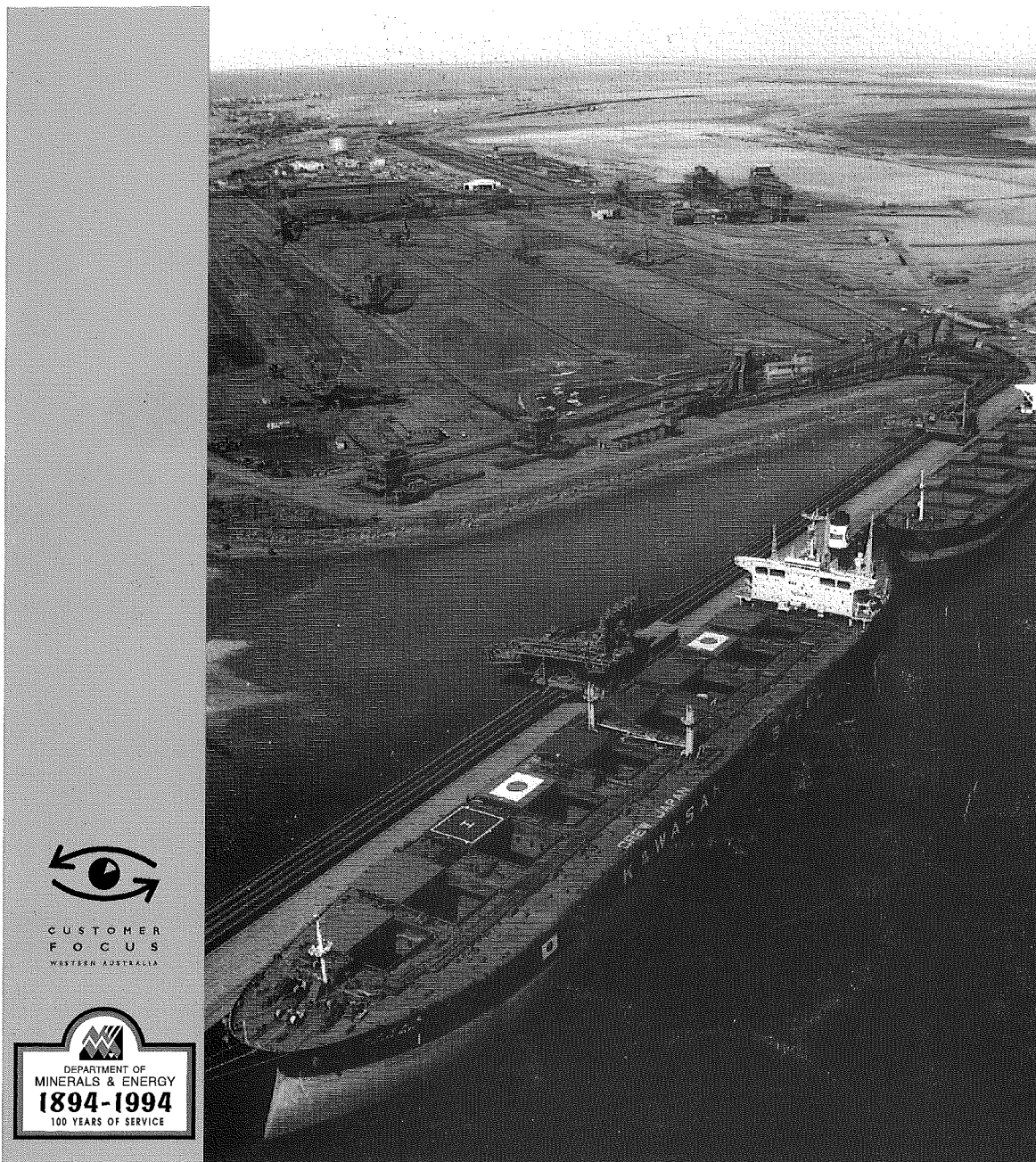


Resource Centre
Policy Branch
Dept. of Minerals & Energy

1993-94

MINERAL AND PETROLEUM PRODUCTION

STATISTICS DIGEST



Royalties, Economic Policy and Public Affairs Division

DEPARTMENT OF MINERALS AND ENERGY

WESTERN AUSTRALIA

AMAZON MARU
BHP
Nelson Point Loading Facility

COVER PHOTOGRAPH:
AMAZON MARU taking on Iron Ore at BHP's
Nelson Point Loading Facility, Port Hedland.



Resource Centre
Policy Branch
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FOREWORD

Since opening one hundred years ago in 1894, an important function carried out by the Department of Minerals and Energy has been the provision of statistics on the mineral and petroleum industry.

These statistics continue to play an important role in the mining industry. They are used by companies and the Government to assist in management and investment decisions.

I am pleased to present the 1993-94 Mineral and Petroleum Statistics Digest, containing the most comprehensive statistical information available on the Western Australian mining industry.

The resource industry has always been important to the economic health of Western Australia. Moreover, with continued concern over Australia's international trade balance, Western Australia's mineral and petroleum exports play an essential role in improving the current account deficit. It is timely, therefore, that this edition of the Digest includes for the first time information on export destinations.

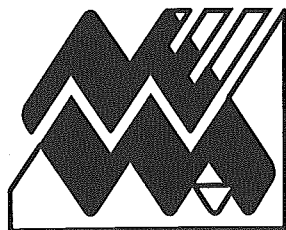
The statistics on mineral and petroleum exports were assembled by the Department with assistance from the Australian Bureau of Statistics and resource companies. I would like to thank these organisations for their help as it would be impossible to present such a comprehensive publication without their support.

Previous surveys of our readers have found that this publication is generally well regarded and useful. We want to ensure that this remains the case and hence this edition includes a survey form canvassing your views. I would appreciate it if you could make suggestions and comments on the form and return it to the Department. This will enable us to provide an improved service to all of our customers.

