, a decrease of less than 0.5% from the record high set in 1993. Australia controlled about 35% of the world's seaborne coal trade by exporting more than two-thirds of its black coal production. The major market was Japan, which imported almost 50% of Australia's coal exports.⁴¹ The coal industry also remained in 1994 Australia's largest foreign-exchange earner, accounting for more than one-quarter of export revenues from the minerals sector and about 15% of the country's export earnings. Australia was the world's fifth largest producer of black coal in 1994. NSW and QLD accounted for more than 95% of the country's black coal production and virtually all of its exports.⁴²

The Electricity Trust for SA (ETSA) approved in March a \$30 million redevelopment plan for the Leigh Creek coalfield, extending the life of the mine by 30 years. Located 350 km north of Adelaide, Leigh Creek produced brown coal to fire ETSA's 500-megawatt power station at Port Augustus, which fulfilled one-half the state's requirements. The plan called for about one-half of the money to be invested in a new fleet of 240-mt to 250-mt coal and overburden trucks to replace its aging 150-mt fleet. The remaining money would be used to buy a 60-cubic meter electric shovel and to fund a review of the mining methodology at the site.⁴³

CRA's coal subsidiary Coal and Allied Industries Ltd. (C&A) signed in August 1994 a letter of intent with the

Guangdong Provincial Coal Corp. (GPCC) of China under which both companies would cooperate towards a coal project in NSW. GPCC was seeking a long-term contract for coal supply from C&A, primarily from a cooperative joint venture.⁴⁴

Petroleum and Natural Gas.—The WA Government announced in November its plans to establish a Petroleum Industry Training Center in Perth to provide hands-on training in courses ranging from basic elements in earth sciences and petroleum engineering to advanced levels in production, processing, and well-testing techniques. The center, supported by a number of Australian oil companies, was to begin operating late in 1995.⁴⁵

Approval was given in November to Mobil Oil Australia Ltd. and Shell Australia Ltd. by the Port of Melbourne Authority to bring oil tankers into Western Port on the Victorian coast following their acceptance of an oil spill contingency plan. This would allow the companies to store and transfer oil at the Crib Point Terminal. The project, however, was not expected to be implemented until production from the offshore Gippsland oilfields declined to much lower levels. It would then be viable for Mobil and Shell to ship in crude from elsewhere to inject into the pipelines to their Melbourne (Altona and Geelong, respectively) refineries.⁴⁶

On December 14, Caltex Australia Ltd., 75% owned by Texaco Inc. of the United States, and Ampol Ltd. announced a \$2.4 billion proposed merger, creating for the first time a leading majority Australian-owned refining and marketing company.⁴⁷ Upon approval by the Foreign Investment Review Board and the Trade Practices Commission, as well as ratification by the companies' shareholders, the merger would represent the definitive phase of a restructuring that has seen the number of major downstream oil groups in Australia reduced from nine to five since 1981. Caltex and Ampol, individually, were the smallest of the five, having 17.3% and 14.7% shares of the Australian retail petroleum market, respectively, according to the Australian Institute of Petroleum Ltd. The merger, however, would displace Shell, which led the market with a 26.8% share. The merged company would draw petroleum products from its two refineries, the Kurnell Refinery in NSW and the Lytton Refinery in QLD.⁴⁸

The total number of petroleum exploration and development wells drilled during 1994 (169) was 7 less than the number drilled during 1993 (176). The number of onshore exploration wells drilled in 1994 (82) was 9 more than that in 1993 (73). The number of offshore exploration wells drilled (46) was 2 less than the number drilled in 1993 (48). The total number of exploration wells drilled in 1994 (128) increased 6% from the number drilled in 1993 (121). The total number of development wells drilled (41) was 14 less than that in 1993 (55), with 16 wells drilled onshore and 25 drilled offshore, compared to 35 and 20 wells,

respectively, drilled in 1993. The total meters drilled for exploration and development wells in 1994 (411,338) was 15% more than that drilled in 1993 (356,815). In seismic survey activity during 1994, the total number of line kilometers recorded (160,628) was marginally less than the number (162,934) recorded in 1993 and less than one-half the number (351,999) recorded in 1992.⁴⁹

Production from Australia's largest energy development undertaking, the massive North West Shelf Gas (NWS Gas) project on the continental shelf about 140 km offshore of Dampier, WA, continued to progress steadily during the year. NWS Gas consisted primarily of providing natural gas to WA through the State Energy Commission of WA (SECWA), supplying liquefied natural gas (LNG) to Japan, and producing gas condensate for domestic and international refineries.

The Goldfields Gas Transmission Joint Venture (GGTJV) submitted a detailed proposal outlining design, construction, and operation plans to the WA Government for the 1,480-km, \$365 million, "Gas to the Goldfields" pipeline project. Although final approval and granting of the pipeline license were not expected until early 1995, relevant WA Government and local authorities had already accepted provisionally the proposed pipeline route and accorded acceptance of the environmental plan. Upon completion, the pipeline would transport natural gas originating from the North West Shelf through the Pilbara region of WA to the State's Eastern Goldfields at Kalgoorlie and Kambalda. Energy cost reductions of between 30% and 50% were anticipated by the gold mining industry because of the substitution of gas-based energy for diesel-based or coal-based power generation once the underground pipeline was completed, expected to be in 1996. With the availability of cheaper energy resulting from gas piped to nearby nickel producers, a number of low-grade nickel laterite deposits discovered in the 1970's also were expected to become viable.⁵⁰ The pipeline would transport gas drawn from the main pipeline between Dampier and Bunbury, through the Pilbara iron ore area, and through the eastern goldfields to the nickel operations at Kambalda. Partners in GGTJV were WMC, 62.664%, Normandy Poseidon Ltd., 25.493%, and BHP Minerals, 11.843%. Australia's largest gas pipeline operator, AGL Pipelines, would be the pipeline operator.⁵¹

Uranium.—The Government signed in August contracts to sell the last remaining portions of the Commonwealth Uranium Stockpile. The stockpile, managed by the Government's Department of Primary Industries and Energy, was located at the Ranger Mine near the town of Jabiru, NT, and at Lucas Heights, Sydney, NSW.⁵² The Government began in 1993 the sale of its 2,053-mt stockpile; most was to be used for power generation in North America.⁵³

WMC announced in August plans to conduct a \$5 million feasibility study for a major expansion at its Olympic Dam multimetal mine at Roxby Downs Station, 560 km

northwest of Adelaide, SA. The study was expected to be completed by mid-1995, with a final decision made by February 1996.⁵⁴ The \$55 million production optimization program started in 1993 was scheduled for completion during 1995, increasing output to 1,500 mt/a of uranium.⁵⁵ All of Olympic Dam's uranium production was sold and exported under long-term contracts to utilities in Europe, Japan, and the United States.

