

Western Australia

# Mineral and Petroleum Statistics Digest

2001

Iron ore sales

**increased over 20%**

...new record of \$5.2 billion



Department of  
Mineral and Petroleum Resources

*Investment Attraction Division*

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# 2001 STATISTICS DIGEST

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## FOREWORD



Jim Limerick  
DIRECTOR GENERAL

A handwritten signature in cursive script that reads "J. Limerick".

As the Director General of the Department of Mineral and Petroleum Resources, I am pleased to release the 2001 edition of the Western Australian Mineral and Petroleum Statistics Digest.

The Digest provides key statistical data on Western Australia's resource sector. It also provides information on the factors which affect both the Western Australian industry as a whole and in greater detail, the mineral and petroleum sectors within it.

After the dramatic record 51% increase in the value of sales in 2000, the Western Australian minerals and petroleum industry has consolidated those gains with relatively more moderate growth of 5.6% in sales in 2001 to \$27.2 billion. This is an encouraging result for the resource sector, which continued to grow despite depressed global commodity prices in 2001. It was particularly encouraging coming after the previous year's high performance where, for example, the petroleum industry alone had more than doubled its value.

In 2001, commodity prices came under pressure from the downturn in the key markets of Europe, the United States and Asia, coupled with the fallout of the events of September 11. Whilst the sales volume of key petroleum products such as crude oil and liquefied natural gas increased to record production levels, the total value of petroleum sales remained almost static due to falls in global oil prices. Similarly, the value of the State's nickel sales decreased due to low prices – despite another record year in terms of physical output.

A weakened Australian dollar in 2001, price lags and contractual arrangements nevertheless assisted in sheltering key sectors such as iron ore, alumina, gold and mineral sands from the full impact of global conditions in late 2001. Significantly in 2001 the iron ore and alumina industries, on the back of increased record-breaking output volumes, achieved new all-time-high sales value records.

The resources sector remains a source of excellent economic growth for Western Australia. Compared to the value of mineral and petroleum production ten years ago, the current level is over 2.2 times that amount. This represents an average annual growth rate of 8.4% per annum and doubling of the value of production every nine years, far outstripping growth of the economy in general.

To compile this Statistics Digest, the Department of Mineral and Petroleum Resources has relied on input from a broad range of agencies. I would therefore like to express my appreciation to the many individuals and companies who have contributed, including the Australian Bureau of Agricultural and Resource Economics (ABARE), the Australian Bureau of Statistics (ABS) and the Western Australian Treasury Department, for their valued cooperation and assistance in preparing this Digest.

## 1. ECONOMIC AND SOCIAL ENVIRONMENT

### 1.1 Global Economy

#### *United States*

In 2001 the global economy narrowly avoided falling into recession, with the IMF estimating output growth of 2.5%. The global slowdown reflected a number of factors, but most notably the downturn and brief recession in the US economy, the consequent flow-on effects to economies reliant on US import demand and weak European growth.

In the US, the underlying cause of the growth slowdown culminating in a small contraction in output in the second half of 2001, was a downturn in business investment that coincided with a rundown in business inventories (or stock holdings). The former occurred in part because the strong business investment of recent years, particularly in manufacturing and IT, led to over-capacity. The combination of this over-capacity and weaker demand caused businesses to cut back on investment. Similarly, as demand slowed, business inventories rose beyond desired levels and businesses cut production. Consequently, the US' unemployment rate rose from its trough of 3.9% in October 2000 to 5.8% in December 2001.

Other factors contributing to the US downturn were the deflation of the stockmarket as the dot.com boom ran out of steam, low corporate profitability and corporate governance concerns highlighted by the Enron case.

Despite rising unemployment, strong consumer spending and housing investment moderated the decline in US growth over the past year. These were supported by robust wages growth, borrowing backed by rising home equity and cashing out of home equity for consumption.

Despite initial fears, the 11 September 2001 terrorist attacks have had limited negative impact on the US economy beyond short-lived effects on consumer confidence and financial markets. Indeed the attacks may have boosted US recovery as they galvanised policy makers to quickly and substantially ease fiscal policy to lift public spending and facilitate tax cuts.

In the wake of 11 September, data began to emerge suggesting that the US economy had reached its

trough and recovery was in train. Manufacturing output bottomed, consumer durable orders picked up and the stockmarket rose back above its post-attack lows. Into 2002, other positive indicators have followed these initial signs of recovery. Consumer confidence has risen, driven by rising confidence in the job market and durable goods orders continue to rise. Encapsulating the stronger performance, annualised GDP growth was reported as 5.8% in the March quarter.

Despite these positive signs, there remains some uncertainty about the strength of US recovery in 2002. This uncertainty was reflected in the Federal Reserve's willingness in early 2002 to keep official interest rates at 1.75% until a clear recovery takes hold.

While monetary and fiscal policy are clearly stimulatory, there are reasons to expect a relatively mild US recovery in 2002. One reason is that the recession has been mild and consumption in particular, remained resilient. This may limit the likelihood of a strong pick-up in consumption demand driving other areas of the economy. Another is that despite the fall in investment that occurred over the past year, the economy retains significant spare capacity and this may limit investment growth. Another is that the surge in business and consumer borrowing that accompanied the strong growth in the US during the 1990s, will constrain consumption and investment spending, if business decides to rebalance balance sheets and consumers restrain consumption to reduce debt levels. In addition, with recovery the Federal Reserve will begin to raise interest rates. Given higher consumer and business debt, these increases will have a relatively larger impact on disposable income as interest payments rise.

The strong US\$, which rose as capital flowed into the US on the strength of high returns associated with strong economic growth and the 'new economy', may also temper growth.

In April 2002, the IMF significantly upgraded its forecasts for the US economy in 2002 to 2.3%, up from 0.7%. For 2003, growth is expected to be 3.4%.

A clear risk to the US economy is the outcome for international oil prices over 2002 in the context of ongoing Middle East instability. Falls during 2001

assisted in cushioning the US economy, further rises from the US\$25 to US\$28 a barrel range experienced in early 2002 would retard the strength of, and possibly abort, any recovery.

## *Japan*

In Japan, along with international oil prices, the recessed Japanese economy is the most significant risk to global and thus to Australian, Western Australian and resources sector growth over 2002. Japan remains the State's largest single export market.

The recession that Japan entered in mid-2001 was driven by a decline in exports, induced by the global downturn, notably in electronics product demand and falling consumption. The manufacturing sector has been particularly hard hit, causing Japan's unemployment rate to hit a record high of 5.6% in December 2001.

Falling prices are a key problem. Deflation causes consumers to put off purchases in the hope of better deals down the track. It also raises the real value of debt. This is putting further pressure on Japan's financial sector, which already faces significant non-performing loan and bad debt problems (estimates range from 16 to 50% of bank loans and GNP). Aside from raising borrowing costs generally, bad debts have constrained the sector's ability to lend (though there is little demand for loans given the depressed state of consumption and investment). Consumption and investment are therefore likely to remain weak until prices at least stabilise and financial sector problems ease.

In terms of policy, the Bank of Japan is limited in its capacity to stimulate the economy (and reverse deflationary pressures) because nominal interest rates are already at zero. With deflation, real interest rates have risen. Following a series of attempts at boosting economic activity through fiscal policy, there are now constraints on the Japanese government's ability to raise debt and boost fiscal spending – Japanese public debt is around 150% of GDP.

The key risk to the outlook remains that bad loans continue to mount and that attempts to deal with problems in the financial sector cause massive withdrawals of deposits. One test will be the ongoing

withdrawal by the government of bank deposit guarantees. Recent action to limit deposit insurance has seen significant levels of funds withdrawn from various regional banks with depositors preferring to hold savings in traditional vehicles like gold – a plus for Australia's gold industry. The erosion of deposit insurance may trigger a sharp jump in deposit withdrawals thus causing a consequent collapse in credit availability as the financial sector contracts. This drying up of finance would precipitate a sharp decline in economic activity and transmit a strong contractionary impulse to the world economy. Such an event and its global consequences would trigger a significant fall in demand and prices for Australian and Western Australian exports.

## *Europe*

Europe's slowdown has been milder than that of the US, though from a lower base. In part, the downturn reflects weaker US import demand. Though much of Europe's trade is intra-regional, some economies, including Germany, are exposed to global trade fluctuations. Other important contributing factors include slower consumption growth and a decline in inventories.

Individual countries experienced different growth patterns over the past year. Germany for example saw a contraction in output driven by lower investment in the September quarter 2001 while in France the economy continued to grow. The UK economy also remained resilient. While economic indicators in early 2002 remain weak, particularly in Germany, it appears that the Euro area economy has troughed. Stronger US growth would help in strengthening a European upturn.

## *Asia (except Japan)*

The downturn in much of non-Japan Asia reflected the downturn in the global economy through falling exports. Economies like Singapore and Taiwan, key Western Australian export destinations, suffered particularly badly because of their exposure to the information technology and communications (ITC) trade and the weak US economy. On the other hand, other IT exporting economies like Korea, another important market for Western Australian exports, grew strongly because of public spending and domestic consumption growth.

It appears that the region is beginning to recover. The badly hit manufacturing sector grew in the September and December quarters of 2001, notably in the ITC economies and this was driven by a pick-up in ITC production. Further improvement in the US and Euro economies should consolidate this trend into 2002.

## **Outlook**

The near-term outlook for the global economy is for the US economy to recover during 2002, picking up speed during the year. This will help consolidate the nascent upturns in Europe and non-Japan Asia as 2002 unfolds and provide some support to the Japanese economy. A key risk to this scenario is the performance of Japan.

In line with improving sentiment about the US economy's outlook, the IMF's April 2002 forecasts suggest that global growth will recover to around 2.8% in 2002, strengthening as the year unfolds. Japan is expected to contract by 1%. 2003 is expected to see strong world growth of around 4%. This scenario would put a floor under Western Australian export growth which has continued to fall since mid-2000, in line with declining world growth. Important Western Australian markets such as Singapore and Taiwan (which have contracted in line with lower US import demand) and Korea, which has remained strong and is likely to strengthen further as global growth improves, should lift their demand for Western Australian exports.

Potentially offsetting stronger world growth, the A\$ may appreciate as both the terms of trade and Australia's interest rate differentials with the rest of the world rise. A higher exchange rate would dampen the State's export earnings and thus the stimulatory effect of stronger world growth.

A major uncertainty for the global economy is the price of oil given current political developments in the Middle East. A surge in oil prices could abort the recoveries in the US and Europe as well as placing further pressure on Japan and the rest of the region.

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

Both the Australian and Western Australian economies saw a significant recovery in economic growth in the second half of 2001 despite very weak growth in the international economy and export markets.

The Australian economy grew by 4.1% in the year to December 2001 compared with growth in the OECD over the same period of less than 0.5%. Key contributors to growth over the year were strong increases in household consumption and a recovery in business and dwelling investment during the second half of the year. A rundown in business inventories detracted from growth. Surprisingly, despite the weak global economy, net exports detracted only mildly from economic growth over the year to December 2001. Total exports in calendar year 2001 were, in fact, slightly higher than in 2000.

The Western Australian economy showed similar patterns to the national economy through 2001. While domestic demand grew by 5.2% in the year to December 2001 in the national economy, Western Australian domestic demand grew by 7.7% over the same period. The State's recovery in the second half of the year was underpinned by a lift in dwelling investment, business investment and strong household consumption.

Over the past few years, both the Consumer Price Index and "underlying" measures of inflation have been on a mild upward trend. Underlying measures have picked up from just under 2% in 1999 to around 3¼% towards the end of 2001. This trend reflected a rebuilding of profit margins following the depreciation of the exchange rate and other cost pressures, such as the higher petrol prices of 2000.

The Reserve Bank of Australia (RBA) has noted that inflation is unlikely to stay above the Bank's inflation target of 2-3% for a significant period. Exchange rate stability since early 2001 should now mean that the price pressure generated by the A\$'s earlier depreciation should now diminish. The key determinants of inflation are wages and productivity growth. Wage costs remain moderate and productivity growth appears to have strengthened over 2001. This suggests inflation in line with the Bank's target in the medium term.

Given the weakness in the world economy and despite the strengthening in domestic growth, moderate inflation gave the RBA room to reduce the official cash rate in 2001 by 200 basis points from 6.25% to 4.25% in December 2001.

With continuing uncertainty about the world economy, inflation forecasts which suggest near term inflation

in line with the RBA's target and ongoing moderate wages outcomes, the Reserve Bank is likely to be cautious during 2002 in tightening monetary policy. However if domestic growth remains resilient as business investment takes up slack as the housing sector cools, it is likely that the RBA will begin a modest series of interest rate increases over the year. This will aim to avert the possibility that inflationary pressures become entrenched in the economy, requiring larger increases in rates later.

## Exchange Rate

Following its sharp depreciation in 2000 as it fell by 15.3% and 8.5% against the US\$ and trade weighted index (TWI) respectively, the A\$ stabilised in 2001. Though the first quarter of 2001 saw further downward pressure and record lows against the US\$, the currency remained fairly close to its average of US\$0.51 for the rest of the year. Into 2002, the currency regained much of the ground lost in early 2001. By end April 2002, it was only 2.6% lower against the US\$ than at end 2000 and had appreciated modestly, by around 1%, against the TWI.

In context of a slowing global economy and world trade, the low dollar has been an important factor maintaining returns to exporters, particularly those in the resources sector, whose prices are set in US\$ terms. The direction of the A\$ over the near term is therefore of interest to exporters.

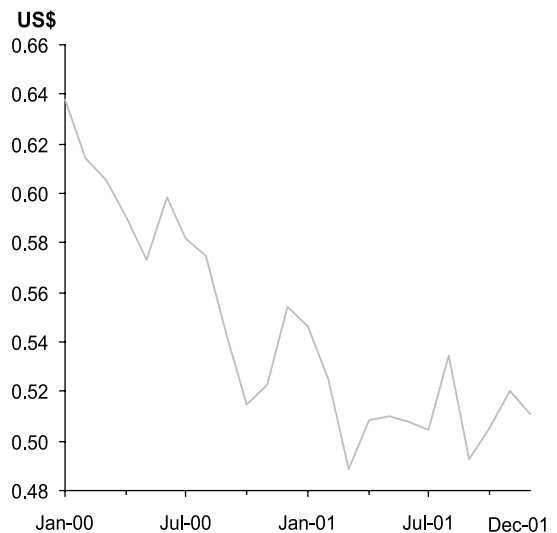
There has been much debate, particularly when it was falling sharply in 2000, about whether the underlying determinants of the value of the A\$ had changed. The depreciation in 2000 occurred at a time when all the usual fundamentals suggested appreciation. For instance, commodity prices and the terms of trade had risen and in the past, this had generally led to appreciation. Also, interest rate differential expectations had improved in Australia's favour in the second half of the year, with Australia expected to more than match monetary policy tightening in the US. Again, rising interest rate differentials have tended to support appreciation. Another longer term factor, the current account deficit, had also peaked and begun to contract as a share of GDP, this too should have provided support for the A\$.

A number of explanations have been put forward for the sharp decline in the A\$ and its current low level. Each of them contribute to explaining recent developments in the A\$.

One was that the unprecedented high productivity-low inflation growth in the US economy which had occurred during most of the 1990s had boosted the returns on US assets relative to those which could be earned by other economies. The US economy was perceived by the markets as having entered a new age of productivity growth driven by technology, and having tamed, if not abolished, the business cycle. This meant that capital flowed into US\$ denominated assets away from assets denominated in other currencies – subsequently causing these to depreciate against the US\$, including the A\$. For much of 2000, US growth was expected to outstrip that of the Australian economy – thus growth differential expectations clearly mattered. In 2001, as the US economy began to falter in early 2001 and the Australian economy began to recover quickly in the second half, we have seen the stabilisation in the A\$ discussed above and more recently some modest appreciation against the US\$.

Another factor which explained the very sharp fall in the A\$ in 2000 was that while the fundamentals were supportive of the A\$, the market perceived that on the other hand, the risks surrounding the A\$ were rising. An element of this in 2000 was that the A\$ began to fall despite the improvement in the fundamentals which had by and large explained its movements since its float in 1983. Investors who held A\$ assets, on the basis of improving fundamentals posted losses as the A\$ fell. These losses increased the risk premium on the A\$ causing further depreciation. Risk on the A\$ was further heightened by the fact that regional currencies were falling. This

**EXCHANGE RATE US\$/A\$**

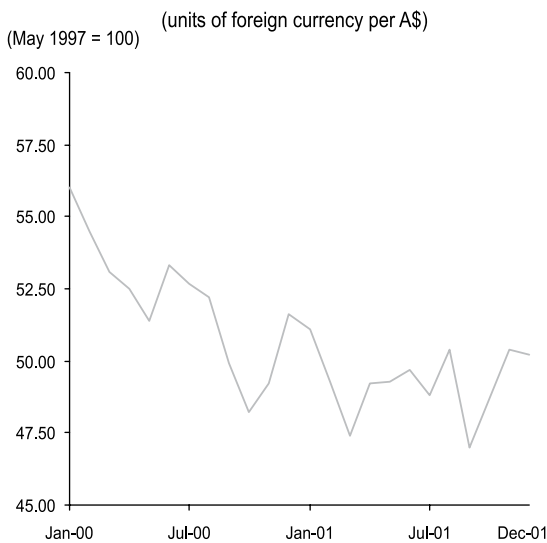


Source: Reserve Bank Bulletin

Figure 1.1



## TRADE WEIGHTED INDEX



Source: Reserve Bank Bulletin

Figure 1.2

heightened risk occurred because the markets for these currencies are relatively illiquid and as the risks surrounding these illiquid currencies rose, the A\$ resumed its role as a proxy for regional risk. This caused investors to sell the highly liquid (thus easy to sell) A\$. As these risk factors stabilised in the second half of 2001 the A\$ also stabilised.

Another long-term factor, identified in HSBC research (*HSBC: Economics. "The Cheap Australian Dollar" October 2000*), is that the sharp rise in foreign liabilities which has occurred to finance Australia's current account deficit has fundamentally changed the market for the Australian dollar. This works in a number of ways. One is that demand for A\$ assets as part of global diversification of portfolios may have been satiated, potentially reducing demand for the A\$. Another is that the demand for the A\$ has become more subject to changes in market risk and decline in returns as the share A\$ assets held by foreigners has risen (the A\$ assets in this instance being for example, portfolio, rather than direct equity in Australian companies and borrowing by Australian financial institutions as opposed to government debt). This can potentially increase the volatility of capital flows and thus demand for the A\$. Importantly, because interest rates have recently not risen in response to the rise in liabilities associated with a rise in the current account deficit – and which had compensated for the associated rise in risk on A\$ assets, downward pressure on the A\$ has become more evident. These factors taken together may have encouraged a structural stepdown in the value of the currency.

Summing up, these changes suggest that the A\$ may fluctuate around this lower level in line with changes in an expanded range of fundamental factors. These factors include the usual suspects such as the terms of trade and interest rate differentials. But they also include changes in the differentials between the performance of the US and global economies and assets and the Australian economy changes in financial market risk and a reduction in the perception of relatively high returns on US\$ assets leading to a fall in the US\$.

In terms of the outlook for the A\$, based on the factors above there should be pressure for an appreciation.

- As the Reserve Bank has recently pointed out the terms of trade appear to have resumed an upward trend due to the impact of lower IT and associated product import prices. Higher commodity prices as the global economy picks up will boost this trend in the near term.
- Australia's economy, as noted in April 2002 by the IMF and OECD, is expected to outperform most industrialised economies. This should also cause expectations of higher interest rate differentials.
- The expected period of smoothly improving global growth should, unless Japan melts down, cause a reduction in market risk in favour of strong growing economy currencies like the A\$.
- One uncertainty is whether expectations of resumed economic and productivity growth in the US during 2002, will begin to attract capital as previously relative to other economies. Should this occur it may reduce the impetus for an appreciation of the A\$.

### 1.3 Policy Issues Affecting the Mining Industry

#### Native Title

The State election in February 2001 saw a change of Government which set in motion a series of initiatives to address Native Title issues.

These initiatives included changes to the former Government's submission in the landmark Miriuwung Gajerrong Native Title Appeals Case which commenced in March 2001. The new State

Government's amendments to the submission to the High Court reduced the State's points of appeal and contentions from 31 to 19.

Significantly however, the position was held firm on Government ownership and control of minerals, petroleum and water resources.

The decision of the court with respect to the Appeals Case is expected in June 2002.

The Government also established a Cabinet Standing Committee on Native Title (CSCNT), which comprises senior members of the Cabinet and the Minister for State Development. The CSCNT enables key Ministers whose portfolios are directly involved with the native title process to be updated on a monthly basis regarding the progress of native title claims throughout the State and any relevant associated issues. Native title proposals endorsed by the CSCNT are then placed before State Cabinet for final consideration and approval.

## Wand Review

In April 2001, the Government announced an expert review (the "WandReview") of native title negotiating principles in a bid to speed up the settlement of the 130 native title claims in the State. This review was conducted by Mr Paul Wand with the aim of providing the Government with recommendations on the best way to achieve native title agreements. Issues considered by the review included:

- the level of evidence required in reports on indigenous connection to country;
- the scope for cooperation between Government and native title claimants in the production of reports;

- potential for joint planning and prioritisation of claims; and

- the applicability of negotiation principles and practices of other states.

The Wand Review was completed and presented to the State Government in mid-November 2001. It backed the State Government's view of negotiating settlement of native title applications and recommended sweeping legislative and policy changes to achieve more agreements.

Recommendations of the Wand Review included:

- applying rigorous assessment of evidence of connection to country;
- enhancing access to Government records that could assist claimants in compiling evidence in support of their application;
- overhauling State land-use and management laws to integrate processes for the recognition of native title and other rights of traditional owners; and
- initiating a public education campaign to encourage agreement-making.

The State Government is considering its response to the recommendations of the review.

## *Technical taskforce: processing of mining, exploration and land title applications*

In April 2001, the State Government also announced the establishment of a technical taskforce to examine ways to speed up the processing of mining, exploration

## TENEMENTS IN FORCE 1978 ACT

	1996-97		1997-98		1998-99		1999-00		2000-01	
	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
Exploration Licences	4,718	38,279	4,505	35,993	3,463	23,732	3,394	20,687	3,162	18,152
Mining Leases	5,180	2,047	5,106	2,031	7,555*	2,263	4,865	1,829	4,841	1,803
Other	1,537	89	1,584	205			2,001	468	2,999	411
Mineral Claims & Other 1904 Act	310	34	309	34	307	34	194	22	812	2,451
<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>

\* Includes Other  
Source: MPR

Figure 1.3

and land title applications in areas where native title might survive. The taskforce was also to consider options to reduce the volume of outstanding tenement applications that had accumulated.

This technical taskforce was chaired by National Native Title Tribunal Member Barty McFarlane and included representatives of Government, industry and Native Title representative bodies.

In December 2001, the technical taskforce completed its final report and submitted it to the CSCNT. At the end of March 2002, State Cabinet endorsed the taskforce's recommendation that working groups be formed to develop Aboriginal Heritage Protocols and to propose amendments to the Mining Act to facilitate the conversion of the backlog of mining lease applications to new exploration/prospecting licence applications.

## *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 was asked to recommend a system of government decision-making for project approvals that is coordinated and integrated; clear and unambiguous; balanced between community and developer needs; and that will lead to Western Australia being viewed as the global location of choice for project investment.

The Review Committee released an interim report in late January 2002 for a period of public comment which was completed on 28 February 2002. A total of 54 comments were received from the public, industry and government agencies. The Review Committee prepared a final report that was provided to the Ministerial Steering Committee for consideration during May 2002.

## *Greenhouse*

Greenhouse is a source of policy uncertainty for the mining and petroleum industries with the Commonwealth Government still considering its options over ratification of the Kyoto Protocol.

The national and Western Australian Government approaches have remained focused on advancing the

implementation of the National Greenhouse Strategy, encouraging Greenhouse gas abatement and examining the implications of the Kyoto Protocol. The Commonwealth is currently assessing the US Greenhouse program and in February 2002 signed an Australia-US Agreement to collaborate on research into climate change.

The Prime Minister has reiterated an earlier statement that Australia will not ratify the Kyoto Protocol until developing countries are committed to Greenhouse reductions and the US also ratifies the Protocol. It is expected that many countries will try to ratify the Protocol before the World Summit on Sustainability in August-September 2002.

A new Taskforce, established by the Western Australian Cabinet Standing Committee on Environmental Policy, has been charged with drafting the State's Greenhouse Strategy. The Western Australian Government is also preparing drafting instructions for Carbon Rights legislation dealing with Greenhouse sink activities.

## *Sustainability*

The mining industry has recognised the need to incorporate sustainability principles into its future practices in order to continue to attract international investment funds. The World Summit on Sustainable Development (WSSD), to be held in Johannesburg at the end of August 2002, will review international progress towards sustainable development since the Rio Earth Summit in 1992. The Global Mining Initiative (GMI) was established to address this issue and to assist the industry in making an effective contribution at the WSSD. The GMI is aimed at ensuring that the mining industry makes a positive contribution as society moves towards more sustainable development.

The GMI's Mining, Minerals and Sustainable Development (MMSD) regional projects have identified specific issues for further development in the GMI process. The GMI report will be discussed at the *Resourcing the Future* conference in Toronto during May 2002.

In Western Australia a Sustainability Policy Unit has been established within the Department of the Premier and Cabinet to develop a State Sustainability Strategy and implement the Government's other commitments to sustainability. The Sustainability Policy Unit is working with business and industry, the tertiary

education sector, unions, community organisations, other government agencies and the public to formulate the strategy, a draft of which will be completed by mid-2002.

## ***Review of the Mines Safety and Inspection Act 1994 and of the Occupational Safety and Health Act 1984 (Laing Reports)***

In December 2000, the Government appointed Mr Robert Laing to conduct a statutory review of the operation of the *Mines Safety and Inspection Act 1994*, (MSIA) as required under the Act. Mr Laing was also appointed to review the *Occupational Safety and Health Act 1984* (OSH).

Consultation drafts for the Reviews were released in February 2002, with public comments sought by 3 May 2002. Mr Laing is expected to produce final reports for both Reviews by the end of June 2002.