K R Perry
DIRECTOR GENERAL



CUSTOMER
FOCUS
WESTERN AUSTRALIA



DEPARTMENT OF
MINERALS AND ENERGY
WESTERN AUSTRALIA

**DIGEST OF MINERAL AND
PETROLEUM STATISTICS**

1993-94

The purpose of this Digest is to show the significance of mineral and petroleum production in the economy of Western Australia, and the interaction of the industry with the global economy.

**ROYALTIES, ECONOMIC POLICY
AND PUBLIC AFFAIRS DIVISION**

MINERAL HOUSE

100 PLAIN STREET

EAST PERTH WA 6004

TELEPHONE: (09) 222 3106
INTERNATIONAL: 61 9 222 3106

FACSIMILE: (09) 222 3069
INTERNATIONAL: 61 9 222 3069

DECEMBER 1994

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ABBREVIATIONS, REFERENCES, UNITS AND CONVERSION FACTORS

As the following 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	f.o.t.	free on truck
f.o.b.	free on board	n.a.	not available
f.o.r.	free on rail	n.ap.	not applicable
\$A	Australian Dollar	\$US	United States Dollar
ABS	Australian Bureau of Statistics	LME	London Metals Exchange
AFR	<i>Australian Financial Review</i>	BMR	Bureau of Mineral Resources
ABARE	Australian Bureau of Agricultural and Resource Economics		

REFERENCES

N.A.	Not available for publication.
(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 Australian Bureau of Statistics.
(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.
(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)	= 2.20462 pounds (lbs)
	1 tonne	(t)	= 1.10231 United States short ton (1 U.S. short ton = 2,000 lbs)
	1 tonne	(t)	= 0.98421 United Kingdom long ton (1 U.K. long ton = 2,240 lbs)
Volume	1 kilolitre	(kl)	= 6.28981 barrels (bbls)
	1 kilolitre	(kl)	= 1 cubic metre (m ³)
	1 cubic metre (m ³)		= 35.3147 cubic feet (ft ³)
Energy	1 kilojoule	(kJ)	= 0.94781 British Thermal Units (Btu)
	1 gigajoule	(GJ)	= 0.94781 million British Thermal Units (MBtu)
	1 petajoule	(PJ)	= 0.94781 million million British Thermal Units (MMBtu)

Prefix:	kilo (k)	10 ³
	mega (M)	10 ⁶
	giga (G)	10 ⁹
	tera (T)	10 ¹²
	peta (P)	10 ¹⁵

1. OVERVIEW

1.1 Review of the World Economy

Growth in the world economy was stronger than expected in 1993-94. This was mainly due to strong recovery in the United States' economy. However, the overall improvement was characterised by a diversity in individual economic performances. While recovery from the recession began in the US, Canada, the United Kingdom, Australia and New Zealand, growth was very slow in Western Europe and Japan and probably negative in the Commonwealth of Independent States (CIS).

The US economy grew strongly in 1993-94 with its GDP increasing by 3.4%. The main contributors to the growth were increased consumption expenditure and equipment and inventory investment. Despite the strong pace of recovery, inflationary pressures remained subdued. To maintain a lid on inflation the Federal Reserve increased interest rates in the second half of 1993-94.

Further strengthening of industrial production and business investment is expected to sustain strong growth in the United States' economy for at least the first half of 1994-95, with forecasts suggesting that GDP growth is likely to reach 4% in 1994. As the rate of industrial capacity utilisation has been maintained at high levels, fears have been expressed that the US economy may be expanding beyond its long term capacity, which together with rising commodity prices, has fuelled inflationary expectations. The unemployment rate for example, towards the end of 1993-94 was around 6% - close to the point where wage and price pressures could be expected to develop. Given perceptions on long term sustainable growth, the US Federal Reserve would be required to further tighten monetary policy if the forecast 4% growth in GDP is carried over into 1995. This could induce a cyclical downturn.

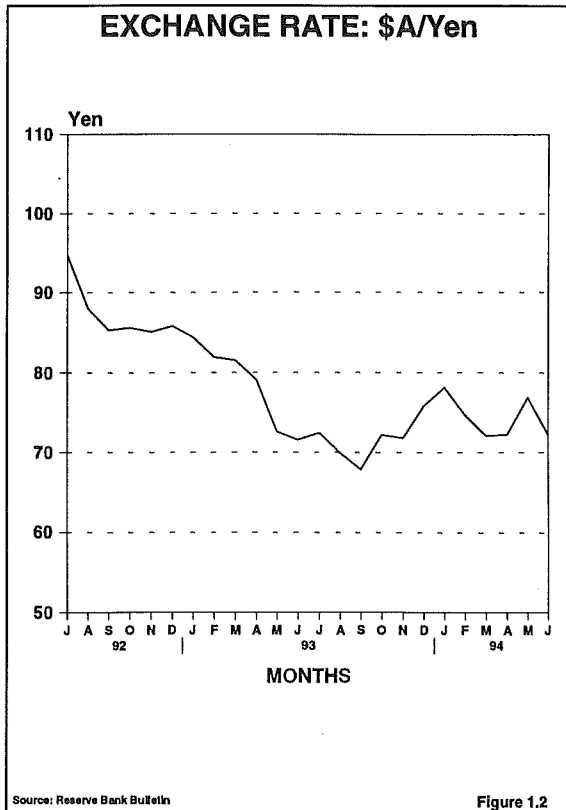
Another aspect of growth in the US economy to consider is that the average duration of post-war US expansion has been about 43 months. As the current period of growth began in April 1991, commentators have expressed pessimism about growth continuing beyond 1995.

In November 1993 the US Congress passed the North American Free Trade Agreement (NAFTA). This regional trade alliance eliminates most barriers to trade and investment between the US, Canada and Mexico over the next 15 years. The Association will help sustain US economic growth and give a boost to the lethargic Canadian economy which has been in recession over the last couple of years. It will also help facilitate and encourage the burgeoning trade between US and Mexico.

