AUSTRALIA

By Natalie Quinn

Australia is a major producer of most metals and minerals and is the world's largest producer of coal and iron ore. Mineral and metal exports represent 29% of the nation's total exports of goods and services. According to key Australian economics research agency ABARE, the strengthened Australian dollar resulted in a drop in combined minerals and energy export earnings in 2001-02 to A$55.4 billion, down from A$56.4 billion the year before. Of the A$55.4 billion, earnings from metals and other minerals contributed A$30 billion, with energy products responsible for the remaining A$25.4 billion. Total mining exports were expected to fall to A$52.5 billion in 2003-04, with unit returns down 8% due to the delayed arrival of a global recovery (Table1). ABARE said that of the 12 mining sectors only gold, iron ore, nickel, copper and mineral sands were set for rising export revenues in 2003-2004.

Gold, nickel and iron were all strongly-performing exports for Australia in 2001-02, while alumina and copper suffered an oversupplied market.

Coal is Australia's biggest export, and Australia is the world's largest single producer. In 2002 the export value of thermal and metallurgical coal increased once more, to an estimated A$13.3 billion, largely due to an increase in thermal coal exports.

Production of iron ore was also up in 2001-02 at 185.3 Mt. This represented a significant increase in export revenue to A$5.2 billion, up from A$3.8 billion in 2000-01 (Table 2). The major miners BHP Billiton and RioTinto were investing heavily in iron-ore expansion projects in the Pilbara, in Western Australia, preparing to enjoy the strong demand.

In 2001-02 the aluminium industry brought in A$8 billion from combined alumina and aluminium earnings. Alumina export earnings contributed A$4.1 billion and aluminium exports A$3.9 billion. ABARE estimated that bauxite production was down nearly 1Mt on 200-01 at 53.9 Mt.

Gold is also a major export for Australia. In 2002 Australia's annual gold output rose to A$5 billion despite full year output being down 3% at 8.8 Moz. The Australian dollar gold price reached A$612/oz in January 2003, the highest since February 1988. This saw Australian gold producers achieving good margins above average cash costs. The gold price charge of 2002-03 was a boon for unhedged producers but a tough year for some tied to forward sales.

Nickel was the best performer in the base-metals sector, with production rising to 191,000 t. An average nickel price increase of 20% predicted by ABARE for 2003 would translate to a rise in export earnings of 22% in 2002-03 (to A$2.2 billion). The strong demand for nickel spurred on several

successful mine start-ups by junior producers. However, 2001-02 saw a levelling off in copper output which remained at 876,000 t, and the decrease in global copper production was not expected to be realised in Australia in 2002-03. Although zinc mine and smelter producers also cut production in 2002, exports were up slightly on 2000-01 at 1.49 Mt. A further rise, to 1.55 Mt, was expected for 2003.

Corporate changes were afoot in the base metals sector with the demise of base metal miner Pasminco Ltd and the takeover of MIM Holdings Ltd by UK-based Xstrata. As well as MIM, some other Australian mining icons took a tumble in 2002-03. The country's biggest gold producer, Normandy Mining Ltd, was purchased by Newmont Mining Corp. of the US; WMC Ltd demerged into WMC Resources Ltd and Alumina Ltd, and AurionGold Ltd (the entity formed by the merger of Delta and Gold Fields in 2001) was acquired by Placer Dome Inc. of Canada.

The long line of companies to float on the Australian Stock Exchange had dwindled a little by 2002, but companies and investors were still optimistic enough to get about ten floats over the line in 2002-03. Gold remained the most popular portfolio base, with companies like Midas Resources listing in 2003, although nickel was also attracting investment, with companies such as Siberia Resources and MPI Mines floating successfully.

Development

Data from the Australian Bureau of Statistics (ABS) show that capital expenditure in the mining industry was 32% higher in 2001-02 at A$7.25 billion, following two years of historic low expenditure levels. According to the ABS this was again set to increase significantly in 2002-03, by 20%, to A$8.9 billion.

Twenty-one major projects were completed in Australia in 2002 with a combined capital expenditure of A$2.1 billion. Ten projects were completed in 2001 with a total value of A$544 million. Of the 21 projects completed in 2002, seven concerned gold, four hard coal, two tantalum, one iron ore, one mineral sands, one diamonds, one copper and four petroleum. At A$800 million, Rio Tinto's West Angelas iron-ore development in the Pilbara region of Western Australia was the largest project in terms of capital cost.

According to ABARE, a further 13 projects are due for completion in 2003, with another 20 under development. The combined projected capital expenditure for these advanced projects is A$3.0 billion, with the greatest percentage being spent on petroleum and coal projects.

Twelve mining projects were committed in 2002, with BHP Billiton's A$1.02 billion Mining Area C iron-ore development and Newcrest's A$1.2 billion Telfer gold mine expansion accounting for 75% of the A$2.9 billion total.

Five minerals processing projects were also committed, Comalco's A$1.5 billion alumina refinery project at Gladstone and Australian Magnesium

Corp.'s embattled A$1.3 billion Stanwell magnesium plant near Rockhampton being by far the largest.

Some observers were not however heartened by expenditure levels. The industry periodical, *Australian Mining Monthly,* said that Australia's large development projects are "yesterdays discoveries" — as projects like Telfer, Mining Area C and Rolleston (MIM) represent developments of discoveries made 30 years ago.

Exploration

Exploration expenditure in Australia, as in the rest of the world, has suffered a significant downturn since the mid 1990s. According to ABARE, total exploration spending declined 49% between 1996-97 and 2001-02 (to A$623 million), the lowest level since 1978-1979. A decline in exploration for gold, base metals and nickel has been the most significant although there has also been a decrease in coal, uranium, diamonds and iron-ore exploration.

Between 1996-97 and 2001-02 gold exploration expenditure fell by 59% and, according to ABARE, if expenditure remains at its current rate, production will decrease by 2.0% by 2006-07. A 20% increase in expenditure is needed if gold production is to increase by 2006-07.

Although reduced spending by the larger mining companies is recognised as a big factor in the decline in exploration, the backlog in processing of mining title applications following the government's High Court Wik decision in 1996 (which extended native title to pastoral land) has deterred some explorers.

According to ABARE, in the first three quarters of 2000-01 there were 5,809 exploration title applications pending and 1,003 granted, and 7,488 mining title applications pending and 329 granted.

The difficulties in securing access to leases has seen an increase in 'brown-fields' exploration. According to the Western Australian Department of Mineral and Petroleum Resources, exploration spending (in Western Australia) more than 5km from mine sites declined from 40% of the total in 1997 to just 28% in 2001. Resolving uncertainties with land access/native title issues and providing tax relief on exploration costs along the lines of Canada's share flow-through scheme, are the most popular remedies suggested to ease the exploration downturn.

Reduced exploration budgets by the larger players has, however, seen junior explorers pick up an increasing number of projects (some at an advanced stage cast-off by the majors. In terms of exploration success, the outstanding discovery in 2001-02 was the Olympic Dam-style copper mineralisation at Prominent Hill announced by Adelaide-based junior explorer Minotaur Resources Ltd. Elsewhere, Pilbara Mines Ltd was having sustained success at its Jaguar base-metals project in Western Australia and Newcrest Mining Ltd proved up its Cracow epithermal deposit in Queensland. Meanwhile, LionOre Mining Inter-national Ltd (listed in Canada and Australia), continued

its exploration success of recent years at the Waterloo and Amorac high-grade nickel sulphide deposits in Western Australia.

