

AUSTRALIA

*By Mick Quinn
Louthean Media*

In gross terms, the Australian mineral resources sector recorded A\$53.5 billion worth of production in 2000/01, while exports totalled just over A\$56 billion. Of this export total, metals and other minerals made up A\$30.5 billion, and energy minerals the balance. On all counts the numbers were significantly ahead of the previous year's efforts, and further increases, though comparably more modest, were forecast by ABARE in the year ahead.

New capital expenditure in 2000/01 came in at A\$5.5 billion and exploration expenditure totalled A\$1.75 billion, comprising A\$1.07 billion in petroleum and A\$680 million in metallic and other minerals.

Australian resource companies had a number of issues to deal with through 2000 including

the low Australian dollar exchange rate and higher energy prices. The Australian dollar dipped below US50¢ at one stage, which, all things being equal, should have provided many miners with boom times. Unfortunately many had earlier hedged at US60¢ to the Australian dollar or more, the prevailing 'wisdom' in the 90s being that the Australian dollar was undervalued and would appreciate. By mid-2001 the Australian dollar was still trading at around US50¢, meaning many local miners were continuing to miss out on the (full) benefits of the low dollar. The average for 2000/01 was US54¢.

The year was also marked by consolidation, with companies like diversified miner North Ltd and diamond miner Ashton Mining being taken over (in both cases by Rio Tinto), and a number of coal producers willingly exiting the



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Australian scene. The biggest single corporate move of the year was of course the BHP-Billiton merger.

In terms of the market, the ASX's All Resources Index ended the year just under 18% higher, with the best gains being made by juniors.

Iron

Iron ore production in 2000/01 totalled 172.7 Mt (159.7 Mt) worth A\$4.96 billion (A\$3.8 billion). ABARE forecasts for the year ahead totalled 175.7 Mt and A\$5.366 billion respectively.

The big change in the Australian iron ore industry in 2000 was the Rio Tinto takeover of major Robe River joint venture partner North Ltd.

Rio Tinto outbid Anglo American for North, and apart from infuriating the Japanese partners in the Robe River joint venture, the takeover delivered the global giant control of the prized West Angeles deposit. The Marra Mamba-style West Angeles ore is expected to receive a relatively high average price given the high proportion (+40%) of lump ore. The 440 Mt deposit is around 100 km east of Paraburdoo and is being developed at a cost of around A\$880 million. All going to plan, it should be producing by 2002, initially at around 4-5 Mt/y before rising to a maximum 20 Mt/y depending on demand. However there were issues between new partner Rio Tinto and the Japanese parties in the Robe River joint venture, including Rio Tinto's plans to scrap construction of a rail line to Cape Lambert for shipping. Rio Tinto wants to build a spur to its existing line, which though saving a reported A\$220 million incurred the ire of the Japanese partners who apparently had concerns with regards the project's independence. In the end Rio Tinto's view held sway though once West Angeles reaches annual output of 15 Mt, the issue may be re-addressed.


BHP also has its own marra mamba-style deposit at the 200 Mt Mining Area C – located about 50 km northeast of West Angelas – and its development will be carried out with joint venture partner POSCO. Production will begin at 5-10 Mt/y at a cost of up to A\$300 million, but there are reports that should that be pushed out to 15 Mt/y capacity, the cost will rise to A\$500 million.

The development of Area C and West Angelas comes as the haematite ores such as the premium quality Brockman and Mount Newman deposits are depleted. The Marra Mamba ores do not have the superior chemical and physical properties or the very high iron content of the haematite ores – but there are large identified reserves and they are expected to be attractive to blast furnaces over the medium term because of the lower prices.

Additional production may come from Hamersley's Nammuldi and Iscor/Hancock Prospecting's Hope Downs projects.

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Highlands Farm, Greys Road, Henley-on-Thames, Oxon. RG9 4PR, UK
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EXPLORATION CONSULTANTS, AUSTRALIA PTY. LTD.
Level 1, 610 Murray Street, West Perth, Western Australia, 6005
+61 (0)8 9322 4333, Fax: +61 (0)8 9322 7254, email: office.oz@ecqc.com

EXPLORATION CONSULTANTS LTD. INC.
9801 Westheimer, Suite 1060, Houston, Texas 77042, USA
Tel: +1 713 784 5800, Fax: +1 713 974 3687, email: office.usa@ecqc.com

Website at www.ecqc.com



Apparently all Nammuldi requires is market interest, while the 402 Mt Hope One deposit – the main deposit of the Hope Downs project – is under feasibility. Hope Downs, which has been known about for many years, got a new lease of life after Rio Tinto's takeout of North created unease with Japanese buyers vis-à-vis supply concentration. Previous blueprints have envisaged a 25 Mt/y operation, and while sharing either BHP or Hamersley's infrastructure has been anticipated in the past – and indeed proved a stumbling block to development – the current Hope Downs study is investigating the viability of building dedicated rail and port infrastructure. The study is due for completion early next year (2002).

In the meantime the big two, Hamersley Iron (Rio Tinto) and BHP, each enjoyed good production years. Each has around 65-70 Mt/y capacity out of their respective ports, with Hamersley shipping a record 67.1 Mt in calendar 2000, while BHP reported 33.5 Mt for the six months ending December 2000. BHP has been reported as saying it was possible that it could be producing in excess of 80-85 Mt/y by 2006/07. Hamersley is generally recognised as the better of the two in terms of production costs. However, BHP has been working to close the gap between the two in terms of costs, and there were reports early in 2001 that they had been reduced by around 15% over the past 18 months or so.

Another Australian producer is Portman Mining which has a rapidly depleting operation off Western Australia's northern coastline at Cockatoo Island and an emerging centre about 400 km east of Perth at Koolyanobbing. Early in 2001, annual production there was around 3.5 Mt but expansions were in train with the company reported to believe it could reach 8 Mt/y capacity by 2004/05. Koolyanobbing ore is shipped from the southern port of Esperance. The company was also considering extending the life of the Cockatoo operation by mining

the 5 Mt of high quality (68% iron) found to 15 m below the current water mark.

Elsewhere, Ivanhoe Mines of Canada produced 2.19 Mt of iron ore pellets and 19,400 t of iron ore concentrate at its Savage River mine and Port Latta pellet plant in Tasmania. The company plans to increase pellet output by one-third to 2.79 Mt annually plus 190,000 t of concentrate and chips.

With regards iron ore miners who are involved in downstream processing, commissioning of BHP's HBI plant started late in 1998 with the first briquette produced in February 1999. However, during commissioning a number of difficulties were experienced, both of a process and a mechanical nature. In terms of process, reduction of the iron ore saw the production of 'sticky' metallised fines, which then resulted in transfer problems. In addition the reduction process didn't reduce to the required specifications, and when higher temperatures were employed, the 'stickiness' was exacerbated.

All of which saw production interruptions, and critically during the commissioning process, a lack of steady-state operation.

With regards mechanical issues, the major problem involved ball valves in the reactor and briquetting buildings that had to deal with high temperatures and gas and solids flow.