Despite the significant increases in government expenditures over the past two years, the Japanese economy grew only marginally in 1993-94. It appears that Japan's economic activity may have reached its nadir in the December quarter of 1993-94 when growth was -0.7%. However, although growth in the March quarter recovered to 1.0%, in the June quarter it slipped again to -0.4%. Japan's poor performance was reflected in industrial production being down 3% in 1993-94. The Japanese labour market suffered accordingly, with unemployment in 1993-94 averaging a rate of 2.7%. Whilst this may be the envy of Western policy makers, in Japan, this represents the highest unemployment rate since 1988.

Weakness in the Japanese economy has been blamed on the relatively poor performance of the export sector. This has been caused by the sharp strengthening of the Yen which significantly reduced export profitability, competitiveness and production in Japan's export and import competing industries. The situation has been compounded with the economy being shackled by the high cost

structure in many sectors of its industry, products and services. Unless the Yen is to decrease significantly in value, it is envisaged that regulatory changes and opening of markets will be required to stimulate demand and make way new for industries.



Some tentative signs of economic improvement emerged from Japanese domestic indicators such as retail sales which increased in June 1994. However, this may simply have resulted from the distribution of tax rebates, as Government programs have also been important in stimulating housing investment, which rose strongly in the final quarter of 1993-94. It was therefore apparent that despite general reports of a Japanese economic recovery towards the end of the financial year, there were in fact very few concrete signs of a recovery gaining momentum.

The short term outlook for Japan remains uncertain and will continue to be influenced by movements in the Yen, especially against the \$US. A weaker Japanese currency would support exports and boost growth.

Growth remained strong in most other Asian countries and continued to fuel concerns about inflation. China is a case in hand, where in 1993-94 GDP growth was in the vicinity of 10%. However, this was accompanied by double digit inflation, fuelled by increasing urban income. The Chinese Government's response to escalating prices and runaway investment has been to tighten credit, place price controls on some basic commodities and restrict 'speculative' financial trading.

Despite these measures, China's industrial output has remained strong and it therefore appears that efforts to reign in inflation have been slow to take effect. This has been the result of having to compromise monetary policy in an effort to keep heavily indebted State enterprises afloat. China has around 11,000 large and medium state firms and at least half are unprofitable. Characteristic of the difficulty in transforming an unwieldy centrally planned economy to a market orientated system, the authorities cannot afford to allow thousands of these businesses to close. To do so, carries the risk of social unrest involving unemployed workers.

Nevertheless, tighter credit and monetary policies have met with some success, by effectively containing and redirecting domestic capital flows away from the real estate industry in favour of state infrastructure. At the same time, new private infrastructure investment is also being encouraged as well as foreign direct investment in infrastructure and manufacturing. These policies are encouraging for China's long term growth prospects.

Singapore's 1993-94 growth rate of over 9% was second only to China. Strong growth reflected an overwhelming strength in exports, with the manufacturing, chemical industry, business and financial sectors of the economy performing strongly. Although Singapore's economy is growing faster than what the authorities would like to see, despite increasing labour market constraints the inflation rate in

1993-94 remained relatively stable at around 4%.

Malaysia also continued to be one of the strongest economies in Asia with an annual GDP growth rate above 8% during 1993-94. Business and consumer confidence is continuing to grow, as did sales and production levels. Domestic investment in Malaysia has also been growing, compensating for the slack in foreign investment. However a threat to the buoyant economy is higher inflation, increasing wages and a widening current account deficit.

Strong growth in exports and investment pushed South Korea's growth rate to well over 6% over 1993-94. This followed a period in which growth slowed in response to tighter policies. Korean economic growth has been underpinned by the robust appreciation of the Japanese Yen. This has increased the competitiveness of the Korean export industry. Prospects are continuing to increase for future growth but a drawback in the Korean economy is its heavy reliance on imports for investment and consumption.

Outputs in both Hong Kong and Taiwan also grew strongly, at annual rates of over 5%. These countries' economic performance is being assisted by their close links with the Chinese economy.

Economic growth in Western Europe strengthened with a lift in industrial production over the latter part of 1993-94. Recovery appeared to be firmly established in Europe with Germany, France and the United Kingdom all recording increases of 1% in real GDP in the June quarter of 1993-94. Western European growth reflected in particular the stronger export performance in Germany where west German new manufacturing orders and industrial production increased, helped by expanding foreign demand. Additionally, German unemployment appeared to have stabilised and eastern Germany also continued to improve. German economic recovery

appears to be export driven as private consumption, for example, remains sluggish. Higher growth in domestic demand however, has figured prominently in the economic recovery of France and the United Kingdom.

Measures announced by several European governments to reign in their fiscal deficits is expected to constrain growth in Western Europe in the short term. In Germany for example, a proposed new package of tax increases is likely to cut in early next year as the economic recovery gains momentum. This will help wind back Germany's growing public sector deficit. This deficit has arisen partly due to expenditures required to sweep away 40 years of Stalinism in the east.

Despite these fiscal measures, continued gradual recovery in Western Europe is expected. However, considerable spare capacity is likely to remain in the short term, which will limit investment.

Inflationary pressures in western Europe also remained subdued. Inflation in western Germany was under 3% over 1993-94. Modest wage increases negotiated in the middle of 1993-94, stable producer prices and a steady currency point to the likelihood of further improvements in that country's inflation performance. These factors have allowed the Bundesbank to ease key interest rates over the last quarter of 1993-94, notwithstanding the rapid growth in monetary aggregates. Most other European countries also reduced their official interest rates.

The outlook for the largest economies in Eastern Europe, such as Poland, the Czech Republic and Hungary, has improved in recent months with increased private sector activity. Significantly reduced inflation rates and continued industrial and market reforms are increasingly positioning these economies to reap the rewards of European growth. However, output in the former Soviet Union is assumed to fall further as political and

economic restructuring continues.

1.2 Review of the Australian Economy

Australian national economic growth strengthened over 1993-94, with real GDP growing by a strong 4.3%. However, Western Australia easily outperformed national GDP growth with real GSP increasing by 6.3% in 1993-94. This was the highest growth rate of all States and Territories.

