

THE MINERAL INDUSTRY OF

AUSTRALIA

By Travis Q. Lyday

Australia was estimated to be the third largest producer of minerals and metals, excluding coal and petroleum, in the world, and its minerals industry was a leading catalyst in promoting the growth of the economy. The country's gross domestic product was estimated to be about \$393.9 billion (U.S. Central Intelligence Agency, 1999, Australia, The World Factbook, accessed October 27, 1999, at URL <http://www.odci.gov/cia/publications/factbook/as.html>). The minerals industry, including exploration, mining, and mineral processing, was estimated to represent about 7% of the Australian economy (Journal of Mines, Metals and Fuels, 1997). The real growth rate of the gross domestic product (GDP) for 1998 was 4.7% (Embassy of Australia, 1999).

In 1998, Australia was the world's leading producer of alumina, bauxite, chrysoprase, diamond, ilmenite, mined lead, monazite, opal, rutile, sapphire, and zircon; second largest producer of uranium; third largest producer of aluminum, gold, iron ore, nickel ore, and mined zinc; fourth largest producer of silver; and the fifth largest producer of aluminum, coal, and copper. Australia was the premier exporter of alumina, coal, ilmenite, iron ore, refined lead, monazite, rutile, and zircon. The country's mineral wealth is so extraordinary that it is virtually self-sufficient in most mineral commodities. The only significant mineral resource in which Australia is not self-sufficient is petroleum. Australia, nevertheless, produces 80% to 85% of its annual crude oil requirements domestically. Australia also is endowed with abundant resources of other mineral fuels, including coal, natural gas, liquefied petroleum gas (LPG), and uranium, and continued to be one of the few market economy countries that was a net exporter of mineral fuels in 1998.

Government Policies and Programs

Australia's Native Title Act of 1993 came into force in January 1994, providing for the establishment and recognition of native title under certain circumstances. In 1996, Australia's High Court held that the granting of pastoral leases had not necessarily extinguished native title. As a result, questions possibly could be raised about the validity of titles granted elsewhere in Australia since January 1994 over pastoral leases where native title may be determined to exist. Amendments to the Native Title Act of 1993, introduced in response to the High Court Wik Judgement, were enacted by Parliament in July 1998. The amendments included provisions enabling the States and the Northern Territory to validate titles issued over pastoral leases since 1994, as well as other measures to facilitate dealings involving native title. The amendments, however, had

not come into effect by yearend.

Environmental Issues

Although less than 0.02% of Australia's land surface has been affected by mining activities, care and maintenance of the environment was a prominent and recurrent concern of the Commonwealth, or Federal, and State Governments. Mining companies must provide a program of care and management of the environment, including subsequent rehabilitation, prior to being granted permission to mine (Journal of Mines, Metals and Fuels, 1997).

In April, Australia signed the Kyoto Protocol, the agreement among 150 industrialized nations to roll back greenhouse gas emissions to near or below 1990 levels between 2008-2012. In October 1997, Australia set its goal to contain greenhouse gas emissions, mainly carbon dioxide, at an 18% increase from the 1990 level by 2012 instead of the projected 28% increase without restraint. Achieving further reductions would be a difficult challenge because fossil fuels account for about 94% of Australia's energy consumption (U.S. Energy Administration, June 1999, Australia, Country Analysis Brief, accessed September 24, 1999, at URL <http://www.eia.doe.gov/emeu/cabs/australi.html>).

The United Nation's (UN) World Heritage Committee urged a stoppage to the construction of the Jabiluka uranium mine in the Northern Territory until possible environmental dangers were further assessed. The Australian Government rejected the request on December 1, with the Environmental Minister saying that the Government will provide a comprehensive rebuttal to the World Heritage Committee recommendation that Jabiluka be scrapped. The Committee will give Australia until April 1999 to demonstrate that Jabiluka poses no threat to the World Heritage-listed Kakadu National Park. The Jabiluka and the Ranger mines are located within the Park but have been excised from it, because the Park was created after the exploration and mining leases were granted (Mining Journal, 1998p). Australia was 1 of 155 signatories to the UN-administered World Heritage Convention, which aims to define and conserve the world's natural and cultural heritage (Mining Journal, 1998h).

Production

Of the approximate \$27.6 billion in mineral and energy production of 1998, metallic minerals contributed an estimated 40%; petroleum (crude oil, natural gas, and natural gas liquids), 30%; coal, 25%; and industrial minerals (clays,

construction materials, dimension stone, peat, and salt), 5%. (See table 1.)

Trade

To bolster economic growth, Australia continued to rely heavily on the export of the majority of its mineral production. Mineral exports were concentrated in just four commodity groups, in descending order—coal, gold, alumina-aluminum-bauxite, and iron ore (U.S. Embassy, Canberra, Australia, 1998). The mineral industry remained Australia's largest commodity export earner, accounting for an estimated 60% of the total. 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.

Structure of the Mineral Industry

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

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

Many of the 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 1998, Australia had six alumina refineries and six smelters; three principal copper smelters and three principal refineries; one principal gold refinery; four principal lead-zinc smelters and/or refineries; one manganese ferroalloy plant; one nickel smelter and two nickel refineries; three principal crude steel plants; one primary tin smelter, one tin refinery, and two secondary tin refineries; two silver refineries; and eight principal petroleum refineries.

Ownership of the mineral rights in Australia is generally vested in the Crown, (i.e., the Government of the relevant State or Territory) or the Commonwealth Government for Commonwealth lands and waters, regardless of ownership or tenure of the surface (Journal of Mines, Metals and Fuels, 1997). That ownership was divided between state ownership in State onshore areas and Commonwealth ownership in

Territories and in offshore areas beyond Australia's 4.8-kilometer (km) (3-mile) territorial limit. The Commonwealth's responsibility for minerals, except for uranium, in the Northern Territory has, however, been transferred to the Government of the Northern Territory. Thus, the individual States and territories administer the mineral industries within their own borders, including registering land titles; issuing exploration and development permits; overseeing mining operations, including administration of inspections; assuring compliance with health, safety, and environmental regulations; and levying royalties and taxes.

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

Commodity Review

Metals

Bauxite, Alumina, and Aluminum.—For the 28th consecutive year, Australia was the world's dominant bauxite producer. Production in 1998 was from the open-cut operations at Weipa-Andoom on the western flank of the Cape York Peninsula in the far north of Queensland; the Gove open cut, including the nearby Aboriginal-owned Rocky Bay ore body, across the Gulf of Carpentaria in northeastern Arnhem Land, Northern Territory; and the surface mines in the Darling Range south of Perth, Western Australia, including Huntly, Willowdale, and Worsley-Mount Saddleback. Substantial bauxite deposits also border Admiralty Gulf at Cape Bougainville and are in the nearby Mitchell Plateau area of the Kimberley region of northern Western Australia, but their remoteness from energy supplies and infrastructure has prevented their development. Australia was dominant in alumina production in 1998, with output coming from six refineries—four in Western Australia and one each in the Northern Territory and Queensland. Ranking third in the world in 1998, Australia also was a significant producer of aluminum. Aluminum was produced at six smelters, two each operating in New South Wales and Victoria and one each operating in Queensland and Tasmania.

In February, Alcan South Pacific Pty. Ltd. (Alspac), a subsidiary of Canada's Alcan Aluminium Ltd., dropped its plans to develop the 175-million-metric-ton (Mt) Ely bauxite reserves adjacent to Comalco Ltd.'s Weipa operations. Instead, Alspac and Comalco signed a mutually beneficial agreement which made Comalco a de facto toll miner for Alspac. Alspac had an agreement with Comalco to buy 1.6 million metric tons per year (Mt/yr) of Weipa bauxite from Comalco for the Queensland alumina refinery in central Queensland, in which Alspac had a 21.4% interest. This agreement will expire at yearend 1999. After a joint review of the Weipa operation, which had excess mining and beneficiation capacity, and the estimated \$122 million cost of developing a 2.5-Mt/yr greenfield mine, both companies decided to optimize the regional mining and shipping infrastructure and to enable the environmental and community aspects of the operations to be managed on an integrated basis. Alspac's annual demand for

bauxite was about 4 Mt; the new agreement was for Comalco to supply this tonnage from the combined Weipa/Ely deposit on the basis that Alspac pays Comalco all costs associated with mining, beneficiation, and transport plus a management fee. The Ely deposit was to remain wholly owned by Alspac, but every metric ton (t) of Weipa bauxite supplied to Alspac from 2000 onwards was to entitle Comalco to mine an equivalent tonnage from Ely (Metal Bulletin, 1998a).

Western Australia's oldest bauxite mine, Alcoa World Alumina Australia's Jarrahdale Mine, ceased mining on December 16. Nearly 168 Mt of bauxite had been mined and railed to the Kwinana bauxite refinery during its 35-year life. Additional ore was reclaimed from stockpiles during the remaining days of 1998, with the last ore train leaving for Kwinana on December 31. The decision to close Jarrahdale was the result of a 2-year feasibility study completed in 1997 in which the technology at Jarrahdale was determined to lack the flexibility and economies of scale that existed at Alcoa's other two bauxite mines, Huntly and Willowdale. Critical issues detracting from the cost effectiveness of the Jarrahdale operation were the outmoded crushing system and the long road-haulage distance for the ore (Prospect, 1999a). Alcoa was expanding its Huntly Mine east of the Pinjarra bauxite refinery to an 18,000-Mt/yr operation in a 2-year, \$53.7 million program that will effectively absorb Jarrahdale's lost output of 7 Mt/yr (Resource Information Unit, 1999, p. 58). Huntly was to supply feed for the Kwinana and the Pinjarra refineries.

Comalco successfully completed a major upgrade designed to simplify operations, reduce costs, and insure a sufficient capacity to supply its customers at its Weipa bauxite mine. The upgrade involved replacement of the haulage truck fleet, refurbishment of the beneficiation plant, and upgrade of the Andoom Mine load-out station (Comalco Ltd., 1999, p. 16).

At yearend 1998, the \$157 million, 440,000-metric-ton (t) expansion that began in late 1997 at Alcoa's Wagerup bauxite refinery, the first stage of a project to increase the smelter's capacity to 3.3 Mt/yr alumina, was proceeding on budget and on schedule for a mid-1999 completion (Prospect, 1999b).

The Victorian Government sold its 25% interest in the Portland Island aluminum smelter to China International Trust Investment Co. (CITIC), a China Government agency, and Japan's Marubeni Australia Pty. Ltd. after they exercised their preemptive right to match the \$296 million bid offered by the consortium of a Swiss-based natural resources group, Glencore International AG, and Century Aluminum Co. of the United States, its 39.6%-owned aluminum producer. CITIC and Marubeni each increased their holdings in the smelter from 10% to 22.5% (Metal Bulletin, 1998e).

Comalco continued to study the feasibility for a 1-Mt/yr greenfield alumina refinery based on the Weipa bauxite deposit. In December, the company had short-listed five companies for the construction and operation of a cogeneration power station at Gladstone, Queensland. Construction of the power station was conditional on development of the proposed gas pipeline from Papua New Guinea proceeding, and the refinery itself was a critical element in the near-term viability of the pipeline. (See Petroleum and Natural Gas section.) Comalco emphasized, however, that the tender process for the

powerplant did not imply that Gladstone was the preferred location for its alumina refinery (Metal Bulletin, 1998d). At yearend, two sites remained under consideration, Gladstone and one near Bintulu in Sarawak, Malaysia. Negotiations with the Australian and the Malaysian federal governments and Queensland's state government continued in the areas of infrastructure, legislative, and fiscal support for the proposed project. The environmental impact studies also were progressing. The technical feasibility studies and commercial evaluation of the refinery were expected to be completed during 1999 (Comalco Ltd., 1999, p. 17).

Cobalt.—In late 1998, Billiton (Australia) Pty. Ltd. acquired QNI Ltd. in a \$275 million cash takeover. Billiton processed lateritic cobalt-nickel concentrates at its Yabulu Refinery near Townsville, Queensland, producing low-grade cobalt sulfides to manufacture pure cobalt oxide hydroxide, QN ChemGrade Cobalt, in its newly commissioned cobalt refinery for use in the cobalt chemicals market. The refinery's feedstock was imported from P.T. Aneka Tambang's mine on Gebe Island, Indonesia, and four suppliers (Nickel Mining Corp., Société des Mines de la Tontouta, Société Minière du Sud Pacifique, and J.C. Berton Mines) on La Grande Terre, the main island of New Caledonia. Billiton's QN ChemGrade Cobalt product mainly was sold to OMG Kokkola Chemicals Oy in Finland for the manufacture of cobalt chemicals and salts.

Finland's Outokumpu Mining Australia Pty. Ltd. mined byproduct cobalt from its nickel sulfide Forrestania and Silver Swan underground mines. The concentrates were shipped from the southern Western Australia port of Esperance to Outokumpu's Harjavalta Smelter in Finland for processing (Department of Resources Development, 1999, p. 45-47).

WMC Resources Ltd. produced mixed nickel-cobalt sulfides at its Kwinana nickel refinery near Perth from cobalt-containing nickel matte produced at WMC Resources' Kalgoorlie nickel smelter. The Kalgoorlie smelter received feedstock from WMC Resources' mines, as well as concentrates from Titan Resources NL's Radio Hill Mine.

Copper.—In 1998, Australia retained its ranking as the fifth largest producer in the world of mined copper, following Chile, the United States, Canada, and Indonesia (World Bureau of Metal Statistics, 1999, p. 37). Virtually all the copper mined in Australia was as a coproduct from mines that produced other metals. Notable polymetallic copper-producing operations in Australia were the Hilton copper-zinc-lead-silver mine at Mount Isa, Queensland, and the Olympic Dam copper-uranium-gold-silver mine at Roxby Downs Station, South Australia.

In May, MIM Holdings Ltd.'s Ernest Henry Mine, 35 km northwest of Cloncurry in central Queensland, began commercial operations. The \$213.5 million project was begun in 1995 with the first ore being processed through the concentrator in August 1997. Production was estimated to be 95,000 metric tons per year (t/yr) (Resource Information Unit, 1999, p. 94).

Near the end of September, Perth-based Western Metals Ltd. announced the shipment of its first copper cathode from its

Mount Gordon Mine and solvent extraction and electrowinning (SX-EW) plant to Port Kembla for product manufacture. The mine and SX-EW plant, formerly known as Gunpowder, was renamed following Western Metals' hostile takeover of Aberfoyle Ltd. At the same time, Western Metals confirmed that the company would dispose of all its noncore projects acquired from Aberfoyle to concentrate on the company's zinc-lead operations in the Lennard Shelf area of Western Australia. The company planned to retain the Gordon copper operation, however, plus the Hellyer zinc-lead-copper mine in Tasmania, also acquired in the takeover (Mining Journal, 1998e). Completion of the expansion of the open pit and new 50,000-t/yr capacity cathode-copper-processing plant was completed in midyear on budget and several weeks ahead of schedule (Mining Journal, 1998i).

In December, WMC Ltd. inaugurated its third haulage shaft at Olympic Dam, naming it after Sir Lindsay Clark who served WMC for 48 years, 22 of them as chairman. The new shaft will enable Olympic Dam to hoist more than 9 Mt/yr of ore to the surface for processing following the completion of the 2-year, \$750 million expansion project that began in late 1996 (Australian Journal of Mining, 1999). Upon completion of the project in early 1999, but with costs escalating to \$1.2 billion, the Olympic Dam Mine will be the largest capacity underground mine in Australia, capable of producing 200,000 t/yr of refined copper upon completion of the commissioning period of the new smelter (WMC Ltd., 1998). The smelter will be Olympic Dam's second direct-to-blister production furnace and only the fourth in the world (MESA Journal, 1998).

During 1998, the city of Mount Isa in northwestern Queensland celebrated the 75th anniversary of the mineral discovery on which MIM Holdings, the parent company of the original Mount Isa Mines Ltd., was founded (MIM Holdings Ltd., 1998, frontispiece). The Mount Isa mining and processing complex was Australia's largest areal underground mine. The underground copper mine, adjacent to the original lead-zinc-silver mine, has been operating for more than 60 years (Resource Information Unit, 1999, p. 98). MIM Holdings' Isasmelt copper smelter at Mount Isa was being upgraded from 80,000 t/yr to 270,000 t/yr, at an estimated cost of \$148 million so that it could treat concentrates from Mount Isa and the Ernest Henry Mines (Metal Bulletin, 1998j).

In midyear, Japan's Furukawa Co. Ltd., which had a majority interest in the reconstruction of the copper smelter at the Port Kembla site of Southern Copper Ltd.'s former smelter in New South Wales, postponed its startup because of adverse weather problems and a shortage of labor. The new 120,000-t/yr facility was scheduled to start in June 1999 (Mining Magazine, 1998b).

Gold.—Australia remained the world's third largest gold producer after South Africa and the United States, with gold mined in all six States and the Northern Territory. Western Australia remained the premier gold mining State in Australia, producing just under 75% of the country's output (Australian Bureau of Agricultural and Resource Economics, 1999, p. 15). Gold was the second largest export earner after coal, earning about \$4.7 billion (Resource Information Unit, 1999, Map Supplement). The Super Pit in Kalgoorlie, Western Australia,

managed by Kalgoorlie Consolidated Gold Mines Pty. Ltd. (KCGM), maintained its position as Australia's largest gold mine despite a 7% production decrease to 20,273 kilograms (kg) compared with 1997 (Resource Information Unit, 1999, p. 282). Following the Super Pit, Australia's largest gold mines and 1998 production were Granny Smith, 16,923 kg; Saint Ives, 13,153 kg; Jundee/Nimary, 10,692 kg; and Telfer, 10,638 kg (Australian Journal of Mining, 1998); all were in Western Australia. Total gold production for the year was 310,070 kg, less than a 1.5% decrease from the record-high level set in 1997.

In February, the Granny Smith Mine produced its two-millionth ounce (62,207 kg) and then went on to set its record-high annual production of gold (Resource Information Unit, 1999, p. 222).