The Commonwealth Government's 12-year-old policy of restricting uranium production to three sites was renewed in September 1994 by the Government.⁵⁶ The mines involved continued to be the operational Olympic Dam Mine in SA and the Ranger Mine in the Alligator Rivers region of the NT. The third permissible site, Queensland Mines Ltd.'s Nabarlek Mine, also in the Alligator Rivers region of the NT, was depleted of reserves and closed in 1988. Processing and exporting of its stockpiled ore was completed in 1990. Thus, the "three mines" policy continued to be in practice a "two mines" policy, as the export permit holders, Energy Resources of Australia Ltd. (Ranger) and WMC (Olympic Dam), were the only ones with viable mines. The Commonwealth Government had de facto control over uranium mining by controlling the licenses for the export of uranium-bearing ores and by prohibiting further downstream involvement in the nuclear fuel cycle, including enrichment or other value-added processes.

Reserves

Australia has a sound resource base of a diverse range of minerals. It is self-sufficient in most minerals of economic importance. However, in spite of extensive exploration, the country still appears to be deficient in chromite, mercury, mica, PGM, and sulfur. Major minerals with known 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 communications and transportation infrastructure of Australia was well developed. There were 837,872 km of roads, including 243,750 km paved; 228,396 km gravel, crushed stone, or stabilized-soil surface; and 365,726 km unimproved earth. Inland waterways, of which there were about 8,368 km usable for mainly small, shallow-draft craft, were of little importance to the transportation industry.

The Government-owned railway system consisted of 40,478 km of track, 16,201 km of which was standard gauge. There were 1,130 km of electrified rail. A few hundred kilometers of rail was privately owned, most of which served the iron ore industry in WA. There were 241 principal airports with permanent-surface runways out of an aggregate of 440 in the country. International shipping ports included

Adelaide, Brisbane, Cairns, Darwin, Devonport, Fremantle, Geelong, Hobart, Launceston, Mackay, Melbourne, Sydney, and Townsville. The merchant marine fleet included 18 petroleum, oils, and lubricant tankers; 3 chemical tankers; 6 liquefied gas tankers; 2 combination ore-oil tankers; 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 in 1992 was 40 gigawatts.⁵⁷

In remote areas where mines, mills, or smelters are usually located, an individual mining company must provide its own 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 special emphasis on those in which Australia is abundantly endowed and for which it is among the world leaders in world supply, Australia would continue to be a significant world resource supplier well into the 21st century.

However, a growing awareness of the importance of environmental protection and conservation by Australians caused the Australian mining industry to employ and continue developing costly modern techniques for rehabilitation of mined lands and preservation of clean air and water. Since Australia became a major world producer for a number of minerals in the mid-1960's, mining has been in the more remote areas of the country, involving lands that would otherwise have been little utilized; however, this may not always be the case and the industry must remain vigilant in maintaining the environment.

By 1994, access to land had also become an important issue to the minerals industry. Entry to lands for exploration either already was prohibited or was made difficult over more than 30% of the country's land mass owing to restrictions in certain areas, such as national parks and Aboriginal reserves. The percentage of lands difficult to access likely would increase as land claims increase under the Native Title Act 1993.

Restricted access to conduct proper exploration programs because of environmental reasons, land rights issues, or any other reason also would mean even fewer funds would be available for exploration and capital investment, and this eventually may have a very significant effect on the development of large greenfields projects that would be needed to maintain the impetus of the mining and processing sectors.

New investment in the minerals industry was tending toward value added rather than the primary producing operations of the recent past and would likely become more vigorous in the near future.

- ¹Text prepared Aug. 1995.
- ²Excluding the centrally planned economic countries.
- ³Embassy of Australia, Washington, DC: Australia, v. 5, No. 8, Dec. 14 1994, p. 2.
- ⁴Australian Mining (Chippendale, New South Wales). v. 86, No. 8, Sept 1994, p. 19.
- ⁵Australia's fiscal year begins on July 1 and ends on June 30 of the year stated.
- ⁶Where necessary, values have been converted from Australian dollars (A\$) to U.S. dollars at the rate of A\$1.00=US\$0.7345.
- ⁷Comalco Ltd. 1994 Annual Report, 85 pp.
- ⁸AluNews (Stabekk, Norway). No. 4, Dec. 1994, p. 12.
- ⁹Alcoa of Australia Ltd. 1994 Annual Report, 33 pp.
- ¹⁰Australian Journal of Mining (Richmond North, Australia). v. 9, No. 95, Aug. 1994, p. 56.
- ¹¹Mintek Bulletin (Randburg, South Africa). No. 80, Jan. 1995, p. 1.
- ¹²Mining Journal (London). v. 322, No. 8269, Apr. 1, 1994, p. 235.
- ¹³_____. v. 323, No. 8300, Nov. 4, 1994, p. 325.
- ¹⁴The Miner (Sydney). Dec. 1994-Jan. 1995, p. 6.
- ¹⁵American Metal Market (New York). v. 103, No. 1, Jan 2, 1995, p. 16.
- ¹⁶Mining Journal (London). v. 323, No. 8289, Aug. 19, 1994, p. 129.
- ¹⁷Western Mining Corp. Holdings Ltd. 1994 Annual Report. 84 pp.
- ¹⁸Page 129 of work cited in footnote 16.
- ¹⁹Work cited in footnote 17.
- ²⁰Mining Journal (London). v. 323, No. 8304, Dec. 2, 1994, pp. 402-403.
- ²¹Page 129 of work cited in footnote 16.
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- ²³Page 401 of work cited in footnote 20.
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- ²⁷The Miner (Sydney). Oct. 1994, p. 14.
- ²⁸Australian Journal of Mining (Richmond North, Australia). v. 9, No. 99 Dec. 1994, p. 42.
- ²⁹Engineering and Mining Journal (Chicago). v. 195, No. 4, Apr. 1994, p. 11.
- ³⁰Pages 50, 52 of work cited in footnote 26.
- ³¹Resource Information Unit Ltd. Register of Australian Mining, 1994/95. 1994, p. 252, Subiaco, Western Australia.
- ³²Portman Mining Ltd. 1994 Annual Report, 47 pp.
- ³³Page 39 of work cited in footnote 28.
- ³⁴Mining Journal (London). v. 324, No. 8315, Feb. 24, 1995, p. 143.
- ³⁵Metal Bulletin (London). No. 7873, Apr. 21, 1994, p. 11.
- ³⁶Renison Goldfields Consolidated Ltd. 1994 Annual Report, 49 pp.
- ³⁷Mining Journal (London). v. 322, No. 8268, Mar. 25, 1994, p. 223.
- ³⁸Page 226 of work cited in footnote 31.
- ³⁹The Miner (Sydney). Aug. 1994, p. 17.
- ⁴⁰Industrial Minerals (London). No. 323, Aug. 1994, p. 8.
- ⁴¹Joint Coal Board, Sydney, Australia: Australian Coal Exports, No. 7-94/95, 2/95, 5 pp.
- ⁴²International Bulk Journal (London). v. 15, No. 2, Feb. 1995, p.15.
- ⁴³Page 211 of work cited in footnote 37.
- ⁴⁴Page 79 of work cited in footnote 26.
- ⁴⁵Petroleum Gazette (Melbourne). v. 29, No. 4, 1994/4, p. 32.
- ⁴⁶Work cited in footnote 45.
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- ⁴⁸U.S. Embassy, Canberra. State Dep. Telegram 06859, Dec. 2, 1994, 1 p.
- ⁴⁹Bureau of Resource Sciences, Canberra, Australia: Australian Petroleum Exploration and Development Statistics, Feb. 1995, 2 pp.
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- ⁵¹Page 22 of work cited in footnote 28.
- ⁵²U.S. Embassy, Canberra. State Dep. Telegram 04873, Aug. 26, 1994, 1 p.
- ⁵³Mining Journal (London). v. 323, No. 8290, Aug. 26, 1994, p. 156.
- ⁵⁴Page 129 of work cited in footnote 16.
- ⁵⁵Work cited in footnote 17.
- ⁵⁶Page 6 of work cited in footnote 24.
- ⁵⁷U.S. Central Intelligence Agency, Washington, DC: The World Factbook 1994, pp. 24-25.