Inflation in 1993-94 remained subdued with the National CPI growing by 1.8%. The beginning of the period saw the final slackening of monetary policy with a cut in the official cash interest rate (which serves as the base for other market determined interest rates). Monetary policy remained unchanged over the balance of 1993-94.

Interest rates were low during 1993-94, particularly in the first half of the period. However, the second half of the financial year saw a greater rise in Australian bond yields and commensurate long term interest rates than in most other countries. This reflected market doubts as to Australia's ability to manage its strong growth without an unacceptable increase in inflation.

Pressure on interest rates was exacerbated by the sell off in the US bond market in response to a perceived overheating in that economy (and the RBA's reluctance to follow the US Reserve with an immediate tightening of monetary policy). Other factors causing the drop in bond prices were the fuelling of inflationary expectations through commodity price increases, a global capital shortage and the miscalculation of hedge funds, where low short term interest rates induced speculative investors to borrow short term funds and buy long term bonds. This strategy was based on the expectation that long term interest rates were to drop. Instead, long term bond rates rose and the misjudgment aggravated the sell off.

The weakness in the bond market spilled over into the equity market where market prices fell sharply over the last quarter. The Australian dollar was to a limited extent also affected by this turbulence.



In conjunction with a relatively loose monetary policy, the Government maintained an expansionary fiscal policy with a substantial budget deficit during 1993-94 of \$13.7 billion compared to \$14.6 billion in 1992-93. A lower deficit of \$11.7 billion is forecast for 1994-95.

The \$A lost ground against other major currencies in the first half of 1993-94, reflecting the maintenance of low domestic interest rates and depressed commodity prices. However, the sharp rise in the domestic long term bond yields and rebounding commodity prices in the second half of 1993-94 reversed the trend. Significantly, the \$A consistently traded above US70 cents over the second half of 1993-94. The \$A finished the financial year higher in Trade Weighted Index (TWI) terms and against the \$US at US 73 cents after having traded on average at US 69 cents over 1993-94. Against the Yen, the \$A traded on average at 73 Yen

over the financial year and closed at that rate - little changed from the level at which it opened at the beginning of 1993-94.

In 1993-94 employment in Australia increased by 1.9%. Western Australia's employment growth by comparison was much stronger, increasing by 4.2% in 1993-94. On an annual basis, Australia's unemployment rate decreased marginally by half a percentage point to 10.5% in 1993-94. Western Australia's unemployment rate was 8.9% - the lowest of all States. A difficulty in reducing the unemployment rate has been the continued increase in labour force participation.

In an effort to reduce unemployment, the Commonwealth Government released the White Paper - "Working Nation" in May 1994. The document contained \$6.5 billion worth of medium term market, industry and regional development policies. The initiatives are aimed at increasing the skills and employment opportunities of the unemployed.

Investment spending remained subdued over most of the year until capital expenditure began to finally increase in the final quarter of 1993-94. Nationally, private business investment was up 2.7% in real terms for 1993-94. Western Australia recorded a much greater equivalent increase of 5.7%. A large component of the increase was accounted for by the mining industry.

The investment rebound added a steady flow of capital goods to the import side of the current account ledger which had a deficit of \$16.4 billion in 1993-94. This was up over 7% on the previous year. The current account deficit expressed as a proportion of GDP increased marginally from 3.8% in 1992-93 to 3.9% in 1993-94. However, due to exchange and interest rate movements, net foreign debt was slightly down at the end of 1993-94 at \$162 billion. The persistence of a large deficit and foreign debt, both of which are forecast to increase further in 1994-95, underline the

important role the minerals and energy sector has in lifting export income.

The consensus among those who try to forecast the Australian economy is that strong annual GDP growth is likely to continue until at least late 1995. The drought in the eastern States, may however, have some minor impact on economic activity and income. Survey results both nationally and for Western Australia also indicate that business conditions and the outlook for investment remain favourable. There is concern is however, regarding the mounting pressure for wage rises and the flow through this will have for inflation. Compounded with strong economic growth, this will require a tightening of monetary and/or fiscal policy.

1.3 Economic Factors Affecting the Mineral Industry

Recession in most world economies in the early 1990s culminated in a bottoming of commodity markets in September 1993. Since then, market focus and the highlight of the year has been the dramatic revival in commodity prices in the second half of 1993-94. While this has been described as a boom, it was essentially a partial recovery of ground lost in recent years.

As many export contracts are written in \$US, the exchange rate between the \$A and \$US is one of the single most significant economic determinants affecting the Australian mineral industry. An ironic twist therefore, to the strong commodity prices in the second half of 1993-94 was that the initially weak \$A began to steadily rise since September 1993. This was to be expected as the international investment community considers the Australian dollar to be a surrogate commodity basket. This is because around three quarters of Australia's exports consist of wool, meat, wheat, iron ore, coal, gold, bauxite/alumina and other base metals. Commodity producing companies also account for approximately one third of

Australia's stock market capitalisation.

Australian mineral producers therefore faced the benefit of increasing prices for mineral commodities being to some extent offset by an appreciating local currency. For example, a 1% appreciation in the value of the \$A against the \$US equates to a decrease in sales value of about \$35 million a year for gold miners and \$29 million a year for the iron ore industry and \$26 million a year for the petroleum sector.

Gains from commodity price rises were also moderated to some extent by forward sale contracts. Gold, iron ore, petroleum products, alumina and mineral sands in particular, are subject to forward sales with set price clauses. It should also be noted that many rallies in mineral prices were not backed up by the fundamentals of the market - i.e. world supply, demand and stock levels. However, further draw downs in inventory levels resulting from global economic recovery are likely to substantiate the positive commodity price outlook.

Differential performance in the world's economies meant that Western Australian mineral and petroleum producers, reliant on exports for most production, faced quite different market conditions. Some sectors such as gold surged forward while those relying on the poorly performing economies of Western Europe and Japan faced depressed markets. Despite production cutbacks, world metal stocks remained high and prices in the first half of 1993-94 low. The problem was compounded with the collapse of the Russian economy releasing substantial quantities of metals and gold on the world markets.

