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FOREWORD

L C Ranford
DIRECTOR GENERAL

Welcome to the Department of Minerals and Energy's 1997/98 Statistics Digest. This publication contains the most comprehensive statistical information available on the Western Australian resource industry.

It has now been over a year since the Asian economic crisis began, yet the statistics in this Digest show continuing strength of the Western Australian minerals and energy industry. Thanks to increased output and the depreciation of the Australian dollar, the value of mining and petroleum production in 1997/98 increased by 8.8% to $17.8 billion. This outcome, in the midst of global economic unrest and poor commodity prices was impressive and all the more admirable because of the many industry production records which were broken.

The value of mineral and petroleum production in 1997/98 was 2.5 times what it was ten years ago. This represents a solid average annual growth of almost 10% per annum or a doubling of the value of production every seven years which is more than the growth of the economy in general.

The final outturn for the State's mineral and energy industry in 1997/98 indicates that the industry has thus far weathered the Asian economic storms relatively unscathed. But the outlook nevertheless remains somewhat uncertain. Much of 1997/98's performance was attributable to the drop in the Australian dollar relative to the US currency. Many contracts were also fulfilled on pre Asian crisis conditions. Unless the Australian currency drops further in 1998/99 and markets are maintained, these benefits will not reappear. Significantly, the world economic outlook has weakened markedly over the past few months. In particular, Japan is in recession, growth in the US may be easing, there are concerns that growth in domestic demand could moderate in western Europe and China's government faces growing economic challenges. None of these developments bode well for mineral and energy prices.

The State's resource industry is entering a challenging period and it is important that uncertainties in the local operating environment be reduced where possible. The recent passage of the Federal Government's Native Title Amendment Bill will go some way to addressing what has been one of industry's chief concerns. The competitiveness of Western Australia's mining industry will also be assisted by the ongoing deregulation and expansion of the State's energy industry. New low cost projects are being developed, such as those in the nickel industry and expansions of facilities are taking place in the iron ore, alumina and base metals sectors to name a few. These changes are placing Western Australia's minerals and energy industry in a strong position to face global economic uncertainty and should lead to increased economic prosperity in this State.

These and other issues are discussed in detail in the Digest. It is not possible to prepare such a comprehensive range of information without valuable assistance from outside the Department. I would therefore like to thank all the various resource companies, Australian Bureau of Agricultural and Resource Economics (ABARE), Australian Bureau of Statistics (ABS) and the Western Australian Treasury Department for their cooperation and help.

1. ECONOMIC AND SOCIAL ENVIRONMENT

1.1 World Economy Review

Economic performance mixed.

The financial crisis which commenced at the beginning of 1997/98 in several emerging market countries in Asia intensified late in 1997, spreading to Korea and exacerbating a pronounced weakening in the Japanese economy. Economic growth over 1997/98 in the OECD area as a result was around 2.5%, reflecting in particular, the poor performance of Japan and South Korea.

However, just as Asia's economic malaise appeared to at least stabilise at the closure of 1997/98, the possibility of a wider spread recessionary pall enveloping the global economy began to emerge as a strong possibility. This has been based on several developments, including Japan's recession, China experiencing a sharp slowdown, steep economic decline of many smaller emerging Asian economies and a US stock market which has begun to show unsettling gyrations. In addition, Russia reverted to economic chaos, with a severe devaluation of the rouble and effective default on its debt obligations. The IMF's reluctance to advance additional funds to re-capitalise the Russian banking system refocused investor attention on credit risk among emerging markets as an asset class. This resulted in a collapse of equity and bond markets in Latin America and eastern Europe and renewed weakness in Asia.

Government policies attempt to boost economic activity as Japanese economy enters recession.

Considering these issues in turn, firstly, the Japanese economy contracted by around 0.3% over 1997/98 to be labelled as "officially" in recession. The already poor Japanese economic situation, as well as the existing weakness of the financial system, was aggravated by the Asian crisis. Unfortunately, Japan's use of monetary policy to stimulate the economy was severely constrained by the already low interest rates and the fragility of the banking sector has contributed to the sluggishness of activity. To stimulate the economy, in April 1998 the Government announced a series of measures culminating in a substantial and comprehensive package including fiscal stimulus measures, structural reforms aimed at revitalising the business sector and measures to facilitate domestic financial flows.

Depreciation of the Japanese yen over 1997/98 also led to renewed concern about recovery in the Asian region as a whole. The weak Japanese yen worsened the credit squeeze already evident in the region. The devaluation of the Japanese yen translated to an increased yen value of assets held abroad by Japanese financial institutions for which credit had been forwarded. This impacted on the capital adequacy ratios of Japanese financial institutions (i.e. increased quantity of money on loan compared to the inherent value of the asset) and forced a reduction in lending. The depreciation also improved the competitiveness of Japanese exports relative to its Asian neighbours and increased the price of imports – both making an export led recovery in Asia more difficult.

Stabilisation evident in South Korea's economy.

Examining some of the Asian economies more specifically, South Korea, after suffering considerable currency depreciation, continued to experience severe economic problems over 1997/98 which necessitated IMF involvement in determining an appropriate structural adjustment program. There are signs however, that the economy has stabilised and there is evidence of some

restoration of investor confidence. South Korea's exports have been increasing strongly as a result of currency depreciation. This could however, be affected by depreciation of the Japanese yen.

South East Asian economies remain weak.

In addition to political and social unrest, the Indonesian economy continued to experience severe economic and financial problems. Investor confidence in the economy remained very weak and due to substantial structural difficulties, Indonesia's economy is not expected to recover appreciably in the near term. While the large depreciation of the currency should stimulate exports, particularly labour-intensive goods, a shortage of working capital is limiting the economy's ability to trade out of its problems.

Like Indonesia, Thailand is also continuing to experience severe economic difficulties, with high interest rates and significant decline in domestic demand impinging on economic growth. Malaysia has also experienced a deterioration in economic and financial conditions. Notably, in an effort to stimulate domestic demand via interest rate cuts whilst maintaining the value of its currency, the ringgit, the Malaysian government in September 1998 stopped foreign dealings in its currency.

North East Asia appears less heavily affected by financial and economic problems than South East Asia.

Overall, the North East Asian economies have been less heavily affected by financial and economic problems than the South East Asian economies. The Taiwanese economy for example, remained quite robust, though the recent slowing in growth of demand from Japan and South Korea will likely impact on Taiwan's economic growth. China's economy also continues to grow, albeit at a reduced pace. GDP growth in the first half of 1998 was 7%, down from 8.8% recorded in 1997. Growth is supported by relatively strong domestic demand and Chinese authorities continue to indicate a commitment to maintaining the US$ peg, resisting pressure for a currency depreciation in line with other nations. The maintenance of the US$ peg has meant that Chinese exports have become much less competitive vis–a–vis other Asian nations. The Chinese authorities expect domestic demand, supported by stimulatory monetary and fiscal policies and the expansion of some of China's public trading enterprises, to be sufficiently strong to sustain a healthy level of economic growth. But analysts are becoming increasingly nervous as to how long this position can be maintained. Ironically, catastrophic floods in early 1998/99 have provided some government policy reprieve by justifying "policy directed bank loans" to target sectors without concern as to credit worthiness and diminished need for grain subsidies due to increased prices.

US growth remains strong but questions raised as to sustainability of situation as markets fluctuate.

Given the economic woes of the Asian region, the maintenance of low inflation and strong 4.5% economic growth in the US has been an important factor in sustaining world growth. The impact of the Asian slump on the US has so far been benign. Lower prices for commodities and manufactured imports and a strong US$ have helped to keep down inflation. But weaker exports and higher imports have swelled the US's current account deficit. Thus far the deficit has been financed by capital fleeing from emerging economies into American banks and securities markets. This is perceived by many as a precarious situation. Recent movements have exemplified the fragility of the US stockmarket and despite the falls, US shares remain expensive by historical standards. As in Asia, there is the risk that because asset prices have been sustained by short term flows of portfolio capital, if these dry up, asset prices could come under pressure.

International financial crisis that began in Asia infects Latin America.

South American stockmarkets have certainly been faced with the above dilemma. At the beginning of 1998/99 the international financial crisis that began in Asia infected Latin America, with regional currencies under intense pressure as foreign and domestic investors panicked to remove their capital in the wake of problems in other economies (e.g. Russia). Brazil, which accounts for nearly half of the output in the region and is the world's second-biggest recipient of emerging market foreign investment after China, was significantly affected. Brazil's Cardoso Government had successfully, until October 1998 tamed the country's once-runaway inflation (down to 4%) and is now attempting to defend its currency with 40% interest rates. Severe devaluation in Brazil would also be painful for its neighbours and yet another global economic blow.

Economic activity strong in continental Europe but concern as to sustainability of growth.

Economic activity was strong in continental Europe, with the gathering pace of domestic economic expansion being one reason that European markets have been least affected by Asia. European share markets in particular have remained stronger than elsewhere. Nevertheless, concern has been expressed that this region may be unable to sustain current growth rates, with at least a moderate slowing predicted by some analysts. Europe has also been more preoccupied with monetary unification from 1 January 1999. From this date, member countries will adopt a single currency, the Euro. Introduction of the single currency will be accompanied by the creation of a European Central Bank (ECB) which will manage European monetary policy independently from the political authorities. The 11 countries joining (in order of GDP size) are Germany, France, Italy, Spain, the Netherlands, Belgium, Austria, Finland, Portugal, Ireland and Luxembourg.

Economic chaos returns to Eastern Europe, particularly Russia.

In Central and Eastern Europe, real economic activity has similarly not been strongly affected by developments in Asia. Nevertheless, Eastern Europe, particularly Russia, returned to economic turbulence. Thanks to a number of industries showing renewed signs of life, 1997/98 looked like the first year since economic transition that the Russian Federation was going to at least halt the ongoing decline in GDP. Real disposable income also rose marginally mid way through 1997/98 and unemployment appeared to stabilise. However, little progress was made in tackling the country's chronic fiscal problems, which combined with heightened internal political conflicts, led to dramatic Russian financial market upheavals at the beginning of 1998 including plummeting stock prices, soaring interest rates and large capital outflows. Similar problems have plagued Ukraine and Bulgaria and like many Asian countries, IMF rescue packages have had to be assembled for these countries.

1.2 Review of the Western Australian and Australian Economies

State economy grew at record pace.

The Western Australian domestic economy grew at a record pace in 1997/98 and continued to outperform all other State economies. While the Australian Bureau of Statistics no longer compiles Quarterly State Accounts, estimates carried out by the Western Australian Treasury Department suggest gross state product growth of between 8.0% and 9.0% in 1997/98. This compared with a national average growth rate of 3.9%.

Western Australia's impressive growth took place despite the Asian downturn, but notably, growth through the year eased following a very strong start. So, while domestic demand grew by 3.1% in the September quarter of 1997, by the June quarter of 1998 growth had slowed to 0.7% per quarter, similar to the growth rate nationally. This reflected an easing in business investment growth following a 12.7% rise in the September quarter of 1997. Overall, business investment grew 29.5% in 1997/98, the fastest rate of growth on record and well ahead of the national growth rate of 8%.

The pace of growth in private consumption expenditure eased during the year but was partially offset by a lift in dwelling investment in the second half of the year. Partial indicators of consumer spending were mixed. Retail turnover fell slightly in the June quarter of 1998, while new motor vehicle registrations increased at a record pace. Building approvals and construction finance data pointed to continued strength in housing activity and household confidence improved. Western Australia's exports also continued to grow at a healthy pace, increasing 18% in 1997/98, underpinned by strong demand from China, Hong Kong, South Korea and Taiwan and the State's major OECD trading partners.

Western Australia's labour market continued to outperform those in other States.

Consistent with growth in domestic demand, Western Australia's labour market continued to outperform all other States. Employment grew 2.9% over the year to August 1998 compared with a national increase of 1.7%. This was accompanied by similar growth in Western Australia's labour force. As a consequence the State's unemployment rate remained at 7.0%. The comparable national unemployment rate was 8.1%.

Inflationary pressure remains subdued.

State inflationary pressures remained subdued by historical standards. The headline consumer price index (CPI) for Perth fell by 0.2% in 1997/98, the first financial year on record in which the Perth CPI fell. Nationally, prices remained static, with the Australian CPI recording zero growth over 1997/98. Wages growth however accelerated over the year with Western Australian average weekly ordinary time earnings (AWOTE) rising 4.2% in 1997/98, up from growth of 2.3% in 1996/97. Nationally, AWOTE rose 4.4% in 1997/98.

Interest rates low and the Australian dollar drops to a new record level.

Interest rates remained low and relatively stable throughout most of 1997/98. However, in early June 1998 short term interest rates rose sharply, reflecting concern that the Reserve Bank of Australia (RBA) would tighten monetary policy as a means of supporting the A$. The value of the A$ relative to the US$ fell consistently over 1997/98. In early August 1998 it touched an all time low of US$ 0.5525 with the Federal Reserve intervening on the RBA's behalf by buying $100 million in New York trading. The amount was insignificant, but it signaled the RBA was unhappy with the speed at which the A$ fell.

Western Australia's nominal trade surplus in 1997/98 rose to $14.2 billion, up from $12.5 billion in 1996/97. Exports grew by $3.5 billion or 18% while imports increased by $1.8 billion or 26%. Australia's trade balance however, deteriorated, with the current account deficit increasing 40% to $24 billion. This represented 4.4% of national GDP.

State and Federal Government budget surpluses.

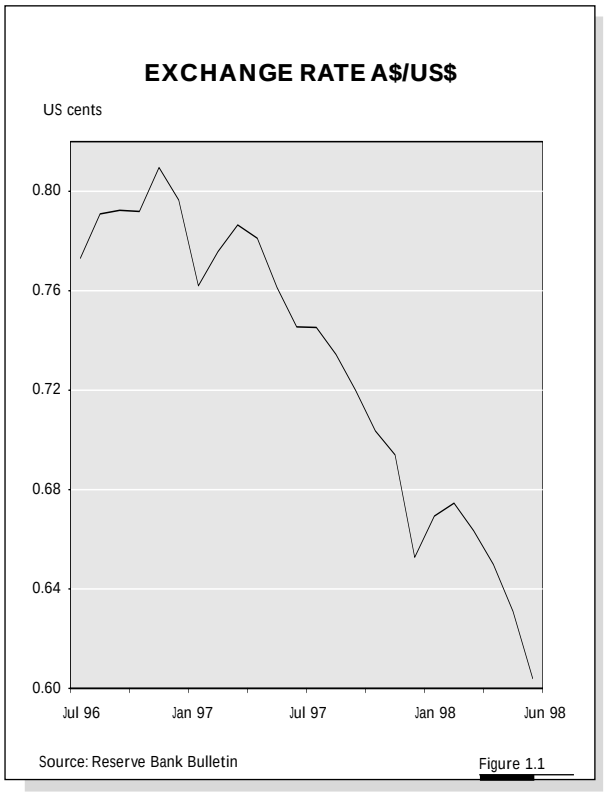
The Western Australian 1998/99 budget was handed down in April 1998. It indicated that the overall finances of the State are in a strong position. Due to the sale of the Dampier to Bunbury natural gas pipeline, Western Australia's public sector achieved a record surplus of $1.8 billion.

The 1998/99 Commonwealth budget was brought down in May 1998. The Federal Government budget also contained an underlying surplus of $2.4 billion – a significant turnaround from the expected deficit of $1.2 billion. As expected, it was a very subdued 'no changes' budget, with major tax changes announced in the Government's tax reform package. Despite no increases in taxes, the Budget outlays as a proportion of GDP were expected to fall from around 27% of GDP to below 24% by 2000/01. This represents an outcome not achieved since the early 1970s.

Of greater significance was the release of the Federal Government's tax reform package in August 1998.

National economic growth predicted to slow to 2% and current account deficit to reach 5% of GDP.

It is now over a year since the first domino fell in Asia and the outlook presented by analysts is that both Western Australia and the nation as a whole will experience slower growth as a result of the deterioration in the external environment and an associated weakening of confidence. The IMF has forecast Australia's growth to drop to 2% in 1999 and the current account deficit to reach 5% of GDP, underscoring the need to maintain a cautious fiscal policy. However, the IMF has pointed out that the achievement of an underlying budget surplus in 1997/98, a year ahead of schedule, means that the projected rise in the current account deficit will be taking place against a background of significantly improving public finances.



Source: Reserve Bank Bulletin

Figure 1.1

1.3 Economic Factors Affecting the Mining Industry

Economic collapse in East Asia pulls down mineral and energy commodity prices.

World mineral and energy commodity prices were pulled down by economic collapse in East Asia. Most major resource commodities were affected. For example, in US$ terms, oil, nickel, and gold were down 23%, 20% and 16% respectively in 1997/98. A recent IMF study has found that the crisis economies of Asia (Indonesia, Malaysia, Korea and the Philippines) plus China have accounted for about two thirds of the growth in world commodity consumption between 1992 and 1996. Not surprisingly therefore, the Asian crisis represented the most significant shock to commodity markets since the dissolution of the Soviet Union and the global economic slowdown in the early 1990s. Japan's poor economic performance also continued to undermine commodity markets.

Economic developments in Russia further undermine commodity markets.

Commodity markets were also adversely affected by developments in Russia. Hopes of a recovery in Russia were dashed at the end of 1997/98 by a sharp rise in interest rates from around 20% to 150% before settling at around 80% in an effort by the government to support the rouble. The longer term effect of this is uncertain. Russia in all likelihood will try to increase supply of commodity exports in an attempt to boost its foreign exchange reserves. However, Russia has already exported large amounts of minerals, scrap, finished metal and oil throughout the 1990s and capacity restrictions may prevent further increases. Ironically, Russia's economic meltdown could also restrict credit to its metal producers, thereby reducing output. Nevertheless, these are disturbing developments, occurring at a time of subdued demand in international commodity markets.

The competitiveness of Western Australia's mining industry continued to improve with the ongoing deregulation and expansion of the State's energy industry. Since 1 January 1998, gas customers taking at least 250 TJ per annum through a single connection were able to contract directly with the supplier of their choice. Significantly, in March 1998 the Dampier to Bunbury gas pipeline was sold to Epic Energy Australia. At $2.4 billion the privatisation was the largest in the State's history, surpassing the $900 million sale of BankWest two years ago. Epic Energy Australia immediately announced it will reduce transportation costs by 20% by 2000, with a further commitment to double the pipeline's capacity by 2007. Planned extensions to the gas pipeline network are also creating new opportunities for value added downstream processing.

Mining and energy industry reaps the benefits of a lower Australian dollar.

As many export contracts are written in US$, the US$/A$ exchange rate is one of the significant economic determinants affecting the State's minerals and energy industry. Developments on this front were very favourable, with the value of the A$ falling due to offshore developments and the heightened uncertainty over the outlook for commodity prices. The value of the A$ relative to the US$ fell consistently over 1997/98, averaging 68 US cents over the year, 13% down on 1996/97's average value. This was overwhelmingly the most significant factor contributing to the growth in the value of Western Australia's minerals and energy industry in 1997/98.

Federal Government proposal to introduce a Goods and Services Tax (GST).

In August 1998 the Federal Government released its tax reform package. The backbone of the package is the proposal to introduce a Goods and Services Tax (GST) from 1 July 2000. Areas of greatest benefit to the minerals and energy industry were the following proposals:

- Exports to be GST free via the ability to claim input tax credits on all inputs used to produce the final goods or service. In the case of the mineral and petroleum sectors this means that regardless of whether the goods produced are exported, input tax credits can be claimed on all inputs used to produce the goods that are then sold;
- The fringe benefits tax (FBT) exemption for remote area housing (currently only applicable to primary producers) to be extended to housing provided by mining industry employers to their employees. This will work towards equalising the options between fly-in, fly-out arrangements versus constructing residences in regional mining areas;
- Revenue from a GST will enable States to abolish a range of taxes affecting the mining industry. These changes will require negotiations with State Governments as the Commonwealth proposes to give all the GST revenue to the States. Taxes proposed to be abolished included Financial Institutions Duty (FID), debits tax, stamp duties on conveyances and transfers of "business property"; and
- Reductions in diesel fuel excise to zero for off road use and to 18 cents per litre for on road use. These changes to the tax treatment of diesel are expected to yield the bulk of the anticipated benefits of the tax reform package to the mining industry, significantly improving the international competitiveness of the State's mining industry.

It should be stressed that the details and implementation of the tax reform package are subject to Senate approval and are by no means guaranteed.

Commencement of Western Australian gold royalty.

After consulting with industry groups the final details of Western Australia's gold royalty were agreed by Cabinet and announced on 28 July 1997. The royalty commenced from 1 July 1998 at a rate of 1.25%. The full 2.5% rate is delayed until July 2000 and is conditional on the gold price exceeding an average A$450 for the quarter. From 2005 the royalty will be unconditional. These concessions are worth about $56 million over the next three years and up to $160 million over the next seven years. The royalty is expected to raise about $28 million in 1998/99.

1.4 Social and Political Factors Affecting the Mining Industry

Native title continues to be a major issue impacting on the industry.

Native title continued to be the major issue impacting on the mining industry. In accordance with the Federal Government's Native Title Act (NTA) procedures, native title claims covering over 82% of the State had been registered with the National Native Title Tribunal (NNTT) by the end of July 1998. The distribution of these claims is such that about 98% of all mineral title applications in Western Australia must now be processed via the future act regime of the NTA.

To 31 July 1998, the impact of the NTA procedures has been to delay the grant of 75% of exploration titles by about three months. Where objections to the NTA "expedited procedure" (sought for all exploration titles in Western Australia) are lodged, the delay is generally extended by a further two to three months.

Senate passes the Federal Government's Native Title Amendment Bill with many amendments very relevant to the mining industry.

Significantly, the Senate finally passed the Federal Government's Native Title Amendment Bill on 8 July 1998 after one of the longest and most bitter debates in the history of the senate.

The NTA amendments most relevant to the mining industry are:

- *Validation*
  State and Territory governments will be able to legislate to validate mining titles issued over leasehold (including pastoral) land between 1 January 1994 (when the Native Title Act came into force) and the High Court Wik decision, 23 December 1996.
- *Right to negotiate on pastoral leases*
  State and Territories can legislate to replace the right to negotiate over mining on pastoral leases with a regime giving native title claimants a series of rights. This means that parties to a native title claim would have the right to be "consulted" in regards to mineral tenement applications. Registered claimants and native title holders would be able to object to the application and that objection be determined by an independent body.
- I*nfrastructure for mining*
  All infrastructure associated with mining, whether it be on leasehold or Crown land is exempt from the right to negotiate. A notification requirement exists and there is a right to object.
- *Renewal of mining leases and ancillary licences and permits*
  Renewals and extensions of terms of mining leases, grants, permits and licences are no longer subject to NTA procedures.
- *Registration test*
  At least one member of a native title claim group is required to have had a traditional physical connection with the land under claim. Existing claims that were lodged after 26 June 1996 will lose the right to negotiate if they fail the new registration test.
- *Racial Discrimination Act*
  The amendments provide for a continuing association between the Native Title Act and the Racial Discrimination Act, but the association must allow the Native Title Act to operate.

States and Territories are drawing up and passing complementary legislation to give themselves the powers to implement many of the provisions in the Commonwealth amendments. This in turn must obtain Commonwealth Parliamentary endorsement.

Western Australian Government drafts legislation allowing the establishment of a State Native Title Commission.

In accordance with this, the Western Australian Government has drafted the Native Title (State Provisions) Bill and amendments to the Titles Validation Act. The Native Title (State Provisions) Bill will allow the establishment of a State Native Title Commission with powers similar to those of the existing National Native Title Tribunal (NNTT). Under the amended NTA all claims will be lodged in the Federal Court and the Commission in Western Australia will have delegated powers. The Commission will undertake the registration of all native title claims, facilitate consultation, provide mediation and make determinations if the parties fail to reach agreement.

Favourable outcome for Australia from Kyoto agreement on greenhouse gas emissions.

Environmental issues pertaining to the minerals and energy industry ranged from international agreements through to State issues. On the international front, in December 1997 the greenhouse gas issue was discussed by world governments at Kyoto, Japan. From Australia's perspective the Kyoto outcome was satisfactory. The agreement is to lead to a 5.2% reduction in world greenhouse emissions below 1990 levels by 2012. However, Australia was one of three countries permitted to increase emissions and additionally, Australia had a special clause included in the Agreement allowing land use clearing to be included in determining 1990 level baseline emissions, a less onerous move to cut emissions.

New Commonwealth Bill streamlines the State–Commonwealth environmental approvals process.

Federally, the Environment Protection and Biodiversity Bill 1998 was drafted to replace Commonwealth environmental laws in place since the 1970s. The changes include removal of various triggers to Commonwealth intervention in environmental matters such as through foreign investment approvals and Commonwealth funding decisions. Instead, the Commonwealth will act only in defined matters of national environmental significance such as, for example, Commonwealth marine areas, World Heritage properties and nuclear actions.

The Bill enhances the Commonwealth's ability to accredit State environmental procedures and to delegate authority to the State. It therefore removes the Commonwealth from State and local issues and streamlines the approvals process. The Bill also allows development proponents to trigger the Commonwealth approvals process to clarify whether the Commonwealth will become involved, rather than having to wait for Commonwealth intervention.

Regional Forest Agreement public consultation paper released.

Also related to the Commonwealth/State arena, in May 1998 the joint Western Australian - Commonwealth public consultation paper, "Towards a Regional Forest Agreement" was released, outlining a range of possible approaches to a long-term Regional Forest Agreement (RFA) between Western Australia and the Commonwealth. The release of the document marked the beginning of the final phase in the RFA's development, which commenced in 1992, when Commonwealth, State and Territory governments signed the National Forest Policy Statement.