Great Central Mines Ltd. (GCM) merged its adjacent Jundee and Nimary Mines at the end of the March quarter to form Australia's fourth largest gold operation, following GCM's acquisition of Nimary through its takeover of Eagle Mining Corp. in 1997. Nimary, which poured its first gold in December 1995 under Eagle Mining's ownership, had produced 8,319 kg prior to the merger with Jundee. The existing Jundee/Nimary operations had a combined milling capacity of 3 Mt/yr; although it had a theoretical capacity of 2 Mt/yr, the Nimary mill operated at 1 Mt/yr on hard ore through 1998. The Nimary mill underwent a \$4 million upgrade in early 1998, with the installation of another ball mill, while higher-grade ore was being stockpiled. In late 1998 at the Nimary plant, GCM began construction of a scats crusher and fine ore stockpile facility that will increase production to 1.2 Mt/yr. The Jundee plant, which had produced 16,889 kg between its commissioning in December 1995 to March 1998, processed open pit oxide, transition, and fresh ore at a rate of 2 Mt/yr (Resource Information Unit, 1999, p. 230.)

Following the grant of a mining lease in March, Ross Mining NL began construction in May at its Timbarra open cut in northern New South Wales. Site preparation included a comprehensive threatened fauna relocation program under Ross Mining's Threatened Species Management Plan prior to vegetation clearance of the access road and the Timbarra Mine site (Engineering and Mining Journal, 1998e). Timbarra was scheduled to produce about 1,800 kilograms per year (kg/yr) gold for an initial mine life of 6 years. Although production was scheduled to begin in October, severe, unseasonable weather pushed the first gold pour into 1999 (Resource Information Unit, 1999, p. 133).

In May, MIM Holdings' Ernest Henry copper-gold mine in northwestern Queensland began commercial operations. Gold production was forecast to be about 3,700 kg/yr (Resource Information Unit, 1999, p. 94).

On October 20, the Australian gold sector formed its own industry body, the Australian Gold Council (AGC), aimed at raising its political and investment profile. The AGC wasted no time in pressing the Federal Government for preferential treatment by immediately requesting tax breaks to encourage exploration (Mining Journal, 1998b).

The Paraburdoo gold project in Western Australia, including the leased areas known as Lynas and Mount Olympus, was

commissioned in the second semester of 1998; it reached full production status at yearend. In March, Lynas Gold NL entered into a joint venture with Arcadia Minerals NL to develop the oxide, transition, and other carbon-in-leach (CIL) treatable ores within the leases. Lynas Gold made available its 600,000 t/yr capacity Lynas Find gold treatment plant in exchange for a 35% interest in and management of the project. Lynas Gold's CIL treatment plant was relocated from the Lynas Find Mine, about 100 km southeast of the coastal city of Port Hedland, to Paraburdoo. The first gold was poured on December 31. The project was expected to produce about 1,900 kg/yr gold during an initial 3.5-year mine life (Resource Information Unit, 1999, p. 266).

In September, KCGM, manager of the Mount Charlotte underground mine, announced the immediate implementation of a revised mining plan for Mount Charlotte owing to an accelerated level of recent ground movement, as well as current economic factors that affect the mine (Engineering and Mining Journal, 1998d). The plan allowed for the mining of 1.4 Mt instead of the planned 2.2 Mt during the ensuing 12 months and excluded the resources below the 20L level of the workings. Production was expected to continue at 1.4 Mt/yr until 2000 (Resource Information Unit, 1999, p. 250). The Mount Charlotte Mine is not far from the huge Super Pit operations and both send their ores to the Fimiston treatment plant. To offset the loss of ore from Mount Charlotte, KCGM planned to increase production from 68 Mt/yr to 75 Mt/yr at the Super Pit (Engineering and Mining Journal, 1998d).

In October, Pacmin Mining Corp. Ltd. announced a further expansion of the mill at its Western Australia Tarmoola Mine, 29 km northwest of Leonora (Mining Magazine, 1998a). Mill throughput would increase from 2.7 Mt/yr to 3.2 Mt/yr through the purchase and construction of a two-stage crushing circuit and reclaim facility. Commissioning was scheduled for March 1999 (Resource Information Unit, 1999, p. 283).

In 1998, Saint Ives production of 13,153 kg was down 8% compared with the record-high level of 1997, which reflected the onset of full production from the Intrepide open cut. The decrease resulted from a major maintenance shutdown in February and a reduction in tonnage of high-grade ore mined at the Junction underground mine during the second quarter. In December, a new open cut, the Leviathan, was under development, with a startup scheduled for January 2000. When Leviathan comes on-stream, mining at Saint Ives will be at three open-cut operations (Intrepide, Leviathan, and Santa Ana) and the Junction underground mine. Saint Ives was owned and managed by WMC (Resource Information Unit, 1999, p. 276).

Iron Ore and Steel.—In 1998, Australia was the world's largest exporter of iron ore and pellets (included pellets, sinter, and briquettes; fines; and lump and run-of-mine ore) for the fifth successive year; shipments totaled 136.4 Mt valued at about \$2.4 billion (Australian Bureau of Agricultural and Resource Economics, 1999, p. 16). The country supplied about 15% of the world iron ore market and represented more than one-third of global seaborne iron ore shipments (Mining Journal, 1998c). As a world producer, Australia ranked third

behind China and Brazil (Mining Journal, 1999). Iron ore production continued to be concentrated in the Hamersley Range of the Pilbara region, Western Australia, which accounted for about 97% of the country's production. Iron ore, however, was produced at Normandy Mining Ltd.'s Tallawang open cut, New South Wales, and Biggenden underground mines, Queensland, both of which supplied magnetite to nearby coal producers. Iron ore also was produced at BHP Steel Pty. Ltd.'s Middleback Range Mine, which included iron ore resources at the Iron Duke and the Iron Knob operations, near Whyalla, South Australia, producing iron ore for BHP Steel's domestic steel requirements. Brisbane-based Goldamere Pty. Ltd. mined magnetite ore at its Savage River Mine in Tasmania, producing iron ore and pellets (Resource Information Unit, 1999, p. 307).

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

Hamersley Iron Pty. Ltd., a part of the international mining giant Rio Tinto Ltd., operated the Brockman No. 2 Detrital, Channar (60% Hamersley Iron), Marandoo, Mount Tom Price, and Paraburdoo Mines in the Hamersley region of the Pilbara, and began production at its new \$515 million Yandicoogina Mine 85 km northwest of Newman. The Yandicoogina Mine often was abbreviated to Yandi, the same name as BHP Minerals Pty. Ltd.'s 55%-owned operation about 15 km to the northwest. Hamersley Iron, Australia's second largest iron ore producer, owned and operated railway links from Paraburdoo through Tom Price to the port of Dampier, Western Australia, 386 km away, where Hamersley Iron shipped to steel mills in China, Europe, Japan, the Republic of Korea, and Taiwan. Spur lines connected the Brockman No. 2 (44 km) and the Marandoo (59 km) Mines; the Channar Mine was linked to Paraburdoo by overland conveyor. During 1998, a 147-km extension to Hamersley Iron's existing railway was constructed, and a \$92 million upgrade of the Dampier port facility was undertaken (Resource Information Unit, 1999, p. 311).

Robe River Iron Associates, with a capacity of 31 Mt/yr, was Australia's third largest iron ore producer and the fourth largest in the world. The principal iron ore mine was the Pannawonica, comprising a mesa-like deposit of pisolitic goethite-hematite iron ore along the present Robe River valley, near the company town of Pannawonica in the Pilbara. Robe River's crushing and port facilities were at Cape Lambert, about 200 km distant on the coast to the northeast. The ore body mined in 1998 was the Mesa J. A major shutdown for maintenance took place in late 1998 during which stockpile levels were reduced by 18%, and a \$5.7 million scrubber/trommel plant was constructed, enabling ore to be recovered from the deeper sections below the water table where heavy clay contamination was encountered (Resource Information Unit, 1999, p. 310).

Koolyanobbing Iron Pty. Ltd., a 60-40 joint venture of

Portman Resources NL and Angang Australia Pty. Ltd., owned by the Chinese Government operated the 3-Mt capacity Koolyanobbing open-cut iron ore mine, 50 km north of Southern Cross, Western Australia. Koolyanobbing Iron also operated the facilities recovering and beneficiating iron ore stockpiles at Cockatoo Island off the northern coast of Western Australia, 140 km north of Derby. Sole-owner Nugold Hill Mines NL received a royalty for each ton of iron ore concentrate shipped from Cockatoo Island, which mainly was to steel mills in China (Resource Information Unit, 1999, p. 308).

In August, after receiving environmental approval and satisfactorily addressing all native title and heritage issues, the Western Australian Government granted approval for an extension of mining operations at the Brockman open cut, which had been scheduled to close in July. Hamersley Iron was given approval to mine the adjacent Nammuldi Marra Mamba-type ore body beginning in September, at an initial rate of 4 Mt/yr for an estimated mine life of about 5 years (Engineering and Mining Journal, 1998c). Marra Mamba-type ore is softer than the more commonly mined Brockman-type iron ore and it has a lower phosphorus content, but the iron content also is lower, averaging about 60% to 62% iron compared with more than 64% iron for Brockman-type ore. The Nammuldi ore will be processed through the existing plant at Brockman, which had been treating high-quality hematite detrital ore (Mining Journal, 1998n).

The contribution of BHP Steel, the only integrated steel producer in Australia, to world steel output is small, ranking 20th and producing about 1% of world production (Metal Bulletin, 1999). BHP Steel's steelworks at Newcastle, New South Wales; Port Kembla, New South Wales; and Whyalla, South Australia; and its minimill in Sydney accounted for just more than 90% of Australia's steelmaking capacity. The remaining capacity was held by Australian National Industries' Comsteel and Palmer Tube Mills and the privately owned Smorgan Steel (Metal Bulletin Monthly, 1998a). BHP Steel announced that its Newcastle steelworks will be closed by yearend 1999 (Metal Bulletin, 1998b).

Although the South Australian Government awarded a \$4.7 million development grant to the South Australian Steel and Energy (SASE) Project in 1997 for construction at the beginning of 1998 of a 2-metric-ton-per-hour demonstration plant, the construction was delayed during the year, while the joint-venture partners were forming an operating company. The ultimate goal of SASE was to produce high-quality pig iron from low-grade iron ore and steaming coal at a lower cost than that of hot briquetted iron (HBI). SASE planned to build a 2.5-Mt/yr commercial plant based on Melbourne-based Ausmelt Ltd.'s submerged lance smelting technology near the Alice Springs-to-Adelaide rail line that traverses the iron and coal deposits. The Government of South Australia, Ausmelt, and Sydney-based Meekatharra Minerals Ltd., which owned the coal leases, each held a 28% interest in the venture, and P.T. Krakatau Steel, owned by the Indonesian Government, had agreed to purchase the remaining equity for \$7.5 million (Metal Bulletin, 1998f).

BHP Steel's 2.5-Mt/yr HBI project at Port Hedland, Western

Australia, was on track to produce its first briquettes in early 1999. The plant was estimated to be about 84% complete at midyear (Metal Bulletin, 1998c).

Lead and Zinc.—In 1998, Australia ranked first in production of mined lead concentrate; third in mined zinc concentrate, following China and Canada; and ninth in production of both refined lead and refined zinc (World Bureau of Metal Statistics, 1999, p. 80-81 and 128-129). Most of the lead production was from zinc-rich deposits that also produced byproduct lead. A major exception was the Cannington lead-silver-zinc mine 85 km south of McKinlay, western Queensland. The Cannington Mine was operated by BHP Minerals and was expected to reach its full capacity of 175,000 t contained lead and 40,000 t contained zinc in 1999 (Resource Information Unit, 1999, p. 312). At full production, Cannington was expected to be the world's largest single producer of lead (Resource Information Unit, 1999, p. 318).

In April, the continuity of feed to the Mount Isa lead and zinc processing plant was assured with the decision to develop MIM Holdings' George Fisher zinc-lead-silver deposit. The George Fisher deposit is 2 km north of MIM Holdings' existing Hilton Mine and 22 km north of its Mount Isa Mine. The extensive 3-year feasibility study completed in early 1998 provided for mining two of George Fisher's 11 ore bodies containing ore reserves of 24 Mt grading 9.1% zinc, 5.6% lead, and 128 grams per metric ton silver. The remaining resource of approximately 70 Mt probably would support an extension of the mine life for an additional 10 years (MIM Holdings Ltd., 1998, p. 21). The George Fisher underground mine will provide a 2.5-Mt/yr throughput, producing about 170,000 t of zinc-in-concentrate and 100,000 t of crude lead. The mine was on track for production to begin in 2000. Production at George Fisher was to begin as output at the existing Mount Isa operations tails off. Some of George Fisher's zinc output was expected to be sold to the Republic of Korea's Korea Zinc Co. Ltd.'s new greenfield smelter-refinery that was under construction near Townsville, Queensland, and on schedule for commissioning in late 1999 (Mining Journal, 1998m). The crude lead was to be shipped via Townsville to MIM Holdings' United Kingdom refinery (Mining Journal, 1998d). Total capital expenditure was estimated to be \$164.7 million, which included \$103.7 million for mine development, \$36.6 million for upgrading the concentrator, and \$24.4 million to extend the life of the lead smelter at Mount Isa (Metal Bulletin, 1998g).

In June, Western Metals agreed to supply 150,000 t/yr of zinc concentrate to Korea Zinc's smelters in Australia, The Republic of Korea, and the United States. The long-term contract represented about 60% of Western Metals' annual output of zinc concentrates from its mines in northern Western Australia's Lennard Shelf operations in the Kimberley region, including the Goongewa, Kapok, and Pillara underground mines (Mining Journal, 1998q). Commissioning of the processing plant at the Pillara underground mine was just beginning; stockpiled ore was being used when the deal was made. Design throughput and recoveries at Pillara were expected to be achieved by mid-1999. At full capacity, Pillara would produce 165,000 t/yr of zinc concentrate and 35,000 t/yr

of lead concentrate and have a mine life of at least 10 years (Resource Information Unit, 1999, p. 328). Although on care and maintenance since 1997, Western Metals continued to operate its processing plant at the Cadjebut Mine, processing ore from the Goongewa and the Kapok Mines and other Lennard Shelf mining operations (Metal Bulletin, 1998i).

By August, major contracts had been signed with Pasminco Century Mine Ltd., a wholly owned subsidiary of Pasminco Ltd., for development of the Century Mine, about 250 km northwest of Mount Isa in the far north of Queensland. Work was progressing ahead of schedule and under budget on mine prestripping, construction of the concentrator processing facility, the slurry pipeline, and the Karumba port and airstrip. The \$518.5 million mining project was scheduled to begin production during the last quarter of 1999 (Pasminco Ltd., 1999). When in full operation, production was expected to be 780,000 t/yr of silver and zinc concentrate and 70,000 t/yr of lead concentrate from 5 Mt/yr ore. The concentrates will be pumped in slurry form through the 300-km underground pipeline to the port at Karumba on the Gulf of Carpentaria, where it will be dewatered and stockpiled prior to export (Resource Information Unit, 1999, p. 318). Initial production was earmarked for Pasminco's Risdon Smelter in Hobart, Tasmania, and its Budel Smelter in the Netherlands (Metal Bulletin, 1998i). A part of Century's production might be sold to Korea Zinc's smelter-refinery at Townsville (Mining Journal, 1998m).

Final commissioning of the replacement, modernization, and expansion project to increase production refining at Pasminco's Port Pirie Smelter was completed in December. The upgrade will increase lead production to 250,000 t/yr (Pasminco Ltd., 1999).

Manganese.—In December, The Broken Hill Pty. Co. Ltd. (BHP) sold its main manganese assets to Billiton Plc. for about \$367 million. Groote Eylandt Mining Co. Pty. Ltd. (GEMCO), BHP's subsidiary, operated the 2.4-Mt capacity, 84-square-kilometer open-cut operations on the northwest portion of Groote Eylandt, off the far north coast of Australia in the west of the Gulf of Carpentaria, Northern Territory. The operations at Groote Eylandt used excavators and 145-t end-dump trucks for removal of overburden and ore mining. The on-site concentrator produced clean lump and fine ore products that were trucked to Milner Port Bay for shipment (Resource Information Unit, 1999, p. 332). Production of manganese ore at Groote Eylandt represented about 10% of world supply (Resource Information Unit, 1999, Map Supplement). GEMCO shipped about 25% per year of its concentrate to the ferromanganese plant operated by another former BHP subsidiary, Tasmanian Electro Metallurgical Co. Pty. Ltd. (TEMCO) at Bell Bay, Tasmania. A smaller percentage was used in an electrolytic manganese dioxide plant at Newcastle owned by Australian Manganese Co. Pty. Ltd., a former subsidiary of BHP; the plant produced high-grade material used in long-life batteries. The TEMCO and Australian Manganese plants were included in the sale of BHP's manganese assets sold to Billiton Plc., but some minor BHP manganese assets not part of the deal will be sold at a subsequent date for about \$10

million (Mining Journal, 1998k).

Mineral Sands.—Australia's mineral sands industry comprised the mining and processing of high concentrations of such titanium minerals as ilmenite, leucogene, and rutile; monazite, a rare-earth phosphate containing a variety of rare-earth oxides, especially cerium; thorium oxide; and zircon, an ore of zirconium and also used in the ceramics-refractories industry. Monazite, however, was not recovered during 1998 owing to lack of demand throughout the year and was returned to the tailings. The Australian mineral sands industry provided about 25% of the world's ilmenite, 50% of its rutile, and 40% of the zircon (Resource Information Unit, 1999, Map Supplement).

The mineral sands industry underwent a dramatic change during the year with the merger of Westralian Sands Ltd. and RGC Ltd. and the abandonment by BHP Titanium Minerals Pty. Ltd. of its much-troubled Beenup Mine near Augusta, Western Australia, after enduring environmental and technical problems since its startup in 1997.