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TABLE 1
AUSTRALIA: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity		1990	1991	1992	1993	1994 e/
METALS						
Aluminum:						
Bauxite, gross weight	thousand tons	41,400	40,500	39,700	41,300 r/	41,700 3/
Alumina	do.	11,200	11,700	11,800 r/	12,600 r/	12,900 3/
Metal, refined:						
Primary	do.	1,230	1,230	1,250 r/	1,380	1,320 3/
Secondary		32,900	29,600	40,000	40,000 e/	40,000
Antimony, Sb content of ores and concentrates						
		1,420	1,500	1,700	1,700 e/	1,700
Bismuth, mine output, Bi content e/						
		400	400	--	--	--
Cadmium:						
Mine output, Cd content		2,100	2,500	2,520	2,380 r/	2,280 3/
Metal, smelter (refined)		638	1,080	1,000	951 r/	910 3/
Cobalt: e/						
Mine output, analytic content of:						
Nickel ore		1,400	1,100	700	500 r/	250
Nickel concentrate		400	500	500	750 r/	950
Zinc concentrate		70	70	70	70	70
Total		1,870	1,670	1,270	1,320 r/	1,270
Recovered cobalt, including that from imported source material e/						
		1,200	1,400	1,600	1,700	2,100
Columbium-tantalum concentrate, gross weight						
		529	703	656	495	700 3/
Copper:						
Mine output, Cu content	thousand tons	327	320	371 r/	360 r/	391 3/
Metal:						
Smelter:						
Primary	do.	192	195	304	323 r/	315 3/
Secondary e/		10,000	10,000	10,000	10,000	10,000
Refined:						
Primary	thousand tons	250	244	271	285 r/	312 3/
Secondary e/		24,000	35,000	32,000	24,000 r/	24,000
Gold:						
Mine output, Au content	kilograms	244,000	234,000	243,000 e/	247,000	256,000 3/
Metal:						
Refined:						
Primary	do.	255,000	250,000 e/	250,000 e/	284,000	303,000 3/
Secondary	do.	18,700	20,000 e/	8,000 e/	8,350	8,500
Iron and steel:						
Iron ore:						
Gross weight	thousand tons	111,000	117,000	112,000 r/	121,000	128,000 3/
Fe content	do.	69,800	68,700	69,800 r/	74,800	80,900
Metal:						
Pig iron	do.	6,130	5,650	6,390	6,770	7,470 3/
Ferroalloys: e/ 4/						
Ferromanganese		70,000	45,000	55,000	75,000	100,000
Ferrosilicon		20,000	19,000	17,000 r/	--	--
Silicomanganese		65,000	74,000	75,000	75,000	100,000
Total		155,000	138,000	147,000	150,000	200,000
Steel, crude	thousand tons	6,670	6,020	6,870	7,840 r/	8,460 3/
Semimanufactures e/		3,000	3,000	3,000	1,790 3/	4,000
Lead:						
Mine output, Pb content	thousand tons	570	579	577 r/	519 r/	537 3/
Metal:						
Primary:						
Bullion, for export	do.	172	172	231	224	197 3/
Refined	do.	212	220	215	221	212 3/
Total	do.	384	392	446	445	409 3/
Secondary excluding remelt	do.	17	19	17	22 r/	17
Manganese ore (metallurgical):						
Gross weight	do.	1,920	1,480	1,210 r/	2,090 r/	1,990 3/
Mn content e/	do.	909	701	568 r/	1,040 r/	950
Nickel:						
Mine output, Ni content	do.	67	69	58	65	79 3/
Metal, smelter (refined Ni and Ni content of oxide)	do.	43 r/	50	51	50	46 3/
Platinum-group metals: e/						
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/ 2/

(Metric tons unless otherwise specified)

Commodity	1990	1991	1992	1993	1994 e/
METALS--Continued					
Rare-earth metals, monazite concentrate: e/					
Gross weight	11,000	7,000	6,000 r/	16,000 r/	6,000
Monazite content	6,050	3,850	3,300 r/	8,800 r/	3,300
Silver:					
Mine output, Ag content	1,170	1,180	1,220 r/	1,090 r/	1,050 3/
Metal, refined	419	400 e/	400 e/	345 3/	362 3/
Tin:					
Mine output, Sn content 5/	7,380	5,700	6,610 r/	8,060 r/	7,100 3/
Metal, refined:					
Primary	312	268	240 r/	222	315 3/
Secondary e/	200	300	360 r/	250	260
Titanium concentrates, gross weight:					
Ilmenite thousand tons	1,600	1,360	1,790 r/	1,800 r/	1,780 3/
Leucoxene	19,000	18,000	20,000 r/	21,000 r/	35,000 3/
Rutile	245,000	201,000	83,000 r/	186,000 r/	233,000 3/
Tungsten, mine output, W content	1,090	237	159 r/	23	11 3/
Uranium, mine output, U content	3,530	3,780	2,340 r/	2,260	2,600 3/
Zinc:					
Mine output, Zn content thousand tons	940	1,020	1,030 r/	1,010 r/	995 3/
Metal, smelter:					
Primary do.	304	322	333 r/	316 r/	323 3/
Secondary e/	4,500	4,500	4,500	4,500	4,500
Zirconium concentrates, gross weight thousand tons	497	292	355 r/	414 r/	502 3/
INDUSTRIAL MINERALS					
Abrasives, natural: e/					
Beach pebble	1,500	2,000	2,000	2,000	2,000
Garnet	20,000	25,000	25,000	25,000	25,000
Barite e/	11,000	11,000	11,000	11,000	11,000
Cement, hydraulic thousand tons	7,070	6,110	5,410	5,500	6,000
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 6/	25,000	25,000	25,000	25,000	25,000
Fuller's earth (attapulgit) e/	20,000	15,000	15,000	15,000	15,000
Kaolin and ball clay 6/	200,000	190,000	180,000	180,000	2,000
Other 6/ thousand tons	1,000	1,000	1,000	1,000	1,000
Diamond:					
Gem thousand carats	17,300	18,000	18,100 r/	18,800	19,700 3/
Industrial do.	17,300	18,000	22,100 r/	23,000	24,000 3/
Total do.	34,600	36,000	40,200 r/	41,800	43,700 3/
Diatomite e/	10,000	11,000	11,000	11,000	11,000
Feldspar including nepheline syenite e/	16,000	16,000	15,000	15,000	16,000
Gemstones, other than diamond: e/					
Opal value, thousands	\$86,700 3/	\$85,000	\$85,000	\$90,000	\$100,000
Sapphire do.	\$40,600 3/	\$40,000	\$40,000	\$40,000	\$50,000
Other do.	\$800	\$900	\$900	\$1,000	\$1,500
Total do.	\$128,000	\$126,000	\$126,000	\$131,000	\$152,000
Gypsum e/ thousand tons	1,800	2,000	2,000	2,000	2,000
Kyanite e/	750	800	800	800	800
Lime e/	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000
Magnesite e/	60,000	100,000	262,000	261,000	286,000 3/
Nitrogen, N content of ammonia	385,000	414,000	392,000 r/	398,000	400,000
Perlite, crude e/	5,000	5,000	5,000	5,000	5,000
Phosphate rock	14,000	4,000	2,000	2,000	2,100
Salt thousand tons	7,230	7,790	7,690 r/	7,740 r/	7,690 3/
Sillimanite e/ 7/	100	100	100	100	100
Spodumene, concentrate e/	40,000	40,700 3/ 7/	42,500 3/ 7/	40,000	53,000
Stone, sand and gravel: e/					
Construction sand 9/ thousand tons	30,000	30,000	30,000	30,000	30,000
Gravel 9/ do.	15,000	15,000	15,000	15,000	15,000
Dolomite do.	1,000	1,000	10,000	10,000	10,000

