

# Mineral and Petroleum Statistics Digest

▶ 2001-02



value

Exploration and Investment

resource focus

Exploration and Investment

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**Jim Limerick**  
Director General

As the Director General of the recently formed Department of Industry and Resources (DoIR), I am pleased to release the Western Australian Mineral and Petroleum Statistics Digest for 2001–02.

The new Department's name of Industry and Resources reflects the recent merging of the former Department of Mineral and Petroleum Resources (MPR) with the industry, trade and physical infrastructure divisions of the former Department of Industry and Technology. This change provides an opportunity for the Government to place greater focus on economic development in Western Australia.

The Digest however remains largely unchanged. It includes a comprehensive collection of statistics covering Western Australia's broad resource sector. It 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 2001–02, the sales value of Western Australia's resource sector production fell by 5% to \$26 billion as a result of adverse global commodity price conditions. This follows the industry's extraordinary record high growth rates of the past two years and highlights the sector's susceptibility to weaker global economic conditions.

In addition to global trends, governments also influence the overall triple bottom line of social, environmental and economic parameters within which the resource industry now operates. The Digest discusses many of the issues currently being addressed by the Western Australian Government.

In releasing the Western Australian Mineral and Petroleum Statistics Digest for 2001–02, may I 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.

A handwritten signature in black ink that reads "J. Limerick". The signature is written in a cursive style with a large initial "J" and a long, sweeping underline.

## 1.1 Global Economy

The world economy recovered slowly during most of 2002, driven by growth in the United States. However, early expectations for a sustained and robust recovery, based on rapid growth in the US in the first quarter of 2002, were revised down. This was due to sharp declines in global sharemarkets, uncertainties in the Middle East and associated oil price rises. The inability of the major economies to move into sustained growth reflects these broad global factors combined with others more specific to each economy.

### **United States**

Global recovery to date has depended heavily on the strong growth recorded by the US economy in late 2001 and early 2002. For example, US demand for Japanese exports helped offset weak domestic Japanese growth. Improved trade in the electronics trade, lifted by US growth, also added to strong domestic growth experienced in Non-Japan Asia. US demand also drove European export growth, compensating for sluggish domestic growth, notably in Germany.

Inventory building and strong consumer spending drove the initial recovery in the US in early 2002, with the latter reflecting low interest rates, wages growth and rising housing prices. However, since early 2002, growth in the US economy has slowed significantly, driven by sharply higher imports and softer consumption amid rising uncertainty in the US economy.

Business investment, the key driver of economic growth, has remained weak, in part explaining the sluggishness of the recovery in the US to date. This weakness has persisted because the strong investment of recent years up to 2001, particularly in manufacturing and information technology, led to over-capacity. The combination of this over-capacity and rising uncertainty about the growth prospects for the US economy have caused US businesses to put off investment spending. As a result, unemployment has continued to drift up from its 2001 trough of 3.9% to near 6%, placing a potential constraint on household spending.

Rising uncertainty in the US has partly been driven by continued sharp declines on US, and international, stock markets. These declines have reflected concerns about corporate governance, downward revisions of

previous excessively optimistic profit expectations and signs that the strong growth of early 2002 was fading.

The US dollar has also fallen sharply against the Euro and Yen reflecting the above concerns and the rising US current account deficit. Concerns about the pace of the recovery have also led to a sharp weakening of consumer and investor confidence from early 2002 highs.

Into this rising uncertainty and reduction in US wealth has been thrown the rising international political tensions surrounding Iraq and the spate of terrorist attacks in a range of economies including Indonesia and the Middle East more generally.

The outlook for the US economy depends to a significant degree on the extent to which lower equity prices and rising global tensions lead to lower consumption growth and/or a further delay in recovery in investment spending. While some economists have pointed out that long-term interest rates have fallen to very low levels and thus should support US investment, to a significant degree the decline in rates has reflected market concerns about the weakness in recovery and associated flows of capital out of equities into safer long-term bonds. The outlook for investment therefore partly depends on the extent to which low interest rates counterbalance the gloom about the economy and the reductions in equity-based wealth that has caused them. As Japan's case indicates, the outcome is not always positive.

A lower US dollar should boost the positive impact of lower long-term interest rates by lifting export competitiveness (though a lower dollar may retard the very weak growth in other major economies, notably Japan, whose growth to date has depended on exports to the US).

On a positive note, there have been signs that investment is beginning to improve, notably in terms of software and capital equipment spending. In addition, oil prices have fallen since earlier peaks, increasing the spending power of consumers. On balance, therefore, the US economy should continue its mild recovery, though consumption and investment are likely to be significantly softer than previously expected.

One of the key risks to this benign outlook is that the equities market continues to sag, causing further

erosion in consumption and investment plans to be further delayed. High levels of consumer and business debt have the potential to exacerbate this factor in two ways. If investors and consumers decide that the associated decline in wealth and ongoing uncertainty about employment and economic growth requires balance sheet rebuilding, households will lift savings and reduce consumption and firms will cut back on investment. Second, if further falls in equities add to the uncertainties in the economy, financial institutions, in a climate of rising bad debts, may decide to restrict access to finance, reducing the ability of households and investors to borrow.

Another risk is that further instability in the Middle East causes oil prices to rise sharply. Sharp rise in fuel prices would reduce real consumer spending and raise business costs, reducing profitability.

### **Japan**

Following the third and most severe contraction in the Japanese economy in the past ten years, economic activity seems to have bottomed. The current outlook is for a modest recovery in 2003.

Activity accelerated mildly in the first half of 2002 driven by net exports and industrial production has picked up in response. Domestic demand however, particularly household consumption, has remained very weak, raising questions about the sustainability of any recovery. Prices have continued to fall, exacerbating consumers' tendency to wait and see before spending. Lack of domestic demand has provided a disincentive for businesses to invest and consequently unemployment has resumed its drift upwards to 5.4% in July 2002.

As with the US, business investment remains a weak link, with investment falling since the beginning of 2001 reflecting lower production and corporate earnings.

There are, however, signs of an initial stabilisation. Shipments of capital goods, which had fallen since early 2001, have stopped declining and software investment has started a reasonable recovery. More recently, business surveys including the Bank of Japan's *tankan* (Short-Term Economic Survey of Enterprises) suggest that business investment is on the verge of picking up. However, with weak retail sales and rising unemployment, any lift is likely to be modest.

Significant excess capacity remains and price deflation continues to increase the real debt burden on firms and the financial sector. The balance sheets of the latter are further weakened by falling equity and land prices, restricting the ability of the sector to lend to willing investors. Macroeconomic policy, with official interest rates already at zero and gross public debt at around 140% of GDP, is proving ineffective in dealing with these problems.

The outlook is for an improvement in domestic demand with household consumption rising and, as noted, business investment slowly recovering. Stronger import demand as consumption and investment rise, combined with the rise of the Yen against the US dollar will weaken net exports' contribution to growth. Tax cuts will offset some of the negative impact of fiscal consolidation on spending.

The key risks to the economy are on the downside and to a large degree external. A deterioration in global, particularly US, growth or a further appreciation of the Yen, would reduce net exports. Internally, further falls in equity prices would erode fragile confidence and the precarious state of the banks.

While a mild recovery is in prospect, the lack to date of concerted structural reform in the Japanese economy is the underlying cause of ongoing weakness in economic growth. Banking reform, including the reduction of bad debts and re-capitalisation of viable banks and corporate restructuring are vital in the process of boosting the attractiveness of investment in Japan. The fact that the short-term costs, particularly in terms of unemployment, of such restructuring are likely to be high may be a political constraint on such changes taking place in the short term.

### **Europe**

Recovery in European economic growth has lagged behind that of the US, Canada and much of Asia.

As in the case of Japan, growth in Europe has been driven by net exports rather than domestic growth with exports rising and imports actually falling.

Household consumption is weak and investment has yet to recover from its 2001 slump. Recent indicators of retail sales, GDP and business confidence, particularly in Germany and Italy, have been softer than expected.

Growth performance across the regional economies has varied widely, with Germany, Italy, Austria, Belgium and the Netherlands performing less well relative to the United Kingdom, France, Spain, Greece and Ireland.

Positive factors supporting the European growth outlook are the likely end of the stock cycle so that production rises to lift inventories, underpinned by stronger consumption spending. The latter reflects higher wages and employment growth and modest inflation. Investment should be boosted by improved corporate earnings and falling levels of capacity utilisation.

There are a number of risks to the outlook. Weaker world growth and/or further appreciation of the Euro would reduce the stimulus from net exports. While Europeans are not as exposed to equities as US investors, European markets have fallen further in recent quarters than their US counterparts. Further falls have the potential to dampen consumer demand and put pressure on financial sector balance sheets, reducing the latter's capacity to lend. There have been signs of some equity-related financial sector difficulties already.

The German economy is of some concern, given its relatively dominant role in the European economy, with an uncertain outlook for industrial production and domestic demand. Generalised weakness in Germany would be a significant drag on Europe as a whole.

### **Non-Japan Asia**

In contrast with other regions, the Asian region (excluding Japan) has seen a stronger than expected recovery in growth from the recession of 2001.

Stronger growth in global trade, particularly in electronic goods, has provided the key boost to growth prospects. However, domestic demand growth in some instances, notably China, India and South Korea, has played an important role. Macroeconomic policy, notably fiscal policy in South Korea, has contributed to kick-starting sustained growth.

The International Monetary Fund's current forecast outlook for the region is for a mild acceleration in growth, specifically, in the newly industrialised Asian economies from 4.7% in 2002 to 4.9% in 2003 and in the developing Asian economies, from 6.1% in 2002 to 6.3% in 2003. China is expected to slow mildly from growth of 7.5% in 2002 to 7.2% in 2003.

The key risk to the outlook is that global growth is disappointing, removing one of the underpinnings present in the strong performance to date.

### **Global Outlook**

Supportive macroeconomic policies in the major economies, in the context of ongoing low inflation, should allow a modest recovery to continue. However, there is significant uncertainty in the outlook and there are major risks on the downside reflecting the potential for further financial market weakness (and associated possibility of systemic financial sector problems), higher oil prices due to Middle East instability and terrorist activity.

The outlook for the global economy as outlined in the International Monetary Fund's September 2002 World Economic Outlook is for slower than expected, but still improving, growth into 2003.

## **1.2 National and Western Australian Economic Context**

Both the Australian and Western Australian economies saw continued strong economic growth in the first half of 2002 and beyond despite only weak growth in the international economy and export markets.

The Australian economy grew by 3.8% in the year to June 2002, with domestic demand growing very strongly by 6.9%. Key contributors to growth over the year were strong increases in household consumption and dwelling investment as well as a recovery in business investment. As expected, given strong domestic and weak international growth, net exports detracted significantly from growth.

The Western Australian economy showed similar growth patterns to the national economy through the year. While domestic demand grew by 6.9% in the year to June quarter 2002 in the national economy, Western Australian domestic demand grew by 7.2% over the same period. The State's strong domestic growth was underpinned by ongoing dwelling investment, higher business investment and strong household consumption.

While the global outlook has worsened over the past six months, Australia's position has remained relatively strong.

Employment has grown, providing solid support to consumer spending. Levels of housing finance and dwelling approvals have been maintained longer

than expected following the winding down of the Government's expanded First Home Owners Grant and business investment and consumption growth have continued to expand, consistent with economic growth of about 4% a year. This strength has withstood the negative impact of a severe drought on the rural sector and slowdown in the US, Europe and Japan.

The Reserve Bank of Australia (RBA) has faced a dilemma in monetary policy-making until recently. Ordinarily, with the official interest rate at 4.75% (in October 2002), below the Bank's estimated neutral rate and the economy growing strongly with inflation already above the mid-point of its target range, the RBA would have continued its series of small increases begun in May and June of 2002. The strong rises in housing prices and related borrowing taking place in recent quarters would have added justification to this approach.

However, given the significant economic and political uncertainties besetting an unexpectedly weak global recovery, the RBA has held rates at 4.75% and is likely to be highly cautious during 2002-03 in determining whether further tightening of monetary policy is justified. The expected detraction from growth due to the drought's effect on the rural sector, external uncertainties and the current lack of price and wage pressures in the domestic economy will be key factors in the Bank's decisions.

Alternatively, if the world economy picks up strength and domestic growth continues, the RBA may resume a modest series of interest rate increases. This will aim to avert the possibility that inflationary pressures become entrenched in the economy, requiring larger increases in rates later.

### Exchange Rate

Following a period of appreciation beginning in the second half of 2001, the Australian dollar fell against major currencies from June 2002.

The early appreciation was driven by a number of basic factors including:

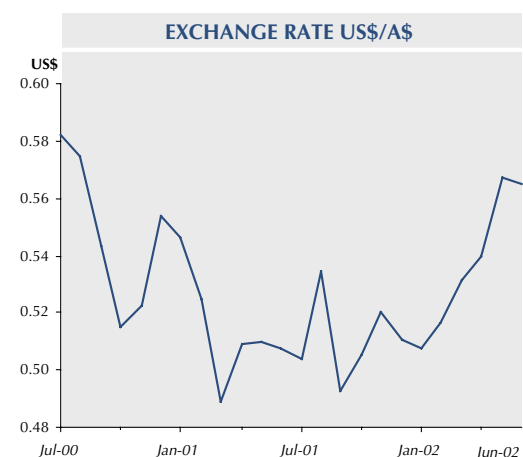
- rising and expectations of further strengthening in global growth;
- rising commodity prices;
- falling risk aversion to peripheral and growth-driven currencies like the Australian dollar; and

- expectation that Australian interest rates would likely rise more quickly than those in other economies due to Australia's relatively strong growth rate.

Since then, these factors have generally turned around and in early November 2002, the Australian dollar was around 4% lower against the Yen, 2% lower against the US dollar, 7% lower against the Euro and 3% lower against the trade weighted index (TWI).

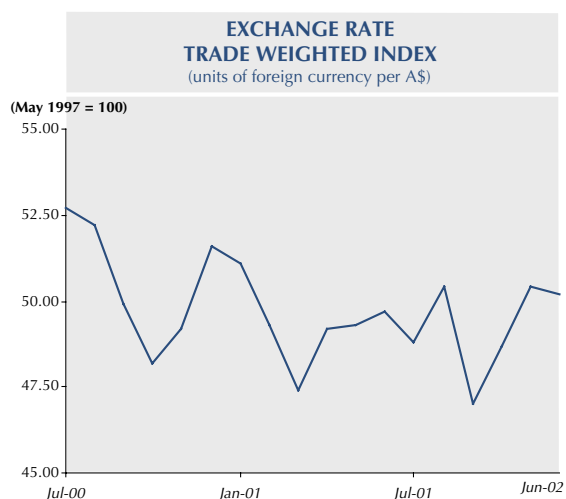
Driving these modest falls have been:

- deterioration in actual and expected global growth reflecting the slowdown in the US economy;
- ongoing volatility in equity markets;
- rising risk aversion to peripheral currencies due to developments relating to Iraq and the war on terror; and
- reduced expectations of further RBA monetary policy tightening.



Source: Reserve Bank of Australia

Figure 1.1



Source: Reserve Bank of Australia

Figure 1.2



Providing some support to the currency has been the strong domestic growth that Australia continues to experience.

The outlook for the Australian dollar remains governed by the factors identified above. Continued declines in equity markets, weaker global growth prospects and ongoing increases in risk aversion, if terrorist attacks like those experienced in Bali persist, would likely put downward pressure on the Australian dollar. However, if global economic and political prospects improve and financial markets stabilise, the Australian dollar may resume the appreciation begun earlier in 2002.

### 1.3 Policy Issues Affecting the Mining Industry

#### **Native Title**

A major development in Native Title in 2002 was the resolution of the Ward High Court decision, in which the Court found that the Miriuwung and Gajerrong people had significant native title rights over a large area of land in the East Kimberley. The Court found that native title did not entail any rights over minerals or petroleum under the ground where native title may apply. This has positive implications for current methods of collecting royalties on minerals and petroleum. The Court also found that the grant of a mining title did not wholly extinguish native title, but did extinguish the right to be asked permission or to have access in relation to the whole of the area of the lease.

A State Government initiative to improve the fairness and workability of the Native Title regime was the Wand Review of the State Government's General Guidelines for Native Title Determinations and Agreements. The Review was released in November 2001. Among its key recommendations were:

- A summit of Government, the Federal Court, peak bodies and claimants to coordinate the resolution of native title applications;
- Rigorous assessment of evidence of connection to the country;
- Enhanced access to Government records that could assist claimants in compiling evidence in support of their application;
- An overhaul of State land use and management

laws to integrate processes for the recognition of native title and other rights of traditional owners; and

- A public education campaign to encourage agreement making.

Progress is being made on implementing the recommendations of the Review. Evidence guidelines for native title claimants were released by the Deputy Premier on 8 October 2002.

#### ***The Keating Review of the Project Development Approvals System***

In September 2001, the Minister for State Development appointed Dr Michael Keating to chair a review of the Project Development Approvals System. The Review Committee released an interim report in late January 2002 for a period of public comment which was completed in February 2002.

The main recommendations of the Review were:

- Reducing the jurisdiction of the Wardens Court with a commensurate expansion of the role of the Environmental Protection Authority (EPA);
- Greater use of timelines to improve levels of certainty and predictability, with a 'stop the clock' mechanism to ensure that project approvals facing deadlines are not penalised for events beyond their control;
- Allowing the State to undertake environmental assessments on behalf of the Commonwealth; and
- An integrated approvals system for projects of 'State significance'.

A Ministerial committee is now considering the Keating Review's recommendations into streamlining the approvals process and recommendations from this report will be considered by Cabinet in the near future.

#### ***Technical Taskforce on Processing of Mining, Exploration and Land Title Applications***

In April 2001, the Government established a Technical Taskforce to assess how mineral, petroleum and land title applications can be dealt with more efficiently, while recognising and protecting the native title rights of Indigenous people.

The Taskforce released a discussion paper in August 2001, which set out options for reducing the current backlog of some 11,000 tenement applications and preventing a backlog developing in the future. The

Taskforce also provided its preferred option for dealing with exploration and mining title applications. The final report of the Taskforce was released by the Government in December 2001.

One of the key recommendations of the taskforce was the introduction of extended exploration licences to mitigate the need for explorers to take up mining leases, with the consequent deferral of native title processes until productive mining is to take place.

Action on the Taskforce's recommendations is progressing. In March 2002 Cabinet approved funding for eleven additional case management/liaison/education staff (\$2.9 million over four years), with four to be allocated to MPR and the remaining seven to support Native Title Representative Bodies.

### **Ministerial Inquiry into Greenfields Exploration in Western Australia**

In April 2002, the Government announced a 'Ministerial Inquiry into Greenfields Exploration' chaired by Mr John Bowler, MLA, Member for Eyre.

The purpose of the Inquiry was to investigate the reasons for reduced levels of private investment in greenfields exploration in Western Australia. Also, the Inquiry was to recommend ways in which Government can achieve a level of exploration expenditure necessary for a sustainable future for the resources industry.

The completed Inquiry, representing the first review of its kind ever undertaken in Australia, was handed to State Development Minister Clive Brown in early November 2002.

The report contained recommendations designed to lay the foundation for new strategies to encourage exploration expenditure. The Inquiry found that tackling the backlog of unprocessed mining title applications in line with addressing the issue of native title was pivotal to restoring the industry.

Other key recommendations of the Inquiry included:

- Increased provision of regional geoscientific data;
- Changes to the heritage protection procedures and support for native title bodies to expedite access to land;
- Establishment of a greenfields exploration title; and
- The introduction of investment incentives for smaller exploration companies such as flow-through share schemes.

The Inquiry received 37 submissions from across the resource industry including the Association of Mining and Exploration Companies, Western Australian Chamber of Minerals and Energy, Amalgamated Prospectors' and Leaseholders' Association and the Australia Petroleum Production and Exploration Association.

A total of 33 recommendations were contained in the Inquiry's report and the report was open for public comment until mid-December 2002.

### **House of Representatives Inquiry into Resource Exploration Impediments**

On 24 May 2002, the Commonwealth Minister for Industry, Tourism and Resources, the Hon. Ian Macfarlane MP, advised that the Standing Committee

#### **Tenements in Force 1978 Act**

	1996-97		1997-98		1998-99		1999-00		2000-01		2000-02	
	Number	000 ha	Number	000 ha	Number	000 ha	Number	000 ha	Number	000 ha	Number	000 ha
Prospecting Licences	8,212	1,100	7,525	992	6,242	809	5,827	745	5,512	711	4,964	635
Exploration Licences	4,718	38,279	4,505	35,993	3,463	23,732	3,394	20,687	3,162	18,152	2,899	
Mining Leases	5,180	2,047	6,690	2,031	7,555*	2,263	4,865	1,829	4,841	1,803	4,820	1,774
Other	1,537	89	1,584	205			2,001	468	3,625	2,840	3,618	3,002
Mineral Claims & Other 1904 Act	310	34	309	34	307	34	194	22	186	21	186	22
<b>Total</b>	<b>19,647</b>	<b>41,515</b>	<b>19,029</b>	<b>39,255</b>	<b>17,567</b>	<b>26,838</b>	<b>16,280</b>	<b>23,751</b>	<b>17,326</b>	<b>23,829</b>	<b>16,487</b>	<b>23,988</b>

\* Includes Other

Source: MPR  
Figure 1.3

on Industry and Resources (chaired by The Hon. Geoff Prosser, MP) would inquire into and report on any impediments to increasing investment in mineral and petroleum exploration in Australia, including:

- An assessment of Australia's resource endowment and the rates at which it is being drawn down;
- The structure of the industry and role of small companies in resource exploration in Australia;
- Impediments to accessing capital, particularly by small companies;
- Access to land including Native Title and Cultural Heritage issues;
- Environmental and other approval processes, including across jurisdictions;
- Public provision of geoscientific data;
- Relationships with Indigenous communities; and
- Contributions to regional development.

Public submissions to the Inquiry have been sought, and the Committee was holding public meetings at the end of 2002 to collect further information. The State Government has provided input into the Inquiry through submissions drawn from the expertise gathered by the Ministerial Inquiry into Greenfields Exploration in Western Australia.

On 12 September 2002, the Commonwealth announced a new action agenda for mining exploration. The Action Agenda will address issues such as investment incentives, Native Title rulings, land access and environmental regulation to develop a set of strategies for the industry to encourage further investment.

### **Electricity Reform Task Force**

In August 2001, the State Government established the Electricity Reform Task Force to develop detailed recommendations regarding the disaggregation of Western Power; the structure of the electricity market to be established in Western Australia; the establishment of a Western Australian Electricity Code; and arrangements for full retail contestability.

The main objective of the Task Force is to remove impediments to competition and to achieve sustainable lower electricity prices for all customers while maintaining a uniform tariff for residential and small business customers. This was to be done without compromising the reliability, security, quality and safety of electricity supply.

The structure of the electricity industry in the future is likely to consist of competitive generation and retail sectors, with private companies competing on an equal footing with government entities created from Western Power, and a State-owned transmission and distribution company, with power being traded through bilateral contracts and a balancing market.

The Electricity Reform Task Force also gave consideration to the role that sustainable/renewable energy has in reducing greenhouse gas emissions.

Two detailed Discussion Papers were released and public comment sought. In October 2002, the Task Force's final report, *Electricity Reform in Western Australia, 'A Framework for the Future'* was provided to the Minister for Energy, the Hon. Eric Ripper, and released publicly.

The reform proposals include converting Western Power into three separate State-owned businesses in the South West Interconnected System – State Generation, State Networks and State Retail. A separate State-owned Regional Power Corporation, independent of these three bodies, is also proposed, to look after the interests of regional consumers and carry out Western Power's current activities in the North West Interconnected System and all other regional systems.

A key aspect of the reform strategy is disaggregation of Western Power by separating the network activity from its generation and retail businesses. Currently, any independent power producer wanting to enter the market must negotiate with Western Power – its competitor in the generation sector – for access to its transmission and distribution networks. This represents a huge disincentive to private sector investment in electricity infrastructure.

The Task Force also recommended the establishment of a market in which buyers and sellers can trade electricity at the wholesale level. This includes a bilateral contract market with features to encourage new entrants, reduce price volatility and minimise transition costs.

Consumer interests are to be protected by the establishment of a strong, independent regulatory system with the retention of the uniform tariff and all existing rebates with all retailers supplying household customers, including State retail, obliged to offer supply

at or below the uniform tariff rates. The Task Force also proposed that funding of uniform tariffs continue in a manner consistent with current arrangements, but that the mechanisms be made more transparent.

### **Greenhouse**

Greenhouse gas emissions control is still a source of uncertainty for the mining and petroleum industries, although the Commonwealth Government has stated that it will not sign the Kyoto Protocol unless the United States also signs and developing countries commit to greenhouse gas reductions. Canada and Russia have indicated their intention to ratify the Kyoto Protocol, giving the Protocol enough signatories to come into force. In February 2002, the Commonwealth Government signed the joint Australia-US Climate Action Partnership to collaborate on research into climate change, and in July 2002 announced 19 joint projects under its auspices.

The Commonwealth and State Governments are tackling greenhouse gas emissions through the National Greenhouse Strategy, and are aiming to meet Australia's commitment under the Kyoto Protocol to reduce greenhouse gas emissions to 108% of 1990 levels by 2010, even if the Protocol is not ratified.

The State Government is also developing its approach to greenhouse gas abatement through the State Sustainability Strategy and Greenhouse Strategy. Approaches already being implemented include:

- carbon rights legislation;
- establishment of a Sustainable Energy Development Office;
- mandatory energy efficiency improvements for Government agencies; and
- improving the carbon efficiency of the Western Power network.

### **Sustainability**

Sustainability has been recognised as a major issue for the resources industry. The World Summit on Sustainable Development was held in Johannesburg in August/September 2002 and gave rise to new initiatives in the resources field such as:

- Establishment of an Association of Southeast Asian Nations Mineral Database;
- Improving transparency of payments to governments by the resources extraction industries;
- A global gas-flaring reduction partnership; and
- Globally harmonised system for chemical classification and labelling.

The private sector has been active in addressing the issues, with the Global Mining Initiative conference held in Toronto in May 2002. The outcome of the conference was the "Toronto Declaration", which is a statement of principles emphasising the role of community engagement and accountability in achieving the goals of economic, social and environmental sustainability. It urges the mining industry to lead the way in achieving industry practice that leads to sustainable outcomes. Its priorities will form the basis of the International Council on Mining and Minerals' work program.

In Western Australia, the State Government has undertaken to produce a State Sustainability Strategy. In September 2002, the Department of the Premier and Cabinet released a public consultation draft of the Strategy. The State Sustainability Strategy encompasses a broad range of policy areas and aims to identify:

- Critical sustainability issues for Western Australia;
- Barriers to achieving sustainability and how these will be overcome;
- Actions to promote and encourage long-term progress towards sustainability, including new initiatives, policy and legislative change and institutional reform;
- Short-, medium- and long-term goals for sustainability across regions and sectors;
- Research and development required to help solve long-term problems for sustainability;
- Examples of best-practice sustainability in different sectors in Western Australia; and
- Means of securing ongoing commitment to sustainability by Government, business and community.

