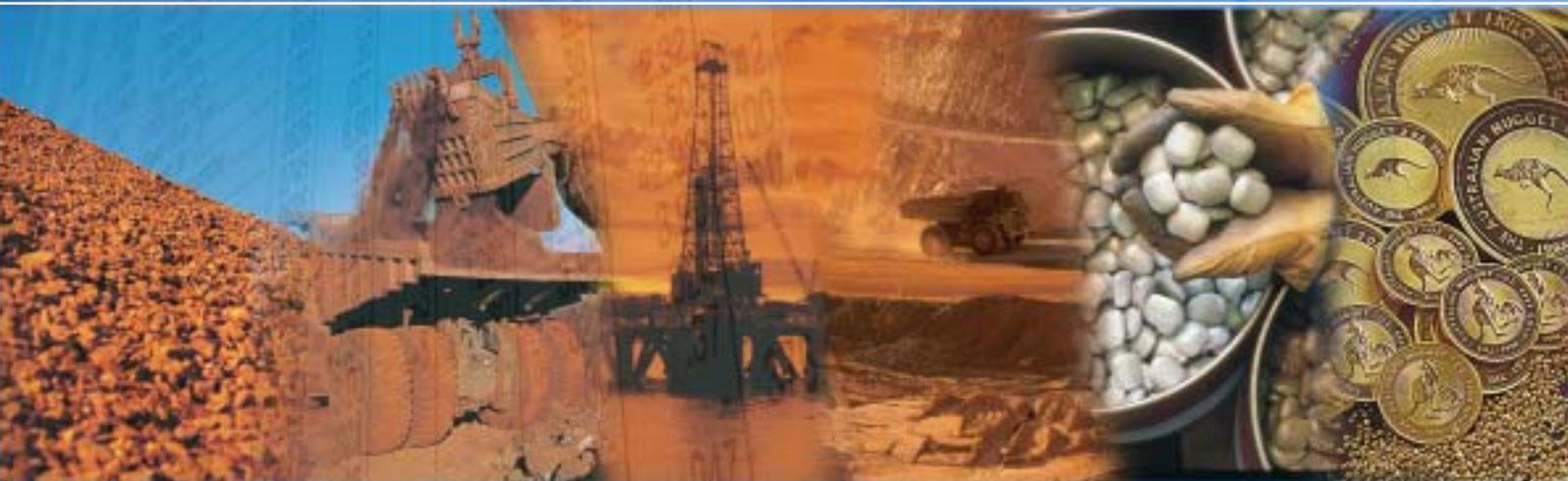




Department of
Industry and Resources

WESTERN AUSTRALIAN



MINERAL AND PETROLEUM STATISTICS DIGEST

2002-03

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Jim Limerick
Director General

Welcome to the Department of Industry and Resources' 2002–03 Statistics Digest. This publication contains the most comprehensive statistical information available on the Western Australian mineral and petroleum industry.

The Digest provides detailed quantity and value data, by commodity and industry sector in addition to figures on employment, royalty receipts, exploration, investment and principal producers. Incorporated with this is analysis explaining the performance of the various mineral and petroleum sectors. Numerous facets of the State's resource sector, including commodity price trends and Western Australia's position as a resource exporter, are also covered.

In 2002–03 the total value of Western Australia's mineral and petroleum sales climbed 4% to \$28 billion. This was a good outcome considering the increased value of the Australian dollar against the US currency and the industry's extraordinarily high growth rates in recent years.

Growth in the value of the industry was assisted by record-breaking physical output of some products. For example, sales quantities for the State's condensate and nickel sectors increased to new all-time highs. Coupled with substantial international price increases for crude oil and nickel during the year, the value of these sales also grew to new all-time highs, despite appreciation of the Australian dollar.

Falls in recent years in Western Australia's gold output and diamond sales were also reversed with sales increases in these sectors. In addition, new milestones were achieved by Western Australia's two largest mineral sectors, iron ore and alumina with the attainment of new production records in 2002–03. However, weak international prices for these products, compounded with the higher value of the Australian dollar meant that these output increases could not be translated into higher sales values.

Growth in the State's resource industry in a difficult environment of an appreciating Australian dollar and weakness in some commodity prices highlights the strategic position the State's mineral and petroleum sector holds. It is well positioned to build on its strengths as a reliable supplier of quality resources at world cost-competitive prices, within close proximity to some of the world's largest and fastest growing markets.

This report provides the statistical information necessary to consider all these issues.

In releasing the Western Australian Mineral and Petroleum Statistics Digest for 2002–03, I would like to express my appreciation to the many individuals and companies who have contributed to the preparation of this report, including the Australian Bureau of Agricultural and Resource Economics (ABARE), the Australian Bureau of Statistics (ABS) and the Western Australian Treasury Department.

1. ECONOMIC AND SOCIAL ENVIRONMENT

1.1 Global Economy

The global economy saw a period of slower growth towards the end of 2002 that persisted into the early months of 2003. The slowdown had been pervasive across the key industrial economies, the United States, Europe and Japan. Much of the attention was focused on the US economy where economic data revealed a significant easing in the pace of growth. Issues of concern were rising unemployment, low profitability and faltering consumer spending.

However, since March 2003, the outlook for global economic recovery has been more optimistic. Strong economic growth in the US is expected to lead to renewed economic growth in Asia since the US is the largest market for Asian exports.

Global optimism has continued to drive equity markets, triggering recent highs for several markets across the globe. Tokyo's Topix reached a 16-month high in October 2003. This was mirrored in the US where the technology-focused Nasdaq Composite was at a 12-month high and the mainstream S&P 500 index closed marginally off its high point for the past year.

Although much of Europe still remains weak, expectations about economic performance are improving following a reduction in European Central Bank (ECB) interest rates and recent increases in stock prices.

United States

The US economy was sluggish during the second half of 2002 and into the early months of 2003. The US Treasury released disappointing economic data that raised concerns that economic recovery in the US was faltering, with growth still being held back following the equity price collapse. In addition, the uncertainties over a prolonged conflict with Iraq weighed on business and consumer confidence.

However, in recent months, there has been good cause to be optimistic that the US has turned a corner. Consumer spending resumed growth supported by low interest rates and tax cuts. JP Morgan Chase and Co. estimated that consumer spending grew at 6.1% between February and August 2003, the fastest pace in 16 years. This is most encouraging for the US economy as consumer spending may provide considerable support for other areas of the economy that have struggled. In addition, the S&P retail



index recently reached three-year highs in 2003. Trading was powered by robust sales results which bolstered hopes that the US economy is indeed improving and that the consumer still has an appetite to spend.

Business sentiment has also improved markedly with the factory sector recovering despite the lack of hiring. This is due to productivity gains that have allowed manufacturers to expand output without adding workers. The Institute of Supply Management survey recently reported that the manufacturing sector is performing more strongly and sentiment among non-manufacturing businesses is at the highest level seen over recent years. Investment spending on capital goods orders has also been gradually picking up. According to the Reserve Bank of Australia (RBA), if these trends continue, they will offer the prospect of a more balanced composition of growth in the US economy as the recovery proceeds.

Still of concern in the US is the labour market. The labour market remains extremely weak, considering the state of the economy. Continuing claims for unemployment benefits remain high as hundreds of thousands of workers exhaust their benefits without finding a job.

According to ABARE, economic growth in the United States is expected to continue to strengthen for the remainder of 2003 and into 2004. On year-average terms, economic growth in the US will increase to around 4% in 2004, up from 2.5% in 2003.

Japan

The Japanese economic recovery that began in the first half of 2002 faltered towards the end of the year as domestic demand remained weak and stronger exports to China were offset by weaker exports to the slowing US economy. However, since the beginning of 2003, Japan seems to have turned the corner. In the second quarter of 2003, GDP grew at an annual rate of 3.9%, of which domestic demand contributed 0.8% and international trade 0.2%.

Data released recently has also shown an improvement in domestic conditions. Industrial production has been gradually increased and recent unemployment data showed a modest decline. Consumers are beginning to spend more, as household savings slipped to 6.6% of disposable income in 2003, down from 11% four years earlier. According to analysts, business investment has increased for four consecutive quarters since the third quarter of 2002.

Recent economic data showed that the debt problem plaguing Japan over the last decade is beginning to ease. However, the country's financial sector still remains weak and is holding back prospects for a sustained economic recovery. Deflation continues to remain entrenched in the economy. Prices of goods and services have fallen for the past four years causing deferrals in spending and a rise in real debt levels.

ABARE cautions that there are a number of factors that could significantly influence Japan's economic performance. The downside risks mainly stem from weakness in the financial sector, slow structural reform and continued price deflation. Much will depend on economic activity in the US, which is the largest market for Japan's exports. A significant increase in economic growth in the US will provide support for Japan's exports.

Overall, it would appear that the Japanese economy is on the mend. Analysts forecast that Japan's economic growth will be around 1% in 2003 and 0.7% in 2004. This compares with growth of 0.2% in 2002.

Europe

Economic conditions remained weak in Europe during 2002–03. Growth has been minimal since mid-2002, with GDP expanding negligibly in the December quarter of 2002. The record-breaking heat waves during

the last European summer had an effect on private consumption. Recent economic data revealed private consumption was weak during July and August 2003.

While growth remained moribund in Germany, France and Italy, the UK economy showed the strongest growth in the Western European region despite key indicators such as the growth rate of employment and household consumption all slowing down. In 2003, the government announced that unemployment had fallen to its lowest level in 28 years, raising hopes that the sluggish UK economy might have turned the corner.

The euro has maintained its recent appreciation against other international currencies and was trading at around US\$1.02 in August 2003.

Looking forward into 2004, ABARE forecast economic growth to be around 1.4% in the Western European region in 2004, compared with 0.5% in 2003.

Non-Japan Asia

Growth in the Asian–Pacific region (excluding Japan) softened a little in the first months of 2003 following strong GDP growth of 6.3% in 2002. Reinforcing the economic downturn was the impact of the SARS outbreak. Business and consumer confidence in Hong Kong, China and Singapore markedly decreased during the most severe period of the outbreak from mid-March to early June 2003. The SARS epidemic has since been contained for the time being. The passing of the epidemic has been accompanied by rebounds in the retail sector and tourism sectors notably in Hong Kong and Singapore.

The Chinese economy continues to expand. GDP grew at an annual rate of 8.2% in the first half of 2003, compared with an official target of 7%. This is particularly significant for Australia as Chinese growth is focused on the consumption of basic raw materials such as steel, thermal coal, iron ore, nickel, copper and aluminium.

The Thai economy is also expanding at a rapid pace. Production of manufactured goods has been increasing and private consumption continues to play a major role with the private consumption index rising by 3.6% year-on-year in July 2003.

The economic outlook for South Korea has weakened in recent months. Consumer and business sentiment has declined markedly despite the passing of the Iraq

conflict and the control of the SARS outbreak in the South East Asian region.

ABARE forecasts that for South East Asia as a whole, economic growth will be around 3.3% in 2003, before strengthening to 4.3% in 2004. This compares with 4% in 2002.

Analysts predict that China will continue to grow rapidly. Furthermore, China will have a positive impact on the world economy and will fill the gap caused by the declining one in South Korea, whose economy is only about 10% the size of Japan's and 35% of China's at market prices.

The Global Outlook

A US-led global economic rebound over the next two years will depend on how far major economies alleviate a series of domestic problems which include the US current account deficit and the defeat of deflation in Japan.

Recent economic data show that the global economy appears to be gradually regaining strength. Control of the SARS outbreak has helped, as has the continued effort in stabilizing the situation in Iraq.

However, whilst the military situation in Iraq is now relatively more stable compared to the crisis in the earlier part of 2003, there are new global uncertainties that may affect a rebound in economic growth. These include the Arab-Israeli conflict, the North Korean nuclear predicament and lingering threats of terrorism.

The East-Asian economies will continue to depend on the US economic outlook. The US is a significant destination for exports from the East and South-east Asian economies, consisting of about 22% of Malaysia's total exports, 15% of Singapore's, 20% of Thailand's and 15% of Indonesia's. A rebound in the US economy should therefore provide a stimulus for economic growth in these APEC member countries.

1.2 National and Western Australian Economic Context

Economic data showed that the Australian economy grew solidly in 2002–03, despite the impact of a severe drought and a number of international setbacks that affected the economy.

The national economy grew by 2.7% in year-average terms in 2002–03 after growing by 3.8% in 2001–02. Growth was driven by strong domestic demand. Household consumption was solid and housing investment continued to hold up for longer than expected, providing a solid boost for domestic spending.

The worst drought in Australia unfolded during 2002–03. This had an effect on farm production which declined by around 28%, subtracting around 1 percentage point from GDP growth in 2002–03. With the passing of the drought, analysts forecast that the volume of production in the farm sector will increase 19% in 2003–04, compared with a decline of 23% in 2002–03.

Employment also grew strongly in 2002–03. The unemployment rate declined to 5.6% in October 2003, a level not seen since December 1989. Wages growth picked up in 2002–03 in line with strengthening labour market conditions. Inflation was moderate with prices increasing by 2.7% through the year, consistent with the Federal Government's medium-term inflation target.

Looking to the future, analysts forecast the economic growth in Australia to rise to 3.2% in 2003–04.

The Western Australian economy performed better than expected in 2002–03 despite the reduction of agricultural output caused by the drought. According to the ANZ State Economic Update, final demand in Western Australia grew at 9.3% over the year ending June 2003. This was above the national average of 4.7%.

The resource sector continues to drive economic growth in Western Australia. Major resource projects such as the expansion of the North West Shelf project and the Telfer Deeps gold mine have underpinned business investment growth in Western Australia.

Western Australia's exports continue to be resilient, with merchandise exports increasing 11% in real terms

in 2002–03. The ABS released trade figures in 2003 that reaffirmed Western Australia’s place as Australia’s leading exporter. Western Australia is now responsible for A\$32.4 billion in merchandise exports, which represents 29% of the nation’s total exports.

Recent ABS data revealed that Western Australia’s unemployment rate was 6.2% in October 2003. Further improvements in the Western Australian labour market will depend on ongoing investment growth.

Western Australia’s Treasury Department expects Gross State Product (GSP) to grow strongly in 2003–04. Analysts forecast it to rise by 4.5% with the recovery in agricultural output being a key driver.

Exchange Rate

The Australian dollar continued to appreciate over the past 18 months to November 2003, though its record against different currencies has varied. Against the US dollar, it has risen by around 34% from around US52 cents at its most significant trough in mid-August 2002 to its highest levels for 6 years, valued at US70.78 cents in early November 2003.

The Australian dollar has rebounded 13% against the euro, 9% against the British pound and 13% against the yen. According to analysts, the Australian dollar rally has been driven by Australia’s favourable interest rate differential with the US and a boom in commodity prices. Another factor contributing to the continuing appreciation of the Australian dollar is the weakness of the US currency highlighted by trade and budget blowouts in the US.

Currency movements are particularly critical in the resources sector. For instance, analysts forecast that Australian iron ore exporters are expected to win price increases in US dollar contract prices over the Japanese 2004–05 fiscal year that runs from April 1 to March 31. However, if the Australian dollar keeps rising, increases in US dollar prices might mean very little as the strong currency will cut into earnings.

ABARE forecasts the Australian dollar to average around US69 cents in 2003-04, compared with an average of US58 cents in 2002–03.

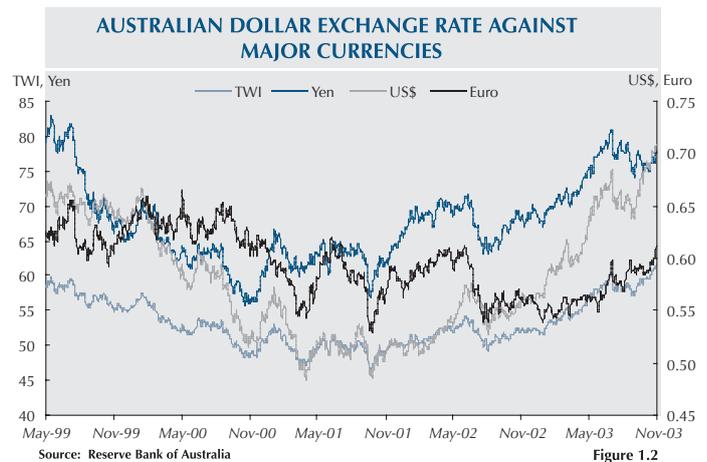


Figure 1.2

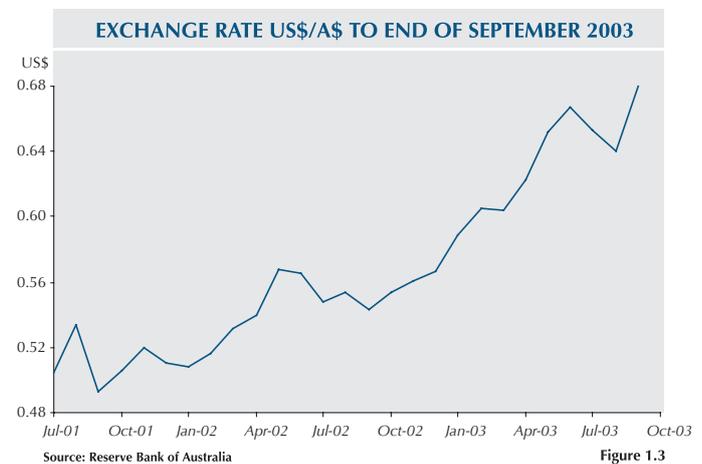


Figure 1.3

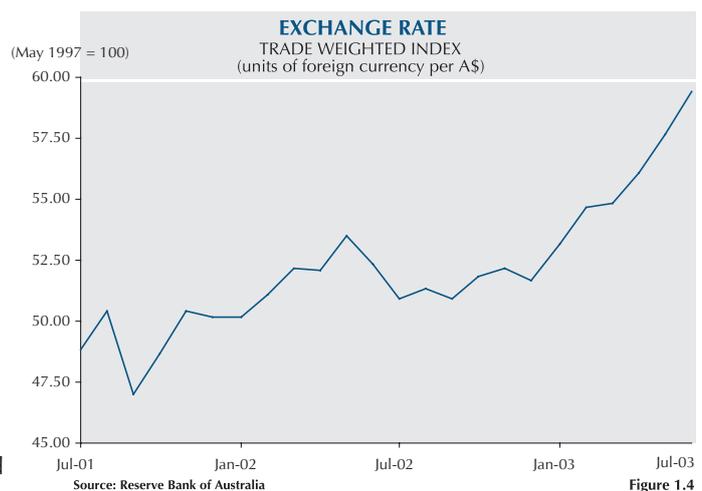


Figure 1.4

1.3 Policy Issues Affecting the Mining and Petroleum Industry

Electricity Reform

The Government has a program in place to comprehensively reform the structure of the State's electricity supply industry. The key elements of this program are:

- disaggregating Western Power;
- establishing full retail contestability;
- establishing an electricity market; and
- developing an electricity code.

An Electricity Reform Implementation Unit (ERIU) has been established under the Office of Energy to oversee the reform process. This Unit is overseen by a steering committee chaired by Ms Anne Nolan and consists of senior cross-Governmental representatives. Further information about the electricity reform program can be found at ERIU's website (www.eriu.energy.wa.gov.au).

Western Power is preparing for disaggregation, with internal reforms being put in place and management change initiated.

Consultation structures have been put in place, including:

- Union Consultation Committee;
- Stakeholder Register;
- Electricity Reform Consumer Forum; and
- Industry Reference Group.

Under legislation currently before Parliament, Western Power will be disaggregated and transitional market arrangements put in place by 1 July 2004. Full market operations are to be in place by 1 July 2006.

The benefits of the reforms are expected to be an average reduction in electricity prices of 8.5%, leading to an increase in GSP of \$300 million per year by 2010 and the creation of 2 900 new jobs. The resources industry is expected to be a major beneficiary of lower energy costs.

Mineral Exploration Action Agenda

To address the national decline in mineral exploration, the Federal Minister for Industry, Tourism and Resources, the Hon. Ian Macfarlane announced the *Mineral Exploration Action Agenda (MEAA)* on 12 September 2002.

A Strategic Leaders Group (SLG) of industry and government representatives was formed to identify the priority issues and assess possible solutions. The SLG

identified the priority issues impeding exploration investment in Australia as being:

- difficulty accessing land;
- difficulty accessing finance;
- increasingly inadequate geoscience data; and
- a need for more mineral exploration research.

The final report detailing 12 recommendations for action was published on the internet (www.isr.gov.au/library) and as printed hard copy on 7 July 2003.

The SLG acknowledges that implementing some of the recommendations may involve amending legislation and policies at State, Territory or Commonwealth levels. Industry bodies will be developing a paper on a lobbying strategy.

Implementation will require the agreement of all major stakeholders, balancing fiscal, conservation, community, industry and Aboriginal interests. The Western Australian Government's input to the MEAA will take into account the recommendations of the Ministerial Inquiry chaired by John Bowler MLA into Greenfields Exploration in Western Australia.

On 18 July 2003, the Minister for State Development released a press statement, and a copy can be viewed at www.mediastatements.wa.gov.au/media that summarised the Minister's responses to the 33 recommendations.

Native Title, Mineral Exploration and Mining, and the Removal of the Backlog of Mineral Title Applications

As at 30 June 2003, there were 11 525 tenement applications outstanding compared to 2 800 when the *Native Title Act 1993 (NTA)* was introduced. Of these, 5 100 are mining lease applications and 6 100 are exploration and prospecting licence applications.

A Technical Taskforce chaired by Tribunal Member Mr Alistair (Bardy) McFarlane provided its report to Government in November 2001 on options to reduce the backlog of mining tenements and to progress new tenement applications.

Key Taskforce Recommendations address the issues surrounding Heritage Surveys; Reducing the Backlog; and Progression of New Mineral Tenement Applications. Transitional and long-term amendments to the *Mining Act 1978* are to be drafted and progressed through Parliament in the Spring 2004 Parliamentary session.

Tenements in Force 1978 Act

| | 1997-98 | | 1998-99 | | 1999-00 | | 2000-01 | | 2001-02 | | 2002-03 | |
|---------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| | Number | 000 ha |
| Prospecting Licences | 7,525 | 992 | 6,242 | 809 | 5,827 | 745 | 5,512 | 711 | 4,964 | 634 | | 575 |
| Exploration Licences | 4,505 | 35,993 | 3,463 | 23,732 | 3,394 | 20,687 | 3,162 | 18,152 | 2,899 | 18,556 | 2,855 | 21,123 |
| Mining Leases | 6,690 | 2,031 | 7,555* | 2,263 | 4,865 | 1,829 | 4,841 | 1,803 | 4,820 | 1,774 | 4,770 | 1,762 |
| Other | 1,584 | 205 | | | 2,001 | 468 | 3,625 | 2,840 | 3,618 | 3,002 | 3,629 | 3,299 |
| Mineral Claims & Other 1904 Act | 309 | 34 | 307 | 34 | 194 | 22 | 186 | 21 | 186 | 22 | 186 | 22 |
| Total | 19,029 | 39,255 | 17,567 | 26,838 | 16,280 | 23,751 | 17,326 | 23,829 | 16,487 | 23,988 | 16,006 | 26,781 |

* Includes Other

Source: DoIR

Figure 1.5

The determination of the Ward case has clarified some issues regarding the “bundle of rights” under native title and this will assist the Government in negotiating agreed native title determinations.

State Sustainability Strategy

The finalised State Sustainability Strategy was released on 17 September 2003 at the International Regional Government for Sustainable Development Conference held in Fremantle, Western Australia. It can be found at: www.sustainability.dpc.wa.gov.au/docs/.

Government agencies will develop sustainability plans and work to implement the Strategy from this point onward.

Initiatives of interest to the resources sector include action items 3.30–3.35 (dealing with the mining and petroleum sectors); 1.1–1.4 (dealing with sustainability assessment of major projects); 2.26–2.31 (dealing with fuel security); and 1.29–1.35 (dealing with Indigenous issues).

In implementing the Strategy, a forum will be convened to bring together Industry, Government and Community representatives. These will include consultation groups or processes on topics of concern to the mining sector such as:

- *Sustainability Assessment* (Recommendation 1.3);
- *Sustainability Operating Principles for the Mining Sector* (Recommendation 3.31);
- *Voluntary Accreditation for Mining Sustainability* (Recommendation 3.34); and

- *Industry Sustainability Covenants* (Recommendation 6.27).

State Greenhouse Policy

At the national level, the Commonwealth Government’s Business Climate Change Dialogue Group, chaired by Federal Minister for the Environment and Heritage, the Hon. Dr David Kemp, and the Federal Minister for Industry, Tourism and Resources, Ian Macfarlane and comprising 34 industry and business groups, has identified long-term greenhouse abatement measures. These measures are to be considered by Commonwealth Ministers over the next few months.

At the State level, the State Government’s Greenhouse Task Force is developing a Western Australian Greenhouse Strategy. It is based on promoting effective action through Government leadership; community and industry awareness and inclusion; and information generation through research. The four substantive themes of the Strategy are:

- reduction of emissions;
- sequester carbon in the short- and medium-term for multiple benefits;
- adaptation to inevitable climate changes; and
- encourage new commercial opportunities.

Stabilising the concentration of carbon dioxide (CO₂) in the Earth’s atmosphere is a major long-term policy issue. Western Australia is committed to achieving its fair share of emission reductions in the most cost-effective and competitive way possible.

Hours of Work Inquiry

In May 2003, Minister Kobelke announced that an Extended Working Hours Review Panel had been formed to examine measures the State Government could take to address the health and safety issues involved in working extended hours. The review covers all industries, for example hospitality, fisheries, agriculture, minerals, transport and health care.

This announcement follows from a government working group set up in late 2002 to develop the project proposal, define the process, draft a discussion paper and determine stakeholder and public consultation methodology.

Professor Laurence Hartley, School of Psychology at Murdoch University, is Chairman of the Review Panel.

A discussion paper outlining various issues relating to working time patterns and extended working hours was developed by the Department of Consumer and Employment Protection and distributed for public comment. (It can be found at: [www.docep.wa.gov.au/cp/reviews/working hours discussion.pdf](http://www.docep.wa.gov.au/cp/reviews/working%20hours%20discussion.pdf).)

The closing date for submissions was 31 October 2003. The panel will now consider public comments and make recommendations for the improvement of the State's occupational safety and health framework that applies to issues arising from extended working hours. The review was expected to be completed by the end of 2003.

Mines Safety and Inspection Act

In accordance with section 110 of the *Mines Safety and Inspection Act 1994* (MSI Act), a review was carried out five years after its introduction. This review, by former Industrial Commissioner Robert Laing, was carried out concurrently with a review of the *Occupational Safety and Health Act 1984* (OSH Act) and accordingly, 40 of the review's recommendations to amend the MSI Act mimic those made for the OSH Act.

Extensive consultation was carried out following the draft report. The final report, which was handed down in January 2003, was closely scrutinised by the Mines Occupational Safety and Health Advisory Board (MOSHAB). Its findings were relayed to the Minister for State Development and contributed to the proposed Government position to approve 51 of the 61 recommendations.

On 18 August 2003, Cabinet approved the proposed position for the MSI Act and the subsequent drafting of amendments. DoIR is working closely with the Department of Consumer and Employment Protection to produce the drafting instructions for the OSH Act amendments.

National Offshore Petroleum Safety Authority

The establishment of a National Offshore Petroleum Safety Authority (NOPSA) is proceeding. The primary purpose of the NOPSA is to create a nationally consistent occupational safety and health regime for the offshore petroleum industry. Provision is also made for the NOPSA to have jurisdiction over onshore petroleum industry sites should the relevant state or territory agree.

Since receiving Federal Cabinet approval on 9 December 2002 to proceed to establish NOPSA, the Project Team has focused on drafting the necessary legislation to establish NOPSA under the *Petroleum (Submerged Lands) Act 1967 (P(SL)A)* and in doing so, make substantive changes to the occupational safety and health provisions of the Act.

Three main areas of recent activity include:

- Developing draft legislation to establish NOPSA under the P(SL)A and to make substantive changes to the occupational safety and health provisions of the Act. (The Exposure Draft of the bill was released for circulation on 1 August 2003, see www.aph.gov.au/library.)
- Development of a funding regime whereby operators of offshore petroleum facilities will pay various levies relating to and funding NOPSA's activities.
- Development of a Transitional Management Plan (TMP) which outlines the guiding principles under which the Authority will be established, identifies the key challenges that lie ahead and records agreement regarding human resources, project governance, organisational design and the regulatory framework. Importantly, it demonstrates the commitment of all jurisdictions to maintain the integrity of the current regulatory framework during the transition process. (See www.isr.gov.au/library.)