The proposed RFA for Western Australia encompasses most of the State's south–west region. It will be an agreement between the State and Commonwealth governments on the future use and management (including exploration and

mining) of the forests of Western Australia's south-west. The Agreement will be in place for 20 years, subject to five-yearly reviews.

The last stage of the RFA process entails considering comments on the consultation paper and development of a preferred approach for submission to the Commonwealth and State governments before signature by the Prime Minister and the Premier.

Commonwealth/State Management Agreement for the Shark Bay World Heritage Area is signed.

An intergovernmental agreement, which was already signed in September 1997, was the Commonwealth/State Management Agreement for the Shark Bay World Heritage Area (SBWHA). The EPA now has to review the environmental implications of any petroleum exploration proposals within the SBWHA for consideration by the Federal Minister for the Environment and the World Heritage Area Ministerial Council.

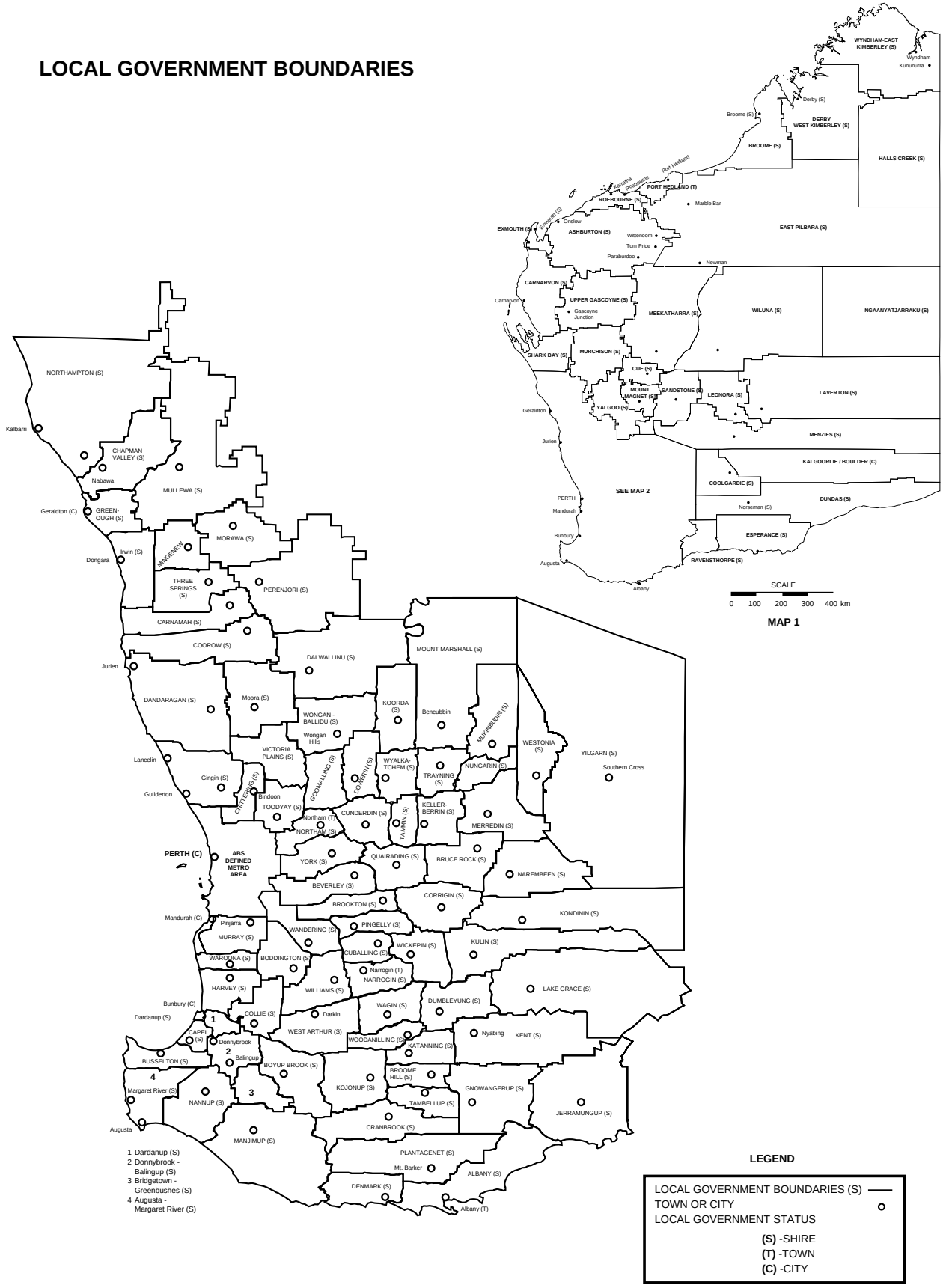
National Environment Protection Council agrees on standards to control air pollution and the movement of hazardous wastes.

In June 1998 the National Environment Protection Council (NEPC) agreed on standards to control air pollution and the movement of hazardous wastes. The National Environment Protection Measure (NEPM) on ambient air quality will cover six major pollutants. State and Territory Governments have committed to adopting the standards as goals for air quality management. The second NEPM, standards on the movement of hazardous wastes, came into force in July 1998. This NEPM sets out how controlled wastes being transported between States and Territories must be properly identified, transported and handled.

By way of background, the NEPC emanates from a Special Premiers' Conference held in October 1990, at which the Prime Minister, Premiers and Chief Ministers agreed to develop an Intergovernmental Agreement on the Environment (IGAE), which came into effect on 1 May 1992. The IGAE included provision for the establishment of a national body with responsibility for making NEPMs. Complementary legislation establishing this national body, the NEPC was also passed in all jurisdictions.

The NEPC is a statutory body with law making powers established under the National Environment Protection Council Act (Commonwealth) 1994. Members of Council are Ministers, not necessarily environment Ministers, appointed by first Ministers from each participating jurisdiction (i.e. Commonwealth, State or Territory Governments). NEPMs are broad framework setting statutory instruments defined in NEPC legislation. They outline agreed national objectives for protecting particular aspects of the environment.

Figure 1.2


LOCAL GOVERNMENT BOUNDARIES
WYNDHAM-EAST KIMBERLEY (S)
Wyndham
Kununurra
Derby (S)
Broome (S)
DERBY WEST KIMBERLEY (S)
BROOME (S)
HALLS CREEK (S)
Karratha
Roebourne
Port Hedland
PORT HEDLAND (T)
ROEBOURNE (S)
Marble Bar
Exmouth (S)
Onslow
EXMOUTH (S)
ASHBURTON (S)
EAST PILBARA (S)
Wittenoom
Tom Price
Paraburdoo
Newman
CARNARVON (S)
Carnarvon
UPPER GASCOYNE (S)
Gascoyne Junction
MEEKATHARRA (S)
WILUNA (S)
NGAANYATJARRAKU (S)
SHARK BAY (S)
MURCHISON (S)
CUE (S)
MOUNT MAGNET (S)
SANDSTONE (S)
LEONORA (S)
LAVERTON (S)
YALGOO (S)
Geraldton
Jurien
MENZIES (S)
KALGOORLIE / BOULDER (C)
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Norseman (S)
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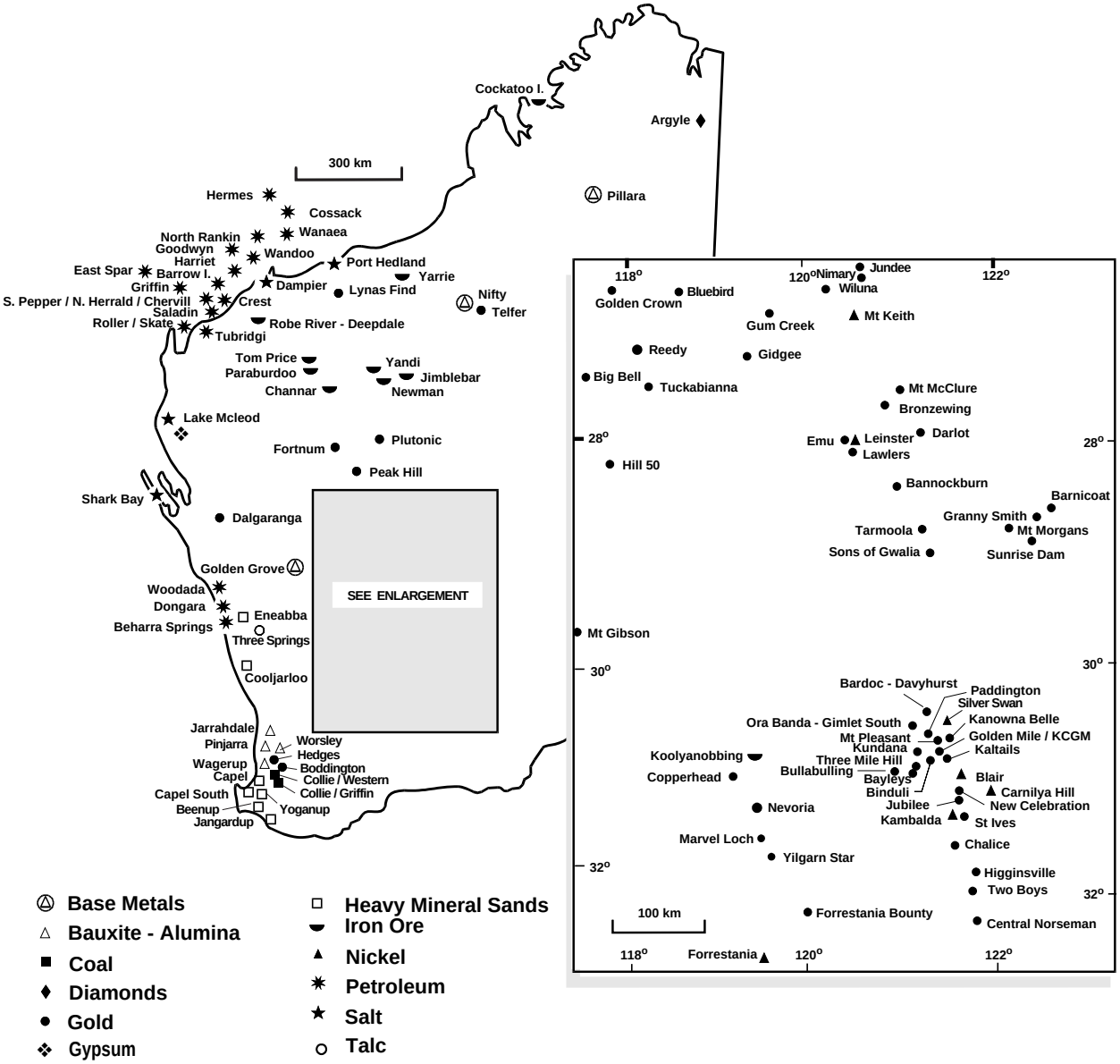
MAP 1
NORTHAMPTON (S)
Kalbarri
CHAPMAN VALLEY (S)
Nabawa
MULLEWA (S)
Geraldton (C)
GREEN-OUGH (S)
MORAWA (S)
Irwin (S)
Dongara
MINGENEW
THREE SPRINGS (S)
PERENJORI (S)
CARNAMAH (S)
COOROW (S)
MOUNT MARSHALL (S)
DALWALLINU (S)
Jurien
DANDARAGAN (S)
Moora (S)
KOORDA (S)
Bencubbin
MUKINBUDIN (S)
WONGAN - BALLIDU (S)
Wongan Hills
WESTONIA (S)
YILGARN (S)
Southern Cross
VICTORIA PLAINS (S)
Lancelin
WYALKA-TCHEM (S)
NUNGARIN (S)
TRAYNING (S)
GOOMALLING (S)
DOWERIN (S)
Gingin (S)
CHITTERING (S)
Guilderton
Bindoon
TOODYAY (S)
CUNDERDIN (S)
KELLER-BERRIN (S)
Northam (T)
NORTHAM (S)
TAMMIN (S)
MERREDIN (S)
PERTH (C)
ABS DEFINED METRO AREA
YORK (S)
QUAIRADING (S)
BRUCE ROCK (S)
NAREMBEEN (S)
BEVERLEY (S)
BROOKTON (S)
CORRIGIN (S)
KONDININ (S)
Mandurah (C)
Pinjarra
WANDERING (S)
PINGELLY (S)
MURRAY (S)
KULIN (S)
WICKEPIN (S)
CUBALLING (S)
WAROONA (S)
BODDINGTON (S)
Narrogin (T)
NARROGIN (S)
HARVEY (S)
WILLIAMS (S)
LAKE GRACE (S)
DUMBLEYUNG (S)
Bunbury (C)
WAGIN (S)
Dardanup (S)
COLLIE (S)
Darkin
1
CAPEL (S)
WEST ARTHUR (S)
Nyabing
KENT (S)
Donnybrook
2
WOODANILLING (S)
KATANNING (S)
Balingup
BUSSELTON (S)
BOYUP BROOK (S)
BROOME HILL (S)
4
KOJONUP (S)
GNOWANGERUP (S)
Margaret River (S)
3
NANNUP (S)
TAMBELLUP (S)
JERRAMUNGUP (S)
Augusta
CRANBROOK (S)
MANJIMUP (S)
PLANTAGENET (S)
Mt. Barker
ALBANY (S)
DENMARK (S)
Albany (T)
1 Dardanup (S)
2 Donnybrook - Balingup (S)
3 Bridgetown - Greenbushes (S)
4 Augusta - Margaret River (S)
LEGEND
LOCAL GOVERNMENT BOUNDARIES (S)
TOWN OR CITY
LOCAL GOVERNMENT STATUS
(S) -SHIRE
(T) -TOWN
(C) -CITY

Figure 1.3

MAJOR MINERAL AND PETROLEUM PROJECTS IN WESTERN AUSTRALIA



2. REVIEW OF MAJOR MINERALS AND PETROLEUM IN WA

2.1 Overview and Outlook

Despite depressed prices of most mineral and energy commodities, the value of mining and petroleum production increased in 1997/98 by 8.8% to $17.8 billion thanks to increased output and the depreciation of the A$. This outcome, in the midst of poor commodity prices, was made all the more impressive in light of the many industry production records which were broken.

Significant contributors to this growth were the iron ore, alumina and diamond industries.The value of iron ore production reached a record value of $3.9 billion. This was the combined result of favourable prices, depreciation of the A$ and increased output. It pushed the sector past gold to regain its position as the State's second largest resource industry. Indeed, it was a difficult year for gold, but despite depressed prices and the closure of several projects, overall gold output grew for the third successive year, increasing over 13 tonnes to reach a record 241 tonnes.

Like iron ore, alumina also broke records with output up to achieve an all time high of over 8.5 million tonnes. Favourable local prices resulting from A$ devaluation meant that the value of production also hit a new record of $2.3 billion. Likewise, nickel production reached a record 135 thousand tonnes, which combined with the $A devaluation helped counteract poor prices to see the value of nickel production grow to a new high of $1,147 million. Despite the volume of sales dropping, diamond sales also hit a record value of $538 million – thanks to the devaluation of the A$ and higher grade of product being sold. In the zinc industry, the State began to achieve new prominence with production up 43% to 126 thousand tonnes. Despite falling over most of 1997/98, zinc prices were on average higher compared to 1996/97 and this in combination with greater volumes boosted the value of zinc production up a significant 61% to $121 million.

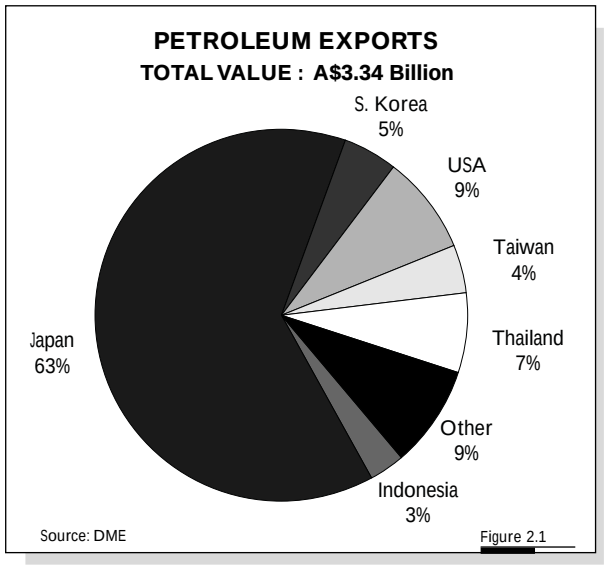
Lower crude oil output and weak oil prices resulted in a small (2%) decrease in the value of production from the State's petroleum industry. Nevertheless, with a value of output of $4.9 billion the petroleum industry remained the State's most significant resource sector. Notably, the value of LNG exports increased $63 million to $1.6 billion and the value of condensate production was up $122 million to over $1 billion.

As discussed earlier, world economic conditions are such that the outlook for commodity prices is therefore not good and as predicted by ABARE, developments in China may be particularly crucial to Western Australian mineral and energy producers. If China substantially devalues its currency it could have significantly adverse effects on economic activity in other parts of Asia as China's exports become more internationally competitive. The effect on local producers would mean less export opportunities into China whilst at the same time increasing the incentive for China to raise metal exports – thereby further dampening world prices.

2.2 Petroleum

A fall in crude oil output and poor oil prices resulted in a small (2%) decrease in the overall value of production from Western Australia's petroleum industry. Nevertheless, this industry remained the State's most significant resource sector. Value of output was $4,932 million, representing 28% of the State's value of mineral and energy production and about half of Australia's value of petroleum output.

In 1997/98 the State exported 68% by value, of its petroleum production. The major destinations were Japan (63%), Thailand (7%) and the US (9%) (Figure 2.1).



1997/98 Petroleum Industry Highlights

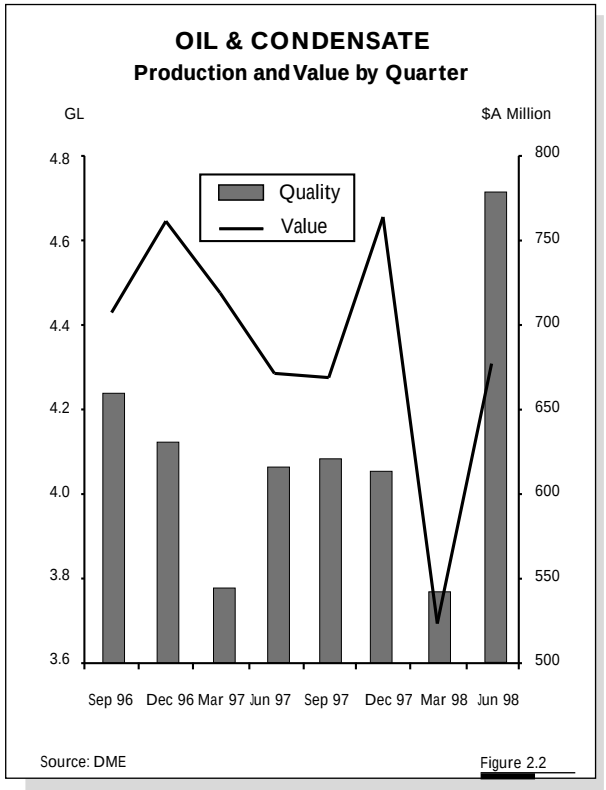
Thanks at least in part to the decreased value of the Australian dollar, the fall in crude oil prices did not significantly impact on prices received for LNG. Value of LNG production was up 4% on the previous year to $1,592 million and represented the most significant petroleum product. Sales volumes were also up, by over 2% to 7.2 million tonnes.

With Western Australia accounting for approximately 10% of world LNG trade, it has now become a significant supplier in the world LNG market. This was highlighted with Perth hosting the world's premier LNG conference in May 1998, attended by the world's major LNG producers and consumers.

In addition to the contracted amounts sold to Japan, deliveries were also made to the US, with cargoes to Boston and Houston. The joint venture participants have indicated that while there is potential for further spot LNG sales, any such sales will not be allowed to affect sales under contracted arrangements with its eight Japanese buyers.

These spot sales are made possible by the North West Shelf Gas Project (NWSGP) having capacity installed beyond that required to meet the current level of firm long-term contract sales to Japan. Capacity could be increased further if plans to construct two additional LNG trains reach fruition. The NWSGP's expansion plans involve, amongst others, adding two more processing trains to the three that have been operating since the mid 1980s. This would double LNG production capacity to almost 14.5 million tonnes per annum.

The addition of the two extra LNG trains is part of an overall expansion project being undertaken for the NWSGP. It includes the installation of a second trunk line to supply gas from offshore fields to the NWSGP's onshore processing facilities, domgas debottlenecking and additional fractionation and stabilisation facilities. At this stage, a front end engineering design contract for the proposed expansion of the LNG project has been awarded. This is a preliminary step before the calling of final tender contracts for procurement and construction of the two new LNG trains making up the proposed expansion. Expenditure on the final



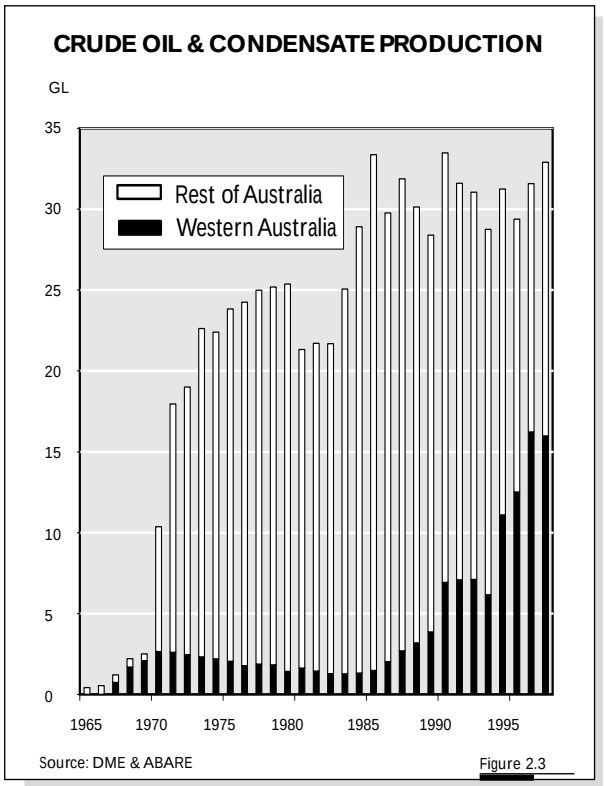
tender contracts is conditional upon the NWSGP joint-venture partners securing long term LNG sales contracts with their Japanese customers.

Crude oil production fell 6%, principally due to the shutdown of the Griffin project for three months for repairs. In addition, oil production from the State's largest oilfield, Wanaea, was lower due to problems in reducing water from gas flow and the scheduled shutdown for maintenance of the Wanaea/Cossack floating production, storage and off-loading (FPSO) facility that occurred in April 1998. But the State's oil output was at least supplemented with the first full year of production from the Wandoo 'B' platform in 1997/98. Oil output was also boosted with the commencement of production from the Agincourt field in August 1997, followed by the Lambert/Hermes project in October 1997. These developments augured well for the State's crude oil production.

Globally, oil supply outstripped demand which led to an accumulation of large stockpiles. As a result, world oil market prices dropped significantly from their previous year's high. This compounded the State's fall in crude oil production in 1997/98 to result in an 18% decrease in value of production to $1,567 million.

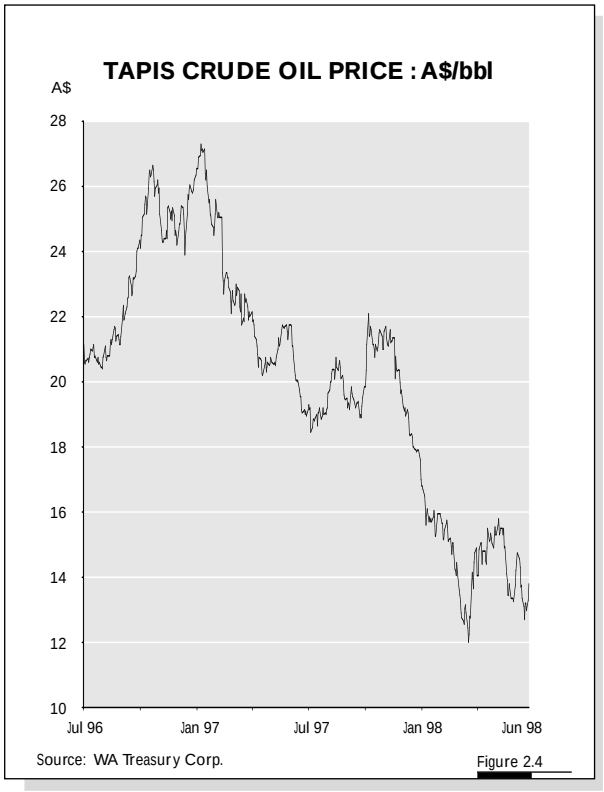
Significantly, the value of Western Australia's condensate production increased 13% to reach a record amount of $1,065 million. This was chiefly due to greater output from the North West Shelf project, particularly North Rankin and Goodwyn which contributed to a dramatic 18% output increase, overcoming lower oil prices. Again, future condensate production is also expected to increase, with the NWSGP's liquids expansion program expected to lift NWSGP condensate production from its present rate of about 115,000 to 130,000 barrels a day. This could take place as early as 2000.

Even though output was stable, the value of natural gas production increased over 4% in 1997/98 to $557 million. 1997/98 was also the second full year of production from Woodside Petroleum's liquefied petroleum gas (LPG) plant. LPG products went to new export markets in 1997/98, particularly South Korea. Over 635,000 tonnes of LPG butane and propane product were produced, worth approximately $151 million. Although prices were down for LPG products, the value of production in 1997/98 nevertheless represented a 31% increase on the previous year. The NWSGP's liquids expansion program is expected to lift LPG production to 6,600 tonnes a day from the present production of just 2,000 tonnes a day.