In regard to the mining and petroleum industries, the Draft Strategy includes recommendations that:

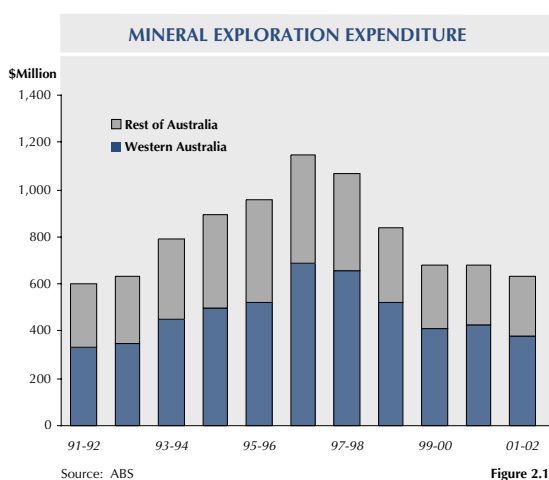
- All major projects be assessed using sustainability criteria;
- A set of sustainability operating principles be developed for the mining sector, building on the work of the Global Mining Initiative; and
- Transparent processes be established to improve community awareness of the regulatory system for mining and mineral production.

The draft Strategy was open for public comment until 10 January 2003.

## 2. EXPLORATION AND INVESTMENT

### 2.1 Mineral Exploration

Australian Bureau of Statistics (ABS) mineral exploration expenditure figures for Western Australia fell for the fifth successive year, from \$424 million in 2000–01 to \$376 million in 2001–02, down by \$48 million (11%). Exploration expenditure in Western Australia for gold, base metals, nickel and cobalt is now close to the lowest levels in a decade. Exploration expenditure activity is now similar to that experienced in the recession years of the early 1990s.



The fall in exploration activity in Western Australia is being led by a weak gold sector, which in 2001–02 was down by \$57 million (19%) compared to 2000–01. However, exploration expenditure for many of the other major commodities in 2001–02 was also lower than in 2000–01. Examples include base metals and nickel-cobalt which was down by \$23 million (26%) and iron ore, down by \$3 million (14%).

Within Western Australia, gold remains the main focus of mineral exploration, accounting for about 63% of all exploration expenditure. Other commodities in their order of importance as exploration targets in Western Australia are base metals and nickel (including cobalt) (17%), diamonds (8%), iron ore (5%), heavy mineral sands (3%) and 'others' which total 5%.

Declining exploration expenditure in Western Australia over the past five years has matched national declines and those around the world. Nevertheless, Western Australia still accounts for 59% of all exploration expenditure in Australia and about 10% of worldwide exploration expenditure.

Mineral explorers spent 88% of their forecasted Australian exploration expenditure for 2001–02 (\$641 million actual versus \$727 million forecast expenditure), a good result given weaker commodity prices, the events of September 11 and slower world growth. Present indications are of a gradual recovery in 2002–03, attributed to a combination of renewed investor interest in both quality and speculative junior mining stocks, the number of initial public offerings launched during 2002 and positive publicity surrounding recent discoveries and successful exploration strategies.

In recognition of the depressed levels of exploration expenditure, two parliamentary inquiries were commissioned during 2001–02. The Federal Government instigated a House of Representatives Inquiry into Resource Exploration Impediments, chaired by the Hon. Geoffrey Prosser MP, Federal Member for Forrest (Western Australia).

In Western Australia, the State Government instigated a Ministerial Inquiry, chaired by Mr John Bowler MLA, Member for Eyre. The Inquiry investigated all avenues by which to increase levels of private investment in mineral exploration in Western Australia, particularly in greenfield or frontier areas.

More detailed information about these inquiries is provided in Section 1.3, "Policy Issues Affecting the Mining Industry".

### 2.2 Petroleum Exploration

Data released by the ABS indicates that petroleum exploration contracted significantly during 2001–02, with expenditure in Western Australia falling by 30% to about \$480 million from \$688 million in 2000–01. Western Australia's share of total Australian petroleum exploration declined to 54% in 2001–02, compared with 66% in 2000–01. The sharpest drop occurred in the June 2002 quarter, which was down by \$80 million or 49% compared with the June 2001 quarter.

For 2001–02, 81% of all petroleum exploration expenditure in Australia was in offshore waters and 63% of all petroleum exploration was expended on drilling. Actual exploration expenditure for both onshore and offshore projects was 20% below that which was forecast

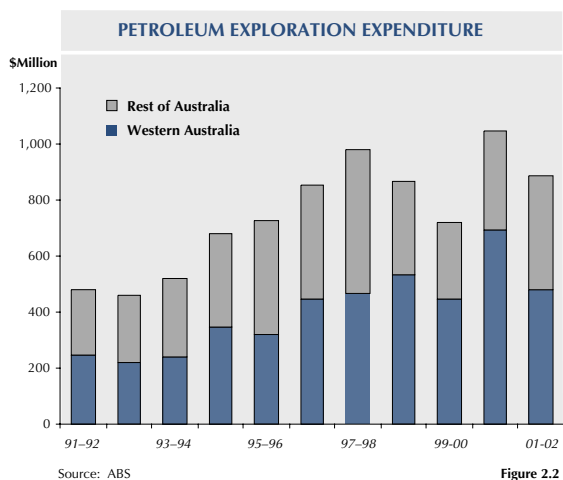


Figure 2.2

for the financial year, due to a combination of events comprising September 11 2001, a general weakening in major commodity prices and slower world growth.

In 2001–02, a total of 59 new wells were drilled in Western Australia. This was a decrease compared to the 75 wells drilled in 2000–01. Wells drilled consisted of 37 new-field wildcats, 12 extension and 10 development wells. The drilling occurred in the Bonaparte (8), Browse (2), Canning (3), Carnarvon (35) and Perth (11) Basins.

Offshore exploration in Western Australia continued at significant levels, with 28 new-field wildcats drilled, 20 of which were in the Carnarvon Basin, one in the Perth Basin, two in the Browse Basin and five in the Bonaparte Basin. Of the nine onshore new-field wildcats drilled, the breakdown comprised three in the Canning Basin, two in the Carnarvon Basin and four in the Perth Basin.

In total, seven oil discoveries and four significant gas discoveries were made from the 37 new-field wildcat wells and the discovery rate for 2001–02 was 29%. Significant gas discoveries were reported from the offshore Bonaparte (Blacktip 1) and Carnarvon (Victoria 1, Denver 1) Basins and from Beharra Springs North 1 in the onshore Perth Basin. Oil discoveries were reported in the Perth (onshore and offshore) and Carnarvon (offshore) Basins. Of particular note was the success of Hovea 1 (onshore) and Cliff Head 1 (offshore) in the Perth Basin and Victoria 1, Pedika 1, Little Sandy 1, Norfolk 1 and Exeter 1 in the offshore Carnarvon Basin. A total of 23,833 line kilometres of 2D seismic data was acquired during 2001–02, and 7,627 line of 3D data.

Surveys were conducted in the Bonaparte, Browse, Carnarvon and Perth Basins, with the majority of line kilometres being in the Carnarvon Basin.

Petroleum explorers predicted that exploration in Australia would continue to decline, in both onshore and offshore basins for the first part of 2002–03. The biggest fall was expected in offshore exploration, of about 21%.

## 2.3 Investment

ABS private new capital expenditure statistics for 2001–02 indicate that mining accounted for around 53% of Western Australia's total investment, compared to around 48% in 2000–01. The total value of State investment rose by 11% from around \$4.95 billion in 2000–01 to \$5.51 billion in 2001–02. In terms of Western Australian mining investment, it rose by around 21.8% from \$2.39 billion in 2000–01 to \$2.91 billion in 2001–02.

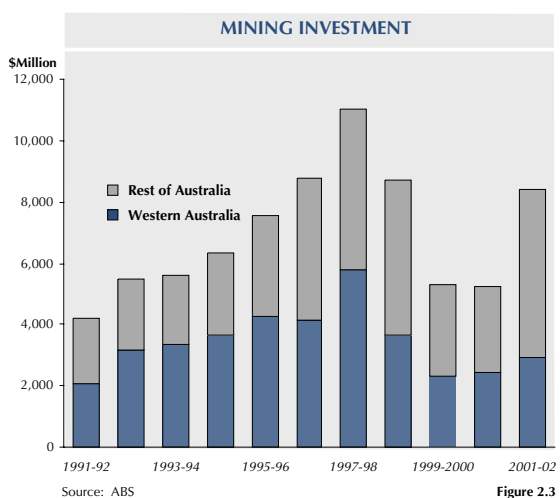


Figure 2.3

Total national mining investment in 2001–02 was \$6.8 billion. Western Australia accounted for around 43% of this.

It is important to note that the figures reported above do not capture all mining investment as the ABS uses classifications specified in the 1993 edition of the Australian and New Zealand Standard Industrial Classification (ANZSIC) (ABS Catalogue number 1292.0). Accordingly, mining is broadly defined as the extraction of minerals occurring naturally as solids such as coal and ores, liquids such as crude petroleum

and natural gas. Downstream mining activities such as smelting of minerals or ores (other than preliminary smelting of gold) or refining are classified as manufacturing activities under the ANZSIC. Products such as coke and alumina are also included in the ANZSIC manufacturing category.

The ABS released a paper which addressed some of the above classification issues relating to the Western Australian resource sector in June 2002 (as a feature

article in ABS Catalogue number 1367.5). However, the resulting investment data cover only the State, not national, economy and does not include data for the years 2000–01 and 2001–02.

Some notable Western Australian mining sector projects currently in construction or committed include:

- The expansion of the North West Shelf LNG project fourth LNG train.
- BHP Iron Ore's iron ore mine—Mining Area C.



*Construction of the fourth LNG train as part of the North West Shelf LNG project is a significant investment currently taking place in the Western Australian resource sector.*

### 3.1 Overview and Outlook

After an impressive 29% increase in the value of sales to record levels in the previous year, the Western Australian mineral and petroleum industry succumbed to adverse global commodity price conditions in 2001-02, contracting in value by 5% to \$26 billion. This outcome needs to be seen in perspective of poor global commodity prices and the industry's extraordinary record high growth rates of the past two years.

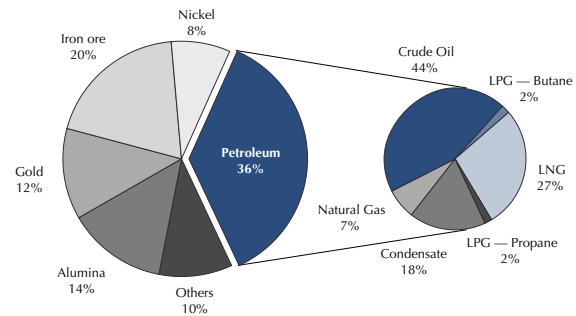
World events driven by a downturn in the key markets of Europe, the United States and Asia coupled with the fallout of the events of September 11 greatly impacted on commodity prices. With the value of the Australian dollar in US terms being on average just 3% lower in 2001-02, it offered little shelter from the depressed prices.

Petroleum, the State's largest resource sector, was particularly hurt. Whilst the sales volume of key petroleum products such as crude oil and liquefied natural gas (LNG) increased to record production levels, the total value of petroleum sales fell by \$980 million, or 9%. This was due to a 20% drop in oil prices, on average over the course of 2001-02. Similarly, lower international prices for nickel, diamonds, alumina and base metals translated to these sectors reporting decreased, or at best static sales values for 2001-02, despite physical sales volume increases.

The gold sector in contrast, despite an 8% drop in sales volumes to 5.9 million ounces, experienced more buoyant prices which translated to a small sales value increase. Similarly, the iron ore industry increased its sales value thanks to higher prices from an earlier round of negotiations.

Despite the check on growth in the Western Australian mineral and petroleum industry during 2001-02, it is

SALES BY COMMODITY

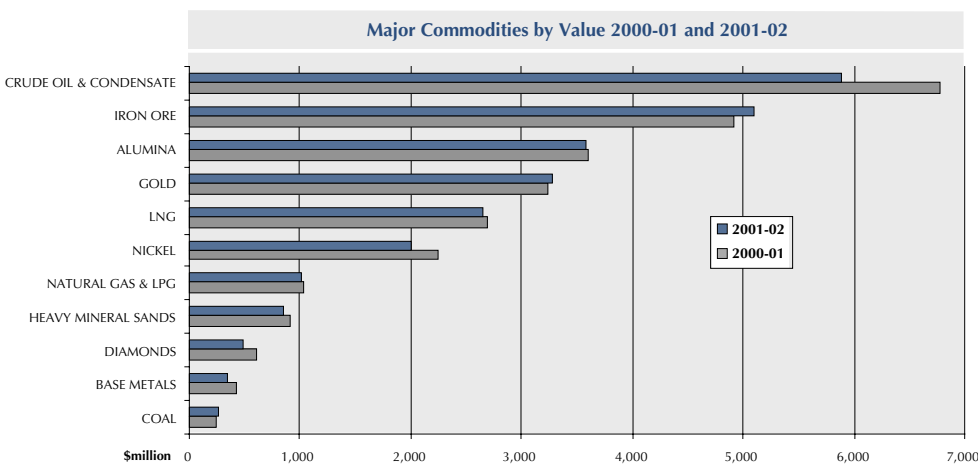


Source: MPR

Figure 3.2

noteworthy that compared to the value of mineral and petroleum production ten years ago, the current level is well over double that amount. It has demonstrated a solid average annual growth rate of 8.1% per annum and represents a doubling of the value of production every ten years, far outstripping growth of the economy in general.

World market prices of metal and energy commodities are currently low. At the closure of 2002, the outlook for Western Australia's minerals and petroleum industry is dependent on world economic growth. Global economic growth needs to strengthen to increase demand and therefore prices for the State's mineral and petroleum commodity exports. To a great extent this in turn depends on economic developments in the US, where a weak business investment environment does not augur well for a pick up in growth. As a result, as foreseen by ABARE, world economic growth is assumed to remain relatively weak, averaging 2.8% in 2003. This compares with 3.7% on average in the five years up to 2000.



Source: MPR

Figure 3.1



Nevertheless, there is cause for some optimism that most metal prices are in fact expected to rise in 2003. This is due to an albeit modest, consumption recovery which will outstrip production. ABARE, for example, has forecasted price increases in major base metals of between 5% for copper and 15% for nickel and for one of the State's major mineral exports, iron ore, prices negotiated for 2003–04 are likely to increase. Increase in steel demand in Asia, particularly strength in China's iron ore import demand will underpin upward pressure on prices. While gold is expected by many to be weaker this depends on hedging and the numerous 'world crisis' factors which may in fact support a rally in 2003. Likewise, oil prices, are expected to ease in 2003 as production outpaces consumption. Again, this of course depends on the extent and rate at which the 'war premium' diminishes and global political developments in 2003 subside.

## 3.2 Commodity Price Index

The Reserve Bank of Australia (RBA) produces a monthly commodity price index comprising non-rural commodity prices. Commodities included in the index are both steaming and coking coal, LNG, gold, iron ore 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 2001–02, the annual average of the non-rural commodity price index figures, in Australian currency terms, indicated that non-rural commodity prices had risen by 7% on the previous year. This was despite an 11% fall in the average price level for the base metals component of the index. The increase in the non-rural commodity price index over the whole of 2001–02 can be partially explained by the Australian dollar being 3% down on average in 2001–02 compared to the previous year (in spite of eight months of appreciation

### ***Reserve Bank of Australia (RBA) Commodity Price Index***

The Reserve Bank of Australia Commodity Price Index is based on the price of 17 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 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, Yen, 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, indexes.

The RBA index is a fixed-weight Laspeyres index, using 1994–95 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.

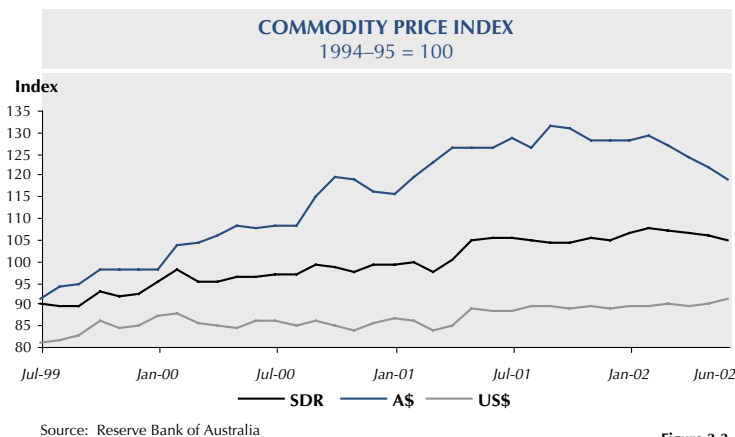


Figure 3.3

commencing September 2001). The depreciated Australian dollar therefore helped ameliorate falling international price levels with the RBA's base metals index showing prices in Australian dollar terms for example, falling less than in US dollar terms.

Importantly, price rises for coal and gold are attributed with having pushed non-rural price index upwards, in spite of sluggish global economic conditions and an overall trend of weaker prices for most other commodities. ABARE data shows for example, that coking and steaming coal prices increased by a minimum of 20% in Australian currency terms in 2001-02 compared to the previous financial year. With coal being Australia's largest export commodity the rise in prices shown by the non-rural commodities price index therefore largely reflects this increase. However, with only 2% of total national coal production in 2001-02 attributable to Western Australia, it is not reflective of the Western Australian position. The base metals component of the index may therefore be a more accurate reflection of the movement of resource prices of relevance to Western Australia.

### 3.3 Petroleum

Despite global challenges, petroleum production in Western Australia continued to rise in 2001-02. Sales volumes of all products except for natural gas increased, ranging from 2% (LNG) to 12% (LPG) compared with 2000-01. Due to a 20% drop in oil prices however, the value of Western Australia's petroleum sales fell by 9% to \$9.5 billion. While the fall in petroleum sales value may appear significant, it needs to be remembered that it came after consecutive impressive increases in

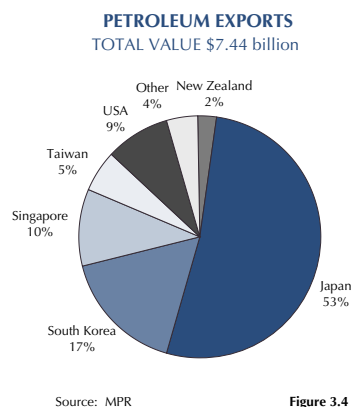


Figure 3.4

sales value in 1999-00 and 2000-01 of 87% and 39% respectively.

Petroleum is the largest resource sector in Western Australia. In 2001-02, the petroleum industry accounted for 36% of the State's total value of mineral and petroleum sales. Crude oil was the principal contributor and accounted for 44% of total petroleum sales value, followed by LNG (28%), condensate (18%), natural gas (7%), LPG-butane (2%) and LPG-propane (2%).

#### Crude oil

Crude oil continued to dominate petroleum production in Western Australia and accounted for 44% of the State's total petroleum sales value in 2001-02. As a consequence of lower oil prices, sales value of crude oil in 2001-02 fell by 12% to \$4.2 billion. This was despite an 8% increase in physical sales volume.

During 2001-02, \$2.9 billion or 70% of Western Australia's crude oil was exported. Major export markets were South Korea (absorbing 31%), Japan (27%), USA (22%), Singapore (8%) and New Zealand (5%).

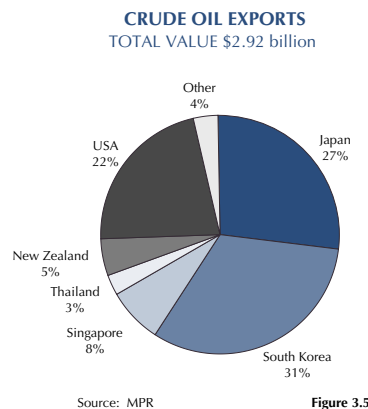


Figure 3.5

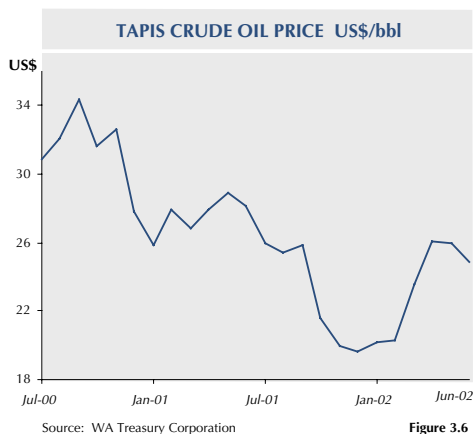


Figure 3.6

In 2001–02, Western Australia produced 95 million barrels of crude oil, accounting for more than 50% of Australia’s total. The top ten oil fields in Western Australia were Wanaea, Legendre, Griffin, Cossack, Stag, Hermes, Wandoo, Chinook, Scindian, Barrow Island and Buffalo. Together, these accounted for 87% of the State’s total production. The Wanaea field was the largest contributor and accounted for nearly 30% of the State’s total. The Legendre (north and south) field that started production in July 2001 took the second position and contributed 12% to the State’s total.

In addition to the Legendre fields, further production increases were attributable to the Laminaria Phase two project, the Hovea field, the Gipsy and North Gipsy field (which began producing late in the first quarter of 2001) and the Simpson field (which commenced production in November 2001). The Laminaria phase two project, which came on-stream in June 2002, will add an extra 70,000 barrels per day to the output of the existing Laminaria and Corallina fields (from which production has typically been around 73,000 barrels per day).

Looking into the short to medium term, significant additional oil production for the State will arise from the proposed development of the Woollybutt field and the Enfield, Laverda and Vincent oil fields by Woodside. The Woollybutt field, located 40-50 km west of Barrow Island, will be developed using floating production, storage and off-loading facilities. First oil production is expected in early 2003. Initial production is expected at a rate of up to 35,000 barrels per day. The Enfield, Laverda and Vincent fields are located 50 km northwest of Exmouth and will also comprise floating production, storage and off-loading facilities. Two development

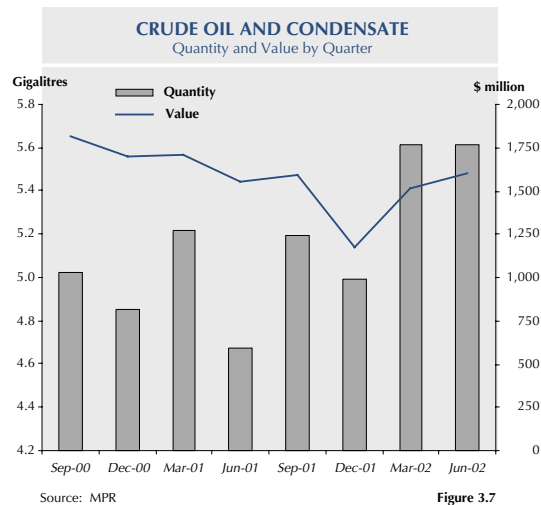
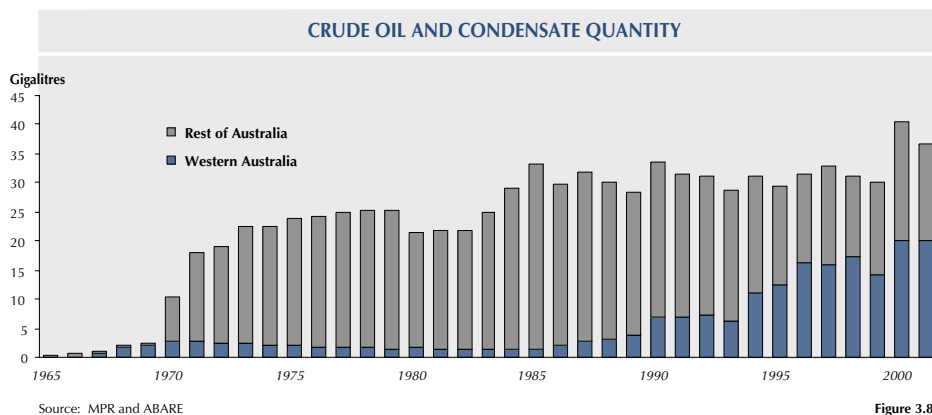


Figure 3.7

scenarios are being considered, which would see the development commence either in late 2005 or 2006. Construction is expected to commence in mid 2004.

Other projects in the pipeline for the oil sector include the Gorgon gas/condensate fields and the Macedon and Pyrenees oil and gas fields. The Macedon and Pyrenees fields are adjacent, but separate offshore hydrocarbon fields within the West Muiron structure, about 50 km north of Exmouth. The Macedon field is wholly gas while the Pyrenees contains both oil and gas. According to ABARE, these oil fields will augment Western Australia’s oil output in the medium term. However in-principle approval for Gorgon is still to be obtained following preparation of an environmental, social and economic (ESE) review of the project by the Gorgon joint venture, and there are also no immediate plans to develop the latter. The ESE Review will be released for 6 weeks of public review and comment early in 2003.

ABARE estimates that crude oil and condensate production in Australia will decline steadily in the medium term. In Western Australia, production declines albeit moderate, are evident and overall production volumes remain steady. While no shutdowns were experienced in 2001–02, at Airlie Island, production volumes are declining from the Chervil field and it is expected to shutdown in the next 12 to 24 months. No other shutdowns are envisaged in the short- to medium-term, however production volumes are also on the decline at the Saladdin, Roller and Skate fields. Output at the Saladdin field, which came on-line in 1989, has declined to approximately one-fifth of the field’s peak oil and condensate output, while the Roller field which was



producing in excess of 50,000 barrels per day in the mid nineties, now produces less than 10,000 barrels per day.

The average price of Brent, Tapis and West Texas in 2001–02 was US\$23.23 per barrel, a drop of 20% on the average price in 2000–01. This caused the State’s total sales value to decrease despite the increased volumes of sales. Even though there was an overall average downward price shift, the year was characterised by a series of international events which placed short-term supply side pressures on international oil trade. Speculations over the potential halt of oil shipments resulting from tense US relations with Iraq, in conjunction with increased fighting between Israel and the Palestinians, increased uncertainty in the oil market. For example, in early April 2002, the Iraqi cabinet voted to suspend oil exports for 30 days — equivalent to a supply reduction of two million barrels per day. The move was intended to engender support for an oil embargo on the US and other allies of Israel. However, by early May, Iraq resumed exports, having failed to gain support from the nation’s oil-producing counterparts. Both Kuwait and Saudi Arabia rejected the notion of attempting to use oil as a ‘weapon’, which was confirmed by increased OPEC production during the thirty-day embargo. According to Bloomberg, six of the other seven OPEC producers from the Middle East actually raised production during this period. While the OPEC response to these events went some way to soften the price effects of these supply constraints, concerns over supply disruptions from other areas emerged during 2001–02, with for example, strikes by oil workers in Venezuela.

