

# AUSTRALIA

*By Michael Quinn*

Australia is a significant producer and exporter of most major metals. Domestic miners enjoyed the weak local dollar in 2001, if not the low commodity prices. Early in 2002 (when the dollar was still relatively weak and prior to gold's subsequent strength), economics and commodity forecaster, ABARE, was estimating total earnings from Australia's mineral and energy exports for 2001/02 would come in at around A\$54.6 billion. Of that total, metals and related minerals make-up around A\$31 billion, and energy, including coal, the balance.

In the year ahead, export receipts could reach A\$59.9 billion, depending on global growth performance. ABARE's numbers were predicated on an assumed average Australian dollar exchange rate of US\$0.51 in 2001/02 and an average of US\$0.53 in 2002/03. (In May 2002 the local dollar was on the climb and was trading around the US\$0.55 mark and higher.)

In terms of capital expenditure in the mining and metals industries, 2001/02 was looking a big year, with forecasts of its moving towards the A\$10 billion mark and well ahead of the previous year's spending of around A\$6.5 billion.

There were also indications that exploration expenditure was looking more healthy in 2001/02 after recording strong gains in the previous year (A\$1.77 billion) and after the 1999/2000 nadir of around A\$1.5 billion. However the increase last year was primarily driven by petroleum expenditure rising 44% to A\$1.044 billion.

Gold exploration rose slightly (to around A\$400 million) during the same period although in real terms spending has declined by 52% since the peak in 1996/97 - sitting at the sort of level it did in 1991/92.

Still the move in the gold price early in 2002 (and a general shift of speculative money back into the exploration companies), was doing wonders at the junior end of the market, with a host of new IPOs and capital raisings rejuvenating the sector to a degree after a tough 4-5 years.

Many of these so-called 'new' companies were based on existing companies spinning out their specific gold assets into new vehicles. But there were also plenty of bona fide new offerings - in the region of 20-30 including more than a few diamond explorers - and often headed by managements previously associated with the disappearing Australian majors. That is, former middle and upper management from companies such as North, Pasminco, Normandy, Acacia, Centaur et cetera.

A feature of the new listings was the often-stated intent to seek advanced projects in order to access a cash flow. The argument was that these opportunities are more prevalent with all the consolidation between the majors that had been taking place. One junior executive also commented that the move may also be seen as a necessary survival strategy, with most of the IPOs at the same levels of 10 years ago, around A\$3-5 million, but with the costs associated with running exploration companies now significantly higher.

## Coal

Coal is Australia's most valuable commodity, with just under A\$11 billion exported in the past financial year and A\$13.2 billion forecast for the current year on the back of output of 267.8 Mt - an 11 Mt increase on the 2000/2001 total of 256.8 Mt. Of that, domestic demand accounts for around 65 Mt, with the balance - 91 Mt thermal and 106 Mt metallurgical - being exported.

In 1960, just over 1 Mt was exported, with that growing to around 70-80 Mt in the mid-1980s when Australia became the largest coal exporter in the world. The expectation is that some 230-240 Mt/y will be exported by the end of the decade.

ABARE identifies some seven development projects are scheduled for completion in 2002, costing around A\$770 million and expected to deliver around 27 Mt when at full capacity. Four of the developments are in the New South Wales, of which the biggest is Enex's new Beltana longwall mine near Woolongong at 6 Mt/y. The other three are in Queensland's Bowen Basin.

Total new production of some 25 black coal projects that could be developed over the next 3-4 years is put at 116 Mt/y. However, a more realistic number (says ABARE) may be 44 Mt costing various developers an estimated total of A\$2.4 billion.

The vast bulk of Australia's coal comes from the Hunter Valley in New South Wales and the Bowen Basin in Queensland, with total resources put at 77,000 Mt. Australian thermal coal is typically high in calorific value, has moderate ash levels and is low in sulphur and heavy metal contents. Its metallurgical coals are recognised as having good coking properties and are generally low in sulphur - and many are low in phosphorous. The industry employs around 19,000 workers, and reforms and technological improvements have seen productivity increase annually by some 15% since 1996/1997. In headline figures, each of the industry's workers averaged 13,000 t of saleable product in 2000.

According to ABARE, general improvements implemented by coal miners over recent years stand to be complimented by other factors such as the privatisation of the state rail authorities in NSW and Queensland and the upgrading of ports. However, ABARE warns that the positives could be moderated by recent moves by the Queensland state government to change the rules on royalties.

Queensland coal mining royalties are currently 7% of the value of the saleable coal at the mine gate. The proposed change would calculate the royalty based on the value of coal loaded on ship for export. This is believed to have the potential to raise the export cost of Queensland coals by an estimated US\$0.50/t. In NSW, royalties are levied at A\$1.70/t of raw coal mined, with discounts available for coals with a high moisture content. A US\$0.50/t surcharge is also levied at some of that state's large open-pit mines.

Corporately there has been plenty happening in the boardrooms: consolidation, junior players emerging (or re-emerging), and a couple of alliances featuring two of the bigger global coal miners. Australia's big-five coal producers - Anglo Coal, BHP Billiton, Xstrata/Enex, MIM and Rio Tinto - between them produce about 70% of the country's coal.

Anglo Coal, a subsidiary of Anglo American plc, produces over 80 Mt/y of coal internationally and is the fourth largest private sector producer worldwide. Recent expansion of interests in Australia include its purchase last year of the Capricorn Coal Developments Joint Venture (German Creek) in central Queensland, and its move (in April 2002) to acquire a 51% stake in the Moura mine formerly held by Rio Tinto plc. As part of the latter deal, Anglo Coal was divesting to Mitsui Coal - which had pre-emptive rights over the 55% interest Moura that Rio Tinto was selling - a number of stakes in operating mines, including a 30% interest in German Creek. Anglo Coal was to manage all the joint venture mines. Plans at Moura include the development of the adjacent Theodore project, with potential future sales from the combined operation of 12 Mt/y. Further to the south, Anglo Coal flagged the staged development of an additional 10 Mt/y from Dawson and Taroom. Anglo Coal made its first big move into Australia in July 2002 when it bought the Australian assets of Shell for (the headline figure) of US\$850 million.

BHP Billiton has various coal interests throughout Queensland and NSW. An alliance

with Mitsubishi covers nine open-pit and one underground mine and a port in the Bowen Basin. The bulk of the mines yield high quality metallurgical coal used for steel-making. Current production is some 25 Mt/y. BHP Billiton is also in partnership with Mitsui covering two other mines in Queensland, and in its own right owns and operates five underground mines in the Illawarra region of NSW. The majority of the coal produced from the NSW operations - around 7-8 Mt/y - is consumed at the company's steelworks at Port Kembla and Whyalla. BHP Billiton recently approved the development of the Dendrobium mine, the first new colliery in the Illawarra region for many years. Dendrobium will cost some US\$151 million and have annual output of 2.6 Mt of coking and 1 Mt of thermal coal.