Asia (excluding Japan), with its rapidly growing economies, remained the fastest growing region in the world. With an increasing proportion of Western Australian exports selling into this region, this greatly helped the State's producers. Western Australian mineral and petroleum producers have a competitive

advantage in the region and were thus particularly helped by the strong growth in China and the tiger nations.

For Australian producers adverse conditions in some traditional markets were also offset to some extent by the weaker \$A in the first half of 1993-94, increased production, cost containment at the operational level and the revival in commodity prices in the second half of 1993-94.

Of particular value to export industries such as mining was continued low inflation, subdued growth in average earnings and low interest rates. This assisted in Australia's international competitiveness and helped exporters in Western Australia remain competitive in world markets.

Restrained nominal wage increases reflected the absence of generalised wage increments between April 1991 and December 1993 and the slow spread of enterprise agreements. An important development in this area was the activation of the Federal Industrial Relations Reform Act in March 1994. This established a more effective framework for enterprise bargaining, including easing access to the scheme by making provisions for enterprise flexibility agreements.

A further development has been the negotiation of agreements between several major mining companies and their employees regarding multi-skilling, extension of work shifts associated with fewer working days, simplification of rosters, abandonment of some penalty rates and increased use of contract staff. These reforms are significant in the context of micro economic reform to maintain competitive prices.

An important development was the Government's moves to reform the energy market and an announcement of a proposal by the Goldfields Gas Transmission Joint Venture to construct and operate a pipeline to transport

natural gas from the northwest of the State to the Eastern Pilbara, Northeastern Goldfields and Eastern Goldfields. These developments have the potential to not only increase the profitability of existing mining operations, but also increase the viability of projects currently considered sub-economic.

1.4 Social and Political Factors Affecting the Mineral Industry

An important development in international trade took place with the conclusion of the Uruguay round of GATT negotiations in December 1993. The Agreement will see lower tariffs on manufactured goods and increased openness of major markets. Mineral exporting nations such as Australia are likely to benefit substantially from the GATT arrangements as Asian economies will require additional raw material inputs necessary to expand into newly opened international markets.

However, there is international concern that the US Congress may fail to ratify the Uruguay round of GATT. Even if ratified, the President (who is under considerable pressure from vested interest groups to block free trade moves) can use the considerable loopholes in the Agreement to protect US interests.

The US also continues to run a trade deficit. Frustration with the persistent size of the trade deficit with Japan has spilled over into overt unilateral actions by the US to pry open the Japanese market. Given Australia's trading involvement with both of these major economies, any trade war between them will adversely affect the domestic economy.

The effect of NAFTA on countries outside the Agreement is uncertain. It may become increasingly difficult for Asia to export goods to NAFTA member countries. If so, this will effect Australia insofar many Asian products contain Australian mineral and energy inputs.

Given that Asia's share of world income over the next 30 years is expected to increase significantly, the Asia Pacific Economic Cooperation forum (APEC) is of greater significance to Australia than GATT. Capturing market share in this region is important in sustaining Australian economic growth and the Federal Government, through APEC, is working towards a mutual commitment to an open and liberal trading system for the region. Australia is developing closer relationships with many member countries and should agreement on trade issues be resolved, Western Australia will be poised to further develop commercial opportunities in the region.

The economic and political reforms in the former USSR have been characterised by social and economic disruption and destabilisation as the region attempts to move to a market based system. It is estimated that output from the CIS fell by 20% in 1992 and decreased further in 1993. With the CIS economies generating only weak internal demand, CIS producers have increasingly resorted to selling their output internationally.

Sales from the CIS have resulted in low prices for several commodities with adverse impacts on the Western Australian resource sector. Aluminium prices for example, have suffered dramatically from CIS' dumping policy. However, the memorandum of understanding between major producer countries in January 1994 seems to have been effective in increasing world aluminium prices and stabilising aluminium production. Of more certain benefit though, for local producers of several vulnerable commodities, would be a speedy resolution to political fragmentation and return to economic stability in the CIS.

Various European Community (EC) countries in 1993/94 ratified the European Energy Charter. The Charter is the main mechanism by which a carbon tax (promoting renewable energy and increased energy efficiency) is to

be introduced for industries in EC countries. This may require countries exporting into the EC to have similar reforms or else incur higher tariffs.

A potentially important political event was the South African elections held in April 1994. South Africa is the predominant world supplier of gold, diamonds and platinum group metals but despite early concerns, the election and outcome had little bearing on the price of these commodities.

On the domestic front, increased concerns were raised by the Australian mining industry that the Federal Government is signing international conventions without sufficient consultation with the States, the business community or the mining industry.

These agreements and the national strategies that go with them, may have ramifications for the viability and international competitiveness of local industry. International and national policies regarding ecologically sustainable development, biological diversity and endangered species have tended to restrict or at least delay access to land for exploration.

The Commonwealth Environmental Protection Agency (CEPA) is likely to broaden the Commonwealth's ability to examine environmental issues. An expanded brief will probably allow CEPA to examine development projects on State lands where they are considered to be inconsistent with Australia's international obligations. The Commonwealth is also moving to allow CEPA to examine any project of National interest.

The Commonwealth also established a National Environment Protection Council with representatives from all States and Territories. The Council is to commence operation in early 1995 with a goal to set nationally uniform standards for the environment. The Western Australian Government has indicated it will not support this initiative. It is argued that the

setting of environmental standards is the sole responsibility of the State and the adoption of inappropriate national standards could be detrimental to Western Australian industry in general.

Both the Commonwealth and the State Government have responded to the High Court decision in the Mabo case (June 1992). In early December 1993 the State Government enacted the Lands (Titles and Traditional Usage) Act 1993. Later that month the Commonwealth passed the Native Title Act 1993. Western Australia has challenged the Commonwealth legislation in the High Court. A High Court decision on the challenge is expected in late 1994 or early 1995.