2. EXPLORATION AND INVESTMENT

2.1 Mineral Exploration

Australian Bureau of Statistics (ABS) data for mineral exploration showed an increase in Western Australian expenditures for the first time in six years measured in constant dollars.

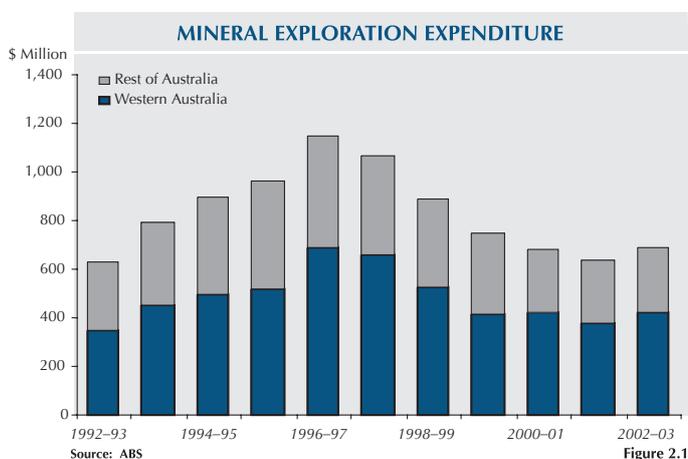
Western Australian mineral exploration expenditure in 2002–03 was \$424 million, up 11% from \$381 million in 2001–02. Nationally there was a 14% increase in mineral exploration expenditure from \$641 million in 2001–02 to \$733 million in 2002–03. As a consequence Western Australia's share of national exploration expenditures declined marginally to 58%.

Some individual commodity fourth quarter data were withheld from publication for confidentiality purposes. Comparing the first three-quarters for the financial year 2002–03 shows that gold exploration continues to dominate exploration expenditure at 64% of the total. Nickel–cobalt exploration comes a distant second at 12%, with iron ore expenditures at 9%, and all others making up the remaining 15%.

The largest expansion in exploration expenditure was in the gold sector, rising \$27.5 million from \$238.1 million in 2001–02 to \$265.6 million in 2002–03. Gains were also seen in base metal (and silver) exploration expenditure, which was up \$10.4 million to \$72.5 million, and for iron ore, which increased \$7.8 million to \$26.5 million (comparing first three-quarters in each year only). The only major decrease in exploration was witnessed in the diamond industry, which dropped \$12.4 million to \$17.8 million in 2002–03.

While there has been a pervasive decline in mineral exploration expenditures in Australia, this has been echoed around the world such that Australia's share of world expenditure has remained steady at around 18%. Western Australia's share of global expenditures represents 10% of the whole. The overall decline in world mineral exploration funding is blamed on a number of factors such as low commodity prices, a perception of mining as a low profit activity, a lack of venture capital and slowing world growth.

The steady decline in exploration expenditure since 1996–97 prompted two government studies. The first is



an Australian Government study chaired by the Hon. Geoffrey Prosser, and the second is a Western Australian Government initiative chaired by Mr John Bowler. Both inquiries are linked from the DoIR home page www.doir.wa.gov.au.

The Bowler Report highlighted several major issues that could improve exploration expenditure, namely reduction in the backlog of mining lease applications, improving the perceptions of the prospectivity and attractiveness of investment in exploration projects, management of native title and mineral title issues, improving land access, research and development, Federal Government issues (particularly taxation), and increasing community understanding of the resources sector.

The Bowler Report made 33 recommendations to address these issues. A response from the Western Australian Government to the report made on 13 July 2003 showed the State Government as strongly supportive of most recommendations and as taking steps to address the issues that were not already in hand.

2.2 Petroleum Exploration

The ABS statistics released for 2002–03 show petroleum exploration expenditure rebounding somewhat from the decline in 2001–02 both in Western Australia and the country as a whole. Western Australian petroleum exploration expenditure increased 25% from \$480 million to \$598 million. Australia-wide, expenditures increased from \$883 million to \$995 million, or by approximately the amount of the Western Australian increase. As a consequence, Western Australia's share of the total expenditures increased from 54% to 60%.

In 2002–03, a total of 66 new wells were drilled in Western Australia, an increase over the 59 drilled in 2001–02. The breakdown of well types was as follows: 38 new-field wildcat (NFW) wells, 16 extension wells, and 12 extension wells. The basins explored were Carnarvon (47 wells), Perth (14), Browse (4) and Bonaparte (1). There was no new drilling in the Canning Basin.

The 25 offshore NFWs drilled in Carnarvon resulted in three significant discoveries (Stybarrow 1, Ravensworth 1 and Cyrano 1). In the Perth Basin, 4 offshore and 3 onshore NFWs were drilled, with the latter resulting in two significant oil discoveries (Eremia 1 and Jingemia 1). Offshore NFWs in the Browse Basin (4 drilled) and Bonaparte Basin (1) did not intersect any significant hydrocarbons.

Seismic survey activities continued to decline in 2002–03 with 17 435 of line km acquired in 2D surveys and 3 342 line km of 3D surveys. This is down from 23 833 and 7 627 km in 2001–02 respectively. The majority of the survey data were collected in the Perth and Carnarvon Basins, with relatively little activity in the Bonaparte and Browse Basins.

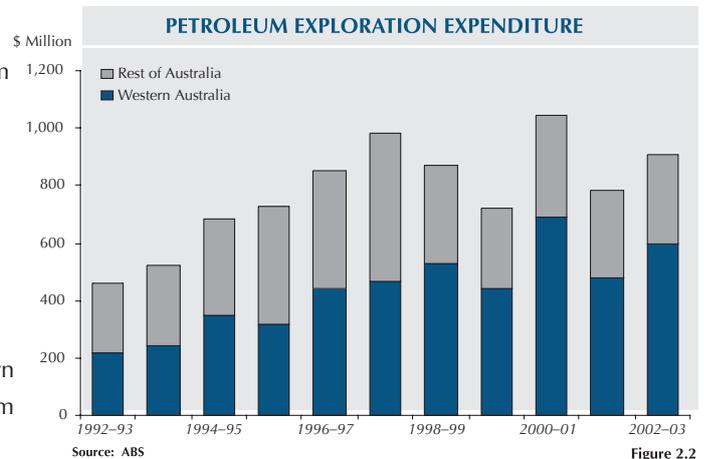
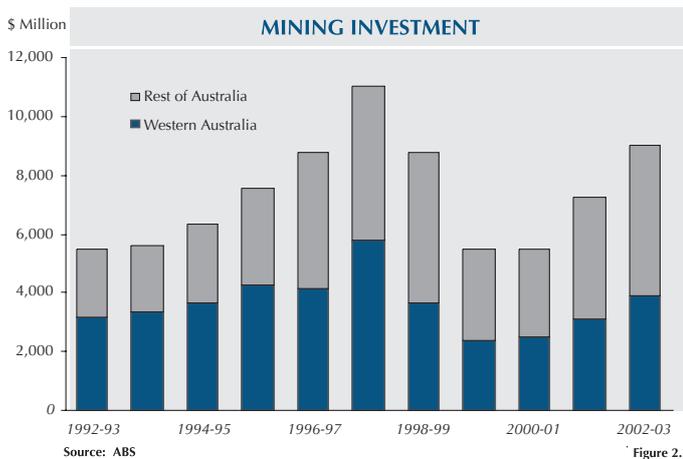


Figure 2.2

2.3 Investment

The ABS capital expenditure data for 2002–03 showed that Australia's investments in the mining sector increased 24% from \$7 250 million in 2001–02 to \$8 989 million in 2002–03. During the same period Western Australia's mining investment increased from \$3 091 million to \$3 902 million. Western Australia's mining investment share remained at 43% of the national total. Total capital investment in Western Australia amounted to \$7 157 million, such that mining investment makes up a 55% share.

Delta Electricity and Access Economics' Investment Monitor takes a longer term perspective by accounting for projects under construction, those committed and those that are merely under consideration or possible. Summary data for the entire project database show Western Australia with \$43 665 million of the mining and metals industry projects compared to the Australian total of \$95 757 million. These projects represent 13.9% and 30.6% shares respectively, of the \$313 434 million of projects listed in all industry investment categories for Australia.



As noted in more detail in previous editions of this publication, the ABS mining investment data should be interpreted with caution as it is based on Australian and New Zealand Standard Industrial Classification (ANZSIC) and does not fully reflect all the investments made in the industry during the year. Downstream processing projects in particular are generally grouped with the manufacturing sectors.

Highlights of major projects that were under development during 2002–03 include:

- Telfer gold mine expansion – Newcrest Mining is investing \$1.2 billion to develop a new ore body and processing facilities.
- Mining Area C – BHP Billiton has invested \$1.0 billion to fast-track this Marra Mamba iron ore deposit to meet strong Asian demand.
- Hismelt Kwinana plant – Hismelt is in a \$600-million joint venture to produce pig iron by direct smelting iron ore fines.
- North West Shelf LNG train 4 – The fourth train and associated trunkline development have been proceeding, with a total expected investment of \$2.4 billion.
- Burrup Peninsula ammonia plant – This \$630 million investment will be converting natural gas to ammonia for export to fertilizer manufacturers in India and the rest of the world.

3.1 Overview and Outlook

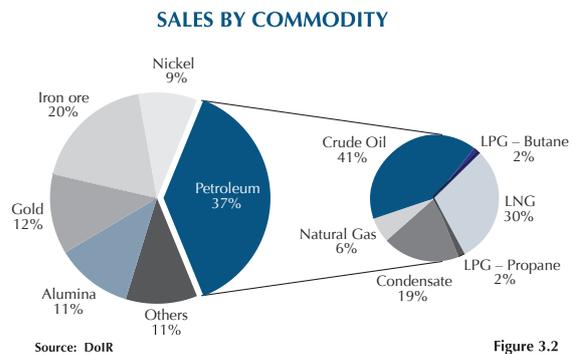
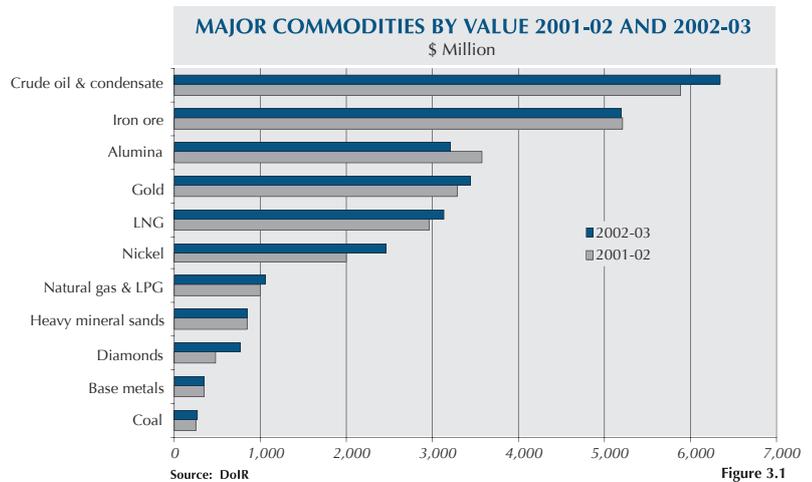
In 2002–03, the total value of Western Australia’s mineral and petroleum sales reached \$28 billion. This is a 4% increase compared to 2001–02 and is a good outcome considering the increased value of the Australian dollar against the US currency and the industry’s extraordinarily high growth rates in recent years.

The increase is also noteworthy considering that global commodity market conditions for some of Western Australia’s key resource exports, particularly iron ore, alumina and mineral sands were not favourable. Positively though, significant global price increases were experienced in the oil, gold and nickel markets. These increases were important in counteracting the adverse affect of the higher value of the Australian dollar, which against the US dollar, appreciated by 12% during 2002–03.

Petroleum, the State’s largest resource sector, benefited from higher prices despite production levels falling for crude oil. However, sales volumes for the remaining key petroleum products, LNG and condensate, increased resulting in the total value of petroleum sales increasing by \$688 million or 7%. Similarly, higher prices for diamonds, nickel and gold translated to these sectors reporting increased sales value despite the appreciation of the Australian dollar.

In contrast, despite the iron ore sector increasing sales in 2002–03 by 14% to achieve a new record of 188 Mt, lower prices from the previous round of negotiations, in combination with the appreciation of the Australian dollar, meant that the record volume of sales could not be translated into increased sales values, with total sales value remaining static at \$5 194 million. Similarly, record production levels of 11.1 Mt in 2002–03 for alumina did not translate into increased value of sales due to lacklustre prices and a strong Australian dollar.

Considering longer term growth in the Western Australian mineral and petroleum industry, results for 2002–03 show that the value of mineral and petroleum production has more than doubled in the last ten years. It has demonstrated a solid average annual growth rate of 8.5% per annum since 1992-93, far outstripping the growth of the economy in general.



The outlook for Western Australia’s mineral and petroleum industry is dependent on world economic growth. Due to higher growth in global industrial activity, world consumption of major minerals and energy commodities is forecast to increase in 2004. China is expected to be a major source of growing commodity consumption and has been reported to account for 25% of global growth in commodity demand over the past seven years. All indications are that the Chinese economic growth will continue for the immediate future, implying a continued growing demand for commodities such as iron ore, nickel, copper, mineral sands and energy.

Despite the forecast increases in consumption of major minerals and higher growth rates of global industrial activity, the price forecast across a range of mineral and petroleum commodities is divergent due to varying supply outlooks. For example, nickel prices are forecast to rise in 2004 due to strong demand coupled with extreme tightness in the global nickel

market due to supply constraints. Supply shortages are also appearing in the iron ore sector leading analysts to forecast a boost in prices of around 9% in 2004. However, the current price rises being forecast for copper and zinc may be moderated by idle copper and zinc capacities coming on-stream again as market conditions improve.

Price forecasts for oil and gold are particularly difficult. In addition to economic factors, the global political climate presents additional challenges in finding a consensus on the price outlook for these commodities. However, ABARE forecasts that the price of gold is to be weaker in 2004 depending on the gradual strengthening of the world economy, interest rates and hedging. Likewise, ABARE forecasts that long-term oil prices are to ease with increases in oil production in 2004. This is dependent on several OPEC members adhering to their announced intentions to increase output. This increase is supposed to include Iraq in its attempts to foster an economic recovery.

3.2 Commodity Price Index

The RBA produces a monthly commodity price index, which includes both non-rural, and base metals commodity price indexes. Commodities included in the non-rural index are steaming and coking coal, LNG, gold, iron ore, alumina and base metals consisting of aluminium, copper, nickel, zinc and lead. The RBA also produces a separate index comprising just the latter group of base metals.

In 2002–03, the average base metals index (consisting of aluminium, nickel, copper, lead and zinc) in US currency terms, showed that base metal commodity prices had risen by 5% in 2002–03. This was primarily due to stronger nickel prices. The annual average non-rural commodity price index figures, in US currency terms, had risen by only 2% compared to the previous year. The latter increase was not as great as that of the base metals due to a significant fall in price for steaming coal, coking coal and iron ore.

However, in Australian currency terms the average base metal and non-rural commodity price index fell 6% and 9% respectively in 2002–03. Comparing the Australian currency index to the US currency index demonstrates the interrelation between world commodity price and the Australian exchange rate.

Reserve Bank of Australia (RBA) Commodity Price Index

The Reserve Bank of Australia Commodity Price Index is based on the price of 19 major commodities exported by Australia. These commodities collectively account for around two-thirds of total commodity exports. The index is apportioned into three sections – rural, non-rural, and base metals.

The non-rural index comprises base metals (which consist of aluminium, copper, nickel, zinc and lead), gold, coking coal, steaming coal, iron ore, alumina and LNG. The index is compiled monthly and is expressed in US dollars, Australian dollars and Special Drawing Rights (SDR).

The RBA's index, expressed in US dollar terms is useful because most commodities are traded in world markets in US dollars. However such an index is subject to changes in the US dollar exchange rate (as it is based on spot prices). In this respect, the SDR index is a better indication of underlying supply and demand for commodities than the US dollar index.

SDR is a unit of account used by the International Monetary Fund (IMF). Its value is based on a basket of currencies comprising the euro, Japanese yen, English pound and US dollar. Weights are assigned to each of these currencies to reflect their relative importance in world terms. The RBA expresses the SDR component of its index in US dollar terms, with commodity prices derived from the London Metal Exchange and Bloomberg and converted to monthly averages of daily data.

Alternatively, the Australian dollar index is useful for gauging the domestic currency price received by Australian commodity exporters as it reflects the interrelation between world commodity prices and the Australian exchange rate. For example, if prices in foreign currency terms remain unchanged but the Australian dollar depreciates, this will be recorded as a favourable upward shift in the index, which would not be evident in either the SDR or US dollar index.

The RBA index is a fixed-weight Laspeyres index, using 2001–02 as the base year and excludes crude oil. The index is re-based every five years in order to make long-run reliable comparisons, unlike the national accounts that are re-based annually to track short-run movements. Base-period weights indicate the relative importance given to individual commodities. They are based on gross exports thus explaining the omission of crude oil (for which Australia is a net importer) and correspond to the export value of each commodity as a share of total exports. These weights change over time to reflect changes in the composition of commodity exports. Movements in the index from one period to the next reflect underlying price movements and do not take into account changes in volumes.

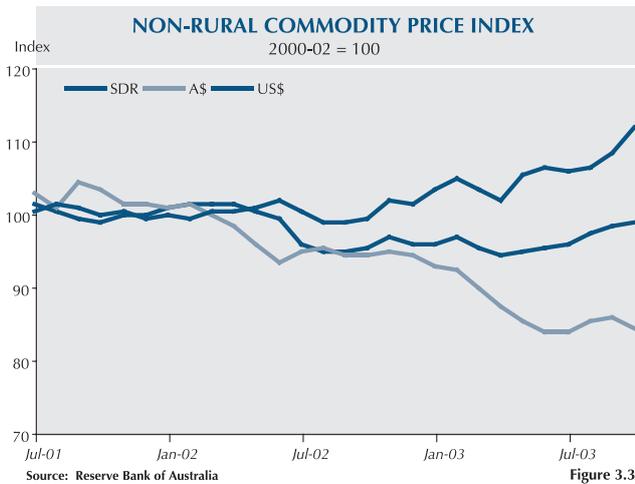


Figure 3.3

The falling index price in Australian currency is due to the net effect of the increases in global commodity prices being negated by a 12% appreciation of the Australian dollar against the US.

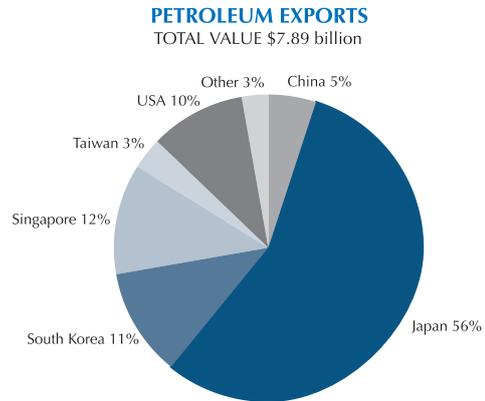
3.3 Petroleum

Petroleum is the largest resource sector in Western Australia. In 2002–03, the petroleum industry accounted for 38% of the State’s total value of mineral and petroleum sales. Crude oil was the principal contributor and accounted for 41% of total petroleum sales value, followed by LNG (30%), condensate (19%), natural gas (6%), LPG-butane (2%) and LPG-propane (2%).

Firmer oil prices and increased sales volumes of LNG, condensate and natural gas contributed to the overall value of Western Australia’s petroleum sales increasing by 7% in 2002–03 compared with 2001–02.

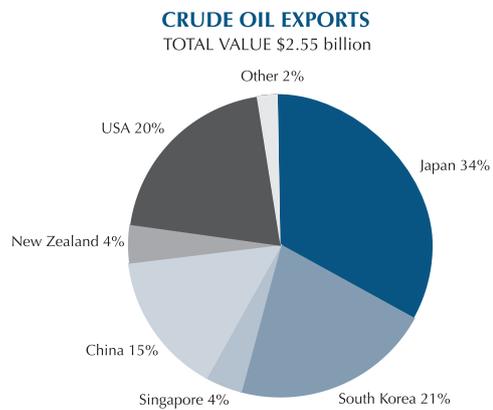
Crude Oil

Crude oil represents the most valuable proportion of Western Australia’s petroleum resource sales. In 2002–03, due to decreased production from several oil fields, the volume of crude oil sales dropped by 8% to 88 MMbbl. Production decreases were most notable in the Cossack–Wanaea and Griffin fields and from oil fields in the Thevenard Island area such as Saladin, Roller–Skate and Cossack. The Harriet area fields experienced a 37% increase in volume of crude oil sales in 2002–03. This was partly attributed to a number of new fields commencing production during the year such as Victoria, South Plato, Pedirka and Gibson and



Source: DoIR

Figure 3.4



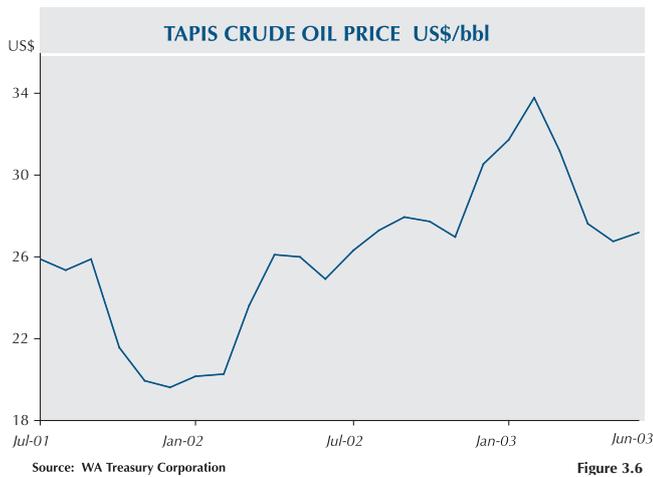
Source: DoIR

Figure 3.5

new wells in the Simpson field. However, with the proposed developments of projects in new fields and the commencement of the Woollybutt, Eremia, Hovea and Jingemia projects in 2003, falls in production levels will be at least partially ameliorated.

World oil prices in 2002–03 averaged US\$29 per barrel and were around 24% higher compared to the previous financial year. Prices peaked in February 2003 at US\$34 per barrel WTI, reflecting concerns over a disruption in oil supplies as a result of possible war with Iraq. The increase in oil prices more than compensated for the fall in output and a strong Australian dollar, resulting in the value of sales increasing by 2% to \$4 296 million.

During 2002–03, \$2.5 billion or 59% of Western Australia’s crude oil was exported. The major export markets for crude oil included Japan, accounting for



Low levels of Organisation for Economic Cooperation and Development (OECD) oil stocks are also placing an upward pressure on price, with stock levels not expecting to return back to normal till early 2004.

Condensate

In contrast to crude oil, a full year of production from the new Echo–Yodel gas and condensate field helped set a new record with the volume of condensate sales increasing by 10% to an all-time high of 44 MMbbl. Aided by high oil prices, this also helped condensate attain a new sales record in 2002 of \$2 052 million, an increase of 22% compared to last financial year. Increase in oil prices and quantity resulted in record sales despite a 12% increase in the value of the Australian dollar against the US dollar.

In 2002–03, condensate exports amounted to \$1 818 million or 89% of the State’s condensate. This represented an increase of 25% on the previous year’s exports of \$1.4 billion. Singapore remains the largest condensate export market accounting for 45% of the State’s total exports. Exports to Taiwan fell by 13% from \$404 million in 2001–02 to \$266 million in 2002–03, now accounting for only 15% of the total exports. Other major export markets were South Korea (15%) and the United States (15%).

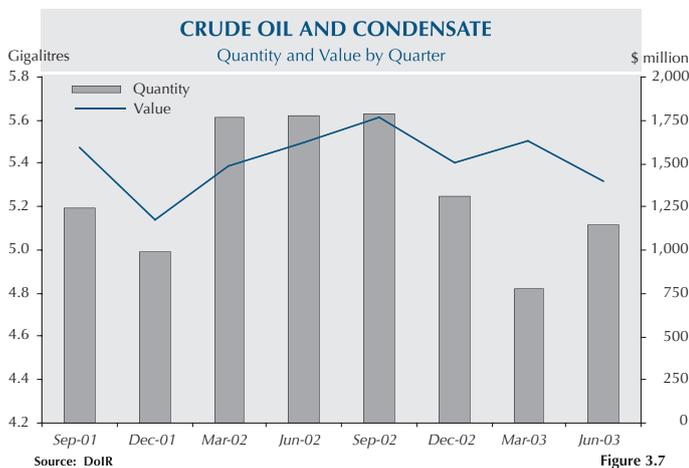


Figure 3.7

34% of the total value of exports, South Korea (21%), United States (20%) and China (15%). Compared to 2001–02, crude oil exports to China increased significantly at the expense of South Korea.

The long- to medium-term outlook for Western Australia looks promising. Petroleum exploration expenditure is up for the second half of the year and a number of significant oil discoveries have been made. This includes Stybarrow in the Carnarvon Basin and the Eremia in the Perth Basin.

ABARE estimates that world oil prices will decrease to US\$27/bbl as the tight supply-demand conditions ease in 2004. Current high prices have been partly attributed to the uncertainty over future oil supplies. Although the war in Iraq ended sooner than expected, the recovery of oil production to pre-war levels has been slow due to sabotage and security problems.

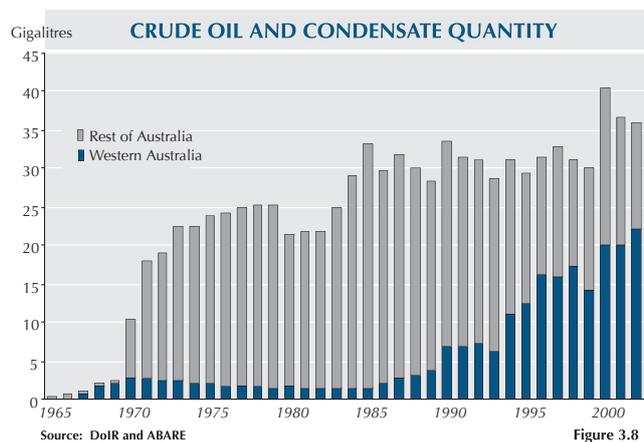
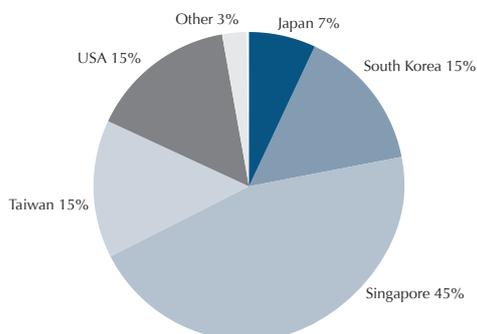


Figure 3.8

Although, Goodwyn continues to be Western Australia’s largest producer of condensate, generating 17 MMbbl, production levels have significantly decreased and were down by 33% compared to 2001–02. Echo–Yodel contributed 28% or 12 MMbbl, making it the State’s second-largest condensate producer and was responsible for the strong recovery in quantity levels in the June 2003 quarter. Western Australia remains the

CONDENSATE EXPORTS
TOTAL VALUE \$1.82 billion



Source: DoIR

Figure 3.9

nation's primary producer of crude oil and condensate, accounting for 61% of production, compared to 55% in 2001. However, the nation's crude oil and condensate output for 2002 has decreased by 16%.

Australia's largest oil company, Woodside Energy Ltd, recorded a 40% increase in condensate sales during the first half of 2003 compared to the same period last year. The increase in sales was primarily due to increases in oil and condensate prices. Woodside's realised oil price increased 22% to A\$46.49/bbl for the first half of 2003. The increases in price more than compensated for the lower production levels. In the first half of 2003, Woodside produced 29.9 MMbbl of oil equivalent, 3% less compared to the same period in 2002. The lower production levels were largely due to declining oil production from Laminaria, Legendre and Cossack.

Liquefied natural gas (LNG)

Liquefied natural gas is Western Australia's second most valuable petroleum product after crude oil. In 2002–03 LNG accounted for 30% of total petroleum sales. LNG sales were up by 5% to 7.8 Mt, partly as a result of a full year of gas production from the Echo–Yodel field. The North Rankin, Lambert, Hermes and Cossack fields also experienced increases in production.