Politically driven tensions continue to underpin uncertainty in the world oil market and will undoubtedly dominate the events and trends in the short to medium term, causing prices to remain relatively high. Despite tempered oil demand arising from a slower than expected global economic recovery, oil prices remain very buoyant, reflecting the potential for supply disruptions from the Middle East and the continued tight stance on OPEC production levels. However, on the latter issue, with OPEC production exceeding quota limits by an estimated 13%, the contradictions between the official OPEC position and actual supply continue with Middle Eastern OPEC producers appearing willing to increase production to meet supply short-falls. Overall, ABARE estimates oil prices will rise by approximately 5% in 2003, reflecting the net effect of this scenario, causing a rise in the value of oil sales. This is pertinent to Western Australia, which exports a higher proportion of its oil than other states in Australia.

### **Condensate**

Western Australia is the nation’s dominant condensate producer. The State’s sales volumes increased by 9% in 2001–02 to 40.9 million barrels, accounting for 83% of Australia’s total. 98% of condensate was produced from five fields — Goodwyn, Perseus, Echo/Yodel, East Spar and North Rankin. The Goodwyn field remained the largest contributor, accounting for about 56% of the State’s total. The Echo/Yodel field, which commenced production in late December 2001 increased the State’s capacity significantly, adding 6.3 million barrels to the State’s total in less than seven months.

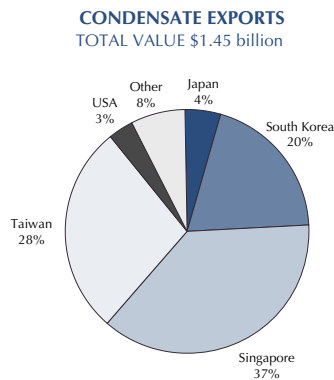


Figure 3.9

Although quantity sold increased by 9%, 2001–02 saw the value of Western Australia’s condensate sales fall by 15% due to significantly lower prices. On average, prices for condensate were 22% lower in the year.

In 2001–02, nearly \$1.5 billion or 87% of the State’s condensate was exported. Singapore was the largest export market, accounting for 37% of Western Australia’s condensate exports, followed by Taiwan (28%) and South Korea (20%).

While Goodwyn remains the State’s chief producer, production volumes from this field have been declining. In 2001–02, Goodwyn’s production was down by 11%. This reflected depletion of the field’s condensate reservoirs. However, it is expected that commencement of production from the North West Shelf Gas Project’s Echo/Yodel field during 2001–02 will ameliorate declining production levels from the Goodwyn field. The Echo/Yodel field is connected via a 23-km sub-sea tie-back to the Goodwyn A platform. At its peak Echo/Yodel is expected to produce 30,000 barrels per day of condensate in addition to gas and is expected to remain in production for approximately five years.

### Liquefied natural gas (LNG)

LNG is Western Australia’s second most valuable petroleum product after crude oil. LNG sales in 2001–02 continued to climb, increasing by 2% to a record 8.24 million tonnes. Due to price lags and contractual arrangements, the value of LNG shipments did not feel the full brunt of weaker oil prices and decreased relatively marginally compared to other petroleum products, by 2% to \$2.6 billion.

The traditional customers of Western Australia’s LNG are the Japanese power utilities. In 2001–02, about 99% of Western Australia’s LNG was exported to

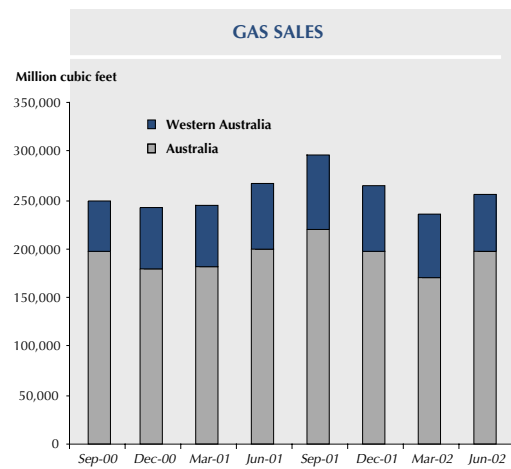


Figure 3.10

Japan. Since 1989, the North West Shelf Gas Project has landed more than 1,300 LNG cargoes in Japan. In addition to the contract sales to existing customers, spot cargoes have also been sold to other customers around the world.

Importantly for the Western Australian economy, in September 2001, construction of the fourth processing train in the North West Shelf LNG plant commenced. The \$1.6-billion LNG Train 4 and the associated \$800-million second trunkline are expected to be operational by mid-2004. Development of a fifth train is currently under consideration.

As with the initial LNG export program, construction of Train 4 is being underpinned by 25–30-year contracts with the Japanese power utilities. Japanese customers have been signed-up for two-thirds of the LNG to be produced by the expansion with letters of intent having been signed by Tokyo Gas and Toho Gas (for supplying 1 million tonnes per annum from 2004), Osaka Gas (1 million tonnes per annum from 2004), Tohoku Electric (0.4 million tonnes per annum from 2005) and Kyushu Electric (0.5 million tonnes per annum).

Another important event was the conclusion to the three-way international battle between Australia, Indonesia and Qatar for a major LNG contract with China. In January 2002, Western Australia’s North West Shelf Venture (NWSV) was short-listed by the Chinese Government to provide LNG to China’s first LNG terminal in Guangdong province. Australian LNG Pty Ltd (ALNG), which is responsible for marketing North West Shelf LNG under long-term contract outside Japan, lodged its final bid in April. After a four-month

waiting period, Australia finally secured its biggest single export deal in August 2002 — to supply China with LNG worth up to \$25 billion. Commencing from 2005–06, the six partners in the North West Shelf Project — Woodside Energy, BHP Billiton, BP, Japan Australia LNG, Chevron and Shell — will supply more than three million tonnes of LNG annually for 25 years to China's Guangdong Province. Winning the 25-year contract means that Western Australia has established another long-term LNG market in addition to Japan since LNG exports began in the late 1980s.

An additional positive development for the Western Australian gas industry was the increased momentum of initiatives which add value to the vast gas reserves in the north of the State. These include several substantial Gas-to-Liquids (GTL) projects proposed for the Burrup Peninsula. These projects (and their respective production capacities) include:

- Sasol Chevron's synthetic diesel plant (initial 30,000 to 45,000 barrels per day growing over the next decade to 200,000 barrels per day);
- Plenty River ammonia/urea project (1,800 tonnes per day of ammonia and 2,200 tonnes per day of urea);
- Burrup Fertiliser ammonia plant (2,000 tonnes per day);
- Japan DME di-methyl ether project (1.7 million tonnes per annum);
- GTL Resources methanol project (1.05 million tonnes per annum); and the
- Methanex methanol project (4 million tonnes per annum).

The gas that would be required for the six projects is estimated to be at least double that of Western Australia's total domestic consumption. The Sasol Chevron project is especially significant in that it would be the biggest resource project since the North West Shelf was brought into production. With an estimated gas intake of 20 trillion cubic feet over the 25-year life of the project, only the Carnarvon basin or the North West Shelf have the capacity to meet the plant's gas needs. The project would aim initially to produce 30,000 barrels per day of diesel, naphtha and LPG expanding upwards to 200,000 barrels per day in the

medium term to capture the advantage of economies of scale. The plant would operate for around 25 years and would potentially coincide with the development of the expansive gas reserves in the Gorgon area.

In other parts of Australia, in conjunction with developments towards capturing gas from the Greater Sunrise Fields in the Timor Sea (expected commencement in 2006), Shell has proposed to utilise the world's first floating natural gas technology. The barge generation facility would be located offshore, 450 km north of Darwin near the Greater Sunrise platform and would have the capacity to manufacture LNG and compressed gas. In Tasmania, the Bassgas Project should commence production in 2003. This project will extract gas from the Yolla gas field, located 147 km from Kilcunda in the Bass Strait, supplying it to Victorian residential and commercial customers and South Australia via a pipeline. Meanwhile, in the Northern Territory, Phillips Petroleum is seeking to establish a 10 million tonnes per annum LNG processing plant at Darwin harbour as part of the Bayu–Undan project. Valued at \$3 billion, the project will be underpinned by a three million tonnes per annum contract with Japanese power utilities.

### ***Natural gas***

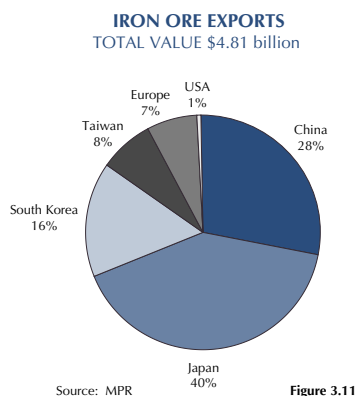
In addition to gas used as feedstock for LNG production, Western Australia also produces natural gas for domestic State consumption in industry and households. In 2001–02, the State produced more than 7.5 billion cubic metres of natural gas for domestic consumption, representing over a third of Australia's total natural gas production. Despite a slight decrease in sales volume, the value of Western Australia's natural gas sales in 2001–02 was up 2% to \$643 million.

### ***Liquefied petroleum gas (LPG)***

Liquefied petroleum gas (LPG) sales (including butane and propane) accounted for 4% of Western Australia's total petroleum sales value in 2001–02. Compared to the previous year, in 2001–02 total sales volume for LPG increased by more than 12% to 856,522 tonnes. Despite the significant increase in quantity sold, lower prices translated to the value of LPG sales falling by nearly 12% to \$362 million. Japan is the dominant user for Western Australia's LPG. In 2001–02, nearly all LPG produced in the State was exported to Japan.

### 3.4 Iron Ore

Western Australian iron ore producers continued to fare well in 2001–02 despite the continued sluggish global economic conditions. At 160 million tonnes, Western Australian iron ore sales volumes were down only marginally by 1%. Higher prices from the previous round of negotiations earlier in 2001 and a low Australian dollar in trade-weighted terms for September 2001 allowed for the value of these sales to rise by almost 4% to \$5,099 million. This was despite a turnaround in the exchange rate for the second half of period, which appreciated by about 5% against the US dollar in the third quarter of 2001–02. This marked the end of a four-year overall depreciation trend for Australia’s exchange rate and increased the competitive pressure on Western Australia’s producers. In value terms, for the Western Australian economy, iron ore remains the second largest commodity after crude oil and condensate.



In 2001–02, the state accounted for approximately 17% of the world’s iron ore production and 97% of Australia’s total production. Less than 5% of Western Australia’s total iron ore production was retained for domestic use. While the value of Western Australian iron ore exports to Japan were down two percentage points from 42% to 40%, 2001–02 saw the value of exports to China rise three percentage points to 28%. Other East Asian destinations were also up, with South Korea and Taiwan accounting for 16% and 8% of Western Australia’s iron ore exports respectively. Only 8% of the State’s iron ore exports were attributable to European (7%) and US customers (1%).

Steady and increasing Chinese demand for iron ore was largely due to strong growth in Chinese blast-furnace–

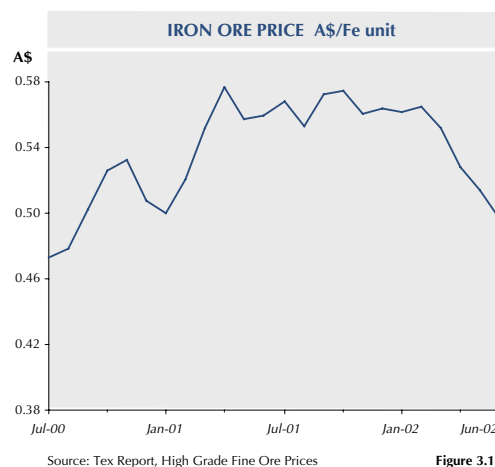
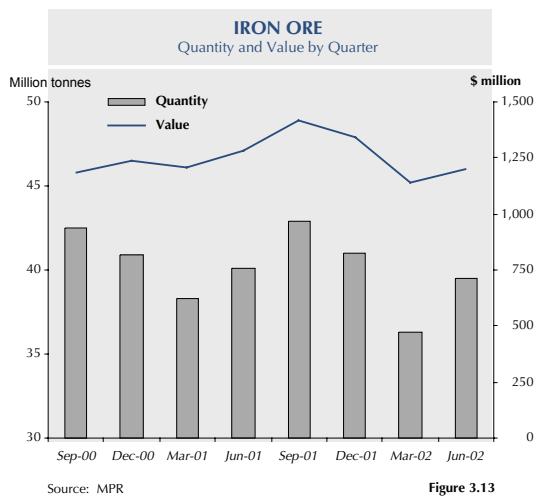


Figure 3.12

based steel output, deregulation of iron ore import arrangements and rationalisation within the domestic iron ore industry. Rationalisation has been based on closure of a large number of small, low iron content, relatively inefficient Chinese mines with high internal transport costs due to their poor location relative to the industrialised steel producing centres on the coast. Efficiently produced, imported, quality iron ore has therefore become more attractive to Chinese steel manufacturers.

With demand flailing in other parts of the globe, the size and relative stability of Chinese iron ore demand presents an attractive market for producers keen to continue increasing production. According to ABARE, in 2001, Australian producers had an estimated 41% share of the Chinese import market, whereas Brazilian suppliers had a 27% share and India 18%. Historically Australia’s high share has been attributed to competitive transport costs due to Australia’s proximity to China. Western Australian iron ore miners also continue to set world standards for production efficiency with further adjustments driving per unit costs down from US\$9.71 per tonne in 1997 to US\$7.08 per tonne in 2001–02.

However, the world’s largest producer, the Brazilian Companhia Vale do Rio Doce (CVRD) continues an aggressive approach to secure a greater share of the Chinese market. CVRD’s share of the world market has already increased over the last three years from 12% to 18%. The Western Australian Chamber of Minerals and Energy estimates that Western Australia’s share of the Chinese market is down four percentage points in 2002 compared to 2001, while CVRD’s share of the Chinese



Source: MPR

Figure 3.13

market has increased by four percentage points over the same period. Meanwhile, India's share of the market has jumped an extraordinary 17 percentage points.

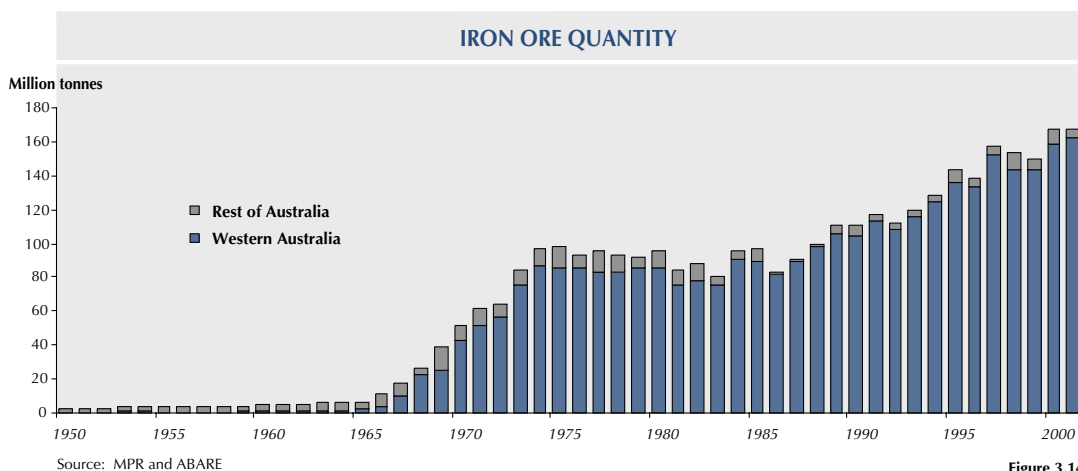
Brazil has rapidly consolidated its iron ore industry, with producers being absorbed through expansion strategies. In 2001–02 for example, CVRD acquired Belem from Bethlehem Steel Corporation and Bethlehem Steel International. The company was also engaged in negotiations with Mitsui over the merger of Ferteco and MBR. Further to this, the Brazilian giant intends to invest US\$6 billion to expand and upgrade its projects, developing new mines and making further acquisitions. As part of this strategy CVRD plans to construct a 450,000-tonne bulk carrier in partnership with its Chinese customers. The resultant reduction in iron ore transport costs will squeeze Western Australia's competitive advantage in transport, reducing the cost margin between Australian and Brazilian supply and

could potentially further erode Western Australia's Chinese market share.

Following protracted negotiations, an agreement on prices for fine, lump and Yandi ore between Australian iron ore producers and Japanese customers was finally reached in June 2002. The price of fine ore dropped by 2.4% to US28.28 cents per dry long ton unit (dltu). The price of lump ore decreased 5% to US36.13 cents per dltu and the price of Yandi ore fell by 2.4% to US26.58 cents per dltu. With the price cuts applying for the Japanese fiscal year commencing April 2002, Western Australia's iron ore producers will collectively experience a loss of around \$100 million.

The outlook for iron ore prices is for this weakness to continue, with price cuts driven by a 30% decline in demand for steel products as the global economy remains slow, in tandem with large iron ore inventories. Lesser contributing factors are weak European and Japanese markets, financially strained iron ore mills and pressure for price cuts from recently consolidated miners in the form of 'olive branch' style gestures of good faith to mills. Proposed changes to steel import barriers in the US will potentially add another factor to the downward pressure on iron ore prices and will have a significant impact on the pattern of world steel trade.

Forecasts by ABARE suggest that iron ore production will continue to climb by 3% over the next twelve months to national levels of about 190 million tonnes per annum, however the value of exports is expected to slip — due to appreciation of the Australian dollar and lower prices. Estimates suggest export values could fall by almost 2%. In the longer term, to 2007 global growth in seaborne trade of 536 million tonnes over the



Source: MPR and ABARE

Figure 3.14



next five years is expected. Around 70% of this growth is attributed to growing Chinese demand, of which 70% will be supplied by Australian and Brazilian iron ore producers. Capacity is being expanded at many Chinese ports in anticipation of increased imports. These include Beilun, Qingdao, Shekou, Xingang and Yantai.

To take maximum advantage of further export opportunities to meet demand over the next ten years, principally in the East Asian region, Western Australia's established and potential new suppliers continue to develop and assess the feasibility of a number of new iron ore projects.

In 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 million tonnes of Marra Mamba reserves, commencing at a rate of seven million tonnes per annum and rising to 20 million tonnes per annum by 2006. Located 110 km west of Newman in the East Pilbara, ore is transported by rail to the 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.

Another major project aiming to exploit Pilbara-based Marra Mamba-type ores is BHP Billiton's Mining Area C (MAC), located 110 km north of Newman. In 2001–02, development continued on finalising the details of this project, which is an addition to the company's existing Yandi mine. The \$350-million project will supply 15 million tonnes per annum to the world iron ore market, with a minimum of three million tonnes per annum of this production 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 ensures a supply deal between POSCO and BHP Billiton, involving a direct stake in the ore body by POSCO.

MAC contains 890 million tonnes of Marra Mamba ore,

the largest undeveloped resource of its kind in the Pilbara. The project is to include a mine and processing facility as well a range of infrastructure including a rail spur to link MAC to the original Yandi Mine, power, water, airstrip and roads. Accommodation for the construction workforce comprising 500 people plus 150 permanent employees is also planned. The mine is expected to commence operations by the second half of 2003.

Elsewhere in the State, the smaller iron ore producer Portman Mining Limited is proposing production increases from its Koolyanobbing mine in the Eastern Goldfields through the development of deposits at Mt Jackson and Windarling. With the bulk of the expansion focusing on these northern tenements, the securing of a key Native Title agreement in 2002 opens the way for the expansion. The expansion will require the construction of a new railway to connect the expansion area to the Koolyanobbing project site. Portman has also announced the resumption of mining on Cockatoo Island in conjunction with Henry Walker Eltin. Located 140 km north of Derby the mine will produce four million tonnes of iron ore over four years. Other expansions in the industry include Hamersley's Yandicoogina mine, which will see production, expand from 15 million tonnes per annum to 18 million tonnes per annum.

Another new major project intending to exploit Marra Mamba-type ore is the Hope Downs project, a joint effort between Hancock Prospecting and South Africa's Kumba Resources. The joint venture aims to develop 400 million tonnes of 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 five million tonnes per annum building up to 25 million tonnes per annum.

In other developments, Mount Gibson Iron Ltd continued to consider the development of its magnetite-rich iron ore deposit at Mount Gibson, located 330 km southeast of Geraldton. In April 2002, Mount Gibson Iron agreed to purchase Kingstream Steel's Tallering Peak iron ore deposits. The Tallering Peak purchase entitles Mount Gibson Iron to an extra 40 million tonnes of hematite and 48 million tonnes of magnetite ore.

It is possible that the Talling Peak deposits may be mined before the Mount Gibson deposit due to Talling Peak's closer location to the port of Geraldton.

It was also announced in April 2002 that the Swiss commodities giant, Glencore, had signed an initial five-year offtake agreement with Mount Gibson Iron, commencing in 2003 with an option to extend the contract for a further five years. Later, in May 2002, Mount Gibson Iron announced that it had entered into an agreement with Ausmelt to investigate the production of pig iron in Western Australia using Mount Gibson iron ore resources, locally sourced coal and Ausmelt's Auslron technology.

During 2002 Hamersley Iron and China's Shanghai Baosteel Group Corporation agreed to form a joint venture which guarantees Baosteel 200 million tonnes of iron ore products over the next twenty years. The joint venture aims to develop a new mine in the Pilbara region, 10 km east of the existing Paraburdoo mine, which will be built and operated by Hamersley who has a 54% share in the venture. Hamersley also intends to develop its Nammuldi iron ore deposits near its current Brockman No. 2 iron ore mine, 55 km northwest of Tom Price. The project will produce Marra Mamba lump and fine ores at around 20 million tonnes per annum.

In terms of iron ore processing, Austeel continued with plans on its \$2.8 billion Cape Preston project. The project involves the development of an open pit iron ore mine based on Fortescue magnetite deposits. Processing will include the production of hot briquetted iron for shipment to the proposed \$1.8-billion Protech Steel Pty Ltd Cold Mill Facility (CMF) on Kooragang Island, Newcastle in New South Wales. The CMF in New South Wales recently received approval from the Environmental Protection Authority, paving the way for the first stage of the project which should be operating by the latter half of 2004. The CMF will produce 520,000 tonnes of coated and painted carbon steel per year. However, the processing component Austeel's project in Western Australia hit a stumbling block in May 2002 when an EPA assessment concluded that the project will contravene greenhouse gas reduction targets. A further \$330 million will need to be spent to reduce the project's environmental impacts.

Other highlights for the iron ore processing industry in 2001–02 included final environmental approval for the proposed Hismelt Corporation commercial facility at Kwinana, a key component in the commercialisation of Marra Mamba fines. 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 aims to produce high quality pig iron at an annual capacity of up to 820,000 tonnes in its first phase, increasing to 1.64 million tonnes per annum in phase two by 2006. Construction is to commence in early 2003 employing an estimated 320 people, while full commissioning is set for late 2004 with an estimated 65 full-time positions required for this operational phase.

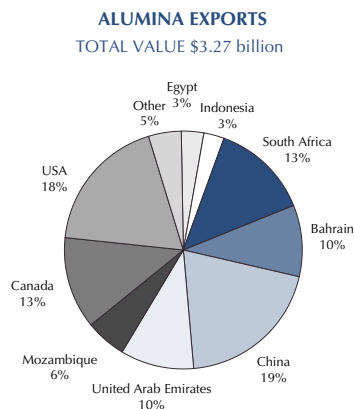
A scoping study is also under way to investigate the feasibility of the potential for a pig iron plant in Collie. Proposed by Westralia Iron and Steel Corporation, the \$700-million plant would produce 1.5 million tonnes per annum of high-grade pig iron for the export market.

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. Esperance Port is set for a \$54-million upgrade to include dredging to create the deepest port facility in southern Australia. Other work will include a new berth and loading facility, construction of a 300,000 tonne iron ore storage facility and reclamation of 23 hectares of land to build a seawall. On completion of the upgrade, Esperance Port will have the capacity to accommodate cape-class vessels and increased export flows of at least 6 million tonnes by 2004, up from 3 million tonnes in 2001. The expansion has been facilitated by the involvement of Portman, which agreed to underwrite the development.

Similarly, Geraldton Port is to undergo a \$100-million enhancement including plans to deepen the harbour to over 12 metres. On a smaller scale BHP Billiton intends to increase its export capacity by developing a new stockpile area and upgraded berth to handle 25,000 tonne ships at its Finucane Island Port Facility. The company also intends to upgrade its harbour tunnel in Port Hedland.

### 3.5 Alumina

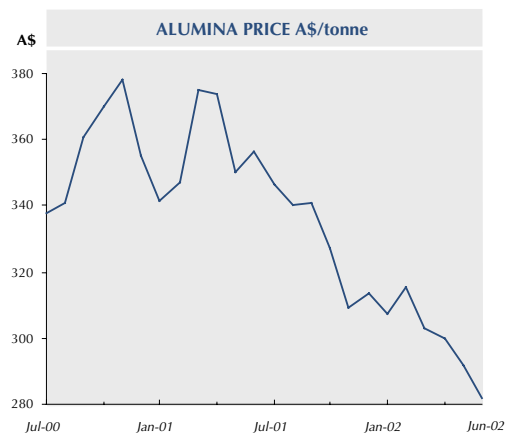
Australia is the largest alumina producer in the world. According to statistics compiled by ABARE and AME Mineral Economics, Australia exports 80% of national alumina production and supplies approximately 33% of the world's total alumina from its six refineries. Four refineries, with a combined production capacity of 9.8 million tonnes per annum, are located in Western Australia at Kwinana, Wagerup, Pinjarra and Collie (Worsley). Worsley is majority owned by Billiton Aluminium (56%) while Alcoa World Alumina — the largest alumina producer in the world responsible for 24% of the world's total alumina output, owns the remaining three refineries.



Source: MPR **Figure 3.15**

Western Australia's refineries set the global standard for operating costs and efficiency, with ongoing world class technical research largely responsible for annual production cost gains estimated at 3% per annum. According to AME Mineral Economics Worsley, Pinjarra and Wagerup refineries make up three of the world's five top rating refineries in terms of lowest production costs per tonne.

In 2001–02 the State produced almost 21% of the world's alumina and accounted for over 66% of Australian production. This translated to export sales valued at \$3.27 billion, down less than 1%, on 2000–01 figures. China comprised the largest share of the State's exports by value, at 19%, followed by the US which accounted for 18% of the State's alumina exports. Other significant export destinations were South Africa (13%), United Arab Emirates (10%) and Canada (13%).



Source: ABARE and ABS **Figure 3.16**

Western Australia's alumina output continued to increase in 2001–02, rising by 4% to a record 10.9 million tonnes. Worsley's alumina production, increasing to maximum capacity following its refinery expansion, contributed to this growth. However, a severe downturn in world alumina prices in 2001–02 translated to local producers receiving lower prices. Total alumina sales value was therefore almost static at \$3.58 billion, marginally below (less than 0.5%) the previous financial year.

While significant price fluctuations ranging from \$338 per tonne to \$378 per tonne characterised the previous financial year, in 2001–02 alumina prices formed a steady trend, albeit downward. Commencing 2001–02 at \$346 per tonne, prices dropped to \$282 per tonne by June 2002, ending 2001–02 with the lowest price recorded for the financial year. Overall, the average alumina price in 2001–02 was \$315 per tonne which was 14% lower compared to 2000–01.