Coal

Australia is the world's leading coal exporter and, according to ABARE, in 2001-02 total exports of thermal and metallurgical coal were 197.9 Mt (representing 32% of world trade) up from 193.5 Mt in 2000-01. Exports are expected to reach 205.1 Mt in 2002-03.

Last year, the export value of thermal and metallurgical coal increased to A$13.3 billion (estimate) from A$10.8 billion in 2001 and A$8.29 billion in 2000, largely due to an increase in thermal coal exports. However, according to ABARE, the emergence of China as a major coal exporter (its exports have trebled in the past three years) could threaten Australia's coal exports to key Asian markets and its dominance of the global market.

Most Australian coal comes from the Hunter Valley in NSW and the Bowen Basin in Queensland. The metallurgical coals have good coking properties and are low in sulphur, and the thermal coal is typically high in calorific value, has moderate ash levels and low sulphur and heavy metal content. These 'environmentally friendly' thermal coals have received new exploration and development focus in recent years.

Seven new coal mines or expansions were planned for 2003 with 60% of new output to come from thermal coal. World thermal coal trade is expected to increase by a massive 34% in 2002-03, with exports of Australian thermal coal expected to increase by 10%.

Australia's biggest coal producers are Anglo Coal Australia Pty Ltd, BHP Billiton Ltd, Xtrata Coal Australia Ltd, MIM Holdings Ltd and RioTinto Ltd, which collectively produce 70% of the nation's coal.

Anglo Coal burst on to the Australian coal scene in 2000 when it purchased Shell's coal assets for US$ 850 million. Last year, it produced 25 Mt from its Bowen Basin and Hunter Valley mines.

The company also acquired a 51% stake in the 6 Mt/y Moura mine in Queensland, formerly held by Rio Tinto, and was planning to develop the adjacent Theodore project which could see future sales from the mine reach 12 Mt/y.

BHP Billiton's 83%-owned Mt Arthur North mine in the Hunter Valley, was ramping up to production of 15 Mt/y of semi-soft and thermal coal by 2006. Completion costs of the expansion were expected to come in at less than A$800 million.

Also in development was Rio Tinto's A$425 million Hail Creek coking coal project in the Bowen Basin. Hail Creek, with reserves of 1,130 Mt, is one of the world's largest undeveloped coking-coal deposits. On its completion in

2003, the mine is scheduled to produce up to 5.5 Mt/y of high quality hard coking coal.

London-listed Xtrata, the world's largest producer of thermal coal, was in takeover mode in 2002-03 acquiring not only MIM but also purchasing Glencore International AG's coal subsidiary Enex Resources Ltd.

MIM Holdings had doubled its coal production in the five years to 2001 and was predicting a further doubling of production, to 38 Mt/y by 2006, including adding the 8 Mt/y Rolleston thermal coal mine. Ironically, many thought the growth of MIM's coal business would reduce its risk of takeover.

Four hard coal projects were commissioned in 2002, adding approximately 13.5 Mt/y to Australia's coal production capacity. These included two new open-cut mines on the Darling Downs in Queensland — namely Newmont's Millmerran mine and New Hope Coal's Acland mine — and expansions at Namoi Hunter's Glennie's Creek in the Hunter Valley in NSW and at BHP Billiton's A$130 million Blackwater mine in Queensland.

Junior coal company Centennial Coal Ltd raised some eyebrows in 2002 when it snapped up the New South Wales Government-owned Powercoal — which owned seven colleries — making it the largest independent supplier of energy coal in NSW and the biggest coal-only company in Australia.

Emerging producer Macarthur Coal listed on the Australian Stock Exchange in 2002 and raised enough capital to upgrade the plant at its 155 Mt Coppabella mine in Queensland and progress two other operations in that State.

Bauxite, alumina and aluminium

Australia earns more than A$8 billion annually from alumina and aluminium exports. It produces nearly one third of the world's alumina and has vast resources of bauxite. The Gove and Weipa regions on the Gulf of Carpentaria in Australia's remote north and southwestern WA currently supply most of production.

The earnings derived from alumina exports decreased in 2002 to $4.1 billion as a result of an oversupplied market. The same trend was seen in aluminium with earnings down to $3.9 billion. The alumina surplus saw fairly flat production in 2002 with producers curtailing production in attempts to correct the market. In 2002, ABARE estimated that bauxite production was down nearly 1Mt on 2001 at 53.9 Mt. Alumina and aluminium were up slightly at 16.2 Mt and 1.8 Mt respectively.

Alcoa's Huntly mine, 70 km south of Perth in Western Australia, produces a massive 20 Mt/y of bauxite. In 2000 Huntly produced a world record 20.2 Mt. About 6 Mt/y of bauxite is produced from Huntly's sister, Willowdale, also south of Perth. The mines have combined reserves of 2,925 Mt at 32.5% alumina. Bauxite is processed at the AWAC-owned Wagerup (2.19 Mt/y), Pinjarra (3.3 Mt/y) and Kwinana (1.9 Mt/y) refineries in Western Australia.

The Rio Tinto's Weipa operations (acquired in 2000 through the acquisition of Comalco) in north Queensland produce about 12 Mt/y bauxite with 90% of this sent to Rio Tinto's Gladstone refinery. In 2002, production at Weipa was cut back. The company also owns the undeveloped Ely deposit 50 km northeast of Weipa and the Mitchell Plateau and Cape Bougainville properties in the northern regions of Western Australia, where resources of about 4,342 Mt have been outlined.

Australia's alumina producers are: the Alcoa World Alumina and Chemicals (AWAC) joint venture comprising Alcoa 60% and Alumina Ltd (formerly WMC Ltd) 40%, which operates the Western Australian Pinjarra, Wagerup and Kwinana refineries; BHP Billiton which produces alumina through Worsley Alumina Ltd, in which it holds an 86% interest, with Kobe Alumina Associates (Aust) Ltd holding the remaining 14%; Rio Tinto, through its Gladstone refinery; and Alcan Aluminium of Canada which produces alumina at Gove in the Northern Territory.

Comalco (now a unit of Rio Tinto) decided not to go ahead with its A$800 million Boyne Island smelter expansion (to increase production from 490,000 t/y to 700,000 t/y), owing to modest growth forecasts for primary aluminium.

2002 was a year of corporate restructuring in the alumina business, with predictions of more rearrangement to come. WMC Ltd underwent its much talked about demerger into WMC Resources Ltd, which retained the nickel, copper and phosphate interests, and Alumina Ltd, which kept WMC's aluminium and alumina assets including its 40% interest in AWAC. Speculation around the demerger suggested that the new entities were formed specifically as neat takeover targets. Although no takeover attempts had materialised by mid-2003, Alcoa was considered an obvious suitor for its joint-venture partner Alumina Ltd.

Also in 2002, Alcan Aluminium Ltd become the sole owner of the Gove operations, absorbing the equites of its subsidiaries Nabalco Pty Ltd and Alsuisse Ltd, and the equity of CSR Ltd, according to the *Australian Mines Handbook*. The operating company at Gove was renamed Alcan Gove Pty Ltd (formerly Nabalco Pty Ltd) to reflect the change. Gove has bauxite reserves of 195 Mt, exports about 2.0 Mt/y and produces up to 1.9 Mt/y of alumina. A decision on whether to double alumina production is expected in 2003.