In South Australia, the South Australian Steel and Energy (SASE) project produced its first pig iron from a demonstration plant late in the year. SASE was formed by Aulron Energy (formerly Meekatharra Minerals) and the Ministry for Mines and Energy of South Australia back in 1995. It is currently owned by Aulron (90%) and Ausmelt Ltd and PT Krakatau Steel with 5% each. The plan is to produce high quality pig iron at low cost (less than US\$80/t fob) by exploiting the iron ore and coal resources within South Australia, with commercial production slated for 2003.

Finally, there were reports that Rio Tinto plans to spend around A\$300 million building an 800,000 t/y Hismelt facility in Western Australia.

Magnesium

The contenders for an Australian magnesium industry continued to line up in 2000 and 2001. At the forefront were two companies, Australian Magnesium Corp. (AMC) and Pima Mining, with Mount Grace Resources owning another with a reasonably well advanced project.

AMC is aiming for production of 90,000 t/y at its Stanwell project (near Rockhampton in Queensland), and by mid-2001 a A\$932 million underwritten debt package for the project had been finalised. The company was proceeding with plans to raise a further A\$680 million via equity. The total direct and indirect capital cost of the project was estimated to be A\$1.3 billion, with the balance raised to go to project contingencies and reserves.

Construction work was set to start in October 2001, with first production likely by 2004.

AMC is basing its future on two years of operating experience – at its industrial-scale demonstration plant – utilising the proprietary Australian Magnesium (AM) process developed by AMC in collaboration with Australian Government research group, the CSIRO. Some A\$200 million were spent on research and the demonstration plant, with over 200 t of magnesium metal produced.

AMC is in a 10-year supply agreement with the Ford Motor Co. whereby 45,000 t/y will be supplied to the car manufacturer once Stanwell is in full production. That was expected to be mid-2004.

Meantime, the profile of Pima's SAMAG project was somewhat smaller at 65,000 t/y. A bankable feasibility study was due to be completed in the second half of 2001, and as with Stanwell, first production was being

mooted as possible by 2004. SAMAG is to utilise the Dow magnesium production technology that delivers magnesium production from magnesium chloride brine. (Pima was also to buy the fluid-bed driers that Dow used at its Freeport magnesium plant.) All metal was to be bought by ThyssenKrupp Metallurgie GmbH (TKMet) under a long-term sales agreement. In 2000, the cost of the originally mooted 52,500 t/y magnesium smelter was put at around A\$639 million, though the company commented in mid-2001 that "latest cost estimates indicate significant capital cost reductions are likely to be achieved". A full bankable feasibility was due for completion during the second half of calendar 2001.

Elsewhere Mount Grace Resources was looking to completion of stage one of its bankable feasibility study by the end of 2001. Like the above two, it had also entered into an agreement with an end user/trader, in this case Frank & Schulte. The German company was to purchase a minimum of 10,000 t/y of magnesium metal. Mount Grace Resources was looking at using a thermal magnesium process at Batchelor (in the Northern Territory), which according to some, will see the unit cost for a Batchelor plant being some one third of plants such as AMC's and Pima's. In terms of size, a 50,000 t/y profile has previously been mooted.

Other potential magnesium producers included Golden Triangle Resources (to be renamed Pacific Magnesium Corp.), Indcor (former Crest Resources) and new company WestMag.

Platinum Group Metals (PGM)

Despite a dearth of producing/dedicated PGM mines in Australia - there were none - the strength in PGM prices meant it wasn't surprising that a (burgeoning) number of companies developed exploration interests towards these rare metals.

Two companies rose to prominence over the year, Platinum Australia (PLA) and Helix

Resources. The latter's interest represented a full cycle so to speak, having originally listed on the ASX in the 1980s on the back of some platinum prospects including Syerston in NSW – which in more recent times has been part of Black Range's nickel laterite project. In the interim, Helix was at the forefront of the somewhat fizzled Gawler Craton gold play of the mid 1990s.

Helix's hope is the Munni Munni project south of Karratha in Western Australia. Munni Munni contains at least 1.3 Moz of PGMs at combined grades of between 2.7-3 g/t (as well as 43,000 t of copper and 23,000 t of nickel). A scoping study showed there was potential to generate reserves for 10 years or more based on a mining rate of around 1.5 Mt/y. The project was in the feasibility study stage in mid-2001, with Lonmin having the right to earn a 50% interest in the project by providing A\$8 million for the first 15 months to cover a full feasibility study. Lonmin also took an equity stake in Helix.

The South African PGM producer also showed an interest in PLA's Panton Sill project in Western Australia's far north by investing A\$12 million into PLA with an entitlement to invest a further A\$40 million and to take its stake in the junior to 55%. After listing in late 2000, PLA had increased the Panton Sill resource some six-fold by mid-2001 to 2.2 Moz of platinum-palladium and gold. The possible production template sees a combination of open-pit and underground mining delivering a concentrate for further processing in an offshore refinery. Lonmin's metallurgical experience with the UG2 chromitite reef was expected to be of particular benefit for the Panton project given its chromitite component. As with Munni Munni, Panton Sill was at the feasibility stage in mid-2001, with a bankable study forecast to be completed by March 2002.

Following in the wake of these two was a host of juniors (and some majors), with PGM grass-roots exploration plays under way throughout Australia in 2001.

Tantalum

With burgeoning demand and its subsequent strong price performance, tantalum became a popular commodity for companies in Australia during 2000 and into 2001.

Sons of Gwalia, which in the 1980s and 1990s had developed into one of Australia's bigger gold miners - and definitely one of the major hedgers - saw its share price head strongly north on the basis that it was the world's biggest producer of Ta₂O₅.

Sons of Gwalia's two tantalum operations are Wodgina in Western Australia's Pilbara and Greenbushes in the southwest of the state. Wodgina produced 569,000 lb in 2000, though capacity is being doubled to around 1 Mlb/y by the first quarter of 2002. The operation has reserves of 65 Mt grading 371 g/t Ta.

At Greenbushes, 737,515 lb were produced, with that operation having reserves of 91 Mt grading 226g/t Ta. As with Wodgina, Sons of Gwalia was planning a major expansion of the operation. All told the miner will spend around A\$100 million to increase total output from the two operations to 2.3 Mlb/y by 2003.

And the company showed it was keen to keep its foot on the sector in general in Australia with its agreement with junior Haddington International Resources.

Haddington, which listed on the ASX early in 2001, picked up the Bald Hill and Cattlin Creek tantalite projects from Sons of Gwalia - as well as other tantalum prospects - and will operate the two under a licence agreement with the major producer. Bald Hill is to be the first mine, with annual output of 145,000 lb expected to commence in the second half of 2001. Early in 2001, Bald Hill contained 920,000 t grading 470 ppm Ta₂O₅. Production for Cattlin Creek is set down for 2002.

Another junior emerging on the scene was Australasian Gold Mines, which looked to have a brighter future than during the late

1990s when it ran into difficulties (including the declining gold price) developing a gold mine near Norseman in Western Australia. In concert with North American electronics giant Kemet, Australasian launched the 50:50 owned Tantalum Australia, a subsidiary which was charged with the task of developing (in the first instance) the Dalgaranga project in Western Australia's north. Dalgaranga was forecast to produce around 80,000 lbs by year end, and ultimately up to 250,000-300,000 lb/y. Add in the Walwa project in Victoria, and Tantalum Australia's aim was to be a 500,000 lb/y producer within the next few years.