The OSH Review reports on the operation of the Act, its administration by the Department (WorkSafe) and other occupational safety and health laws.

The Review of the MSIA comments on various aspects of the operation of the Act. It also makes a number of recommendations for changes to legislative coverage of mines and petroleum safety, as well as explosive and dangerous goods handling, with consequential changes to administrative arrangements. These may have implications for the mining and petroleum industries.

The recommendations of the Consultation Drafts for both Reviews are consistent.

## ***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 must be done without compromising the reliability, security, quality and safety of electricity supply.

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

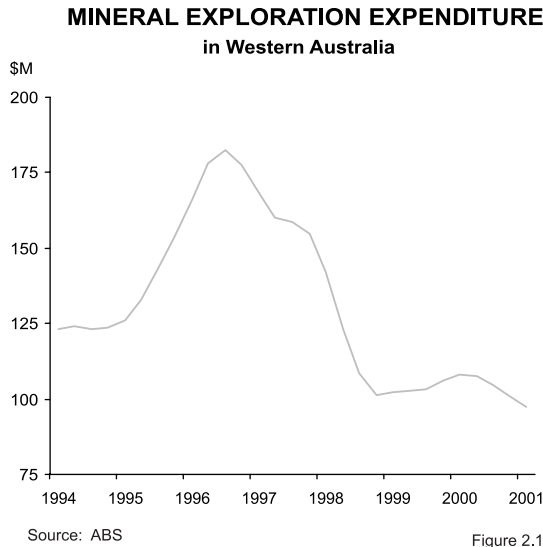
Two detailed Discussion Papers have been released for public comment, closing on 15 May 2002. The Electricity Reform Task Force is expected to submit its Report to the Minister for Energy in late 2002.



## 2. EXPLORATION AND INVESTMENT

### 2.1 Mineral Exploration

Australian Bureau of Statistics (ABS) mineral exploration expenditure figures for Western Australia show that mineral exploration fell by 3% (\$12.2 million) to \$409 million in 2001. This follows three years of substantial decline in mineral exploration in Western Australia when exploration expenditure peaked at \$701 million in 1997.



Mineral exploration expenditure in Western Australia is now at very depressed levels, not seen since 1993. The most recent quarterly data from the ABS show that this trend of subdued spending is still firmly in place, with an estimate of \$96.9 million spent in Western Australia during the December quarter 2001. This is a 12.5% decline on the same period in 2000. Within Western Australia, gold remains the dominant target of exploration, attracting almost 65% of all exploration expenditure during 2001. In order of importance, the major commodities and their exploration expenditure for 2001 were gold (\$276 million), base metals and nickel-cobalt (\$74 million), diamonds (\$30 million), iron ore (\$20 million), and heavy mineral sands (\$8 million).

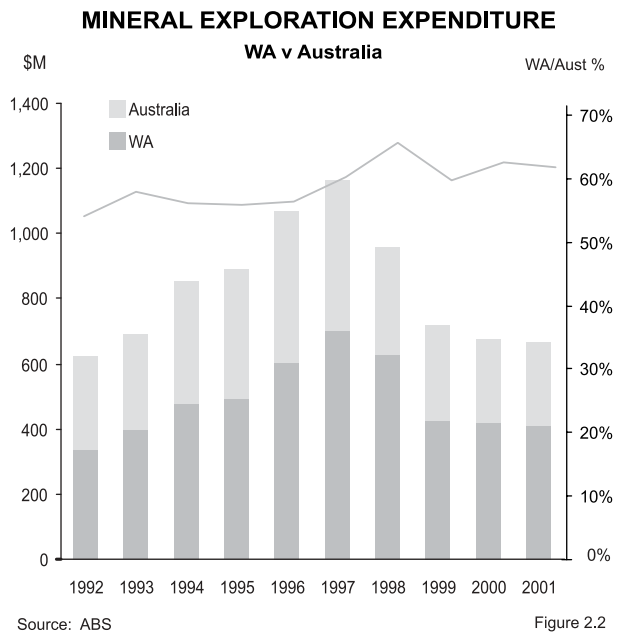
Declining exploration in Western Australia since 1998 has matched declines around Australia and around the world. However, Western Australia still accounts for about 61% of all exploration expenditure in Australia and the State continues to account for about 10% of world-wide exploration expenditure.

Mineral explorers spent only 76% of that originally forecast for the second half of 2001, with this attributed

primarily to the events of 11 September 2001. Forecasts at the time were of slower world growth and weaker demand for many commodities and many commodity prices fell during the last three months of 2001.

Present indications are of a slow recovery during 2002, particularly the second half of the year. However, the mineral sector had forecast subdued levels of exploration in Australia during the first half of 2002. Some encouraging news however, has been the good publicity surrounding recent discoveries and exploration success in Western Australia. Exploration success does give the mining sector a real and psychological boost. This has flowed through to renewed investor interest in mining stocks, including speculative mining stocks, with the successful launch on the Australian Stock Exchange of numerous small junior explorers.

In recognition of the depressed levels of exploration expenditure, in late April 2002 the State Government announced a Ministerial inquiry, to be conducted by Mr John Bowler MLA, Member for Eyre review to identify strategies to increase exploration levels. The inquiry aims to identify reasons for the reduced levels of private investment in greenfields mineral exploration and make recommendations to achieve a sustainable future for the minerals sector.



The Ministerial inquiry will seek submissions from major industry bodies, including the Chamber of Minerals and Energy; the Association of Mining and Exploration Companies; the Amalgamated Prospectors' and Leaseholders' Association of Western Australia; individual companies involved or interested in participating in mineral exploration in this State; and community groups and individuals.

The intention is for the inquiry to have a report completed by September 2002.

## 2.2 Petroleum Exploration

Data released by the ABS indicates that petroleum exploration in Western Australia continues to go from strength to strength with expenditure for Western Australia during 2001 exhibiting an increase of 19.2% (\$105.7 million) to \$655.9 million.

For the third year in succession, the expenditure on petroleum exploration was greater than for all minerals combined. However, despite the strong performance, Western Australia's share of total Australian petroleum exploration has declined from 69% in 2000 to 61% in 2001, but is still very strong when viewed in the longer term. The decline was partly caused by extra drilling during the December quarter 2001 in the area classified by the ABS as the 'Northern Territory, Ashmore and Cartier Islands'.

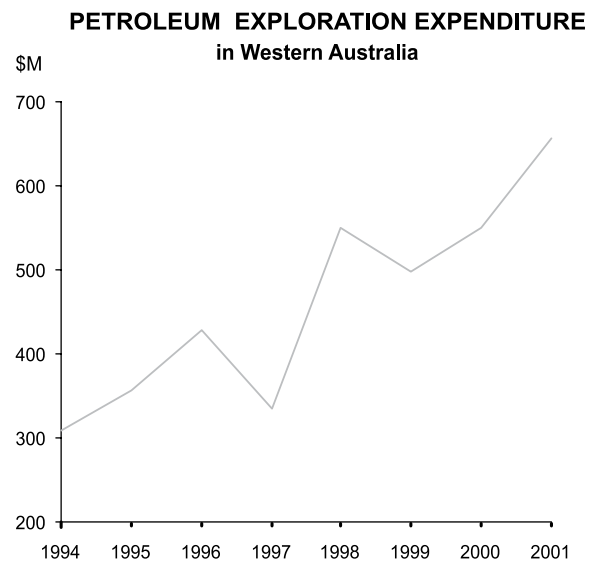
For 2001, about 83% of all petroleum exploration expenditure in Australia was in offshore waters, and with about 66% of all petroleum exploration expended in drilling.

In the wake of the events of 11 September 2001, forecasts were of slower world growth and weaker demand for many commodities and petroleum prices fell during the last three months of 2001. This caused petroleum explorers to spend only 77% of that originally forecast for the second half of 2001.

During 2001, a total of 75 new wells were drilled in Western Australia, exactly the same number drilled as in 2000. Wells drilled consisted of 44 new field wildcats (down from 50 in 2000), 6 extension and 25

development wells. The majority of drilling occurred in the Northern Carnarvon Basin where 28 exploration, 3 extension and 24 development wells were drilled.

In total, three significant gas and five oil discoveries were made from the 44 new field wildcat wells drilled and the potential commercial discovery rate for 2001 was 18%.



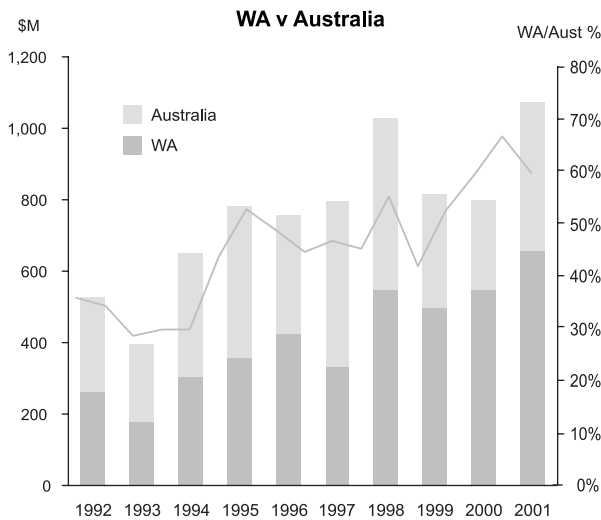
Source: ABS

Figure 2.3

Offshore exploration in Western Australia continued at significant levels, even though exploration drilling fell to 34 new field wildcats, compared to the 44 drilled in 2000. Offshore activity was spread around the Perth, Browse, Bonaparte and Carnarvon Basins. In particular, drilling efforts again concentrated in the offshore Carnarvon Basin where 25 exploration wells, 3 extension and 16 development wells were drilled.

Onshore, there was some evidence of a recovery, however well numbers in 2001 continued at relatively low levels with only 10 new field wildcat and 2 extension wells completed compared to 6 and 1, respectively, in 2000. Nine development wells were drilled on Barrow Island in 2001 compared to 6 in 2000. Of particular note was the success of the limited number of onshore exploration wells, particularly Beharra Springs North 1 and Hovea 1 in the Perth Basin. Another noteworthy event was the discovery of significant oil in the offshore Perth Basin at Cliff Head 1.

## PETROLEUM EXPLORATION EXPENDITURE



Source: ABS

Figure 2.4

Offshore 2D seismic activity increased dramatically in 2001, with a total of 33,575 line km of new 2D data acquired compared to 17,353 km in 2000. 3D seismic was relatively constant at 8,006 sq km compared to 9,073 sq km in 2000. Both 3D and 2D seismic activity were concentrated in the Carnarvon and Browse Basins. Onshore, a total of 60 km of 2D and 180 sq km of 3D seismic data was acquired, showing little improvement over recent years.

At the end of 2001, petroleum explorers predicted that offshore exploration expenditure in Australia will fall by 11% or \$47.6 million and onshore petroleum exploration in Australia will rise by 21% (\$17.3 million).

### 2.3 Investment

ABS private new capital expenditure statistics for 2001 indicate that mining accounted for around 56% of Western Australia's total investment, compared to 42% in 2000. The total value of State investment rose by 20.1% from \$4.7 billion in 2000 to \$5.6 billion in 2001. In terms of Western Australian mining investment, it rose by 62.4% from \$1.9 billion in 2000 to \$3.2 billion in 2001.

Western Australia accounted for 47% of national mining investment of \$6.7 billion in 2001. This compares to 44% of national mining investment of \$4.5 billion in 2000.

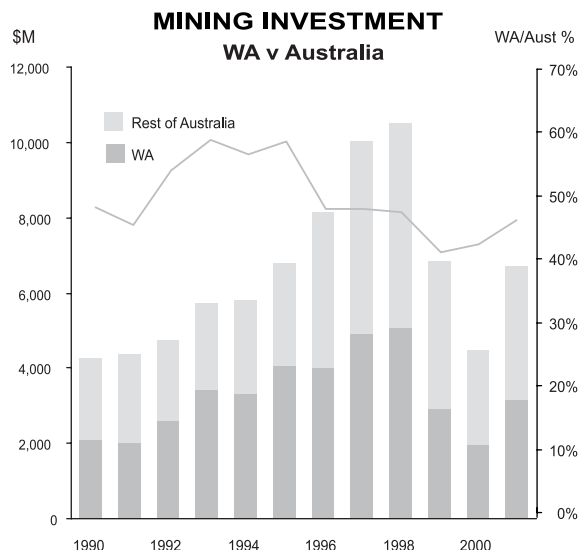
It is important however to treat ABS mining investment figures with some caution, as they do not capture all mining investment. The ABS utilises classifications

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. A breakdown of the manufacturing investment figures into resource processing and other categories is not available.

The Delta Electricity and Access Economics Investment Monitor for March 2002 indicated that there were approximately \$39 billion worth of mining projects in Western Australia either under construction, committed, under consideration or possible. Western Australia accounted for about 56% of such projects nation-wide.

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

- The expansion of the NorthWest Shelf LNG project – fourth train.
- BHP Iron Ore's iron ore mine – Mining Area C
- Burrup Fertilisers (Oswal Group) ammonia plant on the Burrup Peninsula.



Source: ABS

Figure 2.5

## 3. RESOURCE FOCUS 2001

### 3.1 Overview and Outlook

The Western Australian minerals and petroleum industry grew by 5.6% in 2001 to reach \$27.2 billion. This came after a dramatic 51% record increase in the value of sales in the previous year.

Western Australia's petroleum sales were as good as static, rising by just 0.25% in 2001 to \$9,985 million. Whilst these petroleum results may appear lacklustre, it needs to be remembered that they come after a massive 106% increase in sales value in 2000. Within this sector, crude oil sales increased by 2% in 2001 to hit a new record level of 88 million barrels. However, world oil prices, after rising to decade high levels in 2000, eased substantially, on average by 15% over the course of 2001. Consequently, despite the physical volume increase, the value of Western Australia's crude oil sales dropped by 5% in 2001 to \$4,247 million. Likewise, the value of condensate sales decreased, by 8% to \$1,788 million. Again, the drop in sales value was caused by lower world oil prices which was further aggravated by a delay in shipments towards the end of the year. This resulted in a 3% overall decrease in condensate sales volume to 38 million barrels in 2001.

Due to price lags and contractual arrangements, the value of liquefied natural gas (LNG) shipments did not feel the full brunt of weaker oil prices and increased by almost 15% to a record \$2,901 million. This was due to a substantial 16% increase in sales volume.

Thanks to higher prices achieved in the previous round of negotiations earlier in 2001 and the devaluation of the Australian dollar, the iron ore sector's value of sales increased by over 20% to achieve another new record of \$5,246 million in 2001. Sales volumes, showing only a marginal 2% increase to over 162 million tonnes, nevertheless also indicated that a new record had been set.

Western Australia's alumina output also continued to increase, rising by over 7% compared to the previous year to reach a record high of 10.7 million tonnes. An increase in Worsley's alumina production to maximum capacity following expansion of its refinery was a contributor to this growth. In addition, higher prices received by local producers was also an important factor responsible for the value of production soaring by 18% to a record \$3,767 million.

Relatively poor international gold prices which were down around 3% on average in 2001 and a lack of exploration leading to new mining operations contributed to the fourth successive year of falling output from the State's gold industry. In 2001 gold sales were down 4% to 6.2 million ounces. Thanks to the devaluation of the Australian dollar in 2001, the value of these gold sales nevertheless was up by almost 5% to \$3,228 million.

The State's nickel industry on the other hand, saw its sales volumes up by a total of 18% to around 182 thousand tonnes. This represented a record breaking highest year in terms of sales volume. However, international nickel prices were down by almost a third in 2001 and with the devaluation of the Australian dollar notwithstanding, the State's nickel industry's value of sales dropped by 8% to \$2,081 million.

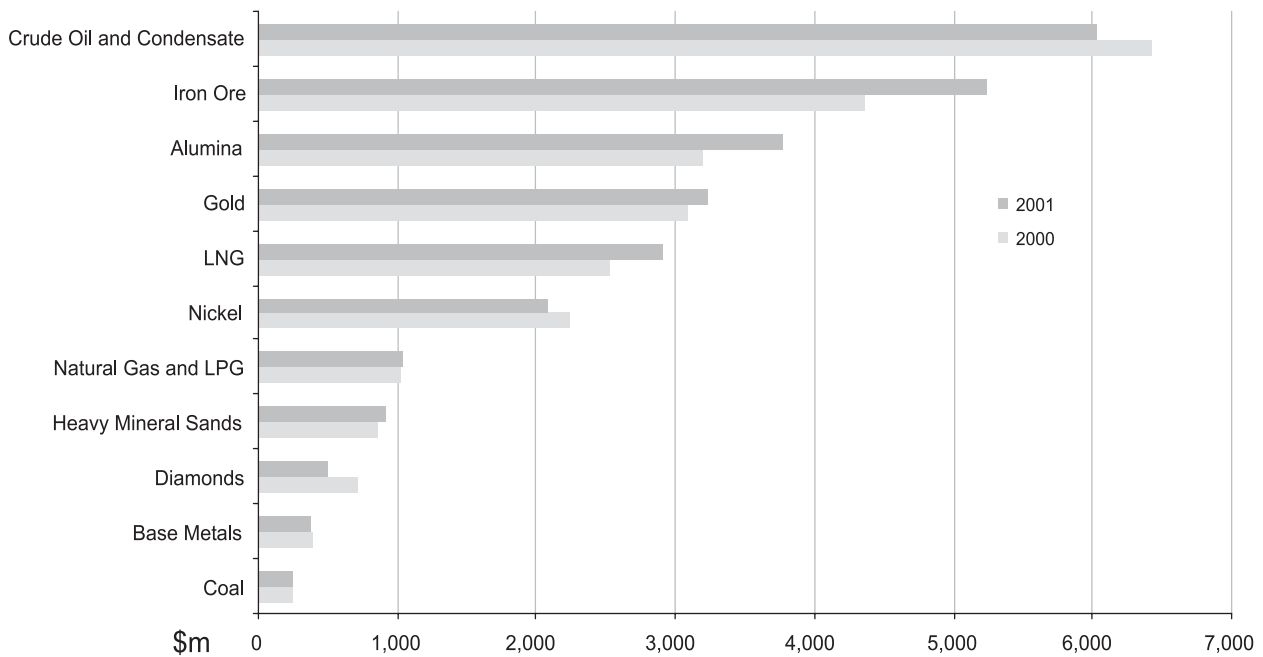
The heavy mineral sands industry grew for the second successive year with the value of sales up over 5% to around \$909 million. This was attributable to healthy price increases for most mineral sand products in 2001. Zircon sales in particular were up by almost 34% to \$230 million thanks to buoyant prices. A significant contribution also came from the upgraded ilmenite sector, where the value of sales increased 11% to \$419 million thanks to local producers receiving favourable contract prices and a weakened Australian dollar. The upgraded ilmenite sector was also assisted by sales volumes which were up by almost 5% to over 646 thousand tonnes.

After record-breaking sale values in 2000, the Western Australian diamond industry slumped in 2001 with a dramatic 49% fall in sales volume to 21.7 million carats. Poor demand which weakened dramatically further after September 11 was the chief factor responsible for the drop. Another casualty of lower world commodity prices was the Western Australian base metals industry where substantial falls in the world prices, exacerbated by volume cuts saw the value of this sector fall almost 6% to around \$375 million.

Two sectors which achieved high growth were the salt and tantalum industries. Salt sales were up by over 11% in 2001 to around 8.6 million tonnes and thanks to better prices, the value of salt sales increased over 26% to a record \$249 million. In 2001, the tantalum sector's sales value increased dramatically by 85% to around \$179 million.



## MAJOR COMMODITIES by Value 2000 and 2001



Source: MPR

Figure 3.1

Overall, 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 in 2001. However, there is a generally positive outlook for most commodities now. As demonstrated by ABARE, the general outlook for world economic activity over the next five years beyond 2001-02 is for moderately strong economic growth, particularly in 2002-03 and 2003-04. This growth should be accompanied with commensurate increases in industrial production which is estimated to increase overall Australian mineral and energy export returns from an estimated \$56 billion in 2001-02 to over \$63 billion in 2003-04. Growth thereafter, beyond 2003-04 has been forecast to ease on the assumption of an appreciated Australian doolar against the American greenback and easing commodity prices.

Whilst this paints a positive medium to long-term picture, ABARE has been quick to point out that a key risk to this projection is the speed at which the US and world economy in general, makes an economic recovery from the 2001 doldrums. If the mid-2002 resumption towards relatively strong economic growth rates take place according to projections, then the focus of concern for world mineral and petroleum commodities will be supply side factors.

Importantly for Western Australian resource exporters, most Asian economies are forecast by ABARE to grow at average annual growth rates of between 3.5 and 7% over the outlook period to 2007 compared to 3.8 to 4% for the world as a whole. This will further increase the region's share of world mineral and energy consumption with healthy increases in demand for fuel such as liquefied natural gas for electricity generation and mineral inputs for manufacturing. For example, the region's share of world steel production is projected to increase from 39% in 2000 to 43% in 2007, accounting for almost 90% of the projected increase in world steel production over the period. In addition to steel, the escalating importance of the region's electronics industry and rapid expansion of its infrastructure will continue to underpin demand for metals such as aluminium, copper and zinc. Within this a significant factor in discussing almost all commodities is the increasing importance of China in the demand and supply fundamentals shaping price direction.

The prognosis therefore is that after the depressing year suffered by most mineral and petroleum commodities in 2001, slight growth in prices is expected in 2002 as the global economy picks up pace in the latter half of the year. Prices are thereafter projected to rise more strongly in 2003 and 2004 before tapering off towards 2007.

## 3.2 Petroleum

Afflicted by economic downturn in the United States, world economic growth slowed significantly in 2001. As a result of weaker energy demand associated with sharply lower global economic growth, oil prices on world markets declined significantly. To stabilise oil prices, OPEC continued to keep a rein on group output throughout the year. Despite efforts to cut production several times by OPEC countries, crude oil prices touched its two-and-a-half-year low of US\$16.7/bbl in November 2001. For 2001 as a whole, average monthly crude oil prices in US\$ terms fell by 15% compared with 2000, to just over US\$25/bbl.

Western Australia is the nation's dominant producer of oil and gas, supplying around 55% of Australia's oil and condensate and 100% of Australia's LNG. Despite difficult global market conditions, the Western Australian petroleum industry performed well in the past year. Volume of sales for all petroleum products except for condensate increased, ranging from 2.3% (crude oil) to 15.7% (LNG) compared with 2000. However, with falling oil prices, the value of Western Australia's petroleum sales increased only marginally by a negligible 0.25% to \$9,985 million in 2001. Whilst this may appear lacklustre, it needs to be remembered that it comes after a massive 106% increase in sales value in 2000. Although its share in Western Australia's total value of mineral and petroleum sales slipped slightly from 38% in 2000 to 37% in 2001, the petroleum sector retained its dominant position in the State's economy.

Petroleum products are an important component of Western Australia's exports. In 2001, \$7,737 million or 77.5% of Western Australia's petroleum products was exported. Compared with 2000, the State's petroleum exports (by value) in the year fell by 4.4% due primarily to lower oil prices and weaker demand in major export markets. Major markets for Western Australia's petroleum exports are Japan (absorbing 50% of the State's petroleum exports), South Korea (16%), Singapore (9%), Taiwan (9%) and the United States (9%).

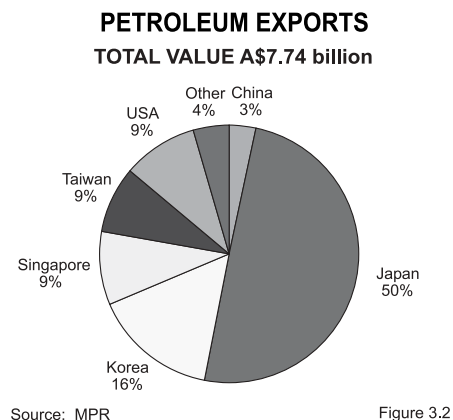
During 2001, crude oil remained the principal contributor and accounted for 42.5% of total petroleum sales in Western Australia, surpassing LNG (29.1%) and condensate (17.9%). Following an exceptionally

strong performance in production on the back of a global oil price hike in 2000, crude oil sales increased moderately by 2.3% to 88.44 million barrels (MMbbl). Despite the physical increase, the value of Western Australia's sales of crude oil dropped by 5.1% to \$4.25 billion as a result of weaker oil prices. This compares with the massive 191.6% increase in the previous year.

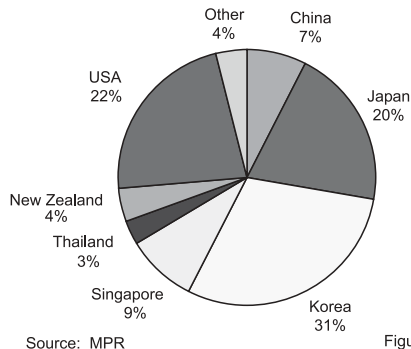
Oil was produced from over 30 fields in Western Australia in 2001. About 85% of the production was contributed by the top 10 fields, including Wanaea, Griffin, Stag, Cossack, Wandoo, Hermes, Legendre North, Barrow Island, Buffalo and Lambert. The Wanaea field alone produced 27.23 MMbbl in the year, accounting for about 30% of the State's total. The Legendre North, Legendre South, Gipsy, North Gipsy and Simpson fields commenced production in 2001, adding 9.1 MMbbl to the State's oil output.

After a significant 11.2% increase in volume and 89.7% increase in sales value in 2000, Western Australia's condensate sales decreased by 2.9% to 37.6 MMbbl in 2001. Lower export volumes and falling prices pushed 2001 sales value figures down 8.1% to \$1.79 billion compared with \$1.95 billion in 2000.

There were 20 fields producing condensate in Western Australia in 2001. The majority of condensate produced in the State came from three fields in the North West Shelf. The North West Shelf Gas Project has produced condensate which is a by-product from the offshore gas fields since 1984. Among the three fields, the Goodwyn field contributed 24.8 MMbbl or 65.9% of the State's total, followed by the Perseus field (6.3 MMbbl or 16.7%) and the North Rankin field (2.3 MMbbl or 6.2%). Together, the three fields accounted for 88.8% of total condensate production in the State.