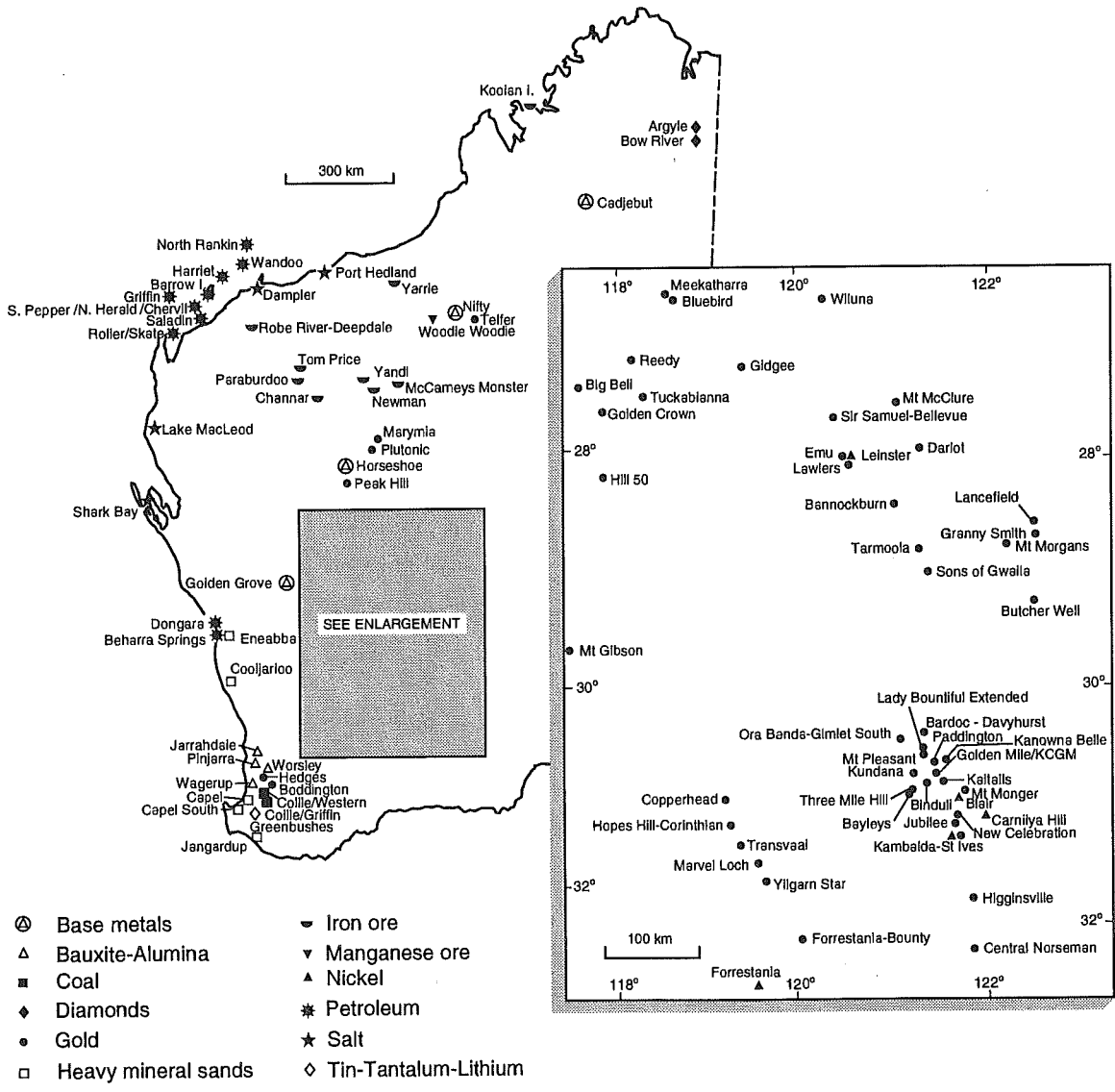
The State continued in 1993-94 to issue land titles valid under State law. Appropriate mechanisms are in place to address native title and other aboriginal issues that may arise in the State's land tenure system.

Recognising the importance of the above issues, the mining industry through its representative bodies, has constructively participated in debating these issues. As a result, community awareness of the importance of the mining industry to Australia's growth and its recent environmental track record has increased.

At the local level, the State Government has catalysed a reappraisal of community attitudes towards a balance between conservation and development. While providing for proper environmental safeguards, significant areas of the State have been made available for mineral and petroleum exploration. A policy for the management of marine reserves, including petroleum developments is being prepared by the Government with its release expected in late 1994. The Government has also restructured the Environmental Protection Authority (EPA) into a Department for Environmental Protection and a 5 member EPA Board.

MAJOR MINERAL AND PETROLEUM PROJECTS IN WESTERN AUSTRALIA

WITH AN ANNUAL VALUE OF PRODUCTION IN EXCESS OF \$10 MILLION



ERS1

Figure 1.3

2. REVIEW OF MAJOR MINERALS AND PETROLEUM

2.1 Overview and Outlook

The value of mining and petroleum production increased by 2.3% in 1993-94 to reach \$12.6 billion. The rise was mainly due to higher volumes of production, as prices for most commodities remained at historically low levels despite the strong rally in world commodity prices in the latter half of the year.

Both iron ore and oil prices fell, with oil reaching a five year low of around \$US15 per barrel in December 1993. Oil prices subsequently recovered slightly over the following months. By contrast, the gold price remained relatively high, after a dramatic rise in the first half of 1993 in response to strong world demand. Alumina prices recovered slightly, albeit from a very low base. Prices also rose for mineral sands in 1993-94. Again, however, the increase followed substantial declines in previous years.

Strong production increases occurred in the State for most mineral and petroleum commodities. This improvement partially reflected Western Australia's successful development of new trading links with Asia and the mining sector's competitiveness on world markets particularly through output increases, to achieve economies of scale. Increases in production levels were recorded for gold, iron ore, alumina, petroleum and nickel. Diamond sales also increased. There were, however, falls in the production of salt and certain mineral sands.