See footnotes at end of table.

TABLE 1--Continued
 AUSTRALIA: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity	1990	1991	1992	1993	1994 e/
INDUSTRIAL MINERALS--Continued					
Stone, sand and gravel: e/--Continued					
Limestone:					
For cement	thousand tons	6,000	6,000	6,000	6,000
For other uses	do.	6,000	6,000	6,000	6,000
Silica in the form of quartz, quartzite, glass sand	do.	2,000	2,000	2,000	2,000
Other: 9/					
Crushed and broken stone	do.	65,000	65,000	65,000	65,000
Dimension stone	do.	100	100	100	100
Unspecified	do.	30,000	30,000	30,000	30,000
Sulfur, byproduct:					
Metallurgy	do.	223 r/	223	295 r/	299 r/
Petroleum	do.	70	75 r/	75	85
Total	do.	293 r/	298 r/	370 r/	384 r/
Talc, chlorite, pyrophyllite, steatite e/		205,000	216,000	215,000	215,000
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Bituminous and subbituminous	thousand tons	199,000	206,000	224,000	226,000 r/
Lignite	do.	47,700	52,100	50,200	48,500 r/
Total	do.	247,000	258,000	274,000	274,000 r/
Coke, metallurgical e/	do.	4,530 3/	4,000	4,000	4,500
Fuel briquets e/	do.	750	750	750	750
Gas, natural, marketed	million cubic meters	20,700	21,700	23,500	24,400
Natural gas liquids	thousand 42-gallon barrels	23,000	22,300	23,400	23,000
Peat 9/ e/		11,000	11,000	11,000	11,000
Petroleum:					
Crude	thousand 42-gallon barrels	211,000	199,000	195,000	186,000 r/
Refinery products:					
Gasoline:					
Aviation	do.	1,350	959	1,080	1,010
Motor	do.	103,000	107,000	108,000	112,000
Jet fuel	do.	21,800	23,300	24,700	27,100
Kerosene	do.	846	315	688	289
Distillate fuel oil	do.	67,500	68,900	65,900	70,500
Residual fuel oil	do.	15,700	17,400	15,800	14,800
Lubricants	do.	4,210	4,230	4,380	4,260
Liquefied petroleum gas	do.	4,850	5,650	5,860	6,320
Bitumen	do.	3,550	3,290	3,560	4,300
Unspecified	do.	5,560	6,760	5,790	6,120
Refinery fuel and losses	do.	2,310	5,760	6,890	3,520
Total	do.	231,000	243,000	243,000	250,000

e/ Estimated. r/ Revised.

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

2/ Includes data available through Aug. 4, 1995.

3/ Reported figure.

4/ Data are for years ending Nov. 30 of that stated for plants owned by the Broken Hill Pty. Co. Ltd.

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

6/ Excludes production from Western Australia.

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

8/ Data are for fiscal years ending June 30 of that stated.

9/ Excludes data from some States.

TABLE 2
AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1994 1/

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities 2/	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	1,700
Do.	do.	Pinjarra Refinery, WA	2,950
Do.	do.	Wagerup Refinery, WA	1,700
Do.	Worsley Alumina Pty. Ltd., operator. [Reynolds Australia Alumina Ltd., 56%; The Shell Co. of Australia Ltd., 37.5%; Kobe Alumina Associates (Australia) Pty. Ltd., 10%; and Nissho Iwai Alumina, 2.5%]	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.	Alcan Australia 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%	Garibaldi-Eleanora (Hillgrove) Mine, NSW	3
Bauxite	Nabalco Pty. Ltd., operator. (Swiss Aluminium Australia Ltd., 70%; and Gove Aluminium Ltd., 30%)	Gove Mine, NT	7,000
Do.	Alcoa of Australia Ltd., 100%	Huntly, Jarrahdale, and Williwdale Mines, WA	22,000
Do.	Worsley Alumina Pty. Ltd., operator. [Reynolds Australia Alumina Ltd., 56%; The Shell Co. of Australia Ltd., 37.5%; Kobe Alumina Associates (Australia) Pty. Ltd., 10%; and Nissho Iwai Alumina, 2.5%]	Mount Saddleback (Worsley) Mine, WA	5,000
Do.	Comalco Aluminium Ltd., 100%	Weipa operations, 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	1,500
Do.	BHP Steel Collieries Division, 100%	Appin underground mine, NSW	2,400
Do.	Powercoal Pty. Ltd., 100%	Awaba State underground mine, NSW	1,000
Do.	Coalex Pty. Ltd., 95% and manager; and Sumitomo Coal Mining Co. Ltd., 5%	Baal Bone underground mine, NSW	3,000
Do.	Central Queensland Coal Associates, 100%. (BHP Australia Coal Ltd., 44.72% and operator; QCT Resources, 27.78%; Mitsubishi Development Pty. Ltd., 13.33%; AMP society, 8.61%; and Pancontinental Mining Ltd., 5.56%)	Blackwater open cut, QLD	5,000
Do.	Pacific Coal Pty. Ltd., 57.19%, operator; ARCO Coal Australia Inc., 31.42%; Electric Power Development Co., 7.97%; and Joint Coal Development Co. Ltd., 3.42%	Blair Athol open cut, QLD	8,500
Do.	Clutha Coal Pty. Ltd., 100%	Brimstone No. 1 underground mine, NSW	2,400
Do.	Camberwell Coal Pty. Ltd., operator. (Navidale Pty. Ltd., 50%; Toyota Tsusho Corp., 40%; and Dia Coal Ltd., 10%)	Camberwell open cut, NSW	2,400
Do.	Coalex Pty. Ltd., 80% and manager; Kyodo Oil Aust Pty. Ltd. (Japan), 10%; and Yukong Ltd. (Republic of Korea), 10%	Clarence underground mine, NSW mine, NSW	1,900
Do.	Powercoal Pty. Ltd., 100%	Cooranbong underground mine, NSW	1,200
Do.	BHP Steel Collieries Division, 100%	Cordeaux underground mine, NSW	2,800

See footnotes at end of table.