World Oil Market and Outlook

Oil prices fell heavily in 1997/98, dropping 23% on average compared to the previous year. A



particularly steep decline in oil prices occurred between November 1997 and mid-March 1998, when the price of North Sea Brent fell to a nine year low of just below US$12 per barrel. This was due to several factors, including OPEC's decision in November 1997 to increase production quotas and the return of Iraq to the market, which reinforced the already negative effects of the Asian crisis.

Prices rebounded somewhat and appeared to stabilize around the US$15/bbl mark from mid-March to May 1998. This was partly in response to proposed cuts in late March 1998 in production ceilings in OPEC and some non-OPEC oil producing countries. However, as the production cuts did not materialize to the extent promised, oil price have since drifted lower again. Low prices were compounded by Russia leaking exports and difficulties in controlling output from Venezuela and Mexico.

In June 1998 seventeen national oil producers (OPEC and non-OPEC) agreed to cut production by 4% of global output. However, this reduction may have done little more than match the seasonal decline in the rate of consumption over the June quarter. Indications so far are that the reductions have started but the process of reining in output is slow and the effects on the market are feeble given the already poor demand and high stock levels. The oil price outlook therefore remains weak, with most analysts expecting prices to remain around the US$13 to US$15 per barrel mark over 1998/99.

State Outlook

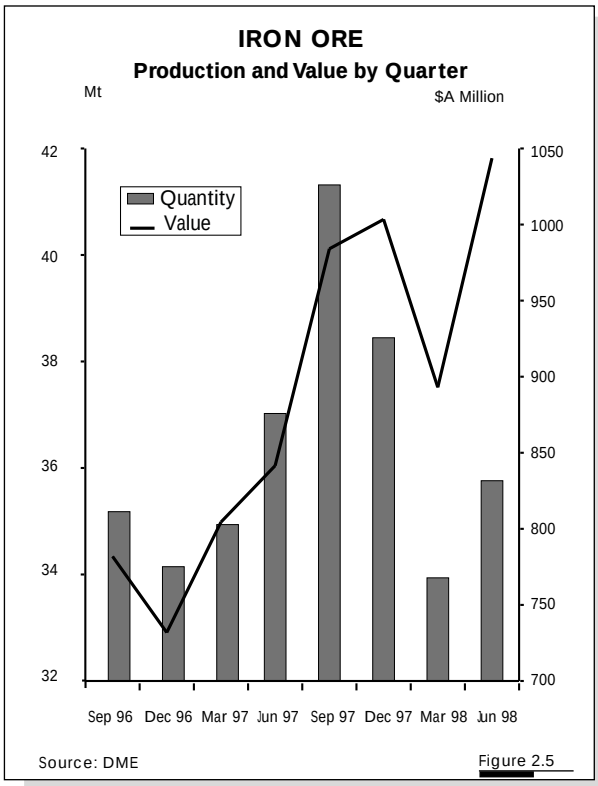
With the resumption of full production from Griffin and Wanaea/Cossack plus a full year's production from Lambert/Hermes and Agincourt fields, crude oil and condensate production is expected to be higher in the coming year. In addition, the commencement of production from the Stag field in May 1998 is expected to further boost output. However, in the longer term, current forecasts indicate total condensate and crude oil production will decline after 2002 unless there is a significant increase in exploration activity over the next few years.

The economic downturn in Asia has led to uncertainty in the LNG industry. Up until the middle of 1997 demand forecasts were universally confident of continually increasing demand. However, the Asian downturn has put in question the LNG industry's expansion plans. It is almost certain that new LNG projects such as the NWSGP expansion plans mentioned earlier will proceed, the question is when. This similarly applies to greenfield developments such as the Gorgon, North Gorgon, Spar, West Tryal Rocks, Chryasor and Dionysus gas fields. So despite the short-term drop in confidence, the long-term outlook is still good as LNG projects are based on long-term commitments between buyers and sellers and the current downturn is likely to have little effect beyond a delay in start up dates.

With the availability of significant resources, Western Australia's gas production is very much dictated by demand which shows steady growth, not only from existing, but also potential new customers. In particular, strong increases in industrial sector demand are expected, particularly in the iron ore, nickel, gold and mineral sands processing and chemical sectors. In relation to the chemical sector, of particular relevance was the announcement by the State Government on 10 June 1998 that the Dow Chemical Company and Shell Chemicals Limited had won the right to develop proposals for the construction of a $3 billion integrated petrochemical plant either on the Burrup Peninsula or Maitland industrial estate near Karratha. The first stage of Dow/Shell's feasibility study is to be completed by the end of 1998 with a view to begin physical implementation of the project in 2000.

2.3 *Iron Ore*

The value of production in Western Australia's iron ore industry increased by a dramatic 24% to reach a record amount of $3,931 million. This was amongst the most significant increases in 1997/98 for the minerals and energy sector, pushing the sector past gold to regain its position as the State's second largest resource industry. Factors responsible for the increase were higher prices, greater production and in particular, very favourable exchange rates.



Production increased by 6% in 1997/98 to reach 150 million tonnes. This represented almost the entire Australian output, accounting for approximately 98% of national production (Figure 2.6). On a global scale, Western Australia is the world's third largest producer after China and Brazil.

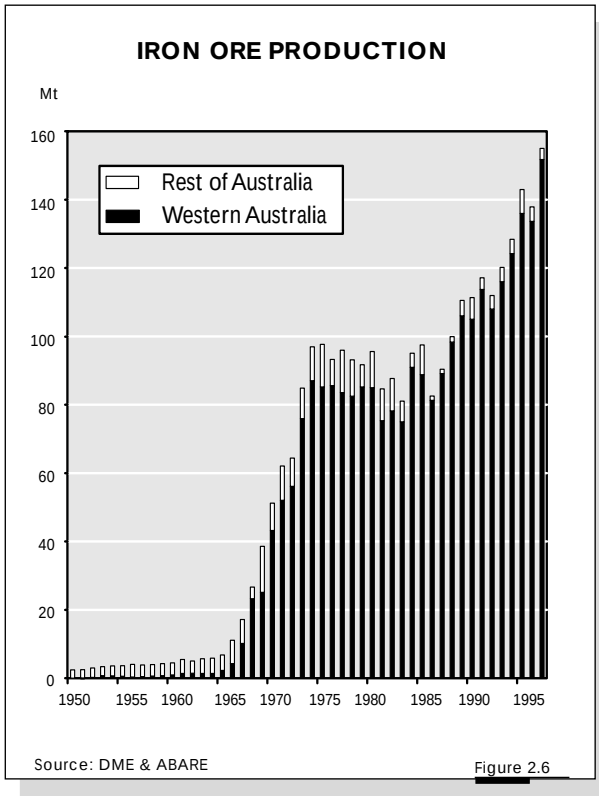
About 95% of Western Australia's iron ore production was exported overseas and the State is the world's leading iron ore exporter. Almost half of the exported iron ore went to Japan, a quarter to China and the remainder mostly split up between South Korea, Europe and Taiwan (Figure 2.7).

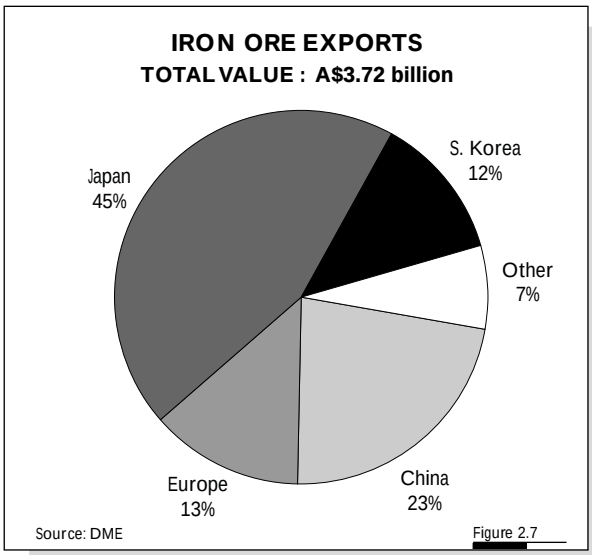
1997/98 Iron Ore Industry Highlights

The13% devaluation of the A$ relative to the US$ during 1997/98 was the most significant contributor to the increased value of production. However, slightly higher prices also helped. For the Japanese fiscal year (JFY) (April 1997 to March 1998), BHP and Hamersley Iron both obtained a 1.1% increase in their US$ fine ore price while Robe River secured a 1.4% increase for its fine ore. Lump ore prices remained unchanged. In 1998, for the 1998/99 JFY, the three major producers secured from Japanese buyers further price increases of 2.9% and 2.8% for lump and fine ore respectively. Despite quite a strong year in worldwide steelmaking, these prices were nevertheless reached under difficult circumstances.

Robe River Iron Associates is Western Australia's third largest iron ore producer and significantly, in 1997/98 increased iron ore shipments by 16% to attain a new record of 28.3 million tonnes.

Whilst the production boost in 1997/98 came from existing operations, Hamersley Iron commenced work on its new Yandicoogina iron ore project in late 1997. In October 1997 Hamersley Iron also started improving and expanding its Dampier port facilities to increase its capacity by some 10 million tonnes per annum. This will accommodate handling of its new Yandicoogina pisolitic type of iron ore product. The expansion entails maximising utilisation of existing equipment and infrastructure, installation of new equipment, construction of a lay–by berth at East





Intercourse Island and dredging of loading basins at Parker Point. Construction of the railway line linking Yandicoogina to existing rail facilities also progressed and it is expected that the Yandicoogina mine will be in full production by the middle of 1999.

In addition, 1997/98 also saw BHP largely complete its iron ore capacity expansion at Nelson Point in Port Hedland. This has been in progress since late 1996. The upgrading of ore handling facilities at Nelson Point has included the installation of a third ore car dumper, crushing and screening plant upgrades, new marshalling yard facilities and rail line debottlenecking. All up, these upgrades have enabled BHP to lift ore handling capacity at Nelson Point from 44 million to 66 million tonnes per annum.

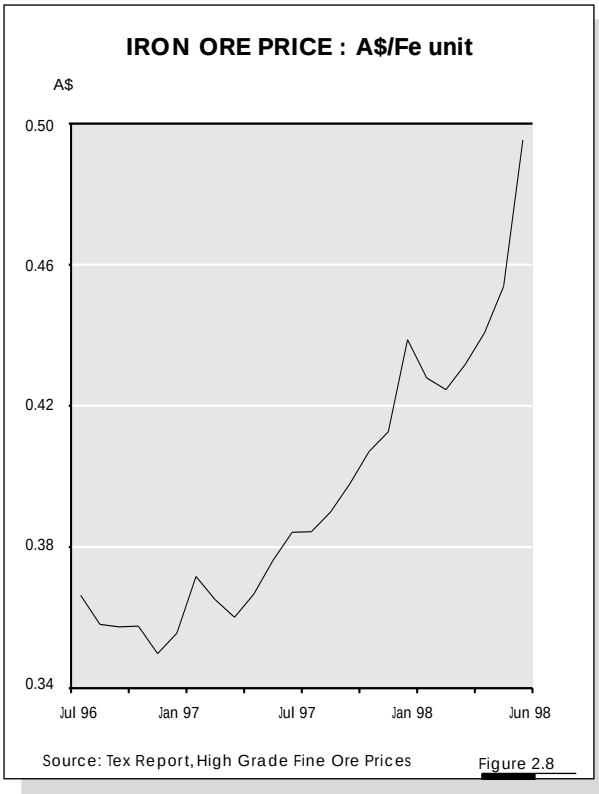
However, the economic turmoil in Asia forced BHP to suspend mine development of its Mining Area C (MAC) and Newman Orebody 18, even though the latter already had railroad formation earthworks in place and a power line under construction.

Outlook

While Japan's steelmaking industry was healthy up to 1997, a sharp reduction is expected over 1998/99, with forecast Japanese output dropping by as much as 9%. Some argue this will be compensated by increased pig iron exports, particularly to the US, but this is questionable in light of expectations that US steel consumption growth will decrease over 1998/99 in line with overall slowing of economic activity.

South Korea is also facing problems of weak domestic demand. So far, South Korea has been able to trade its way out by taking advantage of its low currency and heavily exporting. However, as the threat of antidumping suits by European and US competitors looms large, South Korea's iron ore demand appears increasingly uncertain. European steel production seems healthy, but it appears now that its requirements will be largely satisfied by Russian supply. Steel exports from Russia are expected to grow as a result of boost in competitiveness from the devaluation of the rouble and declining domestic demand.

In the short term at least, Chinese steel production has been predicted to rise, but its iron ore requirements are unclear and any growing demand may perhaps be largely satisfied by domestic stocks. Hence, while some analysts are pointing to increased iron ore consumption in the second half of 1999, this prognosis for Western Australian producers seems optimistic. The odds on iron ore price increases appear stacked against the State's iron ore miners at next year's annual contract negotiations. Recent economic developments including the sharp downturn in Japanese industrial production and the pending over-supply of steel and steel-making raw materials make it difficult to conceive of further price increases.



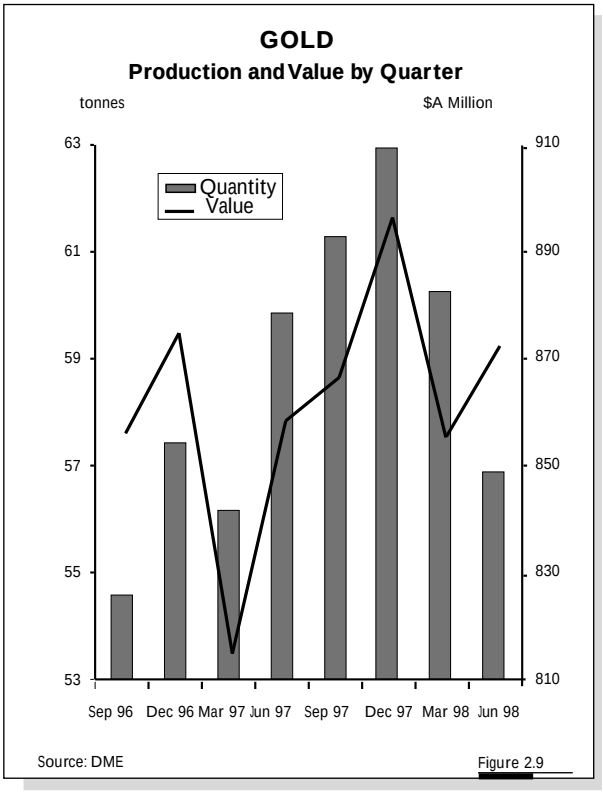
Global economic developments, particularly in Asia, have also enforced a more critical consideration of new iron ore projects and in particular, moves towards downstream processing. A plethora of iron ore processing projects remain simply "under consideration". Western Australia has a ready availability of low cost iron ore and natural gas resources, close proximity to Asia and sophisticated infrastructure. Unfortunately, the Asian economic slowdown now looms as the major hurdle, posing not only marketing difficulties for potential new direct reduced iron (DRI) projects but also initial financing hindrances. Significantly though, BHP continued construction of its DRI plant in Port Hedland. This will be Western Australia's first new downstream iron ore processing facility, with the first briquettes from this plant expected to be produced in 1999.

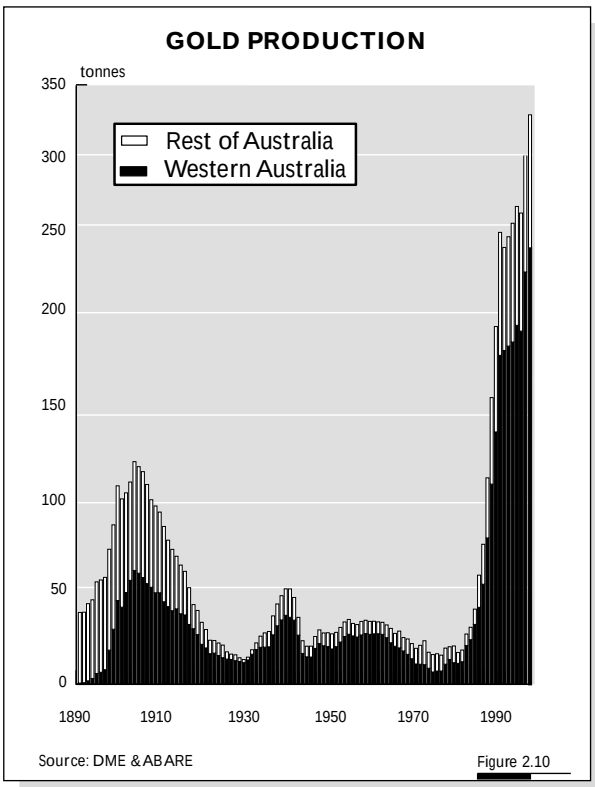
2.4 Gold

Even though depressed gold prices led to the closure of several gold projects, overall gold output grew for the third successive year. Output increased in 1997/98 by over 13 tonnes or 6% to 241 tonnes and Western Australia continued to account for over three quarters of Australia's gold production.

In 1997/98 the price of gold continued to drift lower, hitting an 18-year low of US$280/oz in January 1998. Overall, it averaged US$306/oz, 16% down on the previous year. Consequently, the value of gold production rose by only 3% to $3,496 million. Local producers were sheltered from the full effect of the lower gold price thanks to a depreciated Australian currency which translated to average Australian prices in 1997/98 being just 2% lower compared to the previous year. Local producers were also assisted by maintaining extensive gold hedging positions (Figures 2.9 and 2.11).

In 1997/98 the State's gold exports amounted to $3.98 billion. South Korea(23%), Singapore (20%) and Hong Kong (15%) were the predominant gold export markets (Figure 2.12).





Gold Industry Highlights

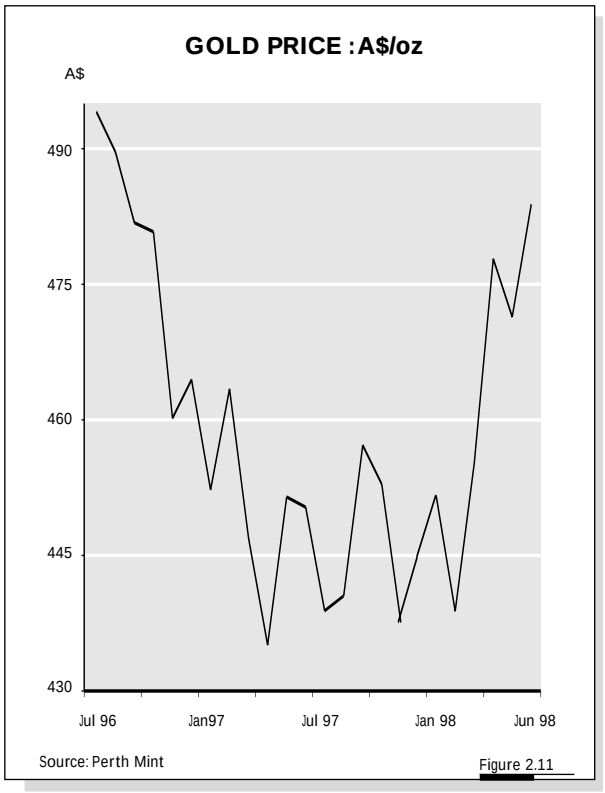
Depressed gold prices have inevitably seen the gold mining industry in Western Australia undergo some rationalisation. This has manifested itself through tenement or lease rationalisation, closures, consolidation of operations and also expansions via corporate takeovers and acquisitions to reap economies of scale in an effort to reduce costs. An example of this was Great Central Mines (GCM) twin takeover of Wiluna Mines and Eagle Mining Corporation. This was part of a strategy by GCM to rationalise and consolidate properties in the Yandal and adjacent Milrose and Wiluna Belts in Western Australia.

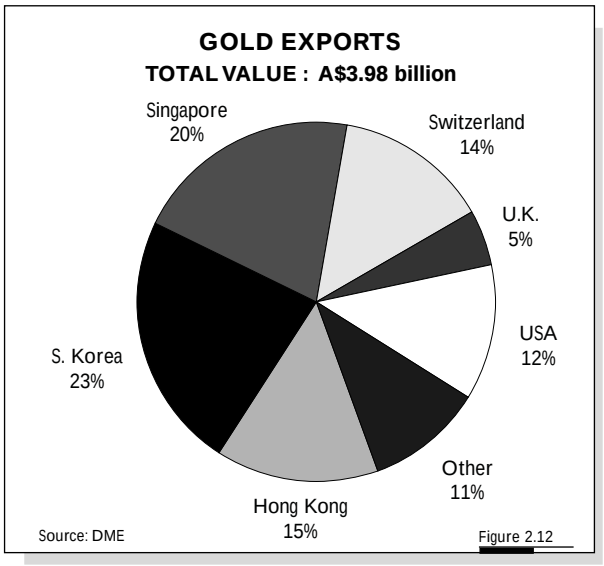
Another consequence has been the presence of overseas gold mining companies, particularly from North America. In addition, weakness in the A$ has increased the attractiveness of local companies to overseas buyers. This was exemplified earlier in 1998 with Homestake Mining Company's acquisition of Plutonic Resources, where not only a large production base was absorbed but also a substantial tenement position in the Yandal Belt.

Western Australia's top 12 producers accounted for over 51% of the State's gold output in 1997/98. The largest projects, with gold production exceeding $100 million in 1997/98 were:

- Golden Mile (Normandy/Poseidon) – 24.8 tonnes
- Granny Smith (Placer/Delta) – 17.1 tonnes
- Kambalda St Ives (WMC) – 13.5 tonnes
- Telfer (Newcrest) – 9.9 tonnes
- Bronzewing (Great Central Mines) – 8.5 tonnes
- Plutonic (Homestake) – 8.2 tonnes
- Boddington (Newcrest, Normandy, Acacia) – 8.0 tonnes
- Kanowna Belle (North, Delta) – 8.0 tonnes
- Jundee-Nimary (Great Central Mines) – 7.2 tonnes

Notably, ownership of the above list of nine projects is relatively concentrated amongst several significant mining companies. Rationalisation also meant that 1997/98 saw a number of relatively large gold mines ceasing operation, deferment of new projects and reconfiguration of some operations. Mine closures in 1997/98 included Bullabulling, Orient Well, Youanmi, Mt Gibson, Mt Monger, Marymia, Lynas Find, Palm Spring, Mt Dimer, Two Boys and Reedy. These operations alone produced approximately 13 tonnes of gold in the previous year.





Absence of new projects also marked 1997/98, with several commencements such as the Boddington expansion, Karonie and Golden Feather projects being deferred. Golden Feather has since commenced mining, with ore trucked to the Paddington mill for processing. Similarly, in efforts to rationalise operations, Resolute shut down its Higginsville processing plant, diverting ore to its joint venture Chalice plant for milling. Sons of Gwalia's Copperhead operation at Bullfinch also ceased mining to just mill ore from its Golden Pig and Frasers underground mines in Southern Cross.

Consequently, Western Australia's higher gold output emanated from increased production by existing projects. Significant contributions to the rise in the State's output came from Bronzewing, Kanowna Belle, Granny Smith and Chalice. These projects alone increased their collective output by approximately 14 tonnes compared to the previous year. Output was also boosted by Sunrise Dam which saw its first full year of operation.

World Gold Market

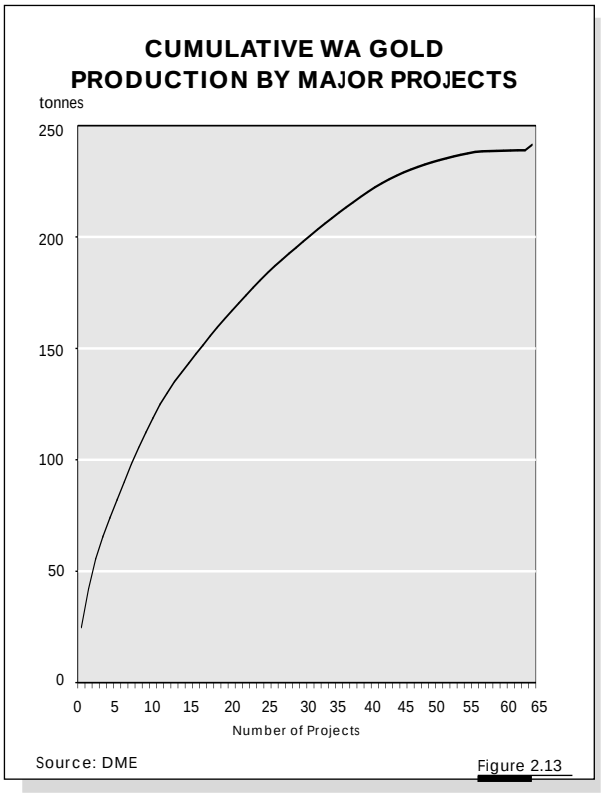
Supply activity from the official sector and the forward sales/options hedging areas played a key role in the softening gold price. Increased central bank divestment dampened prices, but more dramatically, supply via liquidity through forward sales and option hedging rose almost 300% to over 500 tonnes above the previous year.

Activities such as forward selling, derivative transactions, hedging etc. rely on an efficient forward market and continued availability of liquidity, i.e. a physical 'metal' counterpart to the borrowing or lending. Most of the liquidity is sourced from banks that lend bullion into the market to generate a return on their gold holdings. This results in a physical sale either directly by the borrower or after a series of interconnected transactions. Given the crucial role of banks in providing necessary liquidity (to facilitate producer hedging for example) it is therefore ironic that the same institutions should have been so extensively targeted as the guilty parties behind the demise of the gold price in recent times.