The value of LNG sales was also up, by more than 5% to \$3 132 million. This contributed to the overall value of Western Australia's petroleum sales increasing by 7% in 2002–03 to \$10 542 million. However, due to the appreciation of the Australian dollar and the contractual arrangements that characterise the State's LNG sales, the value of the LNG shipments did not fully benefit from the higher oil prices.

Japan continues to dominate as an LNG export destination receiving 98% of exports. The North West Shelf (NWS) project began LNG exports to Japan in 1989 under a long-term contract. In July 2003, the NWS project reached a key milestone by delivering its 1 500th cargo of LNG to customers Osaka Gas and Kansai Electric.

During the year, the NWS project signed a further agreement with Kansai Electric for the long-term supply of LNG. The agreement is for the annual supply and purchase of 0.5 Mt of LNG between 2009 and 2014. This increases to 0.925 Mt of LNG a year between 2015 and 2023. The initial LNG agreement between Kansai Electric and the NWS LNG sellers was signed in 1985. The agreement was for 1.13 Mt a year, for 20 years, starting in 1989.

In addition to contract sales, "spot" cargo sales have also taken place around the world. In August 2003, the NWS LNG sellers signed an agreement for the supply of up to 135 000 cubic metres of LNG. BP will deliver the cargo to a receiving terminal in Spain.

Construction continues on the fourth processing train as part of the NWS LNG expansion project. Currently, the project is at the pre-commissioning phase, with completion scheduled for mid-2004. The fourth train with associated utilities will be fully integrated into the existing three-train plant. It is expected that the new plant will add up to 4.2 Mt/a LNG production on top of the 7.5 Mt/a of existing production levels.

Associated with the NWS project is construction of an \$800-million second offshore trunkline. The new trunkline, scheduled for completion in mid-2004 will complement the current NWS expansion project. The 130-km, 42-inch diameter trunkline will link the NWS offshore gas production facilities with the Burrup Peninsula. The new trunkline will meet increased demand from existing and new customers as well as the additional developments proposed for the Burrup Peninsula.

These additional developments currently proposed include a range of petrochemical projects comprising:

- Sasol Chevron's Gas-to-Liquids (GTL) project (initial production about 50 000 bbl/d of synthetic diesel, expanding to 200 000 bbl/d over the next decade);

- Dampier Nitrogen-Ammonia-Urea project (1.2 Mt/a of granular urea and 100 000 t/a of ammonia);
- Japan DME di-methyl-ether project (1.7 Mt/a of DME); and
- Burrup Fertilisers (commenced construction in May 2003).

A project of great significance to the Western Australian economy is the proposed development of the Gorgon gas field. This project centres on the development of an LNG facility on Barrow Island, which will supply LNG for distribution to markets abroad. In September 2003 an in-principle agreement was signed between ChevronTexaco and the State Government for the restricted use of Barrow Island as part of the \$11-billion Gorgon gas project. The agreement is a major milestone in Western Australia's economic development. The Gorgon gas area (comprising the Gorgon field, West Tryal Rocks, Spar, Chrysaor and Dionysus fields) contains certified gas reserves of 12.9 trillion cubic feet (Tcf). The proponents of the project, the Gorgon Joint Venture, comprise ChevronTexaco (4/7th interest), Shell (2/7th interest) and ExxonMobil (1/7th interest).

Natural gas

Natural gas sales increased by 4% from \$643 million in 2001–02 to \$667 million in the 2002–03 financial year. The increase in production levels was partly responsible for the increase in natural gas sales. In 2002–03, natural gas production increased by 10% to 8.2 Bcm. Figures for 2002–03 also show the quantity of natural gas produced for domestic consumption has more than doubled since 1992–93. Outside of gas used as feedstock for LNG production, all natural gas produced is for domestic industrial and household consumption.

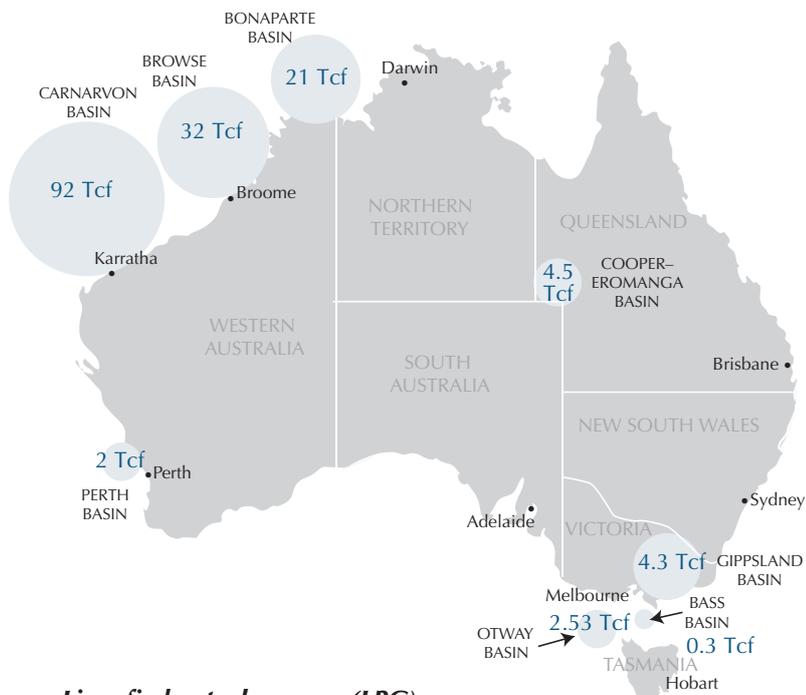
In 2002–03, the top three natural gas producers for domestic consumption were North Rankin producing 3.0 Bcm, followed by Goodwyn producing 1.6 Bcm and East Spar (1.1 Bcm). Production from these fields account for 69% of the State's total natural gas production for domestic consumption.

As at the end of 2002, the gas reserves for Australia were:

- Bonaparte Basin 20 Tcf (Western Australian portion 1.92 Tcf, Northern Territory portion 17.7 Tcf)
- Browse Basin 32 Tcf

- Carnarvon Basin 92 Tcf
- Perth Basin 2 Tcf
- Otway Basin 2.53 Tcf
- Bass Basin 0.3 Tcf
- Gippsland Basin 4.3 Tcf
- Cooper–Eromanga Basin 3.5 Tcf

Reserves for Western Australia are calculated on the basis of a 50% probability of recovery level as well as unbooked resources. An unbooked resource refers to resources that may or may not eventually prove viable. They are resources that have not at present been delineated, audited or appraised by an independent third party. Reserve figures for the rest of Australia are calculated on a 50% probability only.



Liquefied petroleum gas (LPG)

LPG production (including butane and propane) fell to 807 063 t, a reduction of 6% compared to 856 522 t in 2001–02. Although Echo–Yodel recorded over a three-fold increase in production, it was not enough to alleviate significant reductions in production levels most notable in Athena, Goodwyn and Wanaea.

The LPG sales accounted for 4% of Western Australia's total petroleum sales in 2002–03. Despite a reduction in production levels, higher prices translated into the value of LPG sales increasing by 9% to \$394 million. Japan remains the primary export destination for Western Australia's LPG.

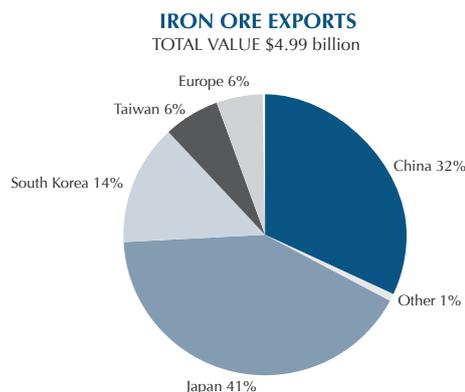
3.4 Iron ore

Surpassed only by the petroleum industry, the iron ore industry is the second-largest commodity sector in Western Australia, accounting for nearly 19% of the State's total mineral and petroleum sales in 2002–03. In terms of physical demand, 2002–03 was a good year for the Western Australian iron ore industry. The volume of iron ore sales increased dramatically by 14% in the financial year to achieve a new record of 188 Mt. However, the previous round of price negotiations in 2002 had resulted in price cuts applying to most of 2002–03. In combination with the appreciation of the Australian dollar, the record volume of sales could not be translated into increased sales values, with total sales value in 2002–03 remaining static at \$5 194 million.

Western Australia is one of the world's major iron ore producers. During 2002, the State alone accounted for more than 16% of the world's iron ore production. Western Australia has also been the overwhelmingly dominant iron ore producing state in Australia since the late 1960s, with a major share varying from 84% to 99%. In 2002, 97% of Australia's iron ore production was from Western Australia.

Western Australia's iron ore industry is highly export oriented and accounts for about 37% of global iron ore seaborne trade. In 2002–03, Western Australian iron ore exports were up 4% to \$4 993 million, representing 96% of the State's iron ore sales. East Asia remained the principal destination for Western Australian iron ore shipments. Compared with 2001–02, the value of Western Australian iron ore exports to China and Japan increased by 19% and 5%, respectively. While Japan remained the largest market for Western Australian iron ore exports, accounting for 41% of Western Australia's total iron ore exports, China had significantly increased its share from 28% in 2001–02 to 32% in 2002–03. Japan, China, South Korea and Taiwan together accounted for about 94% of the State's total iron ore exports.

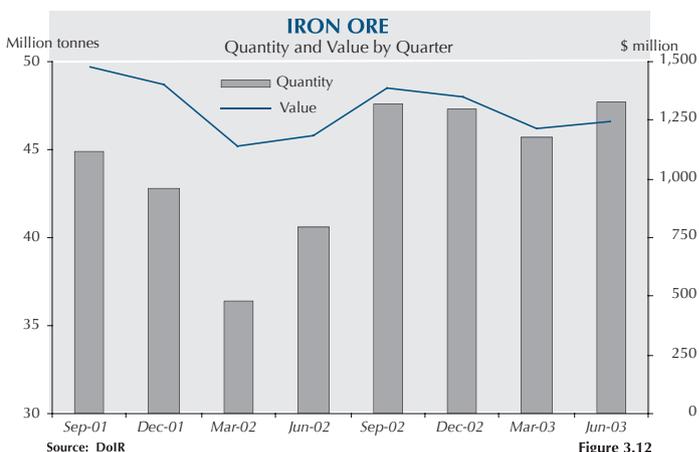
The fundamentals in the world iron ore market improved in the past year. Although iron ore consumption in North America and Europe continued to be weak, demand for iron ore was booming in major Asian markets as steel production grows, particularly in China, which has the largest iron and steel industry



Source: DoIR Figure 3.10



Source: Tex Report, High Grade Fine Ore Prices Figure 3.11



Source: DoIR Figure 3.12

in the world in terms of output. In 2002, China's crude steel production surged by 21% to reach a record 182 Mt. Japan's production was up 4.7% at 108 Mt. Crude steel production in South Korea, India and Taiwan was also up, with increases ranging from 3.5% to 5.6%. Asia as a whole increased crude steel production by more than 11% to reach 393 Mt, accounting for 43.5% of the world's total.

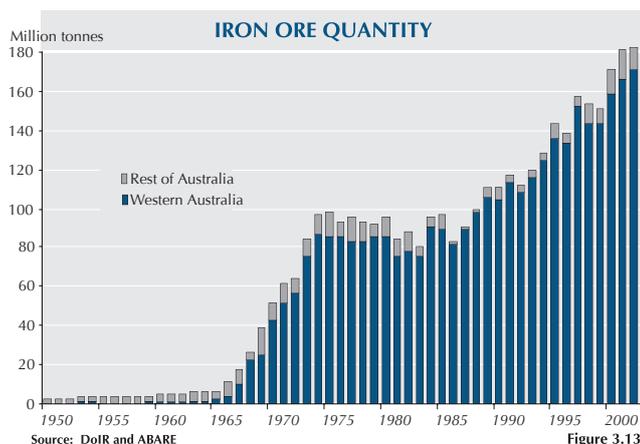


Figure 3.13

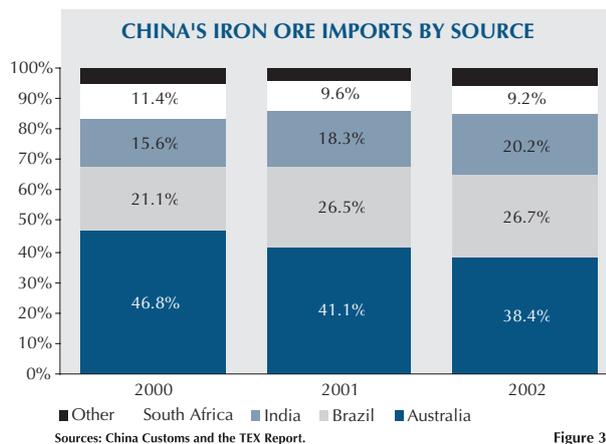


Figure 3.14

Driven by strong growth in crude steel production, China's apparent consumption of iron ore rose by nearly 11% to 343 Mt and its iron ore imports increased by around 20 Mt in 2002. Japan also increased its imports by almost 3 Mt, posting its second highest import level in well over a decade at 129 Mt. Strong demand for iron ore in Asian markets driven by China's thriving steel industry has stimulated iron ore producers throughout the world to increase output. World production of iron ore increased by 4% and for the first time exceeded 1 100 Mt to reach 1 108 Mt in 2002. International iron ore trade also rose by 8% to reach record levels at 522 Mt.

Buoyant demand in major Asian markets boosted both iron ore production and shipments from Western Australia, leading to a dramatic 14% increase in volume sales and a price rise. Price negotiations between Australian iron ore producers and Japanese steel mills for the Japanese fiscal year in 2003 were as tough and protracted as in 2002. However, despite being deadlocked for months, improved market conditions fuelled by strong demand for iron ore in China assisted in obtaining better prices for Western Australian iron ore producers. Following the Brazilian Companhia Vale de Rio Doce (CVRD), the world's largest producer, striking a 9% price increase with European steel maker Arcelor in May 2003, the State's iron ore producers achieved a similar price rise for the Japanese financial year beginning 1 April 2003. Specifically, fine ore prices increased by 9% to US\$30.83 cents per dry long ton unit, lump ore by 8.9% to US\$39.35 cents and Yandi ore by 9% to US\$28.97 cents. The increase in iron ore prices in 2003 is the largest price rise in more than a decade,

reflecting an unprecedented level of demand for iron ore mainly driven by the growing steel industry in Asia, particularly China.

According to AME Mineral Economics, world iron ore imports are forecast to reach a record 560 Mt in 2003 and expand to 584 Mt in 2004 underpinned by continually surging imports in China. China is forecast to become the world's largest iron ore importer in 2003 with imports expected to total 150 Mt. Chinese iron ore imports are expected to rise by another 20 Mt in 2004, accounting for 83% of forecast increase in world iron ore imports for the year.

Booming Chinese demand is likely to change the market structure for Western Australia's iron ore exporters in the future. Although Japan remains the dominant destination for Western Australia's iron ore exports, China has been increasing its iron ore imports from the State over the last three years, with its share in the State's total iron ore exports rising from 20% in 1999 to 28% in 2002. By contrast, the proportion accounted for by Japanese importers has been falling in recent years, from 48% in 1999 to 43% in 2002.

Australia is the largest supplier of iron ore to China, accounting for 38.4% of the market in 2002, followed by Brazil (26.7%), India (20.2%) and South Africa (9.2%). Historically, Western Australia's high share of the Chinese iron ore market has been attributed to competitive transport costs due to Australia's proximity. Also, the State's competitiveness in the Chinese market has now been further enhanced by the greater production efficiency of Western Australian iron ore producers.

However, there are increasing challenges to Western Australia's iron ore exports to China given the fierce

competition between international iron ore producers. Brazil's CVRD for example, continues an aggressive approach to secure a greater share of the Chinese market. CVRD's share of the world iron ore market has already increased over the last three years from 12% to 15.6%. Its share in the Chinese iron ore market has also risen from 21% in 2000 to 28% in 2002. By contrast, Western Australia's share of the Chinese market was down nearly six percentage points in 2001 and down again about three percentage points in 2002. Meanwhile, India's share of the market has also increased from just under 16% in 2001 to more than 20% in 2002.

In the face of these challenges, the Western Australian iron ore producers will work harder to secure their market shares. To take maximum advantage of further export opportunities over the next ten years, principally in China, Western Australia's established and potential new suppliers continued to develop and assess the feasibility of a number of new iron ore projects during 2002-03. Planned expansions could push output capacity to 260 Mt/a over the next three to four years and with new developments gradually attaining design output levels, capacity could increase to around 320 Mt/a.

In August 2002, the formal opening of the \$450-million Robe River Iron Associates West Angelas mine not only signified the arrival of Western Australia's newest Pilbara mine, but also a new generation of projects from which Marra Mamba-type ores will be extracted and processed. It is estimated that the mine will process a total of 440 Mt of Marra Mamba reserves, commencing at a rate of 7 Mt/a. Located 110 km west of Newman and 330 km southeast of Cape Lambert in the East Pilbara of northern Western Australia, the ore is transported by rail to newly expanded port facilities in Cape Lambert. The new ore, which is higher in calcined iron and has lower levels of impurities, is to be supplied to six Japanese steel mills, comprising Nippon Steel, NKK Corporation, Kawasaki Steel, Sumitomo Metal Industries, Kobe Steel and Nisshin Steel. The West Angelas mine was a major contributor to the growth in production in 2002-03. The ramp-up of the West Angelas iron ore mine continues. It is expected to reach a 20 Mt/a production rate in the first half of 2004, two years ahead of schedule.

Another major project aiming to exploit Pilbara-based Marra Mamba-type ores is BHP Billiton's Mining Area C (MAC), located 120 km north of Newman. MAC contains

890 Mt of Marra Mamba ore, the largest undeveloped resource of its kind in the Pilbara. The project is an addition to the company's existing Yandi mine. It is to include a mine and processing facility as well as a range of infrastructure including a rail spur to link MAC to the original Yandi mine, power, water, airstrip and roads. BHP Billiton and the State approved the development of MAC in April 2002. The first 60 000 t of MAC iron ore was loaded on board for trial in South Korea in May 2002. Customer feedback from the trial has been positive. Full iron ore production at MAC is scheduled to begin at the end of 2003. About 500 people are involved in construction decreasing to a permanent workforce of about 100 when operation starts. The \$350-million project was originally planned to produce up to 15 Mt/a to the world iron ore market by 2011 and provide the capacity for further easy expansion to meet any further market demand. In response to surging demand in the world iron ore market, the development has been accelerated and the capacity will now be available by the first quarter of 2004. A minimum of 3 Mt/a of this production is to be supplied to South Korean steel conglomerate Pohang Iron and Steel Company Ltd (POSCO). The supply to South Korea represents part of the development agreement for the project, which entails a supply deal between POSCO and BHP Billiton, involving a direct stake in the ore body by POSCO.

Elsewhere in the State, the smaller iron ore producer, Portman Limited, proposed production increases from its Koolyanobbing mine, located 50 km northeast of Southern Cross, through the development of deposits at Mount Jackson and Windarling Range. The new mining areas are located some 100 km north of Portman's current mining operations at Koolyanobbing. With the bulk of the expansion focusing on these northern tenements, the securing of a key Native Title agreement in July 2002 opens the way for the expansion. The Western Australian Environmental Protection Authority gave conditional approval to the project in April 2003. In early September 2003, the project also received the federal environmental approval. Portman announced formal board approval on 30 September 2003. The expansion will involve haul-road construction and development of a new accommodation camp and services at Windarling. Ore mined from the new areas will be trucked to the existing processing plant for

blending with existing output to extend the life of the Koolyanobbing mine and potentially increase annual production. The capacity of the Koolyanobbing operation is expected to increase from 4.4 Mt/a to about 5.2 Mt/a after the expansion. Work has commenced to bring the new reserves into production in the first quarter of 2004.

Other expansions in the industry include Hamersley's Yandicoogina mine, which will see production expand from 19 Mt/a in 2002 to 24 Mt/a, with potential to exceed 30 Mt/a.

A major new project intending to exploit Marra Mamba-type ore is the Hope Downs project, proposed by Hope Downs Management Services Pty Ltd which is a joint venture owned by Hancock Prospecting and South Africa's Kumba Resources. The joint venture aims to develop a 400 Mt ore reserve 75 km northwest of Newman. The \$1.4-billion project will include a new \$300-million railway, following the Western Australian Supreme Court rejection of the joint venture's attempts to access BHP Billiton's Newman railway line. Despite the setback, it is expected that the mine could be in production by 2005–06 with ramp-up production levels of around 5 Mt/a building up to 25 Mt/a.

In other developments, Mount Gibson Iron Ltd intends to progressively develop a number of iron deposits in the Mid-west region of Western Australia which it owns or over which it holds mining rights. In August 2002, Mount Gibson Iron purchased Kingstream Steel's Talling Peak iron ore deposits in mid-west Western Australia, located 170 km from Geraldton. The acquisition entitles Mount Gibson Iron to an extra 40 Mt of hematite and 48 Mt of magnetite ore.

Mount Gibson Iron's first iron ore mine is currently being developed at Talling Peak. Mining has recently commenced and the first shipment of hematite is scheduled from January 2004. Total capital expenditure in the project is estimated to be \$24.5 million. Planned production rate from the first five years will be 1.6 Mt/a. The life of the mine is expected to be 8 to 10 years. All ore produced has been sold forward for the life of the mine. Subject to receipt of environmental and other approvals within the next 12 months, Mount Gibson Iron intends to proceed with the development of a 1.5 Mt/a hematite mine on the Extension Hill and Iron Hill deposits within the Mount Gibson Range. The first shipment of ore is planned for the second quarter of 2005.

In terms of iron ore processing, one of the highlights in 2002–03 was final environmental approval for Rio Tinto's Hismelt project at Kwinana, a key component in the commercialisation of Marra Mamba fines. Commercialising 20 years of Australian research and development, the new Hismelt technology is the world's most advanced method of direct pig iron smelting through conversion of iron ore to liquid pig iron by the injection of non-coking coal and fine iron ore into a molten bath. The project is a joint venture with Nucor (25%), Mitsubishi (10%) and Shougang (5%). The \$400 million plant has secured \$50 million in Federal Government funding and State Government assistance in the form of land and port access to the value of \$30 million. The project's aim is to produce pig iron at an annual capacity of up to 820 000 t in its first phase and increasing to 1.64 Mt/a in phase two by 2006. Construction of the plant commenced in mid-2003 employing 230 people, while full commissioning is set for late 2004 with an estimated 65 full-time positions required for the operational phase.

Western Australia's export capacity is to be boosted by a number of primarily iron ore-driven port facility upgrades throughout the State as part of the Government's \$225 million port enhancement program. The \$100 million Geraldton Port expansion project is the centrepiece of this program. The project mainly involves deepening the harbour basin and access channel to accommodate fully laden Handymax vessels at a maximum draft of 12.8 m, primarily for Mount Gibson Iron's iron ore exports. Commenced in 2002–03, dredging and facilities upgrade is nearing completion. BHP Billiton intends to increase its export capacity by developing a new stockpile area and upgraded berth handling capacity to accommodate 25 000-tonne ships at its Finucane Island Port Facility. The company also intends to upgrade its harbour tunnel in Port Hedland.

The new developments in the Western Australian iron ore sector will further strengthen Western Australia's position in global iron ore markets. Many industry analysts recognise that the expansion of China's steel industry holds the key to prospects for the iron ore sector in the region and for major raw material suppliers like Western Australia. Although there are some expressed concerns about the sustainability of China's

exceptionally fast growth rate in steel production among iron ore producers and market analysts, the short-term outlook for China's steel production remains bright given its strong economic growth, construction of facilities for the 2008 Beijing Olympic Games and the government's stimulating fiscal policy. As a result, demand for iron ore in the country will continue to grow over the next couple of years. Latest data show that China's iron ore imports for the first seven months of 2003 had risen 38% year-on-year. The continuing strong market conditions in China and new developments undertaken by Western Australia's iron ore miners, in combination with improving world economic growth prospects, augur a very positive prospect for the Western Australian iron ore industry in the coming year.

3.5 Alumina

The State's alumina industry is the fourth largest sector in terms of sales, accounting for 11.5% of total mineral and petroleum sales. During 2002–03, the total quantity of alumina sold continued to break new production records. The quantity sold increased by 3% to 11.1 Mt in 2002–03, compared to 10.9 Mt in 2001–02.

Australia is the world's largest bauxite and alumina producer. Refining bauxite to alumina is a value-adding process that increases the value of bauxite by a factor of ten. In 2002, Western Australia produced 20% and 68% of the world's and Australia's alumina respectively. The State's total alumina production has demonstrated a modest average annual growth rate of 5% per annum over the past ten years. However, the rest of Australia experienced fluctuation in quantities produced over the same time period.

Despite an increase in production, sales dropped by \$380 million or 10.6% to \$3 025 million compared with 2001–02. This is attributed to an 11% decrease in the average annual alumina price from \$315/t in 2001–02 to \$280/t in 2002–03. In 2002–03, alumina prices continued their steady downward trend that had characterised the previous financial year. The year commenced with alumina prices at \$287/t, by June 2003 prices dropped to \$259/t, and ended 2002–03 with the lowest price recorded for the financial year. The average alumina price for 2002–03 was \$280/t,

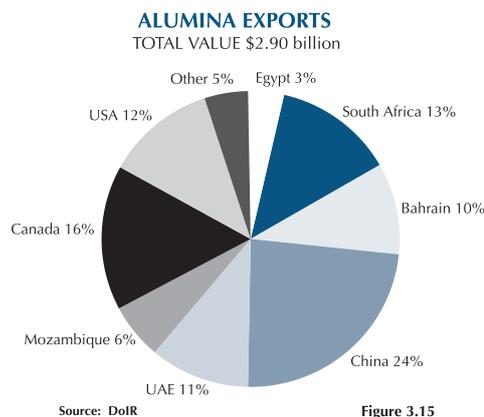


Figure 3.15

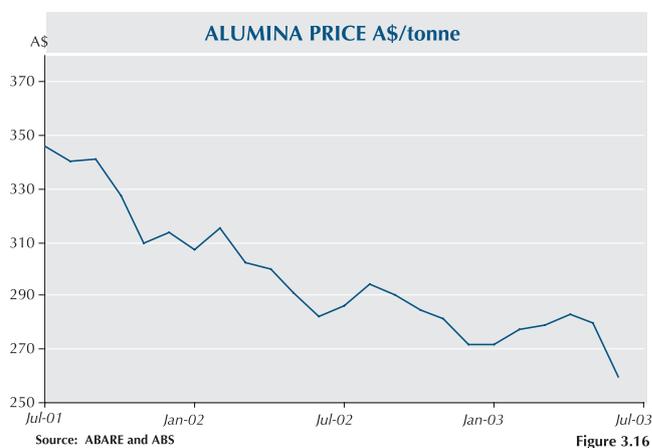
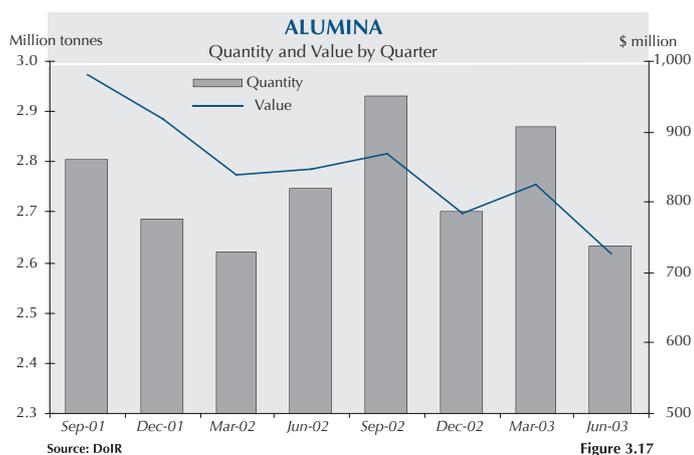


Figure 3.16

which was 11% lower compared to 2001–02.

Due to low alumina prices and a weak A\$ against the US\$, the total value of alumina exports in 2002–03 decreased by 11% to \$2.9 billion. China remained the State's largest export destination, accounting for 24% of exports by value or \$683 million. This was followed by Canada accounting for 16% of the State's alumina exports, an increase of 3 percentage points compared to 2001–02. Other significant export destinations were South Africa (13%), United States (12%), United Arab Emirates (11%) and Bahrain (10%).