## CRUDE OIL EXPORTS TOTAL VALUE A\$2.71 billion

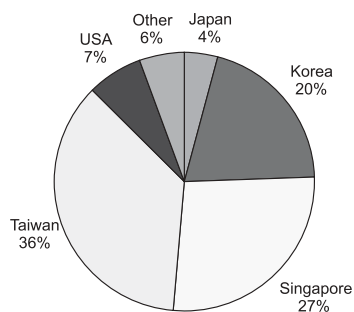


Source: MPR

Figure 3.3

Another major contributor was the East Spar field which produced 2.4 MMbbl or 6.3% of the total. In November 2001, the Athena field near the Perseus field commenced production at a rate of around 17,000 bbl per day. During November and December 2001, the field contributed 1.04 MMbbl or 2.8% to the total. The Echo-Yodel field also started production in late December 2001.

## CONDENSATE EXPORTS TOTAL VALUE A\$1.73 billion



Source: MPR

Figure 3.4

LNG has been the second largest sector within Western Australia's petroleum industry since 2000. In 2001, the LNG industry reinforced its position and accounted for 29.1% of the State's total petroleum sales, compared to 25.4% in 2000. Western Australia's LNG trade is mainly characterised by long-term contracts. The Japanese power utilities are the principal purchasers of the State's LNG exports. In 2001, Japanese customers imported 128 cargoes of LNG from Western Australia. In addition to the contract sales to existing customers, three spot cargoes were also sold to the Korea Gas Corporation, BP Gas Marketing and Tohoku Electric Power Company. The total volume of LNG sales in 2001 was 445,137,300million Btu, which was 15.7% higher than in 2000. Given that energy demand was weaker in those importing countries due to recession, the

substantial increase in volume sales in the year was mainly a reflection of the favourable position of LNG as a clean fuel in power generation in dealing with environmental concerns. Due to price lags and contractual arrangements, the value of LNG shipments did not feel the full brunt of weaker oil prices and increased by almost 15% to a record \$376.4 million.

The North West Shelf Gas Project is the only LNG project in Western Australia. The North Rankin field initially supplied the full gas feed for the LNG production. The Goodwyn and Perseus fields now also provide gas feedstock.

Regarding liquefied petroleum gas (LPG), in 2001 volume of sales for butane and propane increased by 5.5% and 5.8%, respectively, on the previous year. Total volume of LPG (butane and propane) sales increased by 5.6% to 861,080 tonnes. However, lower prices resulting from weaker demand saw value of sales for propane increase only slightly by 0.9% and value of sales for butane decrease by 3.5% compared to the previous year. For LPG (butane and propane) as a whole, the value of sales decreased by 1.5%. Most production was exported to Japan with spot sales to some other countries.

Overall, the Western Australian oil and condensate sector was hit harder than the gas sector by the sluggish world economy and falling oil prices in 2001. The strong performance of the gas sector is likely to continue in the future given Western Australia's large gas reserves and rapidly growing world gas demand. One of the events with huge significance for the Western Australian economy occurring during 2001 was the commencement of construction of the fourth processing train in North West Shelf LNG plant. In April 2001, the North West Shelf Venture participants approved the final investment decision for the fourth LNG processing train and associated infrastructure to be located on the Burrup Peninsula. Construction of the fourth LNG processing train commenced in September 2001. The \$2.4-billion Train-4 will be the largest single LNG processor constructed in the world and the largest project in Australia since the original North West Shelf development in 1980s.

As with the initial LNG export program, the construction of Train-4 to the Burrup Peninsula is being underpinned by 25–30-year contracts with the Japanese utilities. The first two supply deals were struck in October 2001

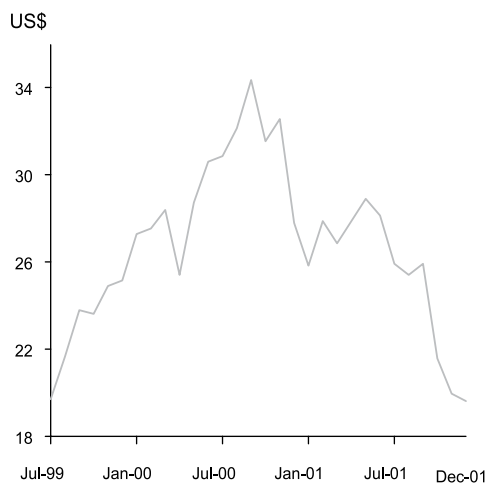
with agreements with Tokyo Gas and Toho Gas for the supply and purchase of 1.37 million tonnes per annum of LNG.

Tokyo Gas distributes gas to more than eight million customers in the Tokyo metropolitan area and is the largest gas utility in Japan, accounting for around 40% of total Japanese sales. The company buys about 6.5 million tonnes of LNG per annum from producers around the world, of which 0.79 million tonnes per annum is currently supplied by Western Australia.

In March 2002, the NWS joint venture partners announced that a third LNG sales and purchase agreement had been signed with Osaka Gas Co Ltd for the supply and purchase of one million tonnes per annum of LNG over 30 years commencing 2004.

An event in the petroleum industry that had attracted wide attention in 2001 was the proposed Shell takeover of Woodside. On 24 November 2000, Shell Australia Investments Limited ("Shell Investments"), a wholly-owned subsidiary of the Shell Group, announced a takeover offer for the shares of Woodside Petroleum Ltd. Because of the important implications the takeover could have for Australia's greatest resource asset — the North West Shelf gas resources, this caused a lengthy debate on whether the Government should intervene and block the takeover or leave it to market forces. On 23 April 2001, the Federal Treasurer, Mr Costello, made orders under section 18 of the *Foreign Acquisitions and Takeovers Act* blocking the \$10-billion Shell takeover of Woodside Petroleum on national interest grounds.

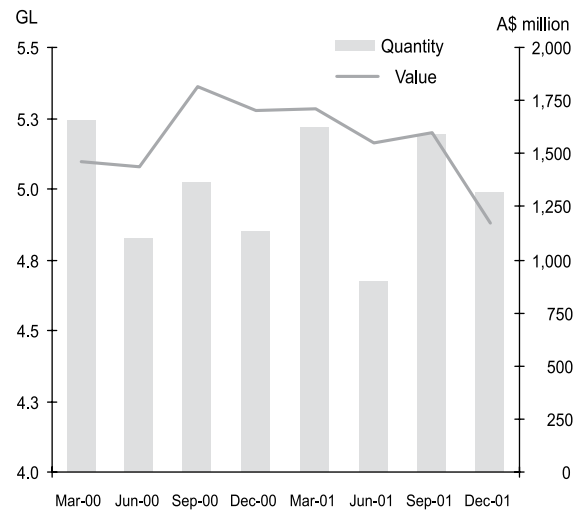
### TAPIS CRUDE OIL PRICE US\$/bbl



Source: WA Treasury Corporation

Figure 3.5

### CRUDE OIL AND CONDENSATE Quantity and Value by Quarter



Source: MPR

Figure 3.6

According to ABARE, based on early signs of recovery that have emerged from the US economy and the expected strengthening global economic growth in 2003 and 2004, world oil demand is forecast to recover in 2003 and to grow steadily at around 1.5% per annum to 2007. As a result of rising oil consumption, oil prices are expected to increase. However, the price rise is unlikely to last long given a lack of compliance with OPEC's production cut quota by its members and rising supplies from non-OPEC countries/regions such as Russia, Latin America and Africa. The heavy reliance on crude oil income by the major OPEC members is expected to make price support objectives difficult over any significantly long period. In Russia, with increasing investment in new fields and reservoirs in the Caspian Sea region and Siberia, oil production is expected to grow steadily. Oil production from deepwater resources off Brazil and Angola is also anticipated to increase due to improvement in deepwater technology. As a result, oil prices are expected to be subject to downward pressures because of deteriorated fundamentals in the long run. ABARE has forecast that oil prices will be above US\$23/bbl during 2003 and 2004 in line with an assumed pick-up in world economic growth. Over the subsequent period, oil prices are projected to soften from above US\$21.5/bbl in 2005 to under US\$20/bbl in 2007.

It should be noted that, however, oil has been used as a strategic weapon from time to time. Thus, the geopolitics can also play a significant part in determining oil prices. The recent intensified volatility in the oil market associated with speculation of the



US taking a tough stance on Iraq, anxiety over security of oil deliveries caused by tension in the Middle East and the idea of an Arab oil embargo, and sudden oust of the Venezuelan President by a military coup and his unexpected quick return to power in less than a week provided a few examples.

In contrast to projected increased oil production in OPEC and other non-OPEC countries/regions, ABARE has forecast that Australia's crude oil production will decline steadily over the medium-term due to the declining productivity of the existing mature oilfields. This projection is in line with forecasts made by other forecasting agencies such as Geoscience Australia. The projected decline has caused substantial concerns in the petroleum industry. For example, a senior executive from a Perth-based leading Australian petroleum company has warned that, as a result of a rapid decline in liquid petroleum production, liquids self-sufficiency is expected to decline from an average of 80-90% over the past decade to less than 40% by 2010. The declining liquids self-sufficiency will in turn lead to deterioration in Australia's trade deficit on liquid hydrocarbons from a surplus of \$1.2 billion in 2000-01 to a deficit of \$7.6 billion by 2009-10.

Given that Australia has been consuming oil much faster than discovering it, options suggested by industries of dealing with rising oil imports resulting from declining liquid petroleum production include both supply and demand measures. On the supply side, increasing exploration effort to find and develop a regular stream of new fields and increasing recovery via infill drilling can help ease declining production. On the demand side, enhancing energy efficiency and increasing fuel substitution can constrain expansion in oil demand.

As Australia has large gas reserves, gas has great potential to meet a significant portion of Australia's future energy requirements. In contrast to the projected declining liquid petroleum production, ABARE's forecasts show that natural gas production in Australia is expected to rise strongly in response to increased LNG export demand. With shrinking oil production and rising gas output in the nation, Western Australia is well placed to play a more prominent role given its abundant resources. Over the past two years, oil production from the Laminaria field has provided some significant relief. In late 2001, the Athena and Echo-Yodel gas and condensate fields and the Legendre oil and gas field came into production. These fields are expected to contribute significantly to the State's petroleum production in coming years. The recent Cliff Head oil discovery in the Perth Basin offshore from Dongara, the Vincent, Enfield and Laverda discovery on the North West Shelf and others in the Carnarvon Basin also bring about a promising prospect for future development.

### 3.3 Iron Ore

Against a background of plummeting steel prices and high inventories coupled with a sharp fall in industrial production and a synchronised world recession, Western Australia's iron ore industry performed relatively strongly during calendar 2001.

Sales volumes increased moderately by 2.1% from 159 million tonnes in 2000 to 162 million tonnes in 2001. In this respect a new record had been set and Western Australia also increased its share of world iron ore production to 17% in 2001. The State currently accounts for 35% of global seaborne trade.

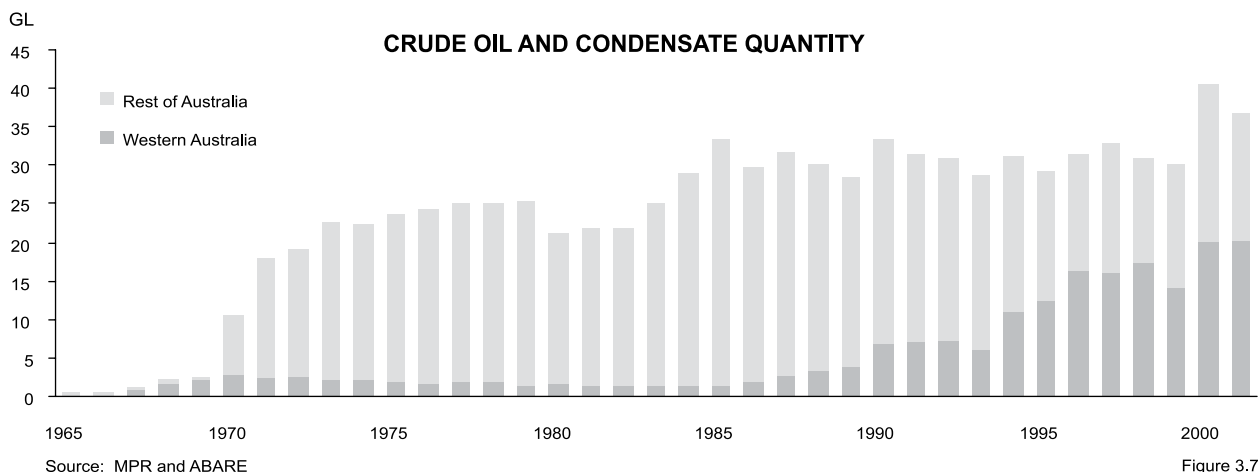


Figure 3.7

Thanks to higher prices achieved in the previous round of negotiations earlier in 2001 and the devaluation of the Australian currency, the iron ore sector's value of sales increased by over 20% to achieve another new record of \$5,246 million in 2001.

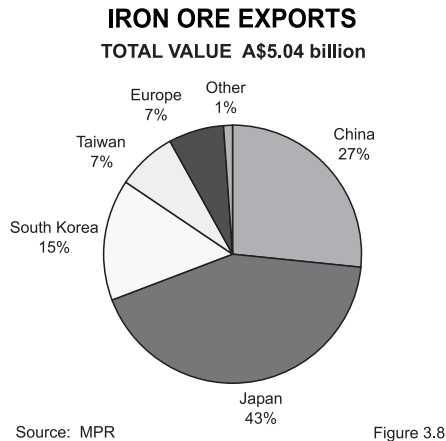


Figure 3.8

East Asia remained the principal destination for Western Australian iron ore shipments. Out of a total 162 million tonnes of iron ore produced, over 85% or 137.5 million tonnes were shipped to this region. Iron ore shipments to Japan totalled 65.5 million tonnes, China 39.2 million tonnes, South Korea 22.9 million tonnes and Taiwan 9.6 million tonnes. Shipments to the European Union totalled around 16 million tonnes.

The international strategic realignment of iron ore producers and steel manufacturers during 2001 has led to dramatic changes and consolidation of the ownership of iron ore operations – establishing Brazil and Western Australia as even more dominant suppliers to the world markets. Currently, these two regions provide over 71% of the world's iron ore exports and, according to industry analysts, their combined share could increase to over 80% in the next few years.

Although 2001 was a difficult period for the iron ore and steel industries, all indications are that consumption of steel will rise moderately in the second half of 2002 and beyond. Steel inventories are expected to fall to normal operating levels which in turn will see a recovery in steel prices. As a result, world steel production is forecast to rise by less than 1% from 837 million tonnes in 2001 to 841 million tonnes in 2002.

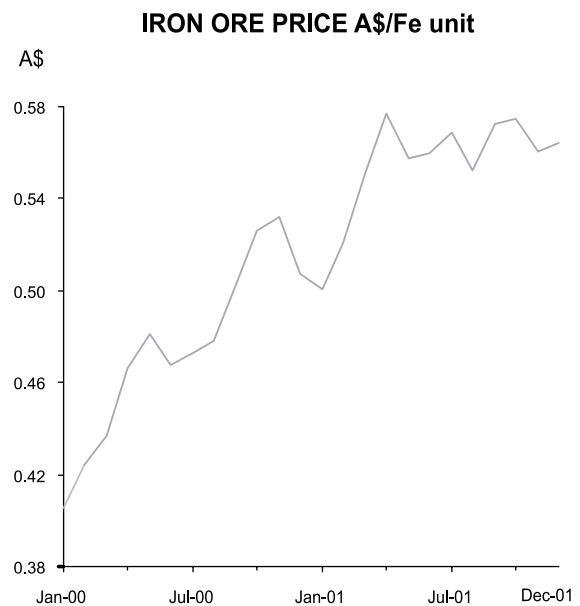
Australian iron ore production, according to ABARE, is expected to increase by 8 million tonnes to

184 million tonnes in 2002. On a longer term basis, Australian iron ore production is forecast to increase from 176 million tonnes in 2001 to around 210 million tonnes by 2007.

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

Over \$2.1 billion is earmarked for the development of four new generation iron ore mines in the Pilbara region, exploiting Marra Mamba iron ore. In addition to Robe River's West Angelas for which development is nearing completion, other projects include BHP's Mining Area C (discussed below), Hancock Prospecting/Kumba Resources Hope Downs and Hamersley Iron's Nammuldi/Silvergrass. Elsewhere in the State, the smaller iron ore producer Portman Mining Limited is proposing increases in production from its Koolyanobbing mine in the Eastern Goldfields from over 3 million tonnes in 2001 to 8 million tonnes per annum by 2005-06 with the development of new resources at the Mt Jackson and Windarling deposits.

On the issue of reducing unit costs, the Western Australian iron ore companies have integrated their mining operations into single, flexible operating units, as opposed to a previous tendency to operate a number



Source: Tex Report, High Grade Fine Ore Prices

Figure 3.9

of separate mining operations, rail and port handling activities. This re-organisation of their structure, has resulted in the removal of duplication of technical services and management functions at each site, resulting in significant reduction of overheads.

According to a report by AME Mineral Economics, Western Australia had the lowest iron ore production costs in the world, with costs having fallen by 27% since 1997. The report found that between 1997 and 2002, the estimated free-on-board (FOB) cash costs for non-agglomerated iron ore among the mines analysed dropped from US\$9.71 to US\$7.08 per tonne.

The report found that well established and efficient infrastructure systems, port, labour productivity gains, improvements in mine processing and transportation contributed to this impressive fall.

Other highlights for 2001 include the announcement by Hismelt Corporation that it is considering developing a commercial facility at Kwinana. The \$400-million plant will initially produce 800,000 tonnes of pig iron. If the facility is successful, up to \$1 billion could be invested in a full-scale plant, fulfilling a desire by successive State Governments for iron ore mines to seek ways to process their material here. BHP-Billiton's Boodarie Iron facility also appears to have resolved its teething problems and can now look forward to having a viable future. The facility had almost doubled six-monthly production to 777,000 tonnes. During the semester,

the facility had all 4 production trains running simultaneously over two periods.

Austeel continues to progress its \$2.8 billion project which involves the development of an open-pit iron ore mine at Cape Preston, and the processing of that iron ore into hot briquetted iron for shipping to its proposed steel mill at Newcastle in New South Wales. Mt Gibson Iron is also assessing the feasibility for the development of its iron ore deposit from Geraldton, through to pellets or DRI product.

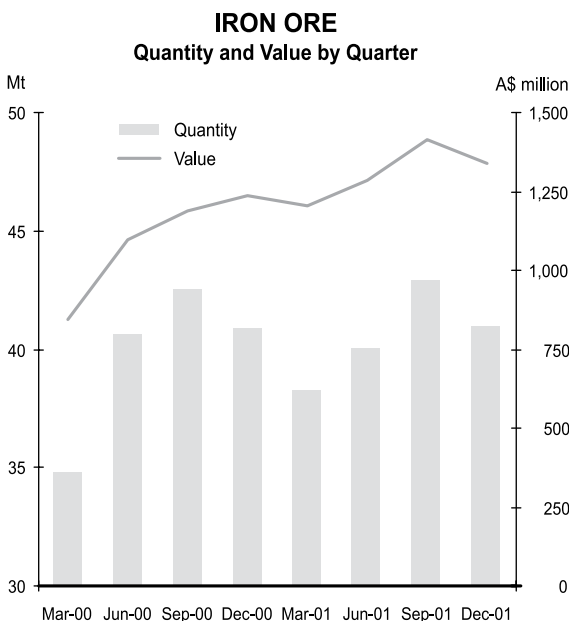
In terms of price negotiations between Australian iron ore producers and Japanese steel mills, at the time of writing they had entered their fifth month with no settlement in sight. This is the first time in many years that the new Japanese fiscal year and the contract period for iron ore sales, has commenced with no firm agreement in place.

The Japanese negotiating team led by the powerful Nippon Steel Corporation, are arguing strongly for a price cut they pay for the iron ore, pointing to the 30% fall in steel prices, the fragile nature of the Japanese economy and the large profits that have been made by the iron ore producers over the last few years.

Prices in real terms have been falling for decades and continue to do so. The iron ore producers won a 4.3% price rise in 2001, but claim they fought for this in order to claw back some of the price drop of over 11% negotiated in 1999.

Iron ore industry analysts are now on record as saying that there is a possibility that iron ore producers may have to settle for a rollover of current prices rather than the widespread price cuts the industry had been anticipating.

In summary, although 2001 was a difficult year for the global iron ore industry, the Western Australia iron ore industry appears to have come out relatively unscathed. The fundamentals in the State's iron ore industry are sound. The drivers which have stood it in good stead throughout its evolution are as important today as they ever were. Accordingly, it is well positioned to continue its growth trend through this century.



Source: MPR

Figure 3.10

## Mining Area C

In early April 2002, BHP-Billiton announced approval for the development of a greenfield iron ore mine at Mining Area C and an expansion of its Port Hedland port and rail facilities in the Pilbara region of Western Australia.

Capital costs for the two projects are estimated to be US\$213 million for the development of the mine and US\$351 million for the Nelson Point Capacity Expansion.

As part of the Mining Area C development, BHP Billiton has entered an agreement with Pohang Iron and Steel Company (POSCO) the world's second largest integrated steel producer, after Nippon Steel Corporation of Japan. Under the agreement, POSCO will acquire a 20% equity in the "C deposit" section of Mining Area C. Other participants include BHP Billiton with 65%, CI Minerals Australia Pty Ltd 8% and Mitsui Iron Ore Corporation with 7%. By having POSCO as an equity partner in the project, BHP Billiton has secured one of the most efficient and innovative steel makers in the world to effectively underwrite the development of the customer-driven business.

POSCO has committed to purchasing a minimum of 3 Mtpa of ore following initial ramp-up and to maintain a long-term strategic alliance with BHP Billiton for supply of other iron ore products.

POSCO is BHP Billiton's largest customer, and its involvement in the "C deposit" follows the signing of a Letter of Intent (LOI) with the then BHP Ltd over a year ago.

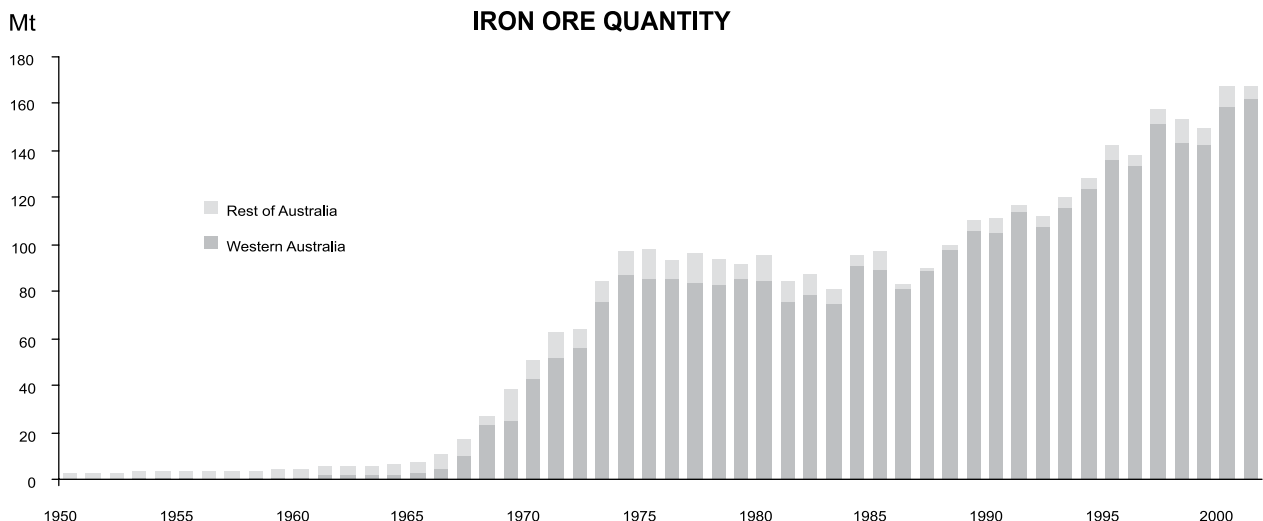
Mining Area C is located 37Km from BHP Billiton's Yandi mine and contains the largest undeveloped Marra Mamba resource in the Pilbara. The resource is estimated at 800 Mt with significant exploration potential.

Mining will be undertaken by a mining contractor and supervised by BHP Billiton staff. The mining rate is expected to be around 5 Mtpa to 15 Mtpa, depending on market forces. The project will have a workforce during construction of around 500, who will be accommodated in a temporary village on site.

During operation, the site workforce is expected to comprise 200 people. All personnel will be employed on a fly-in-fly-out basis and will be housed in a permanent accommodation village.

Statutory approvals and agreements for the project, including environmental obligations, have been obtained from the State Government regulatory bodies.

Development of the mine could start immediately with commissioning in late 2003.



Source: MPR and ABARE

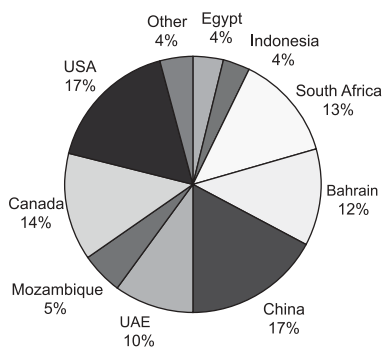
Figure 3.11

## 3.4 Alumina

Western Australia has two major alumina producers (Alcoa and Worsley) and four world-class alumina refineries comprising Worsley's Collie alumina refinery and Alcoa's Kwinana, Pinjarra and Wagerup operations. The State therefore has a significant place in both Australian and world alumina production. Together, Worsley alumina and Alcoa's Kwinana, Pinjarra and Wagerup operations have a total capacity of 10.4 Mtpa, accounting for over 70% of the national total. Outside of Western Australia, two additional alumina refineries (the Gove alumina refinery operated by Nabalco Pty Ltd and the Gladstone alumina refinery operated by Queensland Alumina Limited) are located in the Northern Territory and Queensland, respectively.