Compounding this has been the collapse of many Asian currencies which has severely cut back demand from this region. While the value of holding some gold in a diversified portfolio has been well illustrated, current local prices are prohibitive. Flows of gold out of Asia, as opposed to the usual inward trend have been noted with "distress sales" from East Asia being a significant contributor to an exceptional overall 160% rise in scrap output in the first half of 1998.

Gold Market Outlook

Despite the depressed condition of the gold market through 1997/98, the outlook is mixed. Current negative sentiment as to the world gold market



emanates mainly from the likelihood that even though some of the decrease in gold demand by Asian countries (including Japan) has been offset by increased demand in developing gold markets, this could be insufficient to counteract increased supply. The Asian crisis is far from over, problems in Russia are taking their toll and Latin America appears in trouble. Potentially substantial supply increases could therefore take place due to increased gold lending by Russia, Venezuela and other cash-strapped countries. Russia alone for example, has reportedly already provided 200 to 300 tonnes of gold as collateral for loans from Swiss and German banks.

In addition, analysts point to the uncertain situation regarding gold sales under the European Monetary Union. However, gradual reinterpretation of the market towards the advent of the European Central Bank (ECB) and its attitude towards gold in its reserves may provide some support for the gold price. Statements from central bankers have shed an increasingly positive light as they were taken to mean that any residual gold holdings in (redundant) reserves of national central banks would not be sold in an ad hoc manner as had been feared.

However, whilst central banks have indeed successfully used interest rates to squeeze inflation out of the system in most countries, the current global turmoil may actually be a fillip that gold needs to regain at least some of its former status as the traditional store of value. This is possible if gyrations in the US stock market are precursors to an economic slowdown in the US.

2.5 *Alumina*

Western Australia's alumina output increased by 2% in 1997/98 to reach a new record of over 8.5 million tonnes. The value of this production also soared to hit a record $2,261 million, a 16% increase on the previous financial year (Figure 2.14). Favourable prices received by local producers resulting from Australian currency devaluation was chiefly responsible for the increased value of production.

Over 88% of the State's alumina production was exported overseas. Over a quarter went to the US (27%), with other significant destinations being Canada (15%) and Bahrain (13%) (Figure 2.16).

1997/98 Alumina Industry Highlights

The price of alumina, after slumping in the middle of 1997/98, recovered and stabilised to average US$186/tonne over the year. This was almost unchanged compared to the previous year. Devaluation of the A$ however, resulted in average A$ denominated alumina prices being 17% higher in 1997/98 compared to the previous year.

Despite falling for ten consecutive months to US$1,308/tonne in June 1998, overall, the price of aluminium averaged US$1,511/tonne during 1997/98. This was virtually unchanged compared to

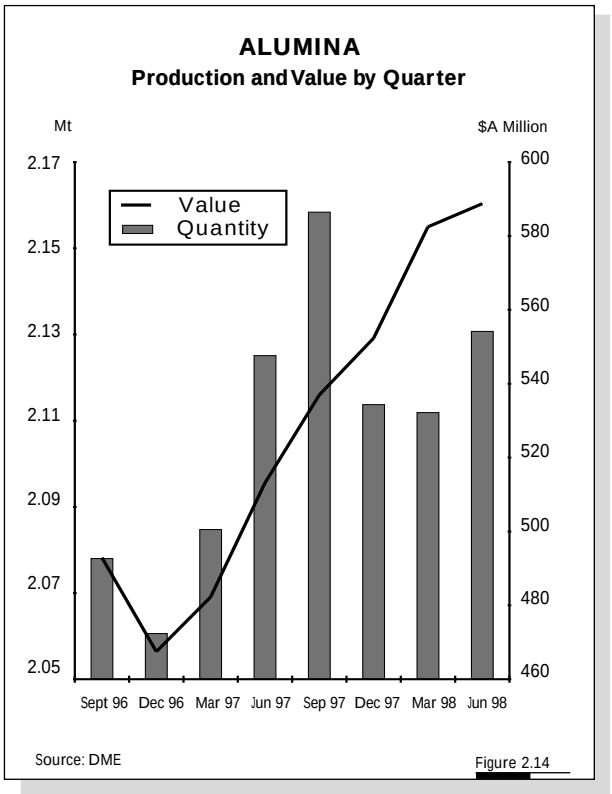


Figure 2.14

the previous year. The slide in the price reflected a substantial stock accumulation emanating from continued rising world production and weak Asian demand.

In September 1997 Worsley Alumina announced plans to increase its alumina production to 3.1 million tonnes per annum. Work has already commenced to expand the refinery which will double its current capacity of 1.75 million tonnes per annum. Completion of the expansion program is targeted for 2000. This is the largest resource development project in the State's South West region for over a decade. Worsley is already one of the world's lowest cost alumina producers and after the expansion, should be a leader in both capacity and quality.

The State's other alumina producer, Alcoa, also announced in November 1997 that it planned to increase the capacity of its Wagerup refinery by 25% to 2.19 million tonnes per annum by mid 1999. This is the first stage of an overall planned expansion to 3.3 million tonnes per annum by the construction of a third production train.

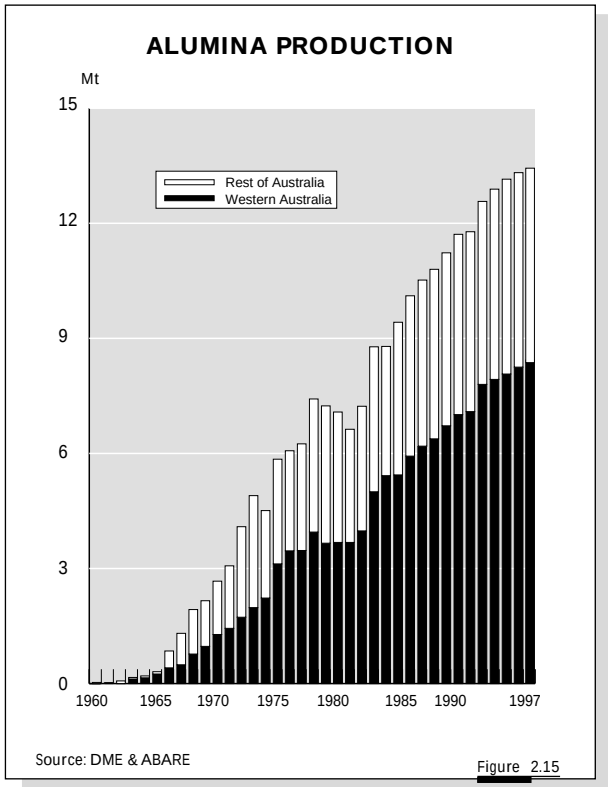
In other developments, Alichem continued work on its plans to establish Australia's first aluminium fluoride plant in Kwinana. A pre-feasibility study for processing alumina hydrate to produce 40,000 tonnes per annum of aluminium fluoride has been completed.

Outlook

Alumina prices are ultimately determined by activity in the aluminium market and slowing consumption, combined with increased production points to the price of aluminium weakening.

On the consumption side, the key factors are developments in China and Japan. Chinese aluminium consumption is forecast to fall as the country's economic growth rate drops. In addition, the competitiveness of China's exports of aluminium and manufactured goods containing aluminium will be adversely affected by the high value of the yuan relative to the currencies of other regional competing countries importing and exporting aluminium products.

Japanese aluminium demand has already been falling as the domestic economy continues to falter. Any recovery in Japanese consumption will depend on the government's ability to stimulate the economy, solve

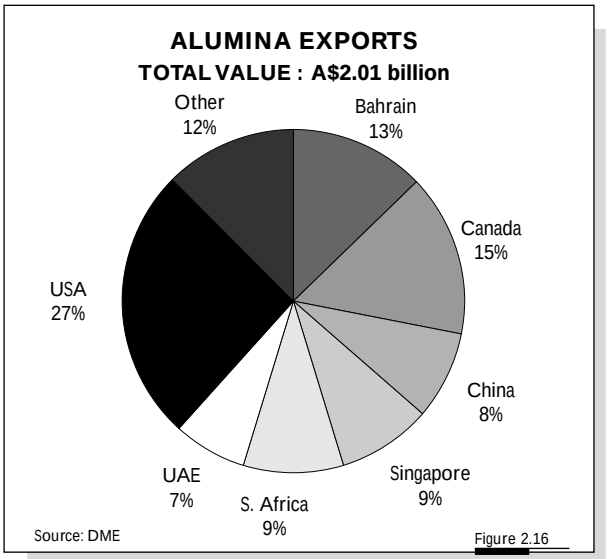


Source: DME & ABARE

Figure 2.15

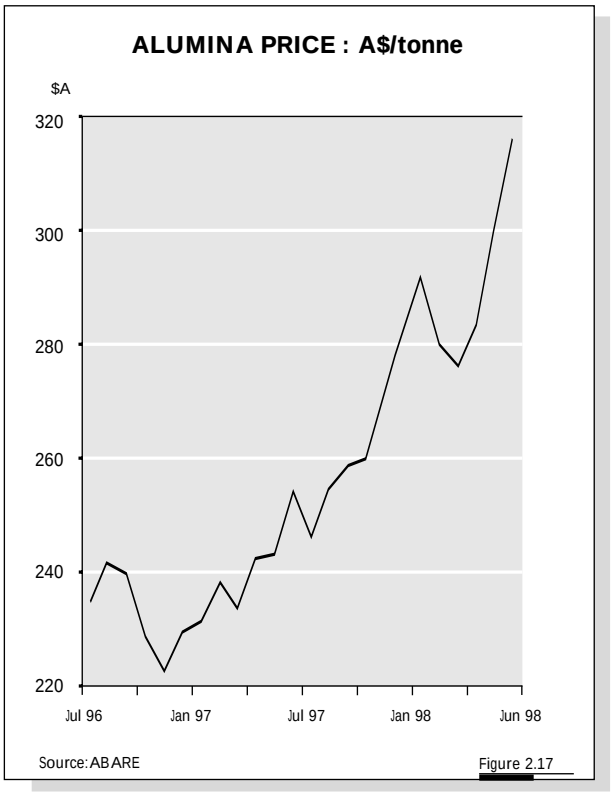
the country's financial sector woes and stabilise the yen. Whilst poor Asian demand has been to some degree countered by strong European consumption, growth in North American aluminium consumption has become subdued.

It may appear at first sight that aluminium prices will be little affected by slowing consumption growth as output from smelters in Cameroon, Ghana, India and Indonesia falters. These new production sources are indeed having difficulties in getting started due to technical difficulties. However, they are insufficient



Source: DME

Figure 2.16



to counterbalance falling world consumption and production increases from other sources. In particular, idle capacity is being restarted in Europe and the US. In addition, capacity expansions are taking place not only in Australian eastern seaboard smelters, but also in Argentina, China, Egypt, Iceland and Iran. All up, it is predicted by ABARE that world aluminium production will increase around 3% in 1999 to 22.8 million tonnes.

Comparing the above with ABARE's prediction of a smaller 2% increase in world consumption in 1999 to around 22.2 million tonnes, means the price outlook for aluminium and alumina is weak.

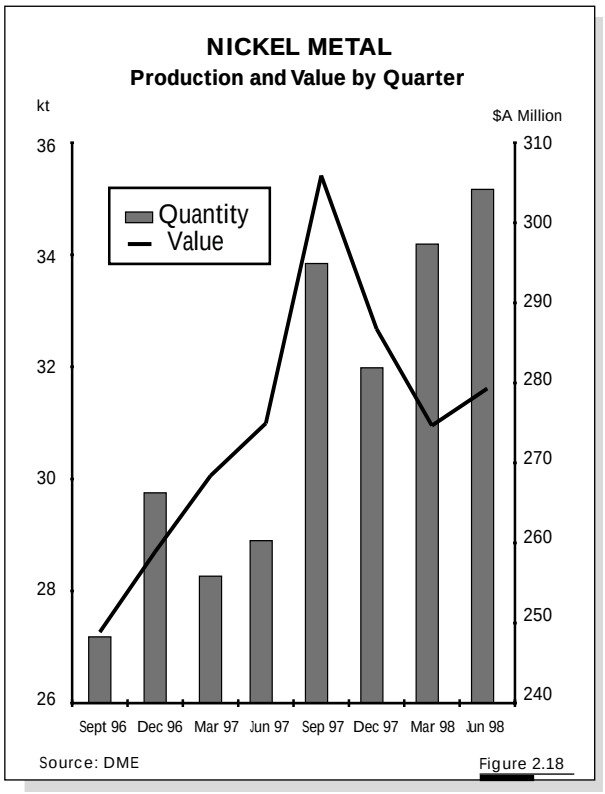
2.6 Nickel

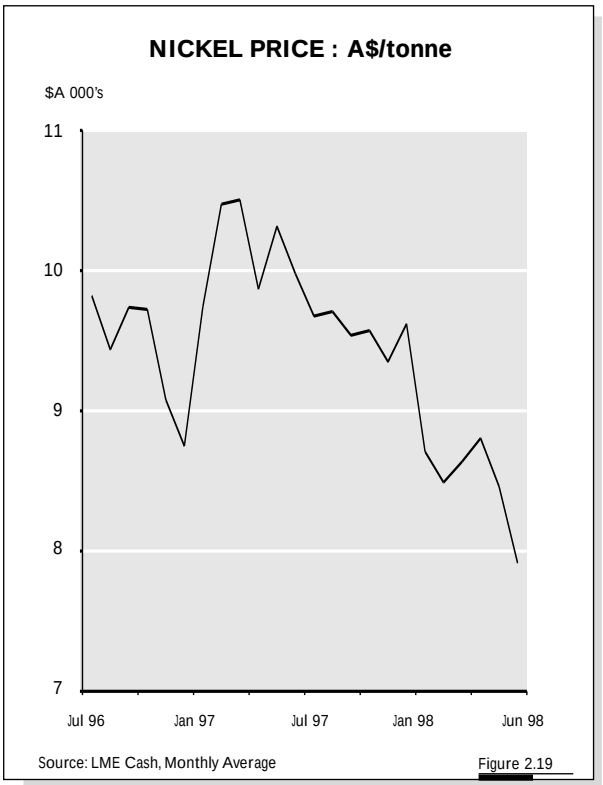
Output of matte, metal and concentrate nickel products in 1997/98 was up by over 18% to reach a record 135 thousand tonnes of contained nickel. Value of production, whilst rising by half that amount, or 9%, nevertheless also reached a record of $1,147 million. This would have been higher had it not been for the continued fall in the international price of nickel since its last peak recorded in 1995. The average US price over 1997/98 was down dramatically by 20%. However, due to devaluation of the Australian dollar, local producers did not bear the full brunt of price weakness with Australian dollar prices down on average by around 8% (Figures 2.18 and 2.19).

Western Australia accounted for around 99% of Australia's nickel production with almost all production exported overseas. Major export destinations were Europe, Japan and North America (Figures 2.20 and 2.21).

1997/98 Nickel Industry Highlights

Western Australia's nickel production continued to climb in 1997/98. This was due to record production levels from WMC's Mt Keith and Leinster projects along with higher output from the company's





Kalgoorlie smelter and Kwinana refinery. New nickel operations also helped boost output.

A new project which added to output in 1997/98 was Black Swan Nickel's underground mine at Silver Swan near Kalgoorlie. This operation commenced shipping concentrates from Esperance in July 1997 and contributed almost nine thousand tonnes of contained nickel to the State's output of various nickel products in 1997/98. On a smaller scale, in April 1998 Titan Resources began production from the resurrected Radio Hill nickel mine, 30 km south of Karratha. Concentrates from Radio Hill are delivered to WMC's drying plant in Kambalda via a 1,900 km inland transport route, believed to be the longest road haul for a resource product anywhere in the State, if not Australia.

In other developments, Dominion Mining finally sold its dormant Yakabindie nickel project to North Ltd. Yakabindie is one of the world's largest undeveloped nickel projects and the sale to North included a licence for the use of the innovative activox processing technology.

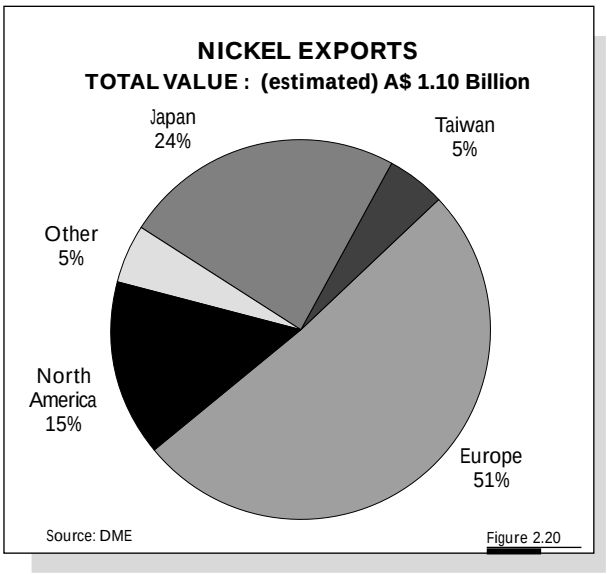
In recent years the nickel market has been in poor condition due to surplus stocks, lacklustre demand from stainless steel producers, the ready availability of nickel and steel scrap from Russia plus the imminent start up of new, low-cost nickel supplies. In addition to these factors, nickel demand has been further hurt by the Asian economic slump and exacerbated by deteriorating world economic growth outlook. While the depressed state of the nickel market was demonstrated by a 20% drop in nickel prices over 1997/98, the bleakness of the situation was underlined in August 1998 when the nickel price dropped to an 11-year low of US$4,005/tonne (US182c/lb).

The significant fall in the price of nickel and poor outlook led WMC to announce in September 1998 the closure of three high-cost mines at its Kambalda nickel operation (Wannaway, Blair and Otter-Juan). These closures alone represent a cut in WMC's production of about 10,000 tonnes a year, or approximately 10%.

Outlook

World nickel prices are forecast to remain relatively low. It is hoped that production cuts will help at least stabilise the negative sentiment that has underpinned the sharp falls in nickel prices since late 1997. However, uncertainty regarding the world economy and in particular, depressed Asian markets plus increased production from new operations will do little to dissipate the negative sentiment surrounding nickel prices.

Over half of the world's nickel is consumed outside Asia and up till now, high rates of industrial production growth in North America and Western Europe have been expected to support increased consumption of stainless steel. However, ABARE has now predicted that nickel demand from these two sources will grow

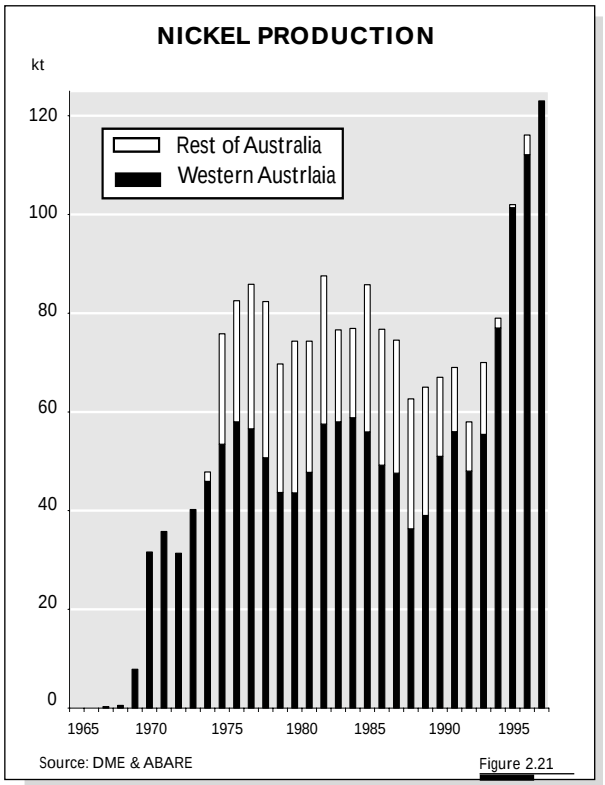


more slowly. In addition, Japan, which consumes over 20% of the world's nickel, is forecast to actually decrease its nickel consumption in response to low domestic demand and reduced export opportunities in Chinese and US markets. This is of direct interest to Western Australian producers as some 20% of the State's nickel exports go to Japan.

As to supply, world production is forecast to increase due to commencement of production from new facilities including those in Western Australia. Some commodity analysts predict that these expansions will more than counteract the small cutbacks seen so far and therefore lead to a glut in world production. The Canadian Voisey's Bay project alone for example, is to produce between 60 and 120 thousand tonnes annually. With such production levels accounting for around 10% of the world's output, prices will receive severe downward pressure leaving an environment in which only the low-cost producers will operate. However, competing projects have been given a reprieve as it is now predicted that commencement of Voisey's Bay operations will be delayed until at least 2002. Amongst other delays, the latest development has seen the government of Newfoundland threatening to withhold a mining permit if Inco does not keep an earlier pledge to process ore from the project within the Newfoundland province.

Voisey's Bay aside, a significant increase in world nickel production will in fact emanate from new laterite projects in Western Australia. Leading the way is Anaconda/Glencore's Murrin Murrin nickel project near Leonora. In its first stage the project proponent's ambitions are to produce around 45,000 tonnes of contained nickel per annum, rising to 70,000 tonnes after expansions. Production from the first stage of the project is expected in late 1998 and there are plans to expand to a second stage reaching 115,000 tonnes per annum. This is almost equivalent to the entire State's current output.

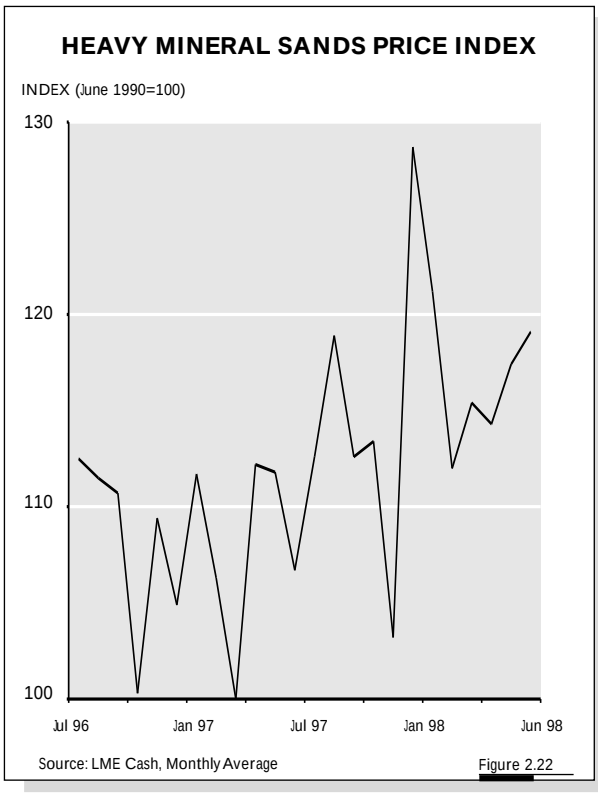
Another new laterite project targeting commencement late in 1998 is Centaur Mining's Cawse nickel project near Kalgoorlie. Cawse is forecast to produce 8,200 tonnes of contained nickel in its first full year of production in 1999. The gold producer Resolute is the third major new entrant into the laterite nickel arena. Resolute's $200 million Bulong project is located east of Kalgoorlie and the first production of nickel metal from Bulong is expected near the end of



1998. The first stage of the project is expected to produce on average around 9,000 tonnes of nickel per annum. Nickel and cobalt cathode are to be the end products produced on site. As of September 1998, ownership of the Bulong project was expected to change over from Resolute to Preston Resources.

2.7 *Heavy Mineral Sands*

The heavy mineral sands industry continued to grow in 1997/98 with the value of production in 1997/98, increasing by 10% to reach $663 million (Figure 2.24). This was attributable to the combined effects of significant increases in ilmenite and synthetic rutile production, local producers receiving favourable contract prices for these products and a weakened Australian dollar.



The value of exported heavy mineral sands reached $561 million, with over a quarter of exports destined for the US. Other significant destinations for the State's mineral sands products were Japan (15%), Netherlands (12%) and the UK (10%) (Figure 2.23).

1997/98 Heavy Mineral Sands Industry Highlights

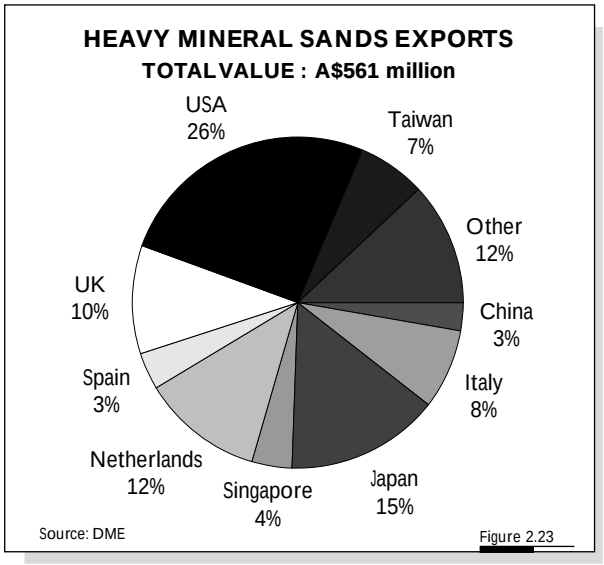
Almost in direct contrast to other metals like nickel and copper, prices of titanium mineral sands products were on average between 5 and 30 percent higher over 1997/98 compared to the previous year. This was mainly due to increasing pigment consumption, particularly in the US and Europe. Consequently, Western Australian value of production outstripped the rise in quantity sold. For example, ilmenite production increased by 212 thousand tonnes or 19% to reach 1.3 million tonnes. But, thanks to producers receiving higher prices, the value of ilmenite output increased by a greater 27%, or $32 million to $149 million.