Others that signalled their interest in tantalum during 2000 were Glengarry Resources, Julia Mines, Alkane Exploration, Anaconda and Kanowna Lights.

Tin

The major tin operation is Australia is Murchison United's Renison mine in Tasmania. Production at this underground operation totalled 8,327 t of tin following the processing of 701,000 t grading 1.67% Sn. These numbers were all down on the previous years.

During the year Murchison announced a significant exploration initiative (in association with the Tasmanian State Government), and a study into retreatment of the 19 Mt of tailings grading 0.4% Sn. However early in 2001, it also announced that following the sustained period of historically low tin prices, retrenchments would be made as efficiencies were sought in mining and milling.

Meantime on the mainland (in NSW), Marlborough Resources brought on stream its Ardlethan tin project. Ardlethan will produce a tin in concentrate to be exported to Malaysia. Initially a rate of 600 t/y was being targeted, though by early 2002 the aim was to get to 1,200 t/y. Altogether around 7,000 t was being targeted.

Uranium

Australia's biggest uranium producer is WMC via its Olympic Dam project in South Australia. Primarily focused on copper, Olympic Dam is nonetheless an impressive uranium producer with output in calendar 2000 of 4,540 t of U_3O_8 .

Just behind is a dedicated uranium mine in Energy Resources of Australia's Ranger operation 230 km east of Darwin in the Northern Territory. That operation produced 4,437 t of U_3O_8 in calendar 2000. However, opposition from green/environmental NGOs to Ranger and the company's nearby Jabiluka development continued during the year, and early in 2001 ERA said Jabiluka was "on a stand-by, environmental and planning phase while stakeholder discussions occur regarding the delivery of better commercial, social and environmental outcomes for the region".

A somewhat more modest arrival on the Australian scene in 2001 was the Beverley *in situ* uranium leaching operation in South Australia's north. The A\$30 million development was set to produce around 1,000 t/y.

Bauxite – Alumina – Aluminium

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. However, they are currently uneconomic. In total, Australia has five bauxite mines, six alumina refineries, six primary aluminium smelters, twelve extrusion mills and four rolled product mills.

In fiscal 2001, Australia produced 1.78 Mt (1.74 Mt) of aluminium metal, 16.02 Mt (15.037 Mt) of alumina and 53.8 Mt (51 Mt) of bauxite. In terms of export value, Australia's alumina returned receipts of A\$4.367 billion

(A\$3.471 billion) and aluminium A\$4.042 billion (A\$3.302 billion).

Slight increases in alumina and aluminium production were forecast for the current year (while bauxite output would drop slightly), with ABARE forecasting some 1.81 Mt of aluminium and 17.6 Mt of alumina annually by 2005/06.

In terms of company and project news, CSR sold out its 30% interest in the Gove operation where Alcan was the majority owner and operator. Billiton – now BHP Billiton – expressed interest in the stake but Alcan pre-empted the offer and paid US\$393 million. The Gove bauxite-alumina project is located on the Gove Peninsula - the northern tip of the Northern Territory – and comprises a mine and alumina refinery. The refinery has a rated capacity of 1.8 Mt/y (and was being expanded to 2 Mt/y), while a further 2 Mt/y of bauxite is exported.

Billiton did, however, have more luck in the Darling Ranges in Western Australia, where it acquired the 56% stake in the Worsley alumina refinery that Alcoa was forced to divest following its acquisition of Reynolds Metal Co. Billiton paid US\$1.49 billion for the stake, which added to the interest it already held, gave it 86% of one of the largest (and lowest cost) refineries in the world.

Worsley's capacity was recently increased to 3.1 Mt/y, with the expansion incorporating a 50 km conveyor belt between the mine and refinery delivering bauxite to the plant at a cost of A\$4/t - on top of the A\$3.50-4/t mining costs. Current mine reserves at the operation are 14 years at current rates of 11-12 Mt/y. And as part of the Worsley acquisition, Alcoa sold some of its nearby bauxite properties (containing around 13 Mt of bauxite), while there was a further 85 Mt identified to the north of the Worsley lease.

The nearby Pinjarra and Kwinana operations owned by Alcoa are also expected to post expansions totalling around 250,000 t/y, with

the increases based on a new modification to the refining process. Meantime Wagerup output will also be boosted, with 1.1 Mt of capacity being added before 2005/06.

The Darling Ranges are a world centre for the industry, with Worsley and the three Alcoa/WMC refineries of Wagerup, Pinjarra and Kwinana having rated capacity in excess of 10.5 Mt, equivalent to 25% of the world's output.

Elsewhere, Rio Tinto chose Gladstone in central Queensland - as opposed to Sarawak in Malaysia - as the site for a 1.4 Mt alumina refinery. A final feasibility study is in progress. Rio Tinto already holds a 30% interest in Australia's biggest alumina refinery, the 3.6 Mt Gladstone refinery.

Confirming Gladstone's status as another major region for alumina/aluminium production, Aldoga was proposing to build an aluminium smelter with an annual production capacity of 450,000 t. No firm dates were available early in 2001.

In the shorter term, increases in aluminium production of around 30,000 t are expected as idled capacity is brought (back) on stream at Alcoa's Point Henry and Portland smelters in Victoria. The new owner of the Kurri Kurri smelter (VAW) was also reportedly evaluating an expansion from 150,000 t/y to 250,000 t/y.

Coal

As in recent years, 2000/01 was a time of change in the Australian coal industry. Production totalled around 249 Mt (237 Mt), of which 189 Mt (176 Mt) was exported for receipts of A\$10.62 billion (A\$8.3 billion). Metallurgical coal exported was worth A\$6.5 billion and thermal the balance. Both volumes and values were expected to increase in the year ahead.

However, the headline numbers weren't the real news. What was were the ownership changes, the rationalisation and the

increased prices producers gained from the market for future production.

Exiting the scene was Royal Dutch/Shell Group, Exxon Mobil, and BP Amoco's ARCO, all of whom entered the market during 1970s when oil prices had soared. Taking their place were more traditional fare, hard-rock miners like Anglo American, BHP Billiton, Rio Tinto and MIM.

Anglo American, through subsidiary, Anglo Coal, was the emerging coal power, paying A\$1.6 billion for Shell's mines in Queensland and NSW.

Rio Tinto's majority-owned Coal & Allied took the US company Peabody's assets, making Rio Tinto the number one player in the Hunter Valley, and indeed, the number one Australian producer with some 55 Mt under its control.

BHP, the world's biggest exporter of coking coal didn't stand still either, with it and Mitsubishi jointly taking-over QCT. By March 2001 the relationship between BHP and Mitsubishi was such that a A\$1 billion deal was announced whereby BHP transferred interests it had in the Bowen Basin into a 50:50 joint venture. The strategic alliance was to oversee the creation of a 13.5 Mt/y super pit at the Blackwater/South Blackwater operations. BHP has five Bowen Basin mines. However, the deal didn't cover BHP interests outside the Basin, namely the Riverside and South Walker Creek mines, nor the Illawarra mines in New South Wales.