Enx Resources, which is owned by Xstrata AG, has interests in and manages, a dozen mines in the Hunter Valley, and the Western and Newcastle coalfields of NSW, as well as Queensland's Bowen Basin. Output is currently put at around 27 Mt/y, following its acquisition of the Ravensworth and Narama mines in the Hunter Valley in December 2001. Operational initiatives during the year included its conversion of the United mine from a bord and pillar operation to a longwall in April/May 2002, with production to rise from 1-2 Mt/y to 2.7 Mt/y.

Enx was to have floated on the Australian stock exchange in 2001, but September 11 and a reported reluctance on the part of some Australian investors regarding the pricing of the issue were among issues that saw the local IPO delayed, postponed and eventually abandoned.

MIM mines coking coal at Oakey Creek and Collinsville and steaming coal at Newlands and Collinsville. Combined production for the year ended June 30, 2001, came in at just over 14 Mt - with the mix roughly 50:50. Production for calendar 2002 was forecast at around 22 Mt - with around 17 Mt attributable to MIM.

The company was looking at continuing to grow its coal business - it has doubled output since 1995 whilst reducing costs from A\$51/t to A\$39/t last financial year - and early in 2002, attempted to acquire Rio's stake in the Moura mine only to be stymied by the preemptive rights accorded to Mitsui. A feasibility study was being carried out on the 300 Mt Rolleston thermal coal deposit in the Bowen Basin, and consideration was being given to the 2,000 Mt Wandoan thermal coal deposit in the Surat Basin. MIM was also spending A\$25 million on coal exploration in 2002, with significant acreage taken up in the Bowen Basin. The company has a stated aim of doubling its production - via expansions and acquisitions - within five years.

Through 72.7% owned subsidiary Coal & Allied, Rio Tinto is a major player in the Hunter Valley with capacity to produce more than 36 Mt/y - which equates to managing roughly one-third of all exports from that region. It acquired (and sold) a number of mines through 2001, including picking up American company Peabody's Australian coal operations (which was where its Moura stake originated). In Queensland, through subsidiary Pacific Coal, Rio owns the Tarong mine and has stakes in the Blair Athol and Kestrel mines. Production from these operations in 2001 came in at just under 20 Mt.

Among the more prominent smaller players during 2001 were Austral Coal, Centennial Coal and new entrant Macarthur Coal. Macarthur was listed during the year on its stake in the Coppabella mine in the Bowen Basin and aspires to be a three-mine company producing some 2.5 Mt/y of coking coal by early 2003.

### **Iron ore**

Australia is a major iron ore producer and exporter, with the vast majority of its output coming from the Pilbara region of Western Australia.

Early in 2002 respected forecaster ABARE was predicting that the volume of Australian

iron-ore production would rise in 2001/02 by 8 Mt to 184 Mt, with exports to rise by nearly 6 Mt (or 4%) to 163 Mt, valued at A\$5.5 billion.

Further out, exports are expected to rise by 17% or 27.5 Mt to 191 Mt over the next five years, with Australia's location near the growing markets of Asia and its positive reputation regarding costs and reliability helping to increase market share in Asia. Increases will be met primarily by Australia's big two producers, BHP Billiton and Rio Tinto.

BHP Billiton produces around 60-65 Mt annually from its Pilbara operations, which comprise the Yandi, Mt Newman and Goldsworthy operations, and, as of early 2002, the Mining Area C Marra Mamba development. Mining Area C, which will cost around A\$800 million to develop, has the potential to increase production by up to 15 Mt annually by 2011, with work on the company's port at Port Hedland and other facilities boosting BHP Billiton's export capacity to 81 Mt by 2004. Mining Area C is the beginning of a long period of expansion by BHP Billiton that will increase the company's output by 40% within a decade to 90 Mt.

The development also sees the arrival of POSCO, the South Korean steel producer, which will have a 20% interest in the mining operation. POSCO has committed to purchase a minimum of 3 Mt/y of ore and to maintain a long-term strategic alliance with BHP Billiton for the supply of other iron ore products. According to the company, the development of the Mining Area C's Marra Mamba ore answers growing requirements for high 'value in use' ore from Asia's direct blast furnace steelmakers. ('Value in use' pertains to the Marra Mamba-type ore being lower in gangue material than the company's other ores while the calcine Fe is above the raw state of the haematite ores). BHP Billiton also produces Brockman and Yandi ores.

All necessary approvals and agreements were in place for construction of the new mine to start, with full-scale mining of the 'C Deposit' sub-lease to begin in 2003. Expansion of port

facilities would begin later this year, subject to final regulatory approvals. Mining Area C is 37 km from BHP Billiton's existing Yandi mine and contains the biggest undeveloped Marra Mamba resource in the Pilbara - estimated at 890 Mt with significant further exploration potential. 'C Deposit' is located on the northern flank of Mining Area C and contains a proven and probable reserve of 201 Mt. BHP Billiton is also planning to deliver a Yandi lump ore product by 2004 via modifications to the existing plant at the project.

Meanwhile its problematic HBI project - the Boodarie iron plant - at Port Hedland continued to splutter, with force majeure declared in March following a plant failure.

Rio Tinto's subsidiary Hamersley Iron has six mines in the Pilbara as well as 630 km of dedicated railway and associated port and infrastructure facilities with a rated capacity of 68 Mt/y - though in 2001 output was a record 69.9 Mt. In December 2001, the company reached agreement with Shanghai Baosteel Group Corp., China's largest steelmaker, to form a joint venture to supply 10 Mt/y of standard Hamersley ore for 20 years starting from 2002. The joint venture will develop a new mine east of the town of Paraburdoo at a cost of US\$64 million. At 23.7 Mt in 2001, China was the single largest destination for Hamersley's shipments.

Process improvement continues to be the main focus for Hamersley and Rio said that further opportunities for cost improvements would be sought in 2002 after reductions worth an annualised A\$30 million were implemented in 2001.

Elsewhere in the Pilbara, Rio Tinto has a 53% stake in Robe River Iron Associates - following its takeover of North Ltd a couple of years back - with its core project being at the town of Pannawonica. Pannawonica has a rated capacity of 32 Mt/y. During 2002, Robe's output will be boosted when the new West Angelas project comes on stream, with output of 18 Mt/y of high grade Marra Mamba-type iron ore.



Perhaps the most significant event for the year for Rio Tinto - if not Australia's iron ore industry in general - was its decision in 2002 to build a commercial scale HIs melt facility near Perth. The process, which has been under development for almost 20 years now, is seen as the key to the commercialisation of Marra Mamba fines which are a huge slice of the Pilbara's gigantic iron ore resources. The process involves injecting the high phosphorus fines, together with non-coking coal, into a molten metal bath. It does not require coke ovens and sinter plants, it significantly reduces the 'greenhouse' gases produced by traditional blast furnaces and the liquid metallised iron product is especially attractive as a feedstock for the rapidly growing electric arc furnace steel industry. The HIs melt expansion project will operate as a joint venture between Rio Tinto (60% through its subsidiary, HIs melt Corp.), US steelmaker Nucor Corp (25%), Mitsubishi Corp (10%) and Chinese steelmaker Shougang Corp (5%). The joint venture will spend A\$400 million on a plant with an annual capacity of up to 800,000 t of high-quality pig iron (96% iron content).