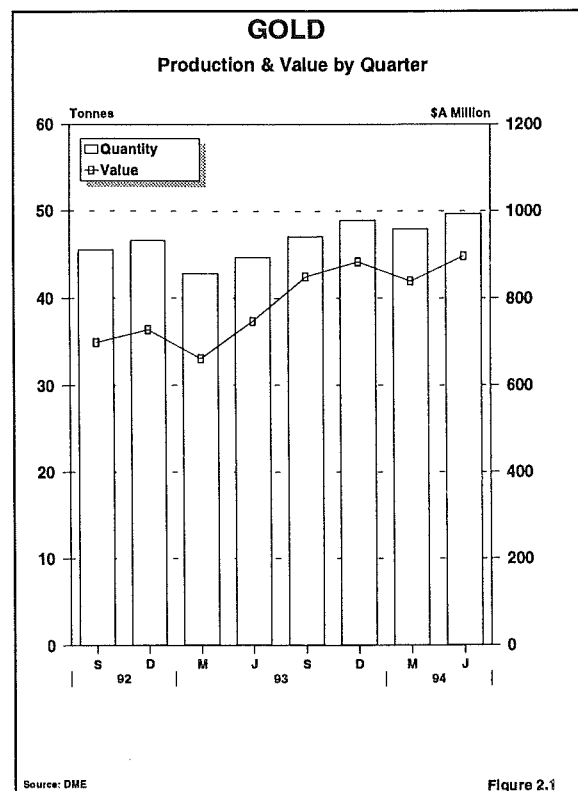
In 1994-95 the United States economy is expected to remain buoyant but only modest growth is expected in the Japanese and European economies. Japan aside, prospects for the Asian economies are very good. Economic growth is expected to strengthen in South Korea, Hong Kong and Taiwan and

remain high in Singapore, Indonesia and Malaysia. These continued improvement in world economic conditions are expected to lead to increased demand for most of Western Australia's major resources. This will sustain, if not improve, the higher prices for a number of mineral and energy commodities experienced in the latter half of 1993-94.

Although higher prices will be counteracted to some degree by an expected firm exchange rate, the outlook for Western Australia's resources industry in 1994-95 is favourable, with a further rise forecast in the value of Western Australia's mineral and energy production.

2.2 Gold

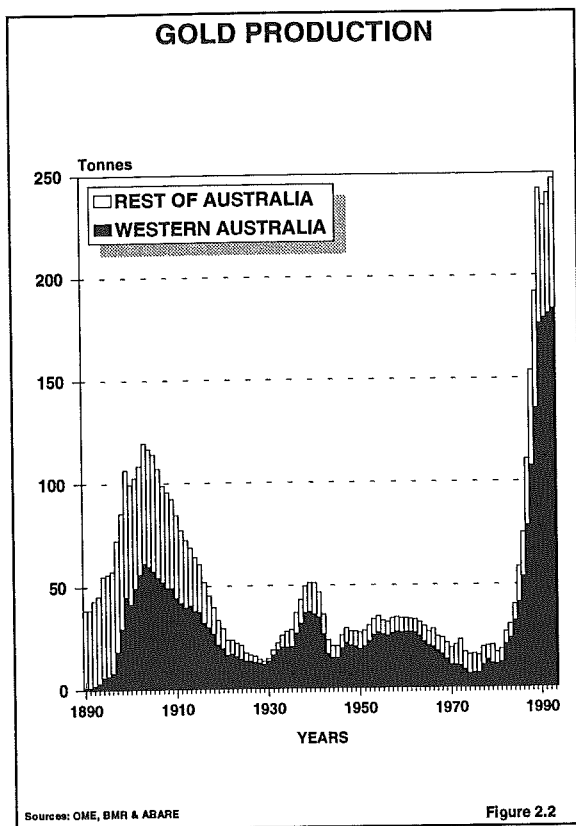
For only the second time in the last 20 years gold surpassed iron ore as the State's most valuable mineral commodity with the value of output in 1993-94 increasing by over 21% to \$3,415 million (Figure 2.1).



At around 194 tonnes of fine gold this represented 76% of Australia's total gold

output (Figure 2.2). Western Australia also now accounts for approximately 8% of the world's gold production.

The 12 biggest producing projects accounted for half of the State's gold production in 1993-94. Of these, the largest projects with gold production worth over \$100 million in 1993-94 were the Golden Mile - Kalgoorlie (22.2 tonnes), Boddington (12.4 tonnes), Telfer (12.2 tonnes), Kambalda-St Ives (9.9 tonnes), Hill 50-Mt Magnet (6.6 tonnes) and Granny Smith (5.9 tonnes).

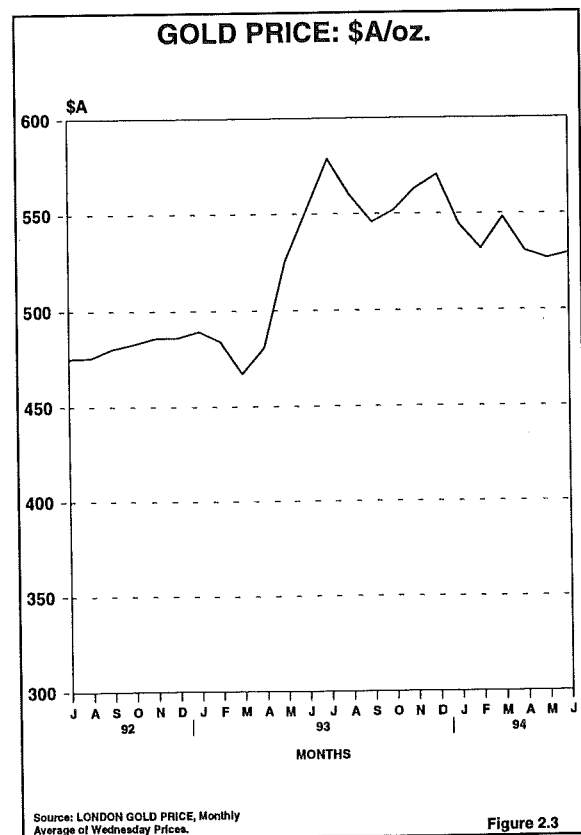


1993-94 saw production commence from the new Kanowna Belle mine in the first half of the year and the commencement of operations at Salmon and Keringal to supplement main pit production at the Plutonic and Granny Smith projects respectively. Smaller developments commencing production during 1993-94 were at Binduli, Theil Well, Sandstone, Mt Dimer and Xanadu. Production also commenced from Perilya's Fortnum mine which was redeveloped after a change in ownership. However, Aurora Gold's Laverton operation was shut

down.