Westralian Sands merged with RGC in December to form one of the world's major titanium minerals production and processing companies. The merger also produced one of Australia's top 10 mineral-resource companies (Mining Journal, 1998a). The new company, renamed Iluka Resources Ltd. in 1999, became the world's second largest producer of titanium dioxide (TiO₂) feedstock, after Rio Tinto, supplying about 32% of the world's supply, and the largest producer of zircon for ceramics and refractories, accounting for about 37% of world production (Industrial Minerals, 1998c). At yearend, planning was in progress to close RGC's Sydney corporate offices, mines at Eneabba and South Capel, and its Eneabba dry separation plant in Western Australia. Production of synthetic rutile from the Nargulu Plant's kilns, near Geraldton, Western Australia, was to be reduced and replaced by increased production from more-efficient plants operating at Capel (Resource Information Unit, 1999, p. 333).

In May, BHP Titanium Minerals declared force majeure on delivery of ilmenite from its Beenup dredging operation owing to production constraints. Because technical problems relating to a high clay content in the ilmenite-zircon ore body had adversely impacted tailings management since its commissioning in March 1997, the operation had never reached a satisfactory production level, originally expected to be 600,000 t/yr of ilmenite and 20,000 t/yr of zircon (Engineering and Mining Journal, 1998b). Production never reached designed capacity, and at the declaration of force majeure, the plant was producing at 40% of design using an interim tailings method. About 50% of production was slated to be processed at BHP Titanium Minerals' Tyssedal Smelter in Norway. Although the force majeure applying to sales contracts for ilmenite was lifted in December, BHP Titanium Minerals closed the operation in early 1999 (Resource Information Unit, 1999, p. 337).

In September, Nimbus Resources NL purchased BHP Titanium Minerals' Hawks Nest mineral sands operation, including the dry separation plant about 50 km northeast of Newcastle, for about \$5.5 million. In December, Nimbus

changed its name to Mineral Deposits Ltd. (Resource Information Unit, 1999, p. 518).

Nickel.—In 1998, the global nickel industry was firmly focused on Western Australia as three new laterite prospects, Bulong, Cawse, and Murrin Murrin, began mining. As they began to ramp-up production, these projects were expected to revolutionize the industry by substantially cutting the cost of producing nickel metal. Annual production, 50,000 t in the early 1990's, was 144,000 t in 1998 and was expected to approach 178,000 t by 2000 (Department of Resources Development, 1999, p. 3). Until the startup of the laterite nickel mines, all nickel production in Australia had been from nickel sulfide ore bodies.

Nickel mining in Australia was conducted solely in the State of Western Australia. WMC Resources pioneered Australia's nickel industry, establishing the operations at Kambalda in 1966. Kambalda quickly developed into a world-class nickel facility, underwriting the construction of the nickel refinery at Kwinana in 1970 and the Kalgoorlie nickel smelter in 1972. WMC Resources was still Australia's leading producer, producing a record-high 120,000 t in 1998. Australia supplied about 13% of the world's primary nickel and was the third or fourth largest producer, ranking after Russia and Canada and about equal with New Caledonia (Department of Resources Development, 1999, p. 6).

WMC Resources announced in September that it was reducing nickel-in-concentrate by 10,000 t/yr production at its Kambalda nickel operations by suspending mining during the next few months at three of WMC Resources' seven mining complexes—Blair, Otter/Juan, and Wannaway. The underground mines were Kambalda's highest cost operations. The cutback represented about 9% of WMC Resources' total nickel production (Engineering and Mining Journal, 1998f).

In early 1998, Titan Resources' NL recommissioned the underground mine and mill at Radio Hill, 35 km south of Karratha and, in April, sent the first shipment of concentrate to WMC Resources for processing. The ore body originally had been developed in 1991 by Agip Australia Pty. Ltd. but operated only a few months until closure in 1992 owing to smelter problems and low nickel prices. Titan upgraded the original treatment plant to 200,000 t/yr from 150,000 t/yr with the addition of new flotation cells and ancillary equipment (Resource Information Unit, 1999, p. 354). The 40,000-t/yr mine had an estimated mine life of 5 years (Metal Bulletin, 1998k).

Of the new laterite mines, Centaur Mining and Exploration Ltd.'s Cawse project, 50 km northwest of Kalgoorlie, was the most advanced. Full-scale open pit mining began in April 1998, producing its first cobalt sulfide concentrate in January 1999 and its first nickel metal production in February 1999 (Resource Information Unit, 1999, p. 346). In late 1998, commissioning of Preston Resources Ltd.'s Bulong nickel-cobalt mine began and was to be followed by a progressive buildup to full metal production of 9,000 t/yr of nickel and 700 t/yr of cobalt in 1999. Ore capacity for Stage 1 was 550,000 t/yr. Stage 2, planned for 2000-01, would increase output to 22,000 t/yr of nickel and 1,700 t/yr of cobalt. Bulong was

expected to have a 25-year mine life with an initial mining rate of 537,000 t/yr of ore, to be increased to 1.6 Mt/yr. Preston purchased the Bulong Mine from Resolute Ltd. in July for \$194.6 million (Resource Information Unit, 1999, p. 345).

The largest of the laterite projects was the Murrin Murrin Mine owned by Anaconda Nickel Ltd. (60%) and Glencore International (40%). At full capacity, Stage 1 of the \$610 million refinery, 60 km east of Leonora, was scheduled to produce 45,000 t/yr of nickel metal, equal to the State's entire nickel industry in 1993, and 3,000 t/yr of cobalt metal in high-purity sintered briquette form (Department of Resources Development, 1999, p. 15). This would make Murrin Murrin the world's fifth largest nickel mine and the third largest cobalt mine. Mining operations started in March 1998, and a mine life of more than 30 years was projected. High-pressure acid leach, sulfide precipitation, and hydrogen reduction recovery technology designed by Sherritt International Corp. was to be used in the on-site refining of the ore (Engineering and Mining Journal, 1998a). The plant was designed to allow for a Stage 2 expansion that would increase production to 115,000 t/yr of nickel and 9,000 t/yr of cobalt. Design, engineering, and procurement for the Stage 2 expansion proceeded in parallel with the completion of Stage 1. Stage 2 was to replicate the existing processing circuit with the possible addition of mixed sulfide roasting as a precursor to leaching (Resource Information Unit, 1999, p. 352).

In September, AGL Power Generation and TransAlta Energy (Australia) signed a development agreement with QNI to build a \$67 million, 150-megawatt cogeneration facility to be located on site at QNI's Yabulu nickel-cobalt refinery. The facility would provide electricity and steam for the refinery, replacing the existing coal-fired power station; surplus electricity would be sold to the Queensland market. The project was to be developed, operated, and owned by AGL and TransAlta.

In late November, Billiton completed acquisition of 100% of QNI following a bid for \$275 million in early September (Engineering and Mining Journal, 1999).

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

Silver.—Australia was a major silver producer in 1998, ranking fourth largest in the world after Mexico, the United States, and Peru (World Bureau of Metal Statistics, 1999, p. 119). Most of the country's production, however, continued to be a byproduct of copper-gold, gold, or lead-zinc mining.

In December, the Western Australia Department of Minerals and Energy conditionally approved the development and operation of the underground Elizabeth Hills (formerly known as Munni Munni) native silver project. The Elizabeth Hills Mine is 40 km southeast of Dampier, Western Australia, and is

managed by East Coast Minerals NL (Resource Information Unit, 1999, p. 324).

At yearend, BHP Minerals' Cannington underground silver-lead-zinc mine was on target to become the world's biggest single producer of silver—producing 750 t/yr. Some of the mine's silver will be used to make all the silver medals for the 2000 Summer Olympic and Paralympic Games in Sydney (Resource Information Unit, 1999, p. 318).

An upgrade of Pasminco's Port Pirie lead refinery in South Australia during the latter third of 1998 also was to double the refinery's silver production to 440 t/yr by midyear 2000 (Mining Journal, 1998f).

Production of byproduct silver from WMC's Olympic Dam Mine will increase from about 12,500 to about 30,000 kg/yr as a result of the expansion program (Resource Information Unit, 1998, p. 108).

Tin.—In August, Perth-based Murchison United NL agreed to purchase the 10,000-t/yr Renison Bell underground tin mine on the west coast of Tasmania from RGC, which merged in December 1998 with Westralian Sands to create Iluka in early 1999. RGC announced that Renison Bell was for sale in April, a time when its corporate strategy was changing to focus on its core business of mineral sands mining. The mine, however, was to be sold only as a going concern. Murchison agreed to purchase the mine for \$24.4 million, with an immediate payment of \$12.2 million followed by annual payments of \$3.05 million beginning during the financial year ending June 30, 2000. Additionally, RGC was to receive a royalty if the tin price exceeded \$4,575 per metric ton during the period from 2000 to 2004 (Metal Bulletin, 1998h).

Tungsten.—Tasmania Mines Ltd. produced a small quantity of low- and high-grade scheelite concentrates from its Kara No. 1 pit 30 km south of Burnie, Tasmania, for use in the specialty steel industry. The Kara Mine also produced magnetite for use in coal washeries (Resource Information Unit, 1998, p. 304).

Vanadium.—In November, construction began on the estimated \$70 million Windimurra vanadium project 80 km southeast of Mount Magnet in Western Australia. Commissioning of the project was scheduled for September 1999. The mine and processing plant would produce 7,170 t/yr of vanadium pentoxide, representing about 12% of world production. In midyear, drilling had increased the measured vanadium resource by 150%, confirming it to be the largest vanadium ore reserve in the world. The joint venture project was owned by Swiss-based Sudelektra Holding AG (51%) and Precious Metals Australia Ltd. (49%) (Resource Information Unit, 1999, p. 377-378). The plant also could produce vanadium trioxide, depending upon market conditions (Smith, 1998).

Industrial Minerals

Cement.—Five industrial conglomerates accounted for most of the country's cement capacity by holding large-share percentages of a multitude of plants around the country.

Adelaide Brighton Cement Ltd. held the most, about 2.1 Mt/yr of capacity, or a 29% share; Blue Circle Southern Cement Ltd., approximately 2 Mt/yr, or 28%; Australian Cement Holdings Ltd., about 1.4 Mt/yr, or 20%; Queensland Cement Ltd., about 1.3 Mt/yr, or 18%; and Cockburn Cement Ltd., 300,000 t, or about 4%.

Diamond.—Since 1986, Australia has been the largest volume producer of natural diamond in the world. In 1998, Australian diamond production was more than 37% of world production (Resource Information Unit, 1999, Map Supplement), all coming from the Argyle open cut in the Ellendale diamond province, western Kimberley region, Western Australia. Because only a small portion of its output is of gem quality, Argyle's production represented less than 5% of the annual world diamond supply by value (Mining Journal, 1998j); in 1998, diamond sales were valued at \$398 million, an increase of 20% compared with that of 1997 and a record high (Ashton Mining Ltd., 1998a, p. 8).

Since the 1995 closure of the Bow River alluvial operations 20 km east of the Argyle Mine, the only commercial production of diamond in Australia was from the AK-1 lamproite pipe and alluvial operations at Argyle. About 5% of Argyle's production was of gem quality, including a small proportion of the highly valued intensely pink stones ("Argyle Pink") that generate about 50% of revenues but represent only about 0.1% of production; 45% was near gem quality that produce about 45% of revenues; and 50% was industrial grade that contributes just 5% of revenues.

Argyle Diamonds Sales Pty. Ltd. was the management company and operator of the Argyle Diamond Mines Joint Venture's (ADMJV) Argyle Mine. Partners in the joint venture were Rio Tinto, 57%; Ashton Mining, 38%; and Western Australia Diamond Trust, 5%. ADMJV marketed all its rough diamond production through its European sales office in Antwerp, Belgium. The majority of the mine's production was cut and polished in India and other Asian cutting centers. ADMJV continued to sell the few handfuls of the Argyle Pink fancy diamonds unique to the Argyle Mine at its annual Argyle Pink Diamond Tenders, as it has since production startup, as well as the slightly more common yellow-to-brown stones that are marketed as "Argyle Champagne" or "Argyle Cognac" depending upon the specific color. These diamonds were cut and polished by using traditional techniques and automated laser-cutting machines at Argyle Diamond Sales Pty. Ltd.'s small facility in West Perth.

In June, ADMJV approved the first stage of further development of the AK-1 open cut to begin immediately. This required the prestripping of approximately 100 Mt of waste to access an additional 17.6 Mt of ore at an average grade of 2.58 carats per metric ton (kt/t) and resulted in estimated reserves of 64 Mt grading 2.58 kt/t. Further extensions of the open cut operations were expected, and scheduling and costing details already were in progress to be completed by 1999. The extension of the mine life of the open-cut operations postponed planned underground mining development of the Argyle Mine, but only until the full potential of open-cut operations has been realized (Ashton Mining Ltd., 1998b).

Acting as manager and on behalf of its then joint-venture partner Aberfoyle Ltd., Ashton Mining announced in June an agreement with the traditional landholders, or native title claimants, giving their consent to the grant by the Government of the Northern Territory of the Merlin mineral lease in the Coanjula area, Northern Territory, near the Gulf of Carpentaria (Ashton Mining Ltd., 1998c). In September, Aberfoyle was taken over by Western Metals, which then sold its 22.57% share in the Merlin property to Ashton, giving Ashton sole ownership (Resource Information Unit, 1999, p. 109). Construction of access roads was completed, and construction and development of a 700,000-t/yr capacity processing plant began, with commissioning scheduled for early January 1999. Stage 1 of the Merlin Project was to mine and process ore from 7 of the 12 known diamondiferous kimberlite pipes and bulk sample the remaining pipes in the Merlin cluster during a 30-month period. Ore grades for Stage 1 were expected to average 0.43 kt/t (Ashton Mining Ltd., 1998c). When commissioned, Merlin will become Australia's second hardrock diamond mine.

Garnet Sand.—During 1998, GMA Garnet Pty. Ltd.'s garnet sand separation plants near Port Gregory, Western Australia, processed garnet for use as an abrasive in industrial cleaning and maintenance and as a high-pressure cutting agent. The product was sold domestically and exported through the ports of Fremantle and Geraldton, Western Australia.

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

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

Jade was discovered in the form of nephrite, one of the two recognized jade minerals (the other being jadeite), near Cowell on the Eyre Peninsula in South Australia. The deposits near Cowell, the world's largest known resource of nephrite jade, are mined every 2 years for enough nephrite to satisfy the

market. Australia produced most of the world's chrysoprase, which is known as Australian Jade outside of Australia.

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

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

Kaolin.—Australian Kaolin Ltd.'s Skardon River kaolin deposit on Cape York Peninsula, 100 km north of Weipa, began production in October, producing hydrous and calcined kaolin for the paint, plastic, and rubber markets. Plant capacity was 200,000 t/yr, and initial projections were for the production of 100,000 t/yr of hydrous kaolin and 75,000 t/yr of calcined kaolin (Industrial Minerals, 1998a).

Lithium and Tantalum.—Gwalia Consolidated Ltd. was the world's largest producer of lithium minerals (spodumene), which were mined from the southern end of the Greenbushes Mine, the world's largest, highest grade spodumene resource, 300 km south of Perth. Gwalia Consolidated also was the world's largest producer of tantalum, supplying approximately 25% of the world's tantalum requirements annually (Sons of Gwalia Ltd., 1998, p. 24). Both commodities were extracted from two separate open cuts, spaced about 300 meters (m) apart, within the Greenbushes pegmatite ore body, one of the largest zoned rare metal pegmatites in the world. Additionally, Gwalia Consolidated produced tantalum from the Mount Cassiterite ore body at its Wodgina Mine, 100 km south of Port Hedland. Wodgina was the largest hardrock tantalum mine in the world, second only to the Greenbushes Mine (Gwalia Consolidated Ltd., 1997, p. 14).

In January, Gwalia Consolidated and Sons of Gwalia Ltd. (SOG), its associated company, agreed to corporate restructuring and consolidation of core assets, resulting in Gwalia Consolidated's becoming a wholly owned subsidiary of SOG. Gwalia Consolidated ceased trading on the Australian Stock Exchange in May. In the restructuring, U.S.-based Cabot Corp., one of the world's largest tantalum processors, acquired a 7% interest in SOG and thereby assured security of tantalite ore processing contracts for both companies (Resource Information Unit, 1999, p. 482-483).

At yearend, a \$9.1 million upgrade of Wodgina's milling facility was in progress to more than double annual production, from 80,000 kg to between 160,000 and 180,000 kg. The upgrade was slated for commissioning in July 1999 (Resource

Information Unit, 1999, p. 366).

Magnesia.—In November, a proposed magnesite-to-magnesium metal project in South Australia was given an official launch by its Parliament in Adelaide. SAMAG Ltd., owned by Pima Mining Ltd. (80%) and Resource Finance Corp. (20%) were granted exploration licenses to develop the cryptocrystalline magnesite deposits in the Flinders and the Willouran Ranges. The proposed project will involve the open-cut mining of from 200,000 to 250,000 t/yr of raw magnesite which, after preliminary treatment, will be shipped by rail from Leigh Creek to a new 50,000- to 55,000-t/yr capacity magnesium metal plant at Port Augusta. A definitive feasibility study was to be completed by June 1999 (Mining Journal, 1998).

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

The Magnesium Metal Project, a 50-50 joint venture of QMC and Commercial Minerals Ltd., a wholly owned Normandy Mining subsidiary, was formed in 1997 to develop process technology for producing magnesium metal and alloys from the magnesite ore. During 1998, the evaluation of magnesite resources outside the existing QMAG mining leases proceeded with infill drilling at the Oldman North portion of the deposit, and infill drilling was completed within the southern portion of the leases to define additional ore reserves (Resource Information Unit, 1999, p. 330.)

Phosphate Rock.—In December, WMC Fertilizers Ltd. reported that its \$427 million Queensland Fertilizer Project at Phosphate Hill, 150 km south of Mount Isa, was on budget and on schedule for completion by yearend 1999 (Mining Journal, 1998g). About 75% of the engineering and 23% of the construction were completed. The mining and processing facilities were scheduled to produce 1 Mt/yr of high-analysis ammonium phosphate fertilizers, monoammonium phosphate (MAP), and diammonium phosphate (DAP). The DAP and MAP produced at Phosphate Hill will be railed to Townsville where they will be shipped to Australian and offshore markets (Resource Information Unit, 1999, p. 302).