Other Australian producers include Portman Mining, which continued to grow its profile based around the Koolyanobbing project east of Perth. Portman is aiming to expand Koolyanobbing from around 3.5 Mt/y to 8 Mt/y by 2006. The company also exports modest tonnages from an operation at Cockatoo Island.

In Tasmania, the Savage River operations owned by Robert Friedland's Ivanhoe Mines were suffering late in 2001 in the wake of the downturn in the steel industry, while the long-running Kingstream Steel Ltd saga and its plan to develop an iron and steel project in the mid-west of WA came to nought when the company went into administration late in 2001.

In other potential developments, Allied Mining and Processing was proposing an iron-ore operation at Mount Nicholas, 100 km northeast of Newman, with other mooted mines at its East Pilbara project having the potential to

contain in excess of 850 Mt. Mt Nicholas is estimated to contain 530 Mt at 55.2% Fe, with the ore able to be beneficiated. A 10 Mt/y operation costing A\$320 million was being considered, with ore delivered to Port Hedland.

Another company, Mt Gibson Iron, was looking at developing a iron ore project in the mid-west, while private company Hancock Prospecting and South African company Kumba Resources continued to push for a 25 Mt/y development of the large Hope Downs Marra Mamba-type deposit. Access to established rail infrastructure was one sticking point for the joint venture.

### Gold

Gold production in Australia continued its downward trend in 2001, falling some 5% to 281 t. This is down 11% on 1997's record of 314 t. It was the year of the disappearing Australian gold company. Some of those that went out the door over the course of 2001 included Australia's biggest producer Normandy, WMC's gold division, Delta Gold and Goldfields who merged to become AurionGold, PacMin Mining, Hill 50, Central Norseman and NewHampton Gold.

Industry watcher Surbiton Associates estimated that foreign control of Australia's gold mining industry has risen from 20% five years ago to 30% by the end of 2000. With take-overs in 2001, including that of Normandy by Newmont and Hill 50 by Harmony, overseas control is estimated to rise to over 60%.

In terms of mines, the Super Pit in Kalgoorlie was the biggest producer with 616,344 oz at cash costs of A\$397/oz. (For calculating the US equivalent cost, Australian cash costs in 2001 can essentially be halved.) The Super Pit output didn't include the 114,822 oz from the sister Mt Charlotte underground mine, which, for the sentimentally inclined, had a year perhaps fittingly representative of the Australian gold sector. It closed after some 40 years of continuous operation. Production from the last underground mine operating on

the world-famous 'Golden Mile' in Kalgoorlie totalled over 3 Moz. And for those that are superstitious, it should be noted that Mt Charlotte had been the last operating mine on the Mile back in the late 1970s - and had been earmarked for closure - before the huge gold surge in 1979 gave her a 22-year reprieve.

Second place, in 2001, for output was either the St Ives operation formerly owned by WMC or the Yandal operation formerly owned by Normandy. Either, because WMC's disclosure on its gold operations is somewhat problematic as reflected in two well-respected industry bodies reporting different output figures.

One report suggested St Ives produced 455,183 oz and the other estimated it at 513,400 oz. In any case, the Yandal operations in the isolated Tanami desert of the Northern Territory proved its quality with 480,314 oz at A\$277/oz, with the world-class Callie underground mine the linchpin of that performance. Callie, which is accessed by a decline has defined mineralisation to well over 1,000 m depth (and still open), and Normandy had been working for sometime on whether a shaft should be developed to improve the project's economics. Truck haulage trials continued through 2001, and the finely balanced decision is (now) in the hands of Newmont. Another question keeping the number-crunchers busy was whether to develop a dedicated mill for Callie, with the ore currently trucked 40 km to the Granites mill.

Another (now) Newmont-owned operation featured in Australia's top-10 with the Jundee/Nimary mines yielding over 403,000 oz in 2001 at cash costs of A\$262/oz.

The ten-year-old Granny Smith operation owned by Placer Dome (60%) and AurionGold came in at number-five, though it continued its big slide over the past few years with production of 347,179 oz at A\$338/oz. Only three years ago Granny Smith produced over 544,000 oz. However, the 7 Moz Wallaby mine, which was commissioned late in 2001, will see a turnaround in declining production in 2002.

In terms of low-cost operations, the Newmont/Battle Mountain high-grade Pajingo (Vera Nancy) mine in Queensland produced 245,840 oz at a mere A\$183/oz. However Australia's lowest-cost mine was again the Sandstone operation in Western Australia owned by Troy Resources, which produced its 53,337 oz at cash costs of A\$174/oz.

New mines to emerge during 2001 included Gindalbie Gold's Minjar operation in the Murchison mineral province of WA, and Barra Resources' small toll-treated Riverina/First Hit mine north of Kalgoorlie. Mines being developed include the Thunderbox operation owned by Toronto-listed LionOre Mining (60%) and local company Dalrymple Resources which will be commissioned late this year and which will initially produce 220,000 oz in its first year before settling at around 150,000 oz/y as the open pit deepens.

Dominion Mining is to (finally) start the ball rolling in the Gawler Craton of South Australia, with first gold due later this year. The Frog's Legs discovery in the 'hot' Kundana region near Kalgoorlie looks on the cusp of development, as does the Newcrest Mining (70%)/Sedimentary Gold high-grade Cracow discovery in Queensland.

However, the Ridgeway operation in the continuing-to-emerge Orange region of NSW will be far-and-away the biggest new gold mine in Australia in 2002. The underground gold-copper orebody is being exploited via a sub-level caving technique with ore crushed underground before being conveyed to surface for further processing. The underground crusher is capable of 9-10 Mt/y, and though current capacity of the plant overall is put at 5 Mt, reports speculate that a mere A\$20 million is needed to expand surface infrastructure (add a ball mill) to take the operation to 8 Mt.

The operation was being commissioned early in 2002, with over 300,000 oz of gold and 30,000 t of copper possible for the calendar year.

Meanwhile, Ridgeway's adjacent operation, Cadia, suffered a somewhat difficult year producing 259,305 oz and 21,469 t of copper at cash costs (net of copper credits) of A\$324/oz. Mine scheduling issues were apparently behind the under-performance.

With Ridgeway, Cracow and Telfer, Newcrest has emerged as 'the' gold growth story of the Australian gold sector. The currently mothballed Telfer could be the biggest operation of the whole sector, with a feasibility now under way and annual production of 800,000 oz or more possible from open pit and underground sources. Telfer has a resource of over 26 Moz, and a decision is imminent. Also awaiting a development green light is the Boddington Extended project near Perth which has three owners - Newmont (44.44%), AngloGold (33.33%) and Newcrest (22.22%) - and which has an 11 Moz resource inventory. A decision on this project is expected during 2002.

Another potentially large resource emerging is Bendigo Mining's project in the Victorian city of Bendigo. Exploration for a mooted 12 Moz orebody continues, with the company targeting first gold in 2003 ahead of an ultimate 400-500,000 oz/y operation. The company attracted the interest of South African miner Harmony Gold Mining which took a 31.8% stake in the junior.