TABLE 2--Continued
 AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1994 1/

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities 2/	Annual capacity e/
Coal, black--Continued	Curragh Queensland Mining Ltd., operator. [ARCO Coal Australia Inc., 60%; R.W. Miller Ltd., 30%; and Mitsui Coal Development (Australia) Ltd., 10%]	Curragh open cut, QLD	6,600
Do.	Capricorn Coal Management Pty. Ltd., manager. (The Shell Co. of Australia Ltd., 46.75%; Minproc Energy Pty. Ltd., 26.06%; British Coal Corp., 14.81%; and Ruhrkohle Australia Pty. Ltd., 12.38%)	German Creek open cut and underground mine, QLD	6,000
Do.	Central Queensland Coal Associates, 100%. (BHP Australia Coal Ltd., 44.72% and operator; QCT Resources, 27.78%; Mitsubishi Development Pty. Ltd., 13.33%; AMP society, 8.61%; and Pancontinental Mining Ltd., 5.56%)	Goonyella-Riverside open cuts, QLD	9,250
Do.	Arco Coal Australia Inc., 80% and manager; Mitsui and Co. Ltd., 15%; and MLC Coal Investments Pty. Ltd., 5%	Gordonstone underground mine, QLD	4,200
Do.	Oakbridge Ltd., 100%	Gretley underground mine, NSW	1,300
Do.	Coal and Allied Industries Ltd., 100%	Hunter Valley No. 1 and No. 2 open cuts, NSW	7,500
Do.	Electricity Trust of SA, 100%	Leigh Creek open cut mine, SA	3,000
Do.	Coal and Allied Industries Ltd., 80% and manager; and Pohang Iron and Steel Co. Ltd., 20%	Mount Thorley open cut, NSW	6,500
Do.	Powercoal Pty. Ltd., 100%	Munmorah State underground mine, NSW	1,200
Do.	do.	Myuna underground mine, NSW	1,500
Do.	MIM Holdings Ltd., 75%; and Agip Coal Australia Pty. Ltd., 25%	Newlands open cut, QLD	4,000
Do.	Powercoal Pty. Ltd., 100%	Newstan State underground mine, NSW	2,500
Do.	Central Queensland Coal Associates, 100%. (BHP Australia Coal Ltd., 44.72% and operator; QCT Resources, 27.78%; Mitsubishi Development Pty. Ltd., 13.33%; AMP society, 8.61%; and Pancontinental Mining Ltd., 5.56%)	Norwich Park open cut, QLD	4,500
Do.	do.	Peak Downs open cut, QLD	5,500
Do.	Oakbridge Ltd., 100%	Pelton-Ellalong underground mine, NSW	2,000
Do.	Central Queensland Coal Associates, 100%. (BHP Australia Coal Ltd., 44.72% and operator; QCT Resources, 27.78%; Mitsubishi Development Pty. Ltd., 13.33%; AMP society, 8.61%; and Pancontinental Mining Ltd., 5.56%)	Saraji open cut, QLD	4,700
Do.	Shell Australia Ltd., 100%	South Bulli underground mine, NSW	3,000
Do.	Kembla Coal and Coke Pty. Ltd., 100%	Tahmoor underground mine, NSW	4,100
Do.	FAI Mining Ltd., 70% and manager; Marubeni Coal Pty. Ltd., 14%; Taiheiyu Australia Pty. Ltd., 10%; Chelsea Coal Pty. Ltd., 3%; and Kokan Kogyo (Australia) Pty. Ltd., 3%	Teralba underground mine, NSW	1,700
Do.	BHP Steel Collieries Division, 100%	Tower underground mine, NSW	1,600
Do.	Ulan Coal Mines Ltd., manager. (Mitsubishi Development Pty. Ltd., 49%; Exxon Coal Authorities Australia Ltd., 36%; and the State Superannuation Board of NSW, 15%)	Ulan No. 2 underground and Ulan open cut mines, NSW	5,500
Do.	Wambo Mining Corp. Pty. Ltd., 100%	Wambo underground and open cut mines, NSW	4,000
Do.	Kembla Coal and Coke Pty. Ltd., 100%	West Cliff underground mine, NSW	3,000
Do.	FAI Mining Ltd., 70% and manager; Marubeni Coal Pty. Ltd., 14%; Taiheiyu Australia Pty. Ltd., 10%; 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 State underground mine, NSW	1,800
Coal, brown	Generation Victoria (formerly State Electricity Commission of VIC), 100%	Latrobe Valley open cut mines (Loy Yang, Morwell, and Yallourn), VIC	48,000
Copper	Denehurst Ltd., 50% and manager; and Macquarie Resources Ltd., 50%	Benambra Mine, VIC	18
Do.	Poseidon Gold Ltd., manager, 40%; Billiton Australia Gold Pty. Ltd., 30%; Newcrest Mining Ltd., 20%; and Kobe Alumina Associates (Australia) Pty. Ltd., 10%	Boddington Mine, WA	10
Do.	GSM Metals Pty. Ltd., operator. (Golden Shamrock Mines Ltd., 70%; and private interests, 30%)	Cobar (CSA) Mine, NSW	35
Do.	Poseidon Gold Ltd., 100%	Gecko Mine, NT	17
Do.	Nord Pacific Ltd., operator. [Straits Engineers Pte. Ltd. (Singapore), 60%; and Nord Pacific Ltd., 40%]	Girilambone Mine, NSW	15
Do.	Murchison Zinc Co. Pty. Ltd., operator. (Normandy Poseidon Ltd., 45%; Esso Australia Resources Ltd., 35%; and Aztec Mining Co. Ltd., 20%)	Golden Grove Project (includes Gossan Hill and Scuddles Mines), WA	4

See footnotes at end of table.

TABLE 2--Continued
 AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1994 1/