BHP's position as a global coal power was further enhanced in May 2001 with its merger with Billiton. London-domiciled Billiton was the largest exporter of thermal coal, and in May it received the go-ahead to proceed with its Mount Arthur North open-pit coal mine in the Hunter Valley.

Further action at the top end of the coal scene saw talk of Swiss commodities group Glencore listing some of its coal assets to

raise capital. Glencore has varying interests in nine projects in New South Wales and 50% of the Cook and 33.34% of the Togara North mines in Queensland.

New South Wales

The NSW coal industry comprises the Hunter, Newcastle, Southern, Western, Gunnedah Coalfields and the Gloucester and Oaklands Basins.

In 1999/2000 133 Mt of raw coal was produced, up from the 131.4 Mt of the previous year. Open-pit output totalled 80.1 Mt and underground the balance, while in terms of saleable product, 105 Mt was produced with around 60% of that coming from open-pit mines. Of the saleable product, 72.3 Mt was exported (worth A\$3.1 billion), made up of 23 Mt metallurgical and 49 Mt steaming.

Some 9,500 people are employed by the NSW coal industry, with productivity per saleable tonne equal to 10,580 t. Productivity has increased by 134% over the past 10 years, with the most significant improvements being made in the last three.

Recoverable coal reserves in NSW exceed 10 Bt and are contained within 57 operating mines and colliery holdings and 30 major potential developments.

A 1999 report predicted that 8-13 mines will close in the Hunter and Newcastle coalfields over the next decade due to depletion, and that by 2007/08 around 50% of production will be from new mines and extensions - a significant proportion of which will come from open-pit mines in the Upper Hunter region (Musswellbrook).

Domestic demand for thermal coal by power stations in the Hunter, Newcastle and Western Coalfields has been increasing in recent years, exceeding 25 Mt in 2000. Some 88% of NSW's electricity comes from local coal-fired power stations. (Several coal mining and petroleum companies are

currently studying coal seam methane resources and extractive technologies for the future recovery and utilisation of methane for power generation and gas reticulation.)

Rio Tinto, through its 71% owned Coal & Allied, is the main player in the Hunter Valley of NSW. It acquired Lemington, previously owned by Exxon, and the Warkworth, Ravensworth, Narama and Bengalla operations formerly held by Peabody. In total, its NSW operations produce around 33 Mt/y, of which around 7 Mt is domestically sold and the balance exported.

BHP's Illawarra mines produce around 3.5 Mt/y of coking coal for the Port Kembla steelworks, with a further 4 Mt/y exported.

Queensland

Saleable coal production from all mines in Queensland for 1999/2000 was a record 124.3 Mt. Of that 104.8 Mt was exported. Raw production rose from 143.9 Mt in the previous year to 155.72 Mt, with open-pit output rising from 116.1 Mt to 117.54 Mt and underground from 27.69 Mt to 38.18 Mt.

The Queensland coal industry employs around 8,000 people, with productivity at 14,483 t/y, up 11.6% on the previous year's 12,982 t/y.

In corporate moves during the year, Shell Coal's exit saw its interests in Moranbah North (88%), German Creek (46.75%), German East Creek (59.47%) and Callide-Boundary Hill (66.7%) sold to Anglo Coal, a subsidiary of Anglo American. Included in the sale were undeveloped coking coal deposits at Grosvenor (around the Moranbah township), and thermal coals at Theodore and Taroom.

Shell also sold its Acland deposits in the Moreton Basin to New Hope Corp. Ltd. New Acland will be an open-pit development and was scheduled to come into production in early 2002, subject to marketing agreements. There were also plans to expand production

at the New Oakleigh mine from 250,000 t/y to about 1 Mt/y.

Mineral sands producer Ticor announced its intention to sell its 26.06% holding in the German Creek operation, with Anglo Coal subsequently paying A\$81 million to complete the purchase. (Anglo Coal and Marubeni jointly acquired Ticor's 31.14% interest in the German Creek East joint venture.)

Elsewhere, Sumitomo sold its North Goonyella mine to RAG International and Thiess, and Santos sold its 35.8% stake in QCT Resources, with BHP and Mitsubishi Development subsequently making a joint takeover for all QCT shares. QCT owned South Blackwater Coal Ltd, operator of the South Blackwater mine and holder of a 32.37% stake in Central Queensland Coal Association.

Peabody spent a short time holding a 55% interest in the Moura mine, purchasing it in August 1999 and selling it some 12 months later as part of its overall exit from the Australian coal industry. (Peabody's interests also took in the Bengalla, Warkworth, Ravensworth and Narama mines in NSW, and these plus Moura were sold to the Rio Tinto controlled Coal & Allied.)

Also in 2000, Wesfarmers Coal purchased ARCO's 87% interest in the Curragh mine.

In terms of operational action, the Foxleigh joint venture commenced operations at a new open-pit in the Bowen Basin near German Creek in December 1999. The partners comprise a mix of Brisbane-based professionals under the CAML Resources banner (60%), Itochu (20%), a subsidiary of Aboriginal and Torres Strait Islander Commercial Development Corp. (16.4%), and others (3%). Mining is by contractor, with the coal washed at the German Creek plant. By July, production had reached 1 Mt with the partners aiming to produce 2 Mt/y.

The Coppabella mine between Nebo and Moranbah completed its first year of production, yielding 3.3 Mt, some three-times that scheduled at feasibility. The major owners of Coppabella are Macarthur Coal (35%) and AMCI (35%), with the former moving towards a public listing (and A\$39 million raising) in mid-2001 based on both Coppabella and the Moorvale project.

Elsewhere, QCT (BHP and Mitsubishi) purchased and recommissioned the Gordonstone mine - renamed Kestrel. In its first full year, 3.79 Mt were mined producing 2.98 Mt of product. Exploration was also undertaken and 120 Mt of additional reserves of coking and thermal coal were identified.

In mid-2001 Rio Tinto gave the green light for the development of the Hail Creek project, recognised as one of the world's largest coking coal deposits with resources estimated at 1.2 billion tonnes. The A\$425 million open-pit development will produce 5.5 Mt/y. Rio Tinto owns the Blair Athol, Meandu and Kestrel operations, to which Moura was added on Peabody's exit. Rio Tinto's Queensland production totals 24 Mt/y, of which 19 Mt is exported.

Anglo Coal's longwall underground operation at Moranbah North completed its first full year of production yielding 3.44 Mt of prime coking coal. Moranbah North cost A\$500 million to develop.

MIM's Newlands southern underground mine converted to longwall production in 1999 and became Australia's leading producing underground mine with 5.6 Mt of raw coal mined in that year, followed by 6.85 Mt in 2000. Feasibility studies were under way at Newlands on the Suttor Creek deposit as was an assessment of the potential of the Northern underground.

MIM's 75% held Oaky Creek on the other hand had a mixed year, with the longwall being buried. However, once it was recovered it set an Australian monthly record in April

2000 with over 770,000 t of ROM coal produced. In total, the Oaky Creek operations (both open pit and underground) produced 7.39 Mt for calendar 2000.