Other growth companies on the Australian gold scene include Kalgoorlie-based Croesus Mining, which during the year merged with Central Norseman Gold. A few years back Croesus was producing around 40,000 oz/y. It aims this year to get to an annualised 300,000 oz.

### **Nickel**

Preliminary numbers show that the nickel industry enjoyed a strong year in 2001/02 in terms of production and the Australian dollar nickel price - if not the LME/US\$ nickel price.

And the trend in terms of nickel mined is expected to continue, with ABARE forecasting

a 5% rise from the 194,000 t in 2000/01 to 203,000 t for the year ending 2001/02.

Expected increased output from the nickel laterite 'flagship' Murrin Murrin mine is behind the boost in production, as is a ramp-up in ex-WMC operations Miitel and Wannaway now owned by Mincor, and the Cosmos operation developed by Jubilee Mines.

Murrin Murrin, however, remains a worry! After reaching 66% capacity in the September quarter of 2001 (with production of 7,467 t of refined metal), it then proceeded to drop back alarmingly to 5,656 t in the December period - though, to be fair, output was affected by two weeks of the quarter being taken up with a major planned shut-down.

Murrin Murrin has operated well in short bursts, but continuity of strong performance continued to elude it through 2001. Total production came in at 24,991 t of nickel (and 1,253 t of cobalt), equivalent to 55% of its rated 45,000 t/y capacity. Its best month was July when it produced over 3,000 t of nickel, or 80% capacity.

Ex-WMC executive Peter Johnston took over the reigns as chief executive officer at Anaconda Nickel - which owns 60% of Murrin Murrin - during the year and said early in 2002 that increasing production and lowering reducing operating and corporate costs remain the focus.

Testament to the seriousness of the situation facing Anaconda was the A\$457 million loss announced for the half-year ending December 31, 2001, with bondholders - owed US\$420 million - in negotiations with company executives in March. Swiss company Glencore owns the other 40% of Murrin Murrin.

Meanwhile, the other two laterite producers, Bulong and Cawse, did not exactly have a year to remember either. Cawse, considered the best technical success of the three, saw its developer Centaur Mining & Exploration Ltd go into administration during the year, with the OM Group, a US vertically integrated producer

and marketer of metal-based specialty chemicals and related materials, subsequently acquiring the project for an undisclosed sum.

At the same time, Bulong continued down its improving path toward rated capacity. Production at Bulong for the year came in at 6,262 t of nickel and 203 t of cobalt, with the June quarter's output of 1,815 t of nickel the best three-month period. Bulong's owner Preston Resources is into its third year of suspension from trading on the Australian stock exchange, having had, as with Anaconda, problems with its onerous debt situation.

On the other hand it was a much better year for the sulphide nickel producers. WMC, Australia's largest nickel producer, recorded its best year ever at the Mt Keith operation with a shade under 48,000 t of nickel in concentrate produced. WMC has been considering a A\$250 million expansion to Mt Keith which could increase annual production up to 65,000 t. The nearby Leinster operations also had a good year with 38,008 t, while Kambalda yielded 18,653 t.

WMC has been divesting some of its nickel mines in the Kambalda region - in return for cash and offtake agreements - with junior company Mincor Resources, mining contractor GBF, and Titan Resources buying three, two, and one mine(s) respectively. The Long Shaft mine in Kambalda was to be sold during the current year. WMC's Kalgoorlie nickel smelter produced 96,650 t of nickel-in-matte (slightly down on 2000's 103,019 t), while the Kwinana refinery was expanded to 67,000 t/y capacity during the year and yielded 61,325 t of nickel metal.

Junior company Mincor enjoyed its first year as a miner, with 6,660 t of contained nickel produced from its 76%-owned Miitel mine and 567 t from its 76%-held Wannaway operation, the latter only taking in the final two months of 2001. Mincor also acquired the nearby Redross mine which may come into production in 2003 depending on exploration results at Redross and the other two mines.

In the meantime, Titan Resources' Radio Hill operation in the Pilbara region of WA produced 4,755 t of nickel in concentrate. More significantly, trials of its innovative BioHeap process continued to progress, with the company increasingly confident that it may prove a breakthrough for the exploitation of low grade, disseminated nickel-copper orebodies. Titan also bought the Widgiemooltha North project south of Kambalda from WMC and the Carr Boyd Rocks project from Defiance Mining.

As with Mincor and Titan, Tectonic Resources sent ore from its underground RAV 8 operation near Ravensthorpe in WA to WMC's processing infrastructure. RAV 8, which was first mined as an open pit, has proved a far more structurally complex orebody for its owner than anticipated by the feasibility.

Another new miner for the year was LionOre Australia, with processing of the Emily Anne orebody commencing in November 2001. In full production, some 250,000 t/y will be processed yielding an average 6,700 t/y nickel at a forecast average operating cost of US\$1.60/lb. Concentrate produced at the A\$42 million operation will be shipped for smelting to Canadian giant Inco.

Probably the outstanding success story for the year was Jubilee Mines, with its Cosmos operation near Leinster performing above expectations in all respects. Production for the full (calendar) year came in at 11,013 t of contained nickel in concentrate - which is also shipped to Inco - and a net operating profit of over A\$30 million for fiscal 2001 was announced in September. The green light was given to develop an underground operation, with Jubilee to be mining until at least 2007. The company is also currently spending some A\$5 million annually on exploration of its 1,000 km<sup>2</sup> of prospective nickel tenements.

Meanwhile, Sally Malay Mining continues to assess the viability of its nickel sulphide deposit in the East Kimberley region of WA, where an operation producing 7,000 t/y of nickel in concentrate is being eyed.



And early in 2002 gold developers LionOre Mining and Dalrymple Resources were reporting strong exploration success at their Waterloo prospect on the doorstep of the developing Thunderbox gold project near Leinster.

### **Lead-Zinc-Silver**

Australia is a reasonably significant producer of lead, zinc and silver. Mine production of lead in 2001/02 was forecast by ABARE at 726,000 t (725,000 t), zinc at 1.5 Mt (1.483 Mt) and primary silver at 1.96 Moz (2.02 Moz).

Main production centres include Pillara in the north of Western Australia, McArthur River in the Northern Territory, Mt Isa, Cannington and Century in Queensland, Broken Hill in New South Wales and on Tasmania's west coast.

Pillara is owned by Western Metals - which also produces copper from the Mt Gordon mine. Output from Pillara totalled 171,287 t of zinc and 73,570 t of lead (in concentrate) from two underground mines - Pillara and Kapok. Elsewhere in WA, the Golden Grove base metal mine recorded production of 77,569 t of zinc, 4,937 t of lead, 975,146 oz of silver, 22,249 t of copper and 5,356 oz of gold. Golden Grove fell into the hands of US gold company Newmont during the year - after its takeout of Normandy Mining - and was considered to be up for sale at the right price.

In the Northern Territory, MIM Holdings has a large lead-zinc resource at the isolated McArthur River operation and is currently undertaking a scoping study into producing zinc metal on site via direct leaching and electrowinning. The company believes that should trials currently underway (utilising its in-house fine grind atmospheric leach technology called the Albion process) prove successful, then the ultimate size of the project will come down to the availability of reasonably priced electricity. In 2001 McArthur River produced 162,233 t of zinc, 38,510 t of lead and 1.53 Moz of silver.