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities 2/	Annual capacity e/
Copper--Continued		Gunpowder Copper Ltd., operator. (Adelaide Brighton Cement Holdings Ltd., 100%)	Gunpowder Mine, QLD	9
Do.		Aberfoyle Ltd., 100%	Hellyer Mine, TAS	4
Do.		Mount Isa Mines Ltd., operator. (MIM Holdings Ltd., 100%)	Hilton Mine at Mount Isa, QLD	180
Do.		Horseshoe Gold Mine Project, manager. (Sabminco NL, 57%; and Asian Pacific Resources Pty. Ltd., 43%)	Horseshoe Mine, WA	15
Do.		Mount Isa Mines Ltd., operator. (MIM Holdings Ltd., 100%)	Mount Isa Smelter, QLD	175
Do.		Gold Mines of Australia Ltd., 100%	Mount Lyell Mine, TAS	25
Do.		Western Mining Corp. Holdings Ltd., 100%	Nifty Mine, WA	16
Do.		North Broken Hill Peko Ltd., operator, 80%; Sumitomo Metal Mining Co. Ltd., 13.3%; and Sumitomo Corp., 6.7%	Northparkes Mine, NSW	65,000
Do.		Olympic Dam Operations Ltd., manager. (Western Mining Corp. Holdings Ltd., 100%)	Olympic Dam Mine, SA	66
Do.		do.	Olympic Dam Refinery, SA	50
Do.		do.	Olympic Dam Smelter, SA	70
Do.		Peak Gold Mines Pty. Ltd., operator. (CRA Ltd., 100%)	Peak Mine, NSW	3
Do.		Southern Copper Ltd., manager. (CRA Ltd., 60%; Furukawa Co. Ltd., 30%; and Nissho-Iwai Corp., 10%)	Port Kembla Refinery, NSW	80
Do.		do.	Port Kembla Smelter, NSW	80
Do.		Red Dome Pty. Ltd., operator. (Niugini Mining Ltd., 100%)	Red Dome Mine, QLD	6
Do.		Pasminco Ltd., 100%	Rosebery Mine, TAS	4
Do.		Australian Resources and Mining Co. NL, 100%	Selwyn (Starra) Mine, QLD	16
Do.		Newcrest Mining Ltd., 100%	Telfer Mine, WA	2
Do.		Pancontinental Mining Ltd., manager, 100%	Thalanga Mine, QLD	9
Do.		Copper Refineries Pty. Ltd., operator. (MIM Holdings Ltd., 100%)	Townsville Refinery, QLD	175
Do.		Denehurst Ltd., 100%	Woodlawn Mine, NSW	8
Diamond	thousand carats	Argyle Diamond Mines Pty. Ltd., manager. (CRA Ltd., 59.7%; and Ashton Mining Ltd., 40.3%)	Argyle Mine (AK-1 lamproite pipe and alluvial deposits), WA	40,000
Do.	do.	Poseidon Bow River Diamond Mine Ltd., 100%.	Bow River Mine, WA	1,000
Gas, condensate	thousand 42-gallon barrels per day	Woodside Petroleum Pty. Ltd., manager; BP Developments Australia Ltd.; Chevron Asiatic Oil Co.; Shell Development (Australia) Pty. Ltd.; BHP Petroleum (North West Shelf) Pty. Ltd.; and Japan Australia Oil (MiMi) Pty. Ltd., 16.67% each	North West Shelf Project, 140 km offshore from Dampier, WA	60
Gas, natural	million cubic meters per day	do.	North West Shelf Project, 140 km offshore from Dampier, WA	20
Gold	kilograms	Poseidon Gold Ltd., 100%	Big Bell Mine, WA	5,500
Do.	do.	Poseidon Gold Ltd., manager, 40%; Billiton Australia Gold Pty. Ltd., 30%; Newcrest Mining Ltd., 20%; and Kobe Alumina Associates (Australia) Pty. Ltd., 10%	Boddington Mine, WA	11,000
Do.	do.	Poseidon Gold Ltd., operator, 62%; and Forrestania Gold NL, 38%	Bounty Mine, WA	2,500
Do.	do.	Great Central Mines NL, 100%	Bronzewing Mine, WA	6,200
Do.	do.	Dominion Mining Ltd., 100%	Cosmo Howley Mine, NT	1,700
Do.	do.	Perilya Mines NL, 100%	Fortnum Mine, WA	1,500
Do.	do.	Poseidon Gold Ltd., 100%	Golden Crown Mine, WA	1,150
Do.	do.	North Flinders Mines Ltd., 100%	The Granites Mine, NT	4,750
Do.	do.	Golden Valley Joint Venture, manager. (Placer Pacific Ltd., 60%; and Delta Gold NL, 40%)	Granny Smith Mine, WA	4,800
Do.	do.	Alcoa of Australia Ltd., 100%	Hedges Mine, WA	4,900
Do.	do.	Hampton Areas Australia Ltd., operator. (Gold Mines of Kalgoorlie Ltd., 100%)	Jubilee Mine, WA	2,300
Do.	do.	Australian Gold Refineries, 100% (State of WA agency)	Kalgoorlie Refinery, WA	46,000
Do.	do.	Kalgoorlie Consolidated Gold Mines Pty. Ltd., manager. (Gold Mines of Kalgoorlie Ltd., 50%; and Homestake Gold of Australia Ltd., 50%)	Kalgoorlie Super Pit (Fimiston), WA	23,000
Do.	do.	Western Mining Corp. Holdings Ltd., 100%	Kambalda-St. Ives Mines, WA	7,500
Do.	do.	Delta Gold NL, manager, 50%; and Peko Gold Ltd., 50%	Kanowna Belle Mine, WA	5,600
Do.	do.	Kidston Gold Mines Ltd., 100%	Kidston Mine, QLD	6,000
Do.	do.	Sons of Gwalia Ltd., 100%	Leonora Mine, WA	2,800
Do.	do.	Dominion Mining Ltd., 100%	Meekatharra area mines, WA	2,300
Do.	do.	Kalgoorlie Consolidated Gold Mines Pty. Ltd., manager. (Gold Mines of Kalgoorlie Ltd., 50%; and Homestake Gold of Australia Ltd., 50%)	Mount Charlotte Mine, WA	4,300
Do.	do.	Reynolds Australia Gold Operations Ltd., 100%	Mount Gibson Mine, WA	3,450
Do.	do.	Mount Leyshon Gold Mines Ltd., 100%	Mount Leyshon Mine, QLD	7,000

See footnotes at end of table.

TABLE 2--Continued
 AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1994 1/