Worsley Alumina's operations (including the Saddleback mine near Collie in southwestern WA) were also subject to ownership changes, with BHP Billiton acquiring Reynold's 56% stake to increase its interest to 86%. Kobe Alumina Associates (Australia) retains 14%. About 3 Mt/y of alumina is produced from the Worsley refinery.

Gold

Gold is Australia's fourth-biggest mineral export. The increase in the US dollar gold price, along with the subdued Australian dollar, saw the Australian dollar gold price rise significantly in 2002-03. In January 2003, it reached A$612/oz, its highest level since February 1988. Production was worth A$5 billion in

2002 despite a decline in production of 40 t since 1997. Industry consultants Surbiton Associates estimated that full year output in 2002 was down 3% to 8.8 Moz.

The strong gold price has led to a general feeling of buoyancy in the Australian gold sector and the declining production trend looked as though it might be stemmed, with the commissioning of several new mines, including Challenger, Paulsens and Thunderbox, and expansions at some of the larger operations such as Granny Smith and Sunrise Dam. Earnings in 2003-04 are expected to increase to A$5.7 billion.

Over the past five years, ownership in the Australian gold sector has contracted by about 60% as a result of takeovers and the disappearance of small gold companies in the dotcom boom. According to Surbiton, foreign ownership of Australia's gold production has risen from 20% five years ago to 70% today. In 2001-02 Normandy Mining Ltd, the gold assets of WMC Ltd, AurionGold Ltd and junior producer Hill 50 Gold NL became foreign-owned. This restructuring saw nine of the ten biggest Australian gold mines pass to overseas domiciled owners.

The Newmont takeover of Normandy was the largest of the deals at $4.56 billion.

In 2001, Gold Fields Australasia Ltd, a subsidiary of the South African company Gold Fields, took-over the gold assets of the former WMC Ltd (now WMC Resources Ltd and Alumina Ltd) and Hill 50 Gold was snapped up by Harmony Gold Mining Co. another South African company.

Placer Dome Inc. of Canada also moved in on some of Australia's better gold assets, with its hostile takeover of AurionGold (the product of the Delta/Gold Fields merger in 2001). As well as AurionGold's overseas interests, Placer assumed control of a swathe of exploration projects and three mines in the Eastern Goldfields region of Western Australia. Kanowna Belle, Paddington and Kundana have combined output of about 500,000 oz/y and combined reserves of about 7 Moz.

In 2002, Australia's largest gold producer was once again the Super Pit, with an output of 719,036 oz at 1.73 g/t Au. Cash operating costs were US$222/oz. The Super Pit, owned 50:50 by Newmont Mining Corp. and Barrick Gold Corp., is located on the Golden Mile in Kalgoorlie, Western Australia, the richest mile of gold-bearing ground ever to be discovered in Australia.

Also in Western Australia, the commissioning of the twelfth pit at Placer Dome's 100%-owned Granny Smith operation, the 7 Moz, A$150 million Wallaby mine, will raise output by some 40% to make Granny Smith Australia's second largest producer. In 2002, production totalled 326,894 oz at a cash operating cost of US$124/oz.

Now owned by Gold Fields of South Africa, the St Ives operation was Australia's third largest producer at 542,200 oz. Gold Fields was conducting a significant drill programme at St Ives which, according to Australia's *Mining Monthly*, could possibly push the mine to top producer status.

In its take over of Normandy, Newmont also gained ownership of Australia's fourth biggest producer the Granites/Dead Bullock Soak operations in the Tanami region of Northern Territory. Affected by a severe wet season, cash costs were up at the Granites to A$360/oz with production of 347,304 oz. Better in the cash cost stakes for Newmont was its Pajingo epithermal mine in Queensland, which produced 290,000 oz at A$149/oz - making it Australia's lowest cost gold mine in 2002.

At AngloGold Ltd's Sunrise Dam operation, production increased by 29% to 382,000 oz with the development of the A$1.6 million Sunrise Dam 'mega-pit' and a plant upgrade to 2.5 Mt/y. The average yield was 3.5 g/t and cash operating costs were US$177/oz.

Seven new gold projects were commissioned in 2002. By far the largest of these, by capital expenditure, was Newcrest Ltd's A$376 million Ridgeway underground mine, adjacent to its Cadia Hill open pit in New South Wales. Ridgeway has resources of 3.5 Moz of gold and is scheduled to produce 350,000 oz/y of gold and 34,000 t/y of copper by sub-level caving. The Cadia Hill open pit is producing close to 300,000 oz/y. The Cadia Far East deposit was discovered in 2001 and is emerging as another very promising deep high-grade deposit. Total resources at at Cadia amount to some 17.4 Moz.

In what could become one of Australia's largest gold operations, Newcrest is planning to reopen its operations at the mothballed Telfer mine in Western Australia. According to Newcrest, the A$1.19 billion project will produce 1 Moz/y. Open-pit reserves amount to some 334 Mt at 1.3 g/t Au, and undeground reserves total 32 Mt at 3 g/t Au.

Newcrest has increased the resource at the 70%-owned Cracow epithermal deposit (Sedimentary Holdings NL 30%) and has approved a development proposal for a A$53 million project to develop an underground mine.

In 2002 Dominion Mining Ltd commissioned its A$17.8 million Challenger Mine in South Australia. Dominion discovered Challenger by testing a coincident gold-in-calcrete and magnetic anomaly in 2001. The open pit was expected to recover 105,000 oz over 20 months, with operations then expected to move underground, subject to a feasibility study. Resources are estimated at 1.72 Mt averaging 8.5 g/t Au.

One of Australia's only true greenfield discoveries in recent years is the Thunderbox deposit near Leinster in Western Australia. The deposit, owned by LionOre Mining International (60%) and Dalrymple Resources (40%), began production in 2002. The A$65 million mine is scheduled to produce 220,000 oz in its first year at cash costs of US$112/oz. Reserves amount to 850,000 oz and the total resource is estimated at 2.0 Moz.

The Frog's Leg mine, due for commissioning in 2003, is another exploration success but is considered a brownfield rather than a greenfield discovery. It is located on Kundana trend near Kalgoorlie and is jointly-owned by the French company Cogema and Dioro Exploration. The operation is expected to produce 108,500 oz in the first 22 months by open pit. Thereafter, underground mining is envisaged for at least eight years. Resources at the end of 2002 stood at about 786,000 oz.

Among the newer developments, Placer Dome and Metex Resources, equal partners in the Laverton Exploration jv in Western Australia, plan to begin trial mining at Whisper, one of the Chatterbox deposits which gained so much attention in 1998. Total resources at Whisper are estimated at around 620,000 oz.

In Victoria, in a taste of things to come, Bendigo Mining NL continued with its efforts to revive mining at one of Australia's most historic mining centres. Gold was discovered at Bendigo in 1851 and the field yielded an estimated 22 Moz. Last year, Bendigo Mining completed a decline and drilling identified two new ore 'ribbons'. The company estimates that a gold resource of up to 12.3 Moz could still exist at depth. In 2002, Harmony Gold Mining of South Africa took up all of a $50 million share placement and acquired a 30% equity interest in Bendigo. The company hopes to begin a 150,000 oz/y operation during 2004, with an ultimate aim of producing 400,000-500,000 oz/y.