At the Togara North project, the joint venture partners including Glencore (33.3%) and Mitsui (33.3%) were working towards development of an underground mine initially producing 3 M t/y and ultimately 6 Mt/y. A small 1 Mt/y open-pit was anticipated in the interim.

Diamonds

Another sector of the Australian mining industry to experience significant change in 2000 was the diamond sector.

In particular Rio Tinto's takeover of Ashton Mining (under the nose of the also-interested De Beers), changed the ownership structure of the world's biggest diamond project, the Argyle diamond mine. Rio Tinto said it made the move to secure the marketing arrangements put in place in Antwerp by Argyle in the late 1990s. Located in the far north of Western Australia, Argyle is owned 95% by Rio Tinto, with the balance held by the Western Australian Diamond Trust. However by mid-2001 Rio Tinto was looking to acquire the outstanding 5% stake.

Argyle produced 26.475 Mct in 2000, slightly down on 1999's 29.699 Mct. In recent years the possibility that Argyle could cease production around mid-decade has been canvassed, but exploration through 2000 has indicated there is likely to be plenty of life in the big mine yet. Early in 2001 Rio Tinto reported that resource modelling indicated over 100 Mct of underground resource in two feeder pipes beneath the open-pit deposit.

Meanwhile, production from Merlin - also owned by Ashton prior to the Rio Tinto takeover - yielded 172,000 ct. Production included a 42 ct diamond, the second biggest ever found in Australia. Conjecture was that Rio Tinto would offload this relatively small operation, but newspaper reports in mid-2001

suggested this would not necessarily be the case. Exploration was ongoing, with diamonds also recovered from the Batten Trough drainages near Merlin.

Outside the Rio Tinto sphere, Kimberley Diamond's long running dispute with the Argyle partners over the Ellendale prospect ended in a win for the junior. Kimberley Diamond was to pay A\$23.5 million for the ground, and plans to develop a project by late 2001 at a cost of around A\$9 million. It will involve a 750,000 t/y capacity plant processing a 950,000 ct resource sourced from the secondary enriched diamondiferous layer of two pipes. A study concluded that this would generate more than A\$56 million in revenue, yielding A\$23 million in net cash flow. The project did not include exploitation of the 57 Mt primary resource grading 7 ct/100 t previously calculated. That and other targets in the region were being worked on.

Elsewhere in the region Striker Resources continued its evaluation of its prospects, and early in 2001 was planning bulk sampling drilling and other evaluation of the diamond-bearing pipes it's identified over some years.

Others active in the region included Conquest Mining, Ellendale Resources, Astro Mining, Diamond Rose and Thundelarra Exploration. Thundelarra was one of a number of companies that reached agreement with BHP concerning the use of BHP's Falcon airborne gravity survey technology.

Meanwhile, on the east coast, Rimfire continued seeking a source for the Bingarra diamonds in NSW, and 2001 listed Tawana Resources was exploring Flinders Island off the South Australian coast. Late in the year another company working in South Australia, Alcaston, reported that it was to commence work at its Hiles Lagoon project in the Central Flinders Rangers, north of Adelaide.

Gold

Gold production in Australia continued to be steady in 2000/01 at 299 t. The biggest single

gold project on the Australian continent is Normandy Mining and Homestake's Kalgoorlie operations, taking in the Superpit and the depleting Mount Charlotte underground mine. The combined operation produced 715,164 oz in calendar 2000, with cash costs coming in at an average A\$324/oz. This was well above the previous year's 592,861 oz, and represented record output. Site initiatives during the year included the changeover to owner-mining - and a record average of 243,000 t/d for the September quarter - the commissioning of an upgraded flotation circuit, and major plant maintenance including relines and bearing replacements late in the year. Mount Charlotte is expected to cease production late in 2001.

Other major producers included Granny Smith, Jundee, Plutonic and St Ives in Western Australia, and Cadia Hill in New South Wales, the Tanami operation in the Northern Territory, and the Mount Leyshon and Pajingo mines in Queensland.

Granny Smith produced 412,000 oz at A\$325/oz, well down on the previous year's 523,000 oz, and a factor of the lower grades, cut-backs in the Sunrise pit, and the failure of a mill trommel in the December quarter. With regards improvements, joint-venture partners Placer Dome and Delta looked at plant availability and truck productivity, and were planning on introducing gas-fired power generation. Despite the recent production decline, the large Wallaby deposit found in 1998 has 2 Moz of reserves and 5 Moz resource to (only) 400 m depth (and remains open), and it should underpin Granny Smith production for many years to come. First production from Wallaby was due early in 2002.

At Normandy's Jundee in the Yandal Belt, 359,186 oz were produced at a cash cost of A\$288/oz, slightly down on 1999's 385,088 oz. However 97,280 oz were produced in the March quarter of 2001.

Homestake's Plutonic recorded an improved year for its owner - production rising 17,000 oz to 253,623 oz at cash costs of US\$196/oz. - while output from WMC's St Ives project near Kambalda remained steady. Early in 2001 WMC confirmed its gold business remained on offer, with all the usual suspects believed interested.

In the Northern Territory, Normandy NFM's Tanami operation produced 382,810 oz at cash costs of A\$297/oz. A A\$5.3 million plant upgrade was successful, with the company reporting that the ability to regenerate all stripped carbon had bought about a significant decrease in gold lost in solution. And despite heavy rainfall the operation was continuing to perform well with another good quarter posted early in 2001.

Over the border in Queensland, another mine owned by the Normandy Group, the Mount Leyshon mine, neared closure with mining completed in February 2001. Processing of stockpiles was continuing with gold production expected to cease early next year. In 2000, the operation produced 275,395 oz at A\$300/oz.

Another major mine near closure in Queensland is Kidston, set for mothballs in the current year. In 2000 it produced 244,144 oz at A\$375/oz. Balancing these latter two to a small degree is Equigold's Mount Rawdon project which came on stream in 2001 at a cost of around A\$34 million, and which is expected to produce annually around 80,000 oz of gold and 200,000 oz of silver. Elsewhere in Queensland, the Pajingo/Vera Nancy mine owned by Normandy and Battle Mountain confirmed its status as one of the more profitable mines in the country - 229,749 oz at A\$157/oz - while the Gympie mine, south-east of Brisbane, had exploration success and was producing cheap ounces by early 2001 - 12,967 oz in the March quarter at A\$288/oz.

Further south at Cadia Hill in New South Wales, owner Newcrest Mining enjoyed

another big year producing over 320,000 oz and 28,431 t of copper. Cadia Hill had reported reserves of nearly 200 Mt, and with promising drill results at Cadia East - 100 m grading 3.9 g/t Au and 0.32% Cu - and the nearby Ridgeway deposit being developed (though on a standalone basis), Newcrest looks as though it will be producing in the Orange region for many years to come. Formal approval for the Ridgeway operation came during the year, with Newcrest planning to utilise block-caving to mine the 32 Mt deposit grading 2.7 g/t Au and 0.76% Cu, (with total resources coming in at 54 Mt).