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities 2/	Annual capacity e/
Gold--Continued	kilograms	Hill 50 Gold Mine NL, operator. (Western Mining Corp. Holdings Ltd., 100%)	Mount Magnet-Hill 50 Mines, WA	6,600
Do.	do.	Mining Corp. of Australia Ltd., 100%	Mount Pleasant Mine, WA	1,750
Do.	do.	Zapopan NL, 100%	Mount Todd Mine, NT	3,100
Do.	do.	Newcrest Mining Ltd., manager, 80%; and Titan Resources NL, 20%	New Celebration Mine, WA	4,750
Do.	do.	North Broken Hill Peko Ltd., operator, 80%; Sumitomo Metal Mining Co. Ltd., 13.3%; and Sumitomo Corp., 6.7%	Northparkes Mine, NSW	2,200
Do.	do.	Olympic Dam Operations Ltd., manager. (Western Mining Corp. Holdings Ltd., 100%)	Olympic Dam Mine, SA	1,500
Do.	do.	Newcrest Mining Ltd., 100%	Ora Banda Mine, WA	2,650
Do.	do.	MIM Holdings Ltd., 100%	Pacific precious metals refinery, NSW	1,900
Do.	do.	Pajingo Gold Mine Pty. Ltd., 100%	Pajingo Mine, QLD	1,900
Do.	do.	Peak Gold Mines Pty. Ltd., operator. (CRA Ltd., 100%)	Peak Mine, NSW	3,700
Do.	do.	Australian Gold Refineries, 100% (State of WA agency)	Perth Refinery (Newburn), WA	95,000
Do.	do.	Renison Goldfields Consolidated Ltd., 100%	Pine Creek Mine, NT	3,100
Do.	do.	Plutonic Resources Ltd., 100%	Plutonic Mine, WA	5,300
Do.	do.	Red Dome Pty. Ltd., operator. (Niugini Mining Ltd., 100%)	Red Dome Mine, QLD	2,000
Do.	do.	Australian Resources Ltd., 100%	Selwyn (Starra) Mine, QLD	3,600
Do.	do.	Stawell Gold Mines Joint Venture, manager. (MPI Gold Pty. Ltd., 50%; and Pittston Mineral Ventures of Australia, 50%)	Stawell Mine, VIC	1,100
Do.	do.	Zapopan NL, 100%	Tanami Mine, NT	1,900
Do.	do.	do.	Telfer Mine, WA	12,000
Do.	do.	Gold Mines of Australia Ltd., 100%	Temora Mine, NSW	2,250
Do.	do.	Carpentaria Gold Pty. Ltd., 100%	Tick Hill Mine, QLD	5,500
Do.	do.	Westgold Resources NL, 100%	Tuckabianna Mine, WA	1,700
Do.	do.	Wiluna Mines Ltd., 100% (formerly Asarco Australia Ltd.)	Wiluna Mine, WA	4,230
Do.	do.	Ross Mining NL, 100%	Wirralie Mine, QLD	3,200
Do.	do.	Gold Mines of Australia Ltd., 100%	Youanmi Mine, WA	2,350
Ilmenite		Cable Sands (WA) Pty. Ltd., operator. [Nissho Iwai Corp. (Japan), 100%]	Busselton East and Waroona Mines, WA	100
Do.		RGC Mineral Sands Ltd., manager. (Renison Goldfields Consolidated Ltd., 100%)	Capel Mine, WA	180
Do.		Minproc Chemical Co. Pty. Ltd., 50% and manager; and Kerr-McGee Chemical Corp. Western Australia Pty. Ltd., 50% (Tiwest Joint Venture)	Cooljarloo Mine, WA	480
Do.		do.	Eneabba West Mine, WA	600
Do.		Mineral Deposits Ltd., operator. (BHP Minerals Ltd., 100%)	Hawks Nest (Stockton, Viney Creek, and Viney Creek North) Mines, NSW	10
Do.		Consolidated Rutile Ltd., 100%	North Stradbroke Island (Bayside and Gordon) Mines, QLD	850
Do.		Westralian Sands Ltd., 100%	Yoganup North Mine, WA	300
Iron ore		Hamersley Iron Pty. Ltd., 100%	Brockman No. 2 Mine, WA	4,500
Do.		Channar Management Services, manager. [Hamersley Iron Pty. Ltd., 60%; and CMIEC (Channar) Pty. Ltd., 40%, a People's Republic of China Government Agency]	Channar Mine, WA	5,500
Do.		Hamersley Iron Pty. Ltd., 100%	Mount Tom Price Mine, WA	28,000
Do.		BHP Iron Ore Ltd., 55% and manager; Pilbara Iron Pty. Ltd., 30%; Mitsui-Itochu Pty. Ltd., 10%; and CI Minerals Australia Pty. Ltd., 5%	Mount Whaleback Mine, WA	35,000
Do.		BHP Iron Ore Ltd., 55% and manager; BHP Australia Coal Pty. Ltd., 30%; CI Minerals Australia Pty. Ltd., 8%; and Mitsui Iron Ore Corp. Pty. Ltd., 7%	Nimingarra-Shay Gap-Sunrise Hill and Yarrarie Mines (Mount Goldsworthy extension project, WA)	6,500
Do.		Robe River Iron Associates, manager. (Peko Wallsend Operations Ltd., 35%; Robe River Mining Co. Pty. Ltd., 30%; Mitsui Iron Ore Development Pty. Ltd., 20%; Pannawonica Iron Associates, 10%; and Cape Lambert Iron Associates, 5%	Pannawonica-Deepdale (Robe River) Mine, WA	27,000
Do.		Hamersley Iron Pty. Ltd., 100%	Paraburdoo Mine, WA	15,000
Do.		Savage River Mines, operator. (Pickands Mather and Co. International, 100%)	Savage River Mine, TAS	1,500
Do.		BHP Iron Ore Ltd., 85%; CI Minerals Australia Pty. Ltd., 8%; and Mitsui Iron Ore Corp. Pty. Ltd., 7%	Yandi Mine, WA	6,500
Lead		Pasminco Ltd., 100%	Broken Hill (South) Mine, NSW	150
Do.		Billiton Australia Ltd., 42%; and private interests, 58%	Cadajebut Mine, WA	22

See footnotes at end of table.

TABLE 2--Continued
 AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1994 1/

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities 2/	Annual capacity e/
Lead--Continued	GSM Metals Pty. Ltd., operator. (Golden Shamrock Mines Ltd. 100%)	Cobar (CSA) Mine, NSW	4
Do.	Pasminco Ltd., 100%	Cockle Creek Smelter, NSW	30
Do.	Pasminco Ltd., 60%; and Korea Zinc Co. Ltd., 40%	Elura Mine, NSW	15
Do.	Aberfoyle Ltd., 100%	Hellyer Mine, TAS	45
Do.	McArthur River Mining Pty. Ltd., operator. (MIM Holdings Ltd., 70%; and ANT Minerals Pty. Ltd. holding the combined Japanese interests of Nippon Mining and Metals Co. Ltd., 15%; 15%; Mitsubishi Materials Corp., 5%; Mitsui & Co. Ltd., 5%; and Marubeni Corp., 5%)	McArthur River Mine, NT	45
Do.	Mount Isa Mines Ltd., manager. (MIM Holdings Ltd., 100%)	Mount Isa Mine, QLD	190
Do.	do.	Mount Isa Smelter, QLD	240
Do.	Peak Gold Mines Pty. Ltd., manager. (CRA Ltd., 100%)	Peak Mine, NSW	4
Do.	Pasminco Ltd., 100%	Port Pirie Refinery-Smelter, SA	220
Do.	do.	Rosebery Mine, TAS	15
Do.	Pancontinental Mining Ltd., manager, 100%	Thalanga Mine, QLD	15
Do.	Aztec Mining Co. Ltd., 100%	Woodcutters Mine, NT	10
Do.	Denehurst Ltd., 100%	Woodlawn Mine, NSW	14
Leucoxene	RGC Mineral Sands Ltd., manager. (Renison Goldfields Consolidated Ltd., 100%)	Capel Mine, WA	3
Do.	Minproc Chemical Co. Pty. Ltd., 50% and manager; and Kerr-McGee Chemical Corp. Western Australia Pty. Ltd., 50% (Tiwest Joint Venture)	Cooljarloo Mine, WA	10
Do.	Westralian Sands Ltd., 100%	Yoganup North Mine, WA	5
Manganese	Groote Eylandt Mining Co. Pty. Ltd., operator. (BHP Minerals Ltd., 100%)	Groote Eylandt Mine, NT	2,300
Do.	Portman Mining Ltd., 100% and manager	Woodie Woodie Mine, WA	400
Manganese alloys	Tasmanian Electro Metallurgical Co. Pty. Ltd., 100%	Bell Bay Smelter, TAS	260
Monazite	RZM Pty. Ltd., operator. [Nissho Iwai Corp. (Japan), 100%]	Tomago Mines, NSW	1
Do.	Westralian Sands Ltd., 100%	Yoganup North Mine, WA	2
Nickel	Outokumpu Australia Pty. Ltd. and Outokumpu Western Australia Pty. Ltd., 50% each and both wholly owned subsidiaries of Outokumpu Oy of Finland	Forrestania area mines, 375 km southeast of Perth, WA	8
Do.	Western Mining Corp. Holdings Ltd., 100%	Kalgoorlie Smelter, WA	80
Do.	do.	Kambalda Nickel Operations (KNO), WA	35
Do.	do.	Kwinana Refinery, WA	42
Do.	do.	Leinster Nickel Operations (LNO), WA	30
Do.	do.	Mount Keith Mine, WA	28
Do.	Queensland Nickel Joint Venture, manager. [QNI Ltd., 80%; and Nickel Resources North Queensland Pty. Ltd. (State of QLD agency), 20%]	Yabulu Refinery, QLD	30
Do.	Dominion Mining Ltd., 100%	Yakabindie Mine, WA 3/	24
Opal	Many small producers	Andamooka and Coober Pedy areas, SA; Lightning Ridge area, NSW	NA
Petroleum thousand 42-gallon barrels per day	Petroleum Refineries (Australia) Pty. Ltd., manager. (Mobile Oil Australia Ltd., 100%)	Altona Refinery, VIC	103
Do.	do. BP Refinery (Bulwer Island) Pty. Ltd., 100%	Bulwer Island Refinery, QLD	52
Do.	do. Shell Refining (Australia) Pty. Ltd., 100%	Clyde Refinery, NSW	75
Do.	do. do.	Geelong Refinery, VIC	110
Do.	do. Caltex Refining Co. Pty. Ltd., 100%	Kurnell Refinery, NSW	107
Do.	do. BP Refinery (Kwinana) Pty. Ltd., 100%	Kwinana Refinery, WA	117
Do.	do. Ampol Refineries Ltd., 100%	Lytton Refinery, QLD	74
Do.	do. Petroleum Refineries (Australia) Pty. Ltd., manager. (Mobile Oil Australia Ltd., 100%)	Port Stanvac Refinery, SA	67
Rutile	RGC Mineral Sands Ltd., manager. (Renison Goldfields Consolidated Ltd., 100%)	Capel Mine, WA	40
Do.	Minproc Chemical Co. Pty. Ltd., 50% and manager; and Kerr-McGee Chemical Corp. Western Australia Pty. Ltd., 50% (Tiwest Joint Venture)	Cooljarloo Mine, WA	35
Do.	RGC Mineral Sands Ltd., manager. (Renison Goldfields Consolidated Ltd., 100%)	Eneabba West Mine, WA	120
Do.	Mineral Deposits Ltd., operator. (BHP Minerals Ltd., 100%)	Hawks Nest (Stockton, Viney Creek, and Viney Creek North) Mines, NSW	35
Do.	Consolidated Rutile Ltd., 100%	North Stradbroke Island (Bayside and Gordon) Mines, QLD	80