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

Dampier Salt supplied more than one-half of Australia's annual salt production from its solar operations at Dampier Field on Mistaken Island near Dampier in the Pilbara area and Lake MacLeod Field near Carnarvon. Salt from the Dampier Field was produced by evaporation of seawater; the evaporating ponds cover more than 9,000 hectares (ha). At Lake MacLeod, natural brine was recovered from the subsurface Lake MacLeod

Aquifer through shallow wells from depths of 4 to 6 m and circulated by gravity through an evaporating pan system where salt crystals were grown for harvest and processing. Dampier Salt produced mainly industrial-grade salt for chemical and industrial uses, but the product also was approved as a food-grade salt.

Dampier Salt supplied more than one-half of Australia's salt exports. Japan remained Dampier Salt's main market, with Indonesia, the Republic of Korea, and Taiwan receiving the bulk of the remaining export sales (Resource Information Unit, 1999, p. 443).

The Cargill, formerly the Leslie Salt, salt project at Port Hedland, owned by the Cargill Salt department of Cargill Australia Ltd., a wholly owned subsidiary of Cargill Inc. of the United States, was the second largest Australian solar salt producer. Salt was produced by a process of evaporation and concentration in which salt water was pumped into a series of concentration and crystallizer ponds covering an area of about 8,000 ha. The Cargill operation had a capacity of about 3 Mt/yr. Cargill exported high-quality salt throughout Asia mainly to the chemical industry (Resource Information Unit, 1999, p. 363).

Silica.—At the Kemerton Mine [SOG (70%) and Itochu Australia Ltd. (30%)], high-quality silica sand containing aluminum and potassium suitable for the container and sheet glass markets was produced; it is about 25 km northeast of Bunbury, Western Australia. Production was exported to Japan. A study to investigate increasing production from 400,000 to 700,000 t/yr was deferred owing to the uncertainty of markets in Japan and Southeast Asia (Resource Information Unit, 1999, p. 303).

Talc.—In September, SOG sold its 50% share in the Mount Seabrook talc open-cut mine to Commercial Minerals for about \$2 million plus working capital. The deal came just 2 years after Gwalia's sale of a 50% interest to Industria Mineraria Italiana Fabi, an Italian talc producer, for \$1.5 million. The mine was capable of producing about 300,000 t/yr of talc product. The Mount Seabrook Mine is about 160 km northeast of Meekatharra, Western Australia, and produced high-grade cosmetic talc and industrial grades (Industrial Minerals, 1998b).

Mineral Fuels

Coal.—In 1998, Australia was the world's largest exporter of coal for the 14th consecutive year (Mining Magazine, 1999). During this time, exports more than doubled to 167 Mt in 1998 from 79 Mt in 1984 (U.S. Energy Information Administration, June 1999, Australia, Country Analysis Brief, accessed September 24, 1999, at URL <http://www.eia.doe.gov/emeu/cabs/australi.html>). Virtually all production for export was based on the mining of black (bituminous and subbituminous) coal in New South Wales and Queensland. Coal exports were shipped from 11 terminals at 7 ports along the country's eastern coast (International Bulk Journal, 1999). The major market for Australia's coal exports was Japan and other Asian

countries, but significant tonnage also was exported to Europe, the Indian subcontinent, the Middle East, and South America (Australian Bureau of Agricultural and Resource Economics, 1999, p. 11-12). In 1998, Australia produced about 6% of the world's salable black coal, ranking fifth after China (35%), the United States (23%), India (8%), and the former U.S.S.R. (8%). Approximately 71% of Australia's raw black coal production was from open-cut mines (Australian Geological Survey Organization, 1999b, p. 13-14). Approximately 74% of Australia's salable black coal production of 225 Mt (58% of raw, or total, production) was exported in 1998, making coal the country's biggest export commodity (Resource Information Unit, 1999, p. 60). Approximately 83 Mt was metallurgical coal, and about 84 Mt was steaming coal.

Australian brown coal, or lignite, production in 1998 was about 65 Mt, up from 61 Mt in 1997. This was more than 7% of the world's brown coal production in 1998 and was the fourth largest tonnage after Germany (21%), the United States (17%), and the former U.S.S.R. (14%) (Australian Geological Survey Organization, 1999b, p. 15).

The principal areas of coal production in Australia are the Bowen Basin, Queensland; Hunter Valley, Western Coalfield, and South Coast Coalfield, New South Wales; Leigh Creek (all brown coal), South Australia; Fingal, Tasmania; Latrobe Valley Coalfield (mostly brown coal), Victoria; and near Bunbury, Western Australia. The Northern Territory does not have any coal production.

Approximately 20,000 people were employed in the black coal industry, mostly in New South Wales and Queensland; employment, however, was locally significant in South Australia, Tasmania, and Western Australia (Australian Geological Survey Organization, 1999b, p. 13).

The Newcastle Wallsend Coal Co. Pty. Ltd. placed its wholly owned Gretley underground mine near Newcastle on a care and maintenance program while the company evaluated the mine's future. Gretley coal was blended at Newcastle to produce a range of products suitable for cokemaking and energy fuel; thermal and coking coals had been exported to Asia and Europe (Resource Information Unit, 1999, p. 66).

In August, Centennial Coal Co. Ltd. acquired a 90% majority share in the Clarence underground mine near Lithgow, New South Wales. Production resumed in September after being placed on care and maintenance by the previous owner in January 1998. The mine produced a premium low-sulfur coal, with production fully secured by long-term export contracts (Resource Information Unit, 1999, p. 64).

In October 1998, Rio Tinto, through Queensland Coal Pty. Ltd., its wholly owned subsidiary, agreed to buy ARCO Coal Australia Inc.'s 80% interest in the Gordonstone underground mine in Emerald, Queensland, for \$150 million. Gordonstone had been Australia's highest capacity longwall mine with output exceeding 4.6 Mt/yr in 1996. In April 1997, ARCO announced it was disposing its coal portfolio. With no acceptable buyers by October 1997, ARCO placed the mine on indefinite care and maintenance following consistently poor investment returns. In February 1998, ARCO announced the mine would not reopen until it could operate competitively. Gordonstone still was on care and maintenance at yearend

(Resource Information Unit, 1999, p. 76).

Petroleum and Natural Gas.—Australia produced about 80% to 85% of its crude oil requirements. About 44% of the crude oil and condensate was produced in the Gippsland Shelf Fields in the Bass Strait between Tasmania and Victoria. The Carnarvon Basin off the northwestern coast of Western Australia was Australia's next largest producer, providing about 41% of total production. The Gippsland Basin in Victoria was the largest producer of natural gas (a 33% share) and LPG (69%). The North West Shelf Development Project on the Continental Shelf about 140 km offshore Dampier, Western Australia, was the source of Australia's liquefied natural gas production (Australian Institute of Petroleum Ltd., 1999, *Where does our oil and gas come from and how long will it last?*, Frequently asked questions, accessed September 24, 1999, at URL <http://www.aip.com.au/education/faq/index.html>).

The first oil production in the Zone of Cooperation Area (ZOCA) in the Timor Sea between Australia and Indonesia began in July when oil from BHP Petroleum Pty. Ltd.'s Elang, Kakatua, and Kakatua North Fields started flowing (Offshore Engineer, 1998). The ZOCA, established by treaty signed by Australia and Indonesia in 1989, was divided into three regions—each country separately controlled its own, and a third was administered jointly (World Oil, 1998).

In August, Shell Australia Ltd. and Mobil Oil Australia Ltd. signed a memorandum of understanding on a proposal to combine their refining operations in Australia into a joint venture to be owned equally. The \$1.2 billion merger did not include the downstream retail marketing area (Petroleum Gazette, 1998).

In September, an explosion and subsequent fire at the Longford, Victoria, gas-processing complex resulted in the shutdown of all production from the Bass Strait oil and gasfields between mainland Australia and Tasmania. The Victorian Government subsequently banned the use of all nonemergency use of natural gas in the State, including the capital city of Melbourne. Longford's three plants, operated by Esso Australia Resources Ltd. in joint venture with BHP Petroleum, processed all the gas produced in Bass Strait, and many producers, including Esso and BHP Petroleum, declared force majeure on crude oil, LPG, and gas contracts as a result of the incident (Financial Times, 1998). Natural gas production resumed in October, and limited crude oil production resumed in early December (Broken Hill Pty. Co. Ltd., 1999, p. 35).

In November, Chevron Asiatic Ltd., developer of the proposed \$1.48 billion, 2,500-km gas pipeline from Papua New Guinea (PNG) to Townsville and Gladstone in Queensland, announced that the participants had signed a pipeline development agreement with the consortium of Sydney's Australian Gas Light Co. and Petronas, the Malaysian national oil corporation, for the construction, operation, and ownership of the Australian sector of the line. The agreement finalized all commercial terms associated with the development of the Australian sector (Petroleum Gazette, 1999b). Although all the key Australian customers of the gas to be brought into the

Townsville-Gladstone areas through the PNG-Queensland Gas Pipeline Project had not yet been signed, the pipeline's promoters were considering near yearend the construction of a 500-km spur from a junction on Cape York Peninsula across the Gulf of Carpentaria to supply Nabalco Pty. Ltd.'s Gove alumina refinery at Nhulunbuy in the Northern Territory. Additionally, Chevron Asiatic indicated its interest in extending the pipeline south from Gladstone to Brisbane because of the knowledge that the gas would be cheaper than that currently supplied from within Queensland and from the Cooper Basin, South Australia (South Sea Digest, 1998). Construction of the 2,000-km Australian section was to begin in April 1999, with the first gas planned for delivery in October 2001 (Petroleum Economist, 1998).

In December, BP Australia Holdings Ltd. and Caltex Australia Ltd. proposed a merger, similar to the venture between Shell Australia and Mobil Oil Australia, to unify their four local refineries and associated oil supply and shipping functions into one company and, at yearend, were in detailed discussions (Petroleum Gazette, 1999a).

Australia has nine oil refineries with a total production capacity of more than 807,000 barrels per day (bbl/d) of oil. The largest facility was BP Amoco Refinery (Kwinana) Pty. Ltd.'s 131,500-bbl/d Kwinana Refinery in Western Australia, followed by Mobil Refining Australia Pty. Ltd.'s 120,000-bbl/d Altona Refinery and Shell Refining (Australia) Pty. Ltd.'s 110,000-bbl/d Geelong Refinery, both in Victoria (U.S. Energy Information Administration, June 1999, Australia, Country Analysis Brief, accessed September 24, 1999, at URL <http://www.eia.doe.gov/emeu/cabs/australi.html>).

The total number of petroleum exploration and development wells drilled during 1998 (266) was 65 fewer than that of 1997 (331, revised). The number of onshore exploration wells drilled in 1998 (94) was 25 fewer than that of 1997 (119, revised). During 1998, the number of offshore exploration wells drilled increased to 74 compared with that of 1997 when 57 (revised) wells were drilled and easily surpassing the record of 64 wells drilled in 1990. The total number of exploration wells drilled in 1998 (168) decreased by 45% from the number drilled in 1997 (176). The total number of development wells drilled (98) was 57 fewer than the 1997 figure (155, revised); 57 wells were drilled onshore, a decrease of 22 wells from the 1997 figure; and 41 were drilled offshore compared with 76 wells drilled in 1997. In 1998, the total meters drilled for exploration and development wells (628,807) was about 12% less than that drilled in 1997 (718,915, revised). The 972,059 line kilometers of seismic survey activity during 1998 was more than double that recorded in 1997, the previous record year with 476,142 (revised) line kilometers. The number of petroleum discoveries offshore in 1998 (10) was near the 1997 record high of 12. There were 32 (30 gas, 2 oil) onshore discoveries in 1998 (Australian Geological Survey Organization, 1999a).

Uranium.—The existence of uranium in Australia has been known since the 1890's. In the 1930's, ores were mined at Mount Painter and Radium Hill in South Australia to recover minute amounts of radium for medical purposes. Additionally,

a few hundred kilograms of uranium also were produced and used as a bright-yellow pigment in glass and ceramics. Uranium ores as such initially were mined and treated in Australia from the mid-1950's until 1971. The Mary Kathleen Mine in Queensland, and the Radium Hill and Rum Jungle mines in the Northern Territory were the largest producers of uranium (as yellowcake, or ammonium diuranate). The uranium material was intended primarily for export to the United Kingdom and the United States for use in their weapons programs of the period, but much also was used in nuclear plants for the production of electricity. Uranium mining resumed in 1979 at the Nabarlek Mine in the Northern Territory, and treatment of its stockpiled ore began in 1980. Since 1981, Australia's uranium oxide concentrates have been sold strictly for electrical power generation. The Commonwealth Government has had appropriate safeguards in place to ensure that Australia-originated uranium material complied with this policy. Australia's uranium reserves were the world's largest—having about 40% of the Western World's and about 25% of the world's total (Minerals Gazette, 1996; Uranium Information Center Ltd., 1999a).

In Australia, uranium oxide (U_3O_8) was produced at two mining-milling operations during 1998—at the Ranger Mine in the Alligator Rivers region of the Northern Territory and at the huge polymetallic (copper-gold-silver-uranium) Olympic Dam Mine at Roxby Downs, South Australia. Australia's total production for 1998 was 5,790 t of U_3O_8 containing 4,910 t of uranium. Ranger produced 4,050 t U_3O_8 (3,434 t uranium), and Olympic Dam, 1,740 t U_3O_8 (1,476 t uranium). Australian production for 1998 was about 11% less than that of 1997 (Australian Geological Survey Organization, 1999b, p. 34).

Energy Resources of Australia Ltd. (ERA) began full-scale production at the Ranger No. 3 ore body in mid-1997, using the mined-out No. 1 open pit, originally opened in 1980, about 1 km to the south as a repository for the mill tailings. ERA supplied about 12% of the world's uranium production. Sales of uranium oxide concentrate in 1998 were to energy utilities in France, Germany, Japan, the Republic of Korea, Spain, Sweden, the United Kingdom, and the United States. All were under the auspices of international and bilateral safeguards regulations (Uranium Information Center Ltd., 1999c).

WMC's Olympic Dam Mine is 560 km north of Adelaide, South Australia's capital city; the massive ore deposit, the largest known uranium ore body in the world, is 350 to 700 m below the surface. Although the mine was primarily a copper producer, the associated uranium produced about 20% of the mine's revenue.

A \$750 million expansion project at Olympic Dam began in late 1996, with commissioning to begin at yearend (MESA Journal, 1998). The expansion, including an automated electric rail haulage system and a new gyratory crusher station underground, a new autogenous mill incorporating the latest grinding technology, a new smelter, an enlarged hydrometallurgical plant, and a third haulage shaft, was to increase production capacity to 3,700 t/yr U_3O_8 by 2001 (Australian Geological Survey Organization, 1999b, p. 35). The expansion program was expedited to bring the increased capacity on-line in early 1999, with the cost escalating to \$1.2

billion and the uranium oxide capacity increasing to 4,600 t/yr from 1,700 t/yr (Mining Journal, 1998o). In 1998, uranium oxide concentrate was sold to electric utilities in Belgium, Canada, Finland, France, the Republic of Korea, Japan, Sweden, the United Kingdom, and the United States under long-term contracts (Uranium Information Center Ltd., 1999b).

The Jabiluka Mine, then owned by Pancontinental Mining Ltd., was scheduled to open shortly following that of Ranger in 1980. Along with the Nabarlek and the Ranger (except the Ranger #2 ore body) Mines, Jabiluka was excluded from the Kakadu National Park in 1979 and 1984 as the park was being created. Full environmental assessment procedures were required for Jabiluka. Additionally, to ensure that the continuing operations did not damage the environment, and especially the Kakadu National Park, the Office of the Supervising Scientist, an independent statutory authority, was established as the Commonwealth's watchdog.

Jabiluka's original environmental impact statement (EIS) was approved in 1979. In 1982, a mineral lease was granted by the Northern Territory for a period of 42 years following the signing of an agreement with the Northern Land Council and the traditional Aboriginal owners. By the end of 1982, all necessary mining and environmental approvals were obtained from the appropriate governments for the underground mining of the Jabiluka #2 ore body, and Pancontinental was cleared by the Commonwealth to seek sales contracts. Although commitments were obtained to supply more than 15,600 t of uranium oxide during a 10-year period, a new Government came to power in the 1983 Federal elections, and approval was withdrawn; development of Jabiluka ceased until the Government changed in the 1996 Federal elections. Meanwhile, ERA, owner and operator of the adjacent Ranger Mine, purchased the Jabiluka Mine in 1991, along with its development agreements, for about \$98 million.

A completely new EIS for Jabiluka was approved in 1997. Under the terms of the original Aboriginal agreement, changes to the design and operation of the mine were renegotiated with the Northern Land Council and agreed upon in May 1998. Because of the opposition of the traditional owners who had inherited the 1982 agreement, ERA faced the possibility of having to mill Jabiluka's ore at the mine site rather than at the Ranger Mine, 20 km to the south, as originally planned. A Public Environmental Report (PER) was addressed as to the merits of the Jabiluka mill alternative. After a modest delay for its consideration and independent review, the PER was approved in August 1998 (Uranium Information Center Ltd., 1999d).

Other Australian uranium-mining developments included two in-situ leach (ISL) operations in South Australia that were at the pilot stage undergoing evaluation for full production in 1999. The Beverley ISL Mine, 520 km north of Adelaide, which had been purchased by Heathgate Resources Pty. Ltd., a wholly owned subsidiary of General Atomics Inc. of the United States, in 1990, was expected to produce 900 t/yr of U₃O₈ during an expected mine life of more than 25 years. By the end of 1998, Heathgate had spent about \$8 million on testing, including an on-site pilot extraction plant. An EIS was prepared, and a Government decision on whether commercial

mining will be allowed to proceed at Beverley was expected during 1999 (Resource Information Unit, 1999, p. 372).