In calendar year 2001, Western Australia's alumina output continued to increase, rising by 7.5% on the previous year to reach a record high of 10.7 million tonnes, accounting for around 20% of the world's total and 67% of Australian production. Following a significant 38% increase in 2000, the value of Western Australian alumina sales increased by a further 18% to \$3.8 billion in 2001 compared to \$3.2 billion the previous year. The State's alumina sector reinforced its third position behind petroleum and iron ore by lifting its share of the total mineral and petroleum sales from 12.4% in 2000 to 13.9% in 2001.

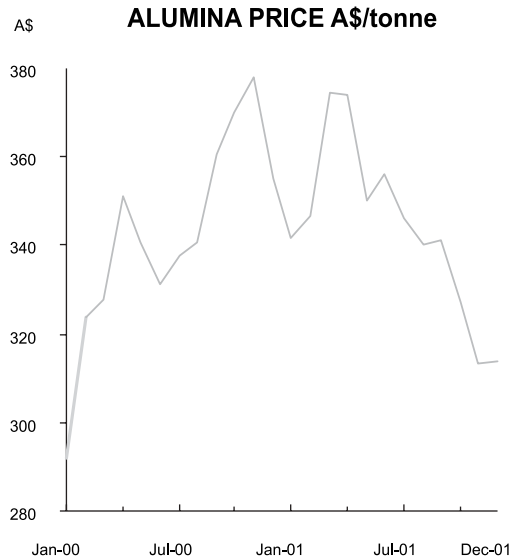
**ALUMINA EXPORTS**  
TOTAL VALUE A\$3.46 billion



Source: MPR

Figure 3.12

Approximately 92% (by value) of the State's alumina was exported, with the major destinations being China, the US, Canada, South Africa, Bahrain and the UAE. In 2001, over 80% of the State's production was shipped to the above countries. Due to lower demand resulting from the shutdown of some aluminium smelters caused by power shortages in the United



Source: ABARE and ABS

Figure 3.13

States, the share of the State's total alumina exports accounted for by the US dropped from 21% in 2000 to 17% in 2001. In contrast, China's strong growth in alumina imports in the first nine months of 2001 due to high production levels of aluminium, saw its share rise to 17% compared to 13% in 2000. The shares accounted for by other countries were 14% for Canada, 13% for South Africa, 12% for Bahrain, 10% for the UAE, 5% for Mozambique, 4% for Egypt and 4% for Indonesia.

A major contributor to growth in Western Australia's alumina output was completion in September 2000 of Worsley's refinery expansion which added about 1.3 million tonnes to the world market annually. The last twelve months have seen Worsley Alumina ramp-up its alumina production to a maximum capacity of 3.1 million tonnes per annum. Due to concerns about market conditions and environmental matters, Alcoa shelved plans to expand the Wagerup refinery. Recently the State Government has appointed an independent environmental auditor to examine ambient and emissions monitoring and associated quality assurance systems at Alcoa's alumina refinery in Wagerup. The appointment is the result of changes to Alcoa's environmental licence enforced by the State Government, which requires independent auditing of emissions and ambient monitoring, odour calculations, emissions inventory work and reports.

Another important factor underpinning strong performance of the Western Australian alumina industry was movement in the exchange rate. Compared with 2000, the value of the Australian dollar

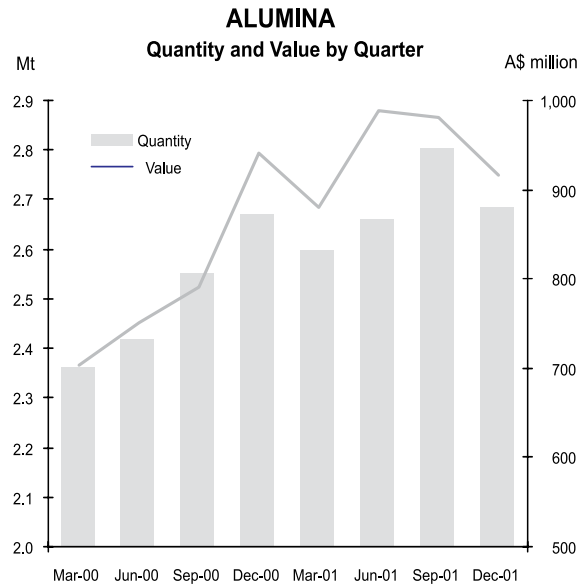


in terms of the US dollar dropped by 11% in 2001. Given that the volume of alumina sales only increased by 7.5% and average prices for alumina fell by about 10% in the year, the impressive increase in sales value of Western Australian alumina was due principally to the weakness of the Australian currency against the US dollar.

Against a background of weakening demand and declining prices in the world alumina markets in 2001, the continuing growth in Western Australia's alumina production reflects the industry's ongoing efficiency gains. Western Australia's refineries operate with the lowest production costs in the world. For example, Worsley Alumina Pty Ltd's Collie refinery is ranked as producing at the lowest cost in the world, with operating costs of US\$88.94 per tonne. Alcoa's Wagerup refinery is ranked as the world's second cheapest producer at US\$93.04 per tonne, while its Pinjarra and Kwinana refineries are rated fourth and tenth, respectively.

A significant local development saw US-based Alcoa Inc acquire Reynolds Metal's 56% interest in the Worsley alumina project in Western Australia as part of its takeover of the company. However, Alcoa was later forced to sell this 56% by the US regulatory authorities and the European Union Commission who had concerns regarding the company's dominance in the industry and the possibility of anti-competitive practices.

Following an auction process that attracted bids from a variety of aluminium industry participants, Alcoa sold its 56% to BHP-Billiton, which already had a 30%



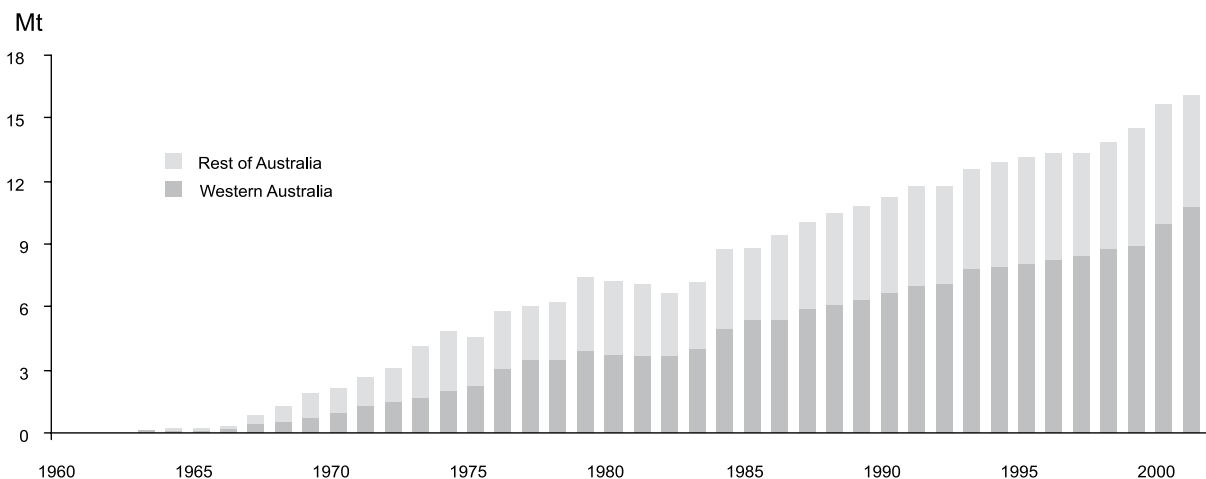
Source: MPR

Figure 3.14

shareholding in the Worsley project. BHP-Billiton now holds 86% of the Worsley alumina project with the remaining 14% owned by Kobe Steel, Nissho Iwai and Itochu.

As an export-oriented industry, the outlook for Western Australian alumina is heavily dependent on the economic climate of global markets and the adequacy of refining capacity and production in the world. During 2001, the world saw a 600 thousand-tonnes-per-year expansion at Nalco's Damanjodi refinery in India and ongoing refinery upgrades in China. Australia's alumina production also increased by 7% to 16.1 million tonnes. Increased production at these refineries was partly offset by production cuts in other

## ALUMINA QUANTITY



Source: MPR and ABARE

Figure 3.15

regions such as North America. In the past year, Alcoa suspended operations at the 600 thousand-tonnes-per-year St Croix refinery in the Virgin Islands and cut production significantly at its Point Comfort refinery in Texas. BHP Billiton also reduced output of its alumina refinery in Brazil by about 12%. Therefore, on balance, world alumina production remained relatively stable in the period.

According to ABARE, there is considerable uncertainty about outlook for alumina in the short term due to re-opening of some aluminium smelters in some countries and Chinese increasing demand for imported alumina. CVRD, Alcoa and BHP Billiton restarted their aluminium smelters in Brazil in January 2002 after energy rationing in northern states came to an end. Alcoa also indicated that it planned to restart two lines of idle capacity at its Ferndale, Washington smelter over the course of the year. There is growing speculation that lower energy costs and higher aluminium prices could see more North American plants, which were shutdown due to soaring power costs in 2001, re-open towards the end of 2002. China's alumina imports slowed in late 2001 following a temporary restriction on imports imposed by the government. However, with China's reduction in import tariffs because of its entry of WTO and more than 500,000 tonnes per year of new aluminium smelting capacity due to come on stream in 2002, strong imports of alumina are likely to re-occur in China.

Beyond 2002, alumina demand is projected to grow strongly in line with requirements driven by growth in aluminium production associated with strengthening of the world economy. On the supply side, some greenfield and brownfield projects are likely to occur in the long run. Examples of these projects include the commissioned Hindalco's greenfield Utkal refinery in India (3 million tonnes annual capacity) and Comalco's greenfield CAR project in Australia (1.4 million tonnes initially, with plans to expand to 4 million tonnes). Gapco in Guinea is also planning a 2.6-million-tonnes-per-year alumina refinery near the Sangarédi mine and there are potential expansions to consider in the Ukraine and Brazil.

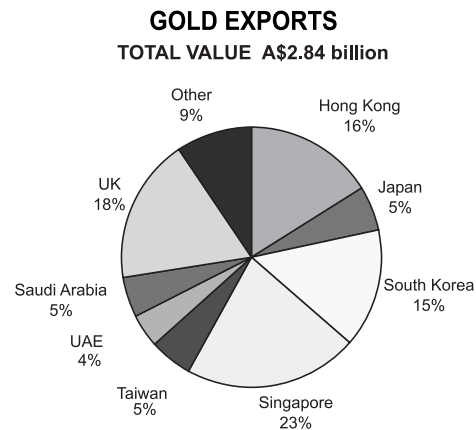
The average alumina price in 2001 was US\$177.7/t, down 10.5% from 2000. Prices can be expected to rise later in 2002 in response to the earliest signs of any pickup in aluminium demand. The expected strengthening world economic growth during 2003 and

2004 will provide an additional boost to alumina prices. However, with additional alumina capacity being expected to come into production in some countries over the next few years, price increases are likely to be constrained in the longer term.

### 3.5 Gold

The international price of gold was down around 3% on average in 2001. Coupled with a lack of exploration leading to new mining operations, this contributed to the fourth successive year of falling output from the State's gold industry. In 2001, gold sales were down 4% to 6.2 million ounces (192 tonnes). However, due to the devaluation of the Australian currency in 2001, average gold prices expressed in Australian dollars were 10% higher, up from \$480/oz in 2000 to \$526/oz in 2001. This resulted in the value of sales increasing almost 5% to \$3,228 million.

The value of gold exports from Western Australia totalled \$2,838 million in 2001. The major export destinations were Singapore, the United Kingdom, Hong Kong and South Korea.

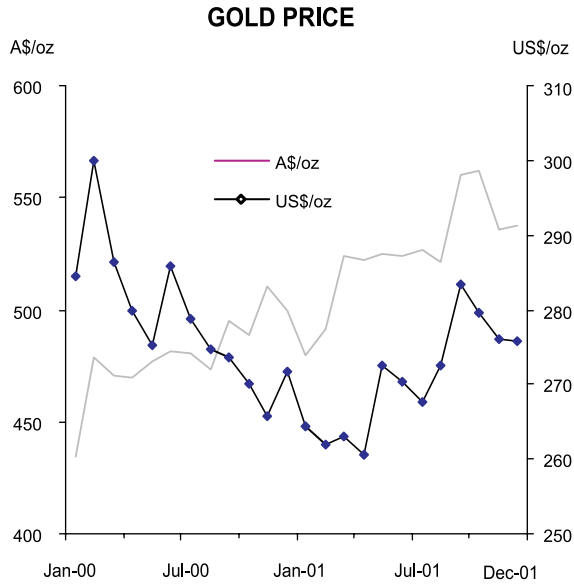


Source: MPR

Figure: 3.16

Western Australia accounts for 70% of Australia's and 8% of the world's gold production.

Characteristic of 2001 was the ongoing consolidation of the Australian gold industry. This has been a significant feature of the sector which has seen a diminishing number of companies involved in the industry. Fewer large companies are now involved in the industry than probably at any time in history. Between 1997 and 2001 the number of mines in Australia has dropped from 137 to 62 and the number of companies from 86 to 35. This has been



Source: Perth Mint and London Fix

Figure 3.17

accompanied by a massive reduction in the number of gold companies trading on the Australian Stock Exchange (ASX). Data supplied by stock exchange authorities in Australia and South Africa show that in 1990 there were 48-gold producing companies listed on the ASX compared with 44 in 2001. In South Africa, the reduction has been even more dramatic with the number having shrunk from 37 in 1990 to just six in 2001.

Among the rationalisation, Barrick Gold Corporation merged with Homestake Gold. This formed the world's most valuable miner and the second biggest by production. With this merger, Barrick acquired part of Kalgoorlie's Super Pit through the Homestake deal. Also, US-based Newmont Mining took over both Australia's Normandy Mining and Canada's Franco-Nevada Gold to create the world's biggest producer.

In Australia, Delta Gold and Goldfields merged to create Aurion Gold, WMC divested its gold assets to South African and Australian interests and South Africa's Harmony Gold took over Perth-based Hill 50 Gold.

Locally, a similar story is told in terms of Kalgoorlie-Boulder's Golden Mile where in the 1970s, four companies operated (North Kalgurli; Gold Mines of Kalgoorlie; Great Boulder Mines; Lake View and Star Limited). Today, only one gold mining company operates, Kalgoorlie Consolidated Gold Mines Pty Ltd, which mines from the Super Pit.

Apart from the takeovers and mergers at the top end, numerous gold mining operations in the Murchison, Yilgarn and Eastern Goldfields have also merged their treatment operations to save on costs. These include Jundee and Nimary, Bronzewing and Mt McLure, and several others that are now treating their ore at central processing plants.

However, the average size of the remaining producers has increased to 258,000 ounces-a-year from 117,000 oz.

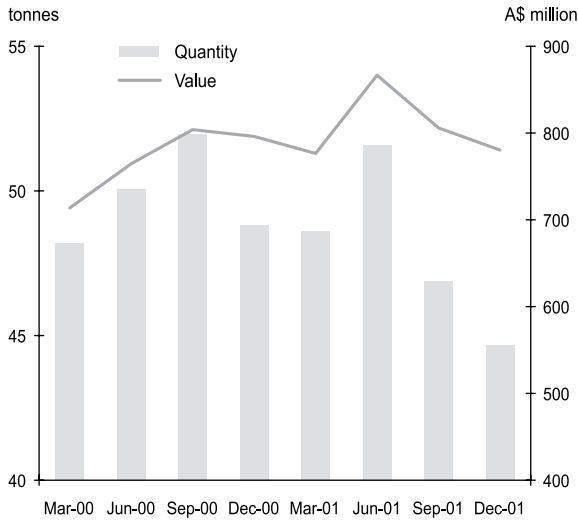
Over half (53%) of Western Australia's gold output in 2001 was accounted for by the following nine projects:

- Golden Mile-Kalgoorlie (KCGM–Newmont, Barrick) - 22.7 tonnes
- St Ives (Gold Fields Limited) - 14.2 tonnes
- Jundee-Nimary (Newmont) - 12.6 tonnes
- Granny Smith (Placer Dome, Aurion Gold) - 9.8 tonnes
- Bronzewing - Mt McClure (Newmont) - 9.7 tonnes
- Plutonic (Barrick) - 9.1 tonnes
- Sunrise Dam (AngloGold) - 9.0 tonnes
- Kanowna Belle (Aurion Gold) - 7.5 tonnes
- Boddington (Newmont, Newcrest, AngloGold) - 7.1 tonnes.

Whilst the international gold price was down on average by 3% in 2001 at US\$271/oz, it has since strengthened in 2002 to rally up to US\$310/oz by early May 2002.

Political upheavals in the Middle East and banking issues in Japan have been at least two factors behind gold's recent rallies beyond the US\$300/oz mark. It may be surprising therefore that the nominal price outlook presented for gold by ABARE was one of only US\$306/oz by 2007. However, it is timely to note that these outlooks derived by ABARE are based on long-term global supply and demand fundamentals, founded on a prognosis of stable official sector sales, flat world production and gently rising fabrication demand. The return to gold as a 'safe haven' amidst crises such as September 11<sup>th</sup> for example, were cited as real possibilities which could, at least in the short-term, lead to price 'spikes' around the long-term perspective. This has been seen as one of the factors temporarily reversing gold's long-term decline in

## GOLD Quantity and Value by Quarter



Source: MPR

Figure 3.18

real terms in 2002. Over an extended period into the future however, the erosion of gold's value by inflation has nevertheless been expected by ABARE to see gold resume its downward trend in real terms towards US\$270/oz by 2007 – the same real value as in 2001.

In discussing the gold sector's outlook, some attention needs to be focused on central banks which loan gold to facilitate forward sales by gold producers. This has an important effect on the gold market because the gold loaned for producers' forward sales (or 'hedging') is immediately sold on the spot market (to be repaid later to the central bank from mine production). It brings future production immediately on to the market and has exerted downward pressure on gold prices, as the rate of new hedging has exceeded gold

repayments. However, this process was reversed for the first time in 2000 with a net reduction in producer hedging of around 15 tonnes which had the effect of increasing the physical demand for gold. The net reduction in hedging was estimated by ABARE to be around 101 tonnes in 2001 before falling to 30 tonnes in 2002. 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 domestic denominated gold prices.

A third factor behind the reduction in hedging activity has been consolidation within the gold industry with many large gold corporations having policies of reduced or no hedge books. For example, two camps have formed on the gold producer scene with the unhedged groups led by US-based Newmont Mining Corporation and the hedged group led by Barrick Gold Corp – and it was Newmont's takeover of Australia's Normandy, a big hedger and its promise to unwind that position over time that has been cited as a key factor in gold's recent jump above US\$300/oz.

Consolidation has therefore been affecting hedging patterns, with half of Australia's annual production foreign-owned and 34% now being unhedged. Overall, global hedging has declined in the past decade and the trend is expected to continue.

In terms of the State gold production outlook, the falling rate of gold exploration, which has failed to keep pace with production rates, is placing pressure on the level

## GOLD PRODUCTION



Source: MPR and ABARE

Figure 3.19

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 included Mount Charlotte, Fortnum, Peak Hill and Lady Ida. In addition, in early 2002, Dalgaranga closed and significantly, operations at Boddington have been suspended pending a feasibility study of a possible expansion.

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

- LionOre's-Dalrymple Resources's Thunderbox gold project. This project near Leinster, is expected to produce some 222,000 ounces of gold in the first year of its operation and 150,000 ounces per annum in subsequent years. Overall, total recovered gold is expected to be 800,000 ounces for the initial five-year open pit mine life; and
- Newcrest's resurrection of the massive Telfer gold mine. This would provide the largest 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 Super Pit as Australia's biggest gold mine when it resumes production in late 2004. Newcrest hopes to commence construction on the mine in the fourth quarter of 2002.

Other projects which will supplement the State's gold output include Gindalbie Gold's Minjar project near Yalgoo and AurionGold Limited and Resources Australia's White Foil project.

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.

### 3.6 Nickel

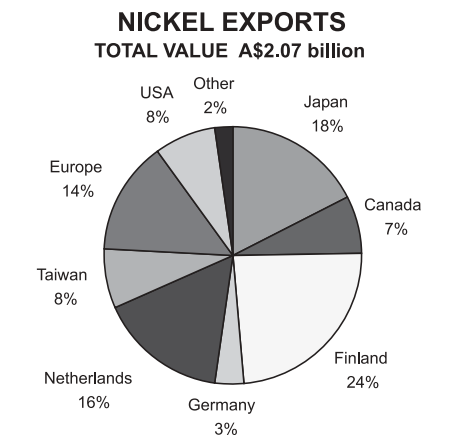
Western Australia currently accounts for all of Australia's nickel production and 18% of world nickel production. Most of Western Australia's nickel is exported to Europe and Japan.

The State's volume of nickel sales increased 18% to around 182 thousand tonnes in 2001. This represented the highest year in terms of sales volume in the industry's history. However, international nickel prices were down by almost a third, from an average in 2000 of US\$8,642/tonne (US\$3.92/lb) to US\$5,941/tonne (US\$2.70/lb) in 2001. Insufficiently compensated by a devaluation of the Australian dollar, lower prices led to the State's value of nickel sales dropping by 8% to \$2,081 million.

Overall, in terms of the major producers and their world share of **refined** nickel production, they comprise Inco, which accounted for 17% of world refined nickel production in 2001; Falconbridge, 8%; BHP Billiton, 6%; WMC, 5%; Eramet-SLN, 5%; Norilsk nickel 19%; and other producers 40%.

The increase in Western Australia's nickel output in 2001 was largely driven by stronger production from WMC's operations, together with the new nickel laterite projects (Cawse, Murrin Murrin and Bulong) gearing up to full production capacity.

In local developments, in August 2001 LionOre Australia (Nickel) Ltd commenced operation at its Emily Ann nickel sulphide project, located 540 km east of Perth. This project uses an on-site nickel sulphide

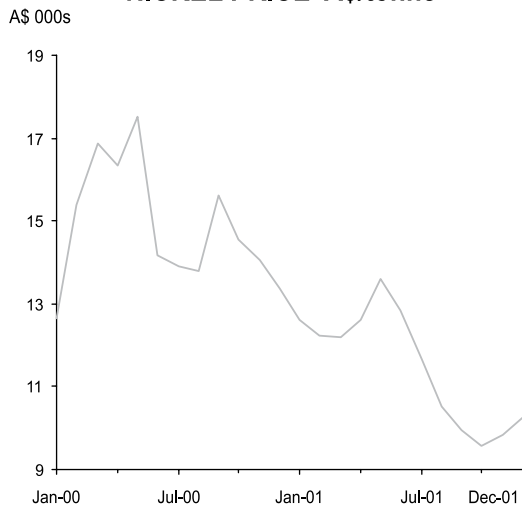


Source: MPR

Figure 3.20



## NICKEL PRICE A\$/tonne



Source: LME Cash, Monthly Average

Figure 3.21

concentrate plant with an annual throughput of 250,000 tonnes of ore producing concentrates containing an average of 6,700 tonnes of nickel per year.

Research into the treatment of nickel laterite also progressed with the opening of an ore pilot testing plant in Kewdale. This pilot plant has been commissioned to optimise the process configurations for the Ravensthorpe project and will provide leading-edge test facilities for other new laterite nickel deposits within Western Australia awaiting development.

Titan Resources also announced the successful development of the BioHeap process used for the biological recovery of nickel from low-grade base metal sulphide ores, with a large-scale pilot plant constructed and operating adjacent to Titan's Radio Hill underground mine, near Karratha. Titan also received a \$1.9-million Commonwealth Government Research and Development Start Grant to assist in the funding of the final phase of field development trials.

In terms of future local output, following the discovery of a high-grade nickel resource at the Cosmos nickel mine, 40 km north of Leinster, Jubilee Mines commenced the development of the Cosmos Deeps underground mine. This development will more than double the life of the present project which came on-stream earlier in mid-2000, increasing its mine life to seven years.

In other expansion developments, WMC launched a feasibility study into the expansion of its Mount Keith

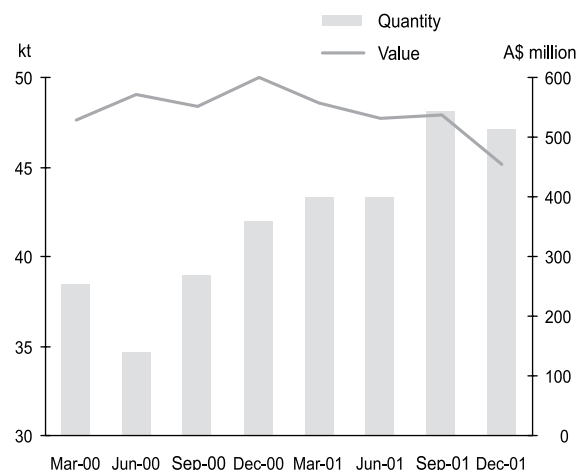
nickel operation near Leinster. The planned expansion would entail both the company's nearby North Six Mile deposit and Yakabindie nickel deposit which WMC acquired from Rio Tinto in early 2001.

Conversely, WMC's long history as a nickel miner at Kambalda came to an end in early 2002 with the closure of its Lanfranchi operation. Kambalda's history as a WMC company town stems back to late 1965 when a WMC drilling program hit massive nickel sulphides. Kambalda Nickel Operations (KNO) was established soon after, employing 1,500 people in its heyday and putting WMC on the map as a major world nickel producer. The Kambalda boom reached its peak in 1970 when South Australian company Poseidon reached \$280 per share on the strength of a nickel strike at its North Windarra project.

Nickel mining nevertheless continues in Kambalda with ex-WMC mines being operated by smaller operators. These include Titan Resources which purchased the north Widgiemooltha exploration block, the Miitel joint venture (Mincor Resources, Clough Mining and Donegal Resources) which bought the Miitel, Redross, Wannaway and Mariners deposits, Goldfields Mine Management which lease the Otter Juan and Coronet North tenements and Macmahon Holdings which operated the Blair mine. At the time of writing, WMC was also considering tenders for the Long Victor complex.