At Mt Isa, where MIM has a lead-zinc concentrator and lead smelter, the (+)A\$200

million George Fisher zinc-lead mine came into full production during 2001. Production from the combined George Fisher/ Mt Isa mines (including Hilton) was 190,798 t of zinc, 158,848 t of lead and 12.25 Moz of silver. Some 3.14 Mt was processed, with MIM planning to increase annual production of lead-zinc ore to 4.5 Mt by 2003/04. MIM also has a lead-silver refinery at Northfleet in the UK.

At BHP Billiton's Cannington operation south of Cloncurry in Queensland, production of 209,528 t of lead, 70,574 t of zinc and 31.1 Moz of silver was achieved, while the Century mine (owned by the struggling Pasminco) yielded 92,756 t of lead, 451,167 t of zinc and 5.3 Moz of silver. After Pasminco fell into major financial troubles during 2001 attempts to sell Century were made but market interest failed to be reflected in the price the administrators were seeking. By mid-2002 it looked as though Pasminco would be re-floated with Century being the company's main asset. The administrators did, however, sell Pasminco's Broken Hill operation to former gold miner Perilya Ltd, with the old mine producing 75,425 t of lead, 179,000 t of zinc and 2.34 Moz of silver. Consideration involving staged payments and potential royalties, and could reach a total of A\$90 million. Meantime, Pasminco's other base metals operations remained on the selling table, with Elura near Cobar and Rosebery in Tasmania (possibly being retained) both enjoying better performances than the previous year. Pasminco also owned smelters at Pt Pirie in South Australia and at Clarksville in the US.

An attempt to re-open the old Wilga mine near Benambra in Victoria - at a processing rate of 600,000 t/y producing a 50,000 t copper concentrate and a similar size zinc concentrate - was stalled owing to low zinc and copper prices. Another project on hold because of zinc prices was Lady Loretta north of Mt Isa, where a A\$200 million development producing annually 125,000 t of zinc, 50,000 t of lead and 850,000 oz of silver was awaiting better times.

Kagara Zinc managed to defy the zinc-price gloom early in 2002 when it gave the green light to developing a zinc mine at Mt Garnet in North Queensland. The plan was to construct a central processing plant producing 80,000 t/y of zinc concentrates over an 11-year mine life plus 15,000 t/y of lead-silver concentrates and 5,000 t/y of copper-gold concentrates. In the early years, production costs are forecast to be among the lowest in the world at US\$0.15-0.20/lb. First production was slated for March 2003, with Korea Zinc, owner of the Sun Metals refinery in Townsville agreeing to a life-of-mine offtake agreement covering production from the Mt Garnet site. Also Kagara has flagged the potential within the next five years for a low-cost expansion up to 150,000 t/y - costing something in the order of A\$5 million - with the King Vol deposit to the northwest at Walsh River likely to play a large role in such a move. The high-grade King Vol deposit has a resource of 1.15 Mt averaging 18.5% Zn.

A lead project on hold was the Magellan project near Wiluna in WA where a feasibility had considered a 55,000 t/y operation costing A\$26 million to develop.

Elsewhere, exploration success was reported north of Leonora at Teutonic Bore in WA, with diamond drilling intersecting significant copper-zinc massive sulphide mineralisation. Teutonic Bore was a joint venture between Canadian company Inmet Mining and local company Pilbara Mines.

In terms of primary silver production, the Elizabeth Hill mine in WA's Pilbara district produced 1.206 Moz for the year, while in Queensland, a company called Macmin was closing in on a decision for the staged development of the Twin Hill (Texas) silver-gold project. Reserves at that project total 4.55 Mt averaging 60 g/t Au (using a 20 g/t cut-off) for a contained 8.777 Moz. Another silver project - although this one was on hold - is the Bowden's project near Mudgee in NSW owned by Silver Standard Australia. A production profile of 4.5 Moz/y of silver in concentrate had been examined.

### Mineral Sands

Australia is a major titanium producer, with most production coming out of Western Australia. In 2001/2002 ABARE was forecasting production of 1.98 Mt (2.092 Mt in 00/01) of ilmenite concentrate, 32,000 t (34,000 t) of leucoxene concentrate, 206,000 t (209,000 t) of rutile concentrate, 687,000 t (650,000 t) of synthetic rutile and 185,000 t (181,000 t) of titanium dioxide pigment. Output in each category was expected to increase in 2002/03, with most to record +10% jumps.

The major producing areas in WA are north and south of Perth, known colloquially as the Mid-West and South-West respectively. Iluka Resources, Cable Sands, Doral Mineral Industries, Ticor and US multinational Kerr McGee are the main players in the two regions.

During 2001 Iluka - formed in the 1990s through the merger of Westralian Sands and the RGC mineral sands assets and now the world's largest zircon producer - said its operations in the South-West set new records for synthetic rutile production whilst also recording improved output from its Geraldton and Eneabba facilities in the Mid-West. The company was constructing a new zircon finishing plant at Geraldton - expected to be commissioned by mid-2002. In WA, Iluka has six open-pit mines, two dry separation plants and two synthetic rutile plants.

Its total production in 2001 was 460,000 t (405,000 t) of synthetic rutile, 175,000 t (201,400 t) of rutile, 1.44 Mt (1.41 Mt) of ilmenite, 345,400 t (315,000 t) of zircon and 12,500 t (12,200 t) of leucoxene. These statistics take in operations in the US and its 50% stake in fellow Australian producer Consolidated Rutile.

Iluka's neighbour in the Mid-West is the 50:50 joint venture of Ticor Ltd and US major Kerr McGee. Their partnership covers the Cooljarloo mineral sands operation 200 km north of Perth, the Chandala synthetic rutile plant 60 km north of Perth, and a chloride route pigment plant at Kwinana. Cooljarloo has been

operating since 1989 and in terms of material movement is the second largest operation in the world behind Richards Bay. The main product is ilmenite, though rutile, leucoxene, zircon and staurolite are separated at the Chandala plant. The Becher process synthetic rutile plant at Chandala can produce in excess of 200,000 t/y. In 2001, Ticor and Kerr McGee produced over 437,000 t of ilmenite, 13,700 t of leucoxene, 28,000 t of rutile, 197,000 t of synthetic rutile and 81,000 t of zircon.

Cable Sands WA, owned by Nissho Iwai, is another significant producer of titanium in WA's southwest, with that company looking to develop a 250,000 t/y mineral sands concentrates operation at Jangardup during 2003 at a cost of A\$40 million. In construction already is Doral Mineral Industries, (owned by Iwatani International) Dardanup project which is set to produce 100,000-115,000 t/y of ilmenite and leucoxene and 8,000-10,000 t/y of zircon.

In Queensland, Consolidated Rutile produced 100,000 t of ilmenite, 61,900 t of rutile and 42,800 t of zircon at its North Stradbroke operation. Elsewhere in Queensland, the Goondicum project continued to advance with a feasibility study early in 2002 looking at the prospects of producing 210,000 t/y of ilmenite and 80,000 t/y of titano-magnetite.