More than 90% of the world's alumina is used in aluminium production, so alumina trends are strongly tied to events in the aluminium industry. Weak demand, oversupply and a contradictory mix of production cutbacks, shutdowns and restarts characterised the aluminium industry throughout 2001–02. Weak demand for aluminium was primarily attributed to the slow global economy and sluggish automotive and aviation sectors. By the end of the financial year, three additional US operations were either closed or scaled back and total annual idled aluminium production capacity for Alcoa stood at 11% or 4 million tonnes.

Meanwhile acquisitions and improvements in energy and water supplies led to capacity expansions and re-starts of idle production in Brazil, the US Pacific Northwest and British Columbia. Aluminium supply growth in the second half of 2001–02 subsequently outweighed growth in demand by one percentage point. This compounded the general oversupply conditions in the aluminium market, fuelling downward pressure on prices which reached a three-year low in November 2001.

China is viewed as the main driver for the global aluminium oversupply with booming production levels moving the country from a net importer to a net exporter in 2001. Since September 2001 alone, China has boosted its aluminium capacity by 25% and is expected to be annually exporting 300,000 tonnes of aluminium by 2005. Other significant production increases were attributed to India and Canada, collectively adding an additional 18% to global supply since September 2001.

The global oversupply of aluminium has kept demand for alumina healthy with any downward pressure on alumina prices due to alumina overproduction. The impacts of the weakening alumina price were evident in Western Australia throughout the financial year. In the second quarter for the period, Alcoa reported its first quarterly loss in nearly eight years, citing the weak economy and prices as primary drivers for costly restructuring. By the end of the third quarter, Western Australia's refineries collectively recorded a 3% fall in production. However, in other parts of the globe, where alumina refining is far less efficient with considerably higher cash costs, production cutbacks

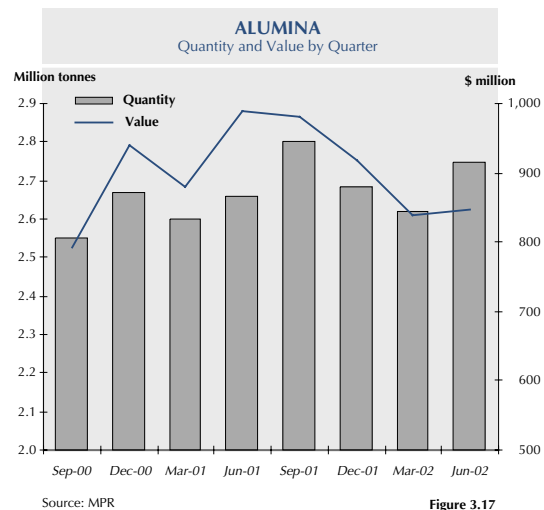


Figure 3.17

were recorded across the world's 70 refineries. For example, Alcoa and BHP Billiton announced cutback measures in North America, Latin America and Eastern Europe.

Weak alumina prices were a major factor in Alcoa deciding to hold off on plans to expand its Wagerup refinery. Environmental concerns were another significant factor in stalling the \$1-billion expansion. The planned expansion would add \$400 million per annum to Western Australia's export revenue. Meanwhile, since the completion in September 2000 of the Worsley refinery expansion, Worsley's output has increased to a maximum capacity of 3.1 million tonnes per annum. BHP Billiton is now considering a further expansion which could see output creep further up by 16% to 3.7 million tonnes per annum.

Environmental concerns have been a significant factor in the operation of Western Australia's alumina

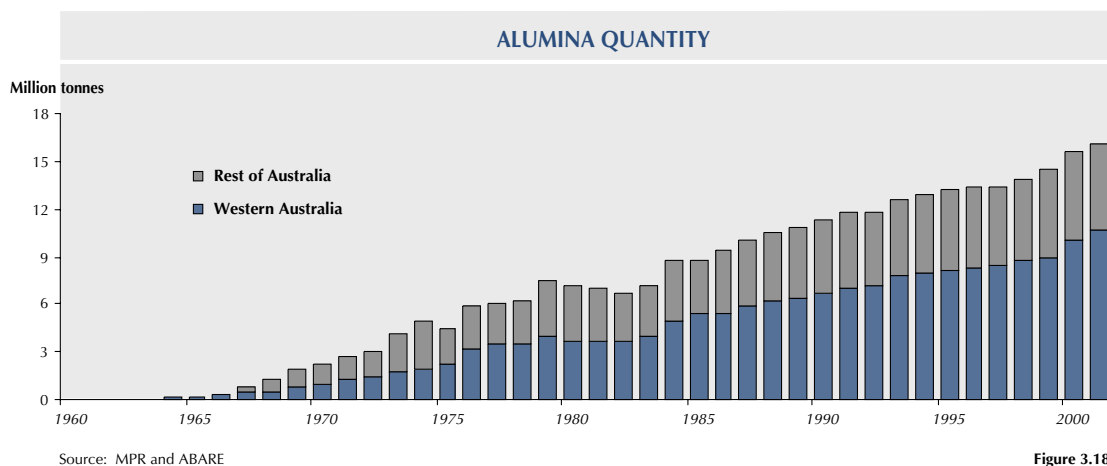


Figure 3.18

refineries. In addition to their impact on the expansion of the Wagerup refinery, Worsley's liquor burner was shut down in May 2002 in response to health concerns raised by the community which began in late 2001. Other environmental matters concerning the industry included ground water pollution arising from Alcoa's operations at Kwinana, Pinjarra and Wagerup.

In other parts of Australia, work has commenced in Chadstone, Queensland, on Comalco's 1.4 million tonnes per annum smelter grade alumina brownfield site. The wholly owned Rio Tinto subsidiary estimates that the refinery will come on-stream by 2005. The State and federal governments have made additional funding and infrastructure commitments to the project which will include wharf facilities, conveyers, grinding mills, storage silos, coal handling and a rail delivery system, gas and electricity distribution systems, a steam generation plant and associated plant buildings. Initial production levels will be 1.4 million tonnes per annum with expansion allowing for production of up to 4 million tonnes per annum. The existing alumina industry in the area was a drawcard for the attraction of the new refinery with bauxite and all other inputs, except caustic soda, being sourced locally.

The number of people employed within the Western Australian alumina industry in 2001–02 rose marginally by 3%, compared to a 12% fall in employment levels recorded in 2000–01, following the completion of the Worsley refinery expansion. The prospect of future expansions could see temporary jumps in employment levels in the medium term. However, Alcoa World Alumina announced 200 voluntary redundancies during 2001–02 in response to increased efficiency at its Pinjarra, Kwinana and Wagerup operations. The effect of these cutbacks is not yet evident.

ABARE forecasts show national Alumina production increasing in excess of 18.6 million tonnes by 2006–07. With few new projects in the pipeline, exports are projected to be relatively constant until expected production increases around 2005–06. On an annual average basis, exports are expected to increase at a rate of 2.1% between 2001–02 and 2006–07, reaching 14.6 million tonnes by 2006–07.

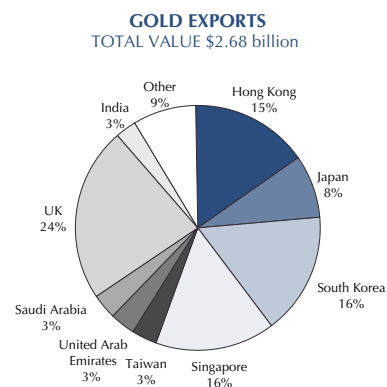
### 3.6 Gold

As experienced of late, 2001–02 continued to be characterised by production reductions and mine closures. This resulted in the fifth successive year of falling output from the State's gold industry. National gold production levels were also down, having reached a seven-year low in the March quarter of 2002. Compared with 2000–01, Western Australian gold sales in 2001–02 dropped 8% to 5.9 million ounces (185 tonnes). Western Australia's contribution to national gold production however, remained considerable at 67%.

In Australian currency terms, in 2001–02 average gold prices were 10% higher, up from \$501 per ounce in 2000–01 to \$553 per ounce in 2001–02. In international terms, the average price of gold in 2001–02 was up by 7% on the average for the previous financial year.

The value of gold exports from Western Australia totalled \$2,681 million in 2001–02, a reduction of 14% on the previous period, while volumes were 16% down. The top four export destinations were the United Kingdom, South Korea, Singapore, and Hong Kong.

The consolidation trend for the Australian gold industry continued throughout 2001–02, driven by the incentives of cost reduction and the increased likelihood of attracting institutional investment. In 2001–02, a number of significant rationalisations occurred, including the merger of Barrick Gold Corporation with Homestake Mining Company (December 2001) and Croesus Mining NL with Central Norseman Gold Corporation Ltd (January 2002). After acquiring Western Mining's (WMC) Agnew and St Ives projects, Goldfields Limited also merged with Delta Gold Limited



Source: MPR

Figure 3.19

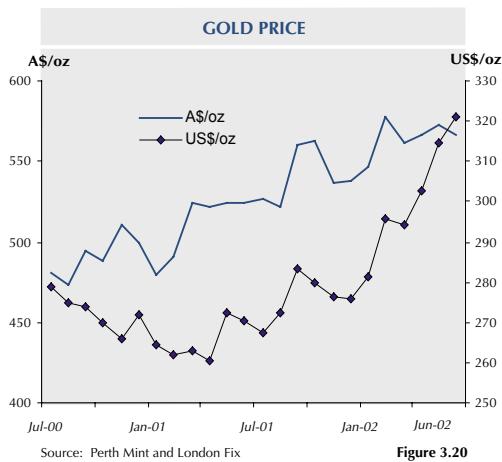


Figure 3.20

to create AurionGold in December 2001. In particular, the Barrick–Homestake merger created the world’s most valuable miner and the second biggest gold producer by production.

Take-overs during the period were equally on a large scale with the loss of Australia’s Normandy Mining (December 2001) and Canada’s Franco-Nevada Gold (February 2002) to Newmont Mining to create the world’s largest gold producer. Also PacMin Mining Corporation was absorbed by Sons of Gwalia (October 2001) and Perth-based Hill 50 was lost to South Africa’s Harmony Gold (June 2002). By the end of the period, negotiations were under way for the take-over of Sydney-based AurionGold Limited by Canada’s Placer Dome, finalisation of which was expected by the end of October 2002. On completion of the deal, Placer Dome may hold up to 90% of AurionGold.

The implications of these consolidations for Western Australia include the transfer of ownership of some of the State’s larger mining projects. The Harmony Gold take-over saw the acquisition of the Mt Magnet and New Celebration mines, which collectively produce 4% of the State’s total output. Barrick Gold Corporation also acquired a share of Western Australia’s largest mine, the Kalgoorlie Superpit, when it merged with Homestake Mining Company. Meanwhile the purchase of the Agnew and St Ives mines by Goldfields Limited in November 2001 saw the transfer of ownership of another 12% of State production.

Western Australia’s ten largest projects accounted for almost 60% of the State’s gold output in 2001–02. These projects were:

- Golden Mile-Kalgoorlie (KCGM – Newmont, Barrick) – 21.8 tonnes

- St Ives (Aurion Gold) – 16.1 tonnes
- Granny Smith (Placer Dome Pty Ltd) – 13.0 tonnes
- Jundee–Nimry (Newmont) – 11.1 tonnes
- Sunrise Dam (Anglo Gold) – 10.1 tonnes
- Plutonic (Barrick) – 8.7 tonnes
- Bronzewing - Mt McClure (Newmont) – 8.5 tonnes
- Kanowna Belle (Aurion Gold) – 7.1 tonnes
- Paddington (Aurion Gold) – 6.6 tonnes
- Marvel Loch–Southern Cross (Sons of Gwalia) – 6.1 tonnes.

Upward shifts in the international gold price has been a significant aspect of 2001–02, reversing gold’s long-term decline in **real** terms. The average price of gold in 2001–02 was up 7% on the previous year at US\$289 per ounce and hit its highest level since 1997 when it reached US\$321 per ounce in June 2002. High gold prices have assisted in offsetting the impact of declining sales output by converting production to a small 1% increase in the sales value of the State’s gold industry to \$3,279 million.

A number of factors have contributed to rises in the price of gold, although the nature of these factors could mean that price rises are short-lived. The use of gold as a safe haven from shocks and uncertainty has played a large role in demand side price rises. This is evident in world investment demand figures for gold in 2001–02, which according to the World Gold Council demonstrated a 51% increase, rising from 245 tonnes in 2000–01 to 369 tonnes. In particular, political upheavals in the Middle East and uncertainty about the valuation of equity markets, major international currencies and bank stability in Japan have contributed

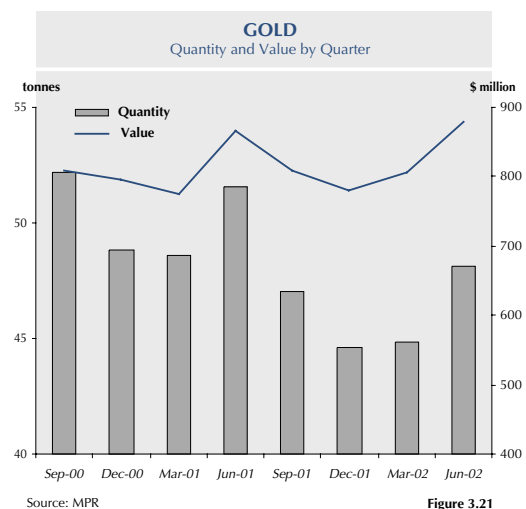


Figure 3.21

to increased demand. Conversely higher prices have impacted on industrial and jewellery demand, which declined by 16% and 14% respectively in 2001–02, while dental demand remained unchanged.

On the supply side, stable central bank sales and flat world production are also responsible for gold rallying above the US\$300 per ounce mark. Other factors include the dramatic shift by gold's major producers away from forward contracts. For example, AngloGold Limited, one of the world's largest producers, cut its hedge book by 60% during the period from 12.9 million ounces to 7.8 million ounces. Despite this, Australia is the only country in the world where all the major gold companies are hedged. Reasons behind producers reducing their hedge books are the recent increases in gold prices virtually eliminating the positive forward contango and perhaps most importantly, the devaluation of local currencies has significantly increased the value of domestically denominated gold prices. Consolidation trends in the industry are further intensifying the spread towards reduced or no hedge books.

ABARE predictions of acceleration in global economic activity for 2003 could mean that investors re-weight their portfolios away from defensive assets such as gold, resulting in a reduction in investment demand.

In terms of the State gold production outlook, the falling rate of gold exploration is placing pressure on the level of economically demonstrated gold resources. Therefore, the State's gold production is forecast by ABARE to continue falling, primarily as a result of older mines coming to the end of their mine life. Important gold mining operations that ceased operations during 2001–02 included the Boddington mine, from which output sales fell from 44,000 ounces in the December 2001 quarter

to 3,000 ounces in the March 2002 quarter. Viceroy Resource Corporation, owners of the Bounty mine, also placed the management and control of their Australian assets with an Administrator, while the Dalgaranga mine ceased operations in June 2002.

There are however, some significant new gold projects which should at least ameliorate the declining rate of production. These include:

- **LionOre's/Dalrymple Resources' Thunderbox gold project.**

This project near Leinster, is expected to produce some 220,000 ounces of gold in the first year of its operation and 150,000 ounces per annum in subsequent years. All up, total recovered gold is expected to be 800,000 ounces for the initial five-year open pit mine life;

- **Newcrest's resurrection of the Telfer gold mine.**

Newcrest Mining has confirmed that the Telfer gold mine resurrection is to go ahead. This mine will provide the biggest and most dramatic boost to the State's gold production. The Telfer operation, which has reserves of 19 million ounces, is expected to topple the Superpit as Australia's biggest gold mine when it resumes production in late 2004. The project will include completion of development of the existing mine with both open pit and underground mines. Power for the project is to be supplied from gas-fired turbines supplied from the North West Shelf; and

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

The Wandoo expansion, estimated to produce around 680,000 ounces per year, is subject to negotiations regarding the proportion of stakes held

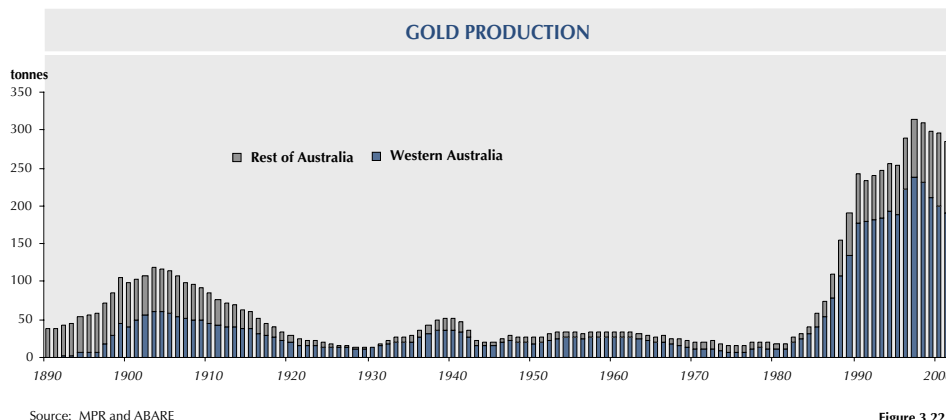


Figure 3.22

by the three owners – AngloGold (33%), Newmont Mining (44%) and Newcrest Mining (22%).

Other projects, which will supplement the State's gold output, include Gindalbie Gold's Minjar project near Yalgoo and Aurion Gold's White Foil project. In addition both the Granny Smith Wallaby mine and the Sunrise Dam mine are set for extension.

With the current level of the Australian dollar supporting gold prices denominated in local currency terms, favourable cash margins exist for most Australian producers. As foreseen by ABARE, these cash margins are expected to be sufficient for gold producers to outweigh the impact of any appreciation of the Australian dollar over the outlook period. Cost-related closures of mines are thus not expected over the outlook period, with the exception perhaps of some smaller mines with unprofitable hedge books.

### 3.7 Nickel

The latter half of 2001–02 saw steady rises in international nickel prices. From February to April 2002, the price of nickel rose 14%, reaching a ten-month high of US\$7,160 per tonne, signifying a peak in prices which were ascending since October 2001. Despite this significant turnaround for nickel, the overall annual average price was down 18% on 2000–01, resulting in the second successive year of overall falling nickel prices. The State's nickel industry suffered as a result, with the value of sales down by 10% to \$2,007 million. This was despite physical sales volumes increasing in 2001–02 by 7% to around 180,000 tonnes.

Chief contributors to growing output were Murrin Murrin, Black Swan and the Miitel operation.

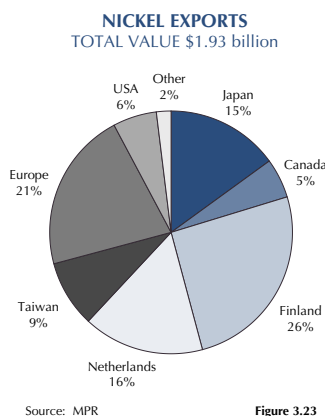


Figure 3.23

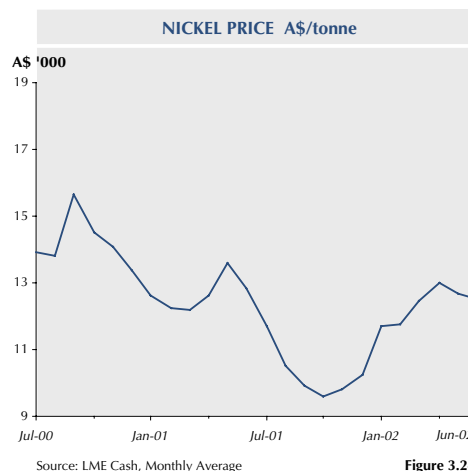


Figure 3.24

In particular, Murrin Murrin produced a record 7,479 tonnes of nickel in the first three months of 2002, despite continued technical and financial difficulties.

There are 11 operating nickel project sites in Western Australia, accounting for all of Australia's nickel production and 18% of world nickel production. Most of Western Australia's nickel is exported to Europe and Japan. In 2001–02, the five largest nickel operations accounting for 88% of Western Australia's output were:

1. Western Mining Corporation (Kambalda, Blair, Leinster and Mount Keith) – 94,321 tonnes
2. Anaconda Nickel Ltd/Glencore (Murrin Murrin) – 26,242 tonnes
3. Mining Project Investors (Black Swan and Silver Swan) – 21,658 tonnes
4. Mincor Operations Pty Ltd (Miitel) – 8,671 tonnes
5. Jubilee Mines (Cosmos) – 7,127 tonnes

The nickel industry is undergoing a period of diversification mainly attributable to the continued divestiture of the major industry players such as Western Mining Corporation (WMC). Western Australia's smaller nickel operators are benefiting from this trend with six of Western Australia's junior nickel companies now listed among the world's top twenty nickel producers. They are:

- Mining Project Investors – Black Swan (7th)
- Mincor Operations Pty Ltd – Miitel and Wannaway (12th)
- Jubilee Mines – Cosmos (13th)
- LionOre – Emily Ann (14th)
- Independence Gold – Long/Victor (17th)
- Fox Resources – Radio Hill (19th)



Nickel is amongst the most volatile of metals in terms of price movements with significant consumption by the stainless steel industry, which is strongly linked to changes in the business cycle. The surge in the nickel price in early 2002 thus augured for an improving world economy.

Surging steel output in the second half of 2001–02 was closely related to strong demand conditions in Asia. In South Korea, domestic stainless steel demand was significant enough to reduce exports to China. This allowed Japanese stainless steel producers to fill the gap. Chinese demand for stainless steel was very strong during 2001–02 and is expected to climb further in anticipation of a number of large-scale infrastructure projects. At present, China is the largest stainless steel consumer with demand growing at around 25% per annum. In addition to strong Asian demand for stainless steel, demand for Asian nickel-based products such as batteries, mobile phones, notebook computers and hybrid electric vehicles was also on the rise.

Significant reductions in the supply of Russian nickel and stainless steel further contributed to rising nickel prices. During the second half of 2001–02, Norilsk Nickel of Russia announced that it would ‘freeze’ 60,000 tonnes of its nickel as loan collateral, thereby reducing European supply. Simultaneously, volumes of stainless steel scrap metal exported from Russia dropped dramatically, halving in 2001, following new Russian regulations to limit its export. With most new stainless steel production comprising 50% scrap, the impact of the reduced Russian supply further heightened the pressure on nickel prices. Further pressure arose out of the cessation of stainless steel de-stocking in Europe and the US. It is anticipated that these events will

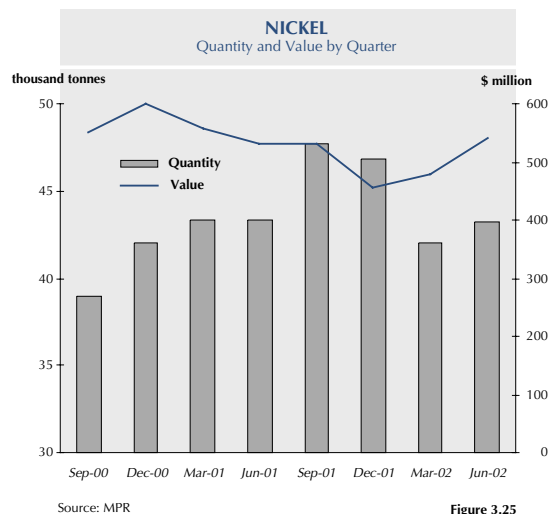


Figure 3.25

considerably tighten the margin between nickel supply and demand, potentially leading to a deficit in 2003–04 until new major nickel operations start to take effect in 2005.

ABARE predicts that strengthening world economic activity will further support increased demand for stainless steel, with supply lags resulting in further de-stocking. The resultant price increases will encourage greater output and thus lead to continued positive flow-on effects for nickel producers. While improvements in demand for nickel will be slightly offset by increased supplies of stainless steel scrap, ABARE estimates that 2003 will see world nickel consumption rise by 8%, leading to increases of around 30% in Australia’s export returns to \$2.3 billion.

Despite unfavourable trends for nickel producers, leading up to early 2001–02, the nickel industry on the local scene was characterised by a level of optimism, evident in the considerable number of new projects

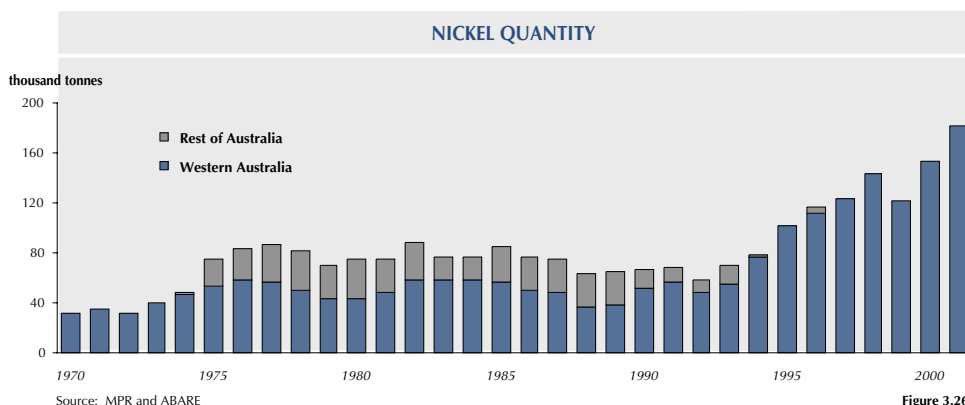


Figure 3.26

and proposed expansions. Driving this optimism are forecasts that export earnings from nickel will grow 75% over the next two years boosted by increases in production and higher world prices. ABARE predicts that earnings in 2003–04 are expected to reach \$3.6 billion. Longer-term growth in production is expected to arise as a result of planned incremental expansions at existing nickel projects. The largest increases in mine output are expected from Anaconda Nickel's Murrin Murrin operation and WMC's suite of mines. Expanding output from LionOres's Emily Ann mine and the soon-to-be-recommissioned Long-Victor will also boost output.

LionOre Australia (Nickel) Ltd commenced operation at its Emily Ann nickel sulphide project in August 2001. Located 540 km east of Perth, this project produces concentrates containing an average of 6,700 tonnes of nickel per year. However, in an attempt to consolidate ownership of the Emily Ann and Maggie Hays mine, Canadian miner LionOre Mining International Ltd has put in a bid to increase its ownership share of LionOre Australia, its 80%-owned subsidiary. This will bring LionOres's total interest in LionOre Australia (Nickel) Ltd to 82.3%. The international company also has a 60% stake in the soon-to-be-commissioned Thunderbox gold mine.

Sally Malay Mining Ltd recently secured US\$5 million project financing for its nickel, copper and cobalt project in the East Kimberley. With strong support for the project including an agreement with Jinchuan Group Ltd and Sino Mining International for uptake of 100% of the project's concentrate production, the mine looks to commence production in December 2003. Construction of the \$54-million operation, which is to include open-cut and underground mining, is expected to commence by March 2003.