Trial mining began in 1998 at the Honeymoon ISL Mine, including the Goulds Dam and the East Kalkaroo properties, by Southern Cross Resources Australia Pty. Ltd. Production was expected to increase to 100 t/yr, and the facilities would then undergo a \$3.8 million expansion to allow commercial production of 450 t/yr in 1999, potentially rising to 900 t/yr (Resource Information Unit, 1999, p. 372). The Honeymoon and adjacent properties are about 75 km northwest of the mining center of Broken Hill, New South Wales, but 30 km inside South Australia.

Reserves

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

Infrastructure

The transportation infrastructure of Australia was well developed. There were 913,000 km of roads, including 353,331 km paved, of which 1,363 km was expressways, and 559,669 km unpaved. Inland waterways, of which 8,368 km was usable for mainly small, shallow-draft craft, were of little importance to the transportation industry (U.S. Central Intelligence Agency, 1999, Australia, The World Factbook, accessed October 27, 1999, at URL <http://www.odic.gov/cia/publications/factbook/as.html>).

The public sector railway system consisted of 38,563 km of track, of which 16,752 km was standard (1.435-m) gauge, 15,728 km was narrow (1.067-m) gauge, and 6,083 km was broad (1.600-m) gauge. There were 2,914 km of electrified rail. A few hundred kilometers of rail were privately owned, most of which served the iron ore industry in Western Australia. Of 408 airports, 262 were principal with permanent-surface runways. International shipping ports included Adelaide, Brisbane, Cairns, Darwin, Devonport (Tasmania), Esperance, Fremantle, Geelong, Hobart (Tasmania), Launceston (Tasmania), Mackay, Melbourne, Sydney, and Townsville. The merchant marine fleet included 8 petroleum-oil-lubricant tankers, 4 chemical tankers, 4 liquefied gas tankers, and 29 bulk ore freighters (U.S. Central Intelligence Agency, 1999, Australia, The World Factbook, accessed October 27, 1999, at URL <http://www.odic.gov/cia/publications/factbook/as.html>).

Pipelines included 5,600 km for natural gas, 2,500 km for crude oil, and 500 km for refined oil products (U.S. Central Intelligence Agency, 1999, Australia, The World Factbook,

accessed October 27, 1999, at URL <http://www.odic.gov/cia/publications/factbook/as.html>). Electric generating capacity was 38.83 gigawatts (U.S. Central Intelligence Agency, 1999, Australia, The World Factbook, accessed October 27, 1999, at URL <http://www.odic.gov/cia/publications/factbook/as.html>).

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

Outlook

Although the Australian economy came through the major financial collapse in Southeast Asia much stronger than initially expected, some of its resource sectors (e.g., coal, copper, gold, and iron ore, among others) were adversely affected. The dominant dependency on Japan saw major reductions in price and supply contracts, especially for coal and iron ore. Most other Asian countries also were importing less, resulting in additional declines in exports from the Australian minerals sector. Australia, however, should remain among the leaders in world mineral supply, particularly in those mineral commodities in which it is abundantly endowed, such as bauxite, coal, copper, diamond, gold, iron ore, lead, manganese, mineral sands, natural gas, and zinc.

Although the Asian financial and economic crisis that manifested itself in 1997 did not have much of an effect on Australia's economy in 1998 (the economy grew by approximately 4.7%) the annual growth rate of the economy was estimated to be only about 3% in 1999, predominantly owing to diminished exports in the minerals sector (U.S. Energy Information Administration, June 1999, Australia, Country Analysis Brief, accessed September 24, 1999, at URL <http://www.eia.doe.gov/emeu/cabs/australi.html>).

References Cited

- Ashton Mining Ltd., 1998a, Annual report: Ashton Mining Ltd., 56 p.
- 1998b, Argyle joint venture announces further AK-1 open pit development: Melbourne, Ashton Mining Ltd. press release, June 23, 1 p.
- 1998c, Ashton announces native title agreement and grant of mineral lease for Merlin diamond project: Melbourne, Ashton Mining Ltd. press release, June 16, 1 p.
- Australian Bureau of Agricultural and Resource Economics, 1999, Australian mineral statistics—June quarter: Australian Bureau of Agricultural and Resource Economics, 32 p.
- Australian Geological Survey Organization, 1999a, Australian petroleum exploration and development activity: Canberra, Australian Geological Survey Organization, 4 p.
- 1999b, Australia's identified mineral resources 1999: Canberra, Australian Geological Survey Organization, 59 p.
- Australian Journal of Mining, 1998, Industry indicators—Top 50 Australian gold mines, 1998: Australian Journal of Mining, v. 14, no. 148, May, p. 22.
- 1999, Olympic Dam update—WMC names new mine shaft at Olympic Dam: Australian Journal of Mining, v. 14, no. 145, February, p. 8.
- Broken Hill Pty. Co. Ltd., 1999, Annual report: Broken Hill Pty. Co. Ltd., 148 p.
- Comalco Ltd., 1999, Annual report: Comalco Ltd., 88 p.
- Department of Resources Development, 1999, Western Australian nickel review 1999: Perth, Department of Resources Development, 64 p.
- Embassy of Australia, 1999, Australia report: Washington, DC, Embassy of Australia, March, 4 p.
- Engineering and Mining Journal, 1998a, In the Pacific—Australia—Anaconda Nickel's \$A1.03B Murrin Murrin nickel-cobalt project: Engineering and Mining Journal, v. 199, no. 11, November, p. 20ww.
- 1998b, In the Pacific—Australia—BHP declared force majeure in late May on delivery of ilmenite: Engineering and Mining Journal, v. 199, no. 8, August, p. 22ww.
- 1998c, In the Pacific—Australia—Hamersley Iron received state government approval in July: Engineering and Mining Journal, v. 199, no. 9, September, p. 19ww.
- 1998d, In the Pacific—Australia—Homestake Mining Co. announced implementation of a revised mining plan: Engineering and Mining Journal, v. 199, no. 11, November, p. 22ww-24ww.
- 1998e, In the Pacific—Australia—Ross Mining has begun construction at its Timbarra project: Engineering and Mining Journal, v. 199, no. 10, October, p. 14ww.
- 1998f, In the Pacific—Australia—WMC Ltd. is reducing production of nickel-in-concentrate by 10,000 t/yr: Engineering and Mining Journal, v. 199, no. 11, November, p. 22ww.
- 1999, In the Pacific—Australia—Billiton completed acquisition of 100% of QNI Ltd.: Engineering and Mining Journal, v. 200, no. 1, January, p. 12ww.
- Financial Times, 1998, Victoria hit by gas shutdown: Financial Times [London], September 28, p. 4.
- Gwalia Consolidated Ltd., 1997, Annual report: Gwalia Consolidated Ltd., 72 p.
- Industrial Minerals, 1998a, World of minerals—AKL Skardon kaolin start-up imminent: Industrial Minerals, no. 373, October, p. 9.
- 1998b, World of minerals—Gwalia sells talc mine to Normandy: Industrial Minerals, no. 374, November, p. 9.
- 1998c, World of minerals—RGC & Westralian in minsands merger worth A\$1.2bn: Industrial Minerals, no. 372, September, p. 8-9.
- International Bulk Journal, 1999, Coal terminal guide 1999—Australia: Supplement to International Bulk Journal, August, p. 1-2.
- Journal of Mines, Metals and Fuels, 1997, The Australian mining industry—An overview: Journal of Mines, Metals and Fuels, v. 45, no. 11-12, November-December, p. 333-344.
- MESA Journal, 1998, Olympic Dam expansion update: MESA Journal, v. 11, October, p. 5-6.
- Metal Bulletin, 1998a, Alcan drops plans to develop Ely bauxite deposit: Metal Bulletin, no. 8251, February 9, p. 5.
- 1998b, BHP cuts production by 14%: Metal Bulletin, no. 8331, November 30, p. 19.
- 1998c, BHP's HBI project on track for 1999 production: Metal Bulletin, no. 8288, June 22, p. 30.
- 1998d, Comalco calls tenders for power station at alumina project: Metal Bulletin, no. 8338, December 24, p. 5.
- 1998e, Eastern Aluminium puts up the for sale sign: Metal Bulletin, no. 8314, October 1, p. 3.
- 1998f, Krakatau reaffirms interest in Australian pig iron project: Metal Bulletin, no. 8300, August 10, p. 27.
- 1998g, MIM receives go-ahead for George Fisher: Metal Bulletin, no. 8271, April 23, p. 7.
- 1998h, Murchison United buys Renison mine from RGC: Metal Bulletin, no. 8305, August 27, p. 5.
- 1998i, Pasminco's Century ahead of schedule: Metal Bulletin, no. 8314, October 1, p. 11.
- 1998j, Stump optimistic about MIM's future in mining: Metal Bulletin, no. 8280, May 25, p. 15.
- 1998k, Titan seeks extra revenue to counteract the effects of the weak nickel price: Metal Bulletin, no. 8331, November 30, p. 7.
- 1998l, Western Metals to commission new plant in June: Metal Bulletin, no. 8269, April 16, p. 9.
- 1999, IISI reports 3% fall in world output last year: Metal Bulletin, no. 8344, January 21, p. 20.
- Metal Bulletin Monthly, 1998a, Australian steel downsizes: Metal Bulletin Monthly, no. 325, January, p. 30.
- 1998b, More BHP iron ore on the way: Metal Bulletin Monthly, no. 330, June, p. 89.
- MIM Holdings Ltd., 1998, Annual report: MIM Holdings Ltd., 77 p.
- Minerals Gazette, 1996, The monster to get bigger: Minerals Gazette, v. 1, no. 91, August, p. 7.
- Mines and Energy South Australia, 1997, South Australia—The jewel in the crown: Eastwood, Mines and Energy South Australia, 4 p.
- Mining Journal, 1998a, Australian titan: Mining Journal, v. 331, no. 8491, July 31, p. 73-74.
- 1998b, Development—Australian gold council formed: Mining Journal, v. 331, no. 8503, October 23, p. 319.
- 1998c, Focus and comment—Iron ore Australia's hopes: Mining Journal, v. 330, no. 8477, April 34, p. 322.

—1998d, Green light for George Fisher: *Mining Journal*, v. 330, no. 8477, April 24, p. 313.

—1998e, Industry in action—Ex-Gunpowder ships first cathode: *Mining Journal*, v. 331, no. 8499, September 28, p. 235.

—1998f, Industry in action—Port Pirie plans: *Mining Journal*, v. 331, no. 8495, August 28, p. 157.

—1998g, Industry in action—WMC's fertilizer project progresses: v. 331, no. 8509, December 4, p. 452.

—1998h, Jabiluka warning: *Mining Journal*, v. 331, no. 8505, November 6, p. 363.

—1998i, Mining week—Aberfoyle lights the fuse: *Mining Journal*, v. 331, no. 8490, July 24, p. 54.

—1998j, Mining week—Argyle to extend pit: *Mining Journal*, v. 330, no. 8486, June 26, p. 485-486.

—1998k, Mining week—Billiton buys Groote Eylandt: *Mining Journal*, v. 331, no. 8512, December 25, p. 501.

—1998l, Mining week—"Flagship" magnesium project in South Australia: v. 331, no. 8510, December 11, p. 466.

—1998m, Mining week—MIM's angle on zinc: *Mining Journal*, v. 331, no. 8497, September 11, p. 195.

—1998n, Mining Week—Nammuldi approval: *Mining Journal*, v. 331, no. 8510, December 11, p. 465-466.

—1998o, Olympic Dam nearly complete: *Mining Journal*, v. 331, no. 8510, December 11, p. 470.

—1998p, Production—Australia rejects UN Jabiluka order: *Mining Journal*, v. 331, no. 8509, December 4, p. 452.

—1998q, Production—Western Metals developments: *Mining Journal*, v. 330, no. 8484, June 12, p. 158.

—1999, Iron and steel annual review: *Supplement to Mining Journal*, v. 333, no. 8543, August 6, p. 65-66.

Mining Magazine, 1998a, Exploration and development—Australasia: *Mining Magazine*, v. 179, no. 5, November, p. 261.

—1998b, Exploration—Australasia—Furukawa: *Mining Magazine*, v. 179, no. 4, October, p. 221.

—1999, Coal news—Australasia—Queensland coal—The facts: *Mining Magazine*, v. 180, no. 1, January, p. 59.

Offshore Engineer, 1998, Timor Gap starts to yield: *Offshore Engineer*, August, p. 12.

Pasminco Ltd., 1999, Review of operations for the quarter ended 31 December 1998: Melbourne, Pasminco Ltd. press release, January 27, 7 p.

Petroleum Economist, 1998, News in brief—Papua New Guinea: *Petroleum Economist*, v. 65, no. 9, September, p. 125.

Petroleum Gazette, 1998, The quarter at a glance—August 1998: *Petroleum Gazette*, v. 33, no. 4, fourth quarter, p. 45-46.

—1999a, Final quarter at a glance—December 1998: *Petroleum Gazette*, v. 34, no. 1, first quarter, p. 45.

—1999b, Final quarter at a glance—October 1998: *Petroleum Gazette*, v. 34, no. 1, first quarter, p. 43.

Prospect, 1999a, Historic Jarrahdale mine: *Prospect*, December 1998-February 1999, p. 18.

—1999b, Wagerup reaches peak: *Prospect*, December 1998-February 1999, p. 20.

Resource Information Unit, 1998, Register of Australian mining 1998-1999: Resource Information Unit, 652 p.

—1999, Register of Australian mining 1999-2000: Resource Information Unit, 648 p.

Smith, R.J.H., 1998, Primary vanadium production—The Windimurra project: Ferroalloys Conference, Boca Raton, Florida, October 26, Proceedings, p. 15.

Sons of Gwalia Ltd., 1998, Annual report: Sons of Gwalia Ltd., 92 p.

South Sea Digest, 1998, Mining and oil—PNG pipeline may be extended: *South Sea Digest*, v. 18, no. 19, December 4, p. 4.

Uranium Information Center Ltd., 1999a, Australia's uranium and who buys it: Melbourne, Uranium Information Center Ltd. Nuclear Issues Briefing Paper 1, July, 6 p.

—1999b, Australia's uranium mines—Olympic Dam: Melbourne, Uranium Information Center Ltd., August, 9 p.

—1999c, Australia's uranium mines—Ranger: Melbourne, Uranium Information Center Ltd., August, 9 p.

—1999d, Jabiluka background: Melbourne, Uranium Information Center Ltd. Mines Paper 8, April, 5 p.

U.S. Embassy, Canberra, Australia, 1998, Prospects good for iron ore exports despite Asian troubles: U.S. State Department Telegram 000829, March 4, 5 p.

WMC Ltd., 1998, Shareholders' Report—Period ended 31 December 1998: WMC Ltd., 4 p.

World Bureau of Metal Statistics, 1999, World metal statistics—October 1999: England, World Bureau of Metal Statistics, 150 p.

World Oil, 1998, South Pacific—Australia's optimism continues [Zone of Cooperation]: *World Oil*, v. 219, no. 8, August, p. 155.

Major Sources of Information

Commonwealth Departments and Enterprises

Australian Bureau of Agricultural and Resource Economics
G.P.O. Box 1563
Canberra, Australian Capital Territory 2601
Australia
Telephone: +61 2 6272 2000
Fax: +61 2 6273 2588
World Wide Web: <http://www.abare.gov.au>

Australian Bureau of Statistics
P.O. Box 10
Belconnen, Australian Capital Territory 2616
Australia
Telephone: +61 2 6252 6627
Fax: +61 2 6207 0282
Email: client.service@abs.gov.au
World Wide Web: <http://www.abs.gov.au>

Australian Geological Survey Organization
G.P.O. Box 378
Canberra, Australian Capital Territory 2601
Australia
Telephone: +61 2 6249 9111
Fax: +61 2 6249 9999
Email: sales@agso.gov.au
World Wide Web: <http://www.agso.gov.au>

Bureau of Rural Sciences
P.O. Box E11
Kingston, Australian Capital Territory 2604
Australia
Telephone: +61 2 6272 4282
Fax: +61 2 6272 4747
Email: info.pubs@brs.gov.au
World Wide Web: <http://www.brs.gov.au/index.html>

Commonwealth Scientific and Industrial Research Organization
P.O. Box 225
Dickson, Australian Capital Territory 2602
Australia
Telephone: +61 2 6276 6766
Fax: +61 2 6276 6608

Department of Industry, Science, and Resources
G.P.O. Box 9839
Canberra, Australian Capital Territory 2601
Australia
Telephone: +61 2 6213 3600
Fax: +61 2 6213 7000
World Wide Web: <http://www.isr.gov.au>

State Government Mines Departments

Mineral Resources Tasmania
P.O. Box 56
Rosny Park, Tasmania 7018

World Wide Web: <http://www.drd.wa.gov.au>

Organizations

Australian Gas Association
G.P.O. Box 323
Canberra, Australian Capital Territory 2601
Australia
Telephone: +61 2 6247 3955
Fax: +61 2 6249 7402
Email: canberra@gas.asn.au
World Wide Web: <http://www.gas.asn.au>

Australian Gold Council
Level 7, 12 St. Georges Terrace
Perth, Western Australia 6000
Australia
Telephone: +61 8 9325 2955
Fax: +61 8 9221 3701
Email: c.crouch@mineralswa.asn.au

Australasian Institute of Mining and Metallurgy
P.O. Box 660
Carlton South, Victoria 3053
Australia
Telephone: +61 3 9662 3166
Fax: +61 3 9662 3662
Email: marketing@ausimm.com.au
World Wide Web: <http://www.ausimm.com.au>

Australian Institute of Petroleum Ltd.
Level 23, 257 Collins St.
Melbourne, Victoria 3000
Australia
Telephone: +61 3 9614 1466
Fax: +61 3 9614 1416
World Wide Web: <http://www.aip.com.au>

Australian Mineral Industries Research Association Ltd.
Level 9, 128 Exhibition St.
Melbourne, Victoria 3000
Australia
Telephone: +61 3 9679 9999
Fax: +61 3 9679 9900
Email: ceo@amira.com.au
World Wide Web: <http://www.amira.au>

Australian Mines and Metals Association Inc.
10-16 Queen St.
Melbourne, Victoria 3000
Australia
Telephone: +61 3 9614 4777
Fax: +61 3 9614 3970
Email: vicamma@amma.org.au
World Wide Web: <http://www.amma.org.au>