Iron Ore

Australia is the world's largest exporter of iron ore and is attributed with being the world's lowest cost producer. Iron ore prices increased in 2002 and, despite reduced demand from Western Europe and Japan, exporters struggled to keep pace with China's ever- increasing requirements. However, Japan continued to be the main export destination, followed by China, South Korea and Europe.

Australian production rose to 185.3 Mt in 2001-02, up from 175.6 Mt in 2000-01, and export revenues increased from A$3.8 billion to $5.2 billion. Profits for Australian iron ore producers remained elevated owing to high Asian demand, low production costs and a big geographical freight advantage, particularly to China.

Most of Australia's iron ore is mined in Pilbara region in Western Australia's north, with the bulk coming from BHP Billiton and Rio Tinto operations at Mt Newman and Tom Price. Together, the two companies produce 26% of the Western world's iron ore. However the strong Chinese demand is predicted to encourage the development of new mines by smaller players. In 2003, ABARE predicts a production increase to 200 Mt as BHP Billiton and Rio Tinto both bring big projects on stream.

In 2002, BHP Billiton produced about 68 Mt from its operations at Yarrie, Yandie, Mt Newman (including Mt Whaleback and orebodies 23, 25, 29, 30

and 35) and Jimble Bar. When the massive Mining Area C (MAC) expansion comes on line in 2003 this will increase output by about 15 Mt/y.

Rio Tinto's subsidiary, Hamersley Iron Pty Ltd, produced a record 68.5 Mt (equal to rated capacity) from its Paraburdoo, Mt Tom Price, Brockman, Yandicoogina and Marandoo operations. Hamersley also produced 10.59 Mt from its Channar operation which it owns in 60:40 joint venture with the Chinese Government organisation, China Metallurgical Import Export.

Robe River Iron Associates (Rio Tinto 53%, Mitsui Iron Ore Development Pty Ltd 33% and Sumitomo Metal Mining Oceana Pty Ltd) produced 36.86 Mt from is Robe River, West Angelas and Pannawonica operations.

The two big new iron-ore projects in Australia, West Angelas and MAC, are both based on mining lower-grade Marra Mamba-type ore. Mining this ore in the past was considered uneconomic but it is becoming more attractive because reserves of higher-grade Brockman-type ore at Tom Price (Rio Tinto) and Whaleback (BHP Billiton) are declining, and because Marra Mamba ore can be used as feed for electric arc furnaces.

Rio Tinto and its Robe River partners commissioned the A$800 million, West Angelas project in the second half of 2002. It is the first Australian operation to produce only Marra Mamba ore and is expected to produce 20 Mt/y by 2006. The ore will initially be exported to Japan. Rio Tinto also approved the development of a A$400 million, commercial-scale Hismelt facility near Perth in Western Australia, to process the Marra Mamba fines into a feedstock for the electric arc furnace steel industry. The plant is a joint venture between Rio Tinto (60%) held through subsidiary Hismelt Corp, US steel maker Nucor Corp. (25%), Mitsubishi Corp (10%) and Chinese steel-maker Shougang Corp. (5%).

BHP Billiton is on track for an October 2003 commissioning of its MAC expansion. The A$1.0 billion, 15 Mt/y expansion will include a rail spur through the Hamersley Ranges for delivery of MAC ore to BHP Billiton's main rail line at Yandi. Korea's POSCO has signed on to purchase the initial 3 Mt/y which is expected to rise to nameplate capacity of 15 Mt/y by 2010. BHP Billiton also approved a project to produce a new high-value lump pisolite product from its 35 Mt/y Yandi operation. The A$27.5 million project will produce 4 Mt/y of the product, initially for export to Japan.

The strong market in 2002, also saw smaller miners ramping up production, with Portman Ltd clearing environmental hurdles and announcing an expansion at its Koolyanobbing operations to a sizeable 5.5 Mt/y in 2003 and 6.0 Mt/y in 2004. Portman sends all of its ore to Anshan Iron and Steel in China under a 20-year sales contract.

Mt Gibson Iron Ltd deferred plans to mine at Mt Gibson following the purchase of the Tallering Peak project from ill-fated Kingstream Steel. The company now plans to begin production of 1.5 Mt/y of haematite ore from

Tallering Peak, which is close to the port at Geraldton, in the second quarter of 2003.

Hancock Prospecting Pty Ltd (controlled by the daughter of Australian explorer and mining magnate Lang Hancock) was still hoping to get its 15 Mt/y, A$450 million Hope Downs project up and running. The project remained on hold because of a dispute with BHP Billiton over rail access. A recent court decision in favour of BHP Billiton was being appealed, but Hancock said that, whatever the outcome, the project was still likely to go ahead, with an additional A$1 billion expenditure for port and rail construction.

AuIron Ltd was not as optimistic, and put its much talked about SASE Pig Iron project in South Australia on hold owing to increasingly evident poor economics and technological uncertainties.

Another project which has had its ups and downs, BHP Billiton's HBI plant in Port Hedland, continued to falter with *force majeure* declared following a plant failure in 2002.

In other potential developments, manganese miner Consolidated Minerals Ltd, purchased the Mindy Mindy prospect near Mt Newman.

A A$5.6 billion integrated iron and steel project was still in development at Fortescue in Western Australia by Austeel Pty Ltd. The consortium is developing a mine and adjacent concentrator to feed a 6 Mt/y pellet plant from which pellets would feed a 4.5 Mt/y capacity Midrex DRI plant and then a 4 Mt/y steel plant. Austeel said that once fully operational the project would generate annual revenues of A$2.5 billion.

One of the few iron-ore operations outside Western Australia, Ivanhoe Mines' Savage River operation in Tasmania, produced 2.06 Mt in 2001. A plan to expand the mine was deferred when the Australian - US dollar exchange rate rendered hedging disadvantageous.

Nickel

Nickel was the most buoyant of the base metals in 2002, with robust prices enjoyed both by the newly demerged nickel giant WMC Resources and by new nickel miners such as Mincor, LionOre and Jubilee Mines. Nickel consumption has surged, thanks largely to strong demand for stainless-steel in China

Nickel production rose slightly in 2001-02 by 4,000 t to 191,000 t. Export earnings were down slightly at A$1.8 billion, although average price increases of 20% in 2003 and a further 11% in 2004 are predicted by ABARE. Such increases would translate into a rise in export earnings of 22% in 2002-03, and 27% in 2003-04, to A$2.8 billion.

In 2002, WMC Resources produced 106,423 t of nickel from its Mt Keith and Leinster operations in WA, and the Kalgoorlie smelter produced 91,547 t of nickel in matte, down slightly on 2001 owing to boiler maintenance. Output

from its Kwinana nickel refinery was up considerably, from 61,809 t in 2001 to 73,850 t.

The company is considering a A$150 million expansion at Mt Keith involving a 30% increase in ore production capacity to 14 Mt/y, which would yield 60,000 t/y of nickel in concentrate. A project to enhance the quality and smelting characteristics of Mt Keith concentrates is also under way.

WMC also has some promising advanced projects, at Yakabindie and North Six Mile. Together, they possess reserves of some 292 Mt at 0.52% Ni. WMC's exploration portfolio has been whittled down considerably although one project that still remains is the West Musgrave nickel sulphide property in WA. The initial discovery hole in 2000 at the Nebo prospect returned 26.5 m at 2.23% nickel, 1.47% copper and 0.123% cobalt from 34 m. Drilling at a second prospect, Babel, returned 148.9 m at 0.3% nickel, 0.42% copper, 0.01% cobalt and 0.29% PGM.