Alumina exports are a reflection of the global aluminium market. More than 90% of the world's alumina is used for aluminium production, therefore, trends between alumina and the aluminium industry are strongly tied. ABARE forecasts world aluminium consumption to have increased by 9% to 26.8 Mt in 2003 and to increase by a further 6% in 2004. The primary source of increased consumption growth is expected to come from China as a result of expanding infrastructure and growth in its manufacturing and construction industries. It is reported that demand for



Increased aluminium smelter capacities to be commissioned in Norway, Brazil, the Russian Federation and India are also expected to increase production. These increases in aluminium production will more than offset a series of power-related smelter shutdowns in the United States, New Zealand and Ghana.

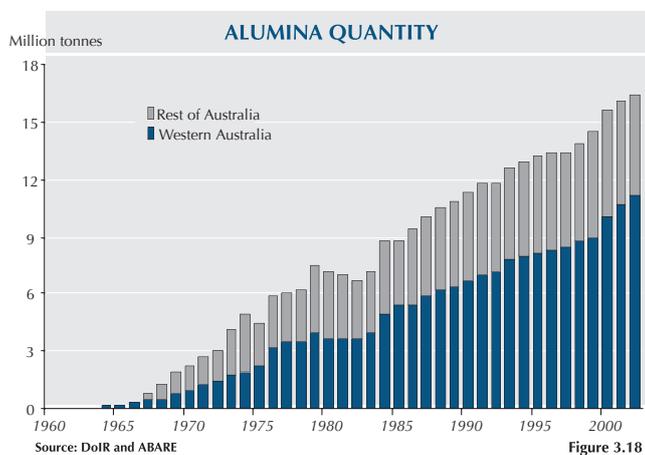
The forecast for the alumina industry looks tight, increases in aluminium smelter capacities have placed a greater demand for alumina. With only a few major increases in alumina refining capacities over 2003–04, the outlook for alumina production growth appears limited. Hence, for 2003, ABARE estimates alumina prices to have increased by 30% to an average of US\$206/t with further increases forecast in 2004.

Increase in alumina prices and demand places the State's alumina industry in a very favourable position.

Western Australia currently has four alumina refineries, located within close proximities to the bauxite mines. The Pinjarra refinery is the State's largest and lowest cost refinery and is the second-largest producer of alumina in the world. Alcoa World Alumina and Chemicals (AWAC) wholly own the Pinjarra refinery. AWAC is a joint venture between Alcoa (60%) and Alumina Ltd (40%). In July 2003, AWAC announced plans for a \$400 million "efficiency upgrade" of its Pinjarra refinery, boosting capacity by 600 000 t/a. Currently, the Pinjarra refinery produces 3.4 Mt of alumina per annum or approximately 7% of the world's refining capacity. The State's second-largest refinery with regards to annual alumina production rate is Worsley, with 3.1 Mt/a. The Worsley alumina project is a joint venture between participants BHP Billiton (86%), Kobe Alumina Associates (Australia) Ltd (10%) and Nissho-Iwai Alumina (4%). The remaining two refineries, in Wagerup and Kwinana, are both wholly owned by AWAC and have annual capacities of 2.2 and 1.9 Mt respectively. Total combined production capacity of the State's four refineries is 10.4 Mt/a.

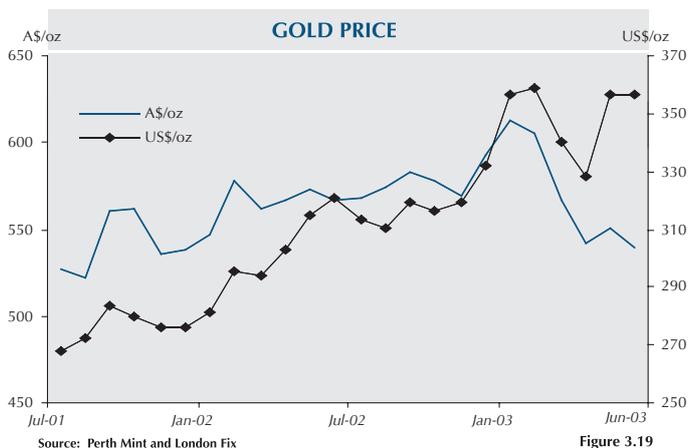
3.6 Gold

In 2002–03, the gold industry jumped to being the third-largest commodity sector in Western Australia, accounting for 12% of the State's total mineral and petroleum sales. On a national scale, in 2002, Western Australia accounted for 69% of Australia's gold production.



aluminium in China was up by around 25% for the first seven months of 2003 compared to the same period last year. Consumption in West Europe is forecast to increase by 2.5% in 2004 as a result of the increased use of aluminium by transport manufacturers. The United States is also forecast to increase its aluminium consumption by 3% in 2004.

World aluminium production is forecast to exceed consumption in 2004 resulting in a surplus in the aluminium market. Hence, in 2004, prices are forecast to fall as global aluminium stocks rise. China is expected to significantly increase aluminium production as a result of rapid growth in its aluminium smelter capacity. China's aluminium production is estimated to have increased by 18% to 5.2 Mt in 2003 and is forecast to increase a further 8% in 2004 to 5.6 Mt. Concerns with the massive growth in Chinese aluminium capacity in the past year and the ongoing plans to add to that capacity have led China's State Development and Reform Commission to disapprove of any new aluminium developments in the short term.



The gold sector is also a significant employer, accounting for about 28% of total employment in the petroleum and mineral sectors in Western Australia. The number of people employed within the gold industry in 2002–03 was more than 12 500, up by 3% on 2001–02.

In 2002–03, the average international price of gold was US\$334, up 16% compared to the previous financial year. Major factors supporting gold prices include low interest rates, weakness in the US dollar, the war in Iraq and producer hedging. In Australian currency terms, in 2002–03, the average gold price was 4% higher, up from \$553 per ounce in 2001–02 to \$573 per ounce in 2002–03. In January 2003, gold hit an average monthly price of \$612.90 per ounce, which was the highest Australian dollar price in nearly 15 years.

Western Australia's gold sales in 2002–03 amounted to 6 million ounces (187 t), representing a 1% increase compared with the previous year. This was largely due to increases in production at Paddington, Kanowna Belle and Golden Mile, coupled with new mines coming on-stream, such as the Thunderbox project plus a full-year's production at East Kundana. This slight increase in sales halted what had been four consecutive years of falling output since the 1997–98 record of 7.7 million ounces (239 t).

The increase in sales and prices helped boost the value of the State's gold sales to \$3 444 million, an increase of 5%. The increase in value could have been much larger, however appreciation of the Australian dollar against the US dollar meant that local gold producers were unable to reap the full benefits of a higher gold price.

Western Australia's ten largest projects accounted for

nearly 60% of the State's gold output in 2002–03. These projects comprised:

- Golden Mile (Kalgoorlie Consolidated Gold Mines Pty Ltd (KCGM)) – 23.5 t
- St Ives (Gold Fields Ltd) – 16.0 t
- Sunrise Dam (AngloGold Ltd) – 11.1 t
- Granny Smith (Placer Dome Inc) – 10.9 t
- Plutonic (Barrick Gold Corp) – 9.7 t
- Paddington (Placer Dome Inc) – 9.5 t
- Kanowna Belle (Placer Dome Inc) – 8.7 t
- Jundee–Nimary (Newmont Mining Corp) – 8.3 t
- Bronzewing – Mount McClure (Newmont Mining Corp) – 7.5 t
- Hill 50 Mount Magnet (Harmony Gold Mining Company Ltd) – 5.7 t

In terms of the State's gold production outlook, there are some significant new gold projects that should further increase production rates in 2003–04. These include:

- **Newcrest's resurrection of the Telfer gold mine**
Progress has continued on Newcrest's mining \$1.2 billion Telfer gold and copper project in Western Australia's Pilbara region. The operation is halfway completed and on schedule to commence during the September quarter in 2004. The Telfer operation has reserves of 19 million ounces and has the potential to be the largest open cut and underground gold mine in Australia. The project is expected to produce 800 000 ounces of gold and 30 000 ounces of copper during the projected life of the mine (24 years). This will provide one of the largest and most dramatic boosts to the State's gold production. Power for the project is to be supplied by gas-fired turbines. The power supply has been converted to gas to avoid shutdowns as a result of floods preventing fuel supplies reaching the mine. Agreements on the supply and transportation of gas are expected to be concluded in the next quarter.
- **The Laverton Exploration Joint Venture Whisper project**
Laverton Exploration Joint Venture will commence a trial mining program over the Whisper deposit, located near Laverton in Western Australia. The Whisper deposit is part of a larger oxide resource comprising the Rumour, Innuendo, Beasley Creek and Garden Wall deposits. The Whisper trial pit

Gold export data update 2003

The Australia Bureau of Statistics (ABS) released trade data in 2003 (Catalogue, 5432.065 or 5368.0) that indicated a significant rise in Western Australian gold exports. However, this apparent increase in gold exports from Western Australia in 2003 has been due to the recent restructuring of Australia's gold refining industry.

The structure of Australia's gold refining industry changed in October 2002 with the formation of AGR Matthey, a partnership between Johnson Matthey (Aust) Ltd, WA Mint (The Perth Mint) and the Australian Gold Alliance Pty Ltd. As a result of the partnership, gold previously produced and refined in Victoria is now being refined in Western Australia.

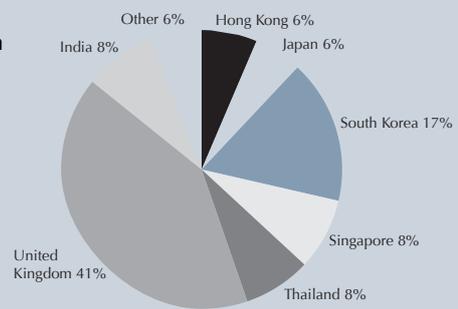
Prior to the formation of the partnership, there were two refineries in Australia, Johnson Matthey's located in Victoria and the WA Mint (The Perth Mint) located in Newburn, Western Australia. The Victorian refinery still refines silver and jewellery products, however it no longer processes gold from Australian mines.

Gold export data published by the ABS from Western Australia must therefore be interpreted with some caution. It includes gold produced in other States and Territories, which is refined and exported from Western Australia. This export figure is therefore larger than Western Australia's level of gold production.

The Australian Bureau of Statistics estimates that gold exports from Western Australia in 2002-03 amounted to approximately \$5 billion. Approximately 70 % or \$3.5 billion was gold produced in Western Australia. The remaining 30 % (approximately \$1.5 billion) can be attributed to gold refined and exported from Western Australia but produced from mining operations in other States and Territories.

Gold produced in overseas mining operations namely Papua New Guinea and Asia plus imported scrap is also refined in Australia and exported. Such gold is excluded from the aforementioned ABS export data and is included separately in a separate ABS series Australian Harmonised Export Commodity Classification (AHECC) 9805.

GOLD EXPORTS TOTAL VALUE \$3.44 billion



Source: DoIR

Figure 3.20

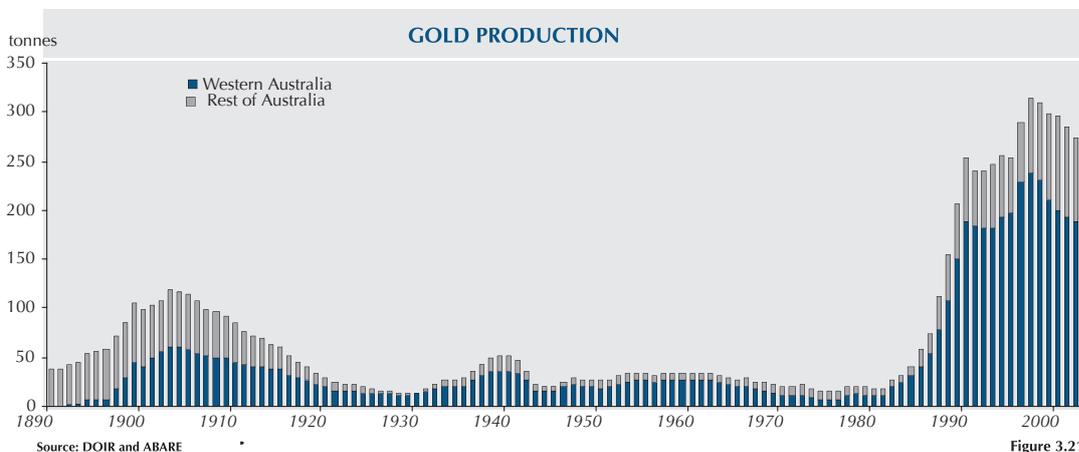


Figure 3.21

is representative of mining conditions expected of the final pit design at Rumour and Innuendo, the results of the trial mining program will be used to complete a feasibility study for the development of the larger oxide ore resource. It is expected the trial mining program will involve the extraction of approximately 100 000 t of ore, recovering about 9 000 ounces of gold. The ore is to be treated at the Granny Smith mill, commencing in the first quarter of 2004.



Figure 3.22

- **Expansion of the Wandoo underground operations at Boddington**

Negotiations between the three joint venture partners, AngloGold, Newmont Mining Corporation and Newcrest Mining regarding the Boddington expansion are still continuing. The Wandoo expansion, if completed, is projected to produce approximately 680 000 ounces per annum.

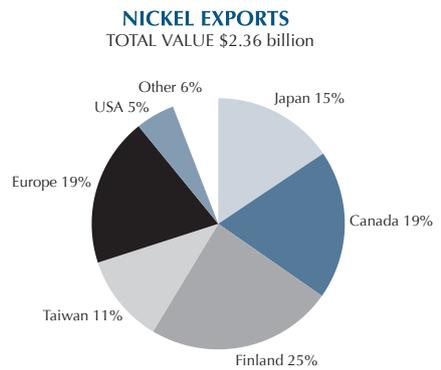
Other projects, which will increase the State's future gold output, include Gindalbie Gold's Mount Mulgine operation located in the South Murchison region of Western Australia. It is expected mining will commence at the Mount Mulgine operation shortly. In addition, both the Granny Smith Wallaby mine and the Sunrise Dam mine are set for extensions.

ABARE statistics show that Australia's gold production increased by 277 t or 4% in 2002–03 compared to 2001–02. The increase was mainly due to growth in output from Western Australia. ABARE forecasts that Australia's gold production will increase by 3% to around 286 t in 2003–04 compared to the previous year.

The direction of gold prices in 2004 will largely depend on world economic growth. ABARE has projected that, with the world economy gradually strengthening, interest rates are expected to rise moderately in 2004. This will in turn reduce producer de-hedging. The brighter prospect of world economic growth is also likely to encourage investors to switch funds from "safe haven" assets such as gold into equities. Further downward pressure on gold prices is also expected from higher production and weaker fabrication demand.

According to Gold Fields Mineral Services (GFMS), mine production rose by 1.8% in the first half of 2003 while, at the same time, world gold fabrication demand dropped by 1.8%. Accordingly, many market analysts expect gold prices to ease in the medium term.

However, considerable uncertainties still exist. The world economic recovery is still in its early stages and the robustness of the recovery is unclear. Other uncertainties and risks that may significantly affect gold prices include the value of the US dollar, lingering threats of terrorism, regional political tensions in the Middle East and North Korea and the renegotiation of the Central Bank Gold Agreement, which will expire in September 2004.



Source: DoIR Figure 3.23



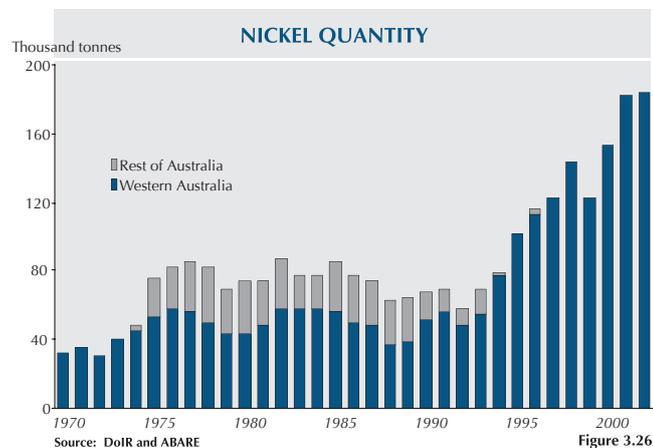
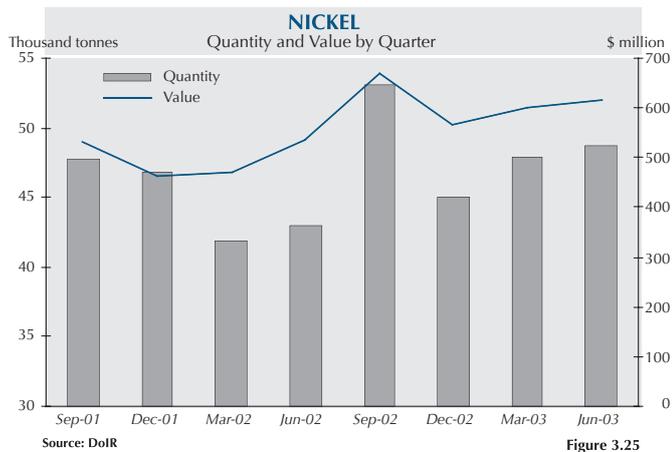
Source: LME Cash, Monthly Average Figure 3.24

3.7 Nickel

Nickel prices increased substantially during 2002–03, up by an average 29% to US\$7 668/t. The quantity sold increased to 191 678 t in 2002–03 compared to 179 458 t in 2001–02, a rise of 7%. The increase in prices coupled with an increase in sales volumes resulted in the value of sales greatly increasing by 23% to a new record of \$2 460 million, despite a 12% appreciation of the Australian dollar.

In Australian dollar terms the 2002–03 average price of nickel increased by 16% to A\$13 090/t. Prices peaked in February 2003 reaching A\$14 496/t, the highest price since October 2000. Nickel exports for 2002–03 totalled \$2.36 billion, a significant increase of 22% from \$1.93 billion in 2001–02. The major export markets for nickel included Finland, accounting for 25% of the total value of exports, Canada (19%), Europe (19%), Japan (15%) and Taiwan (11%).

Western Australia remains Australia's only producer of nickel with production in 2002–03 totalling 191 678 t. In 2002–03, the five largest nickel operators accounting



for 83% of Western Australia's output were:

- Western Mining Corporation (Mount Keith, Leinster, Kambalda) – 87 739 t
- Anaconda Nickel Ltd/Glencore (Murrin Murrin) – 30 565 t
- Sir Samuel Mines NL (Cosmos) – 15 709 t
- Mincor Operations Pty Ltd (Miittel) – 13 992 t
- Mining Project Investors (Black Swan) – 11 979 t

In 2002–03, Australian Nickel Mines' Radio Hill operation and Western Mining Corporation's (WMC) Kambalda operation ceased production. However, Breakaway Resources' Spargoville operation in Coolgardie commenced nickel concentrate production during the June quarter 2003.

The nickel market in 2002–03 was characterised by strong growth in demand particularly from China and rising nickel prices. Refined nickel imports into China from January to May 2003 totalled 30 680 t, an increase of 22 000 t compared to the same period last year. China lacks any significant nickel resources and therefore needs to rely on imports to meet its growing stainless steel demand.

The stainless steel industry is the single largest consumer of primary nickel, consuming approximately 65% of world nickel production. Therefore, the recovery in industrial activity and the high rate of growth in China are forecast to underpin increases in demand for nickel. World stainless steel output is expected to increase due to a greater amount of stainless steel making capacity being created to meet growing demand in China. Overall, world stainless steel production increased almost 5% in the first five months of 2003 compared to the same period last year due to increased demand. Workers at Inco's Sudbury operations, the world's second-largest nickel producer commenced a thirteen-week strike that withdrew around 25 000 t of nickel from the market, causing nickel prices to rally further as pressure was applied to the already tight nickel market. These events were briefly balanced in the short term by the release of Norilsk's remaining nickel stockpile.

ABARE forecasts that the growth of refined nickel output will be limited, with no significant additions to production capacity expected in 2003 or 2004. As a result, world nickel consumption is forecast to exceed production for both 2003 and 2004, resulting in a decline in stocks with a deficit in the nickel market expected in 2004 and 2005. Indications are that the growth in China's economy will continue for the immediate future, implying continued high growth in stainless steel demand and derived demand for nickel. As a consequence forecasts point to sustained high nickel prices for the next one to two years until a significant number of new nickel projects come on-stream to bring the market back into balance.

Increases in nickel demand were partially ameliorated by the settlement of the labour dispute at Inco's Sudbury operations in August 2003. However, ramp-up problems will result in a slower than expected return to full production. Norilsk will also provide additional relief to the short-term tightness that has characterised the nickel market with an expected increase in output of around 240 000 t, with possible further increases to 255 000 t in 2004. Production from Western Australia is also expected to increase due to a number of new projects and proposed expansions. However, these will not be sufficient to meet forecast nickel demand.

The current favourable nickel market for producers has caused urgency in getting new projects operational to

take advantage of current prices. Progress was made on the Sally Malay nickel project as construction of the \$54 million operation, to include open-cut and underground mining, commenced in September 2003. It is anticipated that mining will commence in January 2004 followed by the commissioning of the plant in August 2004. With production levels forecast at 8 000–9 000 t of nickel per annum, it is expected that the first nickel concentrate shipment will take place late 2004.

The nickel industry has undergone diversification mainly attributable to the divestiture by Western Mining Corporation (WMC), which has led to a number of smaller operations taking up WMC interests. These include, the purchase of the Long Nickel mine by Independence Gold, the purchase of the Widgiemooltha exploration block by Titan Resources, the Miitel, Redross, Wannaway and Mariners deposits by the Miitel Joint Venture.

Mincor is set to substantially increase production capacity as it commences development of its Redross Nickel Mine and North Miitel ore body projects. Mincor will invest \$11 million in the development of Redross Nickel Mine, with ore production scheduled for September 2004. Redross is located approximately 15 km south of Miitel mine and will produce over 4 000 t of nickel metal concentrate per annum. Based on current reserves, the mine life is about four years, however, drilling is being undertaken for possible additional reserves.

Mincor also completed the design and engineering work for its North Miitel project and is expected to complete construction in July 2004. The \$13 million project is earmarked to produce around 3 000 t of nickel per annum and has a mine life of three and a half years. The Redross Nickel Mine together with the North Miitel ore body will increase Mincor's production capacity by more than 7 000 t/a.

Mining at the Long Nickel mine in Kambalda which commenced in October 2002 has completed its first full year of operation. The Long Nickel mine, operated by Lightning Nickel (a wholly owned subsidiary of Independence Gold) produced a record 1 907 t of nickel for the September quarter 2003, the share for Independence Gold's was 1 133 t. Independence Gold NL has an agreement with WMC, from whom the mine was purchased, whereby the ore produced from the

Long Nickel mine is transported to WMC's Kambalda nickel smelter for toll treatment and production of nickel concentrates. As part of the agreement, Independence receive payment for 63–65% of the nickel metal in the concentrate, the remaining 35–37% of the nickel metal is taken by WMC as payment.

In 2002–03, BHP Billiton continued to evaluate its Ravensthorpe nickel project. The project is to comprise a mine producing 220 000 t/a of mixed nickel–cobalt hydroxide, which will be transported by sea via Esperance to be processed at QNI's Yabulu refinery in Queensland. The feasibility study is due to be completed late 2003.

Another potential new project may arise from Image Resources' acquisition of five exploration licences totalling 550 km² located north of the Mount Windarra nickel mine near Laverton. Initial exploration has identified several areas that may be representative of the WMC-owned Windarra nickel mine that produced 84 600 t of nickel metal from 1973 to 1989.

In other developments, Titan Resources has confirmed the discovery of a high-grade nickel sulphide deposit at its McEwen prospect at Widgiemooltha. Located 2 500 metres from its Armstrong ore body, the shallow depth of the McEwen mineralisation makes it economically attractive to develop due to the ease of mining. The Armstrong nickel deposit feasibility study is underway and Titan Resources will be lodging a Notice of Intent in the near future.

Western Australia's Anaconda Nickel Murrin Murrin operation remained under technical pressure in 2002–03, with full capacity production remaining some way off. In 2001–02, scheduled maintenance shutdowns in the second quarter saw production fall to 61% of capacity. In 2002–03, output at the pressure acid leach (PAL) plant was down 3% to 27 683 t. Currently Murrin Murrin is focusing on trying to achieve steady-state production of 40 000 t/a by the second half of 2004. Murrin Murrin is one of two remaining nickel laterite operations with Bulong Nickel having stopped mining after being placed into receivership in May 2003.

WMC also experienced a reduction in output due to boiler problems at its Kwinana nickel refinery, with nickel metal output for 2002–03 estimated to be down

by around 5 000 t to 60 000–61 000 t. WMC forecasts further reductions in 2004 as mining at Mount Keith moves to a lower-grade section of the ore body.

In August 2003, WMC signed a \$1 billion nickel supply agreement with Jinchuan Group, China's largest nickel producer. The agreement is for the supply of 120 000 t of nickel-in-matte, which contains about 68% nickel, to Jinchuan between 2005 and 2010. WMC will export the matte from its Kalgoorlie nickel smelter.

3.8 Mineral Sands

In 2002–03, the Western Australian heavy mineral sands industry experienced a \$7 million or 1% drop in total sales value to \$847 million, compared to the previous year. This was primarily due to lacklustre prices for titanium minerals and the higher value of the Australian dollar against its US counterpart.

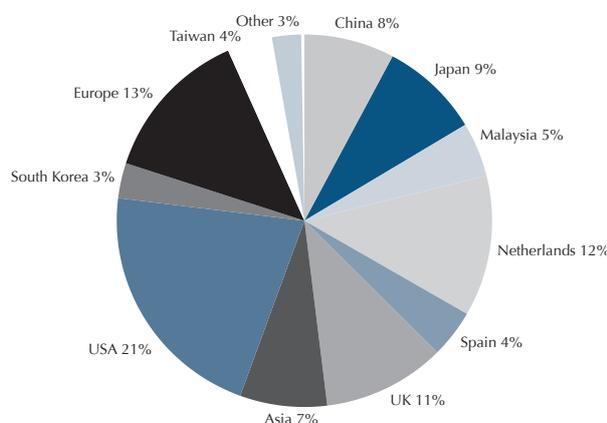
Sales volume for synthetic rutile (upgraded ilmenite), Western Australia's most valuable mineral sand product increased by 2%. However, poor prices received by local producers meant that the value of sales was down by 7% to \$353 million compared to the previous year. This outcome was similar for rutile and leucoxene, although a decrease in output by 7% and 4% respectively further aggravated the drop in sales value for these products.

An exception to the trend of falling sales in titanium minerals was ilmenite. This was largely due to a substantial 20% increase in the volume of ilmenite sales in 2002–03 to 960 367 t compared to 801 236 t in 2001–02. The increase in sales volume saw the value of ilmenite sales increase by 6% to \$137 million compared to the previous year. The volume of zircon sales was also up 29% to 411 078 t compared to the previous year. Consequently, the sales value of zircon increased by 18% to \$259 million. The increase in zircon production was a result of improved production performance at Iluka's operations.

Compared with 2001–02, the average prices for zircon decreased 10% to \$764/t. Average ilmenite and rutile prices also fell by 15% and 12% respectively, the strong Australian dollar accounting for much of the price erosion. Following a 14% rise in July, ilmenite prices retreated in August 2003 with a 23% fall on the previous month to average at US\$70/t. In contrast, prices for rutile and zircon rose by 3% and 4%, respectively, recouping some of the losses of the previous month. The average

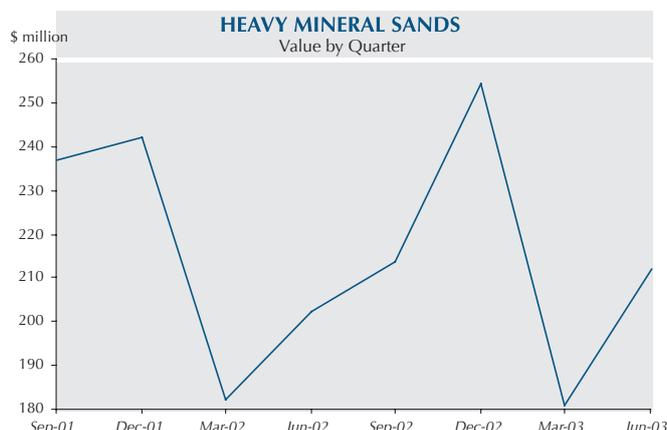
HEAVY MINERAL SANDS EXPORTS

TOTAL VALUE \$685.79 million



Source: DoIR

Figure 3.27



Source: DoIR

Figure 3.28

price for August 2003 was US\$471/t for rutile and US\$476/t for zircon.