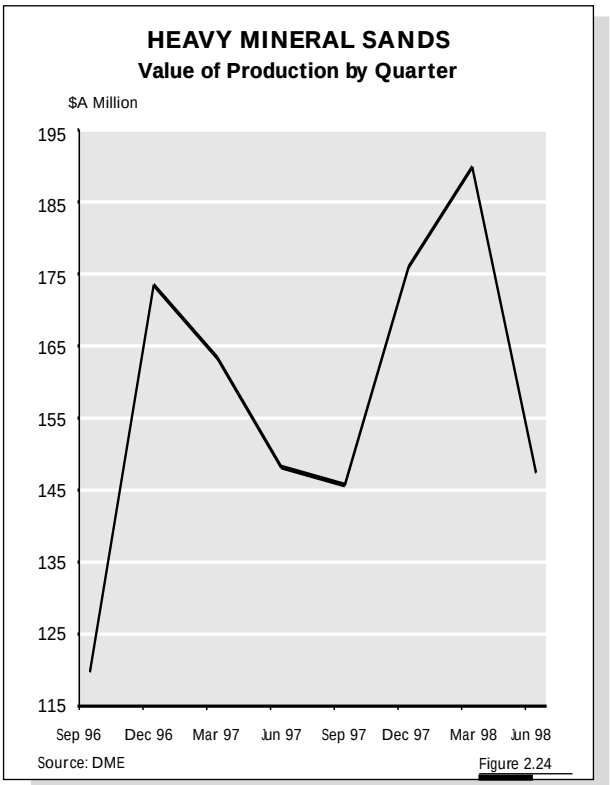
Similarly, upgraded ilmenite (or synthetic rutile) output increased by 54 thousand tonnes or 13% to 467 thousand tonnes. Again, due to the favourable contract prices received by producers, the value of this production was up 18% or $36 million to $242 million.

Rutile production fell 7 thousand tonnes or 6% to 104 thousand tonnes. However, as the average price of rutile received by producers was 8% higher in 1997/98, value of the State's rutile output managed a small 1% increase up to $79 million.

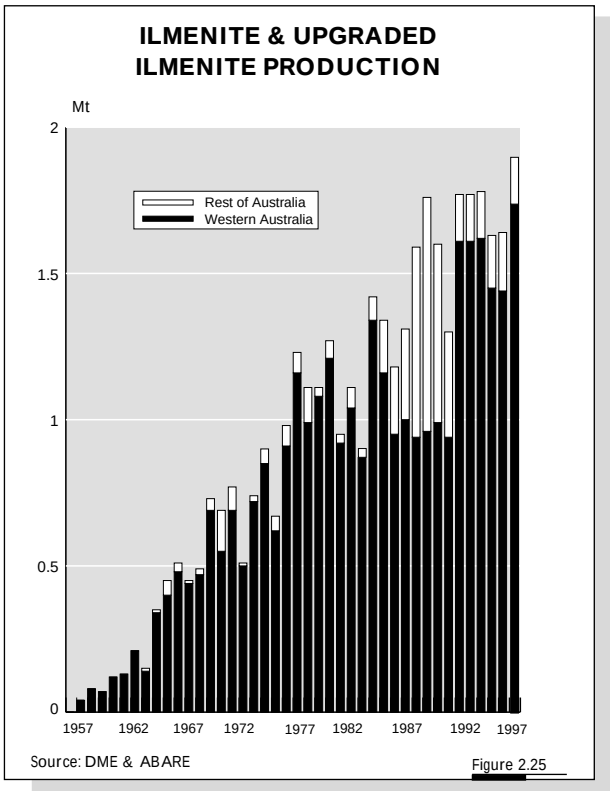
A significant contribution to the physical output increases came from the commencement of operations at Westralian Sands' new synthetic rutile plant in Capel. Additional output was also brought on stream from Cable Sands' new Yarloop mining operation, capacity increases by Tiwest at its Chandala plant and BHP's new Beenup project.

BHP's Beenup project started production in early 1997/98 and whilst contributing to the State's growth in mineral sands output, has nevertheless been plagued with start up problems. The Beenup operation was initially designed to produce 600,000 tonnes of ilmenite and 20,000 tonnes of zircon per annum. So far however, it has only been able to operate at around 40% of its capacity, causing BHP in May 1998 to declare *force majeure* to customers. The target mineral sands are about 45 metres from the surface and are among the deepest to be mined by conventional dredge anywhere in the world. The principal troubles relate to the design and performance of the floating mineral extraction plant and dredge built to mine the sands - touted as one of the world's biggest mineral sands





dredges. Major problems were experienced with forced continual maintenance on the plant as the depth and hardness of the sands wore down the teeth of the dredge. Recently, in addition, unexpected volumes of rock and boulders began blocking the dredge and smashing teeth off the cutting head causing further downtime.



In contrast to titanium minerals, zircon prices received by producers were down some 20% in 1997/98 compared to the previous year. This downturn was somewhat inevitable after a period of very strong demand and high prices for a product which traditionally is in heavy demand in the Asian ceramics industry. Prices were cut by a price war between suppliers and further damage was done by the Asian downturn and now possibly by the Russian crisis. Consequently, despite zircon output increasing 69 thousand tonnes, or 21% to 393 thousand tonnes, the value of this output was down 5% to $169 million.

Outlook

Following the favourable price performance of titanium minerals in 1997/98, further price increases are expected to be modest at best. A predicted slowing in global economic growth will prevent significant upward price movements. Notably, Asia and Russia pose big question marks over future world growth and demand for basic industrial materials including paint, the primary market for titanium dioxide pigment. Some price support should come from supply containment with, for example, one of the world's major rutile mines, in Sierra Leone, remaining off-line because of civil war.

As for zircon, even though ABARE predicts world supplies to remain tight, prices should nevertheless remain subdued as weak Asian demand continues to affect markets. These conditions have been felt locally. Uncertain world market conditions in general and/or environmental factors have put on hold several new Western Australian mineral sands projects including Cable Sands' Jangardup South mine, Millennium Inorganic Chemicals' titanium dioxide pigment plant expansion at Kemerton and Tiwest's Kwinana pigment plant expansion.

The make up of the Western Australian mineral sands industry looks set to change. In July 1998 a proposed merger was announced between RGC and Westralian Sands. The merged entity would dominate the State's mineral sands industry. In production terms, it is expected to rank amongst the world's larger producers accounting for approximately one third of the global titanium dioxide market. What this means however for the $65 million expansion of RGC's Eneabba operation is unclear. Some predict it will be cancelled as reserves to meet volume contracts will now be available from consolidation of minable reserves at RGC's and Westralian's Capel operations.

2.8 Diamonds

The volume of diamonds sold from Western Australia dropped over 19% to 42 million carats. However, due in large part to the devaluation of the Australian dollar and the increased quality of diamonds sold, the value of these sales in 1997/98 was up a very dramatic 36% to $538 million. This was despite US denominated prices remaining on average little changed compared to the previous year. All Western Australian production was from the Argyle operation, the world's biggest individual diamond mine.

1997/98 Diamond Industry Highlights

With the A$ relative to the US$ in 1997/98 being on average 13% down compared to 1996/97, the exchange rate was a significant contributory factor to the increased value of diamonds sold over the year. The increased value of sales was particularly impressive given that physical sales volumes were down. However, a factor behind lower sales volumes in 1997/98 was simply the extraordinarily high sales in the previous period. In 1996/97 a lot of Argyle's deferred low value stocks were purchased by the Central Selling Organisation (CSO). That year also marked Argyle Diamond Mine's first year of selling diamonds directly to the market. Consequently, sales volumes in 1997/98 were inevitably lower compared to the aggressive marketing strategy of 1996/97.

A greater proportion of higher-grade diamonds (gem and near gem) was an additional factor boosting the value of sales in 1997/98. This was helped by more selective production and improved processing techniques which vastly improved the presentation of rough diamonds. Combined, these aided in maximising the run of mine price.

Ironically, market developments stemming from the economic downturn in Asia have also been a factor in the strong growth in demand for lower value diamond products. While strong demand continued from the US, a key market for the Argyle product, benefits have also arisen from "trading down" evident in the traditionally higher value markets of Japan and parts of South East and East Asia. Basically, gem buyers in Asia are opting to buy lower quality diamonds to help overcome the weaker purchasing power of their own currencies.

In 1997/98 Argyle Diamond Mine partners, Ashton Mining and Rio Tinto finally revealed plans as to Argyle's future. In June 1998 it was announced that underground mining plans at the Argyle operation were dropped in favour of a major expansion of the existing open pit operations. The first stage of the expansion involves a substantial cutback of an existing pit wall which will sustain the mine for an extra 18 months. In addition, if given the go ahead, a second phase expansion of the pit will expose enough new ore to keep the mine operational for another seven to 10 years. The second phase expansion, upon completion still provides for the possibility of an underground operation. Prior to these expansion plans, ore reserves in the Argyle operation were scheduled for depletion in 2003.

Outlook

The World Diamond Conference was held in Perth in October 1998. It pointed out that demand in the US and Europe was relatively buoyant, taking up some of the slack from a lacklustre Asian market. World production had also dropped and the CSO was restraining sales, so it appeared as if there was at least some degree of broad balance between overall production and retail demand. However, inventories were still high and production cuts may be insufficient to ward off the effects of the Asian crisis and downturn in the Japanese economy. The diamond conference also did not appear to reach a consensus as to the supply side of the equation. From one perspective, the supply side was seen as more comfortable insofar as Russian output of diamonds was drying up and amidst the economic and political turmoil of that country, it was difficult, if not impossible to refinance and develop Russia's diamond operations. Similar scenarios were unveiled for Angola, the Democratic Republic of Congo and Sierra Leone.

But, a supply side factor which could compound diamond marketing difficulties is the ever growing supply from new and potential projects. The strategy of the CSO is to maintain a tight rein on supply, but this is an increasingly difficult task. Argyle has already abandoned the cartel and the CSO has weathered competition from this source by virtue of Argyle output, albeit huge, being of comparatively low value. However, two new mines will be cause of far greater concern to the cartel.

The two new mines of particular significance are Rio Tinto's Diavik and BHP's Ekati (Lac de Gras) operations, both in Canada and expected to come on stream soon.

Combined, these two operations could account for about 10% of future world supply and will produce much higher quality stones. The CSO has been anxious to market output from these two operations and has been negotiating to market at least a portion of BHP's Ekati production. Some analysts have speculated that De Beers, anxious to maintain the stranglehold of its CSO, might be negotiating to actually buy BHP's 51% interest in the Ekati operation. This idea has emanated from the possibility of Rio Tinto purchasing BHP's interest in Ekati. The result would be that Rio Tinto controls three significant world mines (Diavik, Ekati and Argyle), presenting De Beer's CSO with a major challenge across a wide range of diamond quality.

Whatever, the outcome in these negotiations, care will have to be taken to maintain confidence in what is now a fragile market. The emphasis will need to be on continuing to strengthen prices rather than just volumes. Clearly, global economic conditions are creating a very challenging diamond marketing environment.

2.9 Other Minerals

Base Metals

Total value of base metals production increased over 35% to $189 million. The chief contributor to this was a significant rise in zinc production, which was up by 38 thousand tonnes, or 43% to 126 thousand tonnes. Despite falling over most of 1997/98, zinc prices were on average up over 1997/98 by some 9%. Overall therefore, the value of zinc production was up a significant 61% or $46 million to $121 million.

Western Australia's zinc production continued to come from two sources, Normandy's Scuddles operation and Western Metals' Lennard Shelf mining operations. Western Metals' operations was the chief factor behind the rise in zinc production, with an 87% increase in output from that company's mines alone. Western Metals' activities also saw some changes over 1997/98 with the cessation of mining at Cadjebut in December 1997. The Western Metals operation started life mining the Cadjebut deposit in 1994 after taking over the interests from BHP and Shell and now two new nearby mines, Kapok and Goongewa provide the ore which is transported to Cadjebut for processing.

Lead production emanated solely from Western Metal's operations. Devaluation of the local currency ameliorated the severity of the price falls and with the doubling of reported shipments up to 27 thousand tonnes, this meant that the total value of lead production increased by 71% or $4.3 million to $10.4 million. Internationally, lead prices continued to fall for the second consecutive financial year. In 1997/98 the international lead price averaged US$568/tonne, 19% down on the previous year.

The end of 1997 also saw the resurrection of Derby as a shipping port with the commencement of monthly zinc and lead concentrate shipments from Western Metals' operations. Zinc and lead shipments from Derby should increase significantly in 1998/99 with Western Metals' development of its $80 million Pillara operation (formerly known as Blendevale). Pillara is predicted to more than double Western Metals' annual production to around 165,000 tonnes of zinc metal and elevate the Lennard Shelf operations to the world's seventh biggest zinc mining complex.

Whilst Western Australia's zinc production is therefore expected to grow significantly in the coming year, increases in the value of production will be challenged

by world prices. August 1997 saw zinc prices hit new highs of over US$1,654/tonne. But despite stocks falling continuously through 1998 to reach historically low levels, prices have nevertheless been dropping. By the end of 1997/98 the price of zinc had fallen to around US$1,002/tonne – its lowest level in two years. Lower prices reflect to a significant extent generally negative market sentiment associated with weakening world economic growth and the likely resulting effects on demand for zinc. In particular, falling consumption in South Korea and Japan is expected to offset consumption growth in western Europe, the US and China. This in turn is to be coupled with an expected increase in world zinc output, namely from Western Australia (Pillara), Queensland (Cannington) and Alaska (Red Dog).

Western Australia's copper production increased 6% to 29 thousand tonnes. Production chiefly emanated from Normandy's Scuddles operation and WMC's Nifty mine. In addition, copper by product was produced from WMC's Kambalda and Newcrest's Telfer operations. International copper prices continued sliding downwards, averaging 14% lower in 1997/98 and closing the financial year at an 11-year low of around US$1,595/tonne. Devaluation of the A$ was insufficient to compensate for the fall in prices and the value of Western Australian copper shipments over 1997/98 are estimated to have been marginally down by $714 thousand or just over one percent to $58 million.

In July 1998 WMC's Nifty mine was acquired by Straits Resources Ltd. The Nifty heap leach solvent - electrowinning (SX-EW) operation is similar in nature to Straits Resources' Girilambone joint venture copper project in New South Wales. Straits Resources plans to lift output from Nifty via a capital expenditure program and has also flagged the possibility of expanding the mine into an underground operation.

Coal

Western Australia's coal production from its Griffin and Wesfarmers operations in Collie was up 3% to 5.7 million tonnes in 1997/98. However, the value of production remained static at $257 million. Operations at Wesfarmers' Premier Mine continued to see the consolidation of pits and the introduction of new coal handling equipment. Coal production from the Premier mine will play an integral part in providing feedstock for the 300MW coal fired power station being constructed in Collie. Wesfarmers' seven year contract to supply the new Collie power station will commence from July 1999.

Salt

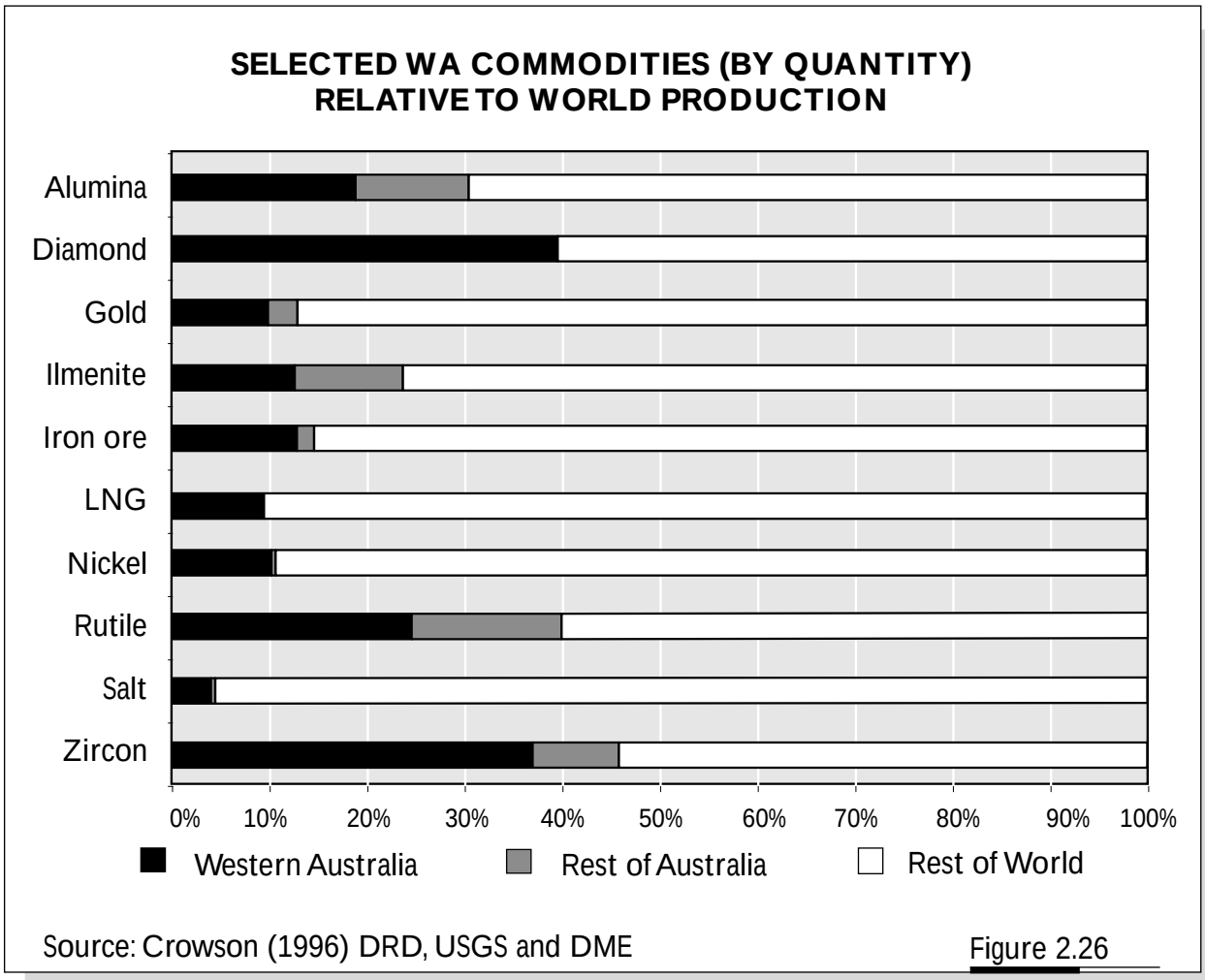
Salt production increased by 8% to 8.2 million tonnes and thanks to favourable prices and devaluation of the Australian dollar, the value of this production increased by 23% to $189 million. In 1997/98 the expansion of Dampier Salt's operations near Karratha was completed. This has boosted its salt production capacity at Dampier from 2.5 million to 4 million tonnes per annum. Shark Bay Salt also started expansion of its primary ponds to increase production capacity. In July 1997 construction of salt ponds and levee banks commenced for the new Onslow salt project which will produce 2.5 million tonnes per annum. In November 1997 the seawater pumps were commissioned and plant, jetty and infrastructure are to be constructed over 1998/99. First salt production is expected in late 1999.

Other

Tantalite production fell 10% to 371 tonnes. However, favourable prices meant that this was not reflected in the value of production which was up by $8 million or 22% to $42 million. Tantalite is chiefly sourced from Gwalia Consolidated's Greenbushes mine, as is spodumene, the production of which totalled 47 thousand tonnes worth $9 million in 1997/98. The Greenbushes mine is reportedly the world's largest hard rock tantalum resource and Gwalia also operates Australia's only tin smelter at Greenbushes. Tin production reached 481 tonnes worth $3.6 million in 1997/98.

The value of Western Australian gypsum production jumped fivefold to $14.3 million in 1997/98. This was due to the first shipments of gypsum in August 1997 from Lake MacLeod Gypsum. Lake MacLeod Gypsum is 68% owned by Rio Tinto and is an offshoot of the parent company, Dampier Salt. The gypsum and salt projects share an operational base and shipping port facilities at Lake MacLeod north of Carnarvon. Western Australia's total gypsum output in 1997/98 was 827 thousand tonnes. Lake MacLeod Gypsum accounted for almost 70% of this output, making it Australia's largest producer.

State manganese production fell off to only 86 thousand tonnes worth $9 million due to the shutdown of the State's sole operation in the Pilbara.



Source: Crowson (1996) DRD, USGS and DME

Figure 2.26

The latest comparable data shows that the Western Australian share (by quantity) of the world's output of the following products was: diamonds 39%, zircon 37%, rutile 24%, alumina 19%, iron ore 13%, ilmenite 13%, gold 10%, nickel 10%, LNG 9% and salt 4%.

3. EXPLORATION, INVESTMENT AND EMPLOYMENT

Mineral Exploration

According to the ABS, mineral exploration expenditure in Western Australia reached $660 million in 1997/98, 4.5% down from the record level in 1996/97 of $692 million. This is the first decline in total exploration expenditure after seven successive years of growth.

Overall this is still a solid performance given the current depressed state of commodity prices and the generally pessimistic outlook resulting from global economic turmoil.

Western Australia received approximately 62% of total Australian mineral exploration expenditure in 1997/98, up from 60% in 1996/97. Gold accounted for 70% of the State's exploration funds in 1997/98, down from 77% in 1996/97. Base metals (copper, silver-lead-zinc, nickel and cobalt) represented 18%, while diamonds accounted for approximately 5%. Iron ore received 5% of exploration funds, while mineral sands attracted just over 1% and uranium less than half a percent.

In 1997/98 $459 million was spent on gold exploration in the State. This represented 71% of Australia's total gold exploration funds. It compares to $532 million in 1996/97, which at the time accounted for 73% of Australian gold exploration expenditure. Overall, most of the exploration effort for gold in 1997/98 concentrated on extending known ore bodies, identifying new lodes, and discovering satellite ore bodies near existing mines.

Exploration for base metals (i.e. ABS definition – copper-lead-zinc and nickel-cobalt) in Western Australia attracted 52% of total Australian base metal expenditure in 1997/98 with expenditure of $117 million. This was up from expenditure in 1996/97 of $88 million, which at the time represented 40% of national base metals exploration. It is widely speculated that copper-lead-zinc exploration is stagnant or falling with most of the expenditure being for nickel-cobalt despite poor nickel price. The focus has been on upgrading known deposits for 'fast-tracking' development prior to 2002 when Canada's Voisey's Bay is expected to commence production. The most notable impact of Western Australia's nickel search and evaluation impetus has been the emergence of laterite nickel deposits as the front runners for the next phase of development (i.e. Murrin Murrin, Bulong and Cawse).

Overall base metals exploration for copper, lead and zinc was concentrated in the Pilbara and Kimberley regions during 1997/98. Western Metals in particular continued advanced exploration work throughout its extensive tenement holding in the Lennard Shelf area.

Diamond exploration expenditure in the State decreased by 20% from $39 million in 1996/97 to $31 million in 1997/98. Expenditure in 1997/98 accounted for 73% of total Australian diamond exploration expenditure. Exploration continued in the Yilgarn Craton with the emergence of the Leonora-Menzies region as a potential kimberlite province. Nonetheless the Kimberley region continued to be the main focus of activity, with a number of defined target areas, particularly the Ashmore pipes, which are located in the Beta Creek project, in addition to the Blina project.

The iron ore sector has continued to experience a high level of interest with numerous projects at the feasibility study stage. The reported level of iron ore exploration in Western Australia was $30 million. This represented a 15% increase compared to 1996/97 expenditure of $26 million. WA accounted for over 99% of the Australian total exploration expenditure for iron ore in 1997/98. This was up from the 1996/97 share of 97%.

The iron ore exploration effort was concentrated in the State's Hamersley Basin. Gradual depletion of reserves of low-phosphorous Brockman ores in the Hamersley Basin is forcing major producers to increasingly evaluate resources hosted by either the Marra Mamba Iron Formation or Robe River Pisolite. Continued interest is also being shown in magnetite-rich deposits within primary banded iron-formations of the western Yilgarn (Tallering Peak, Koolanooka and Mount Gibson) capable of yielding, through beneficiation, a very high-grade product suitable for the direct-reduction iron process.

With expenditure of $9 million in 1997/98, Western Australia retained the top share (63%) of the nation's heavy mineral sands exploration funds. This was up from expenditure in 1996/97 of $8 million which represented 57% of the nation's total that year.

Petroleum Exploration

According to the ABS, the State's petroleum exploration expenditure in 1997/98 increased by 4.5% to $464 million, compared to $444 million in 1996/97. Western Australia's share of Australia's petroleum exploration expenditure, however, decreased from 52% in 1996/97 to 47% in 1997/98. These figures include expenditure on Western Australian leases in the Timor Gap Zone of Cooperation, Area B.

Once again petroleum exploration activity in 1997/98, was concentrated in the offshore Carnarvon, Canning and Bonaparte Basins. The year was highlighted by the announcement in August 1998 of the discovery of the Rose 1 gas and condensate field by Apache Ltd on behalf of the Harriet joint venture participants. Preliminary estimates suggest the field may contain up to 2.8 billion cubic metres of gas reserves. The field also has a considerably higher condensate/gas ratio compared to other gas fields in the area. This factor plus the proximity of the well to Apache's Varanus Island production and processing complex makes the Rose 1 discovery feasible for development in a relatively short time.

In another development, it became apparent that the historic Gingin gas field in the Perth Basin could be back in production after Empire Oil and Gas began a comprehensive reassessment of the field. Results of a seismic program indicate the field has a potential resource of 14 billion cubic metres of gas. There is hope for delineation of additional resources in the area. Commercial prospects are further enhanced due to its very close proximity to the Parmelia (previously named WANG) and Dampier to Bunbury pipelines.