Emerging from the pegging frenzy that followed the WMC discovery was West Musgrave Mining Ltd . WMM was one of the only companies to have gained access to ground in the West Musgrave region and to have started exploration work in earnest. In 2002, it progressed its Blackstone Range project, with BHP Billiton joining in the search by providing funding through equity placements in WMM at a 10% premium to the market price.

The development of nickel mines by small producers has reversed the trend of nickel as a 'majors only' sector. Several of these small companies have also started life as 'nickel only' companies, and include WMM, Mincor Resources, Heron Resources and Sally Malay.

The success of the small miners is largely due to a new scenario where the major miners, having rationalised their assets, are relying on the juniors to help satisfy their hungry customers. WMC Ltd in its pre-demerger phase of divestment, sold off a number of its Kambalda nickel deposits, together with long-term off-take arrangements, in order to ensure feedstock for its smelter. These assets include the Miitel, Wannaway and Redross deposits purchased by Mincor. In 2002, Miitel produced 191,943 t of ore averaging 4.49% Ni and 0.42% Cu, and Wannaway produced 115,664 t at 3.5% Ni. Substantial exploration upside was also becoming apparent at North Miitel, Redross and Mariners. Cash flow from the mines saw Mincor pay a maiden dividend in 2002 and repay its A$28.9 million development debt ahead of time.

Independence Gold NL's subsidiary, Lightning Nickel, purchased what was once WMC's premier nickel asset, the Long Shaft mine. Lightning took over production in 2002 of what was to be a 150,000 t/y ore-processing operation. In its first two months, the Long Shaft operation generated a A$1.4 million cash surplus.

Jubilee Mines Ltd was also enjoying the nickel price boom. It had been mining the Cosmos open pit since 2000, along with a 150,000 t/y mill and pulled the

first ore from its Cosmos underground development in May 2003. In 2001-02 the profitable operation produced 56,440 t of concentrates.
LionOre, which had been in production since 2001 at the Emily Anne deposit, confirmed it was to double production to 10,000 t/y of nickel by integrating the nearby Maggie Hays deposit. Resources were estimated at 10.8 Mt at 1.5% Ni. LionOre continued to make its mark as an explorer, proving up its high-grade Waterloo and Amorac discoveries in the Perseverance corridor which hosts the Mt Keith, Perseverance and Cosmos deposits.

West Musgrave Mining and View Resources were also planning to join the ranks of producers by purchasing the former WMC assets of Blair and Carnilya respectively.

Junior explorer Sally Malay Mining was close to final go-ahead on its $54 million, 8,000 t/y mining venture at its eponymous project in the Kimberly region of WA. The Sally Malay deposit was discovered in the 1960s but had spent considerable time on the backburner at Normandy Mining. Sally Malay has struck a deal with the Chinese Jinchuan group and Sino Mining International for life-of-mine delivery of concentrates.

Titan Resources NL successfully completed mining at Radio Hill in 2002 and sold the deposit to Fox Resources Ltd. Titan said that over the four years of mining it had yielded A$50 million in operating cash flow.

The laterite nickel surge of the past decade has ebbed, and although the once troubled Murrin Murrin project is now finding its feet, most new developments, and exploration dollars, are being directed towards sulphide projects.

Anaconda Nickel Ltd's massive, low-grade, high-tonnage, laterite nickel project at Murrin Murrin is now under new guidance by former WMC executive Peter Johnston. The operation has scaled back many of its development plans, extinguished nearly A$800 million in debt, completed a re-capitalisation and has an initial win in its legal suit with Fluor concerning the technical performance of the plant. Some problems were still being encountered in 2002, however, with lower-than-expected head grades, some batten strip failures and autoclave bogging, and a four-day shut down.

At Bulong, another troubled laterite nickel project, things looked less likely to improve with receivers and administrators appointed. The sale of Bulong also looked unlikely, with WMC Resources planning to cut off critical acid supply which would see the operation become uneconomic. Once owned by Preston Resources Ltd, Barclays Bank took control of Bulong in 2002.

BHP Billiton continued with its advanced Ravensthorpe laterite project in Western Australia, saying that it would use the other pressure acid leach (PAL) projects as learning tools. Ravensthorpe has resources of 210.3 Mt at 0.68% Ni and 0.03% Co.

The feasibility study was based on a mining rate of 5.5 Mt/y and a PAL feed of 1.85 Mt/y at 2% Ni and 0.08% Co. A final decision was expected in mid-2003

and a A$1 billion upgrade at the Queensland Yabulu refinery would follow should mining proceed.

Lead zinc silver

Australia is a relatively large producer of lead, zinc and silver. The main lead-zinc-silver centres are Cannington, Mt Isa and Century in Queensland, Broken Hill in NSW, the west coast of Tasmania, McArthur River in the Northern Territory, and Pillara in Western Australia.

Low demand and prices for zinc have seen miners and smelters cut production in recent years, but Australian exports of 1.49 Mt, were slightly higher than in 2001. According to ABARE, another rise is expected for 2003, to 1,55 Mt, with zinc export earnings expected to rise by over 7% to A$1.6 billion in 2003-04.

BHP Billiton's Cannington silver/base metals mine in Queensland is the world's biggest single producer of silver and, according to the company, the world's lowest-cost silver and lead producer. Cannington earned US$104 million for BHP Billiton in 2001-02, with 60% of this from silver. In 2001-02, Cannington produced 231,764 t of lead-in-concentrate, 58,856 t of zinc in concentrate and 35.97 Moz of silver. A modest expansion of the Northern Block was planned, which would see throughput increase by about 10 % to 2.4 Mt/y. The operation is also involved in the innovative 'Green Lead' project, a scheme designed to minimise the environmental ill effects of lead and to clean up the metal's image.

MIM Holdings, taken over by London-listed Xstrata in 2003, produced lead-zinc-silver from its Mt Isa operations in Queensland and from the MacArthur River deposit in the Northern Territory. In fiscal 2002, 189,494 t of zinc concentrate, 160,385 t of crude lead and 12.081 Moz of silver were produced from Mt Isa, an increase in lead-zinc production of 14%. This was mainly a result of the commissioning of the George Fisher mine which will take over from the Mt Isa lead-zinc-silver ore zones as the main source of ore.

Operations at McArthur River struggled to turn a profit in 2001-02 owing to the flagging zinc price. In 2002, output amounted to 129,750 t of zinc, 30,719 t of lead and 1.25 Moz of silver in concentrates. These were transported by pipeline to a blending and loading facility at the port of Bong Bong in the Gulf of Carpentaria and then by barge to ocean-going vessels anchored about 30 km offshore. MIM had talked about producing zinc metal on site at McArthur River, using its new high temperature acid leach and electrowinning technology Albion process. This could reduce production and transport costs significantly.

In 2002, Western Metals Ltd's Pillara deposit at Fitzroy Crossing in the Kimberly region of WA produced 305,609 t of zinc concentrates (59.63% Zn) for 182,237 t zinc metal and 90,174 t of lead concentrate (77.44% Pb) for 69,833 t of lead metal.

The Golden Grove base metals operation in WA continued to perform well for Newmont. The operation comprises the Scuddles zinc-copper mine and the Gossan Hill copper-zinc-gold-silver mine, and is Newmont's only Australian base- metals asset.