WMC also remains a major player in Kambalda by buying nickel ore from the new operators for its

## NICKEL Quantity and Value by Quarter



Source: MPR

Figure 3.22

Kambalda concentrator. The nickel concentrates are then trucked for further treatment at WMC's Kalgoorlie nickel smelter. WMC has projected however, a small 1% cut in its nickel production forecast for 2002 due to a fire at the Kalgoorlie smelter which broke out in February 2002.

The negative impact of the global slowdown in 2001 on the nickel market was severe, with the biggest fall in western world stainless steel production since 1982. Western world demand dropped 5% in 2001 and overall world consumption fell 3% to 1.089 million tonnes. There were massive falls in the Japanese (-17.5%) and US (-13%) markets. By contrast, European consumption, due to a shortage of scrap, increased 5% and Chinese demand apparently rose by a massive 37%. Western world nickel production on the other hand increased some 6% in 2001 to 1.120 million tonnes. In addition, while scrap exports from the Eastern Bloc collapsed, Russian exports of primary nickel nevertheless rose.

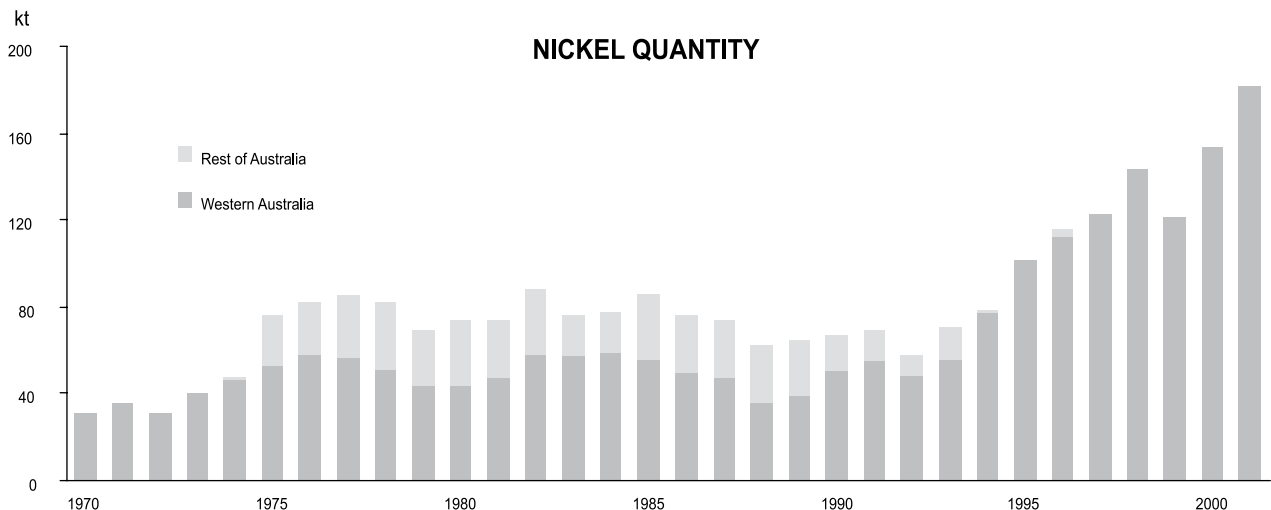
These factors combined to see nickel prices plummet in 2001 and to bottom-out at an average of US\$4,828/tonne (US\$2.19/lb) in October 2001. Average prices have since rallied quite strongly and risen beyond expectations, already at US\$6,541/tonne (US\$2.97/lb) in March 2001. Prices have been boosted by downward revisions in the projected size of surplus nickel supply over consumption in 2002, lower than expected volume of exports from Russia, higher Chinese imports and in addition, the intense destocking of stainless steel in Europe and the US appears to have ended.

A strong recovery in stainless steel production is expected to gather pace from mid-2002 and further

bolster nickel prices. Further into the future, ABARE's Outlook 2002 indicated that in the medium term, world nickel consumption is projected to rise not only in line with increased industrial activity, but also with expected growth in the market share of stainless steel in a range of applications, such as construction and materials containment. Global supply on the other hand is expected to be restricted, with 2003 and 2004 projected to show large deficits and potential shortages of nickel due to the absence of capacity additions.

Restrictions in additional output are seen to at least partly emanate from the inability to finance the next generation of Australian nickel projects. These global supply and demand fundamentals have already made themselves felt with the price of nickel continuing to rise in early April, well beyond the US\$6,900/tonne (US\$3.13/lb) mark. The current stance is now very bullish with ABARE's Outlook 2002 and other analysts projecting long-term nickel prices to reach in the vicinity of US\$9,175-9,370/tonne (US\$4.17-4.25/lb) in 2004 before easing off in later years.

While the above is good news for the bulk of traditional producers mining sulphide orebodies, Western Australia's laterite producers remain under financial pressure. It is estimated that the average cash costs of western world nickel production fell 3% in 2001 to US\$1.88/lb and this has been due largely to high prices received for platinum group metal by-products and the improving (although still relatively high cost) performance of the new Western Australian laterite processing plants. Indeed, Anaconda Nickel's Murrin Murrin mine, Preston Resource's Bulong operation and the OM Group's Cawse mine have all now moved into the middle of the cost curve. However,



Source: MPR and ABARE

Figure 3.23

all three projects continue to be constrained by technical problems, higher than anticipated capital costs and very weak prices for cobalt, production of which was supposed to underpin operational cash flows. As a result Preston Resources was forced to give its US bondholders, headed by London bank Barclays, a 95% stake in the Bulong project and at the time of writing, Anaconda remained locked in talks to reschedule \$820 million owed to bond holders in the US.

Essential to low-cost nickel production from laterite ore is revenue from by-product cobalt and among other difficulties, Anaconda's Murrin Murrin has suffered a double blow in this regard. Firstly, the cobalt price has collapsed and secondly, cobalt production at Murrin Murrin has been less than expected due to poor recovery rates and a lower cobalt grade. The original project budget forecast cobalt revenue of between US\$80 million and US\$100 million per year. That was based on a cobalt price of US\$15.00/lb and a cobalt recovery factor of 75%. However, in 2002, AME Mineral Economics forecasts a cobalt price of US\$8.00/lb and a recovery of 71%, up from only 65% estimated for last year. This equates to cobalt revenue of US\$35 million. In addition, the first high pressure acid leaching (HPAL) laterite plants originally forecast relatively low capital costs of around US\$5/lb of annual nickel production capacity. This compared with an accepted industry average of between US\$10/lb and US\$15/lb. But these estimates have proved optimistic, with AME revealing the true cost being closer to \$8-10/lb of capacity.

The third Western Australian laterite plant, Cawse, was taken over by the OM group from Centaur Mining in 2001. It is only producing intermediate nickel-cobalt hydroxide products at Cawse for supply to its refinery in Finland.

Against this background, AME reported earlier in 2002 that the real success story in nickel has been the continued cost reductions by existing producers around the world, in particular the major sulphide operators in Canada and Australia, even while some input costs have risen. It was reported that WMC has been the most successful in this regard, with average nickel costs falling by 25% over the last five years. A new cash-cost benchmark of around US\$1.00/lb is the goal that both sulphide and laterite nickel producers will now be aiming for, AME reported.

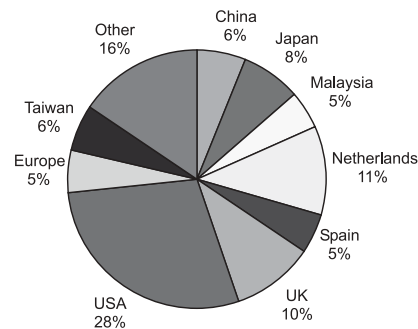
### 3.7 Mineral Sands

Western Australia is rich in mineral sands resources. Heavy minerals produced in the State include ilmenite, synthetic rutile, rutile, leucoxene, garnet, staurolite and zircon. Major producers in Western Australia are Iluka Resources Ltd, Tiwest Pty Ltd and Cable Sands (WA) Pty Ltd.

In 2001, the value of sales of the heavy mineral sands industry in Western Australia increased by 5.4% to \$909 million. Approximately 73%, or \$662 million worth of the State's mineral sands products were exported. The major export destinations for the State's mineral sands were the United States (accounting for 29% of total exports), Netherlands (11%), UK (10%), Japan (8%), China (6%), Taiwan (6%), Europe (5%), Spain (5%) and Malaysia (5%).

#### HEAVY MINERAL SANDS EXPORTS

TOTAL VALUE A\$661.86 million



Source: MPR

Figure 3.24

The sluggish global economy in the past year had a significant impact on sales volume of the Western Australian mineral sands industry. However, the impact varied across mineral sand categories. During 2001, volume of sales of all heavy minerals in the titanium group except for synthetic rutile experienced contraction, ranging from 7.6% (rutile) to 35.6% (ilmenite). Despite a moderate 4.7% increase in quantity of synthetic rutile sold, volume of sales for the titanium group as a whole (including ilmenite, synthetic rutile, rutile and leucoxene) dropped substantially by 21.9% to 1.6 million tonnes. This compares with a 10.4% increase in 2000. Outside the titanium group, the quantity of garnet and zircon sold increased by 11.6% and 1.5%, respectively. While relatively very small in quantity, it is noteworthy that 2001 also saw the first exports of 1,021 tonnes of staurolite. Staurolite is used as a blasting abrasive

and can be described as an aluminium silicate with physical qualities similar to garnet. The product was previously regarded as a contaminant mineral and trash by-product of Tiwest's titanium operations from its Cooljarloo orebodies and Chandala processing plant.

The significant fall in sales volume in the titanium group was mainly attributable to declining feedstock consumption for the manufacture of titanium dioxide (TiO<sub>2</sub>) pigment and weak feedstock demand for titanium metal production. Weak demand for feedstock resulted from the slowdown of the world economy, in particular the US economy and the events of September 11.

Rutile and ilmenite are mainly processed as feedstock to manufacture titanium dioxide pigment for use in paints, plastics, paper, ink, rubber, textiles, cosmetics, leather and ceramics. Approximately 33% of global TiO<sub>2</sub> consumption is accounted for by the United States, followed by Europe (24%) and Japan (8%). The US accounts for 40% of world pigment production. Rutile and ilmenite are also used to produce super strong, light-weight and corrosion-resistant titanium metal for aircraft, spacecraft, motor vehicles and medical implants. The aerospace industry dominates global demand for titanium metal, accounting for more than 50% of its overall consumption.

As a result of slowing economic growth in the US and the sharp downturn in the aerospace sector caused by the events of September 11, 2001 saw a plunge in demand for titanium feedstocks by pigment producers, titanium sponge producers and welding electrode manufacturers. Apparent consumption of TiO<sub>2</sub> pigment in the US dropped 6% year-on-year and world demand for titanium feedstocks fell by 3.2%. Some of the most significant titanium companies have cut production levels. For example, in early 2001, Allegheny Technologies decided to idle its titanium sponge production facility at the Oremet plant in Oregon in the US due to severe market conditions for stainless steel and higher energy costs. Titanium Metals Corp (Timet), one of the world's leading producers of titanium mill products, also reduced production at its Nevada and Pennsylvania facilities in late 2001. Some titanium companies across Europe have cut their orders by 20-50%. Many long-term orders have also been altered to accommodate the decline in demand. Against such difficult market conditions, the decrease in titanium feedstocks sales

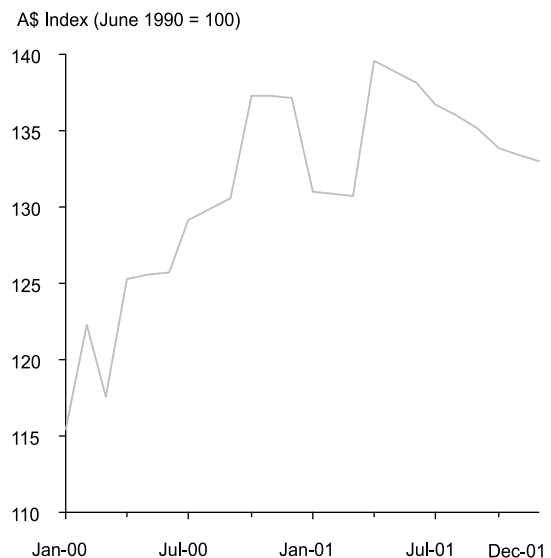
by the Western Australian mineral sands industry is not unexpected given that the industry is highly export-oriented.

Lower ore grades also contributed to falling production of ilmenite and rutile. For example, Iluka reported that the lower rutile contents of ore bodies mined during 2001 caused a 13% drop in its rutile production.

Compared with the poor performance of most titanium minerals, the moderate 4.7% increase in sales volume of synthetic rutile was quite impressive. On the one hand, the resilience of synthetic rutile reflected the commissioning of all Iluka's processing plants in the State in 2000 and the competitiveness of Western Australian producers. On the other hand, it reflected the favourable position of the chloride process in pigment production. Relative to the sulphate route process, the chloride process is taking over as the preferred procedure. Currently, the chloride process accounts for about 57% of world production of TiO<sub>2</sub> pigment. It is forecast that this share will increase to 70% by 2010. Although ilmenite cannot be used as a raw material in the chloride process as its titanium content is too low, upgraded ilmenite (synthetic rutile) is ideally suited to processing via the chloride route. The popular chloride process has seen the world-wide growth in demand for synthetic rutile in recent years.

In terms of sales value, the results for titanium minerals were less disappointing. Due primarily to dramatic depreciation of the Australian dollar which strongly

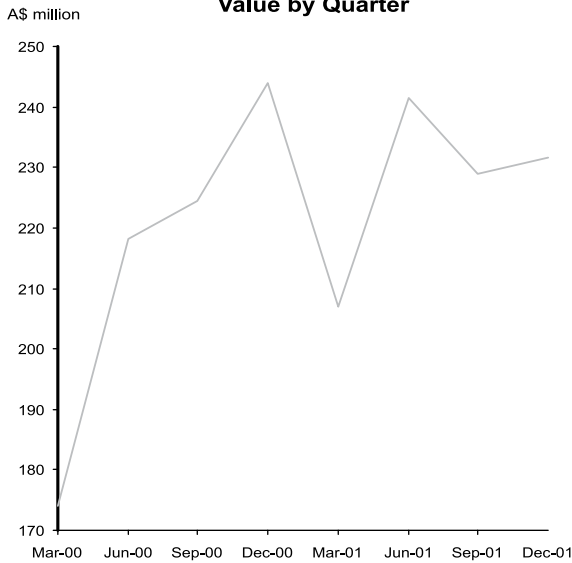
## HEAVY MINERAL SANDS PRICE INDEX



Source: WA Treasury

Figure 3.25

## HEAVY MINERAL SANDS Value by Quarter



Source: MPR

Figure 3.26

boosted export revenue in local currency, the magnitude of the reduction in the value of sales of ilmenite, rutile and leucoxene was not as large compared to the corresponding reduction in sales volume. For the titanium group as a whole, the value of sales in 2001 was just 1.9% below that in 2000. Overall, heavy mineral sands recorded a 5.4% increase in the value of sales for 2001.

The largest sector (by value) of the State's mineral sands industry is upgraded ilmenite (synthetic rutile). The value of synthetic rutile sales climbed almost 11% to \$419 million in 2001. Significant increase in the value of synthetic rutile sales saw its share of total value of mineral sands sales improve by two percentage points to 46%.

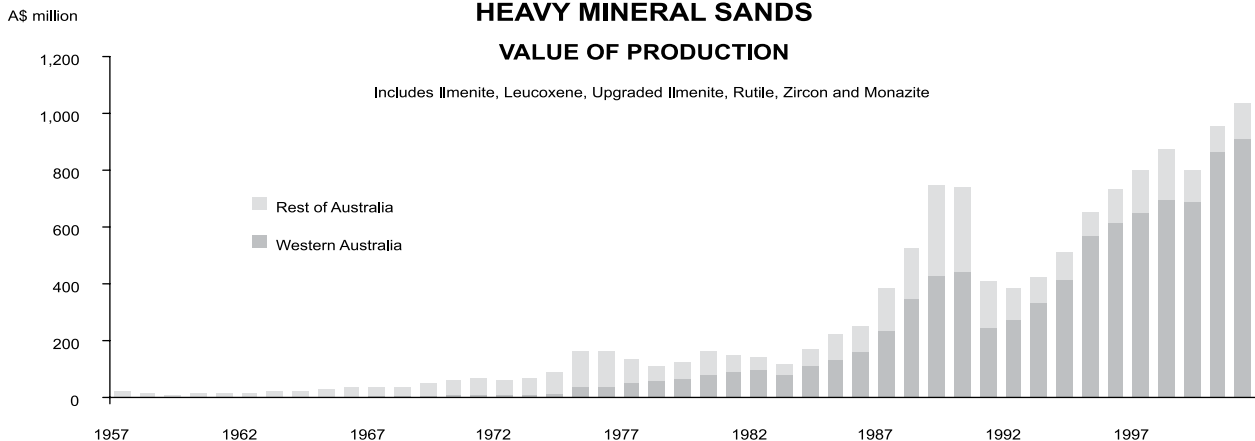
With a substantial 34% increase in the value of sales to \$230 million, the zircon sector became the second-largest contributor (by value) to the State's total mineral sands sales in 2001, surpassing ilmenite. As a portion of total mineral sands sales value, zircon's share rose considerably to 25%, at the expense of ilmenite and rutile, compared to 20% in 2000. Iluka is the world's largest supplier of zircon, contributing a third of the world's total.

The exceptional performance of zircon was mainly due to growing global demand, rising prices and a depreciated Australian dollar. World consumption of zircon increased by 3% in 2001 following a growth rate of over 5% in 2000. A major factor in the continuing increase in world demand for zircon was China, which became the world's largest zircon consumer in 2001. Over the last decade, China's zircon consumption has grown at an average rate of 12% per year. During the first half of 2001, Australia's zircon exports to China (including Hong Kong) were 40% higher above those over the same period in 2000. With strong demand, average prices for zircon in 2001 rose by 14% in US\$ terms and over 27% in A\$ terms compared with 2000.

The State's garnet sector saw its value of sales rise 10.5% above 2000 to almost \$12 million. As a new entrant, staurolite also contributed \$169,505 to the State's value of mineral sands sales in 2001.

During 2001, most activities in the Australian mineral sands industry occurred outside Western Australia. A major headline was development work in the Murray Basin region, which spreads around the adjoining borders of South Australia, New South Wales and

## HEAVY MINERAL SANDS VALUE OF PRODUCTION



Source: MPR and ABARE

Figure 3.27



Victoria. Regarded as Australia's most successful exploration area in recent years, the Murray Basin is viewed as a medium-term replacement for depleting mineral sand deposits in Australia as well as other countries. Companies that have been actively involved in development work in the Murray Basin include Murray Basin Titanium Pty Ltd (MBT), BeMex Resources, Southern Titanium and Basin Minerals. MBT made its first shipment from its Wemen project in January 2001, representing the first commercial production of heavy mineral sands in the Murray Basin.

New developments during 2001 in Western Australia include:

- Iluka began to build a \$20-million-zircon finishing plant at the Company's Geraldton mineral processing complex. Once commissioned in mid-2002 as scheduled, the new plant will grade the mineral into products with application for ceramic glazes, refractory linings and chemical processing.
- Doral Mineral Sands Pty Ltd commenced asset acquisition and construction to bring a new 130,000 tpa open-pit mine at Dardanup into operation at a cost of over \$30 million. The production is due to commence in July 2002. The company plans mining 120,000 tpa of titanium-based minerals and 10,000 tpa of zircon over a nine-year period.
- Magnetic Minerals commenced exploration work at Dongara, adjacent to Iluka's Eneabba tenements in Western Australia.
- The Tiwest Joint Venture commenced evaluating a 50,000-tpa expansion of its synthetic rutile capacity at Chandala in Western Australia. If the expansion proceeds, capacity could increase from 200,000 tpa to 250,000 tpa.
- Cable Sands (WA) continued to evaluate the development of the Jangardup South project in Western Australia to replace production from its Jangardup mine, which was scheduled to continue mining until 2002. Cable Sands (WA) estimated that the deposit in Jangardup South would provide 1.8 million tonnes of minerals. Mining of the deposit will not take place until the project has been fully evaluated by State and federal environmental authorities.

The slowdown in the US economy during 2001, exacerbated by the events of September 11, has reduced demand for pigment and hence titanium feedstock. The strength of the US titanium dioxide pigment industry remains critical to the world titanium feedstocks market in 2002. Although there are early signs of recovery in the US economy, considerable uncertainties still exist with respect to the timing and size of the recovery. As a result, demand for pigment and titanium dioxide feedstock has remained subdued in the short term.

In the medium to longer term, little changes to world pigment capacity are expected. Over the next five years, according to AME Mineral Economics, major proposed additions in the mid-1990s will remain deferred. Expansion will be restricted to marginal increases already announced, mainly through incremental upgrading and reducing bottle-necks in existing plants. In contrast to the relatively stable situation on the demand side, numerous new feedstock projects are under consideration in Africa, Australia, India and North America. Southern Mining Corporation's Corridor project in southern Mozambique, Kenmare's Moma project in northern Mozambique, Tiomin Resources' Kwale project in Kenya, Basin Minerals' Douglas project in the Victorian section of the Murray Basin in Australia and BeMex's Gingko project in the NSW section of the Murray Basin in Australia are just a few examples. In addition, existing feedstock suppliers are actively investigating expansion opportunities to defend their market shares. Feedstock supply capacity is projected to increase by 26% to 6.1 million tonnes per year in 2006. The growing imbalance between the pigment manufacturing and feedstock supply sectors is likely to result in great downwards pressure on sales volume and prices for titanium feedstocks in the longer term.

### **3.8 Diamonds**

2001 was a less-than-encouraging year for diamonds. Compared with the record-breaking level of \$714 million set in the previous year, the sales value of the Western Australian diamond industry fell significantly by 30% to \$500 million. Volume of sales also fell substantially by 48.8% to 21.7 million carats. As a result of falling sales value, the share of the minerals and petroleum industry accounted for by the diamond sector dropped from 2.8% in 2000 to 1.8% in 2001, representing a 33.5% reduction. Nevertheless,

Western Australia remains a prominent diamond producer in the world, accounting for 99.6% of Australia's diamond output and 20% of the world's total mine production in 2001.

The major factor affecting the diamond industry's performance in 2001 was weak demand in the US, Japan and Asia resulting from sluggish global economic growth. The US accounts for 50% of the global retail diamond jewellery market with annual sales of around US\$25 billion per year, well ahead of Japan (US\$11 billion) and Europe (\$7 billion). Sales in the US had been hit by the economic downturn in 2001. In Japan, diamond demand has been falling since the mid-1990s. The falling confidence of consumers accelerated by the events of September 11 and destocking by retailers ahead of an anticipated decline in demand slashed sales of rough diamonds by 21.5% compared to the year before, resulting in 25-30% reduction in diamond prices. Medium-quality products suffered the worst, followed by higher-quality categories. The fact that volume fell more than values in Western Australia was mainly attributable to significant depreciation of the Australian dollar in the year, which offset partly the falling price effects through increasing receipts in local currency.

The world diamond industry has been trying to meet challenges of difficult market conditions. During 2001, South African diamond conglomerate De Beers, the largest diamond mining company in the world, initiated a review of its operations in response to sluggish growth in diamond sales. The De Beers Central Selling Organisation (CSO), which until recently managed the sales of more than 75% of the western world's diamonds, has been the principal controller of rough diamond sales to world markets for decades. As a result of the review, De Beers dismantled and replaced the CSO by the Diamond Trading Company, aimed at streamlining the marketing system for rough diamonds.

Despite difficult conditions confronting the diamond industry in the past year, new developments continued in Western Australia. The highlight of the diamond industry for 2001 was a new diamond mine that could be operating in the State in the near future.

The Argyle Joint Venture, Australia's dominant producer of diamonds, has been operating the only diamond mine in Western Australia over the past two

decades. Between 1994-2001, the average annual production from the Argyle mine was around 35 million carats. The Argyle Joint Venture originally sold its output through the CSO. However, since 1996 the Argyle partners opted to market their production independently of the CSO. The major portion of Argyle's diamonds are exported to Antwerp and sold to 15-16 customers in India.

At the end of 2001, the Western Australian Government cleared the way for a second diamond mine in the State by amending legislation to free the Ellendale Mining Lease for development by Kimberley Diamond Company NL. Amendments comprised changes to the *Diamond (Argyle Diamond Mines Joint Venture) Agreement Act 1981-1983* to excise the Ellendale lease area formerly held by owners of the Argyle diamond mine for transfer to the Perth-based Kimberley Diamond Company. Kimberley Diamonds agreed to compensate Rio Tinto \$23 million for the Ellendale tenement.

The Kimberley Diamond Company is now able to proceed with a potential plan to develop a two-stage mining operation at Ellendale, near Broome in Western Australia's Kimberley region. The first stage is expected to begin operating in May 2002 and is forecast to produce around 100,000 carats per annum. If the operation is successful and diamond reserves in the region are proven, the company will consider increasing throughput at the mine with an additional \$26-million investment to expand the mine and extend the life of the project by ten years. The Kimberley Diamond Company has recently unveiled an impressive mineral resource containing over 2.6 million carats at the field's two main pipes. This discovery enhances the prospect of establishing a long-term diamond mining and processing operation at Ellendale.

The renaissance experienced by the diamond industry in the Kimberley region has aroused wide interest among investors. Examples include:

- an agreement announced in March 2002 between Striker Resources NL and joint venture partner AKD Limited to provide De Beers with a 12-month right to explore for diamonds at the Seppelt Range diamond project in the Kimberley;
- the formation of a joint venture partnership between Thundelarra Exploration and BHP Billiton on the Phillips Range diamond project in the Kimberley;

- the successful completion in February 2002 of a \$3-million initial public offering by Flinders Diamond Limited which plans to explore in an area 200 kilometres south-west of the Argyle Diamond mine.