Another project on the development path is Bendigo Mining's New Bendigo project in Victoria. Some proof that the geological model proposed by Bendigo Mining is valid was forthcoming during the year, and involved a decline being driven under the famous mining town ahead of bulk sampling programmes. The company estimates there are more than 12 Moz to be exploited, with a possible production scenario being 400,000-500,000 oz/y for 25-years at cash costs of A\$150-200/oz by 2007. Initial production of around 100,000 oz is being planned for the December quarter next year.

Currently Victoria's biggest operation is the privately owned (by MPI) Stawell mine which has been producing around 100,000 oz/y for a number of years. This year's return was 115,000 oz, well ahead of the state's next best effort, Perseverance's Fosterville heap-leach operation with just under 16,000 oz.

In Tasmania, the Beaconsfield operation endured a difficult year, with the Biox plant not performing to expectations and a A\$16.6 million claim lodged against the plant contractor. Some 65,002 oz were produced in 2000 at cash costs of A\$526/oz. In contrast Tasmania's other major gold mine, the Henty operation owned by Goldfields, enjoyed a good year on both the mining and exploration fronts. Production of 97,332 oz at A\$236/oz showed the mine was performing well after some difficult early years.

South Australia could soon have its first new gold mine in many years with the Challenger project - now owned 100% by Dominion Mining - likely to be producing early in 2002 at around 50,000 oz/y.

Meanwhile in terms of exploration, Goldfields' Raleigh discovery near Kalgoorlie stood out. Raleigh contains at least 1 Moz, and at an average grade in excess of one ounce to the tonne, it's the sort of find that would make even an old prospector's heart miss a beat. Also significant with Raleigh, is the fact that it was found just over 20 km from Kalgoorlie, scene of over 100 years of mining and exploration.

Other recent significant discoveries included the multi-million ounce Thunderbox deposit near Leonora in Western Australia – set to be mined in 2002 – and the Ground Rush and Chariot finds in the Northern Territory. According to the Australian Gold Council the industry has discovered 245 Moz since 1990.

Mineral Sands

In 1999/2000 Australia produced 2.16 Mt of ilmenite concentrate, 26,000 t of leucoxene concentrate, 221,000 t of rutile concentrate, and an estimated 569,000 t of synthetic rutile and 164,000 t of titanium dioxide pigment. Ilmenite production in 2000/01 was expected to drop another 200,000 t or so, after declining some 230,000 t from 1998/99. Rutile concentrate and synthetic rutile were also expected to drop next year by around 20,000 t, while output of the other products were forecast to remain steady.

Most production comes from Western Australia where Iluka Resources and Ticor are the main players. Iluka, which is the world's largest zircon producer, was formed a few years ago with the merger of Westralian Sands and the RGC mineral sands assets. The company has two main theatres of operations, namely Eneabba and Narngulu in the mid-west of the Western Australia state, and Capel in the southwest. Key products in the midwest are chloride route ilmenite,

synthetic rutile and rutile while in the southwest, the ilmenite is generally sulphate route grade, and also used in synthetic rutile production. It has total estimated heavy mineral resources at the two Western Australian operations of 79 Mt averaging 6.8% heavy minerals (HM).

Ticor has a 50:50 joint venture with Kerr-McGee covering 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 in South Africa. The main product is ilmenite, though rutile, leucoxene, zircon and staurolite are separated at the Chandala plant and sold. In 2000, some 50 Mt of material moved produced over 900,000 t of concentrate, with 2001's output likely to be 40 Mt and 830,000 t respectively. The Becher process synthetic rutile plant at Chandala can produce in excess of 200,000 t/y.

Australian production also comes from Stradbroke Island, near Brisbane, Queensland, where rutile, zircon and ilmenite are mined by Consolidated Rutile (held 43% by Iluka). Two deposits are being worked by dredges with nominal capacities of 3,000 t/h, with wet high intensity magnetic separation used to separate ilmenite. Although not affecting operations early in 2001, environmental issues have emerged in recent times and some analysts consider these to be the biggest threat to the longevity of Ticor's assets.

Small-scale production comes from Mineral Deposit's Hawks Nest project in NSW which yielded 6,635 t of rutile and 2,480 t of zircon for the year.

In terms of a new generation of producers, the Murray Basin continues to be the destination of choice. Covering some 300,000 km² of Victoria, New South Wales, and South

Australia, the strandline deposits of late Miocene-Pliocene marine sand sequences of the Murray Basin have been looked at by various parties for around 30 years. However, work has accelerated in the past five years, and a number of juniors and some majors are now active.

Austpac Resources is one of the former, with it carrying out bulk sampling of the WIM 150 deposit worked on for many years by the then CRA (now Rio Tinto). Austpac gained access to the project in 2000 and is investigating processing options it believes can readily separate the ilmenite from the chromite in the 750 Mt resource. The Australian junior has been working on mineral sands processing technology - Enhanced Roasting and Magnetic Separation (ERMS) and its associated Enhanced Acid Regeneration System (EARS) - for the best part of a decade, and is hopeful of success after Rio Tinto reportedly spent some A\$75 million on WIM 150 and its surrounds.

Another hopeful junior is BeMaX Resources which is undertaking a feasibility study incorporating the 75% owned Ginkgo and Snapper deposits. Ginkgo contains 252 Mt grading 2.8% HM, while Snapper has 104 Mt at 4.8% HM. Major producer Iluka unsuccessfully attempted a takeover of BeMaX during the year, while gold and tantalum heavyweight Sons of Gwalia had a 17.2% stake in the junior with the option to go to 19.9%.

Sons of Gwalia is also involved in a joint venture (with RZM/Nisho Iwai) at the Wemen project, where rutile and zircon was being produced early in 2001 - via a dredge, concentrator and separation plant - from a resource inventory that totalled 14.1 Mt of heavy mineral early in 2001.

Other advanced projects included Basin Mineral's Douglas project where a feasibility study was due no later than mid-2002, and Southern Titanium's Mindarie project, also the subject of a feasibility.

Outside the Murray Basin, explorers include Gunson Resources which is working south of Shark Bay in Western Australia, and Magnetic Minerals, also active in Western Australia with its 78 Mt grading 3% HM Dongara project and its 1,200 Mt at 1.9% HM Mindarra Springs project, both just north of Perth.

In Queensland, Monto Minerals was continuing to push for development of its Goondicum Crater ilmenite and titanomagnetite project west of Bundaberg. A potential joint venture with a construction company fell through early in 2001, though another deal was in the pipeline mid-year. Goondicum has a 78 Mt resource averaging 5% ilmenite and 2.8% magnetite.

Nickel

Nickel mine production in 2000/01 totalled 194,000 t (147,000 t), with export receipts coming in at A\$2.1 billion (A\$1.86 billion). The forecast is for both to increase to 234,000 t and A\$2.73 billion respectively.

Operationally, it was a year of contrast. The traditional sulphide producers had a strong year, while the new the laterite producers, struggled.

In calendar 2000, Bulong produced 5,216 t, Cawse 6,639 t and Murrin Murrin 13,207 t. Of the three, Cawse came closest to achieving nameplate capacity (which is 9,000 t/y), but while it may have had some success on the production front, it did little to allay criticisms that it was little more than a A\$300 million pilot plant that was too small to be financially viable.