Progress was also made during 2001–02 in the development prospects of the proposed \$950-million BHP Billiton Ravensthorpe Nickel Project (RNP). The State Government has committed funding of \$18.4 million to the project on the condition that the Federal Government matches this, although a federal commitment has not yet been made. A decision to go ahead with the project could be reached by mid-2003. The project is regarded as one of national significance in terms of the scale of the capital expenditure

involved, the potential export income and employment and in terms of its strategic importance to the \$300 million enhancement of the Yabulu Nickel Refinery in Townsville.

In other expansion developments, WMC estimates that the expansion of its Mt Keith nickel operation near Leinster is between three and five years away. The planned expansion would entail the company's nearby North Six-Mile deposit and Yakabindie nickel deposit, the latter which was purchased from Rio Tinto early in 2001.

Work on the underground section of the high-grade Cosmos Deeps ore reserve at Cosmos nickel mine 40 km north of Leinster also progressed during 2002. This additional underground development will more than double the life of the present open-pit. Further exploration by Jubilee Mines is focusing on the Randles Find nickel sulphide resource in the northeastern goldfields, which the company hopes to mine. Also, Western Areas is to commence drilling at its Forrestania nickel sulphide project following an additional high-grade find at the site.

In terms of potential new projects, activity has increased in the West Musgrave Region, 1,300 km northeast of Perth. WMC and West Musgrave Mining (WMM) are undertaking drilling in the area, while BHP Billiton has formed an alliance with WMM to fund exploration in the area. In addition, ReLODE has reached an agreement with the Ngaanyatjarra Land Council to explore land in the region.

Reshuffling in the industry saw the purchase of Outokumpu's Kalgoorlie Black Swan and Silver Swan mines in addition to the Honeymoon Well prospect, by a consortium led by Mining Project Investors Pty Ltd (MPI). Honeymoon Well, located between Mt Keith and Wiluna, is yet undeveloped. The consortium consisted of Melbourne-based MPI (80%) and the OM Group (20%). The OM Group also acquired the Cawse project from Centaur Mining and Exploration in December 2001.

Other changes of ownership included the purchase of the Radio Hill Nickel Mine from Titan Resources by Fox Resources in July 2002. However, Titan Resources will continue its BioHeap trials adjacent to the Radio Hill mine, near Karratha. Titan has indicated that the

process is proving successful with an overall nickel recovery rate of 90% in its first large-scale field trials.

Continuing WMC's trend of divesting its small upstream nickel mines to junior companies, the Long Victor Nickel Mine was purchased by Perth-based Independence Gold. Other WMC interests in the area, which have been taken up by smaller operators, include the purchase of the north Widgiemooltha exploration block by Titan Resources; the Miitel, Redross, Wannaway and Mariners deposits by the Miitel Joint Venture; and the leasing of the Otter Juan and Coronet North tenements by Goldfields Mine Management.

Also, in May 2002, Perth-based explorer Dalrymple Resources NL reached agreement with WMC Resources Ltd to secure 100% ownership of the Lake Goongarrie nickel-gold project. The agreement secures for Dalrymple total ownership of WMC's Scotia nickel tenements (exclusive of gold rights) which contain the abandoned Scotia nickel mine. The Scotia mine was in production between 1969 and 1977. Dalrymple also has 40% interest in the Thunderbox Gold mine development, as well as rights to the Waterloo nickel sulphide deposit, which is part of the Wildara Joint Venture, located in the North Eastern Goldfields

In contrast, early 2002 saw the closure of WMC's Lanfranchi operation at Kambalda. The ex-WMC's Blair mine, which was operated by McMahon Holdings, also closed in October 2001 due to low nickel prices.

Western Australia's nickel laterite producers remained under financial and technical pressure throughout 2001–02. In the second quarter of 2001–02, production at Murrin Murrin and Bulong fell to 50% and 61% of capacity, respectively. The cause of both reductions was scheduled maintenance shutdowns, although Bulong also experienced subsequent technical difficulties. However, by the final quarter of the 2001–02, Murrin Murrin had increased operating levels to 73% of capacity. OM Group's Cawse mine also recorded falls in capacity utilisation in the first half of 2001–02. Subsequently, a number of laterite projects such as Anaconda's Mt Margaret project have been placed on the backburner. Despite this, Heron Resources is investigating the possibility of constructing

the Goldfields' fourth nickel laterite processing plant north of Kalgoorlie.

Murrin Murrin and Bulong experienced cuts to their sulphuric acid supplies following the temporary shutdown of the Kalgoorlie Nickel Smelter in late February 2002 due to fire. Production levels were unaffected however, with Murrin Murrin producing a record 7,479 tonnes of nickel in the three months commencing 2002. Unfortunate events continued however throughout the beginning of 2002 for Murrin Murrin, with the mine experiencing a lightning strike in early March and then a fire in May, which damaged electrical cabling. Both incidents were overcome by bringing forward maintenance schedules. Given the string of problems for Murrin Murrin, Anaconda has shifted its management focus to concentrate on achieving sustainable production levels, delaying expansion activities to later in the decade.

A weak market for cobalt during 2001–02 added to the difficulties experienced by Western Australia's nickel laterite producers for whom cobalt was supposed to underpin operational cash flows. Essential to low-cost nickel production from laterite ore is revenue from cobalt by-product. Cobalt prices recorded a 42% fall against 2000–01 prices reaching their lowest level since 1995 at US\$6.89 per pound. Compounding this problem, cobalt production at Murrin Murrin has been less than expected due to poor recovery rates and lower grade. The project produced 1,503 tonnes of cobalt in 2001–02, a 60% increase on production compared to 2000–01, yet still fell considerably short of the 3,000 tonnes per annum production capacity for the project.

Sluggish demand for cobalt was underpinned by slow world economic growth and continued low confidence in air travel in response to the events of September 11. With super alloys (used in power turbines and the aerospace sector) forming 23% of the end-user market for cobalt, this latter issue has been a significant factor in the weakening of the market.

A significant nickel supply decline is anticipated for 2002–03. This is due to the lack of investment in new projects in the Congo and Zambia and constrained supply from Western Australia's nickel laterite producers. Zambia has also experienced a slowdown in the production of cobalt.

Whether this creates a market deficit will depend upon the pace at which the world economy recovers. Expectations are that a recovery will be slow, especially given speculation in relation to the US economy and concerns over future terrorist attacks.

### 3.8 Mineral Sands

Running against the trend for most mineral commodities, heavy mineral sands prices in 2001–02 were generally positive. However, despite this, after a healthy 25% increase in sales value in the previous financial year, the heavy mineral sands industry contracted in 2001–02 with the value of sales down by 6% to \$859 million. This was attributable to drops in sales volumes, chiefly ilmenite and upgraded ilmenite products, which were down 287,000 tonnes (26%) and 57,000 tonnes (9%) respectively. Rutile sales, at 123,000 tonnes were also down by 4% on the previous year. The volume of zircon sales also decreased, by more than 7% to 318,000 tonnes. However, thanks to significant increases in international zircon prices in 2001–02, sales values increased by 10% to \$219 million.

The heavy mineral sands industry in Western Australia is concentrated in the southwest area of the State and is valued at close to \$1 billion per annum. The sector is the sixth largest mineral and petroleum commodity by value to the State. Production from the heavy mineral sands industry comprises titanium minerals such as ilmenite, rutile, leucoxene and synthetic rutile. These minerals are the feedstock for the production of titanium dioxide pigment and titanium metal. Other non-titanium minerals derived from the industry are zircon, garnet, staurolite and monazite.

The heavy mineral sands industry in Western Australia is highly consolidated, similar to the global industry, where five companies control over 75% of current world production capacity. The four major entities dominating the State's mineral sands activities comprise Iluka Resources, created from the merger of RGC and Westralian Sands in late 1998 to form the world's second largest producer of mineral sands; Cable Sands (WA); The Tiwest Joint Venture, jointly owned by Ticor and Kerr McGee Chemical Corporation; and Millennium Chemicals.

Iluka produce mineral sands from two main regions in the State, Eneabba (Mid West) and Capel (South West). Cable Sands operates exclusively in the region around Bunbury. The Tiwest Joint Venture has mining operations approximately 170 km north of Perth at its Cooljarloo mine and processing operations at its Chandala synthetic rutile plant near Muchea, about 60 km north of Perth. Some synthetic rutile from the Chandala processing site is railed to its pigment plant in Kwinana. Millennium Chemicals manufactures titanium dioxide pigment from synthetic rutile at Kemerton near Bunbury.

Throughout the first half of 2001–02, prices for titanium dioxide (TiO<sub>2</sub>) pigment and feedstock were flat, however the latter half of the financial year saw TiO<sub>2</sub> prices begin to pick up as pigment producers in the US and the EU pushed through price increases in the third quarter of 2001–02. Improved pigment demand in the fourth quarter of 2001–02 was evident with increased sales volumes for key producers. For example, Millennium Chemicals, the world's second-largest producer of TiO<sub>2</sub>, reported a 12% improvement in year-to-date pigment sale volumes. Higher demand was attributed to improved global business conditions, healthy demand from coatings manufacturers, customer restocking in advance of anticipated price increases and seasonal effects.

Unfortunately, large inventories initially prevented corresponding flow-on effect to the titanium feedstock sector. Worldwide feedstock prices fell in the early stages of 2002 in response to low demand and corresponding production cutbacks in the US. By June 2002 however, a clear increase in feedstock demand was becoming evident resulting in the restarting of the Tiwest North Cooljarloo mine, which had stopped in January 2002 to reduce stockpiles. Similarly the Chandala synthetic rutile plant near Muchea, which receives production from the Tiwest north and south Cooljarloo mines, returned to full operating capacity after operating at 80% capacity since October 2001. The demand improvements are viewed as a moderate turning point in the otherwise depressed feedstock market, where the outlook in the medium term remains moderate in the wake of anticipated production increases.

Unlike potential improvements in the titanium dioxide pigment market, demand for titanium metals remained weak throughout 2001–02. AME Mineral Economics reported that titanium metal production by Timet, the world’s largest supplier of titanium metal products, experienced falls in sales throughout 2001–02. The fourth quarter of 2001–02 saw mill product sales volumes for Timet drop 30% on the year and 21% on the quarter, while melted products volumes reflected a similar trend. The company subsequently reduced production rates at its US sponge production facility and took actions to reduce worldwide employment levels. Expectations are that a difficult business environment for titanium metal producers will persist in 2003. With the commercial aerospace sector the major source of demand for metal titanium products, the severe downturn in the industry and the sluggish economy are the primary reasons for the depressed titanium metals market.

Western Australia exported heavy mineral sands to the value of \$724 million during 2001–02, totalling 85% of total sales in heavy mineral sands. In terms of destination, the State’s heavy mineral sands are shipped to a variety of countries throughout the globe, however, at 23% of total exports, or \$169 million, the US accounts for the largest proportion. Collectively, European customers comprise 37% of Western Australia’s total heavy mineral sands exports, with the Netherlands (15%) and the UK (11%) the next largest countries after the US in terms of sales. North America alone is attributed with 33% of total world titanium dioxide consumption based on 2001 data and therefore plays an important role in world titanium feedstock markets.

Amongst the titanium feedstock group of minerals, prices compared to the previous year were generally

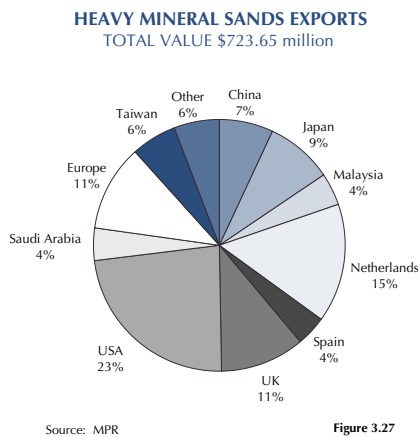


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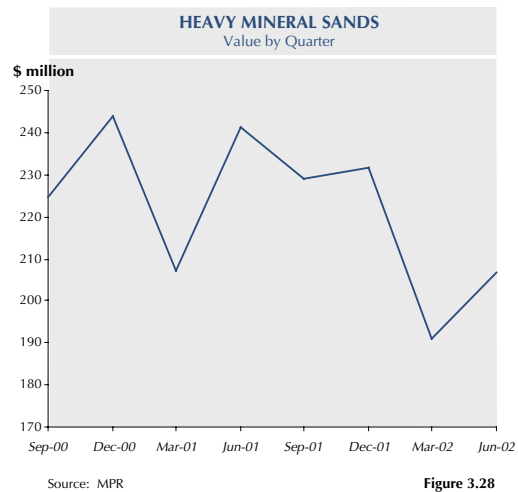


Figure 3.28

up, albeit only marginally. In 2001–02 ilmenite and rutile recorded rises of 3% and 4% respectively, with ilmenite recording an average price of \$155 per tonne while rutile averaged \$960 per tonne. Despite these averages, titanium feedstock prices (especially rutile) fluctuated considerably throughout 2001–02 reflecting the uncertain and depressed global market for titanium pigment and metals.

In terms of value, synthetic rutile, or upgraded ilmenite, continued to dominate Western Australia’s mineral sands industry constituting 44% of total value, despite a fall of \$35 million in 2001–02 to \$374 million. Rutile was also down on the last period, by 3% at \$107 million. Rutile formed just over 17% of the total sales value for the heavy mineral sands sector in Western Australia. Ilmenite sales value also dropped dramatically, by 24% (\$40 million) to \$129 million.

While demand for pigment is expected to remain steady, in the short to medium term the outlook for

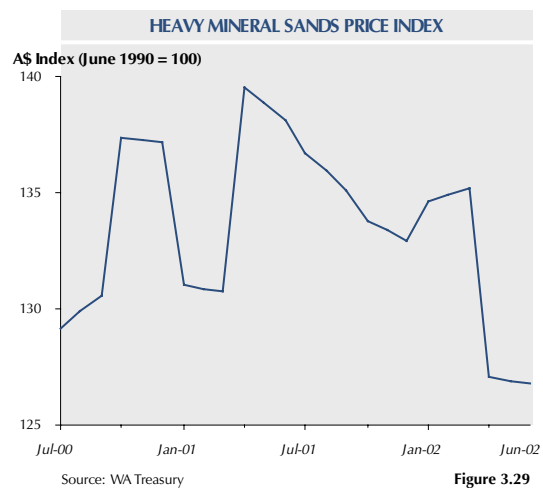


Figure 3.29

the titanium feedstock group of minerals is mixed, with high inventory levels continuing to leave the market oversupplied relative to pigment demand. Macquarie Research estimates average ilmenite prices to increase by approximately \$8 per tonne over the next two years, averaging \$150 per tonne by 2004 and remaining at that level up to 2006. Rutile and upgraded rutile however are expected to experience greater upward price movement in the short to medium term with rutile prices expected to jump from an average of US\$458 per tonne in 2003 to over US\$500 per tonne by 2006. Shifts in the price of synthetic rutile are less pronounced with an increase of US\$5 per tonne expected for 2003, increasing by another US\$33 per tonne to just over US\$360 per tonne by 2006.

In 2001–02 Western Australian zircon sales amounted to approximately 318,000 tonnes, valued at \$219 million. In 2001–02 zircon accounted for 26% of the total sales value of the State's heavy mineral sands industry. While New South Wales, Victoria and Queensland also produce zircon, Western Australia dominates national production, accounting for 86% of the nation's total. Overall, Australia is the world's largest zircon producer.

Iluka Resources, Cable Sands and the Tiwest Joint Venture are the main producers of zircon. In addition to its classification as a gemstone, zircon also has a variety of industrial applications such as in glassmaking, ceramics, electronics and specialty optical glasses including television picture tube glass.

Zircon prices remained remarkably strong following buoyant demand in China, averaging US\$689 per tonne during 2001–02, up 18% on the previous financial year.

According to Industrial Minerals Information Ltd (UK), zircon demand is heavily linked to the ceramics industry, accounting for approximately 55% of demand. Europe is the most important market for zircon followed closely by Asia including China, with China comprising approximately 60% of Asian zircon demand. Chinese ceramics production has boomed in recent years and is expected to increase further in tandem with increased demand for zircon in the production of picture tube glass and zirconium metals production. China is now estimated to account for more than 18% of the world's consumption of zircon. Demand in China has grown on average at 12% per year over the last decade.

Garnet production in Western Australia during 2001–02 was undertaken wholly in the South West and totalled 102,276 tonnes. Meanwhile staurolite production is now being produced in commercial quantities, 2,129 tonnes for 2001–02 by Tiwest at their Cooljarloo operation.

Despite the sombre state of affairs for the duration of 2001–02 in the heavy mineral sands industry, with only leucoxene and zircon recording increases in sales value, the industry is experiencing a steady range of activity with a number of new developments during 2001–02 in Western Australia.

In terms of new mining activity, the commencement of operation at the new \$30-million Doral Dardanup Mineral Sands Mine in the latter half of 2002 marked a significant event in the industry. The project, which includes a refurbishment of the dry processing plant near Picton, is expected to continue for ten years producing 120,000 tonnes per annum of titanium-based minerals and 10,000 tonnes per annum of zircon. Officially opening in October, the mine is the first major greenfields mining project by a new player in the region in recent years. Other developments included the application by Cable Sands (WA) to re-mine the titanium minerals ore body adjacent to D'Entrecasteaux National Park at the Jangardup South Mineral Sands Mine. The application is subject to environmental approval.

Also, exploration by Magnetic Minerals in the Dongara area has resulted in the discovery of significant mineral sands resources. Located 35 km north of the Iluka Resources Eneabba Mine, Magnetic is looking to develop the resources under joint venture, acquisition or merger arrangements.

However, contention continues to shroud the proposed Ludlow Tuart Forest Cable Sands project. The project would occupy 147 hectares or 4.3% of the Ludlow Tuart Forest in the South West, between Bunbury and Busselton and would process 7 million tonnes of ore over 3 to 4 years. An assessment of the proposal by the Environmental Protection Authority (EPA) was expected in June 2002 however the volume of submissions received by the EPA has caused the assessment of the process to now be delayed until early 2003.

In expansion news, Millennium Chemicals announced plans to expand the Kemerton Titanium Dioxide

Pigment Plant. Millennium has valued the planned expansion at \$470 million, although further progress on the proposal will depend upon market conditions. Assuming the expansion takes place, production at the plant will increase to 190,000 tonnes per annum. In other expansions, Tiwest Joint Venture received environmental approval for the expansion of its Kwinana titanium dioxide pigment plant.

In other potential expansion developments, Iluka Resources and Outokumpu-Lurgi Metallurgie announced the intention to develop the first synthetic rutile plant based on a new process which allows the production of synthetic rutile from a wider array of ilmenite feedstocks. Termed "NewGen SR" this new process allows for low-value ilmenite, such as that found in the Murray Basin, to be upgraded into premium synthetic rutile using a low-temperature hydrogen-based reduction technique. The process includes the removal of manganese, magnesium and chromium. Iluka and Outokumpu have signed an exclusive agreement to construct a new synthetic rutile plant, which will incorporate NewGen SR. It is hoped the new plant will be in production by 2006 with the joint venture currently devoting 12 months to establishing the engineering requirements of the plant.

However, on the contractionary side, Iluka decided to cease plans to expand its operations in Capel. Valued at \$50 million, the expansion would have increased production levels by 50,000 tonnes per annum. The expansion was to focus on the refurbishment of an old kiln to bring it back into production. However the age and condition of the plant, in conjunction with the estimated cost of the refurbishment, deemed the proposal unfeasible. Iluka's preference is to increase

output at its existing southwest leaching plant by undertaking a \$2-million upgrade to be completed by early 2003. The upgrade will facilitate extra synthetic rutile production of around 12,000 tonnes per annum. Iluka is also investigating the possibility of increasing output and production efficiency through new processing technologies such as NewGen SR described above.

Meanwhile, research undertaken by CSIRO has centred on the high costs of producing titanium arising from inefficiencies in the standard production process. Research has included the examination of five new titanium technologies which should assist in reducing production costs and increase the size of the titanium market which globally currently stands around 70,000 tonnes per annum. The five technologies include:

- Electrowinning using a molten salt bath;
- Fluidised bed;
- Plasma powder processing;
- Plasma ingot processing; and
- Continuous spray processing.

The technologies aim to reduce the processing chain with the ultimate aim being the production of titanium metal directly from ilmenite. According to the CSIRO, development of lower cost titanium process technology to produce industrial grade titanium could open up new markets to the titanium sector in transport, construction, and chemical processing. In addition, titanium's non-corrosive properties make it especially suitable for the maritime sector. As with the NewGen SR technology, CSIRO processing research aims to assist with the handling of resources from the Murray Darling Basin – believed to be one of the richest mineral sands deposits on Earth. The CSIRO suggests that the potential halving

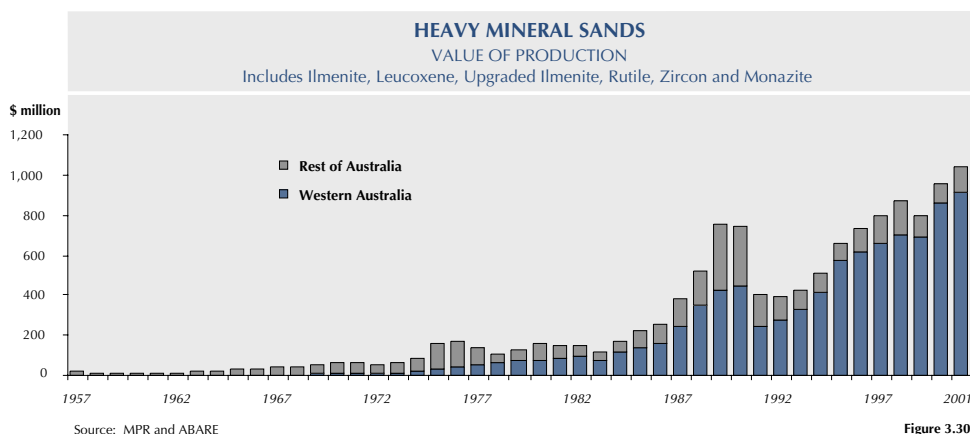


Figure 3.30

of the cost of titanium production, combined with the expansive resource available within the Murray Darling Basin, could herald a new era for titanium within Australia and the light metals group.

The heavy mineral sands industry within Australia underwent moderate ownership shifts during 2001–02. At a corporate level, the Tiwest Joint Venture underwent a slight change of influence following Anglo American's strengthened position in the iron ore industry through acquisition of a 10% stake in Kumba resources. Kumba Resources owns almost 50% of Ticor, which in turn has a 50% share in the Tiwest Joint Venture. Meanwhile, in April of 2002, Japan's Itochu Corporation and Tochu Corporation acquired a 70% share in the Kemerton silica sands project from Sons of Gwalia following Gwalia's divestiture of non-core assets.

Iluka Resources also completed its takeover bid for Basin Minerals in November of 2002. In doing so Iluka became a significant player in the emerging Murray Basin Mineral Sands province through the development of the Douglas and KWR mines. The Murray Basin straddles Victoria, New South Wales and South Australia over an area of 300,000 sq km and at this stage is believed to contain over 80 million tonnes of rutile, zircon, ilmenite and leucosene. Aside from Iluka, these resources are predominantly controlled by BeMax Resources NL (Gingko deposit), Southern Titanium NL (Mindarie) and Murray Basin Titanium (Wemen and Birthday Gift) — a joint venture between Sons of Gwalia and RZM Pty Ltd. According to the New South Wales Department of Mineral Resources, by early 2002, six mines could be operating in the province, with Wemen having commenced operation in 2001.

### 3.9 Diamonds

In contrast to last year's fall in sales, the Western Australian diamond industry recorded a small 1% increase in sales volumes to 25.7 million carats in 2001–02. Diamond prices however, continued to fall leading to a further downward slide in the value of sales, by 20% to \$489 million.

Nevertheless, Western Australia remains a prominent diamond producer on a global scale with the Argyle diamond mine accounting for approximately 22% of world's total mine production. Renewed interest in the industry with increased exploration and investment also

suggests that the contribution of the diamond industry to Western Australia will remain firm.

The world market for diamonds in 2001–02, in keeping with global economic growth, remained sluggish. Key diamond markets in Asia, the US and Europe remained soft with US conditions in particular causing difficulty for those involved in the diamond jewellery market.

A large proportion of Western Australia's uncut diamonds are exported to India and US demand conditions have a significant flow-on effect for the State's industry. About half of the global trade in gem quality diamonds is destined for the supply of US customers and 35% of diamond exports from the Indian cutting and polishing industry are destined for the US. In 2001–02, the Indian diamond industry experienced considerable negative growth with export volumes falling on average 15% in both quarters for the first half of 2001–02. The events of September 11 further contributed to the poor market conditions with an additional downturn noted for the final months of 2001, although Christmas sales were unexpectedly high compared with previous years.

Weak market conditions were reflected in poor sales by the former London-based Central Selling Organisation (CSO), now the De Beers-owned Diamond Trading Company (DTC) which handles about two-thirds of the world's annual supply of rough diamonds by value. Ashton Mining, the wholly owned subsidiary of Rio Tinto and owner of the Argyle Diamond Mine, began stockpiling production in late 2001 in an attempt to limit supply and reduce the downward pressure on prices evident in price cuts offered by De Beers during the period.

Western Australia's economic diamond resources are based on very large, low gem quality diamonds as extracted by the Argyle operation. Subsequently, by value, Australia is ranked seventh in the world for diamond production, yet produces the largest volume of diamonds, accounting for almost 24% of world volume. Only about 5% of Argyle diamonds are gem quality, with 40% near gem quality and the remaining 55% industrial quality diamonds. This compares with overall global production proportions comprising about 10% gem, 55% near gem quality and the remaining 35% industrial quality. Located near Kununurra, the Argyle diamond mine traditionally accounts for about



90% of Australia's diamond production, however the commencement of production at Western Australia's new Ellendale mine during 2001–02 marks the end of Argyle's 20-year role as the State's sole diamond producer. Higher gem quality diamonds are also extracted in the Northern Territory at the Merlin mine.

In 2001–02, a highlight of the State's diamond industry was the opening of stage one of the new Ellendale diamond mine near Broome in the Kimberley region. The commencement of operations follows the amendment of legislation to excise the Ellendale Diamond Lease from the Diamond (Argyle Diamond Mines Joint Venture) Agreement Act 1981-83, facilitating the transfer of the tenement from its former Argyle owners to Perth-based Kimberley Diamond Company who were keen to develop the tenement. The new lease extends over 117 sq km of the West Kimberley and includes 13 diamondiferous pipes.

The commencement of mining operations at Ellendale in May 2002 is expected to currently add 500,000 tonnes of ore per annum to the State's ore processing volume. However, in the long term, treatment rates of between 2 and 4 million tonnes per annum are expected. While the mine was officially opening in September 2002, by July 2002 Ellendale already produced 4,552 carats of gem quality diamonds.

Stage one of the Ellendale project is focused on the Ellendale 9 Pipe comprising rich near-surface resources. After 12 to 15 months, the project will shift its focus to the near surface zone of Ellendale 4. For the first quarter of 2002–03, the new operation is expected to produce around 13,000 carats, increasing to 16,000 carats for the second quarter. Full annual production is expected to be around 60,000 carats.