The North West Shelf also continued to host discoveries with Santos and partners announcing in late August 1998 that they had made a notable new high quality oil discovery at Mutineer 1B, north-east of Woodside Petroleum's Lambert, Egret and Hermes oil fields.

Total Australian petroleum exploration expenditure in 1997/98 was $981 million, a 15% increase from $853 million in 1996/97. Of this total, 7% was spent on production lease areas with the remaining funds going into exploration permit areas. In 1996/97 exploration expenditure on production leases was approximately 16%. Whether these figures show a swing away from exploration expenditure on production leases is not certain due to the very 'lumpy' nature of petroleum exploration expenditure.

ABS data show that Australia-wide, offshore exploration is taking place at record levels. In 1997/98 offshore exploration expenditure was $749 million, up 25% from 1996/97. In 1997/98 offshore expenditure represented 76% of all petroleum exploration. This was up from the 71% level of 1996/97. Onshore petroleum exploration in Australia by contrast decreased by 9% from $252 million in 1996/97 to $232 million in 1997/98. ABS data tend to indicate that this reduction is most likely to have occurred in South Australia and Queensland.

Mining Investment

Strong business investment, particularly in large mineral and energy projects and downstream processing, has largely driven the relatively strong growth forecasts for Western Australia this financial year despite global economic conditions.

The ABS investment statistics for 1997/98 indicate that mining accounted for 65% of Western Australia's total investment, compared to 63% in 1996/97. Total State investment increased by an impressive 34% from the 1996/97 level of $6.6 billion to $8.9 billion. The actual level of mining investment was $5.8 billion in 1997/98, 39% greater than the 1996/97 amount of $4.1 billion.

In 1997/98 Western Australia's share of national mining investment of $10 billion was 58%. This was up from the 1996/97 share of 51% (of the national total of $8.1 billion).

ABS mining investment figures, however, need to be treated cautiously as they do not capture all mining investments. Investment in downstream processing and some mineral projects (such as mineral sands and alumina) are categorised by the ABS as manufacturing investment. A breakdown of the manufacturing figures into resource processing and other categories is not available.

The Delta Electricity and Access Economics Investment Monitor for June 1998, indicates that Australia-wide there is currently just over $78 billion worth of mining projects either under construction, committed, considered or possible. Of these, approximately $37 billion are in Western Australia alone. When including projects with linkages to

mining such as further processing and infrastructure to service the industry, the Western Australian investment figure increases to approximately $60 billion.

The value of mining and related projects under construction or committed for construction in WA totalled nearly $10 billion in the June 1998 quarter. Some of the more notable projects include:

- BHP's $2,240 million Hot Briquetted Iron (or DRI) plant near Port Hedland;
- The $800 million expansion of the Worsley alumina refinery;
- Hamersley Iron's $975 million Yandicoogina iron ore deposit in addition to the associated port and railway projects.The mine is due for commissioning in mid 1999;
- Anaconda Nickel/Glencore International's $1,000 million Murrin Murrin nickel mine which is due to commence production 1998/99; and
- The $874 million doubling of the capacity of the Dampier to Bunbury gas pipeline.

There is some concern that developments in South East Asia, China, Japan, Russia and Latin America will diminish business confidence. However, indications so far are that there has been little change to the timing of major investment projects at least as a result of the downturn in the Asian economies. Whilst a number of projects have been delayed such as in the gold and nickel areas, the reasons for these delays are not solely related to the developments in Asia. Furthermore, many of these projects were still only under consideration, with no formal commitment to proceed.

The 1997/98 series of statistics has also demonstrated that the link between external conditions and business investment is not as strong as might be expected. Large investment projects often require one to three years to construct. Conditions in three years time therefore, are important, when production commences rather than immediate conditions. Nonetheless, if current conditions lead to a change in expectations for the future, the impact of the resultant revisions to capital expenditure plans may not be felt for 18 months or more.

In addition, projects with a 20 to 30 year economic life are expected to be able to operate within a range of demand and price environments within their life. Accordingly, the viability of those projects is tested under a variety of scenarios prior to investment proceeding. These types of projects with a long-term horizon must be capable of withstanding considerable variability in commodity prices and demand conditions, before being firmly committed for development.

Resource developments not only provide a foundation for the long–term viability of the State's resource sector, but also through associated multiplier effects, give a significant impetus to State economic and employment growth. Such benefits are enhanced when projects have a significant degree of local content. Excellent levels of local content have been reached in several of the State's more significant mining developments, such as for example:

- 94% in the $200 million Beenup mineral sands project;
- 86% of the $285 million North West Shelf LPG operation;
- 85% of the $1,000 million Murrin Murrin nickel mine;
- 82% of all costs to date for the $820 million Argyle diamond mine;
- 75% of the $250 million East Spar gas and condensate field; and
- 70% of the $610 million Wandoo oil project.

Mining Employment

The Department of Minerals and Energy's official employment statistics are compiled from monthly industry returns and include contract labour working on the mine sites.

In 1997/98 employment in the State's mineral and petroleum industries increased approximately 4% from 43,507 in 1996/97 to 45,429 persons. Overall, fluctuations in employment in specific sectors offset one another.

The most significant increase, of 40%, occurred in the nickel sector. This was due to the construction of the Murrin Murrin, Cawse and Bulong mines. Employment also grew substantially in the base metals sector with an increase of 31%, albeit from a lower base. The most notable increases in this sector occurred at Western Metals' Pillara mine and Normandy Mining's Scuddles (Golden Grove) mine.

Employment in the petroleum industry was up 24%, in diamonds sector it increased 11% and in the iron ore industry it rose by 8%. The most significant decrease occurred in the gold sector which was down 14%. Overall this was due to industry rationalisation. The largest fall occurred at sites managed by Kalgoorlie Consolidated Gold Mines, i.e. the Super Pit and Mount Charlotte. These sites employed 1,071 personnel in 1997/98, down from 1,534 people at the end of 1996/97.

NOTE

The petroleum employment statistics shown in the 1997 Statistics Digest and volumes prior to this cannot be directly compared to those published in this and future issues. Previous statistics for the petroleum sector did not include contract employees. The employment statistics published in this issue for the petroleum sector in 1996/97 and 1997/98 are comparable.

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

COMMODITY\Mineral	UNIT	1996-97 QUANTITY	1996-97 VALUE ($A)	1997-98 QUANTITY	1997-98 VALUE ($A)
BASE METALS					
Copper Metal	t	27,734 (r)	58,979,700 (r)	29,471	58,265,687
Lead Metal	t	13,486 (r)	6,086,206 (r)	27,002	10,391,495
Zinc Metal	t	88,369 (r)	75,120,390 (r)	126,090	120,831,623
TOTAL BASE METALS			**140,186,296 (r)**		**189,488,805**
BAUXITE-ALUMINA					
Alumina	t	8,347,933	1,955,770,170	8,514,673	2,260,538,170
Gallium	kg	26,746 (r)	10,058,746 (r)	0	0
TOTAL BAUXITE - ALUMINA			**1,965,828,916 (r)**		**2,260,538,170**
CHROMITE	kg	1,398	313,170	16,116	3,658,409
CLAYS					
Attapulgite	t	20,473	4,073,620	24,023	4,362,859
Clay Shale	t	16,689	212,081	36,296	541,990
Fire Clay	t	54,861	65,833	72,975	87,570
Kaolin	t	3,307	211,973	280	31,649
White Clay	t	13,003	130,030	2,360	14,160
TOTAL CLAYS			**4,693,537**		**5,038,228**
COAL	**t**	**5,556,644**	**257,303,044**	**5,708,548**	**257,282,501**
CONSTRUCTION MATERIALS					
Aggregate	t	405,993	2,635,481	272,894	1,808,213
Gravel	t	234,063	1,326,354	180,619	1,011,108
Rock	t	404,438	2,525,448	424,918	2,668,425
Sand	t	1,623,046 (r)	7,594,735 (r)	1,782,464	8,399,858
TOTAL CONSTRUCTION MATERIALS			**14,082,018 (r)**		**13,887,604**
DIAMOND	**ct**	**52,521,276**	**395,793,806**	**42,483,235**	**537,870,611**
DIMENSION STONE					
Black Granite	t	946	283,695	958	287,457
Granite	t	220	11,000	391	80,800
TOTAL DIMENSION STONE			**294,695**		**368,257**
GEM & SEMI-PRECIOUS STONE					
Agate	kg	5,149	3,089	0	0
Chalcedony	kg	41,360	20,680	8,053	4,027
Chrysoprase	kg	37,000 (r)	12,500 (r)	21,536	8,936
Jasper	kg	38,796 (r)	23,798	0	0
Variscite	kg	28,730	17,238	0	0
TOTAL GEM & SEMI-PRECIOUS STONE			**77,305 (r)**		**12,963**
GOLD	**kg**	**228,022 (r)**	**3,409,613,840 (r)**	**241,367(e)**	**3,496,030,479(e)**
GYPSUM	**t**	**251,909**	**2,642,427**	**826,639**	**14,272,318**
HEAVY MINERAL SANDS					
Garnet	t	98,456	11,323,354	116,037	13,644,227
Ilmenite	t	1,100,919	117,284,071	1,313,266	149,137,955
Upgraded Ilmenite (a)	t	413,457	205,199,238	467,258	241,631,970
Leucoxene	t	30,723	15,187,711	28,346	10,986,255
Rutile	t	110,962	77,743,262	104,134	78,581,122
Zircon	t	324,087	177,986,602	392,814	169,129,894
TOTAL HEAVY MINERAL SANDS			**604,724,238**		**663,111,423**

TABLE 1 (cont.) **QUANTITY & VALUE OF MINERALS & PETROLEUM**

COMMODITY\Mineral	UNIT	1996-97 QUANTITY	1996-97 VALUE ($A)	1997-98 QUANTITY	1997-98 VALUE ($A)
INDUSTRIAL PEGMATITE MINERALS					
Felspar	t	63,066	2,725,219	35,742	1,513,545
IRON ORE					
Domestic	t	5,938,893	139,776,550	7,738,897	206,647,943
Exported	t	135,349,473	3,019,871,477 (r)	142,003,029	3,724,124,136
TOTAL IRON ORE		**141,288,366**	**3,159,648,027 (r)**	**149,741,926**	**3,930,772,079**
LIMESAND-LIMESTONE-DOLOMITE					
Dolomite	t	4,387	126,045	2,066	52,096
Limesand-Limestone	t	2,353,431	15,744,780	2,375,068	11,153,151
TOTAL LIMESAND-LIMESTONE-DOLOMITE			**15,870,825**		**11,205,247**
MANGANESE ORE	**t**	**324,113 (r)**	**37,619,254 (r)**	**86,297**	**9,394,938**
NICKEL INDUSTRY					
Cobalt by-product	t	878	50,853,771	1,500	81,778,706
Nickel Concentrate	t	776,490	1,051,111,897	942,471	1,146,639,376
Palladium by-product	kg	433	2,238,476	669	6,785,327
Platinum by-product	kg	255	1,582,314	212	3,105,879
TOTAL NICKEL INDUSTRY			**1,105,786,458**		**1,238,309,288**
PETROLEUM					
Condensate	kl	5,734,946	943,153,536	6,758,237	1,064,677,442
Crude Oil	kl	10,465,951 (r)	1,915,933,489 (r)	9,852,490	1,567,158,552
LNG	Btu 10^6	370,498,578	1,528,770,813	379,543,930	1,591,935,107
LPG - Butane	t	209,685	59,668,659	376,089	90,469,096
LPG - Propane	t	185,737	55,658,974	259,330	60,483,979
Natural Gas	$000m^3$	6,892,911	534,648,055	6,881,955	557,469,069
TOTAL PETROLEUM			**5,037,833,526 (r)**		**4,932,193,244**
PIGMENTS					
Red Oxide	t	0	0	6,910	1,312,900
SALT	**t**	**7,546,294**	**153,616,036**	**8,185,664**	**188,700,479**
SILICA-SILICA SAND					
Silica	t	74,866	748,664	92,427	924,266
Silica Sand	t	625,338	6,306,388	691,884	6,359,165
TOTAL SILICA-SILICA SAND			**7,055,052**		**7,283,431**
SILVER	**kg**	**52,707 (r)**	**9,149,571 (r)**	**56,745**	**13,212,794**
TALC	**t**	**177,540**	**14,077,712**	**191,297**	**15,059,872**
TIN-TANTALUM-LITHIUM					
Spodumene	t	113,191 (r)	18,628,946 (r)	46,566	8,897,759
Tantalite	t	410 (r)	34,255,688 (r)	371	41,864,039
Tin Metal	t	549 (r)	3,576,738 (r)	481	3,622,811
TOTAL TIN-TANTALUM-LITHIUM			**56,461,372 (r)**		**54,384,609**
TOTAL VALUE			**16,395,387,843 (r)**		**17,844,902,194(e)**

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

(a) Also known as synthetic rutile

(e) Estimate

(r) Revised from previous edition

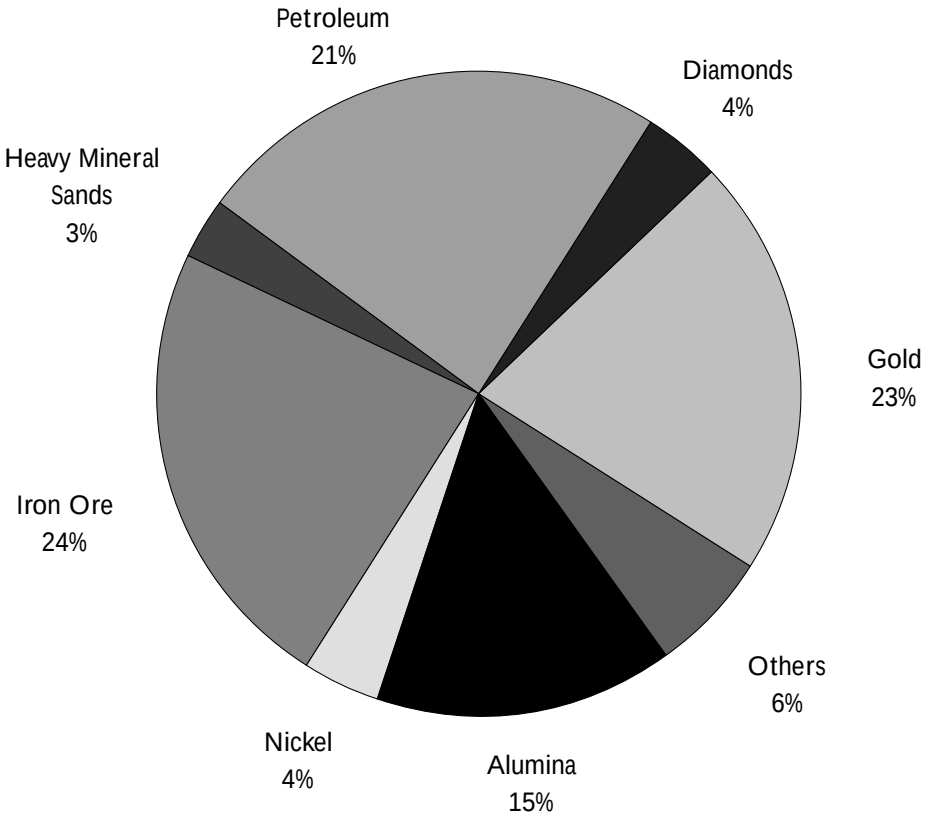
TABLE 2 QUANTITY AND VALUE OF SELECTED MAJOR COMMODITIES

	Unit	1988-89		1989-90		1990-91		1991-92	
		Quantity	Value $M	Quantity	Value $M	Quantity	Value $M	Quantity	Value $M
ALUMINA	Mt	6.17	1,619.23	6.65	2,335.70	6.80	2,099.13	7.13	1,758.15
BASE METALS									
copper	kt	13.08	31.37	14.98	23.92	12.00	20.35	12.02	17.44
lead	kt	2.43	0.92	13.17	7.61	12.48	5.99	21.68	7.30
zinc	kt	28.80	26.79	45.88	59.76	75.20	76.39	142.92	125.58
TOTAL BASE METALS			59.08		91.29		102.73		150.32
COAL	Mt	3.80	161.24	4.16	183.70	5.22	232.92	5.49	243.54
DIAMOND	M ct	36.47	354.75	33.85	413.58	29.96	435.73	47.49	564.77
GOLD	tonnes	130.57	2,072.69	161.79	2,596.45	181.17	2,762.82	182.04	2,689.92
HEAVY MINERAL SANDS									
ilmenite	Mt	0.87	67.18	1.07	89.61	0.97	85.48	0.97	83.15
synthetic rutile	kt	227.98	95.47	284.11	131.11	263.41	131.71	305.12	153.12
rutile	kt	100.48	62.49	82.23	58.54	65.45	49.60	47.47	26.88
zircon	kt	340.14	151.61	300.26	175.19	208.42	100.80	226.93	61.11
other hms			16.32		18.78		20.45		12.04
TOTAL HEAVY MINERAL SANDS			393.07		473.23		388.04		336.30
IRON ORE	Mt	100.42	1,790.45	106.27	2,246.03	107.67	2,648.69	111.64	2,953.27
MANGANESE ORE	kt	0.00	0.00	273.00	1.20	160.32	25.59	395.30	71.86
NICKEL METAL	kt	38.26	633.84	47.83	585.97	54.49	595.88	50.17	489.51
PETROLEUM PRODUCTS									
condensate	Gl	1.15	141.80	1.60	235.65	1.87	370.95	2.00	338.98
crude oil	Gl	2.20	269.86	3.96	601.47	5.14	1,054.06	5.43	941.29
lng	btu 10^{12}	0.00	0.00	104.17	336.09	184.93	836.40	219.70	846.33
lpg - butane	kt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
lpg - propane	kt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
natural gas	Gm^3	3.64	284.64	3.85	356.85	3.61	379.23	3.77	349.26
TOTAL PETROLEUM			696.30		1,530.06		2,640.64		2,475.86
SALT	Mt	6.02	106.71	5.93	124.11	6.41	136.97	6.93	153.14
OTHER			71.45		81.61		83.80		122.55
TOTAL			**7,958.81**		**10,662.93**		**12,152.93**		**12,009.19**

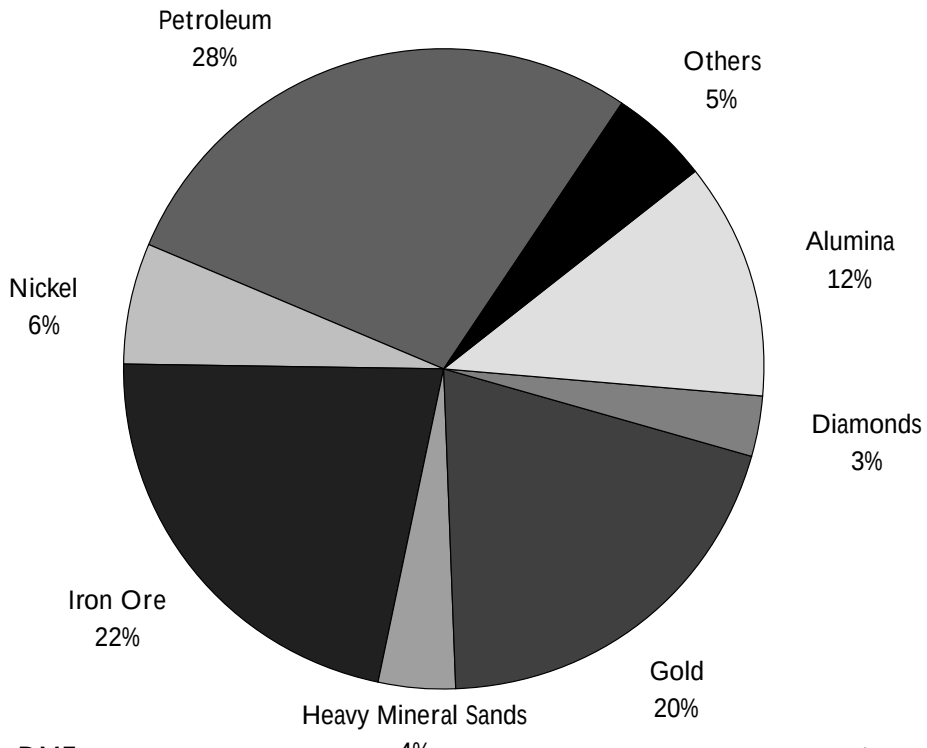
1992-93		1993-94		1994-95		1995-96		1996-97		1997-98	
Quantity	Value $M	Quantity	Value $M	Quantity	Value $M	Quantity	Value $M	Quantity	Value $M	Quantity	Value $M
7.55	1,818.12	7.83	1,784.32	7.91	1,684.60	8.23	1,918.34	8.35	1,955.77	8.51	2,260.54
22.92	27.44	32.46	40.26	29.20	76.54	23.69	65.42	27.73	58.98	29.47	58.27
22.30	6.65	21.11	4.98	21.10	9.20	21.28	12.64	13.49	6.09	27.00	10.39
127.96	104.11	136.39	79.54	132.85	95.84	113.49	75.32	88.37	75.12	126.09	120.83
	138.20		124.78		181.58		153.38		140.19		189.49
5.43	244.77	5.15	236.29	5.86	274.75	5.90	270.36	5.56	257.30	5.71	257.28
24.83	519.98	28.86	476.75	23.93	480.03	33.52	525.21	52.52	395.79	42.48	537.87
179.80	2,834.19	193.89	3,420.06	187.85	3,132.87	205.89	3,404.65	228.02	3,159.65	241.37	3,496.03
0.99	81.66	1.07	92.32	0.99	89.65	1.10	111.18	1.10	117.28	1.31	149.14
361.42	168.55	332.99	153.94	396.28	184.63	408.52	199.57	413.46	205.20	467.26	241.63
75.93	42.14	68.93	35.76	107.78	56.13	119.14	75.06	110.96	77.74	104.13	78.58
302.46	49.19	349.13	63.10	477.05	129.77	410.03	181.21	324.09	177.99	392.81	169.13
	10.29		13.92		14.56		18.50		26.51		24.63
	351.83		359.04		474.74		585.52		604.72		663.11
111.73	2,991.14	119.69	2,865.16	133.13	2,794.31	132.90	2,924.06	141.29	3,159.65	149.74	3,930.77
251.53	46.89	315.79	42.01	71.91	8.84	347.04	41.34	324.11	37.62	86.30	9.39
53.27	472.17	61.11	458.62	92.99	897.12	103.30	1,097.30	114.10	1,051.11	135.19	1,146.64
2.00	363.04	2.35	348.71	2.64	398.34	4.65	685.74	5.73	943.15	6.76	1,064.68
4.54	855.69	5.33	815.33	9.90	1,559.65	9.65	1,535.67	10.47	1,915.93	9.85	1,567.16
254.47	1,025.06	296.36	1,015.68	356.11	1,262.51	379.79	1,350.92	370.50	1,528.77	379.54	1,591.94
0.00	0.00	0.00	0.00	0.00	0.00	100.24	22.71	209.69	59.67	376.09	90.47
0.00	0.00	0.00	0.00	0.00	0.00	87.02	19.73	185.74	55.66	259.33	60.48
3.96	407.02	4.46	413.37	5.37	445.71	6.31	454.76	6.89	534.65	6.88	557.47
	2,650.81		2,593.09		3,666.21		4,069.53		5,037.83		4,932.19
6.63	158.38	6.25	151.31	7.18	155.14	7.45	154.22	7.55	153.62	8.19	188.70
	105.14		119.68		164.52		193.13		192.18		232.88
	12,331.62		**12,631.11**		**13,914.71**		**15,337.04**		**16,395.39**		**17,844.90**

COMPARATIVE VALUE OF PRODUCTION

1992-93 Total : A$12.33 billion



1997-98 Total : A$17.84 billion



Source : DME

Figure 0.1

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

MINERAL	LOCAL GOVERNMENT AREA	QUANTITY TONNES	METALLIC CONTENT	VALUE $A	Ref. (p.61)
BASE METALS			Cu Tonnes		
Copper By-Product	Coolgardie		4,460.350	7,446,662	(a),(b)
			Cu %		
Copper Concentrates	East Pilbara	11,701	21.32	5,757,700	
	Yalgoo	50,006	19.32	12,150,746	
Total Copper Concentrates		**61,707**		**17,908,446**	(a)
			Cu Tonnes		
Copper Cathode	East Pilbara		12,854.458	32,910,579	(a)
Total Copper				**58,265,687**	
			Pb %		
Lead	Derby-West Kimberley	37,376	72.24	10,391,495	(a)
			Zn %		
Zinc	Derby-West Kimberley	109,634	52.63	60,569,811	
	Yalgoo	164,093	41.67	60,261,812	
Total Zinc		**273,727**		**120,831,623**	(a)
TOTAL BASE METALS				**189,488,805**	
BAUXITE - ALUMINA					
Alumina	Boddington	1,717,605		429,626,579	
	Murray	3,148,179		848,376,986	
	Serpentine-Jarrahdale	1,913,639		515,792,369	
	Waroona	1,735,250		466,742,237	
TOTAL BAUXITE - ALUMINA		**8,514,673**		**2,260,538,170**	**(c)**
CHROMITE			Cr_2O_3 %		
Chromite Ore	Meekatharra	38,447	41.92	3,658,409	
CLAYS					
Attapulgite	Mullewa	24,023		4,362,859	(a)
Clay Shale	Collie	36,296		541,990	(a)
Fire Clay	Chittering	72,975		87,570	
Kaolin	Bridegetown-Greenbushes	280		31,649	(d)
White Clay	Swan	2,360		14,160	(d)
TOTAL CLAYS		**135,934**		**5,038,228**	
COAL	Collie	5,708,548		257,282,501	(e)
CONSTRUCTION MATERIALS					
Aggregate	Broome	12,619		233,645	
	Collie	33		1,667	
	Exmouth	19,362		116,168	
	Port Hedland Town	145,118		870,575	
	Roebourne	61,639		381,420	
	Wyndham-East Kimberley	34,123		204,738	
Total Aggregate		**272,894**		**1,808,213**	