In terms of exploration, there has been some exploration in WA - Magnetic Minerals is one junior that has been active over the past couple of years - but it is fair to say that most action on this count is in the Murray Basin. This emerging region stretches across New South Wales and Victoria into South Australia and covers some 300,000 km<sup>2</sup> of strandline deposits of the late Miocene-Pliocene marine sand sequences.

One operation already in production is the Wemen project of Sons of Gwalia and TZ Minerals, which was commissioned during 2001 and which initially aims to produce 30,000 t/y of rutile and 10,000 t/y of zircon. Aside from looking to expand the operation, the joint venture is also investigating the

applicability of technology to produce a high TiO<sub>2</sub>, low-chrome ilmenite, suitable for high-quality pigment production. The so-called ERMS technology is owned by junior Australian company Austpac, which is also active in India.

Aside from Wemen, Sons of Gwalia also has a 25% interest in the emerging Gingko project and is the major shareholder in BeMaX Resources, which holds the rest of the Gingko project. Gingko is a A\$158 million development scheduled to come into production next year at an annual rate of 53,000 t of rutile, 32,000 t of zircon, 124,000 t of ilmenite and 76,000 t/y of HiTi (70% TiO<sub>2</sub>). Austpac also involved with BeMaX which is planning to use the ERMS technology.

Indeed, with the increased interest in the Murray Basin, Austpac in partnership with Ticor was considering building an integrated synthetic rutile plant based on the former's technology at Portland in Victoria.

Elsewhere in the Murray Basin, Basin Minerals was looking at the feasibility of producing around 290,000 t of mineral sands concentrates (including 180,000 t of ilmenite and 75,000 t of zircon) from its Douglas project, while Southern Titanium had completed a final feasibility study for its Mindarie project and was looking to begin production in 2002. Annual output could be 77,000 t of ilmenite, 44,000 t of zircon, 17,500 t of rutile and 14,800 t of leucoxene from a development costing A\$65 million.

### Copper

Mine copper production in Australia was forecast by ABARE in 2001/02 to total 895,000 t, slightly ahead of the previous year's 878,000 t. Refined production was significantly greater at 595,000 t as compared with 518,000 t.

Australia's biggest single copper mine is WMC's Olympic Dam operation in South Australia. Olympic Dam - which is also a major producer of uranium (4,380 t) and, lesser so, of

gold and silver (113,412 oz and 912,859 oz respectively) - produced 200,523 t of copper in calendar 2001, 100 t ahead of the previous year. However as with 1999, Olympic Dam suffered a fire in the SX part of the plant, with estimated losses for 2001 and 2002 of less than 10,000 t of copper. Early in 2002 the SX plant was being comprehensively redesigned, with the uranium SX plant due to be commissioned in October 2002 and the copper SX plant in the second quarter of 2003. Meanwhile the optimisation of the operation so as to achieve production of 235,000 t/y was on schedule to be commissioned late this year (2002), while the study on an expansion to 350,000 t/y was continuing. WMC also announced some promising exploration results at the project during 2001, but with a resource of over 2,320 Mt averaging 1.3% Cu, 0.5 g/t Au and 0.5 kg/t of Um, the significance of the drill hits were perhaps less than they may have been elsewhere.

Second in the production stakes is MIM and its Mt Isa group of operations including the 2001-completed Enterprise underground mine containing reserves of 26.6 Mt at 4.3% Cu. The mine, which cost A\$370 million to develop, extends to 1,800 m depth and features a new refrigeration plant to cool hot working areas and a new paste-fill technique that cures quickly to enable accelerated access to adjoining ore. It also incorporates a new ore-handling system which will see the mine reach production rates of 3.5 Mt/y. Output in 2001 from the Mt Isa smelter - which took mine output from Enterprise, Ernest Henry and the Copper (1100 orebody) mine (at Mt Isa proper) - came in at 293,752 t, well ahead of 2000's 245,361 t. Like Olympic Dam, Mt Isa's plant suffered problems late in 2001, with a molten metal spill halting copper anode production - to the expected tune of 7,000 t of refined copper. In the event, the Townsville refinery delivered 232,006 t of refined copper metal for the year.

Elsewhere, the Mt Gordon mine north of Mt Isa and owned by Western Metals produced 47,557 t for the year. Mt Gordon was established in

1998 and has a capacity of 50,000 t/y of cathode copper - this being the world's first combined mineral processing and copper metal plant of its type. The ore is processed via a relatively low pressure, low temperature autoclave whole-ore leach facility followed by solvent extraction and electrowinning.

At the Osborne mine to the south, owned by Placer, production for the first nine months of 2001 came in at 35,667 t - compared with the full year of 47,509 in 2000 - while the revitalised Selwyn operation produced 19,245 t as further expansions were put in train.

In New South Wales, Newcrest commissioned its Ridgeway underground gold-copper mine in April 2002, with expected copper production in its first year of 34,000 t of copper in concentrate. The adjacent Cadia open-pit mine, also owned by Newcrest, yielded 21,469 t in 2001.

At Rio Tinto's Northparkes mine, some 55,200 t was produced, while in Western Australia, the Golden Grove base metal mine recorded production of 22,249 t of copper, as well as 77,569 t of zinc, 4,937 t of lead, 975,146 oz of silver and 5,356 oz of gold. The copper production was hence well up on 2000's 3,076 t.

In WA's Pilbara, Straits' Nifty mine continued its ramp up to 25,000 t/y nameplate capacity with output of 22,111 t. Further expansions have been mooted incorporating exploitation of the copper sulphide resource to 50,000-70,000 t/y of metal in concentrate.

In terms of exploration, success was achieved north of Leonora at Teutonic Bore in WA, with drilling coring significant copper-zinc massive sulphide mineralisation. Teutonic Bore was a joint venture between Canadian company Inmet Mining and local company Pilbara Mines. Other interesting exploration moves included Phelps Dodge, the world's second biggest copper producer, entering a joint venture with junior company Adelaide Resources over prospective ground in South Australia, and Minotaur Resources' standout



Prominent Hill discovery (also in SA) which, though very early days, has some similarities with Olympic Dam.

### **Bauxite, Alumina and Aluminium**

Behind coal, Australia's aluminium industry is the country's second biggest commodity export earner with sales in excess of A\$8 billion. Production statistics for the fiscal year 2001/02 were forecast by ABARE in March 2002 at 54 Mt of bauxite (the same as the year before), 16.45 Mt of alumina (16.1 Mt), and 1.82 Mt of primary aluminium (1.79 Mt). As with many of Australia's commodities, a weak Australian dollar helped maintain production, export volumes and receipts.

Australia has vast resources of bauxite in the Weipa and Gove regions of the Gulf of Carpentaria in Australia's North, and in the Darling Ranges south of Perth in Western Australia. According to the government department AGSO, there are also significant bauxite deposits at Mitchell Plateau and Cape Bougainville in the north of Western Australia, but they are currently uneconomic.