While India is experiencing a flurry of exploration activity in the wake of the country's new National Minerals Policy, Western Australia's Kimberley region is experiencing its own renaissance. Renewed interest in the area is evident in the opening of the Ellendale mine as well as a series of new joint ventures and exploration activities.

An agreement was announced in March 2002 between Striker Resources NL and joint venture partner AKD Limited to explore for diamonds at the Seppelt Range diamond prospect in the Kimberley. The joint venture

has returned good initial results with the Seppelt 2 kimberlite pipe producing initial findings comprising 2.25 carats per tonne, a result, which potentially signifies a world-class grade. Striker Resources is the largest holder of ground in the north Kimberley, with tenements covering an area of 9,000 sq km. Trial mining on Seppelt 1 and Seppelt 2 is expected to commence in early 2003.

Flinders Diamond Limited has indicated that it plans to explore in an area 200 km southwest of the Argyle Diamond mine known as Skeleton Flat. The company is also hoping to open South Australia's first diamond mine either at its Springfield or Adelaide Hills projects.

In other more global developments, in 2001–02, the United Nations regulatory initiative known as the Kimberley Process gained considerable momentum. The Process is designed to stem the trade of 'conflict diamonds' — defined as those rough diamonds used by rebel movements or their allies to finance weapons, fuels and other material used to undermine legitimate governments. This issue is particularly pertinent in certain areas of Africa such as Angola, the Democratic Republic of Congo and Sierra Leone where atrocities against humanity have been funded by the illicit trade in conflict diamonds. It is estimated that conflict diamonds account for about 4% of the world diamond market.

The Kimberley Process includes the signing of the Conflict Diamonds Treaty by all nations producing, trading and manufacturing rough diamonds. Signatory nations will be required not to accept imports from, nor allow exports to, other nations that have not signed the treaty. In addition an international certification scheme comprising Kimberley Process Certificates (KPC's) will accompany all rough diamond shipments. In July 2002 the World Diamond Congress resolved to implement the process, with signatory nations expected to sign the treaty by the end of 2002.

At a state level, a new Western Australia Police Service Unit, named the Diamond and Pearl Investigation Unit, has been formed to focus on investigating crime and identifying security issues specific to the diamond and pearling industries. The Unit will specifically target systematic and organised theft as well as offer support to companies to resolve security problems.

### 3.10 Base Metals

Another casualty of lower world commodity prices was the Western Australian base metals industry which suffered a 21% drop in sales value to \$338 million. The most significant contributor to the fall in sales value was zinc. The substantial fall in world zinc prices, exacerbated by a 5% cut in zinc sale volumes combined in 2001–02 to see the value of the State's zinc industry fall by 38% to \$173 million.

In Western Australia, zinc is mined at two operations, comprising Newmont Mining's (through Murchison Zinc Company) Golden Grove operation, 225 km east of Geraldton and Western Metals' Lennard Shelf operations, 40 km south of Fitzroy Crossing in the Kimberley.

Compared with 2000–01, zinc prices were 25% lower in 2001–02, averaging US\$791 per tonne. The global economic downturn in 2001 and massive surpluses of zinc production were the major causes for the price decline. Thanks to cuts in mine production and a surge of zinc concentrate imports by China, zinc prices looked likely to have bottomed out in November 2001 when a 14-year low was recorded.

Copper sales on the other hand, at 58,000 tonnes, were up by a substantial 35%. However, due to poor prices, this translated to a smaller 14% increase in sales value to \$127 million. Overall, copper prices in 2001–02 were 15% lower than in 2000–01, with the average in 2001–02 being US\$1,517 per tonne compared to US\$1,784 per tonne in 2000–01.

The chief copper producers in Western Australia, accounting for more than 80% of the State's output are Straits Resources' Nifty project in the Pilbara which produces cathode grade metal and the aforementioned Murchison Zinc Golden Grove operation. Remaining copper is sourced as by-product from a range of nickel projects.

Like zinc, Western Australian lead production comes from only two sources, namely Murchison Zinc's Golden Grove operation and Western Metals' Lennard Shelf operations. In 2001–02, total lead sale volumes were down by 7,250 tonnes, or 9%. The average price of lead in 2001–02 was US\$474 per tonne, almost unchanged from 2000–01. Weak physical demand has been the chief culprit behind lacklustre lead prices and a small depreciation in the Australian dollar over the

year was unable to negate the drop in sale volumes. This translated to a 2% decrease in sales value in 2001–02 to \$37 million. Over the medium to longer term, lead demand from the lead-acid battery industry is anticipated to rise on the back of a strengthening world economy. Downward pressures from the supply side are also likely to be alleviated owing to the lack of committed new mine projects. Accordingly, it is expected that there may be some light in the world lead market for the years beyond 2002.

### 3.11 Other Minerals

#### **Coal**

Western Australia has two coal producers, Wesfarmers and Griffin. They are located in the southwest of the State and all of the State's coal supplies are sold on the domestic market. The majority is used by Western Power for electricity generation. The quantity of coal sales were only marginally higher by 1% in 2001–02 to reach 6.2 million tonnes. The value of these sales was up by 2% to \$258 million.

#### **Salt**

In 2001–02, the quantity of salt sales increased by 4% to 8.6 million tonnes. Thanks to better prices and the devaluation of local currency, the value of Western Australian salt sales increased by 8% to a record \$251 million.

The State's salt production was boosted during 2001–02 in no small part due to Onslow Salt commencing production. The Onslow Salt project began harvesting in April 2001 with first shipments being made in the latter half of 2001. The Onslow salt project is now the seventh solar salt field in Western Australia. It is expected that Onslow will gradually ramp-up to full production of 2.5 million tonnes per annum by mid-2003.

Significantly, in July 2001, Dampier Salt purchased Cargill's Port Hedland salt operation. The Port Hedland operation presently produces and exports around three million tonnes of salt per annum and the acquisition significantly expands Dampier Salt's current production capacity to make it the world's largest salt exporter.

Dampier Salt's production is exported, principally to Asia, with its largest customers in the chemical industry in Japan, South Korea, Taiwan and Indonesia.

A proportion of output is used for food processing and domestic consumption in Malaysia and the Philippines.

Dampier Salt, a majority-owned company of Rio Tinto, originally established the Dampier salt field in 1972 and purchased the Lake MacLeod operation in 1978. Dampier Salt also has a gypsum operation at Lake MacLeod. Cargill Australia is wholly-owned by Cargill Inc., a private company with significant salt interests in North and South America.

### **Tantalum**

Due to favourable sale prices and record sales volume levels, in 2001–02 tantalum and spodumene sector's sales value increased by 36% to around \$220 million.

Tantalum is a rare, grey-blue metal. It is chiefly used in the electronics industry for manufacturing capacitors, with the electronics industry accounting for approximately 60% of total global demand. Another fast growing application for tantalum is as an alloy in the manufacture of turbine blades for power stations and jet engines, as tantalum improves structural integrity of the blades, enabling the turbines to operate at higher temperatures.

Western Australia is the sole source of tantalum production in Australia, with output of tantalum concentrate (30% Ta<sub>2</sub>O<sub>5</sub>) chiefly emanating from Sons of Gwalia's (SOG) operations in Greenbushes and Wodgina. Significantly, Greenbushes and Wodgina are the world's largest and second largest tantalum mines respectively and the two mines together constitute about half of the world's defined tantalum resources. All up, output from these operations currently accounts for 45% of world supply.

Dramatic increases in tantalum sale volumes during 2001–02 were mainly attributable to expansion of SOG's operations. However, in addition, output also came from a new producer, Haddington International Resources.

Haddington commenced mining operations in May–July 2001 at Bald Hill, in the Eastern Goldfields region and made its first shipment of concentrate in August 2001. The company is also carrying out a feasibility study of the Cattlin Creek deposit in the Ravensthorpe area.

The prospects are good for further growth in tantalum

output. In addition to the Haddington operation commencing, the second half of 2002 also saw Australasian Gold Mines NL commence mining operations at Dalgaranga in the Murchison.

Strong growth in the international electronics industry has led to a resurgence in demand for tantalum and commensurately higher prices. Therefore, there has been heightened interest in exploring for and developing new tantalum mines. 2001 has already witnessed the start up of a new operation with Haddington.

### **Cobalt**

The growing nickel industry in Western Australia and burgeoning prominence of nickel laterite projects has seen the State exhibit a commensurately significant increase in its output of cobalt as a nickel by-product. Ten years ago the volume of the State's cobalt sales was less than 500 tonnes, valued at a little over \$6 million. In 2001–02 the volume was 4,512 tonnes, with a sales value greater than \$133 million. Compared with 2000–01, this represented an 8% increase in sales volume, which was in keeping with the growing nickel sales output.

However, cobalt prices averaged US\$8.09 per pound during the year, compared to US\$14 per pound in 2000–01. This 42% drop in prices was primarily due to sluggish world economic growth and the events of September 11. This dramatic fall in prices translated to the value of Western Australian cobalt sales dropping by 24% in 2001–02.

The short run outlook for cobalt remains gloomy. Although some positive signs indicate world economic recovery has emerged, the pace of this recovery is slower than anticipated. Consumer confidence in air travel is still relatively low given the lingering worries about terrorist attacks in the US. As a result, a total recovery of the aerospace sector is still in doubt. Many super alloy producers are expecting difficult times to continue for the next few months. Consequently, cobalt prices look likely to remain below US\$8 per pound in the near term. In line with expected higher output levels, the improvement in world economic growth is unlikely to be able to boost cobalt prices significantly over the medium to longer term.

## Manganese

In Western Australia, manganese is produced by Consolidated Minerals from its Woodie Woodie operation in the Pilbara. The company recommenced mining operations at Woodie Woodie in May 1999 and the project now produces manganese ore for export to China, Japan and the European Union. Following industry consolidation, the company is the only independent supplier of high-grade manganese ore in the Asian region. A key milestone was celebrated in March 2002 with the shipment of the millionth tonne of high-grade manganese ore from the Woodie Woodie manganese mine. In total, the value of the State's manganese sales in 2001–02 was \$69 million. This represented a 17% increase on 2000–01. Sales volumes in 2001–02 totalled 474,000 tonnes, up by 18% on the previous year.

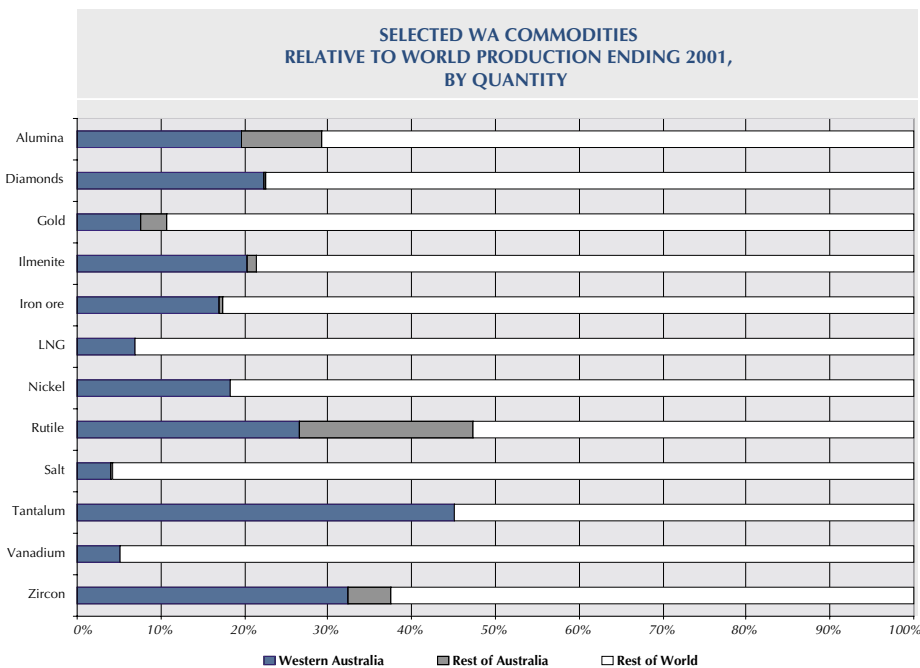


Figure 3.31

TABLE 1 QUANTITY AND VALUE OF MINERALS AND PETROLEUM					
COMMODITY	UNIT	2000-2001		2001-2002	
		QUANTITY	VALUE	QUANTITY	VALUE
ALUMINA	t	10,479,429	3,600,668,963	10,856,507	3,584,378,494
BASE METALS					
Copper Metal	t	42,616 (r)	111,116,266 (r)	57,634	127,050,045
Lead Metal	t	82,326	37,308,780 (r)	75,076	36,723,119
Zinc Metal	t	236,089	280,239,658	223,669	173,815,927
TOTAL BASE METALS			428,664,704 (r)		337,589,091
CHROMITE	t	33,014	6,898,498	5,678	450,582
CLAYS					
Attapulgitite	t	12,366	1,291,319	12,623	1,318,221
Clay Shale	t	11,783	117,830	11,751	117,510
Fire Clay	t	70,320 (r)	150,614 (r)	9,999	58,779
Kaolin	t	440	45,508	400	42,243
Saponite	t	1,273	91,582	1,679	114,216
TOTAL CLAYS			1,696,853 (r)		1,650,969
COAL	t	6,102,813	252,281,765	6,164,194	258,125,908
CONSTRUCTION MATERIALS					
Aggregate	t	284,164	2,776,441	650,749	5,631,178
Gravel	t	161,947	1,059,089	351,451	1,293,087
Rock	t	251,360	2,074,419	249,449	1,625,004
Sand	t	1,174,861 (r)	5,874,215 (r)	1,523,462	6,856,634
Sandstone	t	1,100	55,000	300	16,500
TOTAL CONSTRUCTION MATERIALS			11,839,164 (r)		15,422,403
DIAMONDS	ct	25,419,431	614,453,364	25,690,416	488,543,677
DIMENSION STONE					
Granite	t	1,448 (r)	366,995 (r)	802	176,531
Marble	t	131	48,640	95	31,980
TOTAL DIMENSION STONE			415,635 (r)		208,511
GEM AND SEMI-PRECIOUS STONES	kg	146,787	134,243	435,280	403,929
GOLD	kg	201,205 (r)	3,245,063,559 (r)	184,998 (e)	3,279,499,524 (e)
GYPSUM	t	947,380 (r)	18,470,170 (r)	1,343,995	25,652,962
HEAVY MINERAL SANDS					
Garnet	t	111,637	n/a	102,276	n/a
Ilmenite	t	1,088,613	168,745,136	801,236	128,753,900
Upgraded Ilmenite (a)	t	643,274	409,192,214	585,913	374,202,281
Leucoxene	t	39,814	18,052,535	39,768	19,442,862
Rutile	t	127,213	110,036,230	122,610	106,743,027
Staurolite	t	192	37,407	2,129	332,509
Zircon	t	343,080	198,837,333	317,770	218,836,980
TOTAL HEAVY MINERAL SANDS			904,900,855		848,311,559
INDUSTRIAL PEGMATITE MINERALS					
Feldspar	t	56,245	2,520,890 (r)	36,027	1,685,053
IRON ORE					
Domestic	t	6,646,444	207,408,487	7,248,189	234,109,266
Exported	t	155,123,446	4,705,296,377 (r)	152,538,701	4,864,843,627
TOTAL IRON ORE		161,769,890	4,912,704,864 (r)	159,786,890	5,098,952,893
LIMESAND-LIMESTONE-DOLOMITE					
Dolomite	t	9,103 (r)	146,074 (r)	17,080	315,846
Limesand-Limestone	t	3,825,671 (r)	15,740,387 (r)	2,892,454	14,379,958
TOTAL LIMESAND-LIMESTONE-DOLOMITE			15,886,461 (r)		14,695,804

TABLE 1 QUANTITY AND VALUE OF MINERALS AND PETROLEUM					
COMMODITY	UNIT	2000-2001		2001-2002	
		QUANTITY	VALUE	QUANTITY	VALUE
MANGANESE ORE	t	401,358	58,501,917 (r)	474,267	68,627,829
<b>NICKEL INDUSTRY</b>					
Cobalt By-Product	t	1,947 (r)	94,627,283 (r)	2,070	62,773,900
Cobalt Metal	t	1,322	54,656,716	1,893	54,828,789
Cobalt Sulphide	t	921	25,096,601	549	15,668,639
TOTAL COBALT			174,380,600 (r)		133,271,328
Nickel Concentrate	t	899,619	1,857,503,896 (r)	1,115,185	1,623,906,502
Nickel Metal	t	27,969	381,234,256	35,522	382,964,497
Palladium By-Product	kg	863	39,173,885	828	20,072,174
Platinum By-Product	kg	188	6,062,098	144	3,949,956
TOTAL NICKEL INDUSTRY			2,458,354,735 (r)		2,164,164,457
<b>PETROLEUM</b>					
Condensate	kl	5,809,460	1,984,526,940	6,326,003	1,680,033,506
Crude Oil	kl	13,957,274	4,792,052,082	15,086,852	4,206,169,501
LNG	Btu 10 <sup>6</sup>	429,540,240 (r)	2,695,528,134 (r)	436,826,142	2,640,587,608
LPG - Butane	t	428,900	221,968,789	482,203	193,711,852
LPG - Propane	t	333,470 (r)	187,540,575 (r)	374,319	167,866,073
Natural Gas	'000m <sup>3</sup>	7,625,011	630,363,197	7,533,986	643,277,079
TOTAL PETROLEUM			10,511,979,717 (r)		9,531,645,619
<b>PIGMENTS</b>					
Red Oxide	t	1,065	36,218	2,458	682,817
SALT	t	8,303,628	233,081,734	8,641,580	250,907,621
<b>SILICA-SILICA SAND</b>					
Silica	t	92,375	923,746	100,021	1,000,212
Silica Sand	t	464,952	5,850,341	553,019	6,355,535
TOTAL SILICA-SILICA SAND			6,774,087		7,355,747
SILVER	kg	154,252 (r)	39,921,693 (r)	102,527	24,562,825
SPONGOLITE	t	12,660	1,714,507	13,141	1,725,027
TALC	t	164,320	13,405,119	152,369	13,721,295
<b>TIN-TANTALUM-LITHIUM</b>					
Spodumene	t	68,944	n/a	90,400	n/a
Tantalite	t	738	n/a	905	n/a
Tin Metal	t	885	7,930,963	874	6,007,866
TOTAL TIN-TANTALUM-LITHIUM			169,908,738		225,840,014
VANADIUM	t	4,034	24,695,581	5,190	27,128,981
<b>TOTAL VALUE</b>			27,547,079,093 (r)		26,271,933,591

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 Garnet, spodumene and tantalite values not available

**TABLE 2 QUANTITY AND VALUE OF SELECTED MAJOR COMMODITIES**

	Unit	1992-93		1993-94		1994-95		1995-96	
		Quantity	Value \$M	Quantity	Value \$M	Quantity	Value \$M	Quantity	Value \$M
ALUMINA	Mt	7.55	1,818.12	7.83	1,784.32	7.91	1,684.60	8.23	1,918.34
<b>BASE METALS</b>									
Copper Metal	kt	22.92	27.44	32.46	40.26	29.20	76.54	23.69	65.42
Lead Metal	kt	22.30	6.65	21.11	4.98	21.10	9.20	21.28	12.64
Zinc Metal	kt	127.96	104.11	136.39	79.54	132.85	95.84	113.49	75.32
TOTAL BASE METALS			138.20		124.78		181.58		153.39
COAL	Mt	5.43	244.77	5.15	236.29	5.86	274.75	5.90	270.36
DIAMONDS	M ct	24.83	519.98	28.86	476.75	23.93	480.03	33.52	525.21
GOLD	tonnes	179.80	2,834.19	193.60	3,415.06	187.85	3,132.87	205.89	3,404.65
<b>HEAVY MINERAL SANDS</b>									
Ilmenite	Mt	0.99	81.66	1.07	92.32	0.99	89.65	1.10	111.18
Rutile	kt	75.93	42.14	68.93	35.76	107.78	56.13	119.14	75.06
Upgraded Ilmenite (Synthetic Rutile)	kt	396.00	184.67	402.00	185.84	490.00	228.29	517.00	252.56
Zircon	kt	302.46	49.19	349.13	63.10	477.05	129.77	410.03	181.21
Other HMS			10.29		13.92		14.56		18.50
TOTAL HEAVY MINERAL SANDS			367.95		390.94		518.40		638.51
IRON ORE	Mt	111.73	2,991.14	119.69	2,865.16	133.13	2,794.31	132.90	2,924.06
MANGANESE ORE	kt	251.53	46.89	315.79	42.01	71.91	8.84	347.04	41.34
NICKEL	kt	53.27	472.17	61.11	458.62	92.99	897.12	103.30	1,097.30
<b>PETROLEUM</b>									
Condensate	Gl	2.00	363.04	2.35	348.71	2.64	398.34	4.65	685.74
Crude oil	Gl	4.54	855.69	5.33	815.33	9.90	1,559.65	9.65	1,535.67
LNG	Btu 10 <sup>12</sup>	254.47	1,025.06	296.36	1,015.68	356.11	1,262.51	379.79	1,350.92
LPG - Butane	kt	0	0	0	0	0	0	100.24	22.71
LPG - Propane	kt	0	0	0	0	0	0	87.02	19.73
Natural Gas	Gm <sup>3</sup>	3.96	407.02	4.46	413.37	5.37	445.71	6.31	454.76
TOTAL PETROLEUM			2,650.81		2,593.09		3,666.21		4,069.53
SALT	Mt	6.63	158.38	6.16	149.18	7.18	155.14	7.45	154.22
OTHER			105.14		119.60		164.52		192.44
TOTAL			12,347.74		12,655.80		13,958.37		15,389.35

1996-97		1997-98		1998-99		1999-00		2000-01		2001-02	
Quantity	Value \$M	Quantity	Value \$M	Quantity	Value \$M	Quantity	Value \$M	Quantity	Value \$M	Quantity	Value \$M
8.35	1,955.77	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
27.73	58.98	29.43	61.12	24.44	43.71	30.73	64.62	42.62	111.12	57.63	127.05
13.49	6.09	27.00	10.45	51.55	17.25	64.47	20.24	82.33	37.31	75.08	36.72
88.37	75.12	124.00	117.11	194.90	170.73	232.59	251.01	236.01	280.24	223.67	173.82
	140.19		188.68		231.69		335.87		428.67		337.59
5.56	257.30	5.71	257.28	5.80	256.74	6.50	271.53	6.10	252.28	6.16	258.13
52.52	395.79	42.48	537.87	51.23	610.44	50.98	703.67	25.42	614.45	25.69	488.54
228.02	3,409.61	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
1.10	117.28	1.31	149.14	1.32	158.59	1.16	151.66	1.10	168.75	0.80	128.75
110.96	77.74	104.13	78.58	119.71	90.97	98.49	72.78	127.21	110.04	122.61	106.74
545.00	270.48	688.00	355.79	475.54	275.23	552.51	324.65	643.27	409.19	585.91	374.20
324.09	177.99	321.38	169.13	284.53	136.07	348.11	153.27	343.08	198.84	317.77	218.84
	26.51		24.63		19.44		28.85		18.08		19.78
	670.00		777.27		680.30		731.20		904.90		848.31
141.29	3,159.65	149.74	3,930.77	141.03	3,898.53	151.16	3,722.12	161.77	4,912.70	159.79	5,098.95
324.11	37.62	86.30	9.39	27.40	3.42	212.38	25.68	401.36	58.50	474.27	68.63
114.10	1,051.11	135.19	1,146.64	125.77	876.62	143.93	1,806.29	167.45	2,238.74	179.78	2,006.87
5.73	943.15	6.76	1,065.84	5.55	743.91	6.35	1,583.94	5.81	1,984.53	6.33	1,680.03
10.47	1,915.93	9.85	1,567.16	9.16	1,189.64	12.05	3,144.77	13.96	4,792.05	15.09	4,206.17
370.50	1,528.77	379.54	1,591.94	391.90	1,434.42	393.61	1,971.06	429.54	2,695.53	436.83	2,640.59
209.69	59.67	376.09	90.47	388.69	90.62	443.58	190.90	428.90	221.97	482.20	193.71
185.74	55.66	263.26	61.26	259.21	57.63	334.57	145.94	333.47	187.54	374.32	167.87
6.89	534.65	6.88	557.47	6.44	549.83	6.55	578.76	7.63	630.36	7.53	643.28
	5,037.83		4,934.14		4,066.65		7,615.37		10,511.98		9,531.65
7.55	153.62	8.19	188.70	8.57	199.64	8.81	208.58	8.30	233.08	8.60	250.91
	192.18		234.85		245.00		315.52		546.05		518.47
	16,460.67		17,935.08		16,655.58		21,344.98		27,547.08		26,271.93



TABLE 3 FINANCIAL YEAR 2001–02 QUANTITY AND VALUE BY LOCAL GOVERNMENT AREA					
COMMODITY	LOCAL GOVT AUTHORITY	QUANTITY (TONNES)	METALLIC CONTENT	VALUE	Ref (p. 62)
<b>ALUMINA</b>	Boddington	3,104,023		1,075,827,778	
	Murray	5,474,167		1,770,529,032	
	Warooka	2,278,317		738,021,684	
<b>TOTAL ALUMINA</b>		<b>10,856,507</b>		<b>3,584,378,494</b>	<b>(c), (d)</b>
<b>BASE METALS</b>			Cu tonnes		
Copper By-Product	Coolgardie		7,193	11,289,784	
	Dundas		101	294,132	
	Ravensthorpe		202	580,461	
	Roebourne		3,036	8,791,176	
	Wiluna		269	768,146	
	<b>Total</b>			<b>10,800</b>	<b>21,723,699</b>
Copper Concentrates	Yalgoo		19.75	42,411,962	(a)
			Cu tonnes		
Copper Cathode	East Pilbara		23,308	62,914,384	(a)
	<b>Total Copper</b>			<b>127,050,045</b>	<b>(a), (b)</b>
Lead	Derby-West Kimberley	99,729	71.23	34,787,637	
	Yalgoo	13,811	29.27	1,935,482	
	<b>Total</b>	<b>113,540</b>		<b>36,723,119</b>	<b>(a)</b>
			Pb %		
Zinc	Yalgoo	170,197	40.64	53,104,607	
	Derby-West Kimberley	270,599	57.09	120,711,320	
	<b>Total</b>	<b>440,796</b>		<b>173,815,927</b>	<b>(a)</b>
<b>TOTAL BASE METALS</b>			<b>337,589,091</b>		
<b>CHROMITE</b>	Meekatharra	<b>14,690</b>	<b>38.65</b>	<b>450,582</b>	<b>(a)</b>
<b>CLAY</b>					
Attapulgate	Mullawa	12,623		1,318,221	
Clay Shale	Collie	11,751		117,510	
Fire Clay	Broome	2,350		49,600	
	Chittering	7,649		9,179	
	<b>Total</b>	<b>9,999</b>		<b>58,779</b>	
Kaolin	Bridgetown-Greenbushes	400		42,243	
Saponite	Coorow	1,679		114,216	
<b>TOTAL CLAY</b>		<b>36,452</b>		<b>1,650,969</b>	<b>(e)</b>
<b>COAL</b>		<b>6,164,194</b>		<b>258,125,908</b>	<b>(f)</b>
<b>CONSTRUCTION MATERIALS</b>					
Aggregate	Broome	51,176		1,453,782	
	East Pilbara	4,050		22,713	
	Port Hedland Town	29,527		176,793	
	Roebourne	391,834		2,937,330	
	Wyndham-East Kimberley	174,162		1,040,560	
	<b>Total</b>	<b>650,749</b>		<b>5,631,178</b>	
Gravel	Broome	30,935		192,801	
	Collie	170,000		93,500	
	Coolgardie	38,507		226,992	
	Kalamunda	106,399		744,793	
	Wyndham-East Kimberley	5,610		35,001	
	<b>Total</b>	<b>351,451</b>		<b>1,293,087</b>	