Metaphorically, (if not literally), Bulong was more or less a write-off - particularly for owner Preston Resources' shareholders - while Murrin Murrin, which had produced its first briquettes back in mid-1999, staggered throughout the year with ongoing rectification work.

WMC's position as Australia's premier nickel producer was unchallenged, with Mount Keith in Western Australia's north-eastern goldfields, the stand-out performer with over 47,500 t of nickel in concentrate. The company's smelter at Kalgoorlie produced a record 103,000 t of nickel in matte and its Kwinana refinery 60,500 t of refined nickel. WMC is considering expanding the Mount Keith operation from its present output of under 50,000 t/y to some 70,000 t/y of nickel in concentrate. This would come from Mount Keith increasing processing from 11 Mt/y to 18 Mt/y via a third production module. The nearby Yakabindie project containing an estimated 292 Mt averaging 0.52% nickel could come into the expansion equation after WMC purchased the project from Rio Tinto for A\$40 million. (Yakabindie came into Rio Tinto's portfolio after its takeover of North Ltd.)

New sulphide producers included the high grade, and thus far very well performed Cosmos project. Owned by Jubilee Mines and located near the WMC Leinster operations, Cosmos is exploiting a high grade orebody that at start-up totalled 420,000 t averaging 7.52% Ni. Not only did mining and processing significantly outperform expectations – which were to produce around 10,000 t of nickel in concentrate for three to four years – but exploration success suggests the open-pit/underground operation could be around for many more years than the initial reserve suggested.

A more modest arrival was RAV 8, though, as for Cosmos, it was a more than handy boost for owner (and former gold miner) Tectonic Resources. And, as at Cosmos, exploration was increasing mine-life.

Elsewhere, Outokumpu expanded its Black Swan operation near Kalgoorlie, and is currently producing just under 20,000 t of nickel in concentrate – which is then shipped to its smelter in Finland.

Titan Resources' Radio Hill mine in northwest Western Australia yielded just over 5,000 t of nickel in concentrate, and the company was achieving promising results with a new processing technology – bacterial-oxidation heap-leach – that has the potential to bring into play a host of low-grade disseminated sulphide resources.

In terms of new projects, the Miitel joint venture – featuring the publicly listed Mincor Resources – purchased a number of small nickel mines in the Kambalda region owned by WMC. The purchase included an agreement that processing of the ore be carried out at WMC's operations. The Miitel joint venture expects to produce around 7,000 t/y of nickel in concentrate.

Further to the southwest, LionOre committed to developing the Emily Anne underground mine – 2.1 Mt averaging 3.98% Ni – at a rate of 250,000 t/y.

A number of laterite hopefuls waited (perhaps forlornly) in the wings. Processing of significant laterite resources found at Ravensthorpe and around Kalgoorlie were being considered by various parties, while development of Black Range Minerals' Syerston laterite project in NSW was being stymied by an inability to attract the required financing.

Probably the most exciting exploration success of the year came from WMC's work in the isolated (west) Musgrave Range in central Australia, at the juncture of the states of Western Australia, South Australia and the Northern Territory. Limited drilling has been reported, but its potential can be gauged by the comment attributed to WMC's executive chairman Hugh Morgan pertaining to West Musgrave having the potential to significantly change that company's nickel business. The drill results reported at two separate prospects (Nebo and Babel respectively) were 26.55 m grading 2.45% Ni, 1.78% Cu and 0.74 g/t PGM+gold, and 148.9 m at 0.3% Ni, 0.42% Cu, 0.01% Co and 0.29 g/t

PGM+gold. The mineralisation is associated with the Giles Complex (~1100 million years old mafic and ultramafic rocks), and was speculated to be similar in style to the Voisey's Bay deposit in Canada. In mid-2001, drilling was again under way.

Base Metals

Australian base metal production in 2000/01 included 810,000 t (787,000 t) of copper, with refined output totalling 558,000 t (477,000 t). Zinc mines produced 1.465 Mt (1.26 Mt) and refined output came in at 435,000 t (317,000 t), whilst in the year ending June 30, 2000, lead producers delivered mine production of 692,000 t (662,000 t), refineries 234,000 t (197,000 t) and lead bullion 165,000 t (157,000 t).

Australia is a significant producer of lead and zinc - around 22% of the world's lead mine production and 16% of zinc - and that status is expected to be further confirmed as the large Century zinc mine reaches full production this year.

In terms of copper, Australia produces around 6% of world mine production and over 3% of world primary refined production, with the latter expected to rise marginally in the current year as production from the rebuilt Port Kembla refinery comes on stream.

The outstanding copper asset in Australia is WMC's world-class Olympic Dam operation in South Australia. Some A\$1.9 billion have been spent in the past few years on expansions and enhancements, adding to the A\$1 billion WMC put into the operation prior to 1997. Olympic Dam has the largest long-hole open stope mine in the world and is a fully integrated ore-to-metal complex. In 2000 it treated 8.9 Mt of ore producing 200,000 t of copper, as well as 70,000 oz of gold and 4,540 t of uranium. Cash costs were 29¢/lb (US17¢/lb) of copper (net of by-product credits). Olympic Dam will likely produce 210,000 t of copper in 2001, and a feasibility study to go to 235,000 t/y may go before the WMC board during 2001. Eventually Olympic

Dam could be a 350,000 t/y operation, with current reserves of 707 Mt averaging 1.7% Cu, 0.5 kg/t U₃O₈, and 0.5 g/t Au.

MIM is Australia's other big copper producer, with its two Australian mining operations in Queensland producing around 250,000 t of copper in 2000/01. It also has a 50% stake in the Alumbrera copper-gold mine in Argentina, delivering the company a further 80,000 t or so for the year. Early in 2001 it purchased the 49% of the Ernest Henry copper-gold mine in Queensland that it didn't already own, meaning an additional 45,000-50,000 t/y of mine production will be coming its way henceforth. Production in any case was forecast to increase, with CIBC analysts pointing to a 20% increase at the Mount Isa operation to around 242,000 t in fiscal 2002. MIM also owns two refineries that produced around 430,000 t for the year ending June 30, 2001.

In NSW, Rio Tinto's Northparkes operation produced 41,115 t of copper and 23,740 oz of gold for the year. Rio Tinto became the owner after acquiring North Ltd during 2000, and the conjecture was that Northparkes was unwanted and would subsequently be offloaded. In the event Rio Tinto has apparently been impressed by the operation, and some A\$139 million were being spent on developing the orebody for production till at least 2010.

Nearby the Cadia operation of Newcrest continued on its merry way, producing 28,431t of copper for the year (as well as over 320,000 oz of gold).

Another sizeable copper producer is Western Metals via its Mt Gordon operation in Queensland. Mount Gordon has caused no end of grief in recent years as commissioning of the whole ore, moderate temperature-pressure autoclave ferric leach SX-EW plant proved problematic. However, since mid-2000 production has steadily improved and by early 2001 it was producing around

capacity at 46,000-48,000 t/y with cash costs of US\$0.30-0.40/lb.

Other notable copper producers include Straits Resources - which was embarking on an ambitious growth programme to increase production from around 25,000 t presently to 100,000 t within five years from its Western Australia operation(s) - and Selwyn Mines which acquired the Selwyn mine of failed gold-copper miner Australian Resources. Selwyn started operating the mine in 2000 and is currently working on a feasibility to confirm the viability of producing 19,000 t of copper and 64,000 oz of gold per annum from 2002.