Western Australia exported heavy mineral sands to the value of \$686 million during 2002–03, a 5% decrease compared to 2001–02. The United States is Western Australia's largest export destination for heavy mineral sands, accounting for 21% or \$147 million of the total export values. Collectively, European customers comprise 13% of total exports with the Netherlands and United Kingdom the next largest export destinations accounting for 12% and 11% respectively.

The majority of Western Australia's heavy mineral sands industry is located in the State's South West region and is the sixth-largest resource sector in terms of value. The heavy mineral sands industry can be split into two groups, those comprising titanium minerals such as ilmenite, rutile, leucoxene and synthetic rutile and other non-titanium minerals such as zircon, garnet, staurolite and monazite.



Figure 3.29

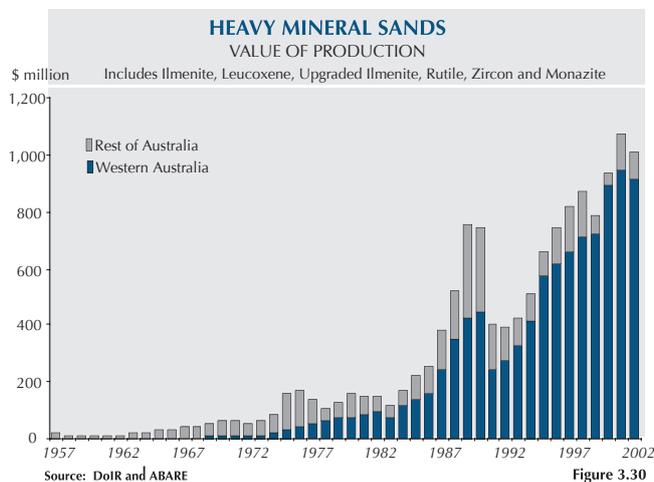


Figure 3.30

Western Australia remains the most prominent producer of mineral sands in Australia. In 2002, the State accounted for 90% of national production, an increase of 2% compared to 2001. Production of heavy mineral sands in Western Australia remains confined to a small number of companies, namely Iluka Resources, Cable Sands (WA) and the TiWest Joint Venture, co-owned by Ticom and Kerr McGee Chemical Corporation.

The Australian heavy mineral sands industry was further consolidated in October 2003 with the announcement of a three-way merger agreement between BeMaX Resources, Nissho Iwai and Sons of Gwalia. This will result in Australia's third-largest titanium dioxide (TiO₂) feedstock producer, accounting for 11% of world ilmenite output and 3.5% of world TiO₂ output. On finalisation of the merger, which is subject to certain regulatory approvals, the major shareholders will be Cristal Australia (27%), Nissho Iwai (20%), Sons of Gwalia (15%), Imperial One Ltd (6%) and other existing BeMaX shareholders (31%).

The TiO₂ pigment industry is the largest consumer of world titanium feedstocks, accounting for 93% of world consumption in 2002. As the dominant user, the demand for titanium feedstocks is dependent on the pigment industry, which in turn is governed by the world economy. Although the sluggish economic recovery in the US continued to make market conditions tough for the pigment industry, results from major pigment producers nevertheless showed continuing improvement in demand. For example, both Du Pont and Kerr McGee reported higher sales in the June quarter 2003. During the past 18 months, TiO₂ pigment use increased substantially in Asia, in particular China. Chinese pigment imports rose by about 18% in 2002. According to Macquarie Bank, pigment consumption is forecast to increase moderately by 2.6% in 2003, before showing stronger growth of over 3% in 2004.

Helped by the improvement in the pigment market, the feedstock market is expected to be reasonably balanced with a small surplus in 2003. However, this surplus is likely to increase significantly in 2004 owing to increases in supply from, for example, the expansion of Iluka's Old Hickory operation in the US, Doral's operation at Dardanup, Ticom's TiO₂ smelter operation in South Africa and higher Indian ilmenite output. Macquarie Bank has also reported that a relatively large number of new titanium feedstock projects are currently under investigation. This increases the likelihood of oversupply of titanium feedstocks in the longer term and dampening of any price rises for titanium feedstocks.

Unlike the titanium feedstock market, the zircon market remained very buoyant. Strong zircon demand from China was chiefly responsible for zircon's resilience. China's building boom has led to an increased demand for ceramic tiles of which zircon is a prime constituent. With limited supply growth, the gap between demand and supply in the zircon market is anticipated to widen in 2004 and benefit zircon prices.

According to TZ Minerals International (TZMI) there is an opportunity for additional zircon production to come on-stream to meet forecast shortfalls due to increased demand and insufficient current production levels. As Western Australia is the world's largest producer of zircon, this places local zircon producers in an excellent position to reap the benefits of forecast increases in zircon prices.

Iluka Resources is the world's largest zircon producer and the world's second-largest titanium minerals producer. Iluka is set to increase zircon output further when its South Tails mine in Western Australia's mid-west is commissioned.

In terms of additional heavy mineral sands projects, Gunson Resources is currently developing its Coburn deposit, which is located in Shark Bay. The Coburn deposit contains the Amy zone, a 26-kilometre long, 1-kilometre wide and 20-kilometre deep zircon-rich deposit. A bankable feasibility study is underway with a report expected to be ready in early 2004.

In September 2003, Cable Sands, the State's second-largest mineral sands producer was granted approval by the State Government to proceed mining at Ludlow State Forest. However, the approval is conditional on Cable Sands (WA) meeting environmental considerations such as the preservation and rehabilitation of the Ludlow Tuart forest. The Ludlow ore body consists of approximately 7 Mt of ore that will produce about 0.8 Mt of heavy mineral sands concentrate consisting mainly of ilmenite, zircon and leucoxene. Land clearing is scheduled to commence late in 2003 with mining lasting three to four years. Cable Sands is also currently preparing an environmental review to be released for public comment later in 2003 regarding its Jangardup South deposit. The Jangardup South deposit is located 3 km from Cable Sands Jangardup mine next to D'Entrecasteaux National Park.

3.9 Diamonds

The Western Australian diamond industry dramatically turned around in 2002–03. In contrast to poor sales over the past two years, the quantity of diamonds sold increased from 25.7 million carats (Mct) in 2001–02 to 38.9 Mct in 2002–03, a substantial rise of 51%. The increase in quantity of diamonds sold was the result of strong marketing efforts and increased production at Argyle. During 2002–03, the value of sales also rose by a significant 58% to \$771 million, despite an appreciating Australian dollar.

On a global scale, De Beers' Diamond Trading Co. (DTC) was able to record sales of US\$2.92 billion, an approximate increase of 3% compared with the first half of 2002. This was the result of strong demand during the six months to June 2003, despite general weakness in the global economy and lack of confidence as a result of the

Iraq war and SARS. De Beers attributed the increase in its sales to strong demand from the cutting centres, with lower interest rates increasing the willingness of cutting centres to increase their level of debt in order to hold greater volumes of rough diamonds for cutting and polishing.

Western Australia accounts for effectively all of Australia's total diamond production and approximately 29% of world production. The Argyle project is the world's largest supplier of diamonds. Argyle is owned and managed by Rio Tinto Limited and produces a high volume of low quality stones, along with the company's signature pink stone. Production at Argyle was reduced in 2000 and 2001 to approximately 26 Mct/a while the west ridge of the mine was being pushed back to further expose more of the AK1 pipe. However, in 2002 production rates returned to normal and contributed to the increase in production during 2002–03.

Production at Argyle consists of only 5% gem quality, 70% near-gem quality and the remaining 25% being industrial diamonds. The size of the average rough diamond at Argyle is less than 0.10 ct. As at the end of 2001, the reserves (material that is economically viable to mine) at the AK1 pipe were 53.7 Mt at a grade of 3.0 ct/t. Therefore, the current mine life for the AK1 pipe resource is estimated to expire in 2007. However, plans are underway to examine an underground option that could extend the productive mine life to about 2020. In February 2003, the Rio Tinto Investment Committee, after receiving a feasibility study completed in January 2003, gave approval to complete a further, follow-up feasibility study. It is expected that a decision regarding an underground mine development will be made in 2005.

Approximately 90% of Argyle's rough diamonds are destined for India's diamond cutting and polishing industry. India is the largest processor of small to medium and low quality diamonds, accounting for over 80% of world processed production in terms of volume. Argyle represents approximately 10% of all diamonds that India imports. Since placing a stronger focus on the US market, India now dominates the polished diamond export market into the US. However, in terms of value, Israel is the top supplier to the US followed by both India and Belgium, which are in second place.

This 2002–03 financial year saw the first full year of production from Kimberley Diamond Company's Ellendale diamond mine, which commenced full-scale mining operations in July 2002. Sales in 2002–03 amounted to 47 398 cts, representing over 240 000 diamonds. The average sales price was US\$159/ct, however, Ellendale's 10th diamond sale by closed tender averaged US\$181/ct. According to the Kimberley Diamond Company, average selling prices have exceeded the original feasibility estimates of US\$132/ct. Total sales revenue achieved for the first year of production is also above budget at \$12.5 million.

Ellendale's signature yellow stones remained in particularly strong demand, hence the world market prices for the quality rough stones remained very robust. In June 2003, the Ellendale Stage 1 operation was approaching its budgeted annual processing rate of 600 000 t/a. The Ellendale Stage 2A expansion project is currently underway with construction taking place for a new 2.2 Mt/a diamond production plant that will eventually be situated adjacent to current operations at Ellendale Pipe 9. The new plant was expected to be fully operational by December 2003. The Stage 2A of the Ellendale project will see further mining of Ellendale Pipe 4. Reports on the Stage 2A project show that it is expected to recover over 1 Mct over an eight-year period.

In October 2003, Kimberley Diamond Company announced that recent drilling of the Ellendale 4 lamproite pipe, one of 50 known diamondiferous pipes contained within the Ellendale project, revealed that both grade and average diamond size had been previously under-estimated. A 20 000 t bulk sample showed an average grade of 12.5 ct per hundred tonnes and an average diamond size of 0.15 ct, compared to previous estimates of 10.8 cts per hundred tonnes and an average size of 0.11 ct. It was expected that mining of the deeper resource of Ellendale 4 to a depth of 80 m was to commence in late 2003 following completion of the Stage 2A expansion project.

The Western Australian Kimberley region has been experiencing a resurgence of renewed exploration interest and activity. During October 2003, following drill samples obtained from the Pilbara region, Flinders Diamonds announced that its Hamersley diamond project had a high diamond potential. The Hamersley project contains three kimberlite pipe targets known as

Cadeuceus, Iraklis and Vancelot. Further drilling of all three targets plus additional geological mapping, rock sampling and geophysical interpretation are scheduled early 2004, pending the granting of additional prospecting licences to cover vacant ground over the Iraklis and Vancelot targets.

Striker Resources NL recently recovered 20 diamonds, each greater than one carat from a 253 t bulk sample from the Seppelt 2 kimberlite in Western Australia's Kimberley region. Included in the discovery were three diamonds each ranging from 3.36 to 4.39 ct. As at September 2003, the valuation parcel of diamonds is in excess of 3 000 ct. The parcel will be valued when approximately 4 000 ct is reached.

In national developments, Striker Resources NL announced that it has entered into an agreement with Rio Tinto Exploration to acquire six tenements, covering approximately 1 800 km² surrounding the former Merlin mine in the Northern Territory. Elkedra Diamonds, one of Australia's smallest and newest diamond explorers has a series of drill programs planned for targets in the Altjarrowarra Craton of Central Australia, roughly located halfway between Alice Springs and Mount Isa. The remote location and lack of mineralisation evident on the surface has meant explorers have overlooked the Altjarrowarra area in the past. Although diamonds are Elkedra's primary focus, they have also identified a number of highly promising base metal and manganese targets.

3.10 Base Metals

The global commodity market conditions for the base metal industry was not subjected to the significant price increase as experienced in the nickel, gold and oil markets. However, the Western Australian base metal industry did record a 3% increase in sales value to \$343 million. The most significant contributor to the increase in sales value was copper.

The LME copper prices increased 5%, however the appreciation of the Australian dollar against the US dollar meant that in local terms the price of copper fell 6%. Despite the fall in local copper prices, the value of copper produced increased by 13% to \$139 million. The volume of copper produced increased by 11% to 59 410 t in 2002–03 compared to 53 496 t in 2001–02. Overall, for Western Australian producers, copper performed well.

This was primarily due to the 11% increase in volume produced and a 36% reduction in treatment costs for the copper concentrate, which increased returns to local producers.

Western Australia produces three copper products; copper cathode, copper concentrates and copper by-product. The volume of copper by-product and copper cathode produced during 2002–03 was down 6% to 28 256 t. Combined with the fall in copper prices, this caused the value of copper by-product and copper cathode to fall 9%. However, the volume of copper concentrate produced during 2002–03 increased by a substantial 32%. Coupled with a 36% reduction in treatment and freight cost, this resulted in the value of copper concentrate increasing by 55%, despite the fall in Australian denominated copper prices. This more than alleviated the fall in value from copper by-product and copper cathode with the overall copper value increasing by 13%.

The reduction in treatment costs was driven by both supply and demand factors. Supply was restricted due to several copper producers either closing mines such as BHP's Tintaya operation, on standby since January 2002 and currently due to resume operations, or reducing production such as Escondida and Phelps Dodge. These operations are scheduled to resume full-scale production as copper prices show signs of recovery. Smelter demand was high due to strong consumption particularly from China. Lower output has forced smelters to compete for scarce copper concentrate. This has caused the market to tighten, resulting in aggressive competition and trader activity between copper concentrate sellers and smelter buyers. Negotiations between copper concentrate suppliers and smelter buyers have led to reduced treatment costs. It is anticipated as copper prices rise and operations resume full-scale production, the treatment costs associated with copper concentrates will increase.

Although copper was the only base metal commodity in 2002–03 to experience an increase in its value of sales, zinc remains the primary product in the State's base metal sector, accounting for 51% of the total sales, followed by copper at 40% and lead accounting for 9% of sales.

The LME price of zinc in 2002–03 fell 2%, averaging US\$775/t compared to US\$791/t in 2001–02. Zinc prices recovered slightly in recent months from historically low prices in August 2002 averaging US\$747/t. The increases

in global zinc stocks coupled with lacklustre zinc demand were the major causes for the decline in prices. The quantity of zinc produced in Western Australia fell 8% to 206 451 t in 2002–03 compared to 223 669 t in 2001–02. This was the third consecutive annual fall in tonnage. Despite the fall in price and production, the value of zinc for 2002–03 remained unchanged. Like copper, this was mainly attributed to dramatic reductions in treatment costs resulting in a 22% increase in the local received price.

Until recently, zinc was mined at two operations in Western Australia. These being Newmont's Golden Grove operation and Western Metals', Lennard Shelf operations. Currently, the Lennard Shelf lead–zinc mine has been placed on care and maintenance following the approved sale and transfer of mining leases associated with the operation to Teck Cominco. Teck Cominco has indicated that the mine will remain temporarily closed until zinc prices improve and a scheduled \$2 million exploration program delivers successful results. Prior to the Lennard Shelf ceasing production, the mine was one of the world's top five zinc mining operations producing concentrates of high zinc grade and low impurities.

Western Australian lead production has originated from the same two sources, namely Newmont's Golden Grove operation and the recently closed Western Metals' Lennard Shelf operation. Lead and zinc are usually found together in lead–zinc deposits, therefore it is not uncommon that the same operation produces lead as a co-product of zinc.

Since lead from the Golden Grove and Lennard Shelf operation is produced in association with zinc, the reduced level of zinc production also caused a reduction in the level of lead output. In 2002–03, total lead volumes were down 5 057 t, or 7%. The average price of lead in 2002–03 was US\$445/t, a fall of 6% compared to 2001–02. Weak western world demand has resulted in lacklustre lead prices. Forecast lead demand from the battery industry is anticipated to be modest with replacement demand reduced as a result of longer Start, Light and Ignition (SLI) battery lives. However, lead prices have begun to recover during the second half of 2003, largely due to a reduction in supply through smelter closures, low concentrate supplies and cutbacks in China's refined lead exports.

3.11 Other Minerals

Coal

In 2002–03, the quantity of coal sold by the State's two coal producers, Wesfarmers and Griffin increased by about 3% to 6.3 Mt. The total value of these sales was up by 6% or \$14.8 million to \$273 million. All of the State's coal supplies are sold on the domestic market and not exported. The majority of coal produced by Wesfarmers is used as thermal coal and sold under a long-term contract to Western Power for domestic power generation. Coal is also supplied to the mineral sands industry in Western Australia as metallurgical coal. Griffin also supplies coal to Western Power, including additional major customers Worsley Alumina Pty Ltd, Cockburn Cement Limited, Iluka Resources and Tiwest Joint Venture.

In September 2003, Griffin Coal announced plans to develop a 120-megawatt coal-driven power station and is currently awaiting approval from the Environmental Protection Authority. It is anticipated the power station will be generating electricity by the end of 2006.

Salt

In 2002–03, the quantity of salt sales climbed 11% to a new record high of 9.6 Mt. However, appreciation of the Australian dollar eroded prices received by local producers to result in the value of the State's salt sales decreasing 9% to \$228 million.

Western Australia is the sole producer of salt in Australia, with Dampier Salt's operations being the State's chief producer. Dampier Salt is the world's largest producer of seaborne salt. The major export destination of the salt produced by Dampier Salt is Japan, followed by South Korea and Taiwan. As well as sales to other regions of Asia, Dampier Salt's export market includes the Middle East, North America and Africa,

Dampier Salt is majority-owned by Rio Tinto (64.9%), Marubeni Corporation (20.5%), Nissho-Iwai Corporation (10.1%) and Itochu Corporation (4.5%). Dampier Salt is also Australia's largest producer and exporter of natural gypsum.

Onslow Salt, Western Australia's second-largest salt producer recorded a milestone when its largest shipment of 47 300 Mt left Onslow in January 2003. All of Onslow Salt's production is exported, with major markets including Japan, South Korea and Indonesia. The product is primarily used in the production of chemicals, glass and plastics.

In possible new developments, Straits Resources is investigating the viability of developing a new solar

salt project in the Exmouth Gulf of Western Australia.

Although the plan is still in its infancy, preliminary work suggests an initial production level of 3 Mt/a, with staged expansion developments to produce up to 10 Mt/a. This would make the Exmouth Gulf project among the world's largest of its type and is aimed at tapping into rising salt demand from China and South Korea.

Tin–Tantalum–Lithium

In 2002–03 the sales volume of tin fell by 13% to 763 t. Coupled with a 2% fall in tin prices, this resulted in tin's sales value in 2002–03 decreasing by 20% to \$4 800 million. After spectacular prices and record sales volume levels in previous years, lower tantalum prices received by the State's producers during 2002–03 dampened growth in the tantalum and spodumene sector's sales value. While the volume of tantalum reached a record high of 1 006 t in 2002–03, the value of tantalum and spodumene sales fell by 4% to \$212 million.

There are indications that the slump in tantalum demand may be ending, based on an apparent slight recovery in the level of tantalum demand spurred by the production of a new generation of semi-conductors and microprocessors.

Tantalum is chiefly used in the electronics industry in the manufacturing of capacitors. The electronics industry accounts for approximately 48% of global tantalum application, followed by tantalum in the production of super alloys (14%). Tantalum's high melting and boiling point properties have resulted in its increasing application in the manufacturing of turbine blades for power station and jet engines.

Western Australia is the sole source of tantalum production in Australia, with output of tantalum chiefly originating from Sons of Gwalia's operations in Greenbushes and Wodgina. Greenbushes and Wodgina are the world's largest and second-largest tantalum mines, respectively and combined represent approximately 75% of the world's defined tantalum resource. At present Sons of Gwalia accounts for 60% of the world's supply of tantalum. In recent years Sons of Gwalia have been undergoing a major expansion of its tantalum operations. In 2003, development of the underground area beneath the Cornwall pit at the Greenbushes operations was placed on care and maintenance following a downturn in the global electronics industry. The underground operations are expected to recommence when tantalum demand improves.

Additional tantalum output also came from Haddington Resource Limited Bald Hill Project, southeast of Kalgoorlie.

However, the State's third tantalum producer, Tantalum Australia NL Dalgarranga operation was placed on care and maintenance during the June quarter 2003. Greenbushes also contains the largest and highest-grade lithium mineral resource in the world with Sons of Gwalia accounting for approximately 60% of the world's supply of lithium in concentrate form, known as spodumene. The Greenbushes operation also produces tin ingots and kaolin.

Cobalt

The growing nickel industry in Western Australia, in particular the nickel laterite projects has seen the State increase its cobalt sales volume by 11% from 4 432 t in 2001–02 to 4 923 t in 2002–03, which was in keeping with the growing nickel sales output.

Cobalt prices experienced a minor 1% increase, due to a stronger demand in the battery sector, averaging US\$8.16/lb during the year. However, the appreciation of the Australian dollar meant the increases in sales volumes and the slight increase in cobalt prices could not be translated into increased sales values. As a consequence, Western Australian cobalt sales dropped by 4% or \$5.5 million to \$122 million.

Cobalt prices have been recovering since sliding to multi-year lows at under US\$6/lb. The 2002–03 financial year ended at a high with the average cobalt price for June being the highest in two years at over US\$11/lb.

Production cuts and rising demand in the battery sector are primary factors underlying the rise. Lithium-ion batteries use a lithium-cobalt-dioxide-cathode material, which typically contains 15–20% cobalt. The increase use of lithium-ion batteries in portable electronic equipment, including mobile phones because of their light weight is driving increased demand for cobalt. For example, Japan's demand for cobalt in lithium-ion batteries is expected to rise 30% in 2003–04 with the world's largest lithium-ion battery producer, Sanyo Electric,

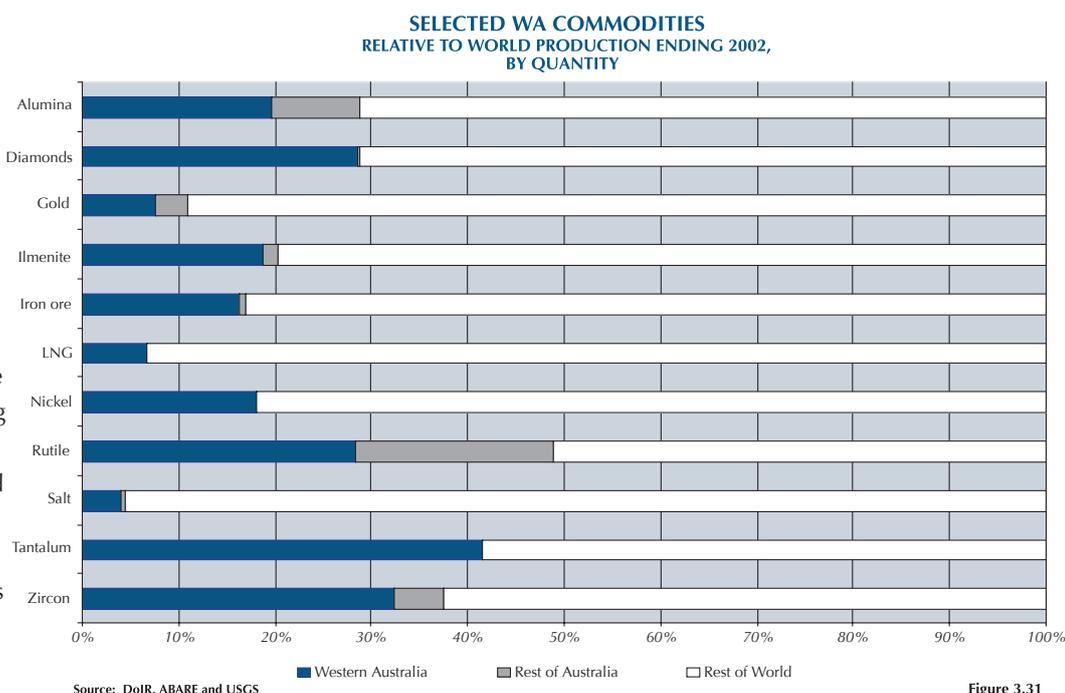
announcing plans to increase world production by 50% within the next two years.

Manganese

Australia is amongst the world's top four producers of high-grade manganese ore along with Brazil, South Africa and Gabon. In 2002–03, the total value of the State's manganese sales increased by 10% to \$75 million compared to 2001–02 and sales volumes increased 31% or 145 384 t. As the steel industry uses 90% of world manganese production in the steel making process, suppliers of manganese to the steel industry are experiencing increased demand as world steel output particularly in China strengthens.

Consolidated Minerals' Woodie Woodie operation in the Pilbara is Western Australia's sole manganese producer. In 2002–03, the mine produced a record 619 356 t of manganese and supplied around 5% of the world's annual manganese exports. The major export destinations for Consolidated Minerals' manganese ore are China and Eastern Europe, which account for 75% of sales.

Following a successful exploration program, Consolidated Minerals announced a potential resource upgrade at Woodie Woodie. This could see the mine life extended from 10 to 15 years.