COMMODITY	LOCAL GOVT AUTHORITY	QUANTITY (TONNES)	METALLIC CONTENT	VALUE	Ref (p. 62)
Rock	Broome	1,265		37,928	
	Dundas	14,551		185,526	
	East Pilbara	233,392		1,400,345	
	Wyndham-East Kimberley	241		1,205	
	<b>Total</b>	<b>249,449</b>		<b>1,625,004</b>	
Sand	Ashburton	31		1,085	
	Broome	38,164		333,035	
	Coolgardie	106,564		602,970	
	Coorow	3,990		19,950	
	Dandaragan	211		1,266	
	Derby-West Kimberley	9,783		90,452	
	Esperance	3,916		19,582	
	Leonora	13,718		82,308	
	Marble Bar	29,092		153,620	
	Menzies	7,147		35,733	
	Northam	91,484		457,420	
	Port Hedland Town	27,738		166,428	
	Roebourne	55,962		342,560	
	Swan	180		1,080	
	Wanneroo	1,128,267		4,513,068	
	Wyndham-East Kimberley	4,395		21,975	
Yilgarn	2,820		14,102		
<b>Total</b>	<b>1,523,462</b>		<b>6,856,634</b>		
Sandstone	Broome	300		16,500	
<b>TOTAL CONSTRUCTION MATERIAL</b>		<b>2,775,411</b>		<b>15,422,403</b>	<b>(e)</b>
<b>DIAMONDS</b>	Wyndham-East Kimberley		carats <b>25,690,416</b>	<b>488,543,677</b>	<b>(a)</b>
<b>DIMENSION STONE</b>					
Granite	Coolgardie	177		32,800	
	Dundas	449		134,931	
	Roebourne	176		8,800	
	<b>Total</b>	<b>802</b>		<b>176,531</b>	
Marble	Ashburton	95		31,980	
<b>TOTAL DIMENSION STONE</b>		<b>897</b>		<b>208,511</b>	<b>(e)</b>
<b>GEM AND SEMI-PRECIOUS STONES</b>					
			kg		
	Ashburton	1,280		989	
	Carnarvon	150,600		155,390	
	Marble Bar	279,400		244,050	
	Meekatharra	2,000		2,500	
	Mt Magnet	2,000		1,000	
<b>TOTAL GEM AND SEMI-PRECIOUS STONES</b>		<b>435,280</b>		<b>403,929</b>	<b>(d)</b>
<b>GOLD</b>					
			Au kg		
	Boddington		3,577	61,985,514	
	Coolgardie		22,217	394,629,117	
	Cue		4,208	74,559,680	
	Dundas		4,065	71,828,695	
	East Pilbara		27	470,934	

TABLE 3 FINANCIAL YEAR 2001–02 QUANTITY AND VALUE BY LOCAL GOVERNMENT AREA					
COMMODITY	LOCAL GOVT AUTHORITY	QUANTITY (TONNES)	METALLIC CONTENT	VALUE	Ref (p. 62)
<b>GOLD (cont.)</b>	Kalgoorlie-Boulder		44,837	794,817,870	
	Laverton		13,071	232,998,501	
	Leonora		40,778	722,401,885	
	Meekatharra		13,926	246,907,146	
	Menzies		3,217	57,222,970	
	Mt Magnet		6,257	110,688,838	
	Sandstone		3,496	62,095,984	
	Wiluna		14,944	264,541,760	
	Yalgoo		1,833	33,122,833	
	Yilgarn		8,546	151,227,796	
<b>TOTAL GOLD</b>			<b>184,998</b>	<b>3,279,499,524</b>	<b>(g)</b>
<b>GYPSUM</b>	Carnarvon	1,060,110		22,790,181	
	Corrigin	4,696		72,246	
	Dalwallinu	74,767		1,079,296	
	Dandaragan	41,589		415,890	
	Dundas	43,032		258,189	
	Esperance	5,155		41,240	
	Irwin	369		5,893	
	Kent	21,350		277,550	
	Koorda	150		3,000	
	Lake Grace	24,481		214,484	
	Merredin	627		7,524	
	Nungarin	14,555		87,328	
	Perenjori	1,085		9,765	
	Ravensthorpe	14,670		91,500	
Wyalkatchem	37,359		298,876		
<b>TOTAL GYPSUM</b>		<b>1,343,995</b>		<b>25,652,962</b>	<b>(f)</b>
<b>HEAVY MINERAL SANDS</b>					
Garnet Sand	Northampton	102,276			n/a
Ilmenite	Bunbury City	300,615	TiO <sub>2</sub> % 55.70	53,726,804	
	Capel	233,645	54.58	40,111,584	
	Carnamah	131,040	58.08	12,307,795	
	Dandaragan	135,936	55.95	22,607,717	
	<b>Total</b>	<b>801,236</b>		<b>128,753,900</b>	
Upgraded Ilmenite	Capel	227,249	TiO <sub>2</sub> % 92.00	136,170,398	
	Carnamah	182,415	92.00	109,304,840	
	Dandaragan	176,250	92.00	128,727,043	
	<b>Total</b>	<b>585,913</b>		<b>374,202,281</b>	
Leucoxene	Bunbury City	4,694	TiO <sub>2</sub> tonnes 4,319	3,062,753	
	Capel	17,125	14,261	8,359,947	
	Dandaragan	17,949	12,089	8,020,162	
	<b>Total</b>	<b>39,768</b>	<b>30,669</b>	<b>19,442,862</b>	

COMMODITY	LOCAL GOVT AUTHORITY	QUANTITY (TONNES)	METALLIC CONTENT	VALUE	Ref (p. 62)
<b>HEAVY MINERAL SANDS (cont.)</b>					
			TiO <sub>2</sub> tonnes		
Rutile	Bunbury City	4,328	4,049	3,801,320	
	Carnamah	91,803	86,409	80,446,637	
	Dandaragan	26,479	25,186	22,495,070	
	<b>Total</b>	<b>122,610</b>	<b>115,644</b>	<b>106,743,027</b>	
Staurolite	Dandaragan	2,129		332,509	
			ZrO <sub>2</sub> tonnes		
Zircon	Bunbury City	32,307	20,999	19,489,857	
	Capel	59,522	38,689	40,026,465	
	Carnamah	145,633	94,662	99,794,235	
	Dandaragan	80,308	52,200	59,526,423	
	<b>Total</b>	<b>317,770</b>	<b>206,550</b>	<b>218,836,980</b>	
<b>TOTAL HEAVY MINERAL SANDS</b>		<b>2,350,417</b>		<b>858,540,920</b>	(a)
<b>INDUSTRIAL PEGMATITE MINERALS</b>					
Feldspar	Marble Bar	34,184		1,645,325	
	Mukinbudin	1,843		39,728	
	<b>Total</b>	<b>36,027</b>		<b>1,685,053</b>	(e)
<b>IRON ORE</b>					
			Fe%		
Domestic Ore	East Pilbara	7,248,189	63.19	234,109,266	
			Fe%		
Exported Ore	Ashburton	74,122,994	61.27	2,272,145,755	
	Derby-West Kimberley	507,793	65.87	17,293,157	
	East Pilbara	74,458,700	63.13	2,463,307,993	
	Yilgarn	3,449,214	61.11	112,096,722	
<b>Total</b>		<b>152,538,701</b>		<b>4,864,843,627</b>	
<b>TOTAL IRON ORE</b>		<b>159,786,890</b>		<b>5,098,952,893</b>	(a)
<b>LIMESAND-LIMESTONE-DOLOMITE</b>					
Dolomite	Lake Grace	7,315		146,300	
	Yilgarn	9,765		169,546	
	<b>Total</b>	<b>17,080</b>		<b>315,846</b>	
Limesand-Limestone	Broome	933		4,664	
	Carnamah	14,151		56,604	
	Cockburn	1,934,876		5,707,883	
	Coorow	17,375		86,875	
	Dandaragan	33,480		200,301	
	Dundas	216,315		3,244,725	
	Exmouth	1,127		6,009	
	Gingin	30,395		587,532	
	Irwin	176,449		505,614	
	Kwinana	7,267		29,961	
	Leonora	86,068		172,136	
	Manjimup	3,163		48,689	
	Shark Bay	805		112,627	
	Wanneroo	333,293		3,542,824	
	Wiluna	36,757		73,514	
	<b>Total</b>		<b>2,892,454</b>		<b>14,379,958</b>
<b>TOTAL LIMESAND-LIMESTONE-DOLOMITE</b>		<b>2,909,534</b>		<b>14,695,804</b>	(e)
<b>MANGANESE ORE</b>					
			Mn%		
MANGANESE ORE	East Pilbara	474,267	51.19	68,627,829	(a)

TABLE 3 FINANCIAL YEAR 2001–02 QUANTITY AND VALUE BY LOCAL GOVERNMENT AREA					
COMMODITY	LOCAL GOVT AUTHORITY	QUANTITY (TONNES)	METALLIC CONTENT	VALUE	Ref (p. 62)
<b>NICKEL INDUSTRY</b>					
		Co tonnes			
Cobalt By-Product	Coolgardie		1,328	38,933,428	
	Dundas		37	1,098,224	
	Kalgoorlie-Boulder		303	9,548,089	
	Ravensthorpe		42	1,364,266	
	Roebourne		243	8,137,688	
	Wiluna		118	3,692,205	
	<b>Total</b>			<b>2,070</b>	<b>62,773,900</b>
Cobalt Metal	Kalgoorlie-Boulder		391	7,282,239	
	Laverton		1,502	47,546,550	
	<b>Total</b>		<b>1,893</b>	<b>54,828,789</b>	
Cobalt Sulphide	Kalgoorlie-Boulder		549	15,668,639	
<b>TOTAL COBALT</b>			<b>4,512</b>	<b>133,271,328</b>	<b>(a), (b)</b>
		Ni tonnes			
Nickel Concentrates	Coolgardie	295,594	18,231	199,300,232	
	Dundas	14,172	1,842	22,953,970	
	Kalgoorlie-Boulder	118,697	24,562	279,309,793	
	Leonora	320,405	38,215	431,559,909	
	Ravensthorpe	35,258	3,324	36,939,662	
	Roebourne	43,362	4,413	49,950,765	
	Wiluna	287,697	53,673	603,892,171	
	<b>Total</b>	<b>1,115,185</b>	<b>144,260</b>	<b>1,623,906,502</b>	
		Ni tonnes			
Nickel Metal	Kalgoorlie-Boulder		9,280	98,368,373	
	Laverton		26,242	284,596,124	
	<b>Total</b>		<b>35,522</b>	<b>382,964,497</b>	
<b>TOTAL NICKEL</b>			<b>179,782</b>	<b>2,006,870,999</b>	<b>(i)</b>
		Pd kg			
Palladium By-Product	Coolgardie		734	17,824,658	
	Roebourne		94	2,247,516	
	<b>Total</b>		<b>828</b>	<b>20,072,174</b>	<b>(b)</b>
		Pt kg			
Platinum By-Product	Coolgardie		144	3,949,956	<b>(b)</b>
<b>TOTAL NICKEL INDUSTRY</b>				<b>2,164,164,457</b>	
<b>PETROLEUM</b>					
		Kilolitres			
Condensate	Ashburton	366,176		92,932,385	
	Carnamah	151		6,717	
	Irwin	990		240,385	
	Roebourne	5,958,686		1,586,854,019	
	<b>Total</b>	<b>6,326,003</b>		<b>1,680,033,506</b>	
		Kilolitres			
Crude Oil	Ashburton	3,615,822		1,115,825,694	
	Irwin	6,129		1,538,318	
	Roebourne	11,464,901		3,088,805,489	
	<b>Total</b>	<b>15,086,852</b>		<b>4,206,169,501</b>	
		Btu 10 <sup>6</sup>			
LNG	Roebourne	436,826,142		2,640,587,608	
		Tonnes			
LPG - Butane	Roebourne	482,203		193,711,852	
		Tonnes			
LPG - Propane	Roebourne	374,319		167,866,073	

COMMODITY	LOCAL GOVT AUTHORITY	QUANTITY (TONNES)	METALLIC CONTENT	VALUE	Ref (p. 62)
<b>PETROLEUM (cont.)</b>					
		'000 m <sup>3</sup>			
Natural Gas	Ashburton	1,361,287		79,768,552	
	Carnamah	36,816		5,323,040	
	Irwin	139,560		16,208,654	
	Roebourne	5,996,323		541,976,833	
	<b>Total</b>	<b>7,533,986</b>		<b>643,277,079</b>	
<b>TOTAL PETROLEUM PRODUCTS</b>				<b>9,531,645,619</b>	<b>(d)</b>
<b>PIGMENTS</b>					
Red Oxide	Cue	<b>2,458</b>		<b>682,817</b>	<b>(a)</b>
<b>SALT</b>					
	Ashburton	836,130		22,852,000	(a)
	Carnarvon	1,517,541		44,203,810	(a)
	Esperance	10,094		405,086	(h)
	Port Hedland Town	1,417,571		40,568,661	(a)
	Roebourne	3,858,695		113,160,913	(a)
	Shark Bay	891,744		24,093,611	(a)
	Wyalkatchem	125		10,277	(h)
	Yilgarn	109,680		5,613,263	(h)
<b>TOTAL SALT</b>		<b>8,641,580</b>		<b>250,907,621</b>	
<b>SILICA-SILICA SAND</b>					
Silica	Moora	100,021		1,000,212	
Silica Sand	Albany	119,473		2,479,800	
	Coolgardie	100,101		245,995	
	Swan	333,445		3,629,740	
	<b>Total</b>	<b>553,019</b>		<b>6,355,535</b>	
<b>TOTAL SILICA-SILICA SAND</b>				<b>7,355,747</b>	<b>(a)</b>
<b>SILVER BY-PRODUCT</b>					
			Ag kg		
	Coolgardie		182	48,783	(a), (j)
	Derby-West Kimberley		1,620	476,925	(a), (b)
	Roebourne		9,142	2,475,727	(a), (j)
	Statewide		26,440	6,662,549	
	Yalgoo		65,143	14,898,841	(a), (j)
<b>TOTAL SILVER</b>			<b>102,527</b>	<b>24,562,825</b>	
<b>SPONGOLITE</b>	Plantagenet	13,141		1,725,027	(h)
<b>TALC</b>	Meekatharra	19,795		2,783,955	
	Three Springs	132,574		10,937,340	
<b>TOTAL TALC</b>		<b>152,369</b>		<b>13,721,295</b>	<b>(f)</b>
<b>TIN-TANTALUM-LITHIUM</b>					
			Li <sub>2</sub> O tonnes		
Spodumene	Bridgetown-Greenbushes	90,400	5,077	n/a	
Tantalite	Bridgetown-Greenbushes	857		n/a	
	Coolgardie	48		n/a	
	<b>Total</b>	<b>905</b>		<b>n/a</b>	
			Sn Tonnes		
Tin	Bridgetown-Greenbushes		874	6,007,866	
<b>TOTAL TIN-TANTALUM-LITHIUM</b>				<b>225,840,014</b>	<b>(a)</b>
<b>VANADIUM</b>					
			V <sub>2</sub> O <sub>5</sub> tonnes		
<b>VANADIUM</b>	Mt Magnet		<b>5,190</b>	<b>27,128,981</b>	<b>(f)</b>
<b>TOTAL VALUE</b>				<b>26,271,933,591</b>	

<b>TABLE 4 ROYALTY RECEIPTS 2000-01 AND 2001-02</b>				
<b>COMMODITY</b>	<b>2000-01 Total \$</b>	<b>2001-02 Total \$</b>	<b>2001-02 Growth</b>	
			<b>\$</b>	<b>%</b>
<b>ALUMINA</b>	<b>55,512,739</b>	<b>61,408,085</b>	<b>5,895,346</b>	<b>11</b>
<b>BASE METALS</b>				
Copper	2,756,502	4,504,871	1,748,369	63
Lead	1,415,710	1,851,352	435,642	31
Zinc	13,743,529	8,958,802	-4,784,727	(35)
<b>TOTAL BASE METALS</b>	<b>17,915,741</b>	<b>15,315,025</b>	<b>-2,600,716</b>	<b>(15)</b>
<b>CHROMITE</b>	<b>295,110</b>	<b>61,079</b>	<b>-234,031</b>	<b>(79)</b>
<b>CLAYS</b>	<b>121,172</b>	<b>84,783</b>	<b>-36,389</b>	<b>(30)</b>
<b>COAL</b>	<b>13,360,949</b>	<b>13,493,003</b>	<b>132,054</b>	<b>1</b>
<b>CONSTRUCTION MATERIALS</b>				
Aggregate	89,606	170,470	80,864	90
Gravel	53,532	55,287	1,755	3
Rock	83,889	71,869	-12,020	(14)
Sand	465,630	464,150	-1,480	(0)
<b>TOTAL CONSTRUCTION MATERIALS</b>	<b>692,657</b>	<b>761,776</b>	<b>69,119</b>	<b>10</b>
<b>DIAMONDS</b>	<b>88,054,636</b>	<b>62,636,372</b>	<b>-25,418,264</b>	<b>(29)</b>
<b>DIMENSION STONE</b>	<b>691</b>	<b>747</b>	<b>56</b>	<b>8</b>
<b>GEM AND SEMI-PRECIOUS STONES</b>	<b>13,054</b>	<b>10,220</b>	<b>-2,834</b>	<b>(22)</b>
<b>GOLD</b>	<b>65,638,722</b>	<b>79,808,781</b>	<b>14,170,059</b>	<b>22</b>
<b>GYPSUM</b>	<b>381,215</b>	<b>528,524</b>	<b>147,309</b>	<b>39</b>
<b>HEAVY MINERAL SANDS</b>				
Garnet	537,933	641,345	103,412	19
Ilmenite	9,685,771	9,319,310	-366,461	(4)
Leucosene	753,408	630,073	-123,335	(16)
Rutile	5,005,295	4,712,566	-292,729	(6)
Zircon	8,816,131	10,563,318	1,747,187	20
Staurolite	1,656	13,829	12,173	735
<b>TOTAL HEAVY MINERAL SANDS</b>	<b>24,800,195</b>	<b>25,880,441</b>	<b>1,080,246</b>	<b>4</b>
<b>INDUSTRIAL PEGMATITE MINERALS</b>				
Feldspar	82,115	125,540	43,425	53
<b>IRON ORE</b>	<b>270,188,217</b>	<b>276,089,286</b>	<b>5,901,069</b>	<b>2</b>
<b>LIMESAND-LIMESTONE-DOLOMITE</b>				
Dolomite	880	3,447	2,567	292
Limesand-Limestone	1,419,328	1,843,617	424,289	30
<b>TOTAL LIMESAND-LIMESTONE-DOLOMITE</b>	<b>1,420,208</b>	<b>1,847,064</b>	<b>426,856</b>	<b>30</b>
<b>MANGANESE</b>	<b>2,842,057</b>	<b>3,569,154</b>	<b>727,097</b>	<b>26</b>
<b>NICKEL</b>				
Cobalt By-Product	2,864,994	2,145,843	-719,151	(25)
Nickel	56,743,210	46,273,109	-10,470,101	(19)
Palladium By-Product	830,063	737,548	-92,515	(11)
Platinum By-Product	130,956	108,621	-22,335	(17)
Rhodium By-Product	4,577	1,546	-3,031	(66)
<b>TOTAL NICKEL INDUSTRY</b>	<b>60,573,800</b>	<b>49,266,667</b>	<b>-11,307,133</b>	<b>(19)</b>

COMMODITY	2000-01 Total \$	2001-02 Total \$	2001-02 Growth	
			\$	%
<b>PETROLEUM</b>				
Condensate	123,475,405	91,924,919	-31,550,486	(26)
Liquified Natural Gas	180,535,656	138,360,497	-35,498,476	(20)
LPG - Butane	14,964,999	10,755,833	-4,209,166	(28)
LPG - Propane	11,256,377	9,175,529	-2,080,848	(19)
Natural Gas	34,216,358	33,032,987	-1,183,371	(4)
Oil	162,266,080	145,037,180	-17,228,900	(11)
<b>TOTAL PETROLEUM</b>	<b>526,714,875</b>	<b>428,286,945</b>	<b>-98,427,930</b>	<b>(19)</b>
<b>PIGMENTS</b>				
Red Oxide	34,758	71,989	37,231	107
<b>SALT</b>	<b>1,932,536</b>	<b>2,063,684</b>	<b>131,148</b>	<b>7</b>
<b>SILICA SAND</b>	<b>328,273</b>	<b>324,169</b>	<b>-4,104</b>	<b>(1)</b>
<b>SILVER</b>	<b>989,532</b>	<b>400,455</b>	<b>-589,077</b>	<b>(60)</b>
<b>SPONGOLITE</b>	<b>137,798</b>	<b>91,007</b>	<b>-46,791</b>	<b>(34)</b>
<b>TALC</b>	<b>88,207</b>	<b>80,501</b>	<b>-7,706</b>	<b>(9)</b>
<b>TIN-TANTALUM-LITHIUM</b>				
Spodumene	884,967	903,027	18,060	2
Tantalite	2,831,611	4,684,840	1,853,229	65
Tin	170,801	180,026	9,225	5
<b>TOTAL TIN-TANTALUM-LITHIUM</b>	<b>3,887,379</b>	<b>5,767,893</b>	<b>1,880,514</b>	<b>48</b>
<b>VANADIUM</b>	<b>318,893</b>	<b>150,952</b>	<b>-167,941</b>	<b>(53)</b>
<b>TOTAL REVENUE</b>	<b>1,136,325,529</b>	<b>1,028,124,143</b>	<b>-108,201,386</b>	<b>(10)</b>

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 MINERAL AND PETROLEUM INDUSTRIES

MINERAL/Company	Operating Site	2000–01	2001–02
<b>ALUMINA</b>			
Australian Fused Materials Pty Ltd	Rockingham Fused Alumina Plant	214	175
Alcoa World Alumina Australia	Huntly	615	738
	Jarrahdale	50	0
	Kwinana Alumina Refinery	1,442	1,497
	Pinjarra Refinery	1,426	1,435
	Wagerup Alumina Refinery	929	980
	Willowdale	253	314
	Worsley Alumina Pty Ltd	Worsley Tunnel Road	239
Worsley Refinery		1,251	1,262
<b>TOTAL ALUMINA</b>		<b>6,419</b>	<b>6,614</b>
<b>BASE METALS</b>			
Normandy Mining Ltd	Scuddles	324	303
Straits Resources Ltd	Nifty	429	467
Western Metals Ltd	Lennard Shelf	555	504
Various	Other	9	4
<b>TOTAL BASE METALS</b>		<b>1,317</b>	<b>1,278</b>
<b>COAL</b>			
Griffin Coal Mining Co. Pty Ltd	Muja	313	284
Wesfarmers Coal Ltd	Premier/WCL	384	378
<b>TOTAL COAL</b>		<b>697</b>	<b>662</b>
<b>DIAMOND</b>			
Argyle Diamond Mines Pty Ltd	Lake Argyle	956	1,060
<b>GOLD</b>			
Agnew Gold Mining Company Pty Limited	Emu	895	1,416
AngloGold Australia Ltd	Sunrise Dam	404	660
Consolidated Gold Mines Limited	Bannockburn	6	0
Australian Gold Resources Ltd	Perth Mint	93	82
Barmenco Pty Ltd	Western Queen–Warda Warra	0	10
Barra Resources Ltd	First Hit	0	14
Barrick Gold of Australia Limited	Darlot	129	122
	Lawlers	206	181
	Plutonic	419	468
Big Bell Gold Operations Pty Ltd	Big Bell Consolidated	409	479
Centaur Mining & Exploration Ltd	Mt Pleasant	250	0
Central Norseman Gold	Norseman	253	197
Croesus Mining NL	Binduli	21	45
	Mayday North	6	0
	Hannan South	28	34
	Davyhurst	43	97
Delta Gold NL	Lady Ida Group	66	2
	Kanowna Belle	344	332
Equigold NL	Dalgaranga	67	15

MINERAL/Company	Operating Site	2000-01	2001-02
Gidgee Gold Pty Ltd	Gidgee	91	92
Gindalbie Gold NL	Minjar	0	49
Paddington Gold Pty Limited	Paddington – Mt Pleasant	225	354
Normandy Mining Ltd	Bronzewing – Mt McClure	247	423
	Jundee–Nimary	594	511
	Wiluna	276	308
Haoma Pty Ltd	Normay	0	10
Hill 50 Gold NL	Hill 50 – Mt Magnet	381	389
Kalgoorlie Consolidated Gold Mines Pty Ltd	Golden Mile – SuperPit	1,141	1,294
King Solomon Mines Limited	Gullewa	0	27
Kundana Gold Pty Ltd	Kundana	291	256
LionOre Australia (Wildara) NL	Thunderbox	0	38
Mines and Resources Australia Pty Ltd	White Foil	0	48
New Hampton Goldfields Ltd	Jubilee–New Hampton	222	207
Newcrest Mining Ltd	Telfer	360	254
Nickelseekers Pty Limited	Daisy-Milano	14	19
Perilya Mines NL	Fortnum	50	0
Placer Dome Inc	Granny Smith	497	571
Resolute Ltd	Chalice	0	6
	Higginsville Group	0	15
Sipa Resources International NL	Mt Olympus	40	44
Sons of Gwalia NL	Carosue Dam	197	223
	Great Victoria Underground	11	1
	Marvel Loch-Yilgarn Star	473	468
	Sons of Gwalia	232	203
	Tarmoola	358	327
South Kal Mines Pty Ltd	New Celebration	138	152
St Barbara Mines Ltd	Bluebird Group	224	314
St Ives Gold Mining Company Pty Limited	Kambalda – St Ives	997	1,218
Troy Resources Ltd	Mt Kemptz	42	52
Viceroy Resource Corporation	Bounty	229	124
Worsley Alumina Pty Ltd	Boddington	502	280
Other	Various	17	27
<b>TOTAL GOLD</b>		<b>10,593</b>	<b>12,458</b>
<b>HEAVY MINERAL SANDS</b>			
BHP Titanium Minerals Pty Ltd	Beenup	31	33
Cable Sands Pty Ltd	Bunbury	347	337
GMA Garnet Pty Ltd	Narngulu Garnet Plant	24	31
	Port Gregory – Hutt Lagoon	15	17
	Rockingham Zirconia Plant	30	28
Hanwah Advanced Ceramics Australia Pty Ltd	Rockingham Zirconia Plant	30	28
Iluka Resources Limited	Capel	715	542
	Eneabba	304	309
	Narngulu Synthetic Rutile Plants	310	407
TiWest Pty Ltd	Chandala–Muecha	251	207
	Cooljarloo	281	291
<b>TOTAL HEAVY MINERAL SANDS</b>		<b>2,308</b>	<b>2,202</b>