The global diamond market has been improving since January 2002. With emerging signs of better than anticipated recovery in the US economy as well as the world economy, future prospects for the global diamond industry appear encouraging. Global production has increased six-fold since 1950, to the current 125 million carats per annum. Some industry observers have forecast that this output could surge to 160 million carats by 2008 in response to increased world demand. Nevertheless, some uncertainties still exist. Areas of concern for the diamond industry include aggressive destocking by De Beers over the past two years, the high level of cutting-centre debt and the continued build-up of stocks of diamonds.

### 3.9 Other Minerals

#### Base Metals

The total value of Western Australian base metal sales decreased 6% in 2001 to \$375 million. This was chiefly due to the State's largest base metal sector, zinc, falling in sales value by 28% on the back of weak international zinc prices which were down 21% in 2001 and quantity of sales which decreased by 16% to 218,000 tonnes.

Copper prices were also down in 2001, on average by 13% in 2001. However, the devaluation of the Australian dollar over 2001 ameliorated this decrease. This meant that in 2001, the copper sector's output increase of 48% to over 50,000 tonnes translated to an almost equal 46% increase in sales value to \$121 million.

In contrast to the above, international lead prices were up some 5% during 2001 which in combination with the value of the Australian currency translated to healthy returns for local producers. Overall, lead sales were up 25% to 91,000 tonnes and the value of sales increased in 2001 by a dramatic 75% to \$45 million.

#### Coal

Western Australia has two coal producers, Wesfarmers and Griffin. They are located in the south-west of the State and all of the State's coal supplies are sold on the domestic market, with the majority being used by Western Power for electricity generation. At 6.2 million tonnes in 2001, the quantity of coal sales remained static for the year. Likewise, the value of these sales was almost unchanged at \$258 million.

#### Salt

In 2001, the quantity of salt produced increased by 11% from 7.7 million tonnes in 2000 to 8.6 million tonnes. Thanks to better prices and the devaluation of local currency, the value of Western Australian salt sales increased by over 26% from \$197 million to \$249 million over the same period.

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, 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.

Dampier Salt's production is exported, principally to Asia, with its largest customers in the chemical industry in Japan, Korea, Taiwan and Indonesia. A proportion of output is used for food processing and domestic consumption in Malaysia and the Philippines.

The State's salt production can be expected to receive a further boost in 2002 with Onslow Salt having commenced production. The Onslow Salt project began its first harvest 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.

## *Tantalum*

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.

During 2001, sales of tantalum from Western Australia increased by a very impressive 32% from 611 tonnes to 806 tonnes. In terms of sales value, the increase was even more dramatic with the value rising by 85% from \$97 million to \$179 million in 2001. These increases 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 2001 at Bald Hill, in the Eastern Goldfields region and made its first shipment of concentrate in August. The company is also carrying out a feasibility study of the Cattlin Creek deposit in the Ravensthorpe area.

It is expected that future output of tantalum will further increase with not only the expansion of the Greenbushes and Wodgina operations, but also with new additional operations. 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 commencement of a new operation with Haddington. In addition, in late 2001, Australasian Gold Mines NL carried out a mining campaign at Dalgaranga in the Murchison. At that time, tantalum ore was stockpiled awaiting completion of a new crushing plant. Once the crusher is in operation, the company expects to commence on-site processing of tantalum concentrate.

## *Manganese*

In Western Australia, manganese is produced by Consolidated Minerals from its Woodie Woodie operation in the Pilbara. The Company re-commenced 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. All up, the value of the State's manganese sales in 2001 was over \$76 million. This represented a dramatic 126% increase on 2000. Devaluation of the Australian currency and an almost doubling in physical sales volume were the chief reasons for this increase. Sales volumes in 2001 totalled 499,000 tonnes, up over 92% on the previous year.

## *Cobalt*

With the growing nickel industry in Western Australia and burgeoning prominence of nickel laterite projects, the State has witnessed 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 only 487 tonnes and the value of this was \$6 million. In 2001 the volume was 1,927 tonnes and the value of sales was over \$75 million. Compared with the previous year, this represented a 23% increase in sales volume, which was in keeping with the growing nickel sales output. However, the value of these cobalt sales was down around 5%, reflecting the very depressed state of cobalt prices which were experienced in 2001.

## 4. MINERAL AND PETROLEUM INDUSTRY EMPLOYMENT 2001

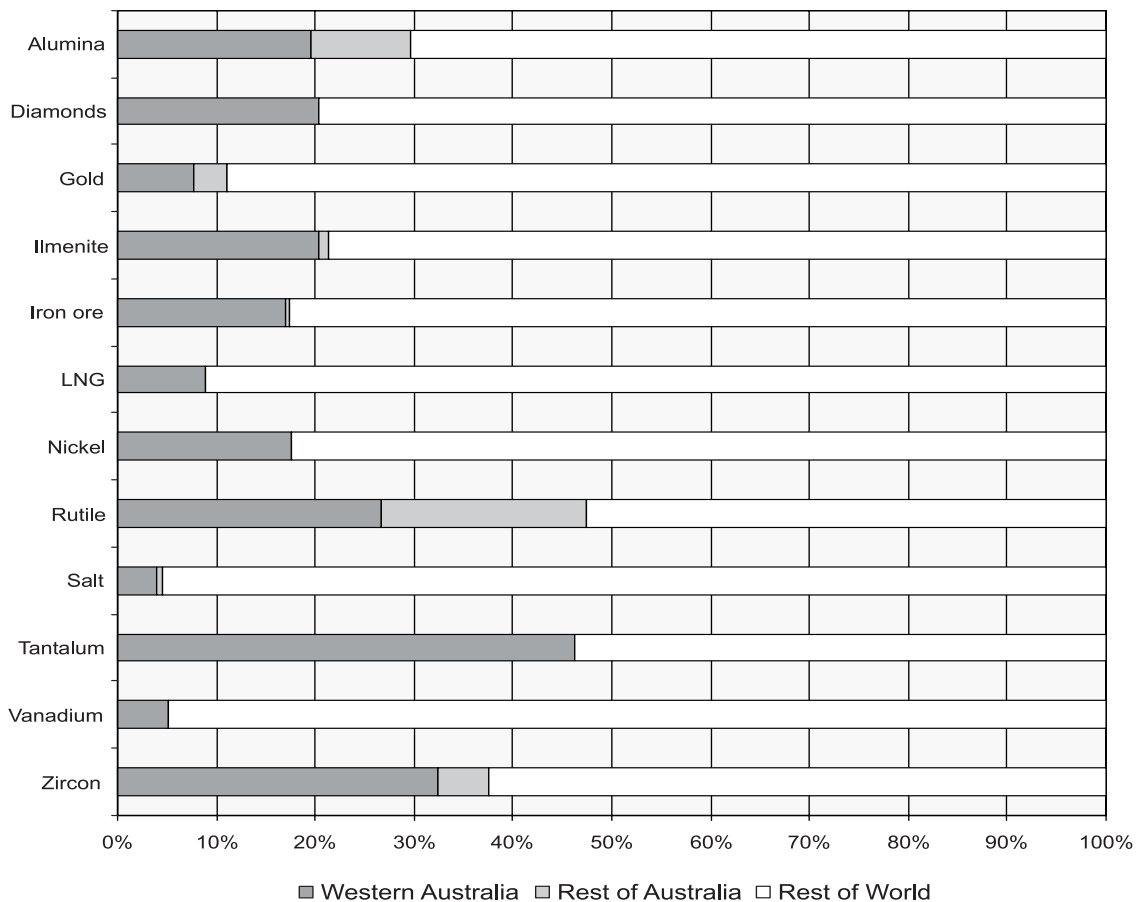
Total direct employment in the industry increased by a little over 4% in 2001 to reach 42,053.

Despite the smaller number of large companies involved, the Western Australian gold mining sector remains the most significant employer in the State's minerals and petroleum industry. In 2001, the gold industry accounted for 11,938 or 28% of all people employed in the State's mining and petroleum industry. Although this was only marginally up on the previous year's employment figure, it represents a 10% increase on the gold industry's employment one decade earlier.

Another significant employer is the iron ore industry, where employment increased almost 6% to 9,103. This represented almost 22% of total employment in the State's mineral and petroleum sector.

The Department of Mineral and Petroleum Resources employment statistics are compiled from monthly industry returns supplied for the purpose of monitoring the number and nature of workplace accidents. The employment figures published therefore reflect the number of employees on a mine site at any point in time, including contract workers.

### SELECTED WA COMMODITIES RELATIVE TO WORLD PRODUCTION ENDING 2001, BY QUANTITY



The latest comparable data show that the Western Australian share (by quantity) of the world's output of the following products was: alumina 20%, gold 8%, ilmenite 20%, iron ore 17%, LNG (world trade) 9%, nickel 18%, rutile 27%, salt 4%, tantalum 45%, vanadium pentoxide 5%, zircon 32% and 20% of diamonds (mainly industrial grade).

Figure 4.1



# 2001 STATISTICS DIGEST

**TABLE 1**
**QUANTITY AND VALUE OF MINERALS AND PETROLEUM**

COMMODITY	UNIT	2000		2001	
		QUANTITY	VALUE (A\$)	QUANTITY	VALUE (A\$)
<b>ALUMINA</b>					
Alumina	t	10,003,058	3,187,472,430	10,748,039	3,766,551,734
<b>BASE METALS</b>					
Copper Metal	t	34,038 (r)	82,608,861 (r)	50,276	120,820,840
Lead Metal	t	73,081	25,761,448	91,383	44,965,159
Zinc Metal	t	257,712	290,114,283 (r)	217,634	208,925,520
<b>TOTAL BASE METALS</b>			<b>398,484,592 (r)</b>		<b>374,711,519</b>
<b>CHROMITE</b>					
Chromite	t	26,927	5,902,204	6,087	996,294
<b>CLAYS</b>					
Attapulgite	t	11,860	1,238,563	13,194	1,377,850
Clay Shale	t	18,785	187,850	7,194	71,940
Fire Clay	t	107,761 (r)	186,574 (r)	29,371	56,215
Kaolin	t	2,434	203,198	480	50,618
Saponite	t	729	49,004	1,659	125,641
<b>TOTAL CLAYS</b>			<b>1,865,189 (r)</b>		<b>1,682,264</b>
<b>COAL</b>					
	t	6,204,588	257,838,999	6,204,695	258,211,794
<b>CONSTRUCTION MATERIALS</b>					
Aggregate	t	184,081	2,023,384	519,620	4,190,023
Gravel	t	188,796 (r)	1,192,908 (r)	170,113	1,131,146
Rock	t	257,623 (r)	1,864,118 (r)	252,791	1,944,452
Sand	t	1,563,908 (r)	7,269,988 (r)	1,118,358	5,453,298
Sandstone	t	1,100	55,000	0	0
<b>TOTAL CONSTRUCTION MATERIALS</b>			<b>12,405,398 (r)</b>		<b>12,718,919</b>
<b>DIAMONDS</b>					
	ct	42,300,118	713,684,538	21,679,930	499,534,159
<b>DIMENSION STONE</b>					
Granite	t	1,585 (r)	399,970 (r)	800	194,886
Marble	t	0	0	227	80,620
<b>TOTAL DIMENSION STONE</b>			<b>399,970 (r)</b>		<b>275,506</b>
<b>GEM AND SEMI-PRECIOUS STONES</b>					
Agate	kg	7,186	4,312	0	0
Chalcedony/Mookaite	kg	0	0	6,344	3,172
Chrysoprase	kg	125	383	16,171	36,315
Emerald	kg	0	0	12	20,000
Jasper	kg	20,742	12,445	14,430	8,658
Variscite	kg	40,090	24,054	111,830	67,098
<b>TOTAL GEM AND SEMI-PRECIOUS STONES</b>			<b>41,194</b>		<b>135,243</b>
<b>GOLD</b>					
	kg	199,043 (r)	3,078,646,487 (r)	191,708 (e)	3,227,581,261
<b>GYPSUM</b>					
	t	1,058,801 (r)	19,248,834 (r)	1,087,432	22,968,576
<b>HEAVY MINERAL SANDS</b>					
Garnet	t	97,443	10,723,191	108,698	11,844,085
Ilmenite	t	1,296,485 (r)	185,466,127	836,225	137,315,560
Upgraded Ilmenite (a)	t	617,534 (r)	377,504,480 (r)	646,459	418,660,055
Leucoxene	t	37,849	16,550,625	24,792	12,149,759
Rutile	t	122,147	100,575,286	112,927	99,085,695
Staurolite	t	0	0	1,021	169,505
Zircon	t	347,933	172,107,391	353,169	229,999,326
<b>TOTAL HEAVY MINERAL SANDS</b>			<b>862,927,100 (r)</b>		<b>909,223,985</b>
<b>INDUSTRIAL PEGMATITE MINERALS</b>					
Feldspar	t	62,631	2,487,199 (r)	29,733	1,494,518

# 2001 STATISTICS DIGEST

**TABLE 1 (Cont.)**
**QUANTITY AND VALUE OF MINERALS AND PETROLEUM**

COMMODITY	UNIT	2000		2001	
		QUANTITY	VALUE (A\$)	QUANTITY	VALUE (A\$)
<b>IRON ORE</b>					
Domestic	t	5,780,878	163,634,792	7,282,826	235,698,057
Exported	t	153,084,739	4,201,552,721	154,962,856	5,010,230,940
<b>TOTAL IRON ORE</b>		<b>158,865,617</b>	<b>4,365,187,513</b>	<b>162,245,682</b>	<b>5,245,928,997</b>
<b>LIMESAND-LIMESTONE-DOLOMITE</b>					
Dolomite	t	2,932	64,504	9,103	146,074
Limesand-Limestone	t	2,968,501 (r)	13,949,154 (r)	3,439,784	14,411,291
<b>TOTAL LIMESAND-LIMESTONE-DOLOMITE</b>			<b>14,013,658 (r)</b>		<b>14,557,365</b>
<b>MANGANESE ORE</b>	t	<b>259,536</b>	<b>33,614,116</b>	<b>498,603</b>	<b>76,091,438</b>
<b>NICKEL INDUSTRY</b>					
Cobalt By-Product	t	1,564	79,316,782	1,927	75,227,135
Cobalt Metal	t	1,013	47,020,250	1,483	48,471,747
Cobalt Sulphide	t	1,022	31,317,780	856	18,861,613
<b>TOTAL COBALT</b>			<b>157,654,812</b>		<b>142,560,495</b>
Nickel Concentrate	t	860,689 (r)	1,912,004,771 (r)	1,010,246	1,678,601,322
Nickel Metal	t	23,939	339,672,398	35,301	402,713,927
Palladium By-Product	kg	812 (r)	28,280,483 (r)	828	32,267,391
Platinum By-Product	kg	171	4,976,316	174	5,302,472
<b>TOTAL NICKEL INDUSTRY</b>			<b>2,442,588,780 (r)</b>		<b>2,261,445,607</b>
<b>PETROLEUM</b>					
Condensate	kl	6,196,347 (r)	1,946,370,988 (r)	6,015,068	1,787,908,337
Crude Oil	kl	13,743,415 (r)	4,472,416,146 (r)	14,061,255	4,246,653,099
LNG	Btu 10 <sup>6</sup>	384,637,059 (r)	2,524,830,245 (r)	445,137,300	2,901,258,286
LPG - Butane	t	450,571	225,367,268 (r)	475,246	217,539,558
LPG - Propane	t	364,533 (r)	183,355,542 (r)	385,834	185,081,893
Natural Gas	'000m <sup>3</sup>	6,929,520	607,642,507 (r)	7,741,021	646,370,705
<b>TOTAL PETROLEUM</b>			<b>9,959,982,696 (r)</b>		<b>9,984,811,877</b>
<b>PIGMENTS</b>					
Red Oxide *	t	1,438 (r)	685,189 (r)	1,332	45,618
<b>SALT</b>	t	<b>7,705,425 (r)</b>	<b>197,315,760</b>	<b>8,576,415</b>	<b>249,240,285</b>
<b>SILICA-SILICA SAND</b>					
Silica	t	92,149	921,493	98,162	981,620
Silica Sand	t	491,046 (r)	6,156,146 (r)	469,987	5,579,428
<b>TOTAL SILICA-SILICA SAND</b>			<b>7,077,639 (r)</b>		<b>6,561,048</b>
<b>SILVER</b>	kg	<b>157,639 (r)</b>	<b>37,362,915 (r)</b>	<b>115,964</b>	<b>29,017,565</b>
<b>SPONGOLITE</b>	t	<b>11,407</b>	<b>2,355,238</b>	<b>14,300</b>	<b>1,908,974</b>
<b>TALC</b>	t	<b>179,381</b>	<b>14,467,388</b>	<b>160,867</b>	<b>14,201,162</b>
<b>TIN-TANTALUM-LITHIUM</b>					
Spodumene	t	65,504	n/a	79,859	n/a
Tantalite	t	611	n/a	806	n/a
Tin Metal	t	713	6,248,086	976	7,787,068
<b>TOTAL TIN-TANTALUM-LITHIUM</b>			<b>119,551,910</b>		<b>205,733,427</b>
<b>VANADIUM</b>	t	<b>2,695</b>	<b>17,493,593</b>	<b>4,450</b>	<b>25,297,369</b>
<b>TOTAL VALUE</b>			<b>25,753,100,530 (r)</b>		<b>27,190,926,504</b>

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

\* Subject to revision

(e) Estimate

(r) Revised from previous edition

n/a Breakdown of spodumene and tantalite values not available

# 2001 STATISTICS DIGEST

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

	Unit	1992		1993		1994		1995	
		Quantity	Value \$M	Quantity	Value \$M	Quantity	Value \$M	Quantity	Value \$M
ALUMINA	Mt	7.08	1,689.72	7.80	1,891.86	7.93	1,684.58	8.07	1,757.36
<b>BASE METALS</b>									
Copper Metal	kt	12.09	18.68	28.98	30.21	35.11	68.13	24.31	73.29
Lead Metal	kt	20.96	7.43	32.28	7.84	20.29	7.32	15.64	8.25
Zinc Metal	kt	141.39	132.98	141.10	87.02	123.62	85.14	126.34	87.73
TOTAL BASE METALS			159.09		125.07		160.59		169.27
COAL	Mt	5.66	251.76	5.47	248.44	5.03	234.02	6.06	280.66
DIAMONDS	M ct	41.15	565.06	22.65	486.77	27.72	470.34	23.45	480.15
GOLD	tonnes	182.10	2,751.38	183.47	3,139.61	192.98	3,265.93	189.48	3,163.66
<b>HEAVY MINERAL SANDS</b>									
Ilmenite	Mt	1.04	87.30	1.01	85.40	1.08	93.52	1.00	96.27
Rutile	kt	68.96	39.05	56.60	29.97	87.16	44.46	124.87	68.14
Upgraded Ilmenite	kt	376.00	177.48	375.00	174.42	453.00	208.47	535.00	254.58
Zircon	kt	265.17	51.46	299.76	46.26	444.26	99.00	458.44	152.54
Other HMS			10.26		6.49		6.62		8.07
TOTAL HEAVY MINERAL SANDS			365.55		342.54		452.07		579.60
IRON ORE	Mt	108.15	2,921.98	116.34	2,996.73	124.26	2,630.61	135.97	2,980.69
MANGANESE ORE	kt	402.84	72.20	247.86	43.40	202.52	22.74	227.90	28.42
NICKEL METAL	kt	48.04	461.54	55.46	437.74	77.00	630.13	101.36	1,094.17
<b>PETROLEUM</b>									
Condensate	Gl	2.06	366.70	2.17	359.86	2.34	331.19	3.83	564.91
Crude oil	Gl	5.05	917.36	4.05	709.32	8.75	1,299.75	8.68	1,384.83
LNG	Btu 10 <sup>12</sup>	237.64	966.47	264.75	997.88	335.11	1,080.17	375.37	1,390.75
LPG - Butane	kt	0	0	0	0	0	0	19.42	4.73
LPG - Propane	kt	0	0	0	0	0	0	14.14	3.44
Natural Gas	Gm <sup>3</sup>	3.78	368.96	4.21	422.96	4.92	441.96	5.83	421.92
TOTAL PETROLEUM			2,619.49		2,490.02		3,153.07		3,770.58
SALT	Mt	6.67	155.39	6.53	159.57	6.86	153.49	7.29	155.81
OTHER			132.36		112.77		149.67		182.81
<b>TOTAL</b>			<b>12,145.52</b>		<b>12,474.52</b>		<b>13,007.24</b>		<b>14,643.18</b>

# 2001 STATISTICS DIGEST

1996		1997		1998		1999		2000		2001	
Quantity	Value \$M	Quantity	Value \$M	Quantity	Value \$M	Quantity	Value \$M	Quantity	Value \$M	Quantity	Value \$M
8.25	1,967.81	8.48	2,084.71	8.75	2,429.70	8.93	2,311.38	10.00	3,187.47	10.75	3,766.55
23.07	51.28	28.32	62.46	28.24	57.13	26.23	46.25	34.04	82.61	50.28	120.82
17.08	9.90	23.20	9.91	39.52	15.09	55.28	17.23	73.08	25.76	91.38	44.96
106.86	71.28	117.20	118.10	149.33	127.85	222.54	219.59	257.72	290.11	217.63	208.93
	132.46		190.47		200.07		283.07		398.48		374.71
5.81	268.38	5.69	260.53	5.61	249.35	6.23	268.02	6.20	257.84	6.20	258.21
47.43	442.01	40.42	421.19	52.27	642.39	51.64	640.06	42.30	713.68	21.68	499.53
221.18	3,528.64	238.34	3,414.61	231.43	3,477.73	211.55	2,939.98	199.04	3,078.65	191.71	3,227.58
1.08	114.29	1.23	133.59	1.29	150.85	1.24	152.95	1.30	185.47	0.84	137.32
110.65	79.17	111.78	78.53	96.93	76.45	113.40	82.26	122.15	100.58	112.93	99.01
522.00	258.23	581.00	292.86	529.48	289.79	522.93	288.01	617.53	377.50	646.46	418.66
372.70	197.54	292.79	160.34	277.35	154.37	322.94	139.14	347.93	172.11	353.17	230.00
	25.26		22.86		26.13		26.13		27.27		24.23
	674.49		688.18		697.59		688.49		862.93		909.22
133.65	2,924.48	151.72	3,633.34	143.75	4,103.92	143.01	3,517.17	158.87	4,365.19	162.25	5,245.93
296.81	32.67	176.99	22.15	79.43	8.13	108.16	13.20	259.53	33.61	498.60	76.09
108.38	1,033.88	122.99	1,136.00	143.08	1,039.12	121.89	1,084.96	153.51	2,243.28	181.79	2,081.32
4.97	773.72	6.44	1,103.31	6.41	887.06	5.57	1,013.30	6.20	1,946.37	6.02	1,787.91
11.26	1,958.82	9.54	1,719.80	10.98	1,497.55	8.49	1,559.29	13.74	4,472.42	14.06	4,246.65
377.82	1,391.20	375.60	1,595.47	387.96	1,402.12	387.38	1,486.32	384.64	2,524.83	445.14	2,901.26
158.96	37.44	320.43	93.17	384.54	86.31	390.08	116.55	450.57	225.37	475.25	217.54
150.84	36.93	253.82	73.83	263.82	55.87	260.44	81.77	364.53	183.36	385.83	185.08
6.62	494.68	7.33	571.51	6.33	527.96	6.60	569.33	6.93	607.64	7.74	646.37
	4,692.80		5,157.09		4,457.20		4,826.57		9,959.98		9,984.81
7.21	143.61	8.12	172.12	8.48	210.17	9.02	212.74	7.71	197.32	8.58	249.24
	207.71		186.27		264.29		230.49		454.67		517.74
16,048.94		17,366.66		17,780.28		17,016.13		25,753.10		27,190.93	

# 2001 STATISTICS DIGEST

**TABLE 3**
**QUANTITY AND VALUE OF MINERALS AND PETROLEUM BY LOCAL GOVERNMENT AREA**

MINERAL	LOCAL GOVERNMENT AREA	QUANTITY TONNES	METALLIC CONTENT	VALUE A\$	Ref. (p. 58)
<b>ALUMINA</b>	Boddington	3,040,096		1,068,829,553	
	Murray	5,401,285		1,890,539,616	
	Waroona	2,306,658		807,182,565	
<b>TOTAL ALUMINA</b>		<b>10,748,039</b>		<b>3,766,551,734</b>	<b>(c), (d)</b>
<b>BASE METALS</b>					
Copper By-Product			Cu tonnes		
	Coolgardie		6,748	11,038,628	(a)
	Ravensthorpe		266	796,345	(a)
	Roebourne		2,995	9,141,997	(a), (b)
	Wiluna		483	1,423,851	(a)
	<b>Total</b>		<b>10,492</b>	<b>22,400,821</b>	
Copper Concentrates	Yalgoo	94,930	Cu % 18.27	32,834,522	(a)
Copper Cathode	East Pilbara		Cu tonnes 22,461	65,585,497	(a)
	<b>Total Copper</b>			<b>120,820,840</b>	<b>(a), (b)</b>
Lead			Pb %		
	Derby-West Kimberley	84,994	71.32	41,995,905	
	Yalgoo	6,389	27.68	2,969,254	
	<b>Total</b>	<b>91,383</b>		<b>44,965,159</b>	<b>(a)</b>
Zinc			Zn %		
	Derby-West Kimberley	270,599	56.83	150,942,357	
	Yalgoo	158,404	40.31	57,983,163	
	<b>Total</b>	<b>429,003</b>		<b>208,925,520</b>	<b>(a)</b>
<b>TOTAL BASE METALS</b>				<b>374,711,519</b>	
<b>CHROMITE</b>					
Chromite Ore	Meekatharra	15,750	Cr <sub>2</sub> O <sub>3</sub> % 38.64	996,294	(a)
<b>CLAY</b>					
Attapulgitic	Mullewa	13,194		1,377,850	
Clay Shale	Collie	7,194		71,940	
Fire Clay	Broome	1,150		22,350	
	Chittering	28,221		33,865	
	<b>Total</b>	<b>29,371</b>		<b>56,215</b>	
Kaolin	Bridgetown-Greenbushes	480		50,618	
Saponite	Coorow	1,659		125,641	
<b>TOTAL CLAY</b>		<b>51,898</b>		<b>1,682,264</b>	<b>(e)</b>
<b>COAL</b>	<b>Collie</b>	<b>6,204,695</b>		<b>258,211,794</b>	<b>(f)</b>
<b>CONSTRUCTION MATERIALS</b>					
Aggregate	Broome	47,732		1,451,844	
	East Pilbara	1,619		9,714	
	Port Hedland Town	156,184		937,108	
	Roebourne	171,529		941,240	
	Wyndham-East Kimberley	142,556		850,117	
	<b>Total</b>	<b>519,620</b>		<b>4,190,023</b>	