The flagging zinc price did little to halt the demise of Pasminco Ltd. Its assets at Broken Hill and Elura were snapped up respectively by junior base metal hopefuls, Perilya Ltd and Consolidated Broken Hill Ltd. It remains to be seen what will become of Pasminco's Century mine and its advanced projects such as Dugald River.

At Broken Hill, Perilya set to work with a scaled-down workforce and mining operation, and after one year of operation it proved it could turn a profit. Perilya spent A$90 million on the Broken Hill acquisition and plans to produce 330,000 t of zinc, 120,000 t of lead concentrate and 2.3 Moz of silver annually. It is reported to be achieving mining grades up to 40% higher than expected, thanks largely to more focused mining.

Consolidated Broken Hill holds title to the central 3.8 km of the Broken Hill Lode system and conducted diamond drilling to confirm the extent of Broken Hill's western mineralisation. The Elura mine, which it has acquired form Pasminco, produces 1.1-1.2 Mt/y of ore, with annual output of approximately 73,000 t of zinc concentrates, 42,000 t of lead concentrates and 880,000 oz of silver.

Kagara Zinc Ltd commissioned its Mt Garnet treatment plant in north Queensland for A$54 million and expects to treat zinc ore from several deposits in the far north.

Mineral sands

Australia is one of the world's largest titanium producers, with annual production of around 2.0 Mt of ilmenite concentrate, 210,000 t of rutile concentrate, 700,000 t of synthetic rutile, 35,000 t of leucoxene concentrate and 185,000 t of TiO_2 pigment. According to TZ Minerals International Pty Ltd, 2002 saw lower production and prices for Australian ilmenite and synthetic rutile, but high demand and prices for zircon.

Most of Australia's mineral sands production comes from WA's 'mid-west' and 'south-west' regions, and the major producers are Iluka Resources Ltd, Cable Sands (WA) Pty Ltd (a subsidiary of Japan's Nissho Iwai), Ticor Ltd and Kerr McGee Corp. of the US (which is in the TiWest JV with Ticor Ltd). Although depressed market conditions have seen a slowdown in mineral sands activity, the Murray Basin (straddling the borders of Victoria, New South Wales and South Australia) is emerging as a promising new mineral sands province.

Iluka Resources Ltd, is the world's largest supplier of zircon, rutile, ilmenite, leucoxene and synthetic rutile, and in 2002 it produced 992,094 t of ilmenite, 80,168 t of rutile, 315,748 t of synthetic rutile and 234,194 t of zircon. The company mines mineral sands near Capel and operates the Narngulu

synthetic rutile plant, both in southwest WA, and mineral sands operations near Eneabba in the mid-west.

The other major producer is the TiWest joint venture (Ticor Ltd and Kerr McGee) which operates the 675,000 t/y Cooljaroo operation, the Chandala synthetic rutile plant, and a chloride route pigment plant 60 km north of Perth. In terms of earth-moving, Cooljaroo is the world's second largest mineral sands mining operation, behind Richards Bay in South Africa. However, in 2002, TiWest responded to the low prices by periodically ceasing production at Cooljaroo and running down its stockpiles.

Ticor purchased Magnetic Minerals NL's Dongara project near Eneabba in Western Australia during the year. Magnetic had outlined a resource of 182 Mt averaging 5% heavy minerals in the northern half of the project area, and a pre-feasibility study has envisaged a mine life of ten years based on mining and concentrating 350,000 t/y of heavy minerals.

The third big Western Australian producer is Cable Sands (WA) Ltd, a subsidiary of Nissho Iwai of Japan. The company owns the Jangardup, Sandalwood and Yarloop mines in the Bunbury region in the southwest. In 2002, it produced about 515,000 t/y of heavy mineral concentrates. During the year, Nissho Iwai attempted to sell Cable Sands and also its share in the Murray Basin Joint Venture but failed to attract a high-enough bidder.

The only mineral sands project commissioned in 2002 was Doral Mineral Industries' Dardanup project in southwestern WA, which was to produce 30,000 t of chloride-grade ilmenite, 4,000 t of zircon and 2,000 t of leucoxene in its maiden year.

Iluka expanded its interests in the Murray Basin by its takeover of Basin Minerals NL and conducting trial mining and metallurgical testwork on Basin's Douglas deposit (58 Mt averaging 10.3% heavy minerals) in Victoria. Basin had completed a definitive feasibility on Stage 1 of the project, which proved financially and technically robust. In other corporate movements, Iluka also finally gained a majority shareholding in Consolidated Rutile Ltd (50.1%).

A strong zircon price looked good for companies such as Southern Titanium NL, 25%-owner of the Mindarie project in the western Murray Basin in South Australia. After two successful share placements to raise capital for the bankable feasibility, and following final financing confirmation, Southern Titanium was set for a 2003 start-up at the rate of 76,000 t/y of ilmenite, 43,000 t/y of zircon, 17,000 t/y of rutile (in two grades) and 15,000 t/y of leucoxene.

At Wemen, the only producing mine in the Murray Basin, Murray Basin Titanium (RZM Pty Ltd 50% and Sons of Gwalia Ltd 50%) increased cut-off grades to keep the project above the line. In 2002 the operation produced 56,255 t of ilmenite, 25,185 t of rutile and 7,765 t of zircon.

Wemen is a relatively small-scale operation and BeMax Resources NL was set to be the first miner to really demonstrate the viability of the Murray Basin with its Ginkgo project. Reserves amount to 184 Mt at 3.1% heavy minerals at Ginkgo and 100 Mt at 5.4% at the Snapper deposit. BeMax planned to transport ore to a separation plant at Broken Hill some 130 km away. In 2002, Sons of Gwalia sold its interest in the project to BeMax, and the latter signed an off-take agreement with DuPont for ilmenite, leucoxene and zircon.

Copper

In 2002 Australian copper production was unchanged from 2001 at 876,000 t. According to ABARE, the total value of copper exports was down slightly in 2002 to $2.2 billion but was an improvement on $1.6 billion in 2000. A production decrease is forecast for 2003, followed by an increase to 912,000 t and export earnings of A$2.3 billion in 2004.

MIM, Australia's largest copper producer, was taken over by Xstrata plc in June 2003. MIM is also the world's seventh-largest copper producer and its operations in Queensland, Australia, include mining and smelting at Mt Isa, mining copper and gold at Ernest Henry and refining in Townsville. It also mines copper and gold at Alumbrera (50%) in Argentina.

In 2001-02, MIM produced 233,000 t of copper from Mt Isa, plus 52,887 t of copper and 143,627 oz of gold at Ernest Henry. At Mt Isa, an additional 55,000 t of copper were to be produced in 2002 and 2003, and plans for an increase to 400,000 t/y by 2006 were also tabled. The underground orebodies at Mt Isa have resources of 36 Mt at 2.8% Cu and the Enterprise mine at Mt Isa has resources of 79 Mt at 2.7% Cu.

The Ernest Henry mine, which has seldom been without ownership controversy, was again the subject of a dispute during 2002, with junior miner Aquila Resources contesting MIM's take-up of Pasminco's 49% stake.

WMC Resources' Olympic Dam mine in South Australia produces about 2% of world copper output. In 2002 Olympic Dam produced 178,120 t of copper, and consideration is being given to an expansion to 350,000 t- 600,000 t/y, depending on the outlook for the uranium, gold and silver by-products.