According to Rio Tinto/Comalco, the industry directly employs more than 15,000 people and has a total annual turnover in the region of A\$10 billion. Australia produces nearly one-third of the world's alumina. Australia's bauxite - alumina producers include the AWAC joint venture (of Alcoa and WMC), BHP Billiton and Rio Tinto/Comalco.

AWAC owns the Wagerup, Pinjarra and Kwinana alumina refineries south of Perth in Western Australian, with annual capacities of 2.19 Mt, 3.3 Mt and 1.9 Mt respectively. Wagerup is the lowest cost of the three (being in the industry's lowest-cost quartile) and a 1.5 Mt expansion has been mooted. However environmental clearance was reportedly one sticking point.

After acquiring a 56% interest early in 2001 at a cost of US\$1.49 billion, BHP Billiton has a total 86% stake in the integrated Worsley operation, also south of Perth in Western

Australia. Worsley has a capacity of 3.1 Mt/y and is considered the world's lowest-cost refinery. It underwent expansion from 1.75 Mt to the current 3.1 Mt between 1998 and 2000, and the company sees it reaching 3.5-3.7 Mt/y within the next five or so years. Indeed, BHP Billiton was, early in 2002, examining its bauxite reserve position (441 Mt - equivalent to 40 years at current rates), to see if it could go beyond 3.7 Mt/y.

Via it moving to a 100% interest in Comalco in late 2000, Rio Tinto has a 38.6% stake in a 3.7 Mt/y alumina refinery near Gladstone, Queensland - with Kaiser, Alcan and Pechiney holding the balance. In its own right Rio Tinto has approved the development of a 1.4 Mt/y alumina refinery, also at Gladstone, at a cost of US\$750 million, with first production expected in 2005. Expansions could eventually boost production to 4.2 Mt/y. Rio Tinto mines bauxite at Weipa in Queensland, with annual production in recent years of over 11 Mt.

Alcan mines bauxite at Gove in the Northern Territory, with some of that bauxite refined on site and the balance exported. The Gove alumina refinery has a capacity of 1.8 Mt/y, with a feasibility study looking at a A\$1.2 billion expansion to increase that to 3 Mt/y.

Aluminium smelters in Australia include Bell Bay in Tasmania owned by Comalco/Rio Tinto and having a production capacity of 142,000 t/y; Boyne Island in Gladstone, Queensland, owned 54.2% by Comalco/Rio Tinto and having capacity of 490,000 t - with an expansion being examined; Portland and Port Henry in Victoria which are majority owned by Alcoa of Australia (via AWAC), and have a combined capacity of 530,000 t/y; and Pechiney, Alcan and Hydro Aluminium, which own the 460,000 t/y Tomago smelter where plans are in train to add a further 70,000 t/y of capacity by 2006. Pechiney, the French-based aluminium producer was also reportedly considering building a smelter near Gladstone, though Port Elizabeth in South Africa was considered the front-runner for any development decision.

### Magnesium

Australia's two biggest magnesium projects, Stanwell and SAMAG continued down the path to development through 2001 with a host of other hopefuls trailing in their wake.

Stanwell in particular took a giant step toward first metal when the project's owner Australian Magnesium Corp. (AMC) raised the A\$525 million in equity needed, and late in November it formally committed to the A\$1.3 billion development. The financing was completed at the second attempt after an earlier shot at A\$680 million came up short.

Site works started in February at Stanwell, near Rockhampton in central Queensland, with AMC forecasting first production from the 97,000 t/y rated project by late 2004 - and possibly earlier.

AMC has a ten-year take-or-pay contract with Ford Motor Co. for 45,000 t/y, with the price paid by Ford in the first five years being fixed, while being calculated with reference to the prevailing market price for the second period. According to AMC, the agreement underwrites in excess of A\$2 billion in revenue.

AMC was confident that process risk would be ameliorated by its extensive testwork and the 10+ years it has been associated with government research body, CSIRO, with which it shares ten patents (and patent applications) over the so-called AM process set to produce the magnesium.

Stanwell's big competitor Pima Mining's SAMAG project (in South Australia), also made good progress, with the bankable feasibility study in progress early in 2002. SAMAG, which has exclusive rights to the Dow magnesium process and product technology, was aiming to produce at a rate of 65,000 t/y by mid-2005 at a capital cost of A\$800 million, with expansions anticipated thereafter. The green light was expected in mid-to-late 2002.

Meanwhile, fellow junior, Mt Grace Resources Ltd, saw its Batchelor project in the Northern

Territory granted 'major project facilitation' status, allowing for a streamlined and co-ordinated process for the approval of relevant requirements. Mt Grace was aiming initially to produce 12,500 t of the lightweight metal in a 14 MW furnace at a capital cost of A\$76 million, with plans to expand production to 30,000 t/y in 2004-05, and to 50,000 t/y in 2006-07. A feasibility study was under way early in 2002 with the total resource at Batchelor providing Mt Grace with enough feed to churn out 50,000 t/y of magnesium metal for the next 60 years. Indeed resource size at all the projects was seemingly the least of the respective developers' problems.

Elsewhere, the ambitious plan of Indcor Ltd to produce 90,000 t/y of magnesium in Tasmania utilising Ukrainian technology fell by the wayside, though it was replaced by Rambora Technologies (in terms of targeted production) with its examination of the viability of producing 100,000 t/y at Latrobe (Victoria) from the brown coal fly ash produced in the generation of power.

Finally, a company called Pacific Magnesium was evaluating a process using asbestos tailing dumps as a feedstock.

### Tin

Australia has two dedicated tin mines and a number of others that produce the metal as a by-product. Total output for 2001/02 was forecast at 9,640 t, down on the previous year's 10,016 t.

The vast majority of Australia's tin comes from the Renison Bell underground mine in Tasmania owned by Murchison United - though in April 2002 reports were surfacing that the company was a seller of the operation, with small gold miner Sirocco Resources being the buyer. Production from that mine in calendar 2001 came in at 8,961 t, slightly ahead of 2000's 8,327 t. In response to the record low tin prices experienced during the year, the company implemented a significant restructuring of operations at the mine, moves which it said confirmed its

position as one of the lowest-cost operations in the world. Murchison has also been involved in a jointly-funded exploration initiative with the Tasmanian government to boost the life of the operation. Reserves as of 2001 were put at 2.01 Mt averaging 1.71% Sn for a contained 34,337 t, within a resource of 20.1 Mt averaging 0.65% Sn.

Australia's second dedicated tin project came on line in late June 2001 with the commissioning of the Ardlethan alluvial operation 500 km southwest of Sydney. Ardlethan was an old hard-rock mine that closed in 1986. The new alluvial operation was designed to produce some 800 t of tin in concentrate annually, but in April 2002 its owner, Marlborough Resources, said it was being expanded to "140% of the original design capacity", with construction expected to be completed by mid-year. Marlborough had reportedly hedged well such that early in 2002 it said it believed it was receiving the highest tin price of any producer in the world. It also mentioned that it was on the lookout for other tin opportunities.

Sons of Gwalia produced 1,094 t of tin at its Greenbushes tantalum mine in Western Australia during calendar 2001.