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

MINERAL	LOCAL GOVERNMENT AREA	QUANTITY TONNES	METALLIC CONTENT	VALUE $A	Ref. (p.61)
Gravel	Broome	18,358		98,057	
	Coolgardie	64,831		365,751	
	Kalamunda	61,683		370,095	
	Kalgoorlie-Boulder	395		4,530	
	Port Hedland Town	27,457		155,000	
	Shark Bay	300		1,340	
	Wyndham-East Kimberley	7,595		16,335	
Total Gravel		**180,619**		**1,011,108**	
Rock	Broome	3,673		140,959	
	Derby-West Kimberley	880		5,280	
	East Pilbara	77,812		466,872	
	Kalgoorlie-Boulder	342,553		2,055,314	
Total Rock		**424,918**		**2,668,425**	
Sand	Broome	31,606		202,752	
	Carnarvon	30		1,050	
	Cockburn	124,029		744,174	
	Collie	98,577		591,463	
	Coolgardie	209,720		1,201,029	
	Coorow	2,894		14,470	
	Dandaragan	2,038		12,228	
	Derby-West Kimberley	4,266		22,901	
	Exmouth	2,133		12,796	
	Kalgoorlie-Boulder	14,111		81,579	
	Leonora	20,287		101,437	
	Meekatharra	29,687		176,324	
	Menzies	12,598		62,988	
	Northam	17,739		53,217	
	Pilbara	5,025		25,125	
	Port Hedland Town	96,959		498,152	
	Roebourne	53,358		351,731	
	Shark Bay	190		950	
	Wanneroo	1,046,039		4,184,156	
	Wyndham-East Kimberley	7,498		42,938	
	Yilgarn	3,680		18,398	
Total Sand		**1,782,464**		**8,399,858**	
TOTAL CONSTRUCTION MATERIALS				**13,887,604**	(d)
		Carats			
DIAMOND	Wyndham-East Kimberley	42,483,235		537,870,611	
DIMENSION STONE					
Black Granite	Dundas	958		287,457	
Granite	Derby-West Kimberley	175		70,000	
	Roebourne	216		10,800	
Total Granite		391		80,800	
TOTAL DIMENSION STONE				**368,257**	(d)

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

MINERAL	LOCAL GOVERNMENT AREA	QUANTITY TONNES	METALLIC CONTENT	VALUE $A	Ref. (p.61)
GEM & SEMI-PRECIOUS STONE		kg			
Chalcedony	Carnarvon	8,053		4,027	
		kg			
Chrysoprase	Menzies	21,536		8,936	
TOTAL GEM & SEMI-PRECIOUS STONE				**12,963**	
GOLD			Au kg		
	Boddington		12,008.143	173,997,445	
	Coolgardie		34,683.271	500,520,739	
	Cue		7,421.759	107,293,191	
	Dundas		4,295.674	62,094,821	
	East Pilbara		11,656.159	168,747,734	
	Kalgoorlie–Boulder		51,284.300	744,270,776	
	Katanning		19.539	276,744	
	Laverton		18,718.338	271,588,058	
	Leonora		42,175.589	611,564,665	
	Meekatharra		16,358.995	236,353,982	
	Menzies		1,829.758	25,998,908	
	Mt Magnet		5,793.363	84,137,710	
	Sandstone		4,385.898	63,524,412	
	Wiluna		14,130.267	204,927,689	
	Yalgoo		1,225.174	17,743,932	
	Yilgarn		15,381.138	222,989,673	
TOTAL GOLD			**241,367.365**	**3,496,030,479**	(f)
GYPSUM	Bruce Rock	980		7,840	(e)
	Carnarvon	565,105		11,209,155	(e)
	Dalwallinu	77,275		1,674,108	(e)
	Dandaragan	9,866		98,660	(e)
	Dundas	9,814		58,882	(e)
	Esperance	3,068		18,407	(e)
	Kondinin	2,375		23,750	(e)
	Koorda	125		1,500	(e)
	Lake Grace	36,944		282,026	(e)
	Merredin	2,000		12,000	(d)
	Mt Marshall	3,980		31,840	(e)
	Nungarin	27,659		165,954	(e)
	Ravensthorpe	17,325		138,600	(e)
	Wyalkatchem	63,258		494,676	(e)
	Yilgarn	6,865		54,920	(e)
TOTAL GYPSUM		**826,639**		**14,272,318**	
HEAVY MINERAL SANDS					
Garnet Sand	Bunbury City	57		6,840	(g)
	Northampton	115,980		13,637,387	(e)
Total Garnet Sand		116,037		13,644,227	

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

MINERAL	LOCAL GOVERNMENT AREA	QUANTITY TONNES	METALLIC CONTENT	VALUE $A	Ref. (P.61)
Ilmenite			TiO_2 %		
	Augusta-Margaret River	145,202	55.61	15,727,923	
	Bunbury City	478,208	56.26	63,490,435	
	Capel	403,300	54.59	46,034,674	
	Carnamah	275,289	57.84	22,663,035	
	Northampton	11,267	60.00	1,221,888	
Total Ilmenite		**1,313,266**		**149,137,955**	(a)
Upgraded Ilmenite			TiO_2 %		
	Capel	242,573	92.58	122,674,060	
	Carnamah	174,003	92.63	91,139,219	
	Dandaragan	50,682	92.00	27,818,691	
Total Upgraded Ilmenite		**467,258**		**241,631,970**	(a)
Leucoxene			TiO_2 Tonnes		
	Bunbury City	2,230	2,062	1,826,130	
	Capel	5,620	5,016	4,151,902	
	Dandaragan	20,496	16,914	5,008,223	
Total Leucoxene		**28,346**	**23,992**	**10,986,255**	(a)
Rutile			TiO_2 Tonnes		
	Bunbury City	11,334	10,598	9,317,687	
	Carnamah	77,131	72,655	58,758,631	
	Dandaragan	15,669	14,614	10,504,804	
		104,134	97,867	78,581,122	(a)
Zircon			ZrO_2 Tonnes		
	Bunbury City	31,934	20,757	17,684,549	
	Capel	55,341	31,013	28,942,592	
	Carnamah	240,432	156,597	85,386,872	
	Dandaragan	65,107	30,916	37,115,881	
Total Zircon		**392,814**	**239,283**	**169,129,894**	(a)
TOTAL HEAVY MINERAL SANDS				**663,111,423**	
INDUSTRIAL PEGMATITE MINERALS					
Felspar	Mukinbudin	2,135		41,255	
	Port Hedland Town	33,607		1,472,290	
Total Felspar		**35,742**		**1,513,545**	(h)
TOTAL INDUSTRIAL PEGMATITE MINERALS				**1,513,545**	
IRON ORE					
Domestic Ore			Fe%		
	East Pilbara	7,738,897	62.80	206,647,943	
Exported Ore			Fe%		
	Ashburton	84,086,705	63.41	2,144,906,116	
	Derby-West Kimberley	827,890	66.16	19,800,655	
	East Pilbara	55,764,429	62.07	1,529,227,269	
	Yilgarn	1,324,005	48.21	30,190,096	
Total Exported Ore		**142,003,029**		**3,724,124,136**	
TOTAL IRON ORE		**149,741,926**		**3,930,772,079**	(a)

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

MINERAL	LOCAL GOVERNMENT AREA	QUANTITY TONNES	METALLIC CONTENT	VALUE $A	Ref. (P.61)
LIMESAND - LIMESTONE-DOLOMITE					
Dolomite	Lake Grace	1,856		46,846	
	Yilgarn	210		5,250	
Total Dolomite		**2,066**		**52,096**	
Limesand - Limestone	Cockburn	1,867,524		5,508,394	
	Coorow	14,320		71,602	
	Dandaragan	28,567		164,873	
	Dundas	102,811		1,542,165	
	Exmouth	10,613		56,145	
	Gingin	144,664		1,546,034	
	Irwin	75,742		292,757	
	Kwinana	22,746		227,460	
	Manjimup	5,579		83,685	
	Shark Bay	344		42,942	
	Wanneroo	102,158		1,617,094	
Total Limesand - Limestone		**2,375,068**		**11,153,151**	
TOTAL LIMESAND-LIMESTONE-DOLOMITE		**2,377,134**		**11,205,247**	(d)
MANGANESE ORE			Mn %		
	East Pilbara	86,297	35.76	9,394,938	(a)
NICKEL INDUSTRY					
Cobalt By-Product			Co Tonnes		
	Coolgardie		1,498.453	81,708,296(a),(b)	
	Kalgoorlie-Boulder		1.337	70,410(a),(b)	
Total Cobalt By-Product				**81,778,706**	
Nickel Concentrates			Ni %		
	Coolgardie	241,046	13.18	270,172,235	
	Kalgoorlie-Boulder	70,922	17.16	98,699,526	
	Kondinin	56,804	14.50	71,021,748	
	Leonora	370,787	11.16	353,279,288	
	Wiluna	202,912	20.52	353,466,579	
Total Nickel Concentrates		**942,471**		**1,146,639,376**	(i)
Palladium By-Product			Pd kg		
	Coolgardie		668.998	6,785,327(a),(b)	
Platinum By-Product			Pt kg		
	Coolgardie		212.162	3,105,879(a),(b)	
TOTAL NICKEL INDUSTRY				**1,238,309,288**	
PETROLEUM					
Condensate		Kilolitres			
	Ashburton	182,029		29,073,978	(d)
	Carnamah	151		9,777	(d)
	Irwin	1,874		324,041	(d)
	Roebourne	6,574,183		1,035,269,646	(a)
Total Condensate		**6,758,237**		**1,064,677,442**	

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

MINERAL	LOCAL GOVERNMENT AREA	QUANTITY TONNES	METALLIC CONTENT	VALUE $A	Ref. (P.61)
Crude Oil		Kilolitres			
	Ashburton	4,209,407		697,252,243	
	Derby-West Kimberley	9,102		1,087,393	
	Irwin	12,666		1,714,865	
	Roebourne	5,621,315		867,104,051	
Total Crude Oil		**9,852,490**		**1,567,158,552**	(a)
Liquified Natural Gas		Btu 10^6			
	Roebourne	379,543,930		1,591,935,107	(j)
LPG - Butane		Tonnes			
	Roebourne	376,089		90,469,096	
LPG - Propane		Tonnes			
	Roebourne	259,330		60,483,979	
Natural Gas		'000 m^3			
	Ashburton	737,993		63,582,810(d)	(j)
	Carnamah	39,448		6,369,203	(j)
	Irwin	269,251		33,915,471	(j)
	Roebourne	5,835,263		453,601,584(d)	(j)
Total Natural Gas		**6,881,955**		**557,469,069**	
TOTAL PETROLEUM				**4,932,193,244**	
PIGMENTS					
Red Oxide	Cue	6,910		1,312,900	
SALT					
	Carnarvon	1,248,530		31,450,106	
	Dalwallinu	6		20	
	Esperance	15,585		515,645	
	Port Hedland Town	2,472,791		55,877,741	
	Roebourne	3,606,121		82,727,992	
	Shark Bay	730,107		13,236,764	
	Wyalkatchem	255		16,247	
	Yilgarn	112,269		4,875,965	
TOTAL SALT		**8,185,664**		**188,700,479**	(a)
SILICA - SILICA SAND					
Silica	Moora	92,427		924,266	(a)
Silica Sand					
	Albany	36,772		551,580	(a)
	Cockburn	155,789		1,713,679	(a)
	Coolgardie	157,488		385,844	(a)
	Swan	341,835		3,708,062	(a)
Total Silica Sand		**691,884**		**6,359,165**	
TOTAL SILICA - SILICA SAND				**7,283,431**	
SILVER BY-PRODUCT			Ag kg		
	Coolgardie		204.335	49,525(a),(b)	
	Derby-West Kimberley		1,144.518	32,004(a),(k)	
	East Pilbara		2,434.589	876,742(a),(k)	
	Statewide		28,113.107	6,445,276	(l)
	Yalgoo		24,848.244	5,809,246(a),(k)	
TOTAL SILVER BY-PRODUCT			**56,744.793**	**13,212,794**	

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

MINERAL	LOCAL GOVERNMENT AREA	QUANTITY TONNES	METALLIC CONTENT	VALUE $A	Ref. (P.61)
TALC					
	Meekatharra	18,683		1,307,810	
`	Three Springs	172,614		13,752,062	
TOTAL TALC		**191,297**		**15,059,872**	(e)
TIN - TANTALUM - LITHIUM					
Spodumene			Li_2O_5 %		
	Bridgetown-Greenbushes	46,566	5.56	8,897,759	(a)
Tantalite			Ta_2O_5 kg		
	Bridgetown-Greenbushes	371	194,775	41,864,039	
Tin			Sn Tonnes		
	Bridgetown-Greenbushes		481	3,622,811	
TOTAL TIN - TANTALUM - LITHIUM				**54,384,609**	

VALUE OF MINERALS	**9,416,678,471**
VALUE OF PETROLEUM	**4,932,193,244**
VALUE OF GOLD	**3,496,030,479**
TOTAL VALUE	**17,844,902,194**

TABLE 4 **ROYALTY RECEIPTS 1996-97, 1997-98**

Mineral	1996-97 $A	1997-98 $A	1997-98 GROWTH $A	%
BASE METALS				
Copper	1,830,922	2,444,734	613,812	34
Lead	643,726	256,316	-387,410	(60)
Zinc	4,763,749	5,608,191	844,442	18
TOTAL BASE METALS	**7,238,397**	**8,309,240**	**1,070,843**	**15**
BAUXITE-ALUMINA				
Alumina	33,622,840	36,205,237	2,582,397	8
Gallium	116,896	42,343	-74,553	(64)
TOTAL BAUXITE-ALUMINA	**33,739,736**	**36,247,580**	**2,507,844**	**7**
CHROMITE - PLATINOIDS				
Chromite Ore	0	171,283	171,283	n/a
CLAYS	**227,903**	**257,791**	**29,889**	**13**
COAL	**12,962,184**	**12,305,053**	**-657,131**	**(5)**
CONSTRUCTION MATERIALS				
Aggregate	115,336	94,087	-21,250	(18)
Gravel	54,142	62,025	7,882	15
Rock	133,425	128,660	-4,765	(4)
Sand	458,546	574,410	115,864	25
TOTAL CONSTRUCTION MATERIALS	**761,450**	**859,182**	**97,732**	**13**
DIAMOND	**35,266,731**	**40,086,339**	**4,819,608**	**14**
DIMENSION STONE	**1,173**	**666**	**-508**	**(43)**
GEM, SEMI-PRECIOUS & ORNAMENTAL STONE	**8,305**	**1,910**	**-6,395**	**(77)**
GOLD	**464,066**	**365,133**	**-98,933**	**(21)**
GYPSUM	**91,450**	**175,072**	**83,622**	**91**
HEAVY MINERAL SANDS				
Garnet	511,070	513,560	2,490	0
Ilmenite	6,863,887	9,190,945	2,327,059	34
Leucoxene	598,433	563,291	-35,143	(6)
Rutile	4,172,120	3,756,738	-415,382	(10)
Zircon	9,302,270	8,083,548	-1,218,722	(13)
TOTAL HEAVY MINERAL SANDS	**21,447,781**	**22,108,082**	**660,301**	**3**
INDUSTRIAL PEGMATITE MINERALS				
Felspar	129,838	115,362	-14,476	(11)
IRON ORE	**161,908,466**	**197,744,007**	**35,835,541**	**22**
LIMESAND-LIMESTONE-DOLOMITE				
Dolomite	1,221	715	-506	(41)
Limesand-Limestone	273,256	388,397	115,140	42
TOTAL LIMESAND-LIMESTONE-DOLOMITE	**274,477**	**389,112**	**114,635**	**42**

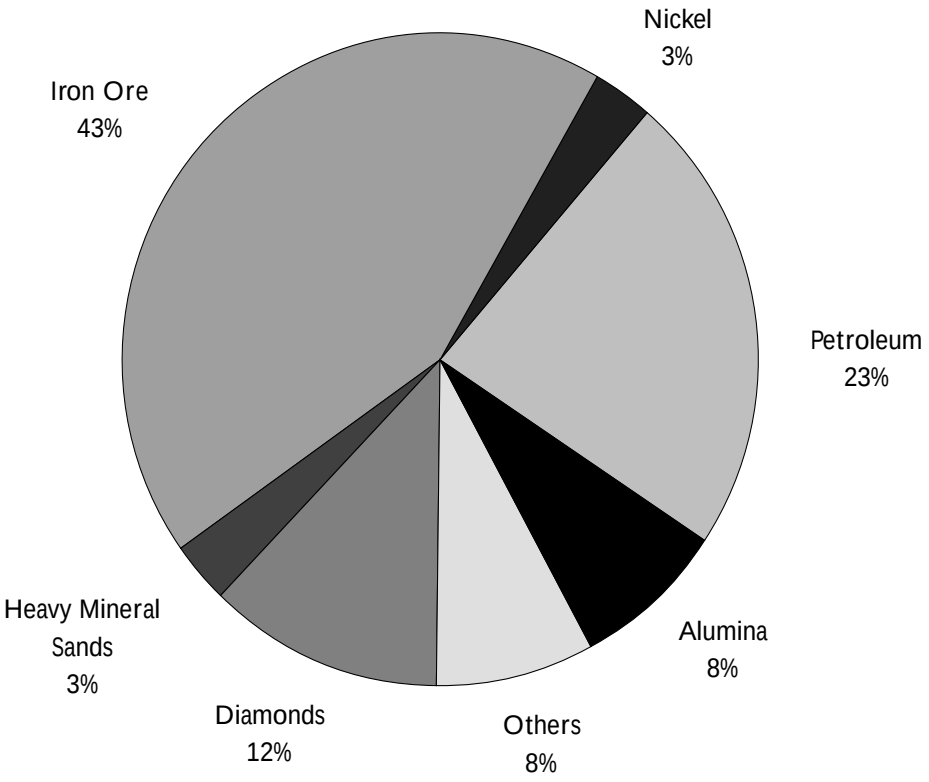
TABLE 4 (cont.) **ROYALTY RECEIPTS 1996-97, 1997-98**

Mineral	1996-97 $A	1997-98 $A	1997-98 GROWTH $A	%
MANGANESE	**1,417,213**	**81,723**	**-1,335,490**	**(94)**
NICKEL				
Cobalt by-product	1,218,420	1,389,448	171,027	14
Nickel	24,659,213	22,853,615	-1,805,598	(7)
Palladium by-product	59,029	97,324	38,295	65
Platinum by-product	73,187	116,438	43,250	59
TOTAL NICKEL INDUSTRY	**26,009,850**	**24,456,824**	**-1,553,025**	**(6)**
PETROLEUM				
Condensate	36,076,077	56,684,536	20,608,459	57
Liquified Natural Gas	77,065,722	90,611,328	13,545,606	18
LPG - Butane	2,543,797	4,533,964	1,990,167	78
LPG - Propane	2,567,199	3,298,684	731,485	28
Natural Gas	26,561,753	29,747,543	3,185,789	12
Oil	84,932,224	62,527,434	-22,404,789	(26)
TOTAL PETROLEUM	**229,746,771**	**247,403,490**	**17,656,718**	**8**
PIGMENTS				
Red Oxide	0	50,730	50,730	n/a
SALT	**1,878,311**	**1,966,169**	**87,858**	**5**
SILICA SAND	**341,519**	**375,689**	**34,169**	**10**
SILVER	**254,332**	**263,339**	**9,007**	**4**
TALC	**88,059**	**82,018**	**-6,041**	**(7)**
TIN-TANTALUM-LITHIUM				
Spodumene	830,253	581,370	-248,884	(30)
Tantalite	741,954	910,228	168,273	23
Tin	79,882	87,317	7,435	9
TOTAL TIN-TANTALUM-LITHIUM	**1,652,090**	**1,578,915**	**-73,175**	**(4)**
TOTAL ROYALTY RECEIPTS	**535,910,103**	**595,394,709**	**59,484,605**	**11**
IRON ORE ADDITIONAL RENTAL	**24,910,937**	**26,838,558**	**1,927,621**	**8**
TOTAL REVENUE	**560,821,040**	**622,233,267**	**61,412,226**	**11**

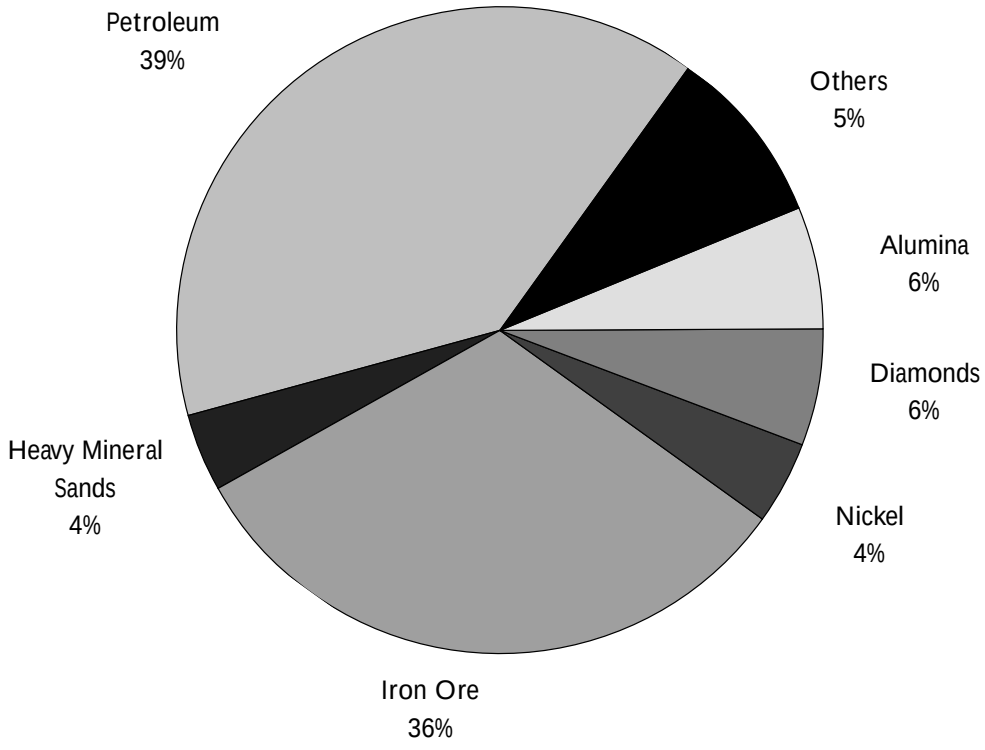
Note: All Royalty Receipts above are only those paid to Consolidated Revenue Fund

COMPARATIVE ROYALTY RECEIPTS

1992-93 Total : A$349.08 million



1997-98 Total : A$622.23 million



Source : DME

Figure 0.2

TABLE 5 **PERSONS EMPLOYED IN THE W.A. MINERALS & PETROLEUM INDUSTRIES AS AT 30 JUNE 1998**

MINERAL/Company	Mine	1996-97	1997-98
BASE METALS			
Normandy Mining Ltd	Scuddles	240	434
Western Metals Ltd	Pillara	281	545
Western Mining Corporation Ltd	Nifty	224	0
TOTAL BASE METALS		**745**	**979**
BAUXITE - ALUMINA			
Alcoa of Australia Ltd	Huntley	345	390
	Jarrahdale	268	251
	Kwinana Alumina Refinery	1,333	1,475
	Pinjarra Refinery	1,387	1,423
	Wagerup Alumina Refinery	858	950
	Willowdale	194	274
Australian Fused Materials Pty Ltd	Rockingham Fused Alumina Plant	71	68
Worsley Alumina Pty Ltd	Worsley - includes Mount Saddleback	150	170
	Worsley Refinery	1,037	1,403
TOTAL BAUXITE - ALUMINA		**5,643**	**6,404**
COAL			
Griffin Coal Mining Co. Pty Ltd	Muja	350	353
Wesfarmers Coal Ltd	Central Services	20	51
	Premier/WCL	183	118
	Western #5	156	185
TOTAL COAL		**709**	**707**
DIAMOND			
Argyle Diamond Mines Pty Ltd	Lake Argyle	1,261	1,406
GOLD			
Amalg Resources NL	Burmill Plant	7	0
Australian Resources Pty Ltd	Gidgee	184	143
	Mt McLure	172	161
Australian Gold Fields NL	Bannockburn	92	125
Australasian Gold Mines NL	Red White and Blue	67	0
Australian Gold Refineries	Perth Mint	89	65
Barminco Pty Ltd	Kookynie	68	0
	Two Boys	30	0
Border Gold NL	Karonie	0	14
Centaur Mining & Exploration Ltd	Mt Pleasant	388	376
	Ora Banda	173	227
Como Engineers	O'Conner - Carbon Stripping Plant	0	4
Consolidated Gold NL	Bardoc - Davyhurst	115	113
	Miranda	0	79
Croesus Mining NL	Binduli	30	77
Dalrymple Resources NL	Sandstone	3	0
Equigold NL	Dalgaranga	95	86
Forrestania Gold NL	Bounty	320	220
General Gold Resources NL	Mt Monger	24	0
Goldfields Kalgoorlie Ltd	Paddington	361	295
	Kundana	248	214