TABLE 5 AVERAGE NUMBER OF PERSONS EMPLOYED IN THE WA MINERAL AND PETROLEUM INDUSTRIES

MINERAL/Company	Operating Site	2000-01	2001-02	
<b>IRON ORE</b>				
BHP Iron Ore (Goldsworthy) Ltd	Finucane Island	211	265	
	Yarrie	213	190	
BHP Iron Ore (Jimblebar) Ltd	Jimblebar	109	113	
BHP Iron Ore Ltd	Mining Area C	0	20	
	Mt Newman Railway	357	365	
	Mt Whaleback	1,014	1,035	
	Nelson Point	641	756	
	Orebody 25	77	88	
	Port Hedland HBI Plant	1,089	885	
	Yandi	204	231	
	Hamersley Iron Pty Ltd	Brockman No. 2 Detritals Group	193	91
		Dampier Port Operations	995	756
		HIsmelt-Kwinana	109	195
Marandoo		175	160	
Paraburdoo-Channar		768	630	
Hamersley Railway		393	289	
Tom Price		1,049	939	
Yandicoogina		216	223	
West Angelas Rail		16	95	
West Angelas Plant		108	191	
Portman Iron Ore Ltd	West Angelas Port Facility	108	283	
	Cockatoo Island	27	22	
Robe River Mining Co. Pty Ltd	Koolyanobbing	50	106	
	Cape Lambert	455	532	
	Pannawonica Deepdale	289	347	
	Robe River Railway	108	118	
<b>TOTAL IRON ORE</b>		<b>8,974</b>	<b>8,925</b>	
<b>NICKEL</b>				
Anaconda Nickel Ltd	Murrin Murrin	610	629	
LionOre Australia (Nickel) Ltd	Emily Ann	48	132	
MacMahon Holdings	Blair	58	5	
OMG Cawse Pty Ltd	Cawse	296	251	
Outokumpu Mining Australia Pty Ltd	Black Swan	259	270	
Preston Resources Limited	Bulong	287	303	
Sir Samuel Mines NL	Cosmos	73	70	
Tectonic Resources NL	Rav 8	102	62	
Titan Resources NL	Radio Hill	83	84	
Western Mining Corporation Ltd	Kalgoorlie Nickel Smelter	850	686	
	Kambalda	375	338	
	Kwinana Refinery	539	331	
	Leinster	911	873	
	Mt Keith	803	838	
<b>TOTAL NICKEL</b>		<b>5,294</b>	<b>4,872</b>	

MINERAL/Company	Operating Site	2000-01	2001-02
<b>PETROLEUM PRODUCTS</b>			
Apache Energy Ltd	East Spar, Harriet, Stag, Campbell, Chervil, Agincourt, Wonnich, Sinbad, Tanami, North Herald, South Pepper	208	233
ARC Energy NL	Dongara	7	7
BHP Billiton Petroleum (North West Shelf) Pty Ltd	Griffin	70	77
Hardman Oil & Gas Pty Ltd	Woodada	5	5
Kimberley Oil NL	Lloyd	4	4
Mobil Exploration & Producing Australia Pty Ltd	Wandoo	20	28
Origin Energy Resources Ltd	Beharra Springs, Tubridgi	10	15
Petro Energy Pty Ltd	Mt Horner	2	2
Nexen Petroleum Australia Pty Limited	Buffalo	40	82
ChevronTexaco Pty Ltd	Barrow Island, Cowle, Roller, Skate, Saladin, Yammaderry	165	139
Woodside Energy Ltd	Cossack, Goodwyn, Hermes, North Rankin, Wanaea, Lambert, Legendre	767	
<b>TOTAL PETROLEUM PRODUCTS</b>		<b>1,298</b>	<b>592</b>
<b>SALT</b>			
Dampier Salt Ltd	Dampier	249	278
	Lake MacLeod	210	199
	Port Hedland	104	76
Onslow Solar Salt Pty Ltd	Onslow	48	62
Shark Bay Salt JV	Useless Loop	74	75
<b>TOTAL SALT</b>		<b>685</b>	<b>690</b>
<b>TOTAL CLAYS</b>		<b>68</b>	<b>82</b>
<b>TOTAL CONSTRUCTION MATERIALS</b>		<b>414</b>	<b>459</b>
<b>TOTAL DIMENSION STONE</b>		<b>89</b>	<b>99</b>
<b>TOTAL INDUSTRIAL PEGMATITE MINERALS</b>		<b>29</b>	<b>26</b>
<b>TOTAL LIMESTONE – LIMESAND</b>		<b>164</b>	<b>122</b>
<b>TOTAL MANGANESE ORE</b>		<b>87</b>	<b>77</b>
<b>TOTAL PHOSPHATE</b>		<b>168</b>	<b>336</b>
<b>TOTAL SILICA – SILICA SAND</b>		<b>201</b>	<b>188</b>
<b>TOTAL TALC</b>		<b>92</b>	<b>88</b>
<b>TOTAL TIN – TANTALUM - LITHIUM</b>		<b>332</b>	<b>586</b>
<b>TOTAL VANADIUM</b>		<b>129</b>	<b>107</b>
<b>ALL OTHER MATERIALS</b>		<b>122</b>	<b>70</b>
<b>TOTAL</b>		<b>40,436</b>	<b>41,593</b>

(SOURCE: AXAT REPORTING SYSTEM, MINING OPERATIONS DIVISION)  
 Figures are as provided by the various operating companies to the Department

TABLE 6

## PRINCIPAL MINERAL AND PETROLEUM PRODUCERS

effective October 2002

**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, 250  
St Georges Terrace,  
Perth WA 6000,  
(08) 9442 2000,  
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,  
PO Box 1220,  
West Perth WA 6872,  
(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*

Midland Brick Co. Pty Ltd,  
102 Great Northern Highway,  
Middle Swan WA 6056,  
(08) 9273 5522,  
Bullsbrook,  
www.midlandbrick.com.au

*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 Ltd,  
28 The Esplanade,  
Perth WA 6000,  
(08) 9261 2800,  
Collie  
www.griffincoal.com.au

Wesfarmers Premier Coal Ltd,  
276 Leach Highway,  
Myaree WA 6154,  
(08) 9333 0391,  
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

Downe and Milne,  
PO Box 10047,  
Kalgoorlie WA 6433,  
(08) 9091 3586,  
Kangaroo Hills.

Rocla Quarry Products,  
1 Casella Place,  
Kewdale WA 6105,  
(08) 9353 3030,  
Gnangarra,  
www.rocla.com.au

The Readymix Group (WA),  
75 Canning Highway,  
Victoria Park WA 6100,  
(08) 9212 2000,  
Marble Bar, Sullivan's Creek,  
Turner River, Widgiemooltha,  
www.readymix.com.au

**DIAMONDS**

Argyle Diamond Mines,  
2 Kings Park Road,  
West Perth WA 6005,  
(08) 9482 1166,  
Argyle,  
www.argylediamonds.com.au  
Kimberley Fine Diamonds  
PO Box 20  
Kununurra WA 6743  
(08) 9169 1133  
Ellendale,  
www.kimberleydiamonds.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.

TABLE 6

## PRINCIPAL MINERAL AND PETROLEUM PRODUCERS

effective October 2002

**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 3847,  
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

AurionGold Limited,  
PO Box 322,  
Victoria Park WA 6979,  
(08) 9442 8100,  
Golden Feather, Kanowna Belle,  
Kundana East, Mt Pleasant,  
Paddington, White Foil,  
www.auriongold.com.au

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

Gidgee Gold Mine,  
PO Box 685,  
West Perth WA 6872,  
(08) 9485 1476,  
Gidgee.

Gindalbi Gold NL,  
PO Box 512,  
West Perth WA 6872,  
(08) 9481 2232,  
Minjar.

Harmony Gold (Australia) Pty Ltd,  
10 Ord Street,  
West Perth WA 6005,  
(08) 9211 3100,  
Big Bell, Jubilee, New Celebration,  
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,  
www.cogema.fr

Newmont Australia,  
100 Hutt Street,  
Adelaide SA 5000,  
(08) 8303 1700,  
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

Sipa Resources International NL,  
87 Colin Steet,  
West Perth WA 6005,  
(08) 9481 6259,

Paraburdoo–Mt Olympus,  
www.sipa.com.au

Sons of Gwalia Ltd,  
16 Parliament Place,  
West Perth WA 6005,  
(08) 9263 5555,  
Bullfinch, 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,  
Meekatharra.  
www.stbarbara.com.au

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

Troy Resources NL,  
44 Ord Street,  
West Perth WA 6005,  
(08) 9481 1277,  
Bulchina – Mt Klemptz,  
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,  
21 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,  
7 Armstrong Road,  
Applecross WA 6153,  
(08) 9364 4951,  
Lake Cowcowing.

**HEAVY MINERAL SANDS***Garnet Sand*

GMA Garnet Pty Ltd,  
PO Box 188,  
Geraldton WA 6531,  
(08) 9923 3644,  
Port Gregory,  
www.gmagarnet.com

*Ilmenite, Leucoxene, Rutile and Zircon*

Cable Sands (WA) Pty Ltd,  
PO Box 133,  
Bunbury WA 6231,  
(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

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

TABLE 6

## PRINCIPAL MINERAL AND PETROLEUM PRODUCERS

effective October 2002

## IRON ORE

BHP Billiton Iron Ore (Goldsworthy) Ltd,  
200 St Georges Terrace,  
Perth WA 6000,  
(08) 9320 4444,  
Nimingarra–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,  
12 St Georges Terrace,  
Perth WA 6000,  
(08) 9421 4747,  
Pannawonica, West Angelas  
www.north.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.

Westdeen Holdings Pty Ltd,  
7 Armstrong Road,  
Applecross 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 12, 2 Mill Street,  
Perth WA 6000,  
(08) 9212 8400,  
Murrin Murrin,  
www.anaconda.com.au

Australian Nickel Mines,  
1st Floor, 24 Outram Street,  
West Perth WA 6005,  
(08) 9481 6040,  
Radio Hill,  
www.titanresources.com.au

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

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 8718,  
Cawse.

Preston Resources Ltd,  
Level 1, 16 Ord Street,  
West Perth WA 6005,  
(08) 9322 4166,  
Bulong,  
www.prestonres.com.au

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

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

WMC Ltd,  
250 St Georges Terrace,  
Perth WA 6000,  
(08) 9442 2000,  
Kambalda, Leinster, Mt Keith,  
www.wmc.com.au

## PALLADIUM

WMC Ltd,  
250 St Georges Terrace,  
Perth WA 6000,  
(08) 9442 2000,  
Kambalda,  
www.wmc.com.au

## PETROLEUM

Apache Energy Ltd,  
Level 3, 256 St Georges Terrace,  
Perth WA 6000,  
(08) 9422 7222,  
East Spar, Harriet, Stag, Campbell,  
Agincourt–Wonnich, Sinbad, Tanami,  
Chervil, North Herald, South Pepper,  
www.apachecorp.com

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

BHP Billiton Petroleum (North West Shelf) Pty Ltd,  
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,  
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.

Mobil Exploration and Producing Australia Pty Ltd,  
Level 7, 30 The Esplanade,  
Perth WA 6000,  
(08) 9480 0300,  
Wandoo,  
www.wandoo.com.au

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

TABLE 6

## PRINCIPAL MINERAL AND PETROLEUM PRODUCERS

effective October 2002

Origin Energy Resources Ltd,  
34 Colin 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) 9381 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

**PLATINUM**

WMC Ltd,  
250 St Georges Terrace,  
Perth WA 6000,  
(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,  
1 Casella Place,  
Kewdale WA 6105,  
(08) 9353 9800,  
Gnangarra,  
www.rocla.com.au

TT Sand Pty Ltd,  
PO Box 1664,  
Fremantle WA 6959,  
(08) 9319 1371,  
Mindijup.

**SILVER**

Elizabeth Hill Joint Venture,  
10 Bond Street,  
Sydney NSW 2000,  
(02) 8227 8900,  
Elizabeth Hill.

**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

**VANADIUM**

Vanadium Australia Pty Ltd,  
Level 7, 26 St Georges Terrace,  
Perth WA 6000,  
(08) 9218 5900,  
Windimurra,  
www.pmal.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

cons	concentrates	n/a	not applicable
f.o.t.	free-on-truck	f.o.b.	free-on-board
A\$	Australian Dollar	¥	Japanese Yen
ABS	Australian Bureau of Statistics	US\$	United States Dollar
AFR	Australian Financial Review	GDP	Gross Domestic Product
CSO	Central Selling Organisation	BMR	Bureau of Mineral Resources
DRI	Direct Reduced Iron	HBI	Hot Briquetted Iron
RBA	Reserve Bank of Australia	IMF	International Monetary Fund
ABARE	Australian Bureau of Agricultural and Resource Economics	LME	London Metal Exchange

## 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
<b>Mass</b>	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)		
<b>Volume</b>	1 kilolitre	(kl)	= 6.28981 barrels (bbls)		
	1 cubic metre	(m <sup>3</sup> )	= 35.3147 cubic feet (ft <sup>3</sup> ) [1 kilolitre (kl) = 1 cubic metre (m <sup>3</sup> )]		
<b>Energy</b>	1 kilojoule	(kj)	= 0.94781 British Thermal Units (Btu)		
<b>Energy Content</b>					
	Coal	19.7 GJ/t		kilo (k)	10 <sup>3</sup>
	Condensate	32.0 MJ/L		mega (M)	10 <sup>6</sup>
	Crude oil	37.0 MJ/L		giga (G)	10 <sup>9</sup>
	LNG	25.0 MJ/L		tera (T)	10 <sup>12</sup>
	Natural gas	38.2 MJ/m <sup>3</sup>		peta (P)	10 <sup>15</sup>
	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

Gypsum

Limesand -Limestone -Dolomite

Silica - Silica Sand

Talc

#### Sales

Alumina

Base Metals (Copper, Lead and Zinc)

Chromite

Diamonds

Gem and Semi-Precious Stones

Gold

Heavy Mineral Sands

Industrial Pegmatite Minerals

Iron Ore

Manganese

Nickel Industry (Nickel, Cobalt, Platinum and Palladium)

Petroleum

Pigments

Salt

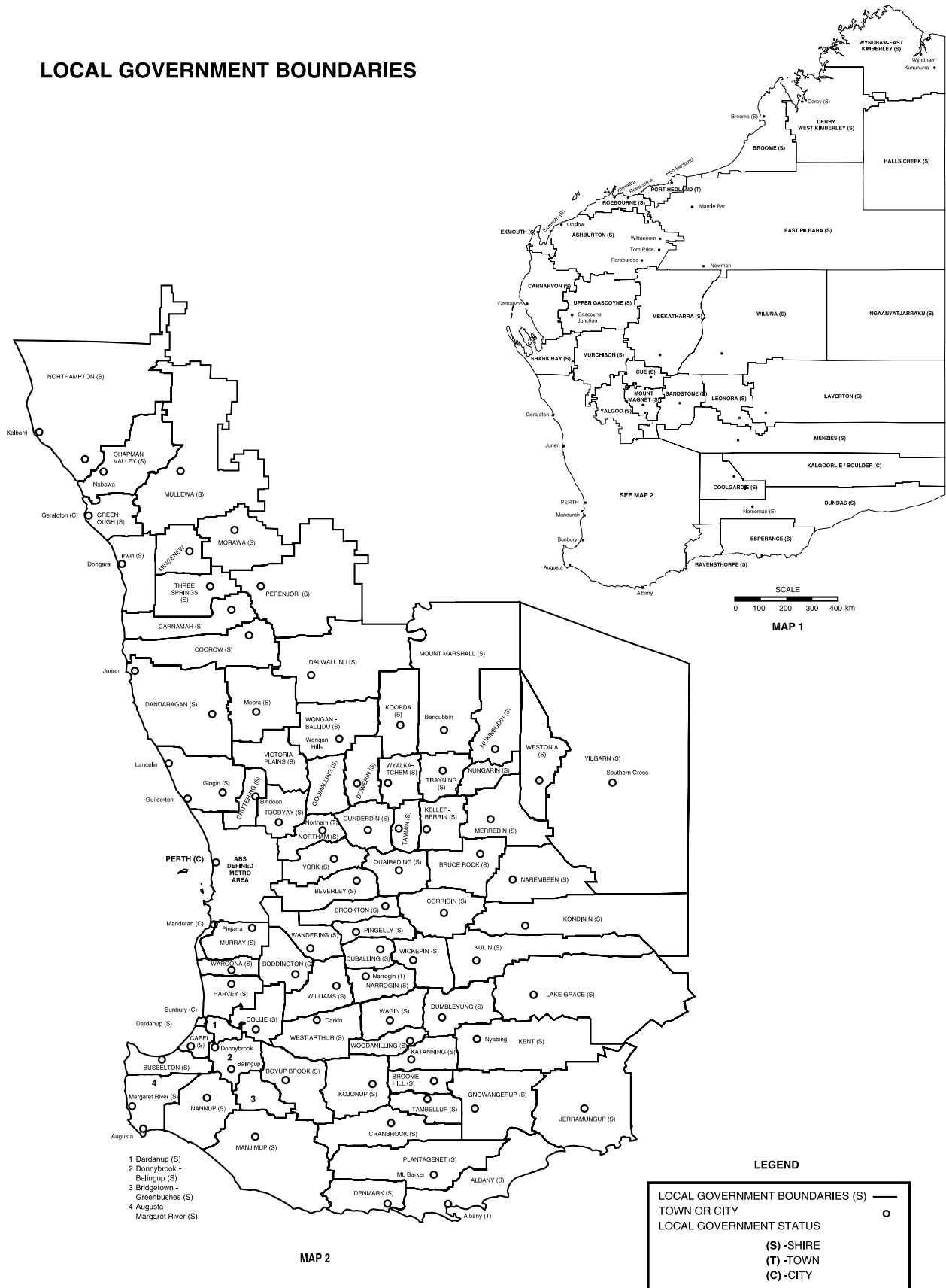
Silver

Spongolite

Tin -Tantalum - Lithium

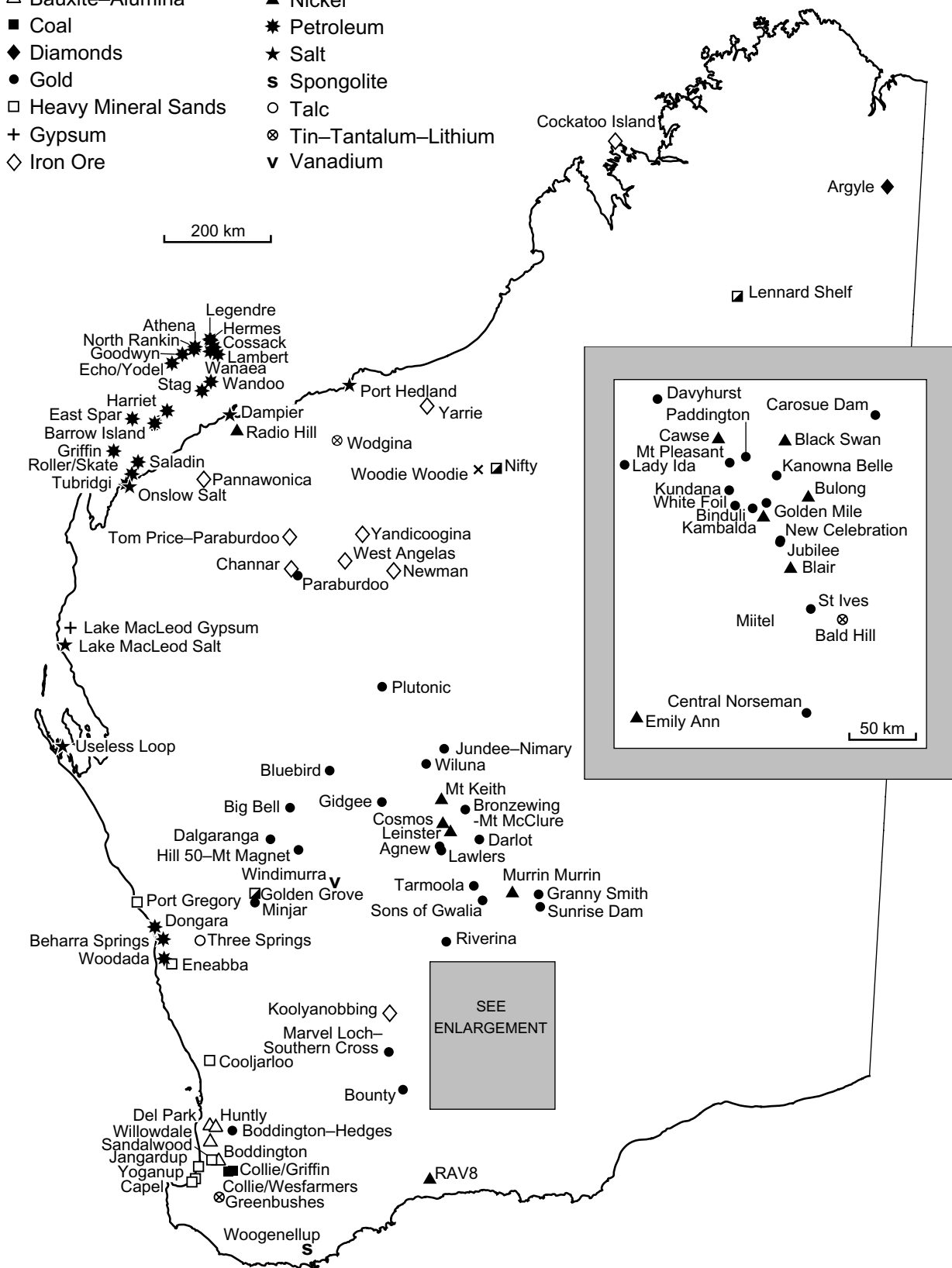
Vanadium

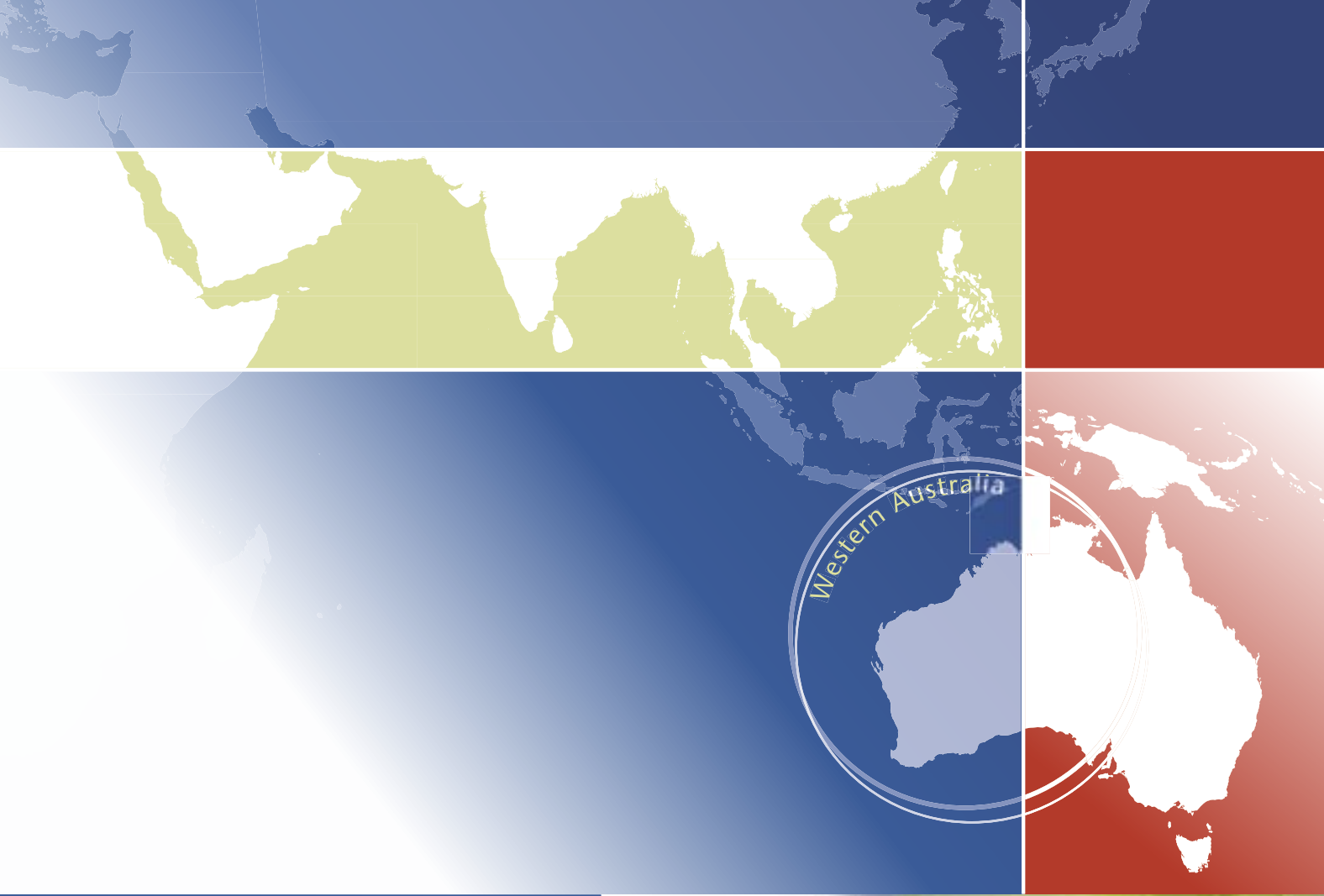
# LOCAL GOVERNMENT BOUNDARIES



## MAJOR MINERAL AND PETROLEUM PROJECTS IN WESTERN AUSTRALIA

- |                       |                        |
|-----------------------|------------------------|
| ▣ Base metals         | × Manganese            |
| △ Bauxite–Alumina     | ▲ Nickel               |
| ■ Coal                | ✱ Petroleum            |
| ◆ Diamonds            | ★ Salt                 |
| ● Gold                | ♠ Spongolite           |
| □ Heavy Mineral Sands | ○ Talc                 |
| + Gypsum              | ⊗ Tin–Tantalum–Lithium |
| ◇ Iron Ore            | ▼ Vanadium             |





This publication is available on our website

[www.doir.wa.gov.au](http://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 2002
- A Guide to Petroleum Exploration and Production in Western Australia
- Prospect magazine



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