### Diamonds

The diamond sector enjoyed quite a reasonable year in 2001 with Kimberley Diamond Co.'s (KDC) decision to develop its Ellendale project in the Kimberley region of Western Australia being the highlight. General exploration also appeared on the increase.

Production from Rio Tinto's Argyle mine came in at slightly under 2000's 26.48 Mct at 26.1 Mct (from the processing of 14.5 Mt). Though consistent with output in recent years, it was well down on 1997/98's 43 Mct and 1998/99's 36 Mct. As of early 2001, Argyle had reserves of 66.6 Mt averaging 2.85 ct/t and resources of 278 Mt at 2.4 ct/t.

Merlin, Australia's second diamond mine and also owned by Rio Tinto, delivered 70,000 ct in 2001, well down on the previous year's

172,000 ct. Located in the Northern Territory, Merlin endured such a wet 'wet season' that fuel and other supplies were unable to be delivered and production was suspended for a period. The project also suffered processing problems, with first clay and later in the year hard ore resulting in reduced throughput.

Meanwhile, Ellendale is scheduled to begin production around May/June 2002. According to the feasibility study, Stage 1 of the project will mine and process a high-grade surface enrichment zone totalling 950,000 t at 30 ct/100 t with an average diamond value of US\$100.40/ct. Utilising a 750,000 t/y plant means Stage 1 will operate for 15 months. The capital cost was put at A\$9.2 million.

Early in 2002, KDC announced a resource of 33.9 Mt at 7.7 ct/t for the Ellendale 4 and 9 lamproite pipes and this will form the basis for Stage 2 of the project. KDC is to spend up to A\$5 million in the current year to determine the optimum treatment throughput rate for the longer-term Stage 2 mining operation, with a feasibility study on the project to be completed by November.

In terms of exploration, one of the higher-profile junior companies to emerge on the scene was Elkedra Diamonds. The company reportedly had a good technical team and held extensive tenements in the under-explored (and isolated) southeast part of the North Australian Craton - the Altjarrowarra region. Also said to be active in that area was the big three comprising De Beers, BHP Billiton and Rio Tinto.

Outside the Northern Territory there was some work being carried out in South Australia (both onshore and offshore - the latter referring to Tawana Resources' Flinders Island efforts) - but the vast bulk of spending continued to be in northern Australia in both Western Australia and the Northern Territory.

Companies active included Striker Resources, Ellendale Resources, Adamus, Thundelarra, Caldera, Diamond Rose and Astro Mining amongst others.

### Platinum

Australia's fledgling platinum industry continued making headway towards developing the first PGM mine on the continent during 2001/02.

The Panton project north of Halls Creek in northern WA is the most advanced project with a bankable feasibility study due to be completed by September 2002.

Panton's PGM resource was 64 Mt averaging 1.7 g/t for a contained 3.42 Moz PGM plus gold, within which there was a higher grade resource of 10.4 Mt at 5.8 g/t PGM+Au.

While finalisation of the project size is yet to be confirmed, owner Platinum Australia is looking at a 0.8-1 Mt/y operation producing a high-grade concentrate(s) containing 100-130,000 oz PGM+Au, 1,000-1,500 t of nickel, 500-800 t of copper and 50-100 t of cobalt. Mine life is put at +10 years and capital costs at A\$80-100 million.

With some 90-95% of the resource to be mined underground, consideration is being given to installing a conveyor up one of the declines and direct to the plant. Uphole stoping is the mining method envisaged.

Platinum Australia is backed by South African PGM major Lonmin plc, which has invested A\$12 million in the Australian junior - via 23 million shares at A\$0.52/share - and the right at completion of bankable feasibility to a further 66 million shares at A\$0.60/share. Such a move would see Lonmin holding 55% of Platinum Australia.

At the Munni Munni intrusion in Western Australia's Pilbara, Helix Resources and (the ubiquitous) Lonmin were spending significant sums on a large drilling programme designed to increase the attractiveness of developing a mine.

A resource of 9.2 Mt averaging 2.9 g/t PGM and gold was the mainstay of the project, and diamond drilling was expected to add to the inventory in the short term. However, the

partners believed exploration could potentially add higher-grade mineralisation, with first assays from the drilling of new targets being expected during May/June 2002. Lonmin, which took equity in Helix, was earning a 50% stake in the project for solely funding the new exploration and preparing a full feasibility study - and in the process spending a minimum of A\$8 million.

Elsewhere, a number of junior explorers referred to the search for PGM at various times through the year.

Tanami Gold was one of the more respected juniors in this crop, with interest being shown in its Harts Range tenements in the Northern Territory and in particular the Kongo prospect where early stage work returned anomalous results.

Also Placer Dome Inc. was to test an interpreted 90 km-long, layered intrusive complex southeast of Kalgoorlie with anomalous surface assays in a joint venture with local junior Western Areas.

### Uranium

Australia has two dedicated uranium operations - Ranger and Beverley - with a third (previously) flagged to come on line late in 2002. Ironically, the single biggest producer is the Olympic Dam copper mine with output in 2001 of 4,380 t of uranium as a by-product (see also copper section).

The Ranger mine 250 km east of Darwin in the Northern Territory produced 4,203 t of uranium, slightly short of the previous year's 4,437t. Ranger had a reserve (as at December 31, 2001) of 21.9 Mt averaging 0.25% U<sub>3</sub>O<sub>8</sub> for a contained 54,241 t.

Heathgate Resources' Beverley project in South Australia came on line during the year - and suffered its share of controversy - while Southern Cross Resources' Honeymoon project was to proceed late in 2002. Both projects feature in-situ leaching, and both have forecast production capacity of around 1,000 t/y.



### **Tantalum**

Tantalum production in Australia is dominated by Sons of Gwalia Ltd, with its two mines at Greenbushes and Wogina - both in Western Australia. Sons of Gwalia says its two mines account for around 75% of the world reserve base and 30% of global production. During 2000 it announced it was expanding capacity at the two mines such that combined production capacity would rise to 2.3 Mlb/y during 2002. At the Greenbushes operation an underground mine below the mainstay Cornwall pit was being developed and additional processing infrastructure installed, as was the case at Wogina. Sales for the first half of 2001/02 came in at 816,699 lbs and were forecast to increase in the second half of the financial year. Sons of Gwalia also commented that it intended to establish a substantial end-of-year inventory to ensure availability of

supply so as to offset industry concerns. Sales for fiscal 2001 totalled 1.6 Mlb.

Arriving on the tantalum production scene during 2001 was Haddington Resources whose Bald Hill project south of Kalgoorlie produced 51,000 lb from July 1 to December 31, 2001. Nameplate capacity of the operation is 145,000 lb/y, and early in 2002 it was reported as having a seven-and-a-half year mine life. Haddington had considered bringing on a second operation in WA at Cattlin Creek but decided to concentrate on exploration around Bald Hill as well as its other properties throughout the state.

Other hopefuls included Australasian Gold Mines - which had a small production unit at Dalgaranga - the unlisted Galaxy Resources, New Holland Mining, Alkane (with its mooted Dubbo zirconia project), and Lynas Corporation, which was looking to develop a rare earths project near Laverton in WA.