The latest comparable data show that the Western Australian share (by quantity) of the world's output of the following products was: alumina 20%, gold 8%, ilmenite 19%, iron ore 16%, LNG (sea borne trade) 7%, nickel 18%, rutile 28%, salt 4%, tantalum 42%, zircon 32% and 29% of diamonds (mainly industrial grade)

Figure 3.31

| TABLE 1 QUANTITY AND VALUE OF MINERALS AND PETROLEUM | | | | | |
|--|------|-----------------|-------------------|-------------|---------------|
| COMMODITY | UNIT | 2001-02 | | 2002-03 | |
| | | QUANTITY | VALUE | QUANTITY | VALUE |
| ALUMINA | t | 10,856,507 | 3,584,378,494 | 11,132,187 | 3,204,651,644 |
| BASE METALS | | | | | |
| Copper Metal | t | 53,496 (r) | 122,573,732 (r) | 59,410 | 138,573,189 |
| Lead Metal | t | 75,076 | 36,723,119 | 70,019 | 30,965,304 |
| Zinc Metal | t | 223,669 | 173,815,927 | 206,451 | 173,193,024 |
| TOTAL BASE METALS | | | 333,112,778 (r) | | 342,731,517 |
| CHROMITE | t | 5,678 | 450,582 | 31,187 | 6,323,498 |
| CLAYS | | | | | |
| Attapulgate | t | 12,623 | 1,318,221 | 11,366 | 1,186,952 |
| Clay Shale | t | 11,751 | 117,510 | 19,117 | 191,170 |
| Fire Clay | t | 10,619 (r) | 76,883 (r) | 0 | 0 |
| Kaolin | t | 400 | 42,243 | 1,837 | 147,239 |
| Saponite | t | 1,679 | 114,216 | 713 | 57,919 |
| TOTAL CLAYS | | | 1,669,073 (r) | | 1,583,280 |
| COAL | t | 6,164,194 | 258,125,908 | 6,323,197 | 272,886,748 |
| CONSTRUCTION MATERIALS | | | | | |
| Aggregate | t | 650,749 | 5,631,178 | 477,673 | 4,354,630 |
| Gravel | t | 353,191 (r) | 1,300,475 (r) | 153,574 | 1,081,368 |
| Rock | t | 249,449 | 1,625,004 | 350,834 | 3,465,632 |
| Sand | t | 1,544,804 (r) | 6,964,844 (r) | 1,432,629 | 7,273,240 |
| Sandstone | t | 300 | 16,500 | 568 | 31,240 |
| TOTAL CONSTRUCTION MATERIALS | | | 15,538,001 (r) | | 16,206,110 |
| DIAMONDS | ct | 25,694,968 (r) | 489,339,885 (r) | 38,892,238 | 770,940,411 |
| DIMENSION STONE | | | | | |
| Granite | t | 802 | 176,531 | 769 | 212,485 |
| Marble | t | 267 (r) | 94,530 (r) | 434 | 152,579 |
| Other | t | 435 | 226,690 | 100 | 45,000 |
| TOTAL DIMENSION STONE | | | 497,751 (r) | | 410,064 |
| GEM & SEMI-PRECIOUS STONES | kg | 435,280 | 403,929 | 169,844 | 220,435 |
| GOLD | kg | 184,998 | 3,279,499,524 | 187,235 | 3,444,049,253 |
| GYPSUM | t | 1,346,341 (r) | 25,704,569 (r) | 1,185,328 | 20,237,490 |
| HEAVY MINERAL SANDS | | | | | |
| Garnet | t | 96,366 (r) | n/a | 107,079 | n/a |
| Ilmenite | t | 801,236 | 128,753,900 | 960,367 | 136,508,821 |
| Upgraded Ilmenite (a) | t | 585,913 | 380,208,229 | 597,274 | 353,104,994 |
| Leucoxene | t | 39,768 | 19,442,862 | 38,060 | 15,935,474 |
| Rutile | t | 122,610 | 106,743,027 | 113,569 | 82,530,715 |
| Staurolite | t | 2,129 | 332,509 | 1,613 | 242,988 |
| Zircon | t | 317,770 | 218,836,980 | 411,078 | 258,777,928 |
| TOTAL HEAVY MINERAL SANDS | | | 854,317,507 | | 847,100,920 |
| INDUSTRIAL PEGMATITE MINERALS | | | | | |
| Feldspar | t | 36,027 | 1,685,053 | 43,144 | 2,169,260 |
| IRON ORE | | | | | |
| Domestic | t | 6,660,230 (r) | 214,483,003 (r) | 7,739,409 | 200,420,603 |
| Exported | t | 157,973,734 (r) | 4,993,130,854 (r) | 180,484,775 | 4,993,127,686 |
| TOTAL IRON ORE | | 164,633,964 (r) | 5,207,613,857 (r) | 188,224,184 | 5,193,548,289 |

| COMMODITY | UNIT | 2001-02 | | 2002-03 | |
|--|---------------------|-----------------|---------------------------|-------------|-----------------------|
| | | QUANTITY | VALUE | QUANTITY | VALUE |
| LIMESAND-LIMESTONE-DOLOMITE | | | | | |
| Dolomite | t | 17,080 | 315,846 | 7,483 | 62,674 |
| Limesand-Limestone | t | 3,195,825 (r) | 15,079,931 (r) | 4,249,941 | 17,742,292 |
| TOTAL LIMESAND-LIMESTONE-DOLOMITE | | | 15,395,777 (r) | | 17,804,966 |
| MANGANESE ORE | t | 474,267 | 68,616,729 (r) | 619,651 | 75,377,357 |
| NICKEL INDUSTRY | | | | | |
| Cobalt By-Product | t | 1,898 (r) | 56,866,445 (r) | 2,038 | 52,081,023 |
| Cobalt Metal | t | 1,985 (r) | 54,828,789 | 2,390 | 55,784,670 |
| Cobalt Sulphide | t | 549 | 15,668,639 | 495 | 13,926,085 |
| TOTAL COBALT | | | 127,363,873 (r) | | 121,791,778 |
| Nickel Concentrate | t | 1,110,357 (r) | 1,619,104,901 (r) | 1,355,148 | 1,972,199,162 |
| Nickel Metal | t | 35,522 | 382,964,497 | 37,915 | 485,414,557 |
| Palladium By-Product | kg | 828 | 20,072,174 | 715 | 10,182,825 |
| Platinum By-Product | kg | 144 | 3,949,956 | 216 | 6,170,500 |
| TOTAL NICKEL INDUSTRY | | | 2,153,455,401 (r) | | 2,595,758,822 |
| PETROLEUM | | | | | |
| Condensate | kl | 6,326,003 | 1,680,033,506 | 6,934,156 | 2,052,017,555 |
| Crude Oil | kl | 15,087,852 (r) | 4,198,780,711 (r) | 13,945,555 | 4,296,360,097 |
| LNG | Btu 10 ⁶ | 386,082,198 (r) | 2,970,606,165 (r) | 403,825,434 | 3,132,407,894 |
| LPG - Butane | t | 482,203 | 193,711,852 | 460,467 | 221,468,636 |
| LPG - Propane | t | 374,319 | 167,866,073 | 346,596 | 172,394,567 |
| Natural Gas | '000m ³ | 7,533,986 | 643,277,079 | 8,273,640 | 667,262,640 |
| TOTAL PETROLEUM | | | 9,854,275,386 (r) | | 10,541,911,389 |
| PIGMENTS | | | | | |
| Red Oxide | t | 2,458 | 682,817 | 1,603 | 444,911 |
| SALT | t | 8,646,154 (r) | 251,041,857 (r) | 9,606,930 | 227,949,656 |
| SILICA-SILICA SAND | | | | | |
| Silica | t | 100,021 | 1,000,212 | 93,957 | 939,568 |
| Silica Sand | t | 553,019 | 6,355,535 | 658,555 | 7,075,787 |
| TOTAL SILICA-SILICA SAND | | | 7,355,747 | | 8,015,355 |
| SILVER | kg | 102,527 | 24,562,825 | 82,591 | 20,496,206 |
| SPONGOLITE | t | 13,141 | 1,725,027 | 12,154 | 1,739,077 |
| TALC | t | 152,369 | 13,721,295 | 157,364 | 14,985,371 |
| TIN-TANTALUM-LITHIUM | | | | | |
| Spodumene | t | 90,400 | n/a | 102,573 | n/a |
| Tantalite | t | 905 | n/a | 1,006 | n/a |
| Tin Metal | t | 874 | 6,007,866 | 763 | 4,799,655 |
| TOTAL TIN-TANTALUM-LITHIUM | | | 225,840,013 | | 216,399,884 |
| VANADIUM | t | 5,190 | 27,128,981 | 2,778 | 16,913,757 |
| TOTAL VALUE | | | 26,696,138,766 (r) | | 27,860,855,670 |

Note: Quantities used in this table only apply to Minerals and Petroleum covered by the Mining Act 1978, the Petroleum Act 1967, the Petroleum (Submerged Lands) Act 1982 and relevant State Agreement Acts.

(a) Also known as synthetic rutile

(e) Estimate

(r) Revised from previous edition

n/a Breakdown of garnet, spodumene and tantalite values not available

| TABLE 2 QUANTITY AND VALUE OF SELECTED MAJOR COMMODITIES | | | | | | | | | |
|--|----------------------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
| | Unit | 1993-94 | | 1994-95 | | 1995-96 | | 1996-97 | |
| | | Quantity | Value \$M |
| ALUMINA | Mt | 7.83 | 1,784.32 | 7.91 | 1,684.60 | 8.23 | 1,918.34 | 8.35 | 1,955.77 |
| BASE METALS | | | | | | | | | |
| Copper Metal | kt | 32.46 | 40.26 | 29.20 | 76.54 | 23.69 | 65.42 | 27.73 | 58.98 |
| Lead Metal | kt | 21.11 | 4.98 | 21.10 | 9.20 | 21.28 | 12.64 | 13.49 | 6.09 |
| Zinc Metal | kt | 136.39 | 79.54 | 132.85 | 95.84 | 113.49 | 75.32 | 88.37 | 75.12 |
| TOTAL BASE METALS | | | 124.78 | | 181.58 | | 153.39 | | 140.19 |
| COAL | Mt | 5.15 | 236.29 | 5.86 | 274.75 | 5.90 | 270.36 | 5.56 | 257.30 |
| DIAMONDS | Mct | 28.86 | 476.75 | 23.93 | 480.03 | 33.52 | 525.21 | 52.52 | 395.79 |
| GOLD | tonnes | 193.60 | 3,415.06 | 187.85 | 3,132.87 | 205.89 | 3,404.65 | 228.02 | 3,409.61 |
| HEAVY MINERAL SANDS | | | | | | | | | |
| Ilmenite | Mt | 1.07 | 92.32 | 0.99 | 89.65 | 1.10 | 111.18 | 1.10 | 117.28 |
| Rutile | kt | 68.93 | 35.76 | 107.78 | 56.13 | 119.14 | 75.06 | 110.96 | 77.74 |
| Upgraded Ilmenite (Synthetic Rutile) | kt | 402.00 | 185.84 | 490.00 | 228.29 | 517.00 | 252.56 | 545.00 | 270.48 |
| Zircon | kt | 349.13 | 63.10 | 477.05 | 129.77 | 410.03 | 181.21 | 324.09 | 177.99 |
| Other HMS | | | 13.92 | | 14.56 | | 18.50 | | 26.51 |
| TOTAL HEAVY MINERAL SANDS | | | 390.94 | | 518.40 | | 638.51 | | 670.00 |
| IRON ORE | Mt | 119.69 | 2,865.16 | 133.13 | 2,794.31 | 132.90 | 2,924.06 | 141.29 | 3,159.65 |
| MANGANESE ORE | kt | 315.79 | 42.01 | 71.91 | 8.84 | 347.04 | 41.34 | 324.11 | 37.62 |
| NICKEL | kt | 61.11 | 458.62 | 92.99 | 897.12 | 103.30 | 1,097.30 | 114.10 | 1,051.11 |
| PETROLEUM | | | | | | | | | |
| Condensate | Gl | 2.35 | 348.71 | 2.64 | 398.34 | 4.65 | 685.74 | 5.73 | 943.15 |
| Crude oil | Gl | 5.33 | 815.33 | 9.90 | 1,559.65 | 9.65 | 1,535.67 | 10.47 | 1,915.93 |
| LNG | Btu 10 ¹² | 296.36 | 1,015.68 | 356.11 | 1,262.51 | 379.79 | 1,350.92 | 370.50 | 1,528.77 |
| LPG – Butane | kt | 0 | 0 | 0 | 0 | 100.24 | 22.71 | 209.69 | 59.67 |
| LPG – Propane | kt | 0 | 0 | 0 | 0 | 87.02 | 19.73 | 185.74 | 55.66 |
| Natural Gas | Gm ³ | 4.46 | 413.37 | 5.37 | 445.71 | 6.31 | 454.76 | 6.89 | 534.65 |
| TOTAL PETROLEUM | | | 2,593.09 | | 3,666.21 | | 4,069.53 | | 5,037.83 |
| SALT | Mt | 6.16 | 149.18 | 7.18 | 155.14 | 7.45 | 154.22 | 7.55 | 153.62 |
| OTHER | | | 119.60 | | 164.52 | | 192.44 | | 192.18 |
| TOTAL | | | 12,655.80 | | 13,958.37 | | 15,389.35 | | 16,460.67 |

| 1997-98 | | 1998-99 | | 1999-00 | | 2000-01 | | 2001-02 | | 2002-03 | |
|----------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
| Quantity | Value \$M |
| 8.51 | 2,260.54 | 8.86 | 2,367.03 | 9.35 | 2,657.89 | 10.48 | 3,600.67 | 10.86 | 3,584.38 | 11.13 | 3,204.65 |
| 29.43 | 61.12 | 24.44 | 43.71 | 30.73 | 64.62 | 42.62 | 111.12 | 53.50 | 122.57 | 59.41 | 138.57 |
| 27.00 | 10.45 | 51.55 | 17.25 | 64.47 | 20.24 | 82.33 | 37.31 | 75.08 | 36.72 | 70.02 | 30.97 |
| 124.00 | 117.11 | 194.90 | 170.73 | 232.59 | 251.01 | 236.01 | 280.24 | 223.67 | 173.82 | 206.45 | 173.19 |
| | 188.68 | | 231.69 | | 335.87 | | 428.67 | | 333.11 | | 342.73 |
| 5.71 | 257.28 | 5.80 | 256.74 | 6.50 | 271.53 | 6.10 | 252.28 | 6.16 | 258.13 | 6.32 | 272.89 |
| 42.48 | 537.87 | 51.23 | 610.44 | 50.98 | 703.67 | 25.42 | 614.45 | 25.69 | 489.34 | 38.89 | 770.94 |
| 239.46 | 3,468.95 | 219.26 | 3,219.52 | 204.96 | 2,951.26 | 201.21 | 3,245.06 | 185.00 | 3,279.50 | 187.24 | 3,444.05 |
| 1.31 | 149.14 | 1.32 | 158.59 | 1.16 | 151.66 | 1.10 | 168.75 | 0.80 | 128.75 | 0.96 | 136.51 |
| 104.13 | 78.58 | 119.71 | 90.97 | 98.49 | 72.78 | 127.21 | 110.04 | 122.61 | 106.74 | 113.57 | 82.53 |
| 688.00 | 355.79 | 475.54 | 275.23 | 552.51 | 324.65 | 643.27 | 409.19 | 585.91 | 380.21 | 597.27 | 353.10 |
| 321.38 | 169.13 | 284.53 | 136.07 | 348.11 | 153.27 | 343.08 | 198.84 | 317.77 | 218.84 | 411.01 | 258.78 |
| | 24.63 | | 19.44 | | 28.85 | | 18.08 | | 19.78 | | 16.18 |
| | 777.27 | | 680.30 | | 731.20 | | 904.90 | | 854.32 | | 847.10 |
| 149.74 | 3,930.77 | 141.03 | 3,898.53 | 151.16 | 3,722.12 | 161.77 | 4,912.70 | 164.63 | 5,207.61 | 188.22 | 5,193.55 |
| 86.30 | 9.39 | 27.40 | 3.42 | 212.38 | 25.68 | 401.36 | 58.50 | 474.27 | 68.62 | 619.65 | 75.38 |
| 135.19 | 1,146.64 | 125.77 | 876.62 | 143.93 | 1,806.29 | 167.45 | 2,238.74 | 179.46 | 2,002.07 | 191.68 | 2,457.61 |
| 6.76 | 1,065.84 | 5.55 | 743.91 | 6.35 | 1,583.94 | 5.81 | 1,984.53 | 6.33 | 1,680.03 | 6.93 | 2,052.02 |
| 9.85 | 1,567.16 | 9.16 | 1,189.64 | 12.05 | 3,144.77 | 13.96 | 4,792.05 | 15.09 | 4,198.78 | 13.95 | 4,296.36 |
| 379.54 | 1,591.94 | 391.90 | 1,434.42 | 393.61 | 1,971.06 | 429.54 | 2,695.53 | 386.08 | 2,970.61 | 403.83 | 3,132.41 |
| 376.09 | 90.47 | 388.69 | 90.62 | 443.58 | 190.90 | 428.90 | 221.97 | 482.20 | 193.71 | 460.47 | 221.47 |
| 263.26 | 61.26 | 259.21 | 57.63 | 334.57 | 145.94 | 333.47 | 187.54 | 374.32 | 167.87 | 346.60 | 172.39 |
| 6.88 | 557.47 | 6.44 | 549.83 | 6.55 | 578.76 | 7.63 | 630.36 | 7.53 | 643.28 | 8.27 | 667.26 |
| | 4,934.14 | | 4,066.65 | | 7,615.37 | | 10,511.98 | | 9,854.28 | | 10,541.91 |
| 8.19 | 188.70 | 8.57 | 199.64 | 8.81 | 208.58 | 8.30 | 233.08 | 8.60 | 251.04 | 9.61 | 227.95 |
| | 234.85 | | 245.00 | | 315.52 | | 546.05 | | 513.74 | | 482.10 |
| | 17,935.08 | | 16,655.58 | | 21,344.98 | | 27,547.08 | | 26,696.14 | | 27,860.86 |

| TABLE 3 CALENDAR YEAR 2002-03 QUANTITY AND VALUE BY LOCAL GOVERNMENT AREA | | | | | |
|--|------------------------|-------------------|---------------------------------------|----------------------|-------------------|
| COMMODITY | LOCAL GOVT AUTHORITY | QUANTITY (TONNES) | CONTENT | VALUE (A\$) | Ref (p.56) |
| ALUMINA | Boddington | 3,191,261 | | 953,496,297 | |
| | Murray | 5,492,407 | | 1,556,687,302 | |
| | Waroona | 2,448,519 | | 694,468,045 | |
| TOTAL ALUMINA | Total | 11,132,187 | | 3,204,651,644 | (c), (d) |
| BASE METALS | | | Cu tonnes | | |
| Copper By-Product | Coolgardie | | 2,167 | 5,241,198 | |
| | Dundas | | 393 | 1,052,795 | |
| | Kalgoorlie-Boulder | | 172 | 482,180 | |
| | Ravensthorpe | | 116 | 320,973 | |
| | Roebourne | | 2,747 | 8,013,867 | |
| | Wiluna | | 602 | 1,684,885 | |
| | Total | | | 6,196 | 16,795,898 |
| Copper Concentrates | Yalgoo | | Cu tonnes | | |
| | | 144,436 | 31,154 | 65,799,990 | (a) |
| Copper Cathode | East Pilbara | | Cu tonnes | | |
| | | | 22,060 | 55,977,301 | (a) |
| Total Copper | | | | 138,573,189 | (a), (b) |
| Lead | Derby-West Kimberley | | Pb tonnes | | |
| | | 90,146 | 65,621 | 29,873,618 | |
| | | 16,913 | 4,398 | 1,091,686 | |
| | | Total | 107,059 | 70,019 | 30,965,304 |
| Zinc | Derby-West Kimberley | | Zn tonnes | | |
| | | 270,599 | 151,991 | 128,313,478 | |
| | | 133,442 | 54,460 | 44,879,546 | |
| Total | 404,041 | 206,451 | 173,193,024 | (a) | |
| TOTAL BASE METALS | | | | 342,731,517 | |
| CHROMITE | | | Cr ₂ O ₃ tonnes | | |
| Chromite Ore | Meekatharra | 77,680 | 31,187 | 6,323,498 | (a) |
| CLAY | | | | | |
| Attapulgit | Mullewa | 11,366 | | 1,186,952 | |
| Clay Shale | Collie | 19,117 | | 191,170 | |
| Kaolin | Bridgetown-Greenbushes | 1,837 | | 147,239 | |
| Saponite | Coorow | 713 | | 57,919 | |
| TOTAL CLAY | | 33,033 | | 1,583,280 | (e) |
| COAL | Collie | 6,323,197 | | 272,886,748 | (f) |
| CONSTRUCTION MATERIALS | | | | | |
| Aggregate | Ashburton | 700 | | 3,500 | |
| | Broome | 93,849 | | 2,435,522 | |
| | East Pilbara | 46,827 | | 234,135 | |
| | Port Hedland Town | 105,371 | | 526,852 | |
| | Roebourne | 133,469 | | 667,344 | |
| | Wyndham-East Kimberley | 97,457 | | 487,277 | |
| | Total | | 477,673 | | 4,354,630 |
| Gravel | Broome | 25,051 | | 256,298 | |
| | Coolgardie | 32,205 | | 161,032 | |
| | Kalamunda | 87,665 | | 613,655 | |
| | Kalgoorlie-Boulder | 1,885 | | 9,425 | |
| | Port Hedland Town | 2,436 | | 15,664 | |
| | Wyndham-East Kimberley | 4,332 | | 25,294 | |
| | Total | | 153,574 | | 1,081,368 |

| COMMODITY | LOCAL GOVT AUTHORITY | QUANTITY (TONNES) | CONTENT | VALUE (A\$) | Ref (p.56) |
|---|------------------------|-------------------|-------------------|--------------------|------------|
| Rock | Broome | 1,514 | | 45,436 | |
| | Derby-West Kimberley | 84 | | 422 | |
| | Dundas | 3,139 | | 40,017 | |
| | East Pilbara | 100,788 | | 503,940 | |
| | Kalgoorlie-Boulder | 161,424 | | 807,124 | |
| | Karratha | 83,609 | | 2,067,312 | |
| | Wyndham-East Kimberley | 276 | | 1,381 | |
| | Total | 350,834 | | 3,465,632 | |
| Sand | Ashburton | 100 | | 3,500 | |
| | Broome | 39,623 | | 322,895 | |
| | Cockburn | 44,984 | | 224,920 | |
| | Coolgardie | 72,342 | | 361,303 | |
| | Coorow | 5,234 | | 20,596 | |
| | Dandaragan | 741 | | 3,705 | |
| | Derby-West Kimberley | 5,465 | | 27,325 | |
| | Esperance | 5,339 | | 26,696 | |
| | Kalgoorlie-Boulder | 440 | | 2,200 | |
| | Marble Bar | 20,492 | | 102,455 | |
| | Meekatharra | 27,649 | | 140,417 | |
| | Menzies | 8,887 | | 44,435 | |
| | Northam | 105,334 | | 532,585 | |
| | Port Hedland Town | 38,053 | | 157,683 | |
| | Roebourne | 51,852 | | 272,054 | |
| | Wanneroo | 1,000,450 | | 5,002,250 | |
| | Wyndham-East Kimberley | 2,549 | | 12,751 | |
| Yilgarn | 3,095 | | 15,470 | | |
| | Total | 1,432,629 | | 7,273,240 | |
| Sandstone | Wanneroo | 568 | | 31,240 | |
| TOTAL CONSTRUCTION MATERIAL | | 2,415,278 | | 16,206,110 | (e) |
| | | | carats | | |
| DIAMONDS | Derby-West Kimberley | | 49,179 | 10,130,267 | |
| | Wyndham-East Kimberley | | 38,843,059 | 760,810,144 | |
| TOTAL DIAMONDS | | | 38,892,238 | 770,940,411 | (a) |
| DIMENSION STONE | | | | | |
| Granite | Coolgardie | 27 | | 3,900 | |
| | Dundas | 597 | | 201,335 | |
| | Roebourne | 145 | | 7,250 | |
| | Total | 769 | | 212,485 | |
| Marble | Ashburton | 434 | | 152,579 | |
| Other | Marble Bar | 100 | | 45,000 | |
| TOTAL DIMENSION STONE | | 1,303 | | 410,064 | (e) |
| GEM & SEMI-PRECIOUS STONES | | | | | |
| | | | kg | | |
| TOTAL GEM & SEMI-PRECIOUS STONES | Carnarvon | 96,331 | | 58,062 | |
| | Marble Bar | 15,770 | | 10,394 | |
| | Meekatharra | 22,281 | | 12,364 | |
| | Menzies | 35 | | 7,000 | |
| | Upper Gascoyne | 1,388 | | 14,624 | |
| | Yalgoo | 34,039 | | 117,991 | |
| TOTAL GEM & SEMI-PRECIOUS STONES | | 169,844 | | 220,435 | (d) |

| TABLE 3 CALENDAR YEAR 2002-03 QUANTITY AND VALUE BY LOCAL GOVERNMENT AREA | | | | | |
|--|----------------------|----------------------|-------------------------|----------------------|------------|
| COMMODITY | LOCAL GOVT AUTHORITY | QUANTITY (TONNES) | CONTENT | VALUE (A\$) | Ref (p.56) |
| GOLD | | | Au kg | | |
| | Boddington | | 9,503 | 174,097,929 | |
| | Coolgardie | | 19,655 | 361,061,015 | |
| | Cue | | 4,768 | 87,795,230 | |
| | Dundas | | 8,717 | 160,049,857 | |
| | Halls Creek | | 33 | 633,282 | |
| | Kalgoorlie-Boulder | | 40,538 | 749,209,230 | |
| | Laverton | | 16,000 | 293,309,041 | |
| | Leonora | | 38,939 | 715,992,860 | |
| | Meekatharra | | 14,135 | 259,568,629 | |
| | Menzies | | 7,947 | 145,939,115 | |
| | Mt Magnet | | 4,829 | 89,299,267 | |
| | Sandstone | | 853 | 15,965,621 | |
| | Statewide | | 182 | 3,173,119 | |
| | Wiluna | | 12,644 | 232,189,962 | |
| | Yalgoo | | 3,245 | 59,130,418 | |
| Yilgarn | | 5,246 | 96,634,678 | | |
| TOTAL GOLD | | | 187,235 | 3,444,049,253 | (g) |
| GYPSUM | Carnarvon | 972,145 | | 17,177,725 | |
| | Corrigin | 1,159 | | 16,226 | |
| | Dalwallinu | 50,079 | | 971,315 | |
| | Dandaragan | 44,682 | | 978,735 | |
| | Dundas | 37,278 | | 322,793 | |
| | Esperance | 3,620 | | 32,722 | |
| | Irwin | 2,500 | | 35,000 | |
| | Kent | 21,428 | | 281,852 | |
| | Koorda | 125 | | 2,500 | |
| | Lake Grace | 11,041 | | 108,350 | |
| | Merredin | 6,584 | | 73,006 | |
| | Nungarin | 15,139 | | 95,228 | |
| | Perenjori | 765 | | 7,475 | |
| | Ravensthorpe | 5,985 | | 30,000 | |
| | Wyalkatchem | 12,223 | | 97,779 | |
| | Yilgarn | 575 | | 6,784 | |
| TOTAL GYPSUM | | 1,185,328 | | 20,237,490 | (f) |
| HEAVY MINERAL SANDS | | | | | |
| Garnet Sand | Northampton | 107,079 | | n/a | |
| Ilmenite | | | TiO ₂ % | | |
| | Bunbury City | 361,352 | 55.00 | 51,293,518 | |
| | Dardanup | 66,169 | 55.00 | 9,809,999 | |
| | Carnamah | 123,653 | 60.00 | 12,735,311 | |
| | Capel | 274,590 | 54.00 | 40,419,739 | |
| | Dandaragan | 134,603 | 54.00 | 22,250,254 | |
| Total | | 960,367 | | 136,508,821 | |
| Synthetic Rutile | | | TiO ₂ tonnes | | |
| | Carnamah | 198,979 | 183,061 | 109,753,447 | |
| | Capel | 224,381 | 206,430 | 123,535,178 | |
| | Dandaragan | 173,915 | 160,001 | 119,816,369 | |
| Total | | 597,274 | 549,492 | 353,104,994 | |

| COMMODITY | LOCAL GOVT AUTHORITY | QUANTITY (TONNES) | CONTENT | VALUE (A\$) | Ref (p.56) |
|--|----------------------|--------------------|-------------------------|----------------------|------------|
| | | | TiO ₂ tonnes | | |
| Leucoxene | Bunbury City | 5,189 | 4,774 | 2,861,964 | |
| | Capel | 7,580 | 6,973 | 4,192,826 | |
| | Dandaragan | 25,291 | 20,449 | 8,880,684 | |
| | Total | 38,060 | 32,196 | 15,935,474 | |
| | | | TiO ₂ tonnes | | |
| Rutile | Bunbury City | 3,569 | 3,354 | 2,753,310 | |
| | Carnamah | 80,971 | 76,113 | 58,408,843 | |
| | Dandaragan | 29,029 | 27,870 | 21,368,562 | |
| | Total | 113,569 | 107,337 | 82,530,715 | |
| Staurolite | Dandaragan | 1,613 | | 242,988 | |
| | | | ZrO ₂ tonnes | | |
| Zircon | Bunbury City | 14,490 | 9,417 | 8,997,966 | |
| | Capel | 50,878 | 33,071 | 33,244,435 | |
| | Carnamah | 239,454 | 155,645 | 153,377,590 | |
| | Dandaragan | 97,998 | 63,698 | 58,394,974 | |
| | Dardanup | 8,258 | 5,367 | 4,762,963 | |
| | Total | 411,078 | 267,199 | 258,777,928 | |
| TOTAL HEAVY MINERAL SANDS | | | | 847,100,920 | (a) |
| INDUSTRIAL PEGMATITE MINERALS | | | | | |
| Feldspar | Marble Bar | 42,358 | | 2,154,395 | |
| | Mukinbudin | 786 | | 14,865 | |
| | Total | 43,144 | | 2,169,260 | (e) |
| IRON ORE | | | | | |
| Domestic Ore | East Pilbara | 7,739,409 | | 200,420,603 | |
| Exported Ore | Ashburton | 80,252,691 | | 2,178,546,031 | |
| | Derby-West Kimberley | 476,873 | | 14,375,074 | |
| | East Pilbara | 95,814,811 | | 2,686,506,160 | |
| | Yilgarn | 3,940,400 | | 113,700,421 | |
| Total | 180,484,775 | | 4,993,127,686 | | |
| TOTAL IRON ORE | | 188,224,184 | | 5,193,548,289 | (a) |
| LIMESAND-LIMESTONE-DOLOMITE | | | | | |
| Dolomite | Lake Grace | 4,875 | | 15,675 | |
| | Yilgarn | 2,608 | | 46,999 | |
| | Total | 7,483 | | 62,674 | |
| Limesand-Limestone | Carnamah | 17,638 | | 53,713 | |
| | Cockburn | 2,053,775 | | 6,085,108 | |
| | Coorow | 6,704 | | 20,260 | |
| | Dandaragan | 24,471 | | 170,391 | |
| | Dundas | 183,632 | | 2,754,480 | |
| | Exmouth | 56,355 | | 244,612 | |
| | Gingin | 32,401 | | 684,387 | |
| | Irwin | 160,042 | | 431,561 | |
| | Kwinana | 55,375 | | 166,125 | |
| | Leonora | 1,279,669 | | 2,559,338 | |
| | Manjimup | 1,679 | | 27,975 | |
| | Shark Bay | 1,921 | | 268,954 | |
| | Wanneroo | 346,174 | | 4,215,178 | |
| | Wiluna | 30,105 | | 60,210 | |
| | Total | 4,249,941 | | 17,742,292 | |
| TOTAL LIMESAND-LIMESTONE-DOLOMITE | | 4,257,424 | | 17,804,966 | (e) |