# 2001 STATISTICS DIGEST

**TABLE 3 (cont.)**
**QUANTITY AND VALUE OF MINERALS AND PETROLEUM BY LOCAL GOVERNMENT AREA**

MINERAL	LOCAL GOVERNMENT AREA	QUANTITY TONNES	METALLIC CONTENT	VALUE A\$	Ref. (p. 58)
Gravel	Broome	9,229		60,587	
	Coolgardie	44,975		263,768	
	East Pilbara	3,472		17,360	
	Kalamunda	109,591		767,137	
	Wyndham-East Kimberley	2,846		22,294	
	<b>Total</b>		<b>170,113</b>		<b>1,131,146</b>
Rock	Broome	2,126		92,435	
	Dundas	51,587		657,735	
	East Pilbara	133,102		798,614	
	Kalgoorlie-Boulder	65,793		394,757	
	Wyndham-East Kimberley	183		911	
	<b>Total</b>		<b>252,791</b>		<b>1,944,452</b>
Sand	Ashburton	70		2,450	
	Broome	20,931		210,433	
	Coolgardie	143,487		836,581	
	Coorow	11,133		55,665	
	Dandaragan	2,345		13,320	
	Derby-West Kimberley	9,013		88,213	
	Esperance	1,505		7,526	
	Kalgoorlie-Boulder	18,075		94,871	
	Leonora	19,433		116,520	
	Marble Bar	22,668		123,529	
	Meekatharra	31,166		186,996	
	Menzies	1,347		7,542	
	Northam	31,831		159,155	
	Port Hedland Town	66,859		387,883	
	Roebourne	49,890		401,184	
	Swan	430		2,330	
	Wanneroo	681,772		2,727,088	
	Wyndham-East Kimberley	3,684		18,416	
	Yilgarn	2,719		13,596	
	<b>Total</b>		<b>1,118,358</b>		<b>5,453,298</b>
<b>TOTAL CONSTRUCTION MATERIAL</b>				<b>12,718,919</b>	<b>(e)</b>
<b>DIAMONDS</b>	Wyndham-East Kimberley		carats	<b>21,679,930</b>	<b>499,534,159</b>
					<b>(a)</b>
<b>DIMENSION STONE</b>					
Granite	Coolgardie	124		30,520	
	Dundas	509		156,016	
	Roebourne	167		8,350	
	<b>Total</b>		<b>800</b>		<b>194,886</b>
Marble	Ashburton	227		80,620	
<b>TOTAL DIMENSION STONE</b>				<b>1,027</b>	<b>275,506</b>
					<b>(e)</b>
<b>GEM AND SEMI-PRECIOUS STONES</b>					
Chalcedony/Mookaite	Carnarvon	2,344	kg	1,172	
	Mt Magnet	4,000		2,000	
	<b>Total</b>		<b>6,344</b>		<b>3,172</b>
Chrysoprase	Kalgoorlie-Boulder	15,016		30,159	
	Meekatharra	1,155		6,156	
	<b>Total</b>		<b>16,171</b>		<b>36,315</b>
Emerald	Mt Magnet	12		20,000	

# 2001 STATISTICS DIGEST

**TABLE 3 (cont.) QUANTITY AND VALUE OF MINERALS AND PETROLEUM BY LOCAL GOVERNMENT AREA**

MINERAL	LOCAL GOVERNMENT AREA	QUANTITY TONNES	METALLIC CONTENT	VALUE A\$	Ref. (p. 58)
<b>GEM AND SEMI-PRECIOUS STONES (Cont.)</b>		<b>Kg</b>			
Jasper	Marble Bar	1,470		882	
	Meekatharra	12,960		7,776	
	<b>Total</b>	<b>14,430</b>		<b>8,658</b>	
Variscite	Carnarvon	111,830		67,098	
<b>TOTAL GEM AND SEMI-PRECIOUS STONES</b>		<b>148,787</b>		<b>135,243</b>	<b>(d)</b>
<b>GOLD</b>			<b>Au kg</b>		
	Boddington		7,104	119,523,370	
	Coolgardie		21,913	368,362,536	
	Cue		4,435	74,788,680	
	Dundas		4,018	67,983,905	
	East Pilbara		31	515,593	
	Kalgoorlie-Boulder		46,687	785,581,243	
	Laverton		9,872	167,043,855	
	Leonora		42,798	720,828,083	
	Meekatharra		15,767	265,174,035	
	Menzies		1,731	29,777,564	
	Mt Magnet		7,491	125,509,927	
	Sandstone		3,487	58,523,969	
	Wiluna		16,294	274,533,045	
	Yalgoo		278	4,735,463	
	Yilgarn		9,802	164,699,993	
<b>TOTAL GOLD</b>			<b>191,708</b>	<b>3,227,581,261</b>	<b>(g)</b>
<b>GYPSUM</b>					
	Bruce Rock	930		9,300	
	Carnarvon	880,163		20,830,310	
	Dalwallinu	45,747		711,610	
	Dandaragan	25,395		253,950	
	Dundas	27,200		163,201	
	Irwin	7,615		121,831	
	Kent	15,979		207,721	
	Koorda	120		2,160	
	Lake Grace	17,355		167,632	
	Merredin	1,457		17,484	
	Nungarin	12,996		77,976	
	Perenjori	12,369		112,221	
	Ravensthorpe	11,150		60,994	
	Wyalkatchem	27,527		220,214	
	Yilgarn	1,429		11,972	
<b>TOTAL GYPSUM</b>		<b>1,087,432</b>		<b>22,968,576</b>	<b>(f)</b>
<b>HEAVY MINERAL SANDS</b>					
Garnet Sand	Northampton	108,698		11,844,085	
Ilmenite	Augusta-Margaret River	5,650	TiO % 54.00 <sup>2</sup>	678,000	
	Bunbury City	363,080	55.33	64,105,538	
	Capel	236,737	54.57	40,302,482	
	Carnamah	119,032	58.49	11,321,098	
	Dandaragan	111,726	59.04	20,908,442	
	<b>Total</b>	<b>836,225</b>		<b>137,315,560</b>	
Upgraded Ilmenite	Capel	252,428	TiO % 92.00 <sup>2</sup>	151,258,278	
	Carnamah	198,397	92.00	118,880,908	
	Dandaragan	195,634	92.00	148,520,868	
	<b>Total</b>	<b>646,459</b>		<b>418,660,055</b>	

# 2001 STATISTICS DIGEST

**TABLE 3 (cont.)**
**QUANTITY AND VALUE OF MINERALS AND PETROLEUM BY LOCAL GOVERNMENT AREA**

MINERAL	LOCAL GOVERNMENT AREA	QUANTITY TONNES	METALLIC CONTENT	VALUE A\$	Ref. (p. 58)
<b>HEAVY MINERAL SANDS (Cont.)</b>			TiO <sub>2</sub> tonnes		
Leucoxene	Bunbury City	5,731	5,272	3,592,452	
	Capel	7,266	6,685	4,543,813	
	Dandaragan	11,795	6,170	4,013,494	
	<b>Total</b>	<b>24,792</b>	<b>18,127</b>	<b>12,149,759</b>	
Rutile	Bunbury City	3,742	3,502	2,967,467	
	Carnamah	83,470	78,628	74,320,626	
	Dandaragan	25,715	24,241	21,797,602	
	<b>Total</b>	<b>112,927</b>	<b>106,370</b>	<b>99,085,695</b>	
Staurolite	Dandaragan	1,021		169,505	
Zircon			ZrO <sub>2</sub> tonnes		
	Bunbury City	33,984	22,089	18,604,748	
	Capel	62,890	40,878	40,986,438	
	Carnamah	165,076	107,300	107,523,477	
	Dandaragan	91,219	59,292	62,884,663	
<b>Total</b>	<b>353,169</b>	<b>229,560</b>	<b>229,999,326</b>		
<b>TOTAL HEAVY MINERAL SANDS</b>		<b>2,502,468</b>		<b>909,223,985</b>	<b>(a)</b>
<b>INDUSTRIAL PEGMATITE MINERALS</b>					
Feldspar	Marble Bar	28,630		1,473,253	
	Mukinbudin	1,103		21,265	
	<b>Total</b>	<b>29,733</b>		<b>1,494,518</b>	<b>(e)</b>
<b>IRON ORE</b>			Fe %		
Domestic Ore	East Pilbara	7,282,826	63.95	235,698,057	
Exported Ore	Ashburton	74,376,592	61.38	2,343,836,053	
	Derby-West Kimberley	1,167,365	64.16	39,595,518	
	East Pilbara	76,236,501	60.73	2,522,057,043	
	Yilgarn	3,182,398	63.80	104,742,326	
<b>Total</b>	<b>154,962,856</b>		<b>5,010,230,940</b>		
<b>TOTAL IRON ORE</b>		<b>162,245,682</b>		<b>5,245,928,997</b>	<b>(a)</b>
<b>LIMESAND-LIMESTONE-DOLOMITE</b>					
Dolomite	Lake Grace	1,359		22,170	
	Yilgarn	7,744		123,904	
	<b>Total</b>	<b>9,103</b>		<b>146,074</b>	
Limesand-Limestone	Broome	1,043		5,215	
	Carnamah	11,702		46,236	
	Cockburn	1,866,960		5,507,530	
	Coorow	8,828		44,140	
	Dandaragan	16,925		109,732	
	Dundas	183,250		2,748,750	
	Exmouth	1,900		12,350	
	Gingin	28,328		535,447	
	Irwin	187,435		473,773	
	Kalgoorlie-Boulder	844,077		1,688,153	
	Kwinana	13,430		40,290	
	Manjimup	2,877		43,156	
	Shark Bay	2,161		302,291	
	Wanneroo	243,247		2,798,986	
	Wiluna	27,621		55,242	
	<b>Total</b>	<b>3,439,784</b>		<b>14,411,291</b>	
<b>TOTAL LIMESAND-LIMESTONE-DOLOMITE</b>		<b>3,448,887</b>		<b>14,557,365</b>	<b>(e)</b>
<b>MANGANESE ORE</b>	East Pilbara	<b>498,603</b>	Mn % <b>51.37</b>	<b>76,091,438</b>	<b>(a)</b>

# 2001 STATISTICS DIGEST

**TABLE 3 (cont.)**
**QUANTITY AND VALUE OF MINERALS AND PETROLEUM BY LOCAL GOVERNMENT AREA**

MINERAL	LOCAL GOVERNMENT AREA	QUANTITY TONNES	METALLIC CONTENT	VALUE A\$	Ref. (p. 58)
<b>NICKEL INDUSTRY</b>			Co tonnes		
Cobalt By-Product	Coolgardie		1,153	43,999,063	
	Kalgoorlie-Boulder		290	11,497,274	
	Ravensthorpe		51	2,077,819	
	Roebourne		229	9,586,434	
	Wiluna		204	8,066,545	
	<b>Total</b>		<b>1,927</b>	<b>75,227,135</b>	
Cobalt Metal	Kalgoorlie-Boulder		1,483	48,471,747	
Cobalt Sulphide	Coolgardie		82	3,132,504	
	Kalgoorlie-Boulder		774	15,729,109	
	<b>Total</b>		<b>856</b>	<b>18,861,613</b>	
<b>TOTAL COBALT</b>			<b>4,265</b>	<b>142,560,495</b>	<b>(a), (b)</b>
Nickel Concentrates	Coolgardie	189,792	Ni % 3.10	194,732,498	
	Kalgoorlie-Boulder	112,506	19.45	248,047,183	
	Leonora	319,096	11.91	438,350,987	
	Ravensthorpe	24,310	17.76	49,196,503	
	Roebourne	41,554	10.00	45,876,912	
	Wiluna	322,989	18.80	702,397,239	
	<b>Total</b>	<b>1,010,246</b>	<b>146,491</b>	<b>1,678,601,322</b>	
Nickel Metal	Kalgoorlie-Boulder		Ni tonnes 35,301	402,713,927	
<b>TOTAL NICKEL</b>				<b>2,081,315,249</b>	<b>(i)</b>
Palladium By-Product	Coolgardie		Pd kg 735	28,773,052	
	Roebourne		93	3,494,339	
	<b>Total</b>		<b>828</b>	<b>32,267,391</b>	<b>(b)</b>
Platinum By-Product	Coolgardie		Pt kg 174	5,302,472	<b>(b)</b>
<b>TOTAL NICKEL INDUSTRY</b>				<b>2,261,445,607</b>	
<b>PETROLEUM</b>			Kilolitres		
Condensate	Ashburton	449,324		114,634,798	
	Carnamah	112		18,209	
	Irwin	1,194		314,591	
	Roebourne	11,579,506		1,672,940,739	
	<b>Total</b>	<b>6,015,068</b>		<b>1,787,908,337</b>	
Crude Oil	Ashburton	3,515,631	Kilolitres	1,083,264,480	
	Derby-West Kimberley	9,435		2,059,295	
	Irwin	6,491		1,848,134	
	Roebourne	10,529,698		3,159,481,190	
	<b>Total</b>	<b>14,061,255</b>		<b>4,246,653,099</b>	
Liquified Natural Gas	Roebourne		Btu 10 <sup>6</sup> 445,137,300	2,901,258,286	
LPG - Butane	Roebourne		Tonnes 475,246	217,539,558	
LPG - Propane	Roebourne		Tonnes 385,834	185,081,893	

# 2001 STATISTICS DIGEST

**TABLE 3 (cont.)**
**QUANTITY AND VALUE OF MINERALS AND PETROLEUM BY LOCAL GOVERNMENT AREA**

MINERAL	LOCAL GOVERNMENT AREA	QUANTITY TONNES	METALLIC CONTENT	VALUE A\$	Ref. (p. 58)
<b>PETROLEUM (Cont.)</b>					
		'000 m <sup>3</sup>			
Natural Gas	Ashburton	1,415,370		82,929,247	
	Carnamah	39,966		4,002,091	
	Irwin	180,347		21,180,382	
	Roebourne	6,105,338		538,258,985	
	<b>Total</b>	<b>7,741,021</b>		<b>646,370,705</b>	
<b>TOTAL PETROLEUM PRODUCTS</b>				<b>9,984,811,877</b>	<b>(d)</b>
<b>PIGMENTS</b>					
Red Oxide	Cue	<b>1,332</b>		<b>45,618</b>	<b>(a)</b>
<b>SALT</b>					
	Ashburton	288,853		8,180,000	(a)
	Carnarvon	1,512,050		43,865,189	(a)
	Esperance	7,381		356,305	(h)
	Port Hedland Town	2,018,111		59,839,138	(a)
	Roebourne	3,841,663		111,464,980	(a)
	Shark Bay	795,428		20,055,431	(a)
	Wyalkatchem	111		9,193	(h)
	Yilgarn	112,818		5,470,049	(h)
	<b>Total</b>	<b>8,576,415</b>		<b>249,240,285</b>	
<b>SILICA-SILICA SAND</b>					
Silica	Moora	98,162		981,620	
Silica Sand	Albany	80,793		1,680,000	
	Coolgardie	39,396		97,267	
	Swan	349,798		3,802,161	
	<b>Total</b>	<b>568,149</b>		<b>5,579,428</b>	
<b>TOTAL SILICA-SILICA SAND</b>			<b>6,561,048</b>	<b>(a)</b>	
<b>SILVER BY-PRODUCT</b>					
			Ag kg		
	Coolgardie		235	64,140	(a), (j)
	Derby-West Kimberley		980	185,939	(a), (b)
	Statewide		21,416	5,268,319	
	Yalgoo		93,332	23,499,167	(a), (j)
<b>TOTAL SILVER</b>			<b>115,964</b>	<b>29,017,565</b>	
<b>SPONGOLITE</b>	Plantagenet	<b>14,300</b>		<b>1,908,974</b>	<b>(h)</b>
<b>TALC</b>					
	Meekatharra	22,572		2,791,868	
	Three Springs	138,295		11,409,294	
<b>TOTAL TALC</b>			<b>160,867</b>	<b>14,201,162</b>	<b>(f)</b>
<b>TIN-TANTALUM-LITHIUM</b>					
Spodumene	Bridgetown-Greenbushes	79,859	Li <sub>2</sub> O % 3,877	n/a	
Tantalite	Bridgetown-Greenbushes	806		n/a	
Tin	Bridgetown-Greenbushes		Sn tonnes 976	7,787,068	
<b>TOTAL TIN-TANTALUM-LITHIUM</b>				<b>205,733,427</b>	<b>(a)</b>
<b>VANADIUM</b>					
	Mt Magnet		V <sub>2</sub> O <sub>5</sub> tonnes <b>4,450</b>	<b>25,297,369</b>	<b>(f)</b>
<b>TOTAL VALUE</b>				<b>27,190,926,504</b>	

n/a Breakdown of spodumene and tantalite values not available



# 2001 STATISTICS DIGEST

**TABLE 4**
**ROYALTY RECEIPTS 2000 AND 2001**

COMMODITY	2000 Total A\$	2001 Total A\$	2001 Growth A\$	%
<b>ALUMINA</b>	<b>47,244,112</b>	<b>62,545,602</b>	<b>15,301,490</b>	<b>32</b>
<b>BASE METALS</b>				
Copper	2,150,692	3,230,825	1,080,133	50
Lead	979,297	1,715,148	735,851	75
Zinc	12,941,644	11,952,797	-988,847	(8)
<b>TOTAL BASE METALS</b>	<b>16,071,633</b>	<b>16,898,770</b>	<b>827,137</b>	<b>5</b>
<b>CHROMITE</b>	<b>316,205</b>	<b>137,106</b>	<b>-179,099</b>	<b>(57)</b>
<b>CLAYS</b>	<b>117,844</b>	<b>94,284</b>	<b>-23,560</b>	<b>(20)</b>
<b>COAL</b>	<b>14,416,916</b>	<b>13,252,070</b>	<b>-1,164,846</b>	<b>(8)</b>
<b>CONSTRUCTION MATERIALS</b>				
Aggregate	63,990	129,415	65,425	102
Gravel	56,411	46,620	-9,791	(17)
Rock	82,110	81,859	-251	(0)
Sand	519,676	351,898	-167,778	(32)
Sandstone	0	330	330	100
<b>TOTAL CONSTRUCTION MATERIALS</b>	<b>722,187</b>	<b>610,122</b>	<b>-112,065</b>	<b>(16)</b>
<b>DIAMONDS</b>	<b>65,775,673</b>	<b>84,697,851</b>	<b>18,922,178</b>	<b>29</b>
<b>DIMENSION STONE</b>	<b>672</b>	<b>908</b>	<b>236</b>	<b>35</b>
<b>GEM &amp; SEMI-PRECIOUS STONES</b>	<b>3,090</b>	<b>20,213</b>	<b>17,123</b>	<b>554</b>
<b>GOLD</b>	<b>43,866,770</b>	<b>79,146,827</b>	<b>35,280,057</b>	<b>80</b>
<b>GYPSUM</b>	<b>387,099</b>	<b>472,947</b>	<b>85,848</b>	<b>22</b>
<b>HEAVY MINERAL SANDS</b>				
Garnet	559,346	560,373	1,027	0
Ilmenite	9,420,018	9,193,664	-226,354	(2)
Leucoxene	929,640	598,466	-331,174	(36)
Rhodium	0	1,183	1,183	n/a
Rutile	4,129,129	5,880,116	1,750,987	42
Staurolite	18	3,714	3,696	100
Zircon	7,339,194	10,471,688	3,132,494	43
<b>TOTAL HEAVY MINERAL SANDS</b>	<b>22,377,345</b>	<b>26,709,204</b>	<b>4,331,859</b>	<b>19</b>
<b>INDUSTRIAL PEGMATITE MINERALS</b>				
Feldspar	274,305	88,884	-185,421	(68)
<b>IRON ORE</b>	<b>232,692,930</b>	<b>285,627,924</b>	<b>52,934,994</b>	<b>23</b>

# 2001 STATISTICS DIGEST

TABLE 4 (cont.)

## ROYALTY RECEIPTS 2000 AND 2001

COMMODITY	2000 Total A\$	2001 Total A\$	2001 Growth A\$	%
<b>LIMESAND-LIMESTONE-DOLOMITE</b>				
Dolomite	880	2,731	1,851	210
Limesand-Limestone	1,463,256	1,819,654	356,398	24
<b>TOTAL LIMESAND-LIMESTONE-DOLOMITE</b>	<b>1,464,136</b>	<b>1,822,385</b>	<b>358,249</b>	<b>24</b>
<b>MANGANESE</b>	<b>2,247,987</b>	<b>3,652,817</b>	<b>1,404,830</b>	<b>62</b>
<b>NICKEL INDUSTRY</b>				
Cobalt by-product	1,817,804	2,405,614	587,810	32
Nickel	51,541,488	53,134,322	1,592,834	3
Palladium by-product	550,288	861,780	311,492	57
Platinum by-product	81,489	95,250	13,761	17
Rhodium by-product	3,394	0	-3,394	100
<b>TOTAL NICKEL INDUSTRY</b>	<b>53,994,463</b>	<b>56,496,966</b>	<b>2,502,503</b>	<b>5</b>
<b>PETROLEUM</b>				
Condensate	138,153,193	111,133,725	-27,019,468	(20)
Liquified Natural Gas	162,299,921	182,040,346	19,740,425	12
LPG - Butane	16,221,723	14,876,844	-1,344,879	(8)
LPG - Propane	12,405,602	11,670,920	-734,682	(6)
Natural gas	33,691,143	37,723,670	4,032,527	12
Oil	147,952,491	137,004,815	-10,947,676	(7)
<b>TOTAL PETROLEUM</b>	<b>510,724,073</b>	<b>494,450,320</b>	<b>-16,273,753</b>	<b>(3)</b>
<b>PIGMENTS</b>				
Red oxide	33,522	2,522	-31,000	(92)
<b>SALT</b>	<b>1,979,850</b>	<b>2,169,931</b>	<b>190,081</b>	<b>10</b>
<b>SILICA SAND</b>	<b>277,372</b>	<b>313,633</b>	<b>36,261</b>	<b>13</b>
<b>SILVER</b>	<b>734,276</b>	<b>661,265</b>	<b>-73,011</b>	<b>(10)</b>
<b>SPONGOLITE</b>	<b>115,532</b>	<b>98,259</b>	<b>-17,273</b>	<b>(15)</b>
<b>TALC</b>	<b>89,769</b>	<b>86,651</b>	<b>-3,118</b>	<b>(3)</b>
<b>TIN-TANTALUM-LITHIUM</b>				
Spodumene	756,185	897,060	140,875	19
Tantalite	2,126,739	4,228,808	2,102,069	99
Tin	121,443	209,998	88,555	73
<b>TOTAL TIN-TANTALUM-LITHIUM</b>	<b>3,004,367</b>	<b>5,335,866</b>	<b>2,331,499</b>	<b>78</b>
<b>VANADIUM</b>	<b>157,636</b>	<b>317,186</b>	<b>159,550</b>	<b>100</b>
<b>TOTAL REVENUE</b>	<b>1,019,089,764</b>	<b>1,135,710,513</b>	<b>116,620,749</b>	<b>11</b>

Note: All Royalty Receipts above are only those paid to the Consolidated Revenue Fund.