Also in South Australia, Minotaur Resources created great excitement with its Prominent Hill discovery in the Gawler Craton in late 2001. The deposit, which has been compared in style to Olympic Dam, delivered sensational initial drilling results including 107 m at 1.94% Cu and 0.65 g/t Au from 200 m, and 152 m at 1.1% Cu and 0.61g/ Au from 429 m. BHP was selling its interest in the joint venture.

In 2002, Newcrest Ltd commissioned its Ridgeway gold-copper mine in New South Wales which produced 246,956 oz of gold and 33,198 t copper. Planned production is 350,000 oz of gold and 34,000 t/y of copper.

Also in NSW, Rio Tinto's Northparkes operation milled 5.36 Mt at a grade varying from 0.64% Cu to 1.04% Cu for the recovery of 38,640 t of copper and 413,111 oz of gold, down from 55,200 t copper in 2001.

Exploration success at Placer Dome's Osborne mine, 200km south of Mt Isa, saw mine life extended three years to 2008. In 2002, Osborne produced 46,109 t of copper and 38,149 oz of gold.

Receivers were appointed to Mt Isa miner, Selwyn Mines Ltd which was producing about 14,000 t/y copper from its Mt Elliot mine based on a resource of 76.6 Mt at 0.9% Cu and 0.88 g/t Au.

Another Mt Isa copper mine, Western Metals Ltd's Mt Gordon mine was the world's first combined mineral processing and copper metal plant of its type. Mt Gordon processed 692,000 t at 8.03% Cu for 48,868 t of copper cathode at 99.9% copper, using a low pressure, low temperature autoclave whole-ore leach facility, followed by solvent extraction and electrowinning.

About 100 km northeast of Mt Isa, newly-listed junior explorer, Universal Resources, had success at its Roseby project where seven oxide deposits possess combined resources of 61.4 Mt at 0.74% Cu (454,000 t of contained copper) and the Little Eva sulphide mineralisation (35 Mt at 0.46% Cu).

Copper Mines of Australia Pty Ltd's historical Mt Lyell deposit in Tasmania produced 31,662 t of copper in 2002-03.

In early 2003, Straits Resources Ltd sold the Nifty deposit in WA (purchased from WMC in 1998 for A$54 million), to the Birla Group of India for A$158 million. The Nifty open pit in the Great Sandy Desert uses SX-EW technology to treat the ore and produced 21,574 t of copper cathode in 2002.

In 2002, Pilbara Mines and Canada's Inmet Mining Corp. (70%), discovered the high-grade Jaguar polymetallic deposit, 4 km south of the old Teutonic Bore copper mine in WA. In 2003, further drilling outlined resources of 1.4 Mt at 3.7% Cu, 13.2% Zn, 0.9% Pb, 140 g/t Ag and 0.18 g/t Au.

Magnesium

Australia's two big magnesium development projects, Stanwell and SAMAG, both failed to get off the groun during 2002. Australian Magnesium Corp.'s A$1.3 billion Stanwell project near Rockhampton in Queensland experienced cost escalations that jeopardised its future. More than A$200 million had already been spent on research and development, pilot plant testing and a demonstration plant.

Newmont Australia subscribed $100 million to a new share issue in AMC, and the Commonwealth Scientific Industrial Research Organisation (CSIRO) and the Queensland Government both contributed heavily to the project. Financiers for the project had walked away, and AMC said it was seeking new development scenarios.

Site work was begun during the year and AMC was still planning for a 2004 start for the 97,000 t/y magnesium metal and alloy operation which was to process ore from the Kunwarra mine. Record production was achieved from Kunwarra in 2002 at 2.17 Mt for 601,223 t of beneficiated magnesite.

Magnesium International Ltd (formerly Pima Mining NL) completed a feasibility study on its $750 million SAMAG project near Port Pirie in South Australia which indicated a production rate of 71,000 t/y of magnesium metal and 6,000 t/y of magnesium alloys at an operating cost of US$0.59/lb, with estimated payback after five years. Magnesium International has a resource of 579 Mt at 42.0% magnesite at its Leigh Creek deposits, and an exclusive world-wide licence for Dow Chemical Co's electrolytic magnesium cell technology. It also has output committed under a long-term contract to Thyssen Krupp Metallurgie GmbH.

Mt Grace Resources completed a feasibility study on its 50,000 t/y Batchelor project in the Northern Territory. Mt Grace has substantial magnesite resources of 16.6 Mt at 43.2% but is awaiting news on a natural gas pipeline to Darwin which would improve economics.

In Tasmania, Indcor Ltd was planning a 90,000 t/y operation at Arthur River which it said had significant competitive advantages over other projects but the plan was still on hold in 2003.

Tin

Australia has two producing tin mines, the new Ardlethan mine in New South Wales and Renison Bell on the west coast of Tasmania.

Murchison United NL's Renison Bell underground tin mine is the larger of the two. Production was down considerably in 2002 at 5,609 t, compared with 8,991 t in the previous year. In mid-2003, administrators were appointed and output at Renison Bell was halted after nearly 40 years of production. This came after Murchison failed to secure capital for decline development to reach ore which was economic at a low tin price.

The Ardlethan tin mine, owned by Sydney-based Marlborough Resources was commissioned in 2001. The hardrock and alluvial tin mine underwent its first upgrade, to 1,500 t, in 2002 improving the economics of the operation. Major tin producer, Malaysia Smelting Corp. Bhd, the mines' major customer, became a 30% shareholder via a A$5.3 million share placement. The increased cash flow was to fund growth and a tailings development which could add five years to the life of the mine. Drought conditions, which affected much of Australia in 2002, saw mine shutdowns for hours each day during the summer months.

Manganese

About 10% of the world's manganese ore is produced on Groote Eylandt, an island off the coast of Northern Territory in the Gulf of Carpentaria. The Groote Eylandt mine was sold by BHP to Billiton in 1999 and is now owned

60:40 by BHP Billiton and Anglo American plc. In 2001-02, 1.61 Mt of ore was produced from the sedimentary manganese deposit.

Manganese is also produced at Consolidated Minerals Ltd's, Woodie Woodie mine near Port Hedland in northern WA. Exploration outlined additional high-grade reserves in 2002 and 396,554 t of ore was produced.

Consolidated Minerals was also earning equity in HiTec Energy Ltd's Ant Hill project in WA. The project is planned to produce 40,000 t/y of electrolytic manganese dioxide (EMD) from manganese sulphate solution, produced from Ant Hill ore, at a capital cost of A$209 million and an annual operating cost of A$39.5 million. Work had slowed in 2002-03 due to funding issues.

Diamonds

Rio Tinto's Argyle mine in the Kimberley region of Western Australia is Australia's largest diamond mine. It accounts for about 20% of the world's annual diamond production by volume. Production in 2002 rose by 6.6 Mct to 32.6 Mct.

During the year, approval was given for a A$70 million underground feasibility study, which was to include development of an exploratory decline. The feasibility study is expected to lead to a decision on underground mining of the AK-1 pipe in 2005. Reserves amount to 167 Mt averaging 2.5-3 ct/t. Current open-pit mining will wind down in 2007, but good results from the study could see mining at Argyle extended to 2020. Rio Tinto is now sole owner of Argyle, having acquired the interests of Western Australian Diamond Trust and Ashton Mining.