Chamber of Minerals and Energy of Western Australia Inc.
Locked Bag N984
Perth, Western Australia 6444
Australia
Telephone: +61 8 9325 2955
Fax: +61 8 9221 3701
Email: chamber@mineralswa.asn.au
World Wide Web: <http://www.mineralswa.asn.au>

Australia
Telephone: +61 3 6233 8333
Fax: +61 3 6233 8338
Email: info@mrt.tas.gov.au
World Wide Web: <http://www.mrt.tas.gov.au>
New South Wales Department of Mineral Resources
P.O. Box 536
St. Leonards, New South Wales 1590
Australia
Telephone: +61 2 9901 8888
Fax: +61 2 9901 8777
Email: webcoord@minerals.nsw.gov.au
World Wide Web: <http://www.minerals.nsw.gov.au>
Northern Territory Department of Mines and Energy
G.P.O. Box 2901
Darwin, Northern Territory 0801
Australia
Telephone: +61 8 8999 5204
Fax: +61 8 8941 1284
World Wide Web: <http://www.dme.nt.gov.au>
Primary Industry and Resources South Australia
Department of Mines and Energy Resources
G.P.O. Box 1671
Adelaide, South Australia 5001
Australia
Telephone: +61 8 8226 0222
Fax: +61 8 8226 0476
Email: mesa@msgate.mesa.sa.gov.au
World Wide Web: <http://www.mines.sa.gov.au>
Queensland Department of Minerals and Energy
G.P.O. Box 194
Brisbane, Queensland 4001
Australia
Telephone: +61 7 3237 1435
Fax: +61 7 3229 7770
Email: enquiries@dme.qld.gov.au
World Wide Web: <http://www.dme.qld.gov.au>
Victorian Department of Natural Resources and Environment
240 Victoria Parade
East Melbourne, Victoria 3002
Australia
Telephone: +61 3 9412 4011
Fax: +61 3 9412 5157
World Wide Web: <http://www.nre.vic.gov.au>
Western Australian Department of Minerals and Energy
100 Plain St.
East Perth, Western Australia 6004
Australia
Telephone: +61 8 9222 3333
Fax: +61 8 9222 3430
World Wide Web: <http://www.dme.wa.gov.au>
Western Australian Department of Resources Development
P.O. Box 7606
Cloisters Square, Western Australia 6850
Australia
Telephone: +61 8 9327 5555
Fax: +61 8 9327 5500
Email: enquiries@drd.wa.gov.au

Minerals Council of Australia
P.O. Box 363
Dickson, Australian Capital Territory 2602
Australia
Telephone: +61 2 6279 3600
Fax: +61 2 6279 3699
World Wide Web: <http://www.mineral.org.au>

New South Wales Minerals Council
P.O. Box A244
Sydney South, New South Wales 1235
Australia
Telephone: +61 2 9267 6488
Fax: +61 2 9264 1121
World Wide Web: <http://www.nswmin.co.au>

Northern Territory Minerals Council Inc.
G.P.O. Box 510
Darwin, Northern Territory 0801
Australia
Telephone: +61 8 8981 4486
Fax: +61 8 8941 1625
Email: ntmc@d130.aone.net.au

Queensland Mining Council
60 Edward St.
Brisbane, Queensland 4000
Australia
Telephone: +61 7 3221 8722
Fax: +61 7 3229 4564
Email: mincomm@qmc.com.au
World Wide Web: <http://www.qmc.com.au>

South Australian Chamber of Mines and Energy
P.O. Box 493
Glenside, South Australia 5065
Australia
Telephone: +61 8 8379 9711
Fax: +61 8 8379 1142
Email: sacome@adelaide.net.au

Uranium Information Centre Ltd.
G.P.O. Box 1649N
Melbourne, Victoria 3001
Australia
Telephone: +61 3 9629 7744
Fax: +61 3 9629 7207
Email: uic@peg.apc.org
World Wide Web: <http://www.uic.co.au>

Victorian Chamber of Mines Inc.
Level 4, 53 Queen St.
Melbourne, Victoria 3000
Australia
Telephone: +61 3 9629 1851
Fax: +61 3 9629 8603
Email: vcm@vicmin.com.au
World Wide Web: <http://www.vicmin.com.au>

Educational Institutions

Curtain University of Technology
PMB 22
Kalgoorlie, Western Australia 6430
Australia
Telephone: +61 8 9088 6110
Fax: +61 8 9088 6100
World Wide Web: <http://www.curtin.edu.au>

Major Publications

Australian Bureau of Agricultural and Resource Economics,
Canberra: Quarterly Mineral Statistics, quarterly.
Australian Bureau of Statistics, Belconnen: Mineral
Production, Australia, fiscal year.
Australian Bureau of Statistics, Belconnen: Production
Statistics, Preliminary, monthly.

TABLE 1
AUSTRALIA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1994	1995	1996	1997	1998 e/
METALS						
Aluminum:						
Bauxite, gross weight	thousand tons	41,733	42,655	43,063	44,465	44,553 2/
Alumina	do.	12,892	13,147	13,348	13,385	13,853 2/
Metal, refined:						
Primary	do.	1,317	1,297	1,372	1,495	1,627 2/
Secondary		55,000	55,000	95,000	100,000	100,000
Antimony, Sb content of ores and concentrates		1,300	900	1,800	1,900	1,800 2/
Cadmium:						
Mine output, Cd content e/		2,275 2/	1,900	1,900	1,900	1,900
Metal, smelter (refined)		910	838	639	632	600
Cobalt: e/						
Mine output, Co content		1,200	1,300	1,400	1,600	1,800
Recovered cobalt, including that from imported source material		2,300	2,500	2,800	3,000	3,300
Columbium-tantalum concentrate, gross weight		700	900	920	1,010	1,150 2/
Copper:						
Mine output, Cu content	thousand tons	415	420	525	560	607 2/
Metal:						
Smelter:						
Primary	do.	315	215	289	208	236 2/
Secondary e/		9,600	1,200	1,200	1,000	1,100
Refined:						
Primary	thousand tons	312	242	314	271	285 2/
Secondary e/	do.	24	18	24	21 r/	22
Gold:						
Mine output, Au content	kilograms	256,188	253,504	289,530	314,500 r/	310,070 2/
Metal:						
Refined:						
Primary	do.	302,612	289,004	329,000	332,700 r/	409,000 2/
Secondary	do.	8,500 e/	8,747	3,620	900 r/	127,000 2/
Iron and steel:						
Iron ore:						
Gross weight	thousand tons	128,493	142,936	147,100	157,766	153,964 2/
Fe content	do.	80,900 e/	88,653	93,000	97,901	95,185 2/
Metal:						
Pig iron	do.	7,466	7,476	7,774	7,884	7,724 2/
Ferrous alloys: e/						
Ferromanganese		100,000	110,000	110,000	95,000	110,000
Silicomanganese		100,000	100,000	95,000	95,000	105,000
Total		200,000	210,000	205,000	190,000	215,000
Steel, crude	thousand tons	8,424	8,447	8,415	8,769	8,888 2/
Semimanufactures e/		4,000	4,000	4,000	5,000	5,000
Lead:						
Mine output, Pb content	thousand tons	537	455	522	531	583 2/
Metal:						
Primary:						
Bullion	do.	197	164	191	178	164 2/
Refined	do.	212	215	204	204	173 2/
Total	do.	409	379	395	382	337 2/
Secondary excluding remelt	do.	21	20 e/	20 e/	25 r/	27 2/
Manganese ore (metallurgical):						
Gross weight	do.	1,924	2,176	2,109	2,136	1,500 2/
Mn content	do.	944	1,066	1,023	1,024	729 2/
Nickel:						
Mine output, Ni content	do.	79	98	113	123 r/	144 2/
Metal, smelter (refined Ni and Ni content of oxide)	do.	67	77	74	74	81 2/
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/

(Metric tons unless otherwise specified)

Commodity	1994	1995	1996	1997	1998 e/
METALS--Continued					
Rare-earth metals, monazite concentrate: e/					
Gross weight	--	200	--	--	--
Monazite content	--	110	--	--	--
Silver:					
Mine output, Ag content	1,045	939	1,013	1,106	1,474 2/
Metal, refined	362	346	356	280	319 2/
Tin:					
Mine output, Sn content	7,495	8,656	8,828	10,168	10,204 2/
Metal, refined:					
Primary	315	570	460	605	319 2/
Secondary e/	260	300	300	300	200
Titanium concentrates, gross weight:					
Ilmenite thousand tons	1,782	1,980	2,028	2,233	2,379 2/
Leucoxene	35,000	31,000	33,000	32,000	30,000 2/
Rutile	233,000	195,000	180,000	214,000 r/	241,000 2/
Tungsten, mine output, W content	11 e/	--	--	--	--
Zinc:					
Mine output, Zn content thousand tons	995	937	1,071	1,035	1,059 2/
Metal, smelter:					
Primary do.	323	320	326	296 r/	304 2/
Secondary e/	4,975 2/	4,500	4,500	11,000 r/	8,000 2/
Zirconium concentrates, gross weight thousand tons	511	518	502	416 r/	393 2/
INDUSTRIAL MINERALS					
Abrasives, natural: e/					
Beach pebble	2,000	2,000	2,000	2,000	2,000
Garnet	25,000	25,000	25,000	25,000	25,000
Barite e/	11,000	11,729 2/	12,000	15,000	15,000
Cement, hydraulic e/ thousand tons	6,500	6,500	6,500	6,500	7,500
Clays: e/					
Bentonite and bentonitic clay	35,000	35,000	35,000	35,000	35,000
Brick clay and shale thousand tons	8,000	8,000	8,000	8,000	8,000
Cement clay and shale do.	500	500	500	500	500
Damourite clay	100	100	100	100	100
Fire clay	25,000	25,000	25,000	25,000	25,000
Fuller's earth (attapulgitic)	15,000	15,000	15,000	15,000	15,000
Kaolin and ball clay	200,000	210,000	210,000	220,000	220,000
Other thousand tons	1,000	1,000	1,000	1,000	1,000
Diamond:					
Gem thousand carats	19,485	18,312	18,897	18,079	18,379 2/
Industrial do.	23,815	22,381	23,096	22,096	22,464 2/
Total do.	43,300	40,693	41,993	40,175	40,843 2/
Diatomite e/	11,000	11,000	11,000	11,000	11,000
Feldspar including nepheline syenite e/	16,000	16,000	17,000	20,000	20,000
Gemstones, other than diamond: e/					
Opal value, thousands	\$100,000	\$100,000	\$100,000	\$110,000	\$126,000
Sapphire do.	\$50,000	\$50,000	\$50,000	\$60,000	\$40,000
Other do.	\$1,500	\$1,500	\$1,500	\$12,000	\$14,000
Total do.	\$151,500	\$151,500	\$151,500	\$182,000	\$180,000
Gypsum e/ thousand tons	2,000	2,000	2,000	2,100 r/	2,100
Kyanite e/	800	800	800	800	800
Lime e/	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000
Magnesite	285,610	263,249	237,707	245,192 r/	360,787 2/
Nitrogen, N content of ammonia	412,600	432,900	446,400	432,400 r/	435,500 2/
Perlite, crude e/	5,000	5,000	5,000	5,000	5,000
Phosphate rock e/	1,500	5,000	17,000	15,000	15,000
Salt thousand tons	7,685	8,148	7,905	8,801 r/	8,879 2/
Sillimanite e/ 3/	100	100	100	100	100
Spodumene, concentrate	45,987	81,841	117,094	88,399	68,666 2/

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1994	1995	1996	1997	1998 e/
INDUSTRIAL MINERALS--Continued					
Stone, sand and gravel: e/					
Construction sand thousand tons	30,000	30,000	30,000	30,000	30,000
Gravel do.	15,000	15,000	15,000	15,000	15,000
Dolomite do.	10,000	10,000	10,000	10,000	10,000
Limestone:					
For cement do.	6,000	6,000	6,000	6,000	6,000
For other uses do.	6,000	6,000	6,000	6,000	6,000
Silica in the form of quartz, quartzite, glass sand do.	2,500	2,500	2,500	2,500	2,500
Other:					
Crushed and broken stone do.	65,000	65,000	65,000	65,000	65,000
Dimension stone do.	100	100	100	100	100
Unspecified do.	30,000	30,000	30,000	30,000	30,000
Sulfur, byproduct:					
Metallurgy do.	230 r/	263	327	474 r/	507 2/
Petroleum e/ do.	35 r/	35 r/	35 r/	35 r/	35
Total e/ do.	265 r/	298 r/	362 r/	509 r/	542
Talc, chlorite, pyrophyllite, steatite e/	215,000	215,000	215,000	215,000	215,000
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Bituminous and subbituminous thousand tons	227,772	193,500	199,800	216,490	222,100 2/
Lignite do.	48,582	50,700	53,600	60,100	66,000 2/
Total do.	276,354	244,200	253,400	276,590	288,100 2/
Coke, metallurgical e/ do.	300	322	325	325	325
Fuel briquets e/ do.	750	750	750	750	750
Gas, natural, marketed million cubic meters	28,146	29,717 r/	29,798 r/	29,950 r/	30,364 2/
Natural gas liquids thousand 42-gallon barrels	23,342	21,560 r/	23,379 r/	25,896 r/	26,116 2/
Peat e/	15,000	15,000	15,000	20,000	20,000
Petroleum:					
Crude thousand 42-gallon barrels	196,539	184,813 r/	198,620 r/	206,965 r/	195,206 2/
Refinery products:					
Gasoline:					
Aviation do.	955	940 r/	980 r/	900 r/	1,072 2/
Motor do.	112,877	113,099 r/	114,534 r/	116,220 r/	115,159 2/
Jet fuel do.	27,008	29,495 r/	31,673 r/	34,082 r/	33,277 2/
Kerosene do.	514	496 r/	1,882 r/	534 r/	510 2/
Distillate fuel oil do.	72,155	75,480 r/	80,471 r/	84,847 r/	82,947 2/
Residual fuel oil do.	14,022	15,588 r/	10,572 r/	11,324 r/	10,362 2/
Lubricants do.	4,903	4,883 r/	4,807 r/	5,321 r/	4,386 2/
Liquefied petroleum gas do.	7,162	8,084 r/	9,689 r/	10,332 r/	9,456 2/
Bitumen do.	4,129	3,825 r/	3,932 r/	4,342 r/	4,053 2/
Unspecified do.	5,976	7,142 r/	6,445 r/	6,512 r/	5,976 2/
Total 4/ do.	249,701 r/	259,032 r/	264,985 r/	274,414 r/	267,198 2/
Uranium, mine output, U content	2,208	3,712	4,945	5,489	4,901 2/

e/ Estimated. r/ Revised.

1/ Includes data available through November 30, 1999.

2/ Reported figure.

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

4/ Excludes refinery fuel and losses.

TABLE 2
AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 1998

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities 1/	Annual capacity e/
Alumina	Queensland Alumina Ltd., operator [Comalco Ltd., 30.3%; Kaiser Aluminum and Chemical Corp. (Australia) Ltd., 28.3%; Alcan South Pacific Pty. Ltd., 21.4%; and Pechiney Australia Pty. Ltd., 20%]	Gladstone Refinery, QLD	3,000
Do.	Nabalco Pty. Ltd., operator, 70%, and Gove Aluminium Ltd., 30%	Gove Refinery, NT	1,600
Do.	Alcoa World Alumina Australia, 100%	Kwinana Refinery, WA	1,900
Do.	do.	Pinjarra Refinery, WA	3,100
Do.	do.	Wagerup Refinery, WA	2,190
Do.	Worsley Alumina Pty. Ltd., operator [Reynolds Australia Alumina Ltd., 56%; Billiton (Australia) Pty. Ltd., 30%; Kobe Alumina Associates (Australia) Pty. Ltd., 10%; and Nissho Iwai Alumina, 4.0%]	Worsley Refinery, WA	1,600
Aluminum	Comalco Aluminium (Bell Bay) Ltd., 100%	Bell Bay Smelter, TAS	142
Do.	Boyne Island Smelters Ltd., operator (Comalco Ltd., 54%; Sumitomo Light Metal Industries Ltd., 17%; Ryawa Development Pty. Ltd., 12%; Kobe Steel Ltd., 5%; and Sumitomo Chemical Co. Ltd., 2%)	Boyne Island Smelter, QLD	490
Do.	Capral Aluminium Ltd., 100%	Kurri Kurri Smelter, NSW	160
Do.	Alcoa of Australia Ltd., 60%, and Western Mining Corp., 40%	Point Henry Smelter, VIC	180
Do.	Alcoa of Australia Ltd., 45% and manager; China International Trust Investment Co., 22.5%, a People's Republic of China Government Agency; Marubeni Australia Pty. Ltd., 22.5%; and Eastern Aluminium Ltd., 10%	Portland Smelter, VIC	345
Do.	Tomago Aluminium Co. Pty. Ltd., operator (Gove Aluminium Finance Ltd., 36%; Pechiney Australia Pty. Ltd., 36%; Australian Mutual Provident Society, 16%; and VAW Australia Pty. Ltd., 12%)	Tomago Smelter, NSW	440
Antimony	Hillgrove Gold Ltd., 100%	Hillgrove open-cut/underground mine, NSW	4
Bauxite	Nabalco Pty. Ltd., operator, 70%, and Gove Aluminium Ltd., 30%	Gove surface mine, NT	7,000
Do.	Alcoa World Alumina Australia, 100%	Huntly and Williwodale surface mines, WA	24,000
Do.	Worsley Alumina Pty. Ltd., manager [Reynolds Australia Alumina Ltd., 56%; Billiton Plc, 30%; Kobe Alumina Associates (Australia) Pty. Ltd., 10%; and Nissho Iwai Australia Pty. Ltd., 4.0%]	Worsley and Mount Saddleback surface mines, WA	5,000
Do.	Comalco Ltd., 100%	Weipa-Andoom surface mine, QLD	12,000
Cement	Blue Circle Southern Cement Ltd., 100%	Berrima Plant, NSW	1,200
Do.	Adelaide Brighton Cement Ltd., 100%	Birkenhead Plant, SA	1,000
Do.	Queensland Cement Ltd., 100%	Darra Plant, QLD	700
Do.	Adelaide Brighton Cement Ltd., 100%	Geelong Plant, VIC	800
Do.	Goliath Cement Holdings Ltd., 100%	Railton Plant, TAS	1,000
Do.	Cockburn Cement Ltd., 100%	South Coogee Plant, WA	1,000
Coal, black	Powercoal Pty. Ltd., 100%	Angus Place underground mine, NSW	2,000
Do.	BHP Steel (AIS) Pty. Ltd., 100%	Appin underground mine, NSW	2,400
Do.	Coalex Pty. Ltd., 95% and manager; and Sumisho Coal Development Pty. Ltd., 5%	Baal Bone underground mine, NSW	3,500
Do.	Coal Operations Australia Ltd., 78.3% and manager; Nippon Oil (Australia) Pty. Ltd., 8.7%; Nippon Steel Australia Pty. Ltd., 8%; and KEPCO Resources Australia Pty. Ltd., 5%	Bayswater No. 3 open cut, NSW	4,800
Do.	Central Queensland Coal Associates, 100% (BHP Coal Pty. Ltd., 52.1%; QCT Resources Ltd., 32.37%; and Mitsubishi Development Pty. Ltd., 15.53%)	Blackwater open cut, QLD	5,000
Do.	Queensland Coal Pty. Ltd., 57.195% and manager; Coney Investments Pty. Ltd., 31.416%; EPDC (Australia) Pty. Ltd., 7.973%; and Japan Coal Development Co. Ltd., 3.416%	Blair Athol open cut, QLD	11,000
Do.	Bloomfield Collieries Pty. Ltd., 100%	Bloomfield open cut, NSW	2,000

See footnotes at end of table.