See footnotes at end of table.

TABLE 2--Continued
 AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1994 1/

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities 2/	Annual capacity e/	
Rutile--Continued	RZM Pty. Ltd., operator. [Nissho Iwai Corp. (Japan), 100%]	Tomago Mines, NSW	35	
Do.	Westralian Sands Ltd., 100%	Yoganup North Mine, WA	115	
Salt	Dampier Salt (Operations) Pty. Ltd., 100%	Dampier and Lake Macleod salt fields, WA	4,500	
Do.	Leslie Salt Division, Cargill Australia Ltd., 100%	Leslie Salt operations, WA	2,750	
Spodumene	Gwalia Consolidated Ltd., 100%	Greenbushes Mine, WA	84	
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 Mines, WA	200	
Tin	Spectrum Resources Australia Pty. Ltd., 98% and manager; and Nargun Pty. Ltd., 2%	Anchor (Blue Tier) Mine, TAS	3	
Do.	Gwalia Consolidated Ltd., 100%	Greenbushes Mine, WA	1	
Do.	do.	Greenbushes Smelter, WA	1	
Do.	Renison Goldfields Consolidated Ltd., 100%	Renison Bell Mine, TAS	6	
Uranium	tons U ₃ O ₈	Olympic Dam Operations Ltd., manager. (Western Mining Corp. Holdings Ltd., 100%)	Olympic Dam Mine, SA	1,500
Do.	do.	Energy Resources of Australia Ltd., 100%	Ranger Mine, NT	4,500
Zinc	Pasminco Ltd., 100%	Beltana Mine, SA	30	
Do.	do.	Broken Hill (South) Mine, NSW	210	
Do.	Billiton Australia Ltd., 42%; and private interests, 58%	Cadjebut Mine, WA	65	
Do.	Pasminco Ltd., 100%	Cockle Creek Refinery-Smelter, NSW	85	
Do.	Pasminco Ltd., 60%; and Korea Zinc Co. Ltd., 40%	Elura Mine, NSW	30	
Do.	Murchison Zinc Co. Pty. Ltd., manager. (Normandy Poseidon Ltd., 45%; Esso Australia Resources Ltd., 35%; and Aztec Mining Co. Ltd., 20%)	Golden Grove Project (includes Gossan Hill and Scuddles Mines), WA	95	
Do.	Aberfoyle Ltd., 100%	Hellyer Mine, TAS	115	
Do.	McArthur River Mining Pty. Ltd., operator. (MIM Holdings Ltd., 70%; and ANT Minerals Pty. Ltd. holding the combined Japanese interests of Nippon Mining and Metals Co. Ltd., 15%; 15%; Mitsubishi Materials Corp., 5%; Mitsui & Co. Ltd., 5%; and Marubeni Corp., 5%)	McArthur River Mine, NT	160	
Do.	Mount Isa Mines Ltd., manager. (MIM Holdings Ltd., 100%)	Mount Isa Mine, QLD	250	
Do.	Pasminco Ltd., 100%	Port Pirie Refinery-Smelter, SA	45	
Do.	do.	Ridson Refinery, TAS	220	
Do.	do.	Rosebery Mine, TAS	45	
Do.	Pancontinental Mining Ltd., manager, 100%	Thalanga Mine, QLD	45	
Do.	Aztec Mining Co. Ltd., 100%	Woodcutters Mine, NT	45	
Do.	Denehurst Ltd., 100%	Woodlawn Mine, NSW	55	
Zircon	RGC Mineral Sands Ltd., manager. (Renison Goldfields Consolidated Ltd., 100%)	Capel Mine, WA	68	
Do.	Minproc Chemical Co. Pty. Ltd., 50% and manager; and Kerr-McGee Chemical Corp. Western Australia Pty. Ltd., 50% (Tiwest Joint Venture)	Cooljarloo Mine, WA	67	
Do.	do.	Eneabba West Mine, WA	300	
Do.	Mineral Deposits Ltd., operator. (BHP Minerals Ltd., 100%)	Hawks Nest (Stockton, Viney Creek, and Viney Creek North) Mines, NSW	25	
Do.	Consolidated Rutile Ltd., 100%	North Stradbroke Island (Bayside and Gordon) Mines, QLD	65	
Do.	RZM Pty. Ltd., operator. [Nissho Iwai Corp. (Japan), 100%]	Tomago Mines, NSW	30	
Do.	Westralian Sands Ltd., 100%	Yoganup North Mine, WA	30	

e/ Estimated. NA Not available.

1/ Data are rounded by the U.S. Bureau of Mines to three significant digits.

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

3/ Scheduled to commence development in 1995.