TABLE 5 (cont.) **PERSONS EMPLOYED IN THE W.A. MINERALS & PETROLEUM INDUSTRIES AS AT 30 JUNE 1998**

MINERAL/Company	Mine	1996-97	1997-98
GOLD (Continued)			
Gold Mines of Australia Ltd	Reedy	113	0
	Youanmi	186	0
Golden West Refining Corporation Ltd	Kewdale - Golden West Refinery	34	34
Great Central Mines NL	Bronzewing	286	340
	Jundee	383	615
	Nimary	128	0
Hedges Gold Pty Ltd	Hedges	103	111
Herald Resources Ltd	Sandstone	216	75
	Three Mile Hill	49	25
Hill 50 Gold NL	Hill 50	223	273
International Mineral Resources NL	Badgebup	25	0
Kalgoorlie Consolidated Gold Mines Pty Ltd	Golden Mile - Superpit	1,534	1,071
Lynas Gold NL	Lynas Find	48	7
Morning Star Mines NL	Hannans South	17	16
Mt Edon Gold Mines Ltd	Tarmoola	204	226
New Hampton Goldfields NL	Dawns Hope	0	177
	Mt Martin	152	0
Newcrest Mining Ltd	New Celebration	214	133
	Telfer	687	610
Nickel Seekers	Daisy - Milano	9	0
Normandy Mining Ltd	Golden Crown	52	0
	Big Bell	320	302
North Gold (WA) Ltd	Peak Hill	88	36
	Kanowna Belle	272	384
Oriole Resources Ltd	Mt Gibson	106	38
Perilya Mines NL	Fortnum	121	126
Placer Pacific Pty Ltd	Granny Smith	375	286
Plutonic Operations Ltd	Darlot	407	428
	Lawlers	237	172
	Mt Morgans	234	95
	Plutonic	484	408
Posgold Pty Ltd	Kaltails	75	80
Resolute Ltd	Bullabulling	159	0
	Chalice	145	152
	Higginsville	298	0
	Marymia	116	0
Sons of Gwalia NL	Barnicoat	112	48
	Copperhead	153	79
	Cornishman	0	1
	Golden Pig and Frasers	166	55
	Marvel Loch	223	238
	Sons of Gwalia	124	209
	Yilgarn Star	300	274
St. Barbara Mines Ltd	Bluebird	397	363
Stockdale Prospecting Ltd	Sunrise Dam	149	140

TABLE 5 (cont.) **PERSONS EMPLOYED IN THE W.A. MINERALS & PETROLEUM INDUSTRIES AS AT 30 JUNE 1998**

MINERAL/Company	Mine	1996-97	1997-98
GOLD (Continued)			
Tectonic Resources NL	Mt Dimer	66	0
Western Mining Corporation Ltd	Emu	195	425
	Kambalda/St. Ives	1,189	1,140
	Mt Magnet	282	227
Wiluna Mines Ltd	Wiluna	380	450
Worsley Alumina Pty Ltd	Boddington	388	546
TOTAL GOLD		**14,690**	**12,614**
HEAVY MINERAL SANDS			
BHP Ltd	Beenup	189	192
Cable Sands Pty Ltd	Bunbury	341	324
GMA Garnet Pty Ltd	Narngulu Garnet Plant	24	24
	Port Gregory - Hutt Laggoon	18	22
Hanwah Advanced Ceramics Australia Pty Ltd	Rockingham Zirconia Plant	21	20
RGC Mineral Sands Pty Ltd	Capel	240	174
	Eneabba	449	557
	Narngulu Synthetic Rutile Plants	60	66
	Narngulu Dry Plant	227	197
TiWest Pty Ltd	Chandala-Muchea	187	212
	Cooljarloo	133	153
Westralian Sands Ltd	Capel	727	561
TOTAL HEAVY MINERAL SANDS		**2,616**	**2,502**
IRON ORE			
BHP Iron Ore (Goldsworthy) Ltd	Finucane Island	386	500
	Yarrie	179	145
BHP Iron Ore (Jimblebar) Ltd	Jimblebar	136	137
BHP Iron Ore Ltd	Mt Whaleback	1,583	1,528
	Nelson Point	987	1,735
	Orebody 25	96	108
	Mt Newman Railway	685	620
	Port Hedland Harbour Tunnel	53	0
	Yandi	175	132
Hamersley Iron Pty Ltd	Brockman No. 2 Detritals Group	112	117
	Dampier Port Operations	679	700
	Hismelt/Kwinana	115	109
	Marandoo	221	195
	Paraburdoo/Channar	677	563
	Hamersley Railway	403	360
	Tom Price	928	736
	Yandicoogina	0	519
Koolyanobbing Iron Pty Ltd	Cockatoo Island	47	44
	Koolyanobbing	27	29
Robe River Mining Co. Pty Ltd	Cape Lambert	444	435
	Pannawonica Deepdale	406	290
	Robe River Railway	93	93
TOTAL IRON ORE		**8,432**	**9,095**

TABLE 5 (cont.) **PERSONS EMPLOYED IN THE W.A. MINERALS & PETROLEUM INDUSTRIES AS AT 30 JUNE 1998**

MINERAL/Company	Mine	1996-97	1997-98
NICKEL			
Anaconda Nickel Ltd	Murrin Murrin	162	254
	Murrin Murrin Plant	162	1,457
Consolidated Gold NL	Black Swan	176	130
Centaur Mining & Exploration	Cawse	0	544
Outokumpu Australia Ltd	Forrestania	190	191
Resolute Ltd	Bulong	72	300
Titan Resources NL	Radio Hill	0	54
Western Mining Corporation Ltd	Kalgoorlie Nickel Smelter	428	385
	Kambalda/Blair	1,165	1,106
	Kwinana Refinery	787	448
	Leinster	935	834
	Mt Keith	671	928
TOTAL NICKEL		**4,748**	**6,631**
PETROLEUM PRODUCTS			
Apache Energy Ltd	Campbell, Agincourt, East Spar, Harriet, Rosette, Sinbad, Tanami	130	125
ARC	Dongara, Mondara	24	27
BHP Petroleum (Australia) Pty Ltd	Griffin	223	212
Boral	Beharra Springs, Tubridgi	14	30
Capital	Blina, Boundary, Lloyd, Sundown, West Terrace	8	4
Mobil Exploration & Producing Australia Pty Ltd	Wandoo	117	146
Novus	Chervil, North Herald, South Pepper, Airlie Island	17	26
Phoenix	Woodada	283	351
Premier Oil Australia Pty Ltd	Mt Horner	6	10
West Australian Petroleum Pty Ltd (WAPET)	Barrow Island, Cowle, Crest, Roller-Skate, Saladin, Yammaderry	218	250
Western Mining Corp. Ltd	Chervil, North Herald, South Pepper	2	0
Woodside Energy Ltd	Cossak, Goodwyn, Hermes, North Rankin, Wanaea	1,643	2,152
TOTAL PETROLEUM PRODUCTS		**2,685**	**3,333**
SALT			
Cargill Salt Co.	Port Hedland	116	116
Dampier Salt Ltd	Dampier	242	197
	Lake MacLeod	141	151
Onslow Solar Salt Pty Ltd	Onslow	0	5
Shark Bay Salt JV	Useless Loop	77	69
TOTAL SALT		**576**	**538**
TOTAL CLAYS		**85**	**60**
TOTAL CONSTRUCTION MATERIALS		**374**	**314**
TOTAL DIMENSION STONE		**77**	**66**
TOTAL INDUSTRIAL PEGMATITE MINERALS		**35**	**0**
TOTAL LIMESTONE - LIMESAND		**94**	**174**
TOTAL MANGANESE ORE		**90**	**0**
TOTAL SILICA - SILICA SAND		**213**	**193**
TOTAL TALC		**40**	**43**
TOTAL TIN - TANTALUM - LITHIUM		**287**	**268**
ALL OTHER MATERIALS		**107**	**102**
TOTAL		**43,507**	**45,429**

(SOURCE:AXTAT REPORTING SYSTEM, MINING OPERATIONS DIVISION)

TABLE 6 **PRINCIPAL MINERALS & PETROLEUM PRODUCERS 1997/98**

BASE METALS

Copper

Murchison Zinc Co. Pty Ltd, 100 Hutt Street,Adelaide SA 5000, (08) 8303 1700: Golden Grove.
Newcrest Mining Ltd, 600 St Kilda Road, Melbourne VIC, 3004, (03) 9522 5333:Telfer.
Straits Resources Ltd, 1 Alfred Street, Sydney NSW 2000, (02) 9252 2011: Nifty.

Lead - Zinc

Murchison Zinc Co. Pty Ltd, 100 Hutt Street,Adelaide SA 5000, (08) 8303 1700: Golden Grove.
Western Metals Ltd, 263 Adelaide Terrace, Perth WA 6000, (08) 9221 2555: Cadjebut.

BAUXITE – ALUMINA

Alumina

Alcoa of Australia (WA) Ltd, cnr Davey & Marmion Streets, Booragoon WA 6154, (08) 9316 5111: Del Park, Jarrahdale, Willowdale.
Worsley Alumina Pty Ltd, PO Box 344, Boddington WA 6225, (08) 9734 8311: Boddington.

CLAY

Attapulgite

Hudson Resources Ltd, James St Narngulu, Geraldton WA 6530, (08) 9923 3604: Lake Nerramyne.

Clay Shale

Griffin Coal Mining Co. Ltd, 28 The Esplanade, Perth WA 6000, (08) 9325 8155: Collie.
Wesfarmers Coal Ltd, 276 Leach Highway, Myaree WA 6153, (08) 9333 0391: Collie.

Fire Clay

Midland Brick Co Pty Ltd, Bassett Rd, Middle Swan WA 6056, (08) 9273 5522: Muchea

Kaolin

Gwalia Consolidated Ltd, PMB 16,West Perth WA 6872, (08) 9481 1988: Greenbushes.

White Clay

Metro Brick, Locked Bag 100, Midland WA 6936, (08) 9250 2111: Middle Swan.

COAL

Griffin Coal Mining Co. Ltd, 28 The Esplanade, Perth WA 6000, (08) 9325 8155: Collie.
Wesfarmers Coal Ltd, 276 Leach Highway, Myaree WA 6153, (08) 9333 0391: Collie.

CONSTRUCTION MATERIALS

Aggregate

The Readymix Group (WA), 75 Canning Highway, Victoria Park WA 6100, (08) 9472 2000: Boodarrie, Boulder, Burrup-Dampier.

Gravel

Boral Resources (WA) Ltd, 63 Abernethy Road, Belmont WA 6105, (08) 9333 3400: Grosmont.
WA Limestone, 41 Spearwood Avenue, Bibra Lake WA 6163, (08) 9434 2299: Pickering Brook.

Rock

Boral Resources (WA) Ltd, 63 Abernethy Rd, Belmont WA 6104, (08) 9333 3400: Grosmont.
The Readymix Group (WA), 75 Canning Highway, Victoria Park WA 6100, (08) 9472 2000: Kalgoorlie

Sand

Rocla Quarry Products, 1 Newburn Road, Kewdale WA 6104, (08) 9353 3030: Jandakot.
The Readymix Group (WA), 75 Canning Highway, Victoria Park WA 6100, (08) 9472 2000: Comet Vale, Pinnacles, Sandy Hill, Sullivan's Creek,Turner River,Warrawanda,Widgiemooltha.
Boral Resources (WA) Ltd, 63 Abernethy Rd, Belmont WA 6104, (08) 9333 3400: Grosmont.

TABLE 6 (cont.) **PRINCIPAL MINERALS & PETROLEUM PRODUCERS 1997/98**

DIAMOND

Argyle Diamond Mines, 2 Kings Park Road,West Perth WA 6005, (08) 9482 1166:Argyle.

DIMENSION STONE

Fraser Range Granite NL,The Esplanade (cnr Manning St), Scarborough,WA 6019 (08) 9245 8003: Mt Malcolm.

GOLD

Acacia Resources Ltd, 60 City Road, South Melbourne VIC 3205, (03) 9684 4999: Sunrise Dam.
Australian Gold Fields NL, 66 St George's Terrace, Perth WA 6000, (08) 9486 7300: Bannockburn, Miranda.
Australian Resources Ltd, 100 William Street, East Sydney NSW 2060, (02) 9326 9277: Gidgee, Mt McClure.
Barminco Pty Ltd, 9 Bowman Street, South Perth WA 6151, (08) 9474 1340:Two Boys.
Centaur Mining & Exploration Ltd, 210 Kings Way, Sth Melbourne VIC 3205, (03) 9234 1122: Mt Pleasant, Ora Banda.
Central Norseman Gold Corp. NL, 60 City Road, Southbank VIC 3006, (03) 9685 6000: Central Norseman.
Consolidated Gold NL, 83 Mill Point Road, South Perth WA 6151, (08) 9367 5340: Davyhurst..
Delta Gold NL, 99 Walker Street, North Sydney NSW 2060, (02) 9903 4000: Golden Feather.
Croesus Mining NL, 39 Porter Street, Kalgoorlie WA 6430, (08) 9091 2222: Binduli.
Equigold NL, 7 Sleat St, Applecross WA 6153, (08) 9316 3661: Dalgaranga.
Gindalbie Gold NL, 31-33 Dugan Street, Kalgoorlie WA 6430, (08) 9021 1877: Karonie.
Goldfields Kalgoorlie Ltd, 1 Alfred St, Sydney NSW 2000, (02) 9934 8800: Kundana, Paddington.
Great Central Mines NL, 210 Kings Way, Sth Melbourne VIC 3205, (03) 9234 1111: Bronzewing, Jundee, Wiluna.
Hedges Gold Pty Ltd, Pinjarra - Williams Road, Boddington WA 6390, (08) 9538 4500: Hedges.
Herald Resources Ltd, 40 Kings Park Road, West Perth WA 6005, (08) 9322 2788: Sandstone,Three Mile Hill.
Hill 50 Gold NL, 10 Ord Street, West Perth WA 6005, (08) 9485 0070: Hill 50.
Homestake Mining Company, 2 Mill Street, Perth WA 6000, (08) 9212 5777: Darlot, Lawlers, Mt Morgans, Peak Hill, Plutonic.
Kalgoorlie Consolidated Gold Mines Pty Ltd, Private Bag 27, Kalgoorlie WA 6430, (08) 9022 1100: Golden Mile.
Lionore Australia Pty Ltd, 15 Ord St, West Perth WA 6005, (08) 9481 5656: Bounty.
New Hampton Goldfields NL, 9 Havelock St, West Perth WA 6005, (08) 9321 0611: Jubilee.
Newcrest Mining Ltd, 600 St Kilda Road, Melbourne VIC 3004, (03) 9522 5333: New Celebration, Telfer.
Normandy Mining Ltd, 100 Hutt Street, Adelaide SA 5000, (08) 8303 1700: Big Bell, Golden Crown, Kaltails.
North Ltd, 476 St Kilda Road, Melbourne VIC 3004, (03) 9207 5111: Kanowna Belle.
Pacific Mining Corporation Limited, 35 Ventnor Avenue, West Perth WA 6005, (08) 9321 0616: Mt Gibson, Tarmoola.
Perilya Mines NL, 31 Ventnor Avenue, West Perth WA 6005, (08) 9423 1700: Fortnum.
Placer Dome Inc, 1 Alfred Street, Sydney Cove NSW 2000 (02) 9256 3800: Granny Smith.
Resolute Ltd, 28 The Esplanade, Perth WA 6000, (08) 9261 6100: Chalice, Higginsville.
Sons of Gwalia NL, 16 Parliament Place, West Perth WA 6005, (08) 9263 5555: Bullfinch, Laverton, Marvel Loch-Southern Cross, Sons of Gwalia, Yilgarn Star.
St Barbara Mines Ltd, 28 The Esplanade, Perth WA 6000, (08) 9323 3333: Bluebird.
WMC Ltd, 250 St George's Terrace, Perth WA 6000, (08) 9442 2000: Agnew, Kambalda-St Ives.
Worsley Alumina Pty Ltd, PO Box 48, Boddington WA 6390, (08) 9883 8260: Boddington.

GYPSUM

Dampier Salt (Operations) Pty Ltd, 152-158 St George's Terrace, Perth WA 6000, (08) 9327 2299: Lake Macleod.
H.B. Brady & Co. Pty Ltd, PO Box 42, Bayswater WA 6933 , (08) 9279 4422: Lake Brown.
Quantum Holdings Pty Ltd, 17 Hawkstone St, Cottlesloe WA 6011, (08) 9481 4101: Jurien Bay.
Swan Cement Ltd, PO Box 528, Kwinana WA 6966, (08) 9499 2222: Lake Hillman.
Westdeen Holdings Pty Ltd, 7 Armstrong Road, Applecross WA 6153, (08) 9364 4951: Lake Cowcowing.

TABLE 6 (cont.) **PRINCIPAL MINERALS & PETROLEUM PRODUCERS 1997/98**

HEAVY MINERAL SANDS

Garnet Sand

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

Ilmenite, Leucoxene, Rutile & Zircon

BHP Titanium Minerals Pty Ltd, PO Box 22, Karridale WA 6288, (08) 9758 2500: Beenup.
Cable Sands (WA) Pty Ltd, PO Box 133, Bunbury WA 6230, (08) 9721 4111: Busselton, Jangardup, Waroona.
RGC Mineral Sands, PO Box 62, Geraldton WA 6530, (08) 99568 822: Capel, Eneabba North, Eneabba West, Narngulu.
TiWest Pty Ltd, 1 Brodie Hall Drive, Bentley WA 6102, (08) 9365 1390: Cooljarloo, Chandala.
Westralian Sands Ltd, PO Box 96, Capel WA 6271, (08) 9780 3200:Yoganup, Yoganup Extended.

INDUSTRIAL PEGMATITE MINERALS

Feldspar

Commercial Minerals Ltd, 26-28 Tomlinson Road,Welshpool WA 6106, (08) 9362 1411: Mukinbudin, Pippingarra.

IRON ORE

BHP Iron Ore (Goldsworthy) Ltd, 200 St George's Terrace, Perth WA 6000, (08) 9320 4444: Nimingarra, Yarrie.
BHP Iron Ore (Jimblebar) Ltd, 200 St George's Terrace, Perth WA 6000, (08) 9320 4444: Jimblebar.
BHP Iron Ore Ltd, 200 St George's Terrace, Perth WA 6000, (08) 9320 4444: Newman, Yandicoogina.
Channar Mining Pty Ltd, 152 George's Terrace, Perth WA 6000, (08) 9327 2327: Channar.
Hamersley Iron Pty Ltd, 152 George's Terrace, Perth WA 6000, (08) 9327 2327: Brockman, Marandoo, Tom Price, Paraburdoo.
Koolyanobbing Iron Pty Ltd, 1 William St, Perth WA 6000, (08) 9426 3388: Cockatoo Island, Koolyanobbing.
Robe River Iron Associates, 12 St George's Terrace, Perth WA 6000, (08) 9421 4747: Pannawonica.

LIMESAND – LIMESTONE

Cockburn Cement Ltd, Russell Road, East Munster WA 6166, (08) 9411 1000: Cockburn Sound, Coogee.
Swan Cement Ltd, PO Box 528, Kwinana WA 6966, (08) 9499 2222:Wanneroo.
Westdeen Holdings Pty Ltd, 7 Armstrong Rd,Applecross WA 6153, (08) 9364 4951: Lancelin
Loongana Lime Pty Ltd, PO Box 808, Kalgoorlie WA 6430, (08) 9021 8055: Loongana

MANGANESE

Consolidated Minerals Ltd, 250 George's Terrace, Perth WA 6000, (08) 9321 3797:Woodie Woodie.

NICKEL

Mining Project Investors Pty Ltd, 600 Bourke Street, Melbourne VIC 3000, (03) 9672 3222: Black Swan.
Outokumpu Australia Pty Ltd, 141 Burswood Road, Burswood WA 6100, (08) 9472 3144: Forrestania.
WMC Ltd, 250 St George's Terrace, Perth WA 6000, (08) 9442 2000: Blair, Carnilya Hill, Kambalda, Leinster, Mt Keith.

PETROLEUM

Apache Energy Ltd, 256 St George's Terrace, Perth WA 6000, (08) 9422 7222:Campbell, Agincourt, East Spar, Harriet, Rosette, Sinbad, Tanami.
ARC Energy NL, 35 Ventnor Avenue,West Perth WA 6005, (08) 9486 7333: Dongara, Mondara.
BHP Petroleum Pty Ltd, 152-158 St George's Terrace, Perth WA 6000, (08) 9278 4800: Griffin
Boral Energy Resources Ltd, 60 Hindmarsh Square,Adelaide SA 5000, (08) 8235 3737: Beharra Springs, Tubridgi.
Capital Energy N.L., Level 7,The Landmark, 345 George Street, Sydney NSW 2000, (02) 9262 6833: Blina, Boundary, Lloyd, Sundown,West Terrace.
Mobil Exploration & Producing Australia Pty Ltd, 250 St George's'Terrace, Perth WA 6000, (08) 9424 9200: Wandoo
Novus West Australia Pty Ltd, 76 Kings Park Road, West Perth WA 6005, (08) 9486 7700: Chervil, North

TABLE 6 (cont.) **PRINCIPAL MINERALS & PETROLEUM PRODUCERS 1997/98**

Herald, South Pepper, Airlie Island.
Phoenix Energy Pty Ltd, 28 The Esplanade, Perth WA 6000, (08) 9261 2800: Woodada.
Premier Oil Australia Pty Ltd, 31 Ventnor Avenue, West Perth WA, 6005, (08) 9480 4100: Mt Horner.
West Australian Petroleum Pty Ltd (WAPET), QV1, 250 St George's Terrace, Perth WA 6000, (08) 9263 6000: Barrow Island, Cowle, Crest, Roller-Skate, Saladin, Yammaderry.
Woodside Energy Ltd, 1 Adelaide Terrace, Perth WA 6000, (08) 9224 4111: Cossack, Goodwyn, Hermes, North Rankin, Wanaea.

SALT

Cargill Australia Ltd, PO Box 420, Port Hedland WA 6721, (08) 9140 1255: Port Hedland.
Dampier Salt (Operations) Pty Ltd, 152-158 St George's'Terrace, Perth WA 6000, (08) 9327 2299: Dampier, Lake Macleod.
Shark Bay Salt Joint Venture, 22 Mount Street, Perth WA 6000, (08) 9322 4811: Useless Loop.
WA Salt Koolyanobbing Pty Ltd, Cockburn Road, Hamilton Hill WA 6163, (08) 9430 5495: Lake Deborah East, Pink Lake.

SILICA - SILICA SAND

Silica

Simcoa Operations Pty Ltd, PO Box 1389, Bunbury WA 6231, (08) 9791 2588: Dalaroo.

Silica Sand

Rocla Quarry Products, 1 Newburn Road, Kewdale WA 6105, (08) 9353 3030: Jandakot.
Boral Resources WA Ltd, 136-138 Gt Eastern Highway, South Guildford WA 6055, (08) 9279 0000: Jandakot.
The Readymix Group (WA), 75 Canning Highway, Victoria Park WA 6100, (08) 9472 2000: Jandakot.
WMC Ltd, 250 St George's Terrace, Perth WA 6000, (08) 9442 2000: Mt Burgess.

TALC

Gwalia Minerals NL, PMB 16, West Perth WA 6872, (08) 9481 1988: Mt Seabrook.
WMC Ltd, PO Box 116, Three Springs WA 6519, (08) 9954 5047:Three Springs.

TIN - TANTALUM – LITHIUM

Spodumene

Gwalia Consolidated Ltd, PMB 16, West Perth WA 6872, (08) 9481 1988: Greenbushes.

Tantalite – Tin

Gwalia Consolidated Ltd, PMB 16, West Perth WA 6872, (08) 9481 1988: Greenbushes, Wodgina.

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
f.o.r.	free on rail	¥	Japanese Yen
A$	Australian Dollar	US$	United States Dollar
ABS	Australian Bureau of Statistics	GDP	Gross Domestic Product
AFR	*Australian Financial Review*	BMR	Bureau of Mineral Resources
CSO	Central Selling Organisation	HBI	Hot Briquetted Iron
DRI	Direct Reduced Iron	IMF	International Monetary Fund
RBA	Reserve Bank of Australia		
ABARE	Australian Bureau of Agricultural and Resource Economics		

REFERENCES

(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) Value at works.
(e) Estimated ex-mine value.
(f) Value based on monthly production and average gold price of that month as supplied by GoldCorp.
(g) Estimated f.o.t value.
(h) Estimated f.o.r value.
(i) Estimated f.o.b value based on the current price of nickel containing products.
(j) Delivered value.
(k) Metallic by-product of copper mining.
(l) By-products of gold mining
(r) Revised from previous edition.

UNITS AND CONVERSION FACTORS

	Metric Unit	Symbol		Imperial Unit
Mass	1 gram	(g)	=	0.032151 troy (fine) ounce (oz)
	1 kilogram	(kg)	=	2.204624 pounds (lbs)
	1 tonne	(t)	=	1.10231 United States short ton [1 US short ton =2,000 lbs]
	1 tonne	(t)	=	0.98421 United Kingdom long ton [1 UK long ton = 2,240 lbs]
Volume	1 kilolitre	(kl)	=	6.28981 barrels (bbls)
	1 cubic metre	(m^3)	=	35.3147 cubic feet (ft^3) [1 kilolitre (kl) = 1 cubic metre (m^3)]
Energy	1 kilojoule	(kj)	=	0.94781 British Thermal Units (Btu)

Energy Content

Coal	19.7 GJ/t
Condensate	32.0 MJ/L
Crude oil	37.0 MJ/L
LNG	25.0 MJ/L
Natural gas	38.2 MJ/m^3
LPG-butane	28.7 MJ/L (1tonne LPG-butane = 1,720 litres)
LPG-propane	25.4 MJ/L (1tonne LPG-propane = 1,960 litres)

Prefix

kilo (k)	10^3
mega (M)	10^6
giga (G)	10^9
tera (T)	10^{12}
peta (P)	10^{15}