TABLE 2--Continued
 AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 1998

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities 1/	Annual capacity e/
Coal, black--Continued:	Shell Coal (Callide) Pty. Ltd., 66.7% and manager, and AMP Life Ltd., 33.3%	Boundary Hill open cut, QLD	3,500
Do.	Bulga Coal Management Pty. Ltd., 90% and manager, and Nippon Steel Australia Pty. Ltd., 10%	Bulga open-cut/underground mine, NSW (formerly Saxonvale-Bulga mine)	9,000
Do.	Thiess Contractors Pty. Ltd., 5% and operator, and Portman Mining Ltd., 95%	Burton open-cut, QLD	4,000
Do.	Shell Coal (Callide) Pty. Ltd., 66.7% and manager, and AMP Life Ltd., 33.3%	Callide open cut, QLD	4,500
Do.	Camberwell Coal Pty. Ltd., manager. [Navidale Pty. Ltd., 50%; Toyota Tsusho Mining (Australia) Pty. Ltd., 40%; and Dia Coal Mining (Australia) Pty. Ltd., 10%]	Camberwell open cut, NSW	4,000
Do.	Centennial Coal Co. Ltd., 90% and manager, and SK Corp., 10%	Clarence underground mine, NSW	2,200
Do.	Collinsville Coal Co. Pty. Ltd., 75% and manager, and Itochu Coal Resources of Australia Pty. Ltd., 25%	Collinsville open cut mine, QLD	1,750
Do.	Powercoal Pty. Ltd., 100%	Cooranbong underground mine, NSW	1,600
Do.	BHP Steel (AIS) Pty. Ltd., 100%	Cordeaux underground mine, NSW	2,800
Do.	BHP Minerals Pty. Ltd., 64.14% and manager; QCT Resources Ltd., 32.37%; and Mitsubishi Development Pty. Ltd., 3.49%	Crinum longwall mine, QLD	4,000
Do.	Cumnock No. 1 Colliery Pty. Ltd., 100%	Cumnock No. 1 open-cut/underground mine, NSW	2,750
Do.	ARCO Coal Australia Inc., 87% and manager, and Mitsui Coal Development Australia Pty. Ltd., 13%	Curragh open cut, QLD	6,600
Do.	Dartbrook Coal Pty. Ltd., manager (A and B Coal Co. Pty. Ltd., 75%; Marubeni Thermal Coal Pty. Ltd., 15%; Ssangyong Resources Pty. Ltd., 7%; and Showa Coal (NSW) Pty. Ltd., 3%)	Dartbrook longwall mine, NSW	3,200
Do.	Shell Coal (Drayton) Pty. Ltd., 74.8% and manager; AMP Life Ltd., 13.4%; Mitsui Coal Development Australia Pty. Ltd., 3.8%; Mitsui Mining (Australia) Pty. Ltd., 3%; Daesung Australia Pty. Ltd., 2.5%; and Hyundai (Aust) Pty. Ltd., 2.5%	Drayton open cut, NSW	4,500
Do.	Ebenezer Mining Co., 100%	Ebenezer open cut, QLD	3,000
Do.	BHP Steel (AIS) Pty. Ltd., 100%	Elouera underground mine, NSW	2,500
Do.	Capricorn Coal Management Pty. Ltd., 100% [Shell Coal Holdings (Australia) Ltd., 46.75% of German Creek and 59.47% of German Creek East; Tigor Energy Pty. Ltd., 26.06% of German Creek and 31.14% of German Creek East; Ruhrkohle Australia Pty. Ltd., 27.19% of German Creek; and Marubeni Coal Pty. Ltd., 9.39% of German Creek East]	German Creek and German Creek East open-cut/underground mines, QLD	7,000
Do.	BHP Coal Pty. Ltd., manager, and 52.1% of Goonyella and 80% of Riverside; QCT Resources Ltd., 32.37% of Goonyella; Mitsubishi Development Pty. Ltd., 15.53% of Goonyella; and Mitsui and Co. (Australia) Ltd., 20% of Riverside	Goonyella Riverside open cut, QLD	7,500
Do.	BHP Minerals Pty. Ltd., 64.14% and manager; QCT Resources Ltd., 32.37%; and Mitsubishi Development Pty. Ltd., 3.49%	Gregory open cut, QLD	4,500
Do.	Novacoal Australia Pty. Ltd., 60% and manager, and Mitsubishi Coal Development Pty. Ltd., 40%	Howick open cut, NSW	5,000
Do.	Coal and Allied Industries Ltd., 100%	Hunter Valley No. 1 open cut, NSW	6,300
Do.	Optima Energy, 100%	Leigh Creek open cut, SA	3,000
Do.	Lemington Coal Mines Ltd., 100%	Lemington open cut, NSW	3,500
Do.	Liddell Coal Operations Pty. Ltd., manager (Pasmenco Ltd., 67.5%; and Mitsui Matsushima Australia Pty. Ltd., 32.5%)	Liddell open cut, NSW	4,000
Do.	Moranbah North Coal (Management) Pty. Ltd., manager; Moranbah North Coal Pty. Ltd., 88%; Japanese private interests, 7%	Moranbah longwall mine, QLD	5,000

See footnotes at end of table.

TABLE 2--Continued
 AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 1998

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities 1/	Annual capacity e/
Coal, black--Continued:	Rio Tinto Coal (NSW) Pty. Ltd., manager; Coal and Allied Industries Ltd., 80%, and Pohang Steel Australia Pty. Ltd., 20%	Mount Thorley open cut, NSW	6,500
Do.	BHP Ltd., 80%, and Mitsui and Co. (Australia) Ltd., 20%	Moura open cut, QLD	5,000
Do.	Muswellbrook Coal Co. Ltd., 100%	Muswellbrook No. 2 open cut, NSW	1,850
Do.	The Griffin Coal Mining Co. Pty. Ltd., 100%	Muja open cut, WA	2,000
Do.	Powercoal Pty. Ltd., 100%	Myuna underground mine, NSW	3,000
Do.	Newlands Coal Pty. Ltd., 75% and manager, and Itochu Coal Resources of Australia Pty. Ltd., 25%	Newlands open-cut/underground mine, QLD	7,000
Do.	Powercoal Pty. Ltd., 100%	Newstan underground mine, NSW	2,500
Do.	Sumisho Coal Development Pty. Ltd., 100%	North Goonyella longwall mine, QL	5,000
Do.	BHP Coal Pty. Ltd., 52.1% and manager; QCT Resources Ltd., 32.37%; and Mitsubishi Development Pty. Ltd., 15.53%	Norwich Park open cut, QLD	5,200
Do.	Oaky Creek Coal Pty. Ltd., 75%, operator and manager; Sumitomo Coal Australia Pty. Ltd., 15%; and Itochu Coal Resources of Australia Pty. Ltd., 10%	Oaky Creek open-cut/underground mine, QLD	6,000
Do.	BHP Coal Pty. Ltd., 52.1% and manager; QCT Resources Ltd., 32.37%; and Mitsubishi Development Pty. Ltd., 15.53%	Peak Downs open cut, QLD	7,000
Do.	Wesfarmers Coal Ltd., 100%	Premier open cut, WA	3,000
Do.	Peabody Resources Ltd., 100% at Ravensworth and 50% at Narama. Iluka Resources Ltd., 50% at Narama	Ravensworth-Narama open cut, NSW	6,200
Do.	BHP Coal Pty. Ltd., 52.1% and manager; QCT Resources Ltd., 32.37%; and Mitsubishi Development Pty. Ltd., 15.53%	Saraji open cut, QLD	5,500
Do.	South Blackwater Coal Ltd., 100%	South Blackwater open-cut/long-wall and bord pillar mine, QLD	4,500
Do.	Cyprus Springvale Ltd., 50% and manager, and Samsung Development (Australia) Pty. Ltd., 50%	Springvale underground mine, NSW	2,000
Do.	Austral Coal Ltd., 100%	Tahmoor underground mine, NSW	2,000
Do.	Queensland Coal Pty. Ltd., 100%	Tarong-Meandu open cut, QLD	5,500
Do.	Oceanic Coal Australia Ltd., 80% and manager; Marubeni Australia Ltd., 17%; and Kokan Kogyo (Australia) Pty. Ltd., 3%	Teralba underground mine, NSW	1,700
Do.	BHP Steel (AIS) Pty. Ltd., 100%	Tower underground mine, NSW	2,000
Do.	Ulan Coal Mines Ltd., manager (Mitsubishi Development Pty. Ltd., 49%; Exxon Coal Australia Ltd., 36%; and Morgan Grenfell, 15%)	Ulan open cut-underground mine, NSW	5,500
Do.	Wambo Mining Corp. Pty. Ltd., 100%	Wambo underground mine, NSW	3,000
Do.	Peabody Resources Ltd., 28.75% and manager (Mitsubishi Coal Development Pty. Ltd., 22.75%; Ticor Energy Pty. Ltd., 20%; Peabody Australia Pty. Ltd., 15%; Nippon Steel Australia Pty. Ltd., 7.5%; and Mitsubishi Materials (Australia) Pty. Ltd., 6%)	Warkworth open cut, NSW	5,000
Do.	BHP Steel (AIS) Pty. Ltd., 100%	West Cliff longwall mine, NSW	3,000
Do.	Oceanic Coal Australia Ltd., 80% and manager, and Marubeni (Australia) Pty. Ltd., 3%	West Wallsend underground mine, NSW	2,400
Do.	Powercoal Pty. Ltd., 100%	Wye underground mine, NSW	1,800
Coal, brown	Alcoa World Alumina Australia, 100%	Anglesea open cut, VIC	1,100
Do.	Hazelwood Power Corp., 100%	Hazelwood open cut, VIC	13,000
Do.	Loy Yang Power Ltd., 100%	Loy Yang open cut, VIC	30,700
Do.	Yallourn Energy Pty. Ltd., manager (Powergen International, 49.9%; AMP Life Ltd., 26%; Itochu Australia Ltd., 10.4%; Morgan Grenfell, 8%; and Hastings Fund Management, 5.7%)	Yallourn open cut, VIC	18,500
Cobalt	Preston Resources Ltd., 100%	Bulong open cut, WA 2/	1
Do.	Centaur Mining and Exploration Ltd., 100%	Cawse open cut, WA 2/	2
Do.	Anaconda Nickel Ltd., 60%, and Glencore International AG, 40%	Murrin Murrin open cut, WA 2/	3
Do.	Billiton (Australia) Pty. Ltd., 100%	Yabulu Refinery, QLD	1
Copper	Newcrest Mining Ltd., 100%	Cadia Hill open cut, NSW	23
Do.	Ernest Henry Mining Pty. Ltd., operator and manager (MIM Holdings Ltd., 51%, and Savage Resources Ltd., 49%)	Ernest Henry open-cut, QLD	95

See footnotes at end of table.

TABLE 2--Continued
 AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 1998

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities 1/	Annual capacity e/	
Copper--Continued:	Girilambone Copper Co. Pty. Ltd., manager (Straits Resources Ltd., 60%; and Nord Pacific Ltd., 40%)	Girilambone open cut, NSW	18	
Do.	Murchison Zinc Co. Pty. Ltd., 100%	Golden Grove (includes Gossan Hill and Scuddles) underground mine, WA	16	
Do.	Western Metals Ltd., 100%	Hellyer underground mine, TAS	4	
Do.	MIM Holdings Ltd., 100%	Hilton underground mine, QLD	180	
Do.	Murchison United NL, 60% and manager; and Brancote Australia NL, 40%	Mount Cuthbert open cut, QLD	8	
Do.	Western Metals Ltd., 100%	Mount Gordon open cut, QLD	50	
Do.	MIM Holdings Ltd., 100%	Mount Isa underground mine, QLD	100	
Do.	do.	Mount Isa Smelter, QLD	255	
Do.	Copper Mines of Tasmania Pty. Ltd., 100%	Mount Lyell underground mine, TAS	25	
Do.	Straits (Nifty) Pty. Ltd., 100%	Nifty open cut, WA	10	
Do.	North Ltd., 80% and operator; Sumitomo Metal Mining Oceania Pty. Ltd., 13.3%; and SC Mineral Resources Pty. Ltd., 6.7%	Northparkes open-cut/underground mine, NSW	80	
Do.	Olympic Dam Operations Pty. Ltd., manager (WMC Ltd., 100%)	Olympic Dam underground mine, SA	200	
Do.	do.	Olympic Dam Refinery, SA	50	
Do.	do.	Olympic Dam Smelter, SA	70	
Do.	Placer Pacific Ltd., 100%	Osborne underground mine, QLD	45	
Do.	Peak Gold Mines Pty. Ltd., 100%	Peak underground mine, NSW	3	
Do.	Furukawa Co. Ltd., 52.5%; Nittetsu Mining Co., 20%; Nissho Iwai Corp., 17.5%; Itochu Corp., 10%	Port Kembla Refinery, NSW	80	
Do.	do.	Port Kembla Smelter, NSW	120	
Do.	RGC Thalanga Pty. Ltd., 68.85% and manager; and BML Holdings Pty. Ltd., 31.15%	Reward open cut, QLD	170	
Do.	Pasminco Ltd., 100%	Rosebery underground mine, TAS	4	
Do.	Australian Resources Ltd., 100%	Selwyn open-cut/underground mine, QLD	16	
Do.	Normandy Gold Ltd., 100%	Tennant Creek open-cut/underground mines, NT	17	
Do.	Copper Refineries Pty. Ltd., operator. (MIM Holdings Ltd., 100%)	Townsville Refinery, QLD	225	
Diamond	thousand carats	Argyle Diamond, manager (Rio Tinto Ltd., 57%; Ashton Mining Ltd., 38%; and Western Australian Diamond Trust, 5%)	Argyle Mine (AK-1 lamproite pipe and alluvial deposits), WA	42,000
Gas, condensate	thousand 42-gallon barrels per day	Woodside Petroleum Pty. Ltd., manager [BHP Petroleum Pty. Ltd.; BP Australia Holdings Ltd.; Chevron Asiatic Ltd.; Japan Australia LNG (MIMI) Pty. Ltd.; Shell Development (Australia) Pty. Ltd.; and Woodside Petroleum Ltd., 16.67% each]	North West Shelf operations, 130 kilometers offshore from Dampier, WA	60
Gas, natural	million cubic meters per day	do.	North West Shelf operations, 130 kilometers offshore from Dampier, WA	20
Gas, liquefied natural	million tons per year	do.	Three-train liquefaction plant, Burrup Peninsula, WA	8
Gold	kilograms	WMC Ltd., 100%	Agnew open cut-underground mine, WA	4,000
Do.	do.	Normandy Mining Ltd., 100%	Big Bell Consolidated (includes former Golden Crown) open-cut/underground mine, WA	7,000
Do.	do.	Saint Barbara Mines Ltd., 100%	Bluebird open cut, WA	4,000
Do.	do.	Worsley Alumina Pty. Ltd., manager (Normandy Gold Ltd., 44.45%; Acacia Resources Ltd., 33.33%; and Newcrest Mining Ltd., 22.22%)	Boddington open-cut/underground mine, WA	12,000
Do.	do.	Great Central Mines Ltd., 100%	Bronzewing open-cut/underground mine, WA	6,200

See footnotes at end of table.