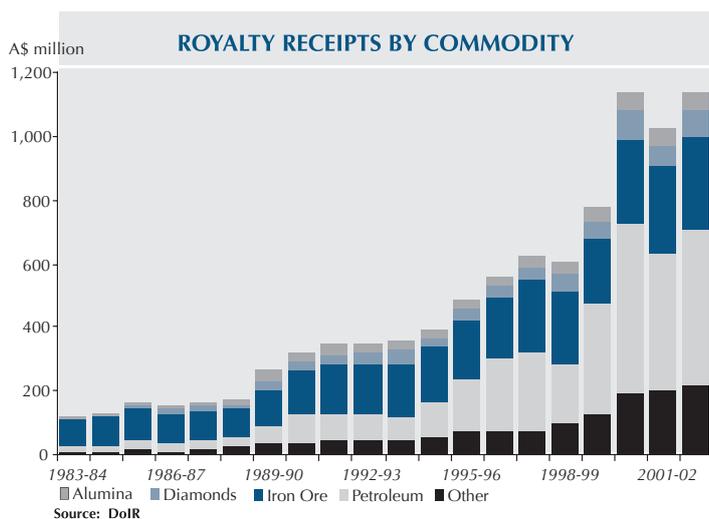
| TABLE 3 | | CALENDAR YEAR 2002-03 QUANTITY AND VALUE BY LOCAL GOVERNMENT AREA | | | |
|------------------------------|----------------------|--|-----------------------------|----------------------|-----------------|
| COMMODITY | LOCAL GOVT AUTHORITY | QUANTITY (TONNES) | CONTENT | VALUE (A\$) | Ref (p.56) |
| MANGANESE ORE | East Pilbara | 619,651 | Mn tonnes 297,476 | 75,377,357 | (a) |
| NICKEL INDUSTRY | | | Co tonnes | | |
| Cobalt By-Product | Coolgardie | | 1,277 | 31,103,277 | |
| | Dundas | | 142 | 3,907,285 | |
| | Kalgoorlie-Boulder | | 267 | 7,472,853 | |
| | Ravensthorpe | | 38 | 1,022,901 | |
| | Roebourne | | 61 | 1,633,815 | |
| | Wiluna | | 254 | 6,940,892 | |
| | Total | | 2,038 | 52,081,023 | |
| Cobalt Metal | Kalgoorlie-Boulder | | 455 | 6,304,370 | |
| | Laverton | | 1,935 | 49,480,300 | |
| | Total | | 2,390 | 55,784,670 | |
| Cobalt Sulphide | Kalgoorlie-Boulder | | 495 | 13,926,085 | |
| TOTAL COBALT | | | 4,923 | 121,791,778 | (a), (b) |
| | | | Ni tonnes | | |
| Nickel Concentrates | Coolgardie | 440,962 | 18,313 | 232,794,988 | |
| | Dundas | 51,001 | 7,393 | 96,754,440 | |
| | Kalgoorlie-Boulder | 157,224 | 24,995 | 312,066,956 | |
| | Leonora | 323,551 | 40,630 | 518,161,884 | |
| | Ravensthorpe | 73,939 | 2,353 | 31,967,465 | |
| | Roebourne | 8,327 | 1,066 | 13,041,882 | |
| | Wiluna | 300,144 | 59,013 | 767,411,547 | |
| | Total | 1,355,148 | 153,763 | 1,972,199,162 | |
| | | | Ni tonnes | | |
| Nickel Metal | Kalgoorlie-Boulder | | 7,350 | 95,389,117 | |
| | Laverton | | 30,565 | 390,025,440 | |
| | Total | | 37,915 | 485,414,557 | |
| TOTAL NICKEL | | | 191,678 | 2,457,613,719 | (i) |
| | | | Pd kg | | |
| Palladium By-Product | Coolgardie | | 697 | 9,846,636 | |
| | Roebourne | | 18 | 336,189 | |
| | Total | | 715 | 10,182,825 | (b) |
| | | | Pt kg | | |
| Platinum By-Product | Coolgardie | | 216 | 6,170,500 | (b) |
| TOTAL NICKEL INDUSTRY | | | | 2,595,758,822 | |
| PETROLEUM | | | Kilolitres | | |
| Condensate | Ashburton | 350,047 | | 87,365,238 | |
| | Carnamah | 164 | | 15,907 | |
| | Irwin | 1,479 | | 369,706 | |
| | Roebourne | 6,582,466 | | 1,964,266,704 | |
| | Total | 6,934,156 | | 2,052,017,555 | |
| | | | Kilolitres | | |
| Crude Oil | Ashburton | 3,116,140 | | 952,808,724 | |
| | Irwin | 127,715 | | 32,974,303 | |
| | Roebourne | 10,701,700 | | 3,310,577,070 | |
| | Total | 13,945,555 | | 4,296,360,097 | |
| | | | Btu 10 ⁶ | | |
| LNG | Roebourne | 403,825,434 | | 3,132,407,894 | |
| | | | Tonnes | | |
| LPG - Butane | Roebourne | 460,467 | | 221,468,636 | |

| COMMODITY | LOCAL GOVT AUTHORITY | QUANTITY (TONNES) | CONTENT | VALUE (A\$) | Ref (p.56) |
|-----------------------------------|------------------------|----------------------------------|---|-----------------------|------------|
| LPG - Propane | Roebourne | Tonnes 346,596 | | 172,394,567 | |
| Natural Gas | Ashburton | '000 m ³ 1,419,605 | | 81,234,606 | |
| | Carnamah | 37,579 | | 5,863,586 | |
| | Irwin | 140,895 | | 14,581,268 | |
| | Roebourne | 6,675,561 | | 565,583,180 | |
| | Total | 8,273,640 | | 667,262,640 | |
| TOTAL PETROLEUM PRODUCTS | | | | 10,541,911,389 | (d) |
| PIGMENTS | | | | | |
| Red Oxide | Cue | 1,603 | | 444,911 | (a) |
| SALT | | | | | |
| | Ashburton | 1,291,155 | | 30,727,000 | (a) |
| | Carnarvon | 1,001,633 | | 23,191,210 | (a) |
| | Esperance | 12,305 | | 522,430 | (h) |
| | Port Hedland Town | 2,263,579 | | 53,084,172 | (a) |
| | Roebourne | 3,886,522 | | 90,952,755 | (a) |
| | Shark Bay | 1,036,832 | | 23,375,361 | (a) |
| | Wyalkatchem | 151 | | 14,317 | (h) |
| | Yilgarn | 114,753 | | 6,082,411 | (h) |
| TOTAL SALT | | 9,606,930 | | 227,949,656 | |
| SILICA-SILICA SAND | | | | | |
| Silica | Moora | 93,957 | | 939,568 | |
| Silica Sand | Albany | 117,472 | | 2,317,836 | |
| | Coolgardie | 138,484 | | 339,284 | |
| | Swan | 402,599 | | 4,418,667 | |
| | Total | 658,555 | | 7,075,787 | |
| TOTAL SILICA-SILICA SAND | | | | 8,015,355 | (a) |
| SILVER BY-PRODUCT | | | | | |
| | Coolgardie | | Ag kg 199 | 47,530 | (a), (j) |
| | Derby-West Kimberley | | 1,143 | 726,891 | (a), (b) |
| | Roebourne | | 7,693 | 2,046,739 | (a), (j) |
| | Statewide | | 27,909 | 6,546,947 | |
| | Yalgoo | | 45,647 | 11,128,099 | (a), (j) |
| TOTAL SILVER | | | 82,591 | 20,496,206 | |
| SPONGOLITE | Plantagenet | 12,154 | | 1,739,077 | (h) |
| TALC | Meekatharra | 29,138 | | 4,406,717 | |
| | Three Springs | 128,226 | | 10,578,654 | |
| TOTAL TALC | | 157,364 | | 14,985,371 | (f) |
| TIN-TANTALUM-LITHIUM | | | | | |
| Spodumene | Bridgetown-Greenbushes | 102,573 | Li ₂ O tonnes 6,162 | n/a | |
| Tantalite | Bridgetown-Greenbushes | 909 | | n/a | |
| | Coolgardie | 82 | | n/a | |
| | Yalgoo | 15 | | n/a | |
| | Total | 1,006 | | n/a | |
| Tin | Bridgetown-Greenbushes | | Sn tonnes 763 | 4,799,655 | |
| TOTAL TIN-TANTALUM-LITHIUM | | | | 216,399,884 | (a) |
| VANADIUM | | | | | |
| | Mt Magnet | | V ₂ O ₅ tonnes 2,778 | 16,913,757 | (f) |
| TOTAL VALUE | | | | 27,860,855,670 | |

| TABLE 4 ROYALTY RECEIPTS 2001-02 AND 2002-03 | | | | |
|---|------------------------------|------------------------------|-------------------------------|-------------|
| COMMODITY | 2001-02 Total A\$ | 2002-03 Total A\$ | 2002-03 Growth A\$ | % |
| ALUMINA | 61,408,085 | 54,952,314 | -6,455,771 | (11) |
| BASE METALS | | | | |
| Copper | 4,504,871 | 4,524,661 | 19,790 | 0.4 |
| Lead | 1,851,352 | 1,289,977 | -561,375 | (30) |
| Zinc | 8,958,802 | 7,779,257 | -1,179,545 | (13) |
| TOTAL BASE METALS | 15,315,025 | 13,593,895 | -1,721,130 | (11) |
| CHROMITE | 61,079 | 262,425 | 201,346 | 330 |
| CLAYS | 84,783 | 76,471 | -8,312 | (10) |
| COAL | 13,493,003 | 16,584,755 | 3,091,752 | 23 |
| CONSTRUCTION MATERIALS | | | | |
| Aggregate | 170,470 | 169,681 | -789 | (1) |
| Gravel | 55,287 | 97,245 | 41,958 | 76 |
| Rock | 71,869 | 107,769 | 35,900 | 50 |
| Sand | 464,150 | 404,299 | -59,851 | (13) |
| TOTAL CONSTRUCTION MATERIALS | 761,776 | 778,994 | 17,218 | 2 |
| DIAMONDS | 62,636,372 | 89,292,744 | 26,656,372 | 43 |
| DIMENSION STONE | 747 | 808 | 61 | 8 |
| GEM AND SEMI-PRECIOUS STONES | 10,220 | 45,290 | 35,070 | 343 |
| GOLD | 79,808,781 | 85,356,089 | 5,547,308 | 7 |
| GYPSUM | 528,524 | 523,391 | -5,133 | (1) |
| HEAVY MINERAL SANDS | | | | |
| Garnet | 641,345 | 534,804 | -106,541 | (17) |
| Ilmenite | 9,319,310 | 8,036,174 | -1,283,136 | (14) |
| Leucoxene | 630,073 | 716,390 | 86,317 | 14 |
| Rutile | 4,712,566 | 4,958,734 | 246,168 | 5 |
| Zircon | 10,563,318 | 12,402,779 | 1,839,461 | 17 |
| Staurolite | 13,829 | 12,077 | -1,752 | (13) |
| TOTAL HEAVY MINERAL SANDS | 25,880,441 | 26,660,958 | 780,517 | 3 |
| INDUSTRIAL PEGMATITE MINERALS | | | | |
| Feldspar | 125,540 | 103,081 | -22,459 | (18) |
| IRON ORE | 276,089,286 | 286,707,552 | 10,618,266 | 4 |
| LIMESAND-LIMESTONE-DOLOMITE | | | | |
| Dolomite | 3,447 | 6,653 | 3,206 | 93 |
| Limesand-Limestone | 1,843,617 | 1,754,588 | -89,029 | (5) |
| TOTAL LIMESAND-LIMESTONE-DOLOMITE | 1,847,064 | 1,761,241 | -85,823 | (5) |
| MANGANESE | 3,569,154 | 3,983,891 | 414,737 | 12 |
| NICKEL | | | | |
| Cobalt | 2,145,843 | 2,935,195 | 789,352 | 37 |
| Nickel | 46,273,109 | 56,690,384 | 10,417,275 | 23 |
| Palladium By-Product | 737,548 | 242,558 | -494,990 | (67) |
| Platinum By-Product | 108,621 | 82,806 | -25,815 | (24) |
| Rhodium By-Product | 1,546 | 0 | -1,546 | (100) |
| TOTAL NICKEL INDUSTRY | 49,266,667 | 59,950,943 | 10,684,276 | 22 |

| COMMODITY | 2001-02 Total A\$ | 2002-03 Total A\$ | 2002-03 Growth A\$ | % |
|-----------------------------------|----------------------|----------------------|-----------------------|------------|
| PETROLEUM | | | | |
| Condensate | 91,924,919 | 121,492,454 | 29,567,535 | 32 |
| Liquified Natural Gas | 138,360,497 | 147,784,874 | 22,343,461 | 16 |
| LPG - Butane | 10,755,833 | 12,375,807 | 1,619,974 | 15 |
| LPG - Propane | 9,175,529 | 9,695,963 | 520,434 | 6 |
| Natural Gas | 33,032,987 | 36,516,444 | 3,483,457 | 11 |
| Oil | 145,037,180 | 160,703,958 | 15,666,778 | 11 |
| TOTAL PETROLEUM | 428,286,945 | 488,569,500 | 60,282,555 | 14 |
| PIGMENTS | | | | |
| Red Oxide | 71,989 | 45,002 | -26,987 | (38) |
| SALT | 2,063,684 | 2,146,242 | 82,558 | 4 |
| SILICA SAND | 324,169 | 306,711 | -17,458 | (5) |
| SILVER | 400,455 | 609,910 | 209,455 | 52 |
| SPONGOLITE | 91,007 | 89,846 | -1,161 | (1) |
| TALC | 80,501 | 72,995 | -7,506 | (9) |
| TIN-TANTALUM-LITHIUM | | | | |
| Spodumene | 903,027 | 875,739 | -27,288 | (3) |
| Tantalite | 4,684,840 | 5,332,841 | 648,001 | 14 |
| Tin | 180,026 | 126,983 | -53,043 | (30) |
| TOTAL TIN-TANTALUM-LITHIUM | 5,767,893 | 6,335,563 | 567,670 | 10 |
| VANADIUM | 150,952 | 168,577 | 17,625 | 12 |
| TOTAL REVENUE | 1,028,124,143 | 1,138,979,188 | 110,855,045 | 11 |

Note: All royalty receipts above are only those paid into the State's Consolidated Revenue Fund during the period. It does not include royalty receipts collected on behalf of the Commonwealth.



| TABLE 5 AVERAGE NUMBER OF PERSONS EMPLOYED IN THE WA MINERALS AND PETROLEUM INDUSTRIES | | | |
|---|--------------------------------|---------------------------|----------------|
| MINERAL/Company | Operating Site | 2001-02 | 2002-03 |
| ALUMINA | | | |
| Australian Fused Materials Pty Ltd | Rockingham Fused Alumina Plant | 175 | 208 |
| Alcoa World Alumina Australia | Huntly | 738 | 792 |
| | Kwinana Alumina Refinery | 1,497 | 1,513 |
| | Pinjarra Refinery | 1,435 | 1,408 |
| | Wagerup Alumina Refinery | 980 | 981 |
| | Willowdale | 314 | 334 |
| | Worsley Alumina Pty Ltd | Worsley Mining Operations | 213 |
| | Worsley Refinery | 1,262 | 1,379 |
| TOTAL ALUMINA | | 6,614 | 6,835 |
| BASE METALS | | | |
| Normandy Mining Ltd | Scuddles | 303 | 316 |
| Straits Resources Ltd | Nifty | 467 | 316 |
| Western Metals Ltd | Lennard Shelf | 504 | 515 |
| Various | Other | 4 | 2 |
| TOTAL BASE METALS | | 1,278 | 1,149 |
| COAL | | | |
| Griffin Coal Mining Co. Pty Ltd | Muja | 284 | 302 |
| Wesfarmers Coal Ltd | Premier/WCL | 378 | 338 |
| TOTAL COAL | | 662 | 640 |
| DIAMONDS | | | |
| Argyle Diamond Mines Pty Ltd | Lake Argyle | 1,060 | 1,029 |
| Kimberley Diamond Company Ltd | Ellendale | 0 | 66 |
| TOTAL DIAMONDS | | 1,060 | 1,095 |
| GOLD | | | |
| Agnew Gold Mining Company Pty Limited | Emu | 1,416 | 946 |
| AngloGold Australia Ltd | Sunrise Dam | 660 | 688 |
| Australian Gold Resources Ltd | Perth Mint | 82 | 102 |
| Barmenco Pty Ltd | Western Queen-Warda Warra | 10 | 0 |
| | Lights of Israel | 0 | 41 |
| | First Hit | 14 | 12 |
| Barra Resources Ltd | First Hit | 14 | 12 |
| Barrick Gold of Australia Limited | Darlot | 122 | 132 |
| | Lawlers | 181 | 268 |
| | Plutonic | 468 | 607 |
| Big Bell Gold Operations Pty Ltd | Big Bell Consolidated | 479 | 341 |
| Central Norseman Gold | Norseman | 197 | 237 |
| Croesus Mining NL | Binduli | 45 | 2 |
| | Hannan South | 34 | 30 |
| | Davyhurst | 97 | 92 |
| Delta Gold NL | Lady Ida Group | 2 | 0 |
| | Kanowna Belle | 332 | 479 |
| Equigold NL | Dalgaranga | 15 | 0 |
| | Kirkalocka | 0 | 117 |
| Gidgee Gold Pty Ltd | Gidgee | 92 | 120 |
| Gindalbie Gold NL | Minjar | 49 | 66 |
| Paddington Gold Pty Limited | Paddington-Mt Pleasant | 354 | 447 |

| MINERAL/Company | Operating Site | 2001-02 | 2002-03 |
|--|---------------------------------------|---------------|---------------|
| Normandy Mining Ltd | Bronzewing-Mt McClure | 423 | 444 |
| | Jundee-Nimary | 511 | 410 |
| | Wiluna | 308 | 197 |
| Haoma Pty Ltd | Normay | 10 | 6 |
| Hill 50 Gold NL | Hill 50-Mt Magnet | 389 | 399 |
| Kalgoorlie Consolidated Gold Mines Pty Ltd | Golden Mile - Super Pit | 1,294 | 1,269 |
| King Solomon Mines Limited | Gullewa | 27 | 12 |
| Kundana Gold Pty Ltd | Kundana | 256 | 104 |
| LionOre Australia (Wildara) NL | Thunderbox | 38 | 172 |
| Mines and Resources Australia Pty Ltd | White Foil | 48 | 190 |
| Newcrest Mining Ltd | Telfer | 254 | 630 |
| Nickelseekers Pty Limited | Daisy-Milano | 19 | 22 |
| Placer Dome Inc | Granny Smith | 571 | 417 |
| Resolute Ltd | Chalice | 6 | 2 |
| | Higginsville Group | 15 | 0 |
| | Nicholsons Find | 0 | 15 |
| Rewa Gold Mining Ltd | Nicholsons Find | 0 | 15 |
| Sipa Resources International NL | Mt Olympus | 44 | 56 |
| Sons of Gwalia NL | Carosue Dam | 223 | 295 |
| | Great Victoria Underground | 1 | 0 |
| | Marvel Loch-Yilgarn Star | 468 | 518 |
| | Sons of Gwalia | 203 | 339 |
| | Tarmoola | 327 | 123 |
| South Kal Mines Pty Ltd | New Celebration, Jubilee, New Hampton | 152 | 441 |
| St Barbara Mines Ltd | Bluebird Group | 314 | 196 |
| St Ives Gold Mining Company Pty Limited | Kambalda-St Ives | 1,218 | 1,444 |
| Troy Resources Ltd | Mt Kemptz | 52 | 54 |
| Viceroy Resource Corporation | Bounty | 124 | 8 |
| Worsley Alumina Pty Ltd | Boddington | 280 | 48 |
| Other | Various | 27 | 29 |
| TOTAL GOLD | | 12,251 | 12,567 |
| HEAVY MINERAL SANDS | | | |
| BHP Titanium Minerals Pty Ltd | Beenup | 33 | 27 |
| Cable Sands Pty Ltd | Bunbury | 337 | 292 |
| Doral Mineral Sands Pty Ltd | Dardanup | 0 | 104 |
| GMA Garnet Pty Ltd | Narngulu Garnet Plant | 31 | 33 |
| | Port Gregory - Hutt Lagoon | 17 | 17 |
| | Rockingham Zirconia Plant | 28 | 26 |
| Hanwah Advanced Ceramics Australia Pty Ltd | Rockingham Zirconia Plant | 28 | 26 |
| Iluka Resources Limited | Capel | 542 | 446 |
| | Eneabba | 309 | 290 |
| | Narngulu Synthetic Rutile Plants | 407 | 368 |
| TiWest Pty Ltd | Chandala-Muchea | 207 | 216 |
| | Cooljarloo | 291 | 259 |
| TOTAL HEAVY MINERAL SANDS | | 2,202 | 2,078 |
| IRON ORE | | | |
| BHP Iron Ore (Goldsworthy) Ltd | Finucane Island | 265 | 533 |
| | Yarrie | 190 | 206 |
| BHP Iron Ore (Jimblebar) Ltd | Jimblebar | 113 | 157 |
| BHP Iron Ore Ltd | Mining Area C | 20 | 276 |

| TABLE 5 AVERAGE NUMBER OF PERSONS EMPLOYED IN THE WA MINERALS AND PETROLEUM INDUSTRIES | | | | |
|---|---|--------------------------------|----------------|-------|
| MINERAL/Company | Operating Site | 2001-02 | 2002-03 | |
| IRON ORE cont. | Mt Newman Railway | 365 | 778 | |
| | Mt Whaleback | 1,035 | 1,109 | |
| | Nelson Point | 756 | 1,022 | |
| | Orebody 25 | 88 | 106 | |
| | Port Hedland HBI Plant | 885 | 959 | |
| | Yandi | 231 | 338 | |
| | Hamersley Iron Pty Ltd | Brockman No. 2 Detritals Group | 91 | 139 |
| | | Dampier Port Operations | 756 | 750 |
| | | Eastern Range Group | 0 | 28 |
| | | Hismelt/Kwinana | 195 | 368 |
| | | Marandoo | 160 | 197 |
| | | Paraburdoo/Channar | 630 | 642 |
| | | Hamersley Railway | 289 | 0* |
| | | Tom Price | 939 | 1,074 |
| | | Yandicoogina | 223 | 296 |
| | | West Angelas Rail | 95 | 0* |
| | Portman Iron Ore Ltd | West Angelas Plant | 191 | 193 |
| | | West Angelas Port Facility | 283 | 0 |
| | | Cockatoo Island | 22 | 87 |
| | | Koolyanobbing | 106 | 174 |
| Robe River Mining Co. Pty Ltd | Cape Lambert | 532 | 579 | |
| | Pannawonica Deepdale | 347 | 395 | |
| | Robe River Railway | 118 | 0* | |
| * Pilbara Railway Company | Hamersley, Robe River and West Angelas Rail | 0 | 470 | |
| TOTAL IRON ORE | | 8,925 | 10,876 | |
| NICKEL | | | | |
| Anaconda Nickel Ltd | Murrin Murrin | 629 | 661 | |
| BHP Billiton Minerals Pty Ltd | Ravensthorpe | 0 | 5 | |
| Lightning Nickel Pty Ltd | Long Nickel | 0 | 58 | |
| LionOre Australia (Nickel) Ltd | Emily Ann | 132 | 146 | |
| MacMahon Holdings | Blair | 5 | 0 | |
| Mincor Operations Pty Ltd | Miitel | 0 | 127 | |
| | Wannaway | 0 | 59 | |
| OMG Cawse Pty Ltd | Cawse | 251 | 191 | |
| Outokumpu Mining Australia Pty Ltd | Black Swan | 270 | 227 | |
| Preston Resources Limited | Bulong | 303 | 365 | |
| Sir Samuel Mines NL | Cosmos | 70 | 92 | |
| Tectonic Resources NL | Rav 8 | 62 | 68 | |
| Titan Resources NL | Radio Hill | 84 | 10 | |
| Western Mining Corporation Ltd | Kalgoorlie Nickel Smelter | 686 | 805 | |
| | Kambalda | 338 | 245 | |
| | Kwinana Refinery | 331 | 320 | |
| | Leinster | 873 | 960 | |
| | Mt Keith | 838 | 1,004 | |
| TOTAL NICKEL | | 4,872 | 5,343 | |

| MINERAL/Company | Operating Site | 2001-02 | 2002-03 |
|---|---|---------------|---------------|
| PETROLEUM PRODUCTS | | | |
| Agip Australia Ltd | Woollybutt | 0 | 2 |
| Apache Energy Ltd | East Spar, Harriet, Stag, Campbell, Chervil, Agincourt-Wonnich, Sinbad, Tanami, North Herald, | | |
| | South Pepper | 233 | 218 |
| ARC Energy NL | Dongara, Erimia, Hovea | 7 | 12 |
| BHP Billiton Petroleum (North West Shelf) Pty Ltd | Griffin | 77 | 93 |
| Hardman Oil & Gas Pty Ltd | Woodada | 5 | 5 |
| Kimberley Oil NL | Blina, Boundary, Lloyd, Sundown, West Terrace | 4 | 4 |
| Mobil Exploration & Producing Australia Pty Ltd | Wandoo | 28 | 27 |
| Origin Energy Resources Ltd | Beharra Springs, Tubridgi, Jingemia | 15 | 22 |
| Petro Energy Pty Ltd | Mt Horner | 2 | 2 |
| Nexen Petroleum Australia Pty Limited | Buffalo | 82 | 23 |
| ChevronTexaco Pty Ltd | Barrow Island, Cowle, Roller-Skate, Saladin, Yammderry | 139 | 128 |
| Woodside Energy Ltd | Athena, Cossack, Echo-Yodel, Goodwyn, Hermes, North Rankin, Wanaea, Lambert, Legendre | 725 | 957 |
| TOTAL PETROLEUM PRODUCTS | | 1,317 | 1,491 |
| SALT | | | |
| Dampier Salt Ltd | Dampier | 278 | 229 |
| | Lake MacLeod | 199 | 163 |
| | Port Hedland | 76 | 101 |
| Kooyanobbing Pty Ltd | Lake Deborah | 9 | 9 |
| Onslow Solar Salt Pty Ltd | Onslow | 62 | 90 |
| Shark Bay Salt JV | Useless Loop | 75 | 67 |
| TOTAL SALT | | 699 | 659 |
| TOTAL CLAYS | | 82 | 67 |
| TOTAL CONSTRUCTION MATERIALS | | 459 | 305 |
| TOTAL DIMENSION STONE | | 99 | 100 |
| TOTAL INDUSTRIAL PEGMATITE MINERALS | | 26 | 25 |
| TOTAL LIMESTONE - LIMESAND | | 122 | 118 |
| TOTAL MANGANESE ORE | | 77 | 126 |
| TOTAL PHOSPHATE | | 336 | 187 |
| TOTAL SILICA - SILICA SAND | | 188 | 214 |
| TOTAL TALC | | 88 | 97 |
| TOTAL TIN - TANTALUM - LITHIUM | | 586 | 457 |
| TOTAL VANADIUM | | 107 | 63 |
| ALL OTHER MATERIALS | | 70 | 48 |
| TOTAL | | 42,120 | 44,474 |

SOURCE: AXTAT Reporting System, Safety, Health and Environment Division, for minerals data and petroleum producers for petroleum data. Figures are as provided by the various operating companies to the Department.