# 2001 STATISTICS DIGEST

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

MINERAL/Company	Operating Site	2000	2001
<b>BASE METALS</b>			
Barminco Pty Ltd	Elizabeth Hill	18	1
Normandy Mining Ltd	Scuddles	346	313
Straits Resources Ltd	Nifty	381	474
Western Metals Ltd	Pillara	586	513
<b>TOTAL BASE METALS</b>		<b>1,331</b>	<b>1,301</b>
<b>BAUXITE - ALUMINA</b>			
Alcoa of Australia Ltd	Huntly	523	732
	Jarrahdale	63	20
	Kwinana Alumina Refinery	1,449	1,466
	Pinjarra Refinery	1,443	1,404
	Wagerup Alumina Refinery	832	942
	Willowdale	264	260
Australian Fused Materials Pty Ltd	Rockingham Fused Alumina Plant	192	204
Worsley Alumina Pty Ltd	Worsley- includes		
	Mount Saddleback	230	209
	Worsley Refinery	1,710	1,332
<b>TOTAL BAUXITE - ALUMINA</b>		<b>6,706</b>	<b>6,569</b>
<b>COAL</b>			
Griffin Coal Mining Co. Pty Ltd	Muja	330	289
Wesfarmers Coal Ltd	Premier/WCL	379	388
<b>TOTAL COAL</b>		<b>709</b>	<b>677</b>
<b>DIAMONDS</b>			
Argyle Diamond Mines Pty Ltd	Lake Argyle	<b>940</b>	<b>1,009</b>
<b>GOLD</b>			
AngloGold Australia Ltd	Sunrise Dam	237	579
Australian Gold Fields NO	Bannockburn	8	3
Australian Gold Resources Ltd	Gidgee	102	92
	Perth Mint	89	91
	Newhaven	2	0
Barminco Pty Ltd	Newhaven	2	0
Centaur Mining & Exploration Ltd	Mt Pleasant	287	108
Central Norseman Group	Norseman	255	223
Croesus Mining NL	Davyhurst	0	90
	Binduli	43	21
	Mayday North	4	2
	Hannan South	19	33
Nickel Seekers	Daisy-Milano	10	16
	Golden Feather Group	5	0
Delta Gold Ltd	Kanowna Belle	366	343
	Lady Ida	72	30
	Dalgaranga	102	55
Equigold NL	Dalgaranga	102	55
Gindalbie Gold NL	Minjar	0	17
Goldfields Kalgoorlie Ltd	Kundana	279	261
	Paddington	196	295

# 2001 STATISTICS DIGEST

**TABLE 5 (cont.) AVERAGE NUMBER OF PERSONS EMPLOYED IN THE WA MINERAL AND PETROLEUM INDUSTRIES**

MINERAL/Company	Operating Site	2000	2001
<b>GOLD Continued</b>			
Hill 50 Gold NL	Hill 50-Mt Magnet	378	398
Homestake Mining Company	Darlot	147	110
	Lawlers	206	192
	Plutonic	376	430
	Golden Mile - Superpit	1,155	1,180
LionOre Australia Pty Ltd	Bounty	231	166
Lynas Gold NL	Mt Olympus	46	41
New Hampton Goldfields NL	Big Bell	387	445
	Jubilee	250	221
	Lakewood	0	11
	Tuckabianna	6	0
	New Celebration	234	121
	Telfer	448	326
Normandy Mining Ltd	Kaltails	6	0
Normandy Yandal Operations Ltd	Bronzewing-Mt McClure	234	321
	Jundee-Nimary	554	563
	Wiluna	246	304
Pacmin Mining Corporation Limited	Carosue Dam	120	191
	Tarmoola	337	356
	Fortnum	67	21
Perilya Mines NL	Granny Smith	439	586
Placer Dome Inc	Chalice	9	2
	Higginsville	3	4
	Barnicoat	7	0
Sons of Gwalia NL	Great Victoria Underground	52	4
	Marvel Loch	342	228
	Sons of Gwalia	217	217
	Yilgarn Star	139	24
	Bluebird	174	247
	Bulchina-Mt Klemptz	42	47
WMC Resources Ltd	Emu	634	1,248
	Kambalda-St. Ives	903	1,142
	Boddington	404	498
Worsley Alumina Pty Ltd		10	35
Other		10	35
<b>TOTAL GOLD</b>		<b>10,879</b>	<b>11,938</b>
<b>HEAVY MINERAL SANDS</b>			
BHP Titanium Minerals Pty Ltd	Beenup	34	34
Cable Sands Pty Ltd	Bunbury	331	347
Doral Mineral Sands Pty Ltd	Dardanup	0	10
GMA Garnet Pty Ltd	Narngulu Garnet Plant	24	28
	Port Gregory - Hutt Lagoon	16	16
	Rockingham Zirconia Plant	32	26
Hanwah Advanced Ceramics Australia Pty Ltd			
Iluka Resources Limited	Capel	699	654
	Eneabba	297	300
	Narngulu Synthetic Rutile Plants	218	267
	Narngulu Dry Plant	63	63
	Chandala-Muchea	234	247
TiWest Pty Ltd	Cooljarloo	295	283
<b>TOTAL HEAVY MINERAL SANDS</b>		<b>2,243</b>	<b>2,275</b>

# 2001 STATISTICS DIGEST

TABLE 5 (cont.)

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

MINERAL/Company	Operating Site	2000	2001
<b>IRON ORE</b>			
BHP Iron Ore (Goldsworthy) Ltd	Finucane Island	239	235
	Yarrie	186	193
BHP Iron Ore (Jimblebar) Ltd	Jimblebar	114	110
BHP Iron Ore Ltd	Mt Newman Railway	360	348
	Mt Whaleback	1,060	1,028
	Nelson Point	626	702
	Mt Newman Orebody 25	80	75
	Port Hedland HBI Plant	1,044	979
	Yandi	205	199
	Hamersley Iron Pty Ltd	Brockman No. 2 Detritals Group	219
Hamersley Iron Pty Ltd	Dampier Port Operations	957	858
	Hismelt/Kwinana	77	143
	Marandoo	164	152
	Paraburdoo	749	687
	Hamersley Railway	405	382
	Tom Price	937	1,016
	Yandicoogina	223	224
Koolyanobbing Iron Pty Ltd	Cockatoo Island	35	18
	Koolyanobbing	33	70
Robe River Mining Co. Pty Ltd	Cape Lambert	449	483
	Pannawonica Deepdale	267	336
	Robe River Railway	112	152
	West Angelas Rail	14	93
	West Angelas Port Facility	33	247
	West Angelas Plant	16	198
<b>TOTAL IRON ORE</b>		<b>8,604</b>	<b>9,103</b>

## NICKEL

Murrin Murrin Operations	Murrin Murrin	687	578
Centaur Mining & Exploration	Cawse	316	268
LionOre Australia (Nickel) Ltd	Emily Ann	4	104
Outokumpu Mining Australia Pty Ltd	Black Swan	247	261
	Forrestania	5	0
Preston Resources Ltd	Bulong	286	303
Sir Samuel Mines NL	Cosmos	111	60
Tectonic Resources NL	RAV 8	73	89
Titan Resources NL	Radio Hill	75	88
Western Mining Corporation Ltd	Kalgoorlie Nickel Smelter	751	812
	Kambalda Group	454	404
	Kwinana Refinery	371	528
	Leinster	890	831
	Mt Keith	768	834
<b>TOTAL NICKEL</b>		<b>5,038</b>	<b>5,160</b>



# 2001 STATISTICS DIGEST

TABLE 5 (cont.)

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

MINERAL/Company	Operating Site	2000	2001
<b>PETROLEUM PRODUCTS</b>			
Apache Energy Ltd	Campbell, Agincourt/Wonnich, East Spar, Harriet, Sinbad, Tanami, Stag, Chervil, North Herald, South Pepper	190	208
ARC Energy NL	Dongara	6	6
BHP Billiton Petroleum (North West Shelf) Pty Ltd	Griffin	93	45
ChevronTexaco Australia Pty Ltd	Barrow Island, Cowle, Roller-Skate, Saladin, Yammaderry	114	158
Empire Oil & Gas NL	Rough Range	6	0
Hardman Oil & Gas Pty Ltd	Woodada	8	5
Kimberley Oil NL	Lloyd	4	4
Mobil Exploration & Producing Australia Pty Ltd	Wandoo	34	29
Nexen Petroleum Australia Pty Ltd	Buffalo	0	20
Origin Energy Resources Ltd	Beharra Springs, Tubridgi	10	10
Petro Energy Pty Ltd	Mt Horner	3	2
Woodside Energy Ltd	Cossack, Goodwyn, Hermes, Lambert, Legendre, North Rankin, Wanaea	812	759
<b>TOTAL PETROLEUM PRODUCTS</b>		<b>1,280</b>	<b>1,246</b>
<b>SALT</b>			
Dampier Salt Ltd	Port Hedland	107	93
	Dampier	235	274
	Lake MacLeod	211	213
Onslow Solar Salt Pty Ltd	Onslow	65	47
Shark Bay Salt JV	Useless Loop	80	72
<b>TOTAL SALT</b>		<b>698</b>	<b>699</b>
<b>TOTAL CLAYS</b>		<b>68</b>	<b>75</b>
<b>TOTAL CONSTRUCTION MATERIALS</b>		<b>403</b>	<b>460</b>
<b>TOTAL DIMENSION STONE</b>		<b>87</b>	<b>91</b>
<b>TOTAL INDUSTRIAL PEGMATITE MINERALS</b>		<b>30</b>	<b>20</b>
<b>TOTAL LIMESTONE - LIMESAND</b>		<b>165</b>	<b>144</b>
<b>TOTAL MANGANESE ORE</b>		<b>83</b>	<b>81</b>
<b>TOTAL PHOSPHATE</b>		<b>177</b>	<b>172</b>
<b>TOTAL SILICA - SILICA SAND</b>		<b>195</b>	<b>200</b>
<b>TOTAL TALC</b>		<b>108</b>	<b>90</b>
<b>TOTAL TIN - TANTALUM - LITHIUM</b>		<b>287</b>	<b>501</b>
<b>TOTAL VANADIUM - LITHIUM</b>		<b>150</b>	<b>125</b>
<b>ALL OTHER MATERIALS</b>		<b>127</b>	<b>117</b>
<b>TOTAL</b>		<b>40,308</b>	<b>42,053</b>

Source: AXTAT Reporting System, Mining Operations Division  
 Figures are as provided to the Department by the various operating companies.

**TABLE 6**
**PRINCIPAL MINERAL AND PETROLEUM PRODUCERS effective April 2002**

## BASE METALS

### Copper

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

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

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

### Lead-Zinc

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

Western Metals Ltd, 263 Adelaide Terrace, Perth WA 6000, (08) 9221 2555, Lennard Shelf, <http://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, <http://www.alcoa.com.au>

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

## CHROMITE

### Chromite Ore

Pilbara Chromite Pty Ltd, PO Box 1220, West Perth WA 6872, (08) 9321 3633, Coobina.

## 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, <http://www.griffincoal.com.au>

### Fire Clay

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

### Kaolin

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

### Saponite

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

## COAL

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

Wesfarmers Premier Coal Ltd, 276 Leach Highway, Myaree WA 6153, (08) 9333 0391, Collie, <http://www.wesfarmers.com.au>

## CONSTRUCTION MATERIALS

### Aggregate

The Readymix Group (WA), 75 Canning Highway, Victoria Park WA 6100, (08) 9212 2000, Boodarie, Burrup–Dampier, <http://www.readymix.com.au>

### Gravel

Boral Resources (WA) Ltd, 63 Abernethy Road, Belmont WA 6104, (08) 9333 3400, Grosmont, <http://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, <http://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, <http://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, <http://www.readymix.com.au>

## DIAMONDS

Argyle Diamond Mines, 2 Kings Park Road, West Perth WA 6005, (08) 9482 1166, Argyle, <http://www.ashton.net.au/about/locations.asp>

**TABLE 6 (cont.)**
**PRINCIPAL MINERAL AND PETROLEUM PRODUCERS effective April 2002**
**DIMENSION STONE**
**Granite**

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

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

**FELDSPAR**

Unimin Australia Ltd, 26–28 Tomlinson Road, Welshpool WA 6106, (08) 9362 1411, Pippingarra, Mukinbudin.

**GOLD**

Agnew Gold Mining Co Pty Ltd, PMB 10, Leinster WA 6437, (08) 908 3847, Agnew, <http://www.goldfields.co.za>

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

AurionGold Limited, PO Box 322, Victoria Park WA 6979, (08) 9442 8100, Golden Feather, Kanowna Belle, Mt Pleasant, Paddington, <http://www.auriongold.com.au>

Central Norseman Gold Corp. NL, Level 37, 250 St Georges Terrace, Perth WA 6000, (08) 9442 2000, Central Norseman, <http://www.wmc.com.au>

Croesus Mining NL, 39 Porter Street, Kalgoorlie WA 6430, (08) 9091 2222, Binduli, Davyhurst, <http://www.croesus.com.au>

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

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

Harmony Gold (Australia) Pty Ltd, 9 Havelock Street, West Perth WA 6005, (08) 9321 0611, Big Bell, Jubilee, <http://www.harmony.co.za>

Hill 50 Gold NL, 10 Ord Street, West Perth WA 6005, (08) 9485 0070. Hill 50 Mt Magnet, <http://www.hill50.com.au>

Homestake Mining Company, 2 Mill Street, Perth WA 6000, (08) 9212 5777, Darlot, Lawlers, Plutonic, <http://www.barrick.com>

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

Newmont Australia, PO Box 1123, West Perth WA 6872, (08) 9366 3232, Bronzewing, Jundee, Wiluna, <http://www.newmont.com>

Placer Dome Asia Pacific Ltd, GPO Box 465, Brisbane, Qld, (07) 3510 6700, Granny Smith, <http://www.placerdome.com>

**GOLD (cont.)**

Sipa Resources International NL, PO Box 214, West Perth WA 6872, (08) 9481 6259, Paraburdoo-Mt Olympus, <http://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, <http://www.sog.com.au>

South Kalgoorlie Mines Pty Ltd, PO Box 2125, Boulder WA 6432, (08) 9021 9222 New Celebration, <http://www.hill50.com.au>

St Barbara Mines Ltd, Level 2, 16 Ord Street, West Perth WA, 6005 (08) 9476 5555, Meekatharra. <http://www.stbarbara.com.au>

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

Troy Resources NL, 44 Ord Street, West Perth WA 6005, (08) 9481 1277, Bulchina–Mt Klemptz, <http://www.troy.com.au>

Viceroy Australia Pty Ltd, PO Box 585, Victoria Park WA 6979, (08) 9039 4502, Bounty.

Worsley Alumina Pty Ltd, PO Box 48, Boddington WA 6390, (08) 9883 8260, Boddington, <http://wapl.com.au>

**GYPSUM**

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, <http://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 6530, (08) 9923 3644, Port Gregory, <http://www.gmagarnet.com>

**Ilmenite, Leucoxene, Rutile and Zircon**

Cable Sands (WA) Pty Ltd, PO Box 133, Bunbury WA 6230, (08) 9721 0200, Busselton, Jangardup, Waroona, Sandalwood, <http://www.cablesands.com.au>

Iluka Resources Ltd, 5<sup>th</sup> Floor, 553 Hay Street, Perth WA 6000, (08) 9221 7611, Capel, Eneabba, Yoganup, Stratham.

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

**TABLE 6 (cont.)**
**PRINCIPAL MINERAL AND PETROLEUM PRODUCERS effective April 2002**

## IRON ORE

BHP Billiton Iron Ore (Goldsworthy) Ltd, 200 St Georges Terrace, Perth WA 6000, (08) 9320 4444, Nimingarra–Yarrie, <http://www.bhpbilliton.com>

BHP Billiton Iron Ore Ltd, 200 St Georges Terrace, Perth WA 6000, (08) 9320 4444, Jiblebar, Newman, Yandicoogina, <http://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, Brockman, Marandoo, Paraburdoo, Tom Price, Yandicoogina, <http://www.hamersleyiron.com>

Portman Iron Ore Ltd, 1 William Street, Perth WA 6000, (08) 9426 3388, Cockatoo Island, Koolyanobbing, <http://portman.com.au>

Robe River Iron Associates, 12 St Georges Terrace, Perth WA 6000, (08) 9421 4747, Pannawonica, <http://north.com.au>

## LIMESAND-LIMESTONE

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

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, <http://www.consminerals.com.au>

## NICKEL

Anaconda Nickel Ltd, Level 12, 2 Mill Street, Perth WA 6000, (08) 9212 8400, Murrin Murrin, <http://www.anaconda.com.au>

Australian Nickel Mines, 1<sup>st</sup> Floor, 24 Outram Street, West Perth WA 6005, (08) 9481 6040, Radio Hill, <http://titanresources.com.au>

Centaur Mining Exploration Pty Ltd, Ora Banda Gold Mine, Kalgoorlie WA 6430, (08) 9024 2283, Cawse.

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

## NICKEL (cont.)

Outokumpu Mining Australia Pty Ltd, 1<sup>st</sup> Floor, 15 Joel Terrace, East Perth WA 6004, (08) 9328 9777, Black Swan, <http://www.outokumpu.com>

Preston Resources Ltd, Level 1, 16 Ord Street, West Perth WA 6005, (08) 9322 4166, Bulong, <http://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, <http://www.tectonicres.com.au>

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

## PALLADIUM

WMC Ltd, 250 St Georges Terrace, Perth WA 6000, (08) 9442 2000, Kambalda, <http://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, North Herald, South Pepper, <http://www.apachecorp.com>

ARC Energy NL, Level 1, 46 Ord Street, West Perth WA 6005, (08) 9486 7333, Dongara, <http://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, <http://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, <http://www.chevrontexaco.com>

Hardman Oil and Gas Pty Ltd, 5 Ord Street, West Perth WA 6005, (08) 9321 6881, Woodada, <http://www.hdr.com.au>

Kimberley Oil NL, Suite 12B, 573 Canning Highway, Alfred Cove WA 6154, (08) 9330 8876, Blina, Boundary, Lloyd.

Mobil Exploration & Producing Australia Pty Ltd, Level 7, 30 The Esplanade, Perth WA 6000, (08) 9480 0300, Wandoo, <http://www.wandoo.com.au>

Nexen Petroleum Australia Pty Limited, Level 18, 44 St George's Terrace, Perth WA 6000, (08) 9218 8911, Buffalo, <http://www.nexeninc.com>

Origin Energy Resources Ltd, 34 Colins Street, West Perth WA 6005, (09) 9324 6111, Beharra Springs, Tubridgi, <http://www.originenergy.com.au>

TABLE 6 (cont.)

PRINCIPAL MINERAL AND PETROLEUM PRODUCERS effective April 2002

## PETROLEUM (cont.)

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, Goodwyn, Hermes, Lambert, Laminaria, Legendre, North Rankin, Perseus, Wanaea, <http://www.woodside.com.au>

## PLATINUM

WMC Ltd, 250 St Georges Terrace, Perth WA 6000, (08) 9442 2000, Kambalda, <http://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, <http://www.dampiersalt.com.au>

Shark Bay Salt Joint Venture, 22 Mount Street, Perth WA 6000, (08) 9420 4320, Useless Loop, <http://www.clough.com.au>

WA Salt Supply Ltd, Cockburn Road, Hamilton Hill WA 6163, (08) 9335 9911, Lake Deborah East, Pink Lake, <http://www.wasalt.com.au>

## SILICA-SILICA SAND

### Silica

Simcoa Operations Pty Ltd, PO Box 1389, Bunbury WA 6231, (08) 9780 6666, Dalaroo.

### Silica Sand

Rocla Quarry Products, 1 Casella Place, Kewdale WA 6105, (08) 9353 9800, Gnangarra, <http://rocla.com.au>

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

## SPONGOLITE

Supersorb Minerals NL, 55 Collie Street, Albany WA 6330, (08) 9842 1955, Woogenellup, <http://www.supersorb.com.au>

## TALC

Luzenac Australia Pty Ltd, GPO Box A42, Perth WA 6837, (08) 9327 2844, Three Springs, <http://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, <http://www.sog.com.au>

### Tantalite-Tin

Sons of Gwalia Ltd, 16 Parliament Place, West Perth WA 6005, (08) 9263 5555, Greenbushes, Wodgina, <http://www.sog.com.au>

## VANADIUM

Vanadium Australia Pty Ltd, Level 7, 26 St Georges Terrace, Perth WA 6000, (08) 9218 5900, Windimurra, <http://www.pmal.com.au>



## ABBREVIATIONS, REFERENCES, UNITS AND 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
<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 TiO <sub>2</sub>	Unit	= 1 tonne of contained metal
<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>			<b>Prefix</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

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

# 2001 STATISTICS DIGEST

## LOCAL GOVERNMENT BOUNDARIES

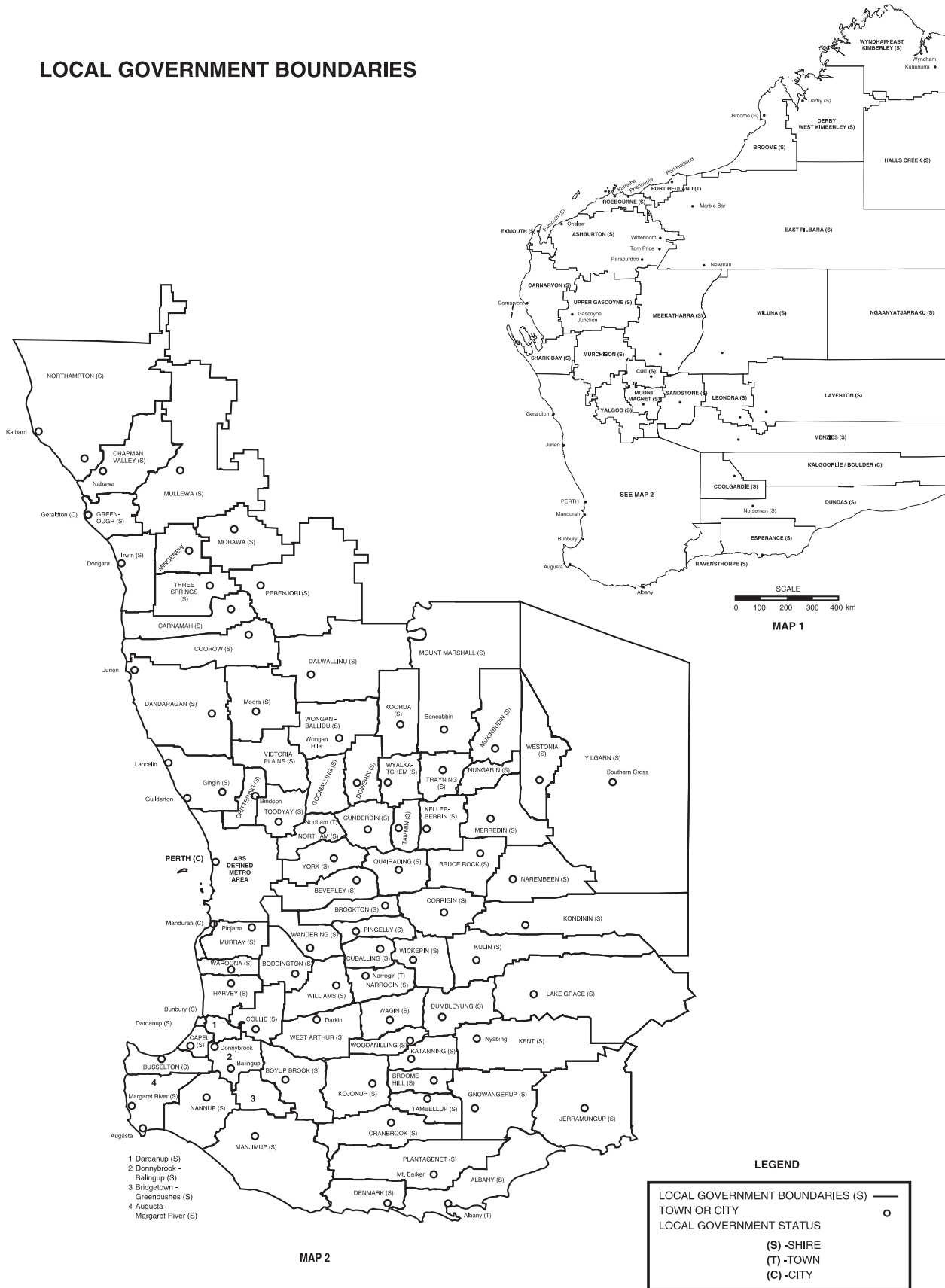
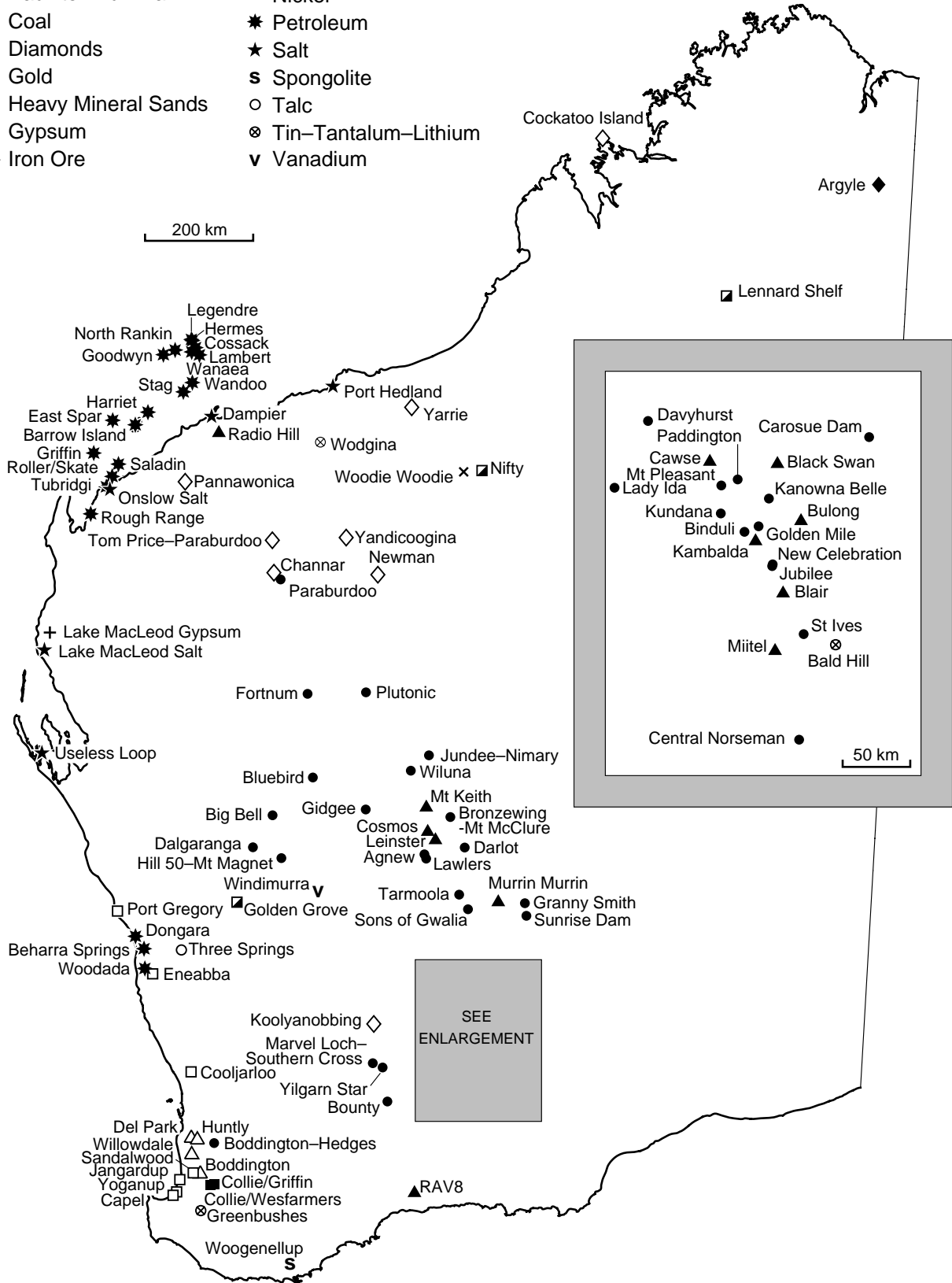


Figure 0.1

# 2001 STATISTICS DIGEST

## 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             |



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Figure 0.2



**This publication is now available on our web site**

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

- Mineral and Petroleum Exploration and Development
- Atlas of Mineral Deposits and Petroleum Fields



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