TABLE 2--Continued
 AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 1998

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities 1/	Annual capacity e/
Gold--Continued:	kilograms	Newcrest Mining Ltd., 100%	Cadia Hill open cut, NSW	9,000
Do.	do.	Herald Resources Ltd., 100%	Coolgardie open-cut/underground operations, WA	4,000
Do.		Ernest Henry Mining Pty. Ltd., operator and manager (MIM Holdings Ltd., 51%, and Savage Resources Ltd., 49%)	Ernest Henry open cut, QLD	4,000
Do.	do.	Normandy NFM Ltd., 100%	Granites-Dead Bullock Soak open-cut/underground mines, NT	7,000
Do.	do.	Placer (Granny Smith) Pty. Ltd., manager (Placer Pacific Ltd., 60%; and Delta Gold NL, 40%)	Granny Smith open cut, WA	4,800
Do.	do.	Alcoa of Australia Ltd., 100%	Hedges open cut, WA	4,900
Do.	do.	Goldfields Ltd., 100%	Henty underground mine, TAS	2,800
Do.	do.	Hill 50 Gold NL, 100%	Hill 50 open-cut/underground	4,000
		Great Central Mines Ltd., 100%	Jundee open cut, WA	6,600
		Australian Gold Refineries, 100% (State of WA agency)	Kalgoorlie Refinery, WA	46,000
Do.	do.	North Ltd., manager, 50%; and Delta Gold NL, 50%	Kanowna Belle open-cut/underground mine, WA	5,300
Do.	do.	Kidston Gold Mines Ltd., 100%	Kidston open cut, QLD	6,500
Do.	do.	Sons of Gwalia Ltd., 100%	Marvel Loch-Southern Cross open-cut/underground mines, WA	3,000
Do.	do.	Kalgoorlie Consolidated Gold Mines Pty. Ltd., manager (Homestake Gold of Australia Ltd., 50%; and Gold Mines of Kalgoorlie Ltd., 50%)	Mount Charlotte underground mine, WA	4,300
Do.	do.	Normandy Mount Leyshon Ltd., 100%	Mount Leyshon open cut, QLD	7,500
Do.	do.	Australian Resources Ltd., 100%	Mount McClure open-cut/underground mine, WA	3,100
Do.	do.	Central Norseman Gold Corp. Ltd., 100%	Norseman open-cut/underground mine, WA	3,700
Do.	do.	North Ltd., 80% and operator; Sumitomo Metal Mining Oceania Pty. Ltd., 13.3%; and SC Mineral Resources Pty. Ltd., 6.7%	Northparkes open-cut/underground mine, NSW	3,500
Do.	do.	Olympic Dam Operations Pty. Ltd., manager (WMC Ltd., 100%)	Olympic Dam underground mine, SA	1,500
Do.	do.	MIM Holdings Ltd., 100%	Pacific precious metals refinery, NSW	1,900
Do.	do.	Goldfields Kalgoorlie Ltd., 100% and manager	Paddington open cut, WA	4,100
Do.	do.	Peak Gold Mines Pty. Ltd., 100%	Peak underground mine, NSW	4,700
Do.	do.	Australian Gold Refineries, 100% (State of WA agency)	Perth Refinery (Newburn), WA	95,000
Do.	do.	Homestake Mining Co., 100%	Plutonic open-cut/underground mine, WA	5,800
Do.	do.	Carpentaria Gold Pty. Ltd., 50.1% and manager; and Haoma Mining NL, 49.9%	Ravenswood open cut, QLD	
Do.	do.	WMC Ltd., 100%	Saint Ives open-cut/underground mine, WA	7,500
Do.	do.	Sons of Gwalia Ltd., 100%	Sons of Gwalia open cut, WA	4,000
Do.	do.	MPI Gold Pty. Ltd., 50% and Pittston Mineral Ventures of Pty. Australia Pty. Ltd., 50%	Stawell underground mine, VIC	2,700
Do.	do.	Kalgoorlie Consolidated Gold Mines Pty. Ltd., manager (Homestake Gold of Australia Ltd., 50%; and Gold Mines of Kalgoorlie Ltd., 50%)	Super Pit (includes Fimiston) operation, WA	22,000
Do.	do.	Otter Gold Mines Ltd., 60% and manager; and Acacia Resources Ltd., 40%	Tanami open cut, NT	4,000
Do.	do.	Newcrest Mining Ltd., 100%	Telfer open-cut/underground mine, WA	12,000
Do.	do.	Normandy Gold Ltd., 100%	Tennant Creek open-cut/underground mines, NT	4,000
Do.		Wiluna Mines Ltd., 100%	Wiluna open-cut/underground mine, WA	3,300
Do.	do.	Sons of Gwalia Ltd., 70% and manager; Coeur D'Alene Mines Corp. 25%; and Gemini Mining Pty. Ltd., 5%	Yilgarn Star open-cut/underground mine, WA	3,400

See footnotes at end of table.

TABLE 2--Continued
 AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 1998

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities 1/	Annual capacity e/
Ilmenite	Tiwest Joint Venture, operator (KMCC Western Australia Pty. Ltd., 50%, and Tigor Resources Pty. Ltd., 50%)	Cooljarloo Dredge, WA	480
Do.	Iluka Resources Ltd., 100%	Eneabba Dredge and open cut, WA	600
Do.	Mineral Deposits Ltd., 100%	Hawks Nest (Fullerton and Viney Creek) Dredges, NSW	10
Do.	Cable Sands (WA) Pty. Ltd., 100%	Jangardup Dredge, WA	100
Do.	Consolidated Rutile Ltd., 100%	North Stradbroke Island (Gordon) Dredge, QLD	200
Do.	Cable Sands (WA) Pty. Ltd., 100%	Sandalwood Dredge, WA	50
Do.	Iluka Resources Ltd., 100%	South Capel Dredge, WA	450
Do.	do.	Yoganup open cut, WA	300
Iron ore	Commercial Minerals Ltd., 100%	Biggenden underground mine, QLD	25
Do.	Hamersley Iron Pty. Ltd., 100%	Brockman No. 2 Detrital (includes Nammuldi) open cut, WA	4,000
Do.	Hamersley Iron Pty. Ltd., 60% and manager, and China Iron and Steel Industry and Trade Group Corp., 40%, a People's Republic of China Government Agency	Channar open cut, WA	10,000
Do.	Koolyanobbing Iron Pty. Ltd., manager. (Nugold Hill Mines NL, 100%)	Cockatoo Island iron ore stock-pile, WA	750
Do.	BHP Iron Ore Pty. Ltd., 85% and manager; CI Minerals Australia Pty. Ltd., 8%; and Mitsui Iron Ore Corp. Pty. Ltd., 7%	Goldsworthy open cut (includes Nimingarra, Shay Gap, and Yarrie) WA	8,000
Do.	BHP Iron Ore Pty. Ltd., 100%	Jimblebar open cut, WA	6,000
Do.	Koolyanobbing Iron Pty. Ltd., manager (Portman Resources NL, 60%, and Angang Australia Pty. Ltd., 40%)	Koolyanobbing open cut, WA	3,000
Do.	Hamersley Iron Pty. Ltd., 100%	Marandoo open cut, WA	12,000
Do.	BHP Steel Pty. Ltd., 100%	Middleback Range open cut, SA	2,000
Do.	Saint Barbara Mines Ltd., 100%	Mount Gould open cut, WA	6,000
Do.	BHP Iron Ore Pty. Ltd., 85% and manager; Mitsui Itochu Iron Pty. Ltd., 10%; and CI Minerals Australia Pty. Ltd., 5%	Mount Newman (includes Whaleback Orebody 23-25, and Orebody 29) open cut, WA	35,000
Do.	Hamersley Iron Pty. Ltd., 100%	Mount Tom Price open cut, WA	28,000
Do.	Robe River Iron Associates, operator (Robe River Mining Co. Pty. Ltd., 53%; Mitsui Iron Ore Development Pty. Ltd., 33%; Nippon Steel Australia Pty. Ltd., 10.5%; and Sumitomo Metal Australia Pty. Ltd., 3.5%)	Pannawonica-Deepdale (includes Mesa J) open cut, WA	31,000
Do.	Hamersley Iron Pty. Ltd., 100%	Paraburdoo open cut, WA	50,000
Do.	Goldamere Pty. Ltd., 100%	Savage River open cut, TAS	1,500
Do.	Commercial Minerals Ltd., 100%	Tallawang open cut, NSW	50
Do.	BHP Iron Ore Pty. Ltd., manager (BHP Minerals Pty. Ltd., 55%; Pilbara Iron Pty. Ltd., 30%; CI Minerals Australia Pty. Ltd., 8%; and Mitsui Iron Ore Corp. Pty. Ltd., 7%)	Yandi open cut, WA	25,000
Do.	Hamersley Iron Pty. Ltd., 100%	Yandicoogina open cut, WA	15,000
Lead	Pasminco Broken Hill Mine Pty. Ltd., 100%	Broken Hill open-cut/underground (South) mine, NSW	82
Do.	Western Metals Ltd., 100%	Pillara underground mine, WA	35
Do.	BHP Minerals Pty. Ltd., 100%	Cannington underground mine, QLD	140
Do.	Pasminco Ltd., 100%	Cockle Creek Smelter, NSW	30
Do.	do.	Elura underground mine, NSW	45
Do.	Western Metals Ltd., 100%	Hellyer underground mine, TAS	50
Do.	MIM Holdings Ltd., 100%	Hilton underground mine, QLD	80
Do.	McArthur River Mining Pty. Ltd., operator (Mount Isa Mines Ltd., 70%; and ANT Minerals Pty. Ltd., 30%)	McArthur River underground mine, NT	26
Do.	Mount Isa Mines Ltd., 100%	Mount Isa underground mine, QLD	150
Do.	do.	Mount Isa Smelter, QLD	240
Do.	Peak Gold Mines Pty. Ltd., 100%	Peak underground mine, NSW	4
Do.	Pasminco Ltd., 100%	Port Pirie Refinery-Smelter, SA	250

See footnotes at end of table.

TABLE 2--Continued
 AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 1998

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities 1/	Annual capacity e/
Lead--Continued:		do.	Rosebery underground mine, TAS	15
Do.		Normandy Metals Ltd., 100%	Woodcutters underground mine, NT	10
Leucoxene		Tiwest Joint Venture, operator (KMCC Western Australia Pty. Ltd., 50%, and Tigor Resources Pty. Ltd., 50%)	Cooljarloo Dredge, WA	10
Magnesite		Orind Industries, 100%	Thuddungra open cut, NSW	32
Do.		Queensland Metals Corp. Ltd., 100%	Kunwarara open cut, QLD	
Manganese		Groote Eylandt Mining Co. Pty. Ltd., 100%	Groote Eylandt open cut, NT	2,300
Manganese alloys		Tasmanian Electro Metallurgical Co. Pty. Ltd., 100%	Bell Bay Smelter, TAS	260
Nickel		Preston Resources Ltd., 100%	Bulong open cut, WA 2/	9
Do.		Centaur Mining and Exploration Ltd., 100%	Cawse open cut, WA 2/	9
Do.		Outokumpu Mining Australia Pty. Ltd., 100%	Forrestania underground mines (2), WA	9
Do.		WMC Resources Ltd., 100%	Kalgoorlie Smelter, WA	100
Do.		do.	Kambalda Nickel Operations, WA	35
Do.		do.	Kwinana Refinery, WA	42
Do.		do.	Leinster Nickel Operations, WA	44
Do.		do.	Mount Keith Mine, WA	42
Do.		Anaconda Nickel Ltd., 60%, and Glencore International AG, 40%	Murrin Murrin open cut, WA 2/	45
Do.		Titan Resources NL, 100%	Radio Hill underground mine, WA	4
Do.		Outokumpu Exploration Ventures Ltd., 100%	Silver Swan underground mine, WA	12
Do.		Billiton (Australia) Pty. Ltd., 100%	Yabulu Refinery, QLD	30
Opal		Many small producers	Andamooka and Coober Pedy areas, SA; Lightning Ridge area, NSW	NA
Petroleum		Mobile Refining Australia Pty. Ltd., 100%	Altona Refinery, VIC	135
thousand 42-gallon barrels per day				
Do.	do.	BP Amoco Refinery (Bulwer Island) Pty. Ltd., 100%	Bulwer Island Refinery, QLD	74
Do.	do.	Shell Refining (Australia) Pty. Ltd., 100%	Clyde Refinery, NSW	86
Do.	do.	do.	Geelong Refinery, VIC	119
Do.	do.	Caltex Refineries (NSW) Ltd., 100%	Kurnell Refinery, NSW	116
Do.	do.	BP Amoco Refinery (Kwinana) Pty. Ltd., 100%	Kwinana Refinery, WA	138
Do.	do.	Caltex Refineries (QLD) Ltd., 100%	Lytton Refinery, QLD	100
Do.	do.	Mobile Refining Australia Pty. Ltd., 100%	Port Stanvac Refinery, SA	78
Rutile		Tiwest Joint Venture, operator (KMCC Western Australia Pty. Ltd., 50%, and Tigor Resources Pty. Ltd., 50%)	Cooljarloo Dredge, WA	35
Do.		Iluka Resources Ltd., 100%	Eneabba Dredge and open cut, WA	120
Do.		Mineral Deposits Ltd., 100%	Hawks Nest (Fullerton and Viney Creek) Dredges, NSW	35
Do.		Cable Sands (WA) Pty. Ltd., 100%	Jangardup Dredge, WA	100
Do.		Consolidated Rutile Ltd., 100%	North Stradbroke Island (Gordon) Dredge, QLD	80
Do.		Cable Sands (WA) Pty. Ltd., 100%	Sandalwood Dredge, WA	50
Do.		Iluka Resources Ltd., 100%	South Capel Dredge, WA	120
Do.		Pacific Mining Ltd., 100%	Tomago Dredge, NSW	18
Salt		Dampier Salt Ltd., 100%	Dampier and Lake Macleod salt fields, WA	4,500
Do.		Cargill Salt, 100%	Leslie Salt operations, WA	2,750
Silver	kilograms	Pasminco Broken Hill Mine Pty. Ltd., 100%	Broken Hill open-cut/under- ground (South) mine, NSW	52,000
Do.	do.	BHP Minerals Ltd., 100%	Cannington underground mine, QLD	750,000
Do.	do.	Pasminco Ltd., 100%	Elura underground mine, NSW	35,000

See footnotes at end of table.

TABLE 2--Continued
 AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 1998

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities 1/	Annual capacity e/
Silver--Continued:	do.	McArthur River Mining Pty. Ltd., operator (Mount Isa Mines Ltd., 70%; and ANT Minerals Pty. Ltd. holding the combined Japanese interests of Nippon Mining and Metals Co. Ltd., 15%; Mitsubishi Materials Corp., 5%; Mitsui & Co. Ltd., 5%; and Marubeni Corp., 5%)	McArthur River underground mine, NT	28,000
Do.	do.	Mount Isa Mines Ltd., 100%	Mount Isa underground mine, QLD	375,000
Do.	do.	Olympic Dam Operations Pty. Ltd., manager (WMC Ltd., 100%)	Olympic Dam underground mine, SA	12,900
Do.	do.	Peak Gold Mines Pty. Ltd., 100%	Peak underground mine, NSW	20,000
Do.	do.	Pasminco Ltd., 100%	Rosebery underground mine, TAS	20,000
Spodumene	do.	Gwalia Consolidated Ltd., 100%	Greenbushes open cut, WA	100
Steel		BHP Steel (AIS) Pty. Ltd., 100%	Newcastle steelworks, NSW	1,800
Do.	do.	do.	Port Kembla steelworks, NSW	4,000
Do.	do.	do.	Sydney (Rooty Hill) minimill, NSW	250
Do.	do.	do.	Whyalla steelworks, SA	1,200
Talc		Three Springs Talc Pty. Ltd., 100%	Three Springs open cut, WA	200
Tantalite	pounds Ta ₂ O ₅	Gwalia Consolidated Ltd., 100%	Greenbushes open cut, WA	600,000
Do.	do.	do.	Wodgina open cut, WA	500,000
Tin		do.	Greenbushes open cut, WA	1
Do.	do.	do.	Greenbushes Smelter, WA	1
Do.	do.	Murchison United NL, 100%	Renison Bell underground mine, TAS	6
Uranium	tons U ₃ O ₈	Olympic Dam Operations Pty. Ltd., manager (WMC Ltd., 100%)	Olympic Dam underground mine, SA	1,500
Do.	do.	Energy Resources of Australia Ltd., 100%	Ranger open cut, NT	4,500
Zinc		Pasminco Broken Hill Mine Pty. Ltd., 100%	Broken Hill open-cut/underground (South) mine, NSW	350
Do.		Western Metals Ltd., 100%	Pillara underground mine, WA	165
Do.		BHP Minerals Ltd., 100%	Cannington underground mine, QLD	40
Do.		Pasminco Ltd., 100%	Cockle Creek Refinery-Smelter, NSW	85
Do.		do.	Elura underground mine, NSW	125
Do.		Western Metals Ltd., 100%	Hellyer underground mine, TAS	250
Do.		MIM Holdings Ltd., 100%	Hilton underground mine, QLD	82
Do.		McArthur River Mining Pty. Ltd., operator (Mount Isa Mines Ltd., 70%; and ANT Minerals Pty. Ltd., 30%)	McArthur River underground mine, NT	95
Do.		Mount Isa Mines Ltd., 100%	Mount Isa underground mine, QLD	250
Do.		Western Metals Ltd., 100%	Pillara underground mine, WA	165
Do.		Pasminco Ltd., 100%	Port Pirie Refinery-Smelter, SA	45
Do.		do.	Ridson Refinery, TAS	220
Do.		do.	Rosebery underground mine, TAS	45
Do.		Normandy Mining Ltd., manager (Murchison Zinc Co. Pty. Ltd., 100%)	Scuddles (includes Golden Grove and Gossan Hill) underground mine	150
Do.		Normandy Metals Ltd., 100%	Woodcutters underground mine, NT	54
Zircon		Iluka Resources Ltd., 100%	Capel South Dredge, WA	300
Do.		Tiwest Joint Venture, operator (Kerr-McGee Chemical Chemical Corp. Western Australia Pty. Ltd., 50%, and Ticor Resources Pty. Ltd., 50%)	Cooljarloo Dredge, WA	67
Do.		Iluka Resources Ltd., 100%	Eneabba Dredge and open cut, WA	300
Do.		Mineral Deposits Ltd., 100%	Hawks Nest (Fullerton and Viney Creek) Dredges, NSW	25
Do.		Consolidated Rutile Ltd., 100%	North Stradbroke Island (Gordon) Dredge, QLD	50
Do.		Pacific Mining Ltd., 100%	Tomago Dredge, NSW	15

See footnotes at end of table.

TABLE 2--Continued
 AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 1998

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities 1/	Annual capacity e/
Zircon--Continued:	Iluka Resources Ltd., 100%	Yoganup open cut, WA	60

e/ Estimated. NA Not available.

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

2/ Scheduled to come on-stream in early 1999.