Rio Tinto also moved to full ownership of the Merlin mine in the Northern Territory through its Ashton takeover, but announced this year that the mine will close later in 2003. Merlin, Australia's second largest diamond mine, produced 117,000 ct in 2002 up from a low 70,000 ct in 2001 when an extremely wet 'wet season' hindered operations. At the end of 2002, reserves amounted to 11.7 Mt averaging 0.2 ct/t.

In 2002, Kimberley Diamond Co. NL (KDC) brought its Ellendale deposit in the West Kimberley region of WA into production as Australia's third diamond mine. KDC had purchased Ellendale from Rio Tinto for A$23.35 million and is mining the Ellendale No.4 and No. 9 pipes discovered by CRA Exploration. KDC has upgraded resources significantly, to 45.9 Mt at 7.33 ct/t. Output in 2002 was expected to be 28,000 ct, with plant upgrades scheduled for 2003-04. Higher- than-expected grades were achieved in 2002 and those high-quality yellow stones recovered are to be marketed as 'Kimberley Gold'.

Gravity Capital Ltd, the result of a merger of Dwyka Diamonds Ltd and geophysical specialists Grenfell Resources, obtained a licence to use BHP Billiton's Falcon airborne gradiometer and is exploring actively. The company is in joint venture with Kimberley Diamond Co. at Ellendale, with Thundelarra Exploration Ltd and BHP Billiton in the Phillips Range, and with Striker Resources NL on the King George Leases near Kununarra.

Striker Resources has received encouraging results from its Seppelt pipes in the Kimberley over the past three years and is advancing a scoping study for both open-pit and underground mining. Fellow diamond junior Adamus Resources Ltd, which holds the Bollinger project on the same structure as Seppelt, was encouraged by its neighbour's results.

Platinum

Australia does not produce any platinum or palladium but has seen a resurgence in exploration for these metals in recent years, albeit with slightly less momentum in 2002-3 owing to the depressed palladium price.

London-listed Lonmin plc joined Australian explorers in their efforts, including Platinum Australia NL at its Panton project in Western Australia. Lonmin is funding a bankable feasibility study through a take-up of 23 million Platinum Australia shares at A$0.52/share. Previous owners at Panton had found the project metallurgically challenging, but Platinum Australia believes it can overcome these difficulties. The plan is for a 1 Mt/y open cut and underground operation with initial capital costs of about A$100 million. The higher-grade Top Reef (10.6 Mt at 2.4 g/t Pt, 2.7 g/t Pd) and Middle Reef (2.3 Mt at 1.6 gt Pt and 1.2 g/t Pd) would be mined and treated, and the lower-grade dunite-hosted ore (58.9 Mt at 0.4 g/t Pt and 0.5 g/t Pd) stockpiled. The overall resource is estimated at 75.2 Mt averaging 1.9g/t PGM+gold.

The low palladium price in 2003 led to problems for the Munni Munni project in WA's Pilbara region. Helix Resources and Lonmin halted their development plans and Lonmin subsequently left the project. Munni Munni has estimated resources of 24 Mt containing 2.1 Moz of PGM with a high palladium content.

Meanwhile, exploration for platinum is still taking place in some areas. Thundelarra Exploration was drilling at Eileen Bore north of the Panton project, where drilling returned a best result of 36 m at 0.62 g/t PGM+gold at Baron. Elsewhere, Placer Dome and Rio Tinto are exploring the Giles Complex in the West Musgrave region of WA (Nebo and Babel territory) for Voisey's Bay-type Ni-Cu-PGM deposits.

Uranium

Australia accounts for almost 22% of world uranium production, based on output at the Ranger and Beverly mines, and as a by-product at WMC Resources' Olympic Dam operation. In 2001-02, uranium exports were worth A$361 million.

Olympic Dam in South Australia has produced as much as 4,500 t/y of uranium oxide. A A$250 million uranium solvent extraction plant is nearing completion and the feasibility of a further expansion is being considered. In 2002, the remaining resource was estimated at 2,660 Mt at an average grade of 0.4 kg/t.

Energy Resources of Australia (68.4%-owned by Rio Tinto) produced 3,815 t of uranium in 2001-02 from its Ranger mine in the Northern Territory, down from 4,203t in 200-01. The remaining resource amounts to 28 Mt at 2.3 kg/t,

sufficient for a further ten years at current production rates. It is planned to phase in the Jabiluka underground mine as Ranger's resources become depleted.

Heathgate Resources Pty Ltd's, Beverly mine in South Australia produced 649 t of uranium in 2001-02 after a problematic few years, and output is expected to increase to 1,000 t/y for a further 15 years.

Approvals for Australia's third primary uranium mine, Honeymoon in South Australia, were granted in 2001. A 500 t/y in-situ leach operation is expected to be in production by the end of 2003 expanding to 1,000 t/y at a later stage.

Tantalum

Most of the tantalum produced in Australia is produced by Sons of Gwalia Ltd at its Greenbushes and Wodgina mines in Western Australia. According to Sons of Gwalia, production from these two mines comprises 30% of global production and they contain 75% of world reserves.

In 2002, Sons of Gwalia commissioned an expansion of its Greenbushes operation from an annual capacity of 300,000 lb to 1.3 Mlb of Ta_2O_5, and production for the year totalled1.23 Mlb of Ta_2O_5 and 791 t of tin. The expansion followed a A$65 million exploration programme. At the end of 2002 and into 2003 production was reduced owing to the depressed tantalum market. Underground mining is due to start this year. The 1.0 Mlb/y Wodgina operation produced 636,428 lb of Ta_2O_5 in 2002.

Haddington International Resources Ltd commissioned its Bald Hill project in 2001, and was to produce about 145,000 lb/y under a licence agreement with Sons of Gwalia. The agreement effectively insulated Haddington from market price fluctuations.

Tantalum Australia NL has been conducting a pilot mining and treatment operation at its Dalgaranga project in Western Australia. In partnership with Kemet Tantalum Pty Ltd it has outlined resources of 9.1 Mt averaging 216 g/t of Ta_2O_5 within 50 m of surface, and the partners are conducting a feasibility study for a 500,000 t/y mining operation.

Table 1

Australian Mineral Statistics (A$million)			
	2000-01	**2001-02**	**2002-03f**
Value of metals and other mineral exports	30,742	30,018	31,023
Value of energy minerals exports	25,678	25,411	25,160
Total value of mineral exports	**56,420**	**55,428**	**56,183**
Mineral exploration expenditure	684	640	Na
New capital expenditure	5,491	7,250	8,950

Source ABARE: *Australian Commodities* Vol. 10 No. 1 2003. f: forecast

Table 2

Australian Metal and Mineral Production						
	Unit	**1999-2000**	**2000-2001**	**2001-2002**	**2002-2003f**	**2003-2004f**
Coal	Mt	239.4	258.2	273.2	272.0	278.5
Gold	t	299	296	264	274	284
Iron Ore	Mt	159.7	175.6	185.3	195.0	200.0
Alumina	Mt	15.04	16.1	16.42	16.50	16.59
Aluminium	Mt	1.74	1.79	1.81	1.83	1.86
Bauxite	Mt	51.0	54.6	53.9	55.1	57.0
Nickel	Kt	177	187	191	201	231
Copper	kt	796	876	876	863	912
Zinc	kt	1,265	1,483	1,490	1,531	1,564

Source ABARE: *Australian Commodities* Vol. 10 No. 1 2003. f: forecast