TABLE 6

PRINCIPAL MINERAL AND PETROLEUM PRODUCERS

effective 1 July 2003

BASE METALS*Copper*

Newmont Australia
PO Box 1123,
West Perth WA 6872,
(08) 9366 3232,
Golden Grove.
www.newmont.com

Straits Resources Ltd
Level 1, 35 Ventnor Avenue,
West Perth WA 6005,
(08) 9480 0500,
Nifty,
www.straits.com.au

WMC Ltd
191 Great Eastern Highway,
Belmont WA 6104,
(08) 9479 0500,
Kambalda,
www.wmc.com.au

Lead-Zinc

Newmont Australia
PO Box 1123,
West Perth WA 6872,
(08) 9366 3232,
Golden Grove.
www.newmont.com

Western Metals Ltd
263 Adelaide Terrace,
Perth WA 6000,
(08) 9221 2555,
Lennard Shelf,
www.westernmetals.com.au

BAUXITE-ALUMINA*Alumina*

Alcoa World Alumina Australia,
181-205 Davy Street,
Booragoon WA 6154,
(08) 9316 5111,
Del Park, Willowdale, Huntly,
www.alcoa.com.au

Worsley Alumina Pty Ltd
PO Box 344,
Collie WA 6225,
(08) 9734 8311,
Boddington,
www.wapl.com.au

CHROMITE*Chromite Ore*

Pilbara Chromite Pty Ltd,
62 Colin Street,
West Perth WA 6005,
(08) 9321 3633,
Coobina,
www.consminerals.com.au

CLAY*Attapulgit*

Hudson Resources Ltd
James Street, Narngulu,
Geraldton WA 6530,
(08) 9923 3604,
Lake Nerramayne.

Clay Shale

The Griffin Coal Mining Company Pty Limited
28 The Esplanade,
Perth WA 6000,
(08) 9261 2800,
Collie
www.griffincoal.com.au

Fire Clay

Broome Brick Company Pty Ltd
PO Box 323,
Broome WA 6725
(08) 9192 1385
Broome

Kaolin

Gwalia Consolidated Ltd
16 Parliament Place,
West Perth WA 6005,
(08) 9263 5555,
Greenbushes,
www.sog.com.au

Saponite

Watheroo Minerals Pty Ltd
PO Box 353,
Dunsborough, WA 6281,
(08) 9756 6121,
Watheroo Clays,
www.bentoniteproductswa.com.au

COAL

The Griffin Coal Mining Company Pty Limited,
28 The Esplanade,
Perth WA 6000,
(08) 9261 2800,
Collie
www.griffincoal.com.au

Wesfarmers Premier Coal Ltd,
Premier Road,
Collie WA 6225,
(08) 9780 2222
Collie
www.wesfarmers.com.au

CONSTRUCTION MATERIALS*Aggregate*

The Readymix Group (WA)
75 Canning Highway,
Victoria Park WA 6100,
(08) 9212 2000,
Boodarie, Burrup-Dampier,
www.readymix.com.au

Gravel

Boral Resources (WA) Ltd
63 Abernethy Road,
Belmont WA 6104,
(08) 9333 3400,
Grosmont,
www.boral.com.au

WA Limestone Co.
41 Spearwood Avenue,
Bibra Lake WA 6163,
(08) 9434 2299,
Pickering Brook.

Sand

Boral Resources (WA) Ltd
63 Abernethy Road,
Belmont WA 6104,
(08) 9333 3400,
Grosmont,
www.boral.com.au

Rocla Quarry Products
130 Fauntleroy Avenue,
Redcliffe WA 6104,
(08) 9475 2555,
Gnangarra,
www.rocla.com.au

The Readymix Group (WA)
75 Canning Highway,
Victoria Park WA 6100,
(08) 9212 2000,
Various sites,
www.readymix.com.au

Tuma Holdings Pty Ltd
42 Noel Road,
Gooseberry Hill WA 6076,
Mobile: 0408 923 801
The Lakes, Mundaring

DIAMONDS

Argyle Diamond Mines
2 Kings Park Road,
West Perth WA 6005,
(08) 9482 1166,
Argyle,
www.argylediamonds.com.au

Kimberley Diamond Company,
12 Walker Avenue,
West Perth WA 6005,
(08) 9321 5887,
Ellendale,
www.kimberleydiamondco.com.au

DIMENSION STONE*Granite*

Allied Granites Pty Ltd,
4 Koojan Avenue,
South Guildford WA 6055,
Fraser Range Granite.

Mungari Quarries Pty Ltd,
Level 2, 343 Pacific Highway,
North Sydney NSW 2060,
(02) 9957 2002,
Drydens Find Granite.

FELDSPAR

Unimin Australia Ltd
26-28 Tomlinson Road,
Welshpool WA 6106,
(08) 9362 1411,
Pippingarra, Mukinbudin,
www.unimin.com.au

GOLD

Abelle Limited
35 Ventnor Avenue,
West Perth WA 6005,
(08) 9485 1476,
Gidgee,
www.abelle.com.au

Agnew Gold Mining Co Pty Ltd
PMB 10,
Leinster WA 6437,
(08) 9088 3834,
Agnew,
www.goldfields.co.za

AngloGold Australia Ltd
Level 13, 44 St Georges Terrace,
Perth WA 6000,
(08) 9425 4600,
Sunrise Dam,
www.anglogold.com

Croesus Mining NL
39 Porter Street,
Kalgoorlie WA 6430,
(08) 9091 2222,
Binduli, Central Norseman,
Davyhurst,
www.croesus.com.au

Gindalbie Gold NL
PO Box 512,
West Perth WA 6872,
(08) 9481 2232,
Minjar,
www.gindalbie.com.au

Harmony Gold (Australia) Pty Ltd
10 Ord Street,
West Perth WA 6005,
(08) 9211 3100,
Big Bell, Jubilee, New Celebration,
Hill 50-Mt Magnet,
www.harmony.co.za

Barrick Gold of Australia Limited
2 Mill Street,
Perth WA 6000,
(08) 9212 5777,
Darlot, Lawlers, Plutonic,
www.barrick.com

**Kalgoorlie Consolidated Gold
Mines Pty Ltd**
Private Bag 27,
Kalgoorlie WA 6433,
(08) 9022 1100,
Golden Mile,
www.kalgold.com.au

Menzies Gold Ltd,
122 Kewdale Road,
Kewdale WA 6105,
(08) 9353 7200,
King Solomon,
www.menziesgold.com.au

**Mines and Resources Australia
Pty Ltd**
256 Adelaide Terrace,
Perth WA 6000,
(08) 9202 1100,
White Foil

Newmont Australia
PO Box 1123,
West Perth WA 6872,
(08) 9366 3232,
Bronzewing-Mt McClure, Jundee-
Nimary, Wiluna,
www.newmont.com

Placer (Granny Smith) Pty Ltd
PO Box 33,
Laverton WA 6440,
(08) 9088 2217
Granny Smith,
www.placerdome.com

Placer Dome Asia Pacific Limited
PO Box 1662,
Kalgoorlie WA 6430,
(08) 9080 6111,
Kanowna Belle,
www.placerdome.com

Placer Dome Asia Pacific Limited
PO Box 622,
Kalgoorlie WA 6433,
(08) 9080 6400,
Kundana, Paddington,
www.placerdome.com

Sipa Resources International NL
87 Colin Street,
West Perth WA 6005,
(08) 9481 6259,
Paraburdo,
www.sipa.com.au

Sons of Gwalia Ltd
16 Parliament Place,
West Perth WA 6005,
(08) 9263 5555,
Carosue Dam,
Marvel Loch-Southern Cross,
Sons of Gwalia, Tarmoola,
www.sog.com.au

St Barbara Mines Ltd
Level 2, 16 Ord Street,
West Perth WA, 6005
(08) 9476 5555,
Bluebird,
www.stbarbara.com.au

St Ives Gold Mining Co Pty Ltd
C/- Kambalda Post Office,
Kambalda WA 6442,
(08) 9088 1111,
Kambalda-St Ives,
www.goldfields.co.za

Troy Resources NL
44 Ord Street,
West Perth WA 6005,
(08) 9481 1277,
Bulchina,
www.try.com.au

Worsley Alumina Pty Ltd
PO Box 48,
Boddington WA 6390,
(08) 9883 8260,
Boddington,
www.wapl.com.au

GYP SUM

Cockburn Cement Ltd
Russell Road,
East Munster WA 6166,
(08) 9411 1000,
Lake Hillman.

CSR Limited
19 Sheffield Road,
Welshpool WA 6106,
(08) 9365 1686,
Jurien Bay North.

Dampier Salt (Operations) Pty Ltd
152 St Georges Terrace,
Perth WA 6000,
(08) 9327 2257,
Lake MacLeod,
www.dampiersalt.com.au

Gypsum Industries
PO Box 952,
Canning Bridge WA 6153,
(08) 9364 4951,
Lake Cowcowing

Lake Hillman Mining Pty Ltd
PO Box 1,
Kalannie WA 6468,
(08) 9666 2045,
Lake Hillman

HEAVY MINERAL SANDS

Garnet Sand

GMA Garnet Pty Ltd
PO Box 188,
Geraldton WA 6530,
(08) 9923 3644,
Port Gregory,
www.gmagarnet.com

Ilmenite, Leucoxene, Rutile and Zircon

Cable Sands (WA) Pty Ltd
PO Box 133,
Bunbury WA 6230,
(08) 9721 0200,
Jangardup, Sandalwood, Yarloop,
www.cablesands.com.au

Iluka Resources Ltd
5th Floor, 553 Hay Street,
Perth WA 6000,
(08) 9221 7611,
Capel, Eneabba, Yoganup, Stratham,
www.iluka.com

TABLE 6

PRINCIPAL MINERAL AND PETROLEUM PRODUCERS

effective 1 July 2003

TiWest Pty Ltd
1 Brodie-Hall Drive,
Bentley WA 6102,
(08) 9365 1333,
Cooljarloo,
www.tiwest.com.au

IRON ORE

BHP Billiton Iron Ore (Goldsworthy) Ltd
200 St Georges Terrace,
Perth WA 6000,
(08) 9320 4444,
Nimngarra-Yarrie,
www.bhpbilliton.com

BHP Billiton Iron Ore Ltd
200 St Georges Terrace,
Perth WA 6000,
(08) 9320 4444,
Jimblebar, Newman, Yandicoogina,
www.bhpbilliton.com

Channar Mining Pty Ltd
152 St Georges Terrace,
Perth WA 6000,
(08) 9327 2327,
Channar.

Hamersley Iron Pty Ltd
152 St Georges Terrace,
Perth WA 6000,
(08) 9327 2327,
Marandoo, Paraburdoo, Tom Price,
Yandicoogina,
www.hamersleyiron.com

Portman Iron Ore Ltd
1 William Street,
Perth WA 6000,
(08) 9426 3388,
Cockatoo Island, Koolyanobbing,
www.portman.com.au

Robe River Iron Associates
Level 15, The Quadrant
1 William Street
Perth WA 6000
(08) 9217 4747
Pannawonica, West Angelas
www.roberiver.com.au

LIMESAND-LIMESTONE

Cockburn Cement Ltd
Russell Road,
East Munster WA 6166,
(08) 9411 1000,
Cockburn, Dongara, Wanneroo

Limestone Resources Australia Pty Ltd
Parkland Road, Cnr Hasler Street,
Osborne Park WA, 6017,
(08) 9443 4244,
Wanneroo, Moore River,
Carabooda

Loongana Lime Pty Ltd
PO Box 808,
Kalgoorlie WA 6430,
(08) 9021 8055,
Loongana.

WA Limestone Co.
41 Spearwood Avenue,
Bibra Lake WA 6163,
(08) 9434 2299,
Postans

Gypsum Supplies
PO Box 952,
Canning Bridge WA 6153,
(08) 9364 4951,
Dongara-Denison, Cervantes,
Lancelin, Jurien.

MANGANESE

Pilbara Manganese Pty Ltd
62 Colin Street,
West Perth WA 6005,
(08) 9321 3633,
Woodie Woodie,
www.consminerals.com.au

NICKEL

Anaconda Nickel Ltd
Level 4, 30 The Esplanade,
Perth WA 6000,
(08) 9212 8400,
Murrin Murrin,
www.anaconda.com.au

Independence Gold
PO Box 893,
South Perth WA 6951,
(08) 9367 2755,
Long Nickel,
www.independencegold.com.au

LionOre (Australia) Nickel Ltd
Level 2, 10 Ord Street,
West Perth WA 6005,
(08) 9481 5656,
Emily Ann,
www.lionore.com

Mincor Resources NL
Level 1, 1 Havelock Street,
West Perth 6005,
(08) 9321 7125,
Miitel, Wannaway,
www.mincor.com.au

MPI Mines Ltd
Level 8, 10-16 Queen Street,
Melbourne Vic 3000,
(03) 9628 2214,
Black Swan,
www.mpimines.com.au

OMG Cawse Pty Ltd
Cawse Nickel Operations,
Locked Bag 32,
Kalgoorlie WA 6433,
(08) 9024 8800,
Cawse.

Sir Samuel Mines NL
24 Outram Street,
West Perth WA 6005,
(08) 9213 1588,
Cosmos,
www.jubileemines.com.au

Tectonic Resources NL
Suite 4, 100 Hay Street,
Subiaco WA 6008,
(08) 9388 3872,
RAV8,
www.tectonicres.com.au

WMC Ltd
191 Great Eastern Highway,
Belmont WA 6104,
(08) 9442 2000,
Kambalda, Leinster, Mt Keith,
www.wmc.com.au

PALLADIUM

WMC Ltd
191 Great Eastern Highway,
Belmont WA 6104,
(08) 9442 2000,
Kambalda,
www.wmc.com.au

PETROLEUM

Apache Energy Ltd
Level 3, 256 St Georges Terrace,
Perth WA 6000,
(08) 9422 7222,
Agincourt, Campbell, Chervil, East Spar, Endymion, Gibson, Gipsy, Harriet, Little Sandy, North Gipsy, North Herald, Pedirka, Rosette, Simpson, Sinbad, South Pepper, South Plato, Stag, Tanami, Victoria, Wonnich,
www.apachecorp.com

ARC Energy NL
Level 1, 46 Ord Street,
West Perth WA 6005,
(08) 9486 7333,
Dongara, Hovea
www.arcenergy.com.au

BHP Billiton Petroleum (North West Shelf) Pty Ltd
Level 42, Central Park,
152-158 St Georges Terrace,
Perth WA 6000,
(08) 9278 4888,
Chinook-Scindian, Griffin,
www.bhpbilliton.com

ChevronTexaco Australia Pty Ltd
Level 24, QV1 Building,
250 St Georges Terrace,
Perth WA 6000,
(08) 9216 4000,
Barrow Island, Cowle, Crest, Roller-Skate, Saladin, Yammaderry,
www.chevrontexaco.com

Hardman Oil and Gas Pty Ltd

5 Ord Street,
West Perth WA 6005,
(08) 9321 6881,
Woodada,
www.hdr.com.au

Kimberley Oil NL

Suite 12B, 573 Canning Highway,
Alfred Cove WA 6154,
(08) 9330 8876,
Blina, Boundary, Lloyd,
Sundown, West Terrace.

**Mobil Exploration & Producing
Australia Pty Ltd**

Level 7, 30 The Esplanade,
Perth WA 6000,
(08) 9480 0300,
Wandoo,
www.mobil.com.au

**Nexen Petroleum Australia Pty
Limited**

Level 18, 44 St Georges Terrace,
Perth WA 6000,
(08) 9218 8911,
Buffalo,
www.nexeninc.com

Origin Energy Resources Ltd

34 Collins Street,
West Perth WA 6005,
(09) 9324 6111,
Beharra Springs, Tubridgi,
www.originenergy.com.au

Petro Energy Pty Ltd

242 Railway Parade,
West Leederville WA 6007
(08) 9 381 4744,
Mt Horner.

Woodside Energy Ltd

1 Adelaide Terrace,
Perth WA 6000,
(08) 9348 4000,
Athena, Cossack, Echo-Yodel,
Goodwyn, Hermes, Lambert,
Laminaria, Legendre,
North Rankin, Perseus, Wanaea,
www.woodside.com.au

Agip Australia Limited

Level 3, 40 Kings Park Road,
West Perth WA 6005,
(08) 9320 1111,
Woollybutt.

PLATINUM**WMC Ltd**

191 Great Eastern Highway,
Belmont WA 6104,
(08) 9442 2000,
Kambalda,
www.wmc.com.au

SALT**Dampier Salt (Operations) Pty Ltd**

152-158 St Georges Terrace,
Perth WA 6000,
(08) 9327 2257,
Dampier, Lake MacLeod, Port
Hedland,
www.dampiersalt.com.au

Onslow Salt Pty Ltd

PO Box 23,
Onslow WA 6710,
(08) 9184 9000,
Onslow Salt,
www.onslowsalt.com

Shark Bay Salt Joint Venture

22 Mount Street,
Perth WA 6000,
(08) 9420 4320,
Useless Loop,
www.clough.com.au

WA Salt Supply Ltd

Cockburn Road,
Hamilton Hill WA 6163,
(08) 9335 9911,
Lake Deborah East, Pink Lake,
www.wasalt.com.au

SILICA-SILICA SAND*Silica***Simcoa Operations Pty Ltd**

PO Box 1389,
Bunbury WA 6231,
(08) 9780 6666,
Dalaroo,
www.simcoa.com.au

*Silica Sand***Rocla Quarry Products**

180 Fautleroy Avenue,
Kewdale WA 6105,
(08) 9475 2555
Gnangarra,
www.rocla.com.au

TT Sand Pty Ltd

PO Box 1664,
Fremantle WA 6959,
(08) 9319 1371,
Mindijup.

SPONGOLITE**Supersorb Minerals NL**

55 Collie Street,
Albany WA 6330,
(08) 9842 1955,
Woogenellup,
www.supersorb.com.au

TALC**Luzenac Australia Pty Ltd**

GPO Box A42,
Perth WA 6837
(08) 9327 2844,
Three Springs,
www.luzenac.com

Unimin Australia Ltd

26-28 Tomlinson Road,
Welshpool WA 6106,
(08) 9362 1411,
Mt Seabrook.

TIN-TANTALUM-LITHIUM*Spodumene***Sons of Gwalia Ltd**

16 Parliament Place,
West Perth WA 6005,
(08) 9263 5555,
Greenbushes, Wodgina,
www.sog.com.au

*Tantalite-Tin***Sons of Gwalia Ltd**

16 Parliament Place,
West Perth WA 6005,
(08) 9263 5555,
Greenbushes, Wodgina,
www.sog.com.au

**Haddington International
Resources Ltd**

PO Box 1909,
West Perth WA 6872,
(08) 9226 1550,
Bald Hill,
www.haddington.com.au

ABBREVIATIONS, REFERENCES, UNITS & CONVERSION FACTORS

As the document makes use of abbreviations and references, an explanation of each has been included below. A conversion table, relating the units by which various commodities are measured, has also been provided.

ABBREVIATIONS

| | | | |
|--------|--|-----------------|-----------------------------------|
| A\$ | Australian Dollar | HBI | Hot Briquetted Iron |
| ABARE | Australian Bureau of Agricultural and Resource Economics | IMF | International Monetary Fund |
| ABS | Australian Bureau of Statistics | km | kilometres |
| AFR | Australian Financial Review | km ² | square kilometres |
| ANZ | Australia New Zealand bank | LME | London Metal Exchange |
| bbbl | barrels of oil | Mbbl | thousand barrels of oil |
| Bcm | billion cubic metres | MMbbl | million barrels of oil |
| BMR | Bureau of Mineral Resources | Mt | million tonnes |
| cons | concentrates | Mt/a | million tonnes per annum |
| CSO | Central Selling Organisation | n/a | not applicable |
| ct | carat | RBA | Reserve Bank of Australia |
| DRI | Direct Reduced Iron | SARS | Severe Acute Respiratory Syndrome |
| ECB | European Central Bank | t | tonnes |
| f.o.b. | free-on-board | t/a | tonnes per annum |
| f.o.t. | free-on-truck | Tcf | trillion cubic feet |
| GDP | Gross Domestic Product | US\$ | United States Dollar |
| | | WTI | West Texas Intermediate |

REFERENCES TABLE 3

- (a) Estimated f.o.b. value
- (b) Metallic by-product of nickel mining
- (c) Value based on the average Australian value of alumina as published by the ABS
- (d) Delivered/shipped value
- (e) Value at works
- (f) Estimated ex-mine value
- (g) London PM Gold Fix price as supplied by WA Treasury Corporation
- (h) Estimated f.o.t. value
- (i) Estimated f.o.b. value based on the current price of nickel-containing products
- (j) By-products of gold mining
- (r) Revised from previous edition

UNITS AND CONVERSION FACTORS

| | Metric Unit | Symbol | Imperial Unit | | Prefix |
|-----------------------|---------------|---|--|----------|------------------|
| Mass | 1 gram | (g) | = 0.032151 troy (fine) ounce (oz) | | |
| | 1 kilogram | (kg) | = 2.204624 pounds (lbs) | | |
| | 1 tonne | (t) | = 1.10231 United States short ton [1 US short ton = 2,000 lbs] | | |
| | 1 tonne | (t) | = 0.98421 United Kingdom long ton [1 UK long ton = 2,240 lbs] | | |
| | 1 tonne LNG | (t) | = 52,000,000 (Btu) | | |
| Volume | 1 kilolitre | (kl) | = 6.28981 barrels (bbls) | | |
| | 1 cubic metre | (m ³) | = 35.3147 cubic feet (ft ³) [1 kilolitre (kl) = 1 cubic metre (m ³)] | | |
| Energy | 1 kilojoule | (kj) | = 0.94781 British Thermal Units (Btu) | | |
| Energy Content | | | | | |
| | Coal | 19.7 GJ/t | | kilo (k) | 10 ³ |
| | Condensate | 32.0 MJ/L | | mega (M) | 10 ⁶ |
| | Crude oil | 37.0 MJ/L | | giga (G) | 10 ⁹ |
| | LNG | 25.0 MJ/L | | tera (T) | 10 ¹² |
| | Natural gas | 38.2 MJ/m ³ | | peta (P) | 10 ¹⁵ |
| | LPG-butane | 28.7 MJ/L (1tonne LPG-butane = 1,720 litres) | | | |
| | LPG-propane | 25.4 MJ/L (1tonne LPG-propane = 1,960 litres) | | | |

DATA SOURCES

DATA SOURCES

Quantities for minerals and petroleum in this publication are collected by the Department's Royalty Branch and are based on information provided by the producers in royalty and production returns. The quantities specified relate to either mine production or sales as listed below for each commodity.

Mine Production

Clays

Coal

Construction Materials

Dimension Stone

Gold

Gypsum

Limesand -Limestone -Dolomite

Silica - Silica Sand

Talc

Sales

Alumina

Base Metals (Copper, Lead and Zinc)

Chromite

Diamonds

Gem and Semi-Precious Stones

Heavy Mineral Sands

Industrial Pegmatite Minerals

Iron Ore

Manganese

Nickel Industry (Nickel, Cobalt, Platinum and

Palladium)

Petroleum

Pigments

Salt

Silver

Spongolite

Tin -Tantalum - Lithium

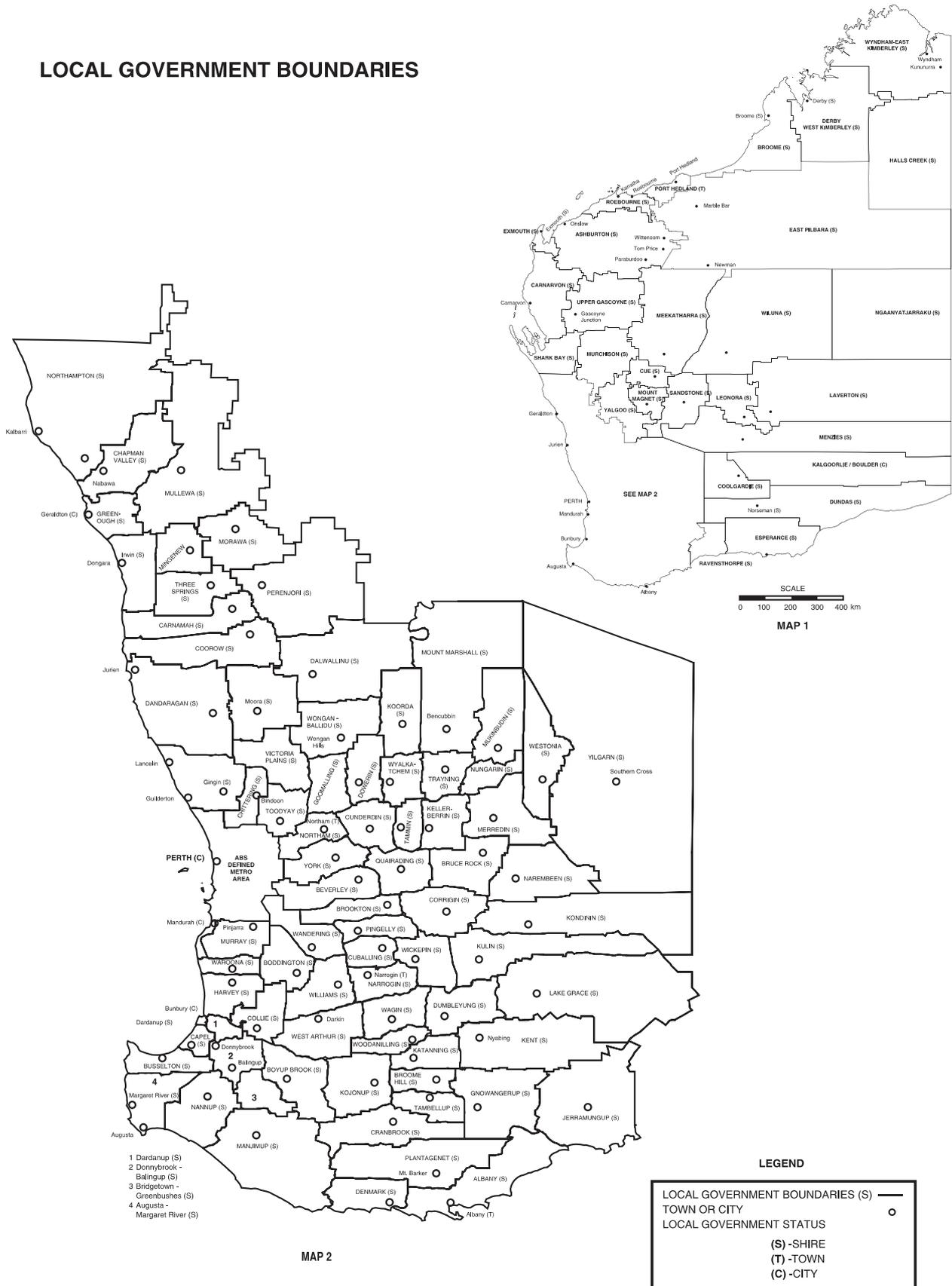
Vanadium

CLASSIFICATION OF COUNTRIES

| Euro area ¹ / European Union | | Non-Japan Asia | | Newly Industrialised Asia |
|---|-----------------------|-------------------|---------------------------|---------------------------|
| <i>Austria</i> | <i>Ireland</i> | Afghanistan | Nepal | Hong Kong |
| <i>Belgium</i> | <i>Luxembourg</i> | Bangladesh | Pakistan | Korea |
| <i>Denmark</i> | <i>Netherlands</i> | Bhutan | Papua New Guinea | Singapore |
| <i>Finland</i> | <i>Portugal</i> | Brunei Darussalam | Philippines | Taiwan |
| <i>France</i> | <i>Spain</i> | Cambodia | Samoa | |
| <i>Germany</i> | <i>Sweden</i> | China | Solomon Islands | |
| <i>Greece</i> | <i>United Kingdom</i> | Fiji | Sri Lanka | |
| <i>Italy</i> | | India | Thailand | |
| | | Indonesia | Tonga | |
| | | Kiribati | Vanuatu | |
| | | Lao PD Republic | Vietnam | |
| | | Malaysia | Newly industrialised Asia | |
| | | Maldives | Mongolia | |
| | | Myanmar | | |

¹Italics indicate countries that are members of the euro area.

LOCAL GOVERNMENT BOUNDARIES





Department of
Industry and Resources

This publication is available on our website

www.doir.wa.gov.au

For further information on the mineral and petroleum resources of Western Australia to complement this publication please refer to:

Western Australia Mineral Exploration and Development

Western Australia Atlas of Mineral Deposits and Petroleum Fields 2003

Western Australian Oil and Gas Industry 2003

Western Australian Iron Ore Industry 2003

A Guide to Petroleum Exploration and Production in Western Australia

Prospect magazine

Head office:

Mineral House

100 Plain Street

EAST PERTH WA 6004

Telephone: +61 8 9222 3333

Facsimile: +61 8 9222 5460

Email: enquiries@doir.wa.gov.au

For specific data enquiries please email: jill.gregory@doir.wa.gov.au