On the lead-zinc front, the big news for the year was, from Queensland --the commissioning of MIM's George Fisher zinc-lead mine north of Mount Isa, and Pasminco's A\$788 million Century zinc mine.

Century, which was discovered back in 1990 and was previously owned by CRA/Rio Tinto, was due to reach its full production capacity of 5 M t/y producing 880,000 t of zinc and 70,000 t of lead in concentrate by late 2001, with half of its production set to go to its Budel Zink smelter in The Netherlands. Century's flat-lying orebody measures 1.2 by 1.4 km, and totals 105 Mt averaging 12.1% Zn, 1.69% Pb and 46 g/t Ag. Full production was likely not to be a moment too soon for beleaguered owner Pasminco. Despite being one of the world's major zinc producers, Pasminco was plagued by negative issues in 2000, including ageing mines, environmental protests and court actions at one of its smelters, and a currency hedging programme gone totally awry. All of which led to widespread shareholder disenchantment.

Also under shareholder pressure has been Western Metals. As with Pasminco, this related to a whole host of issues which culminated in the company's managing director leaving under a cloud late in the year. Not at question, however, was Western Metals' Lennard Shelf lead-zinc operations in

Western Australia's north. It produced 261,000 t of zinc and 100,000 t of lead in the year ending June 2000. In late 2000 the company undertook rationalisation of the Lennard Shelf operations, upgrading the Pillara plant from 1.5 Mt/y to 2.4 Mt/y and closing down the Cadjebut mill. A review is now underway on lifting that to 3 Mt/y. Based on the resource inventory, and the current exploration potential, Western Metals has a further 10 years or so of production life.

As with copper, MIM was making something of a lead-zinc comeback in terms of improved operational efficiencies. Its Mount Isa and McArthur River mines were solid performers in 1999/2000, with zinc production steady at 260,600 t and lead output increasing to 168,600 t. Both those trends were continuing in the current financial year.

In terms of new developments, Kagara Zinc is looking to develop its Mount Garnet project in Queensland. The feasibility envisages a 500,000 t/y central processing facility treating ore from both the Mount Garnet and the-high grade zinc-lead Balcooma deposits. The concentrate produced may then be processed at the Sun Metals Townsville zinc refinery.

North of Mount Isa, Canadian major Noranda Inc. has exercised an option to acquire a 75% stake in the high-grade Lady Loretta project. A feasibility is looking at developing an underground mine yielding 230,000 t/y of zinc concentrate averaging 55% zinc An. Lady Loretta has a reserve of 11.5 Mt averaging 15.5% zinc and 5.4% Pb, with development expected to cost in the order of A\$200 million.

Working to develop a new mine in the famous Broken Hill region is Consolidated Broken Hill (CBH), which is looking to drive a decline to a deposit called the Western Mineralisation. Containing 2.2 Mt at 5.97% Zn, 4.07% Pb and 48.7 g/t Ag, the deposit is believed to have the potential to be much larger, and CBH is staging production starting at 120,000 t/y. The aim is to get production up to

500,000 t/y in 2002 yielding 21,000 t of zinc, 14,000 t of lead and 700,000 oz of silver annually.

Another possible development was Compass Resources' Browns polymetallic project south of Darwin in the Northern Territory. Browns contains 69.3 Mt at 2.59% Pb, 0.12% Co, 0.81% Cu, 0.11% Ni and 10 g/t Ag, while the nearby Area 55 deposit had 12.4 Mt at 0.56% Pb, 0.14% Co, 0.49% Cu and 0.14% Ni. A commercialisation options study was under way early in 2001.

Finally, Tectonic Resources is hopeful of developing its Trilogy polymetallic deposit west of Esperance in Western Australia by 2002. Trilogy contains 52,000 t of copper, 149,000 oz of gold, 7.76 Moz of silver, 76,400 t of lead and 51,500 t of zinc within 4.3 Mt of ore. Some 95% of the metal is said to be within 150 m of surface.

Others

Production is under way at WMC's A\$700 million Queensland fertiliser project south of Mount Isa. Mining of the 44 Mt reserve averaging 23.31% phosphate began in 1999 with commissioning of the 1 Mt/y rated plant carried out through 2000. Commissioning had its moments, including a long delay due to compressor problems in the second half of the year. Early in 2001 the operation was reported as operating at 77-80% of nameplate.

Elsewhere, Rio Tinto was continuing work at its 80% held Wonara Phosphate project 240 km east of Tennant Creek in the Northern Territory. A resource of 115 Mt at 22% phosphate was inferred and beneficiation test work had reportedly shown the potential for the production of an acceptable fertiliser project. Australian junior AKD Ltd holds the 20% balance in the project.

In terms of manganese, resources are found in all states (and the Northern Territory) with the biggest operation being Billiton's 60% owned Groote Eylandt project off the

Northern Territory coast. Groote Eylandt produces some 1.8 Mt/y.

A somewhat smaller producer is Consolidated Minerals Ltd (which was apparently aiming to list in the UK on the AIM). Consolidated Minerals owns the Woodie Woodie project southeast of Port Hedland in Western Australia, which produced 323,205 t of manganese in 2000.

Another with manganese aspirations is HiTec Energy, which has for some years been trying to develop a project located at Port Hedland producing electrolytic manganese dioxide. A demonstration plant was built in 2001.

Australia's vanadium industry suffered in 2000 on the back of the slump in the vanadium price.

Australia's first commercial operation, Windimurra (near Mount Magnet in Western Australia), was officially opened in May 2000, but less than six months later, the company that got the project off the ground, Precious Metals Australia sold off its contributing 40% interest. Following the sale, Xstrata AG holds a 60% stake and Glencore the balance. Windimurra, which has a nameplate capacity of 17.6 Mlb/y, was operating at around 75% in the second half of 2000 and through into early 2001. Full capacity was expected to be achieved by mid-2001. Windimurra had 55 Mt of reserves averaging 0.5% vanadium.

Active explorers for the metal included Greater Pacific Gold and Copper Mines and Metals, (both working in Western Australia), and Fimiston Resources which was looking to develop a massive vanadium/oil shale resource at Julia Creek in Queensland.

In terms of other minerals, Alkane Exploration was continuing its feasibility study into development of the Dubbo zirconia-tantalum-yttrium project 400 km northwest of Sydney. In mid-2001 a pilot plant was expected to be operating as the 83 Mt deposit underwent metallurgical testwork.

On the other side of the continent a definitive feasibility was under way at the Mt Weld rare earths project near Laverton in Western Australia. Anaconda was earning a 50% stake in the project from Lynas Corp., with potential production of tantalum, niobium, zirconium and titanium, and by-product rare earths, phosphate and aluminium. Mount Weld's rare earths resource totals 1.69 Mt

averaging 19.6% rare earths, 145 Mt averaging 0.03% Ta and 273 Mt averaging 0.9% Niobium.

The author wishes to expressly acknowledge (and thank) ABARE, and the various state government exploration, mining and energy departments.