The trend continued for the progressive increase in underground development and expansion by a number of operations such as the Bounty mine. Improvements in techniques to find and exploit deposits below salt lakes and old shallow open pit mines also continued. This is leading to the development of significant new operations such as St Ives' Revenge orebody under Lake Lefroy and Norseman's Harlequin deposit under lake Cowan.

In regards to the gold market, the year saw investors and speculators in Europe and North America push the price of gold up to a peak of \$US406.70/oz in August 1993, the highest since 1990. At that price the market was perceived to have overheated and the price quickly dropped to a low of \$US342.05/oz in September. Gold prices subsequently recovered to trade in the narrow \$US370 to \$US395/oz range (figure 2.3).



The combination of a higher price and the

economic weakness in Europe and Japan caused the first fall in gold fabrication since 1987. Only the United States recorded a growth in jewellery consumption and fabrication. In addition the Chinese austerity program in the first half of 1993-94 caused the Chinese gold rush to slow down.

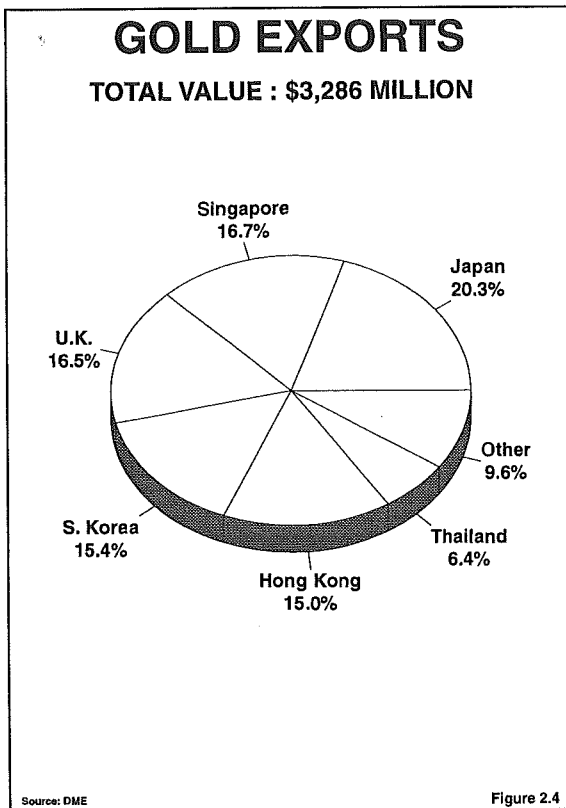
The outlook for gold prices is uncertain. The fundamentals point to gold prices being firm at least over 1994-95 as demand, including that for jewellery fabrication in Asia, appeared to recover in early 1994 and is expected to strengthen further. A popular theory amongst those who attempt to forecast gold price movements is that the potential for the price to break through the \$US400/oz barrier depends on the extent to which world inflation rates pick up.

each of which imported between 15% and 17% of the States' gold production (Figure 2.4).

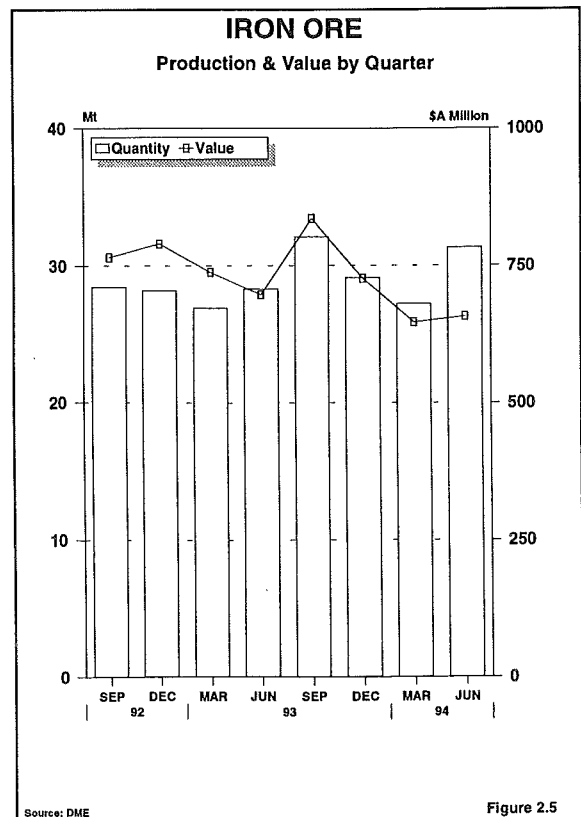
Gold output in Western Australia is likely to continue its rise to unprecedented levels in 1994-95. Current production will be assisted by new mines coming into operation such as Bronzewing, Orient Well, Gullewa, Kathleen Valley, Palm Springs and Lynas Find and new underground extensions at projects such as Big Bell and Youanmi. Kanowna Belle will also see the first full year of production. In addition, many of the State's existing producers, such as Paddington are undertaking significant expansions.

2.3 Iron ore

The value of Western Australia's iron ore production fell by over 4% to \$2,865 million (Figure 2.5). This fall was due entirely to lower prices which fell in terms of the benchmark standard to Japan by an average 10% in US\$ terms (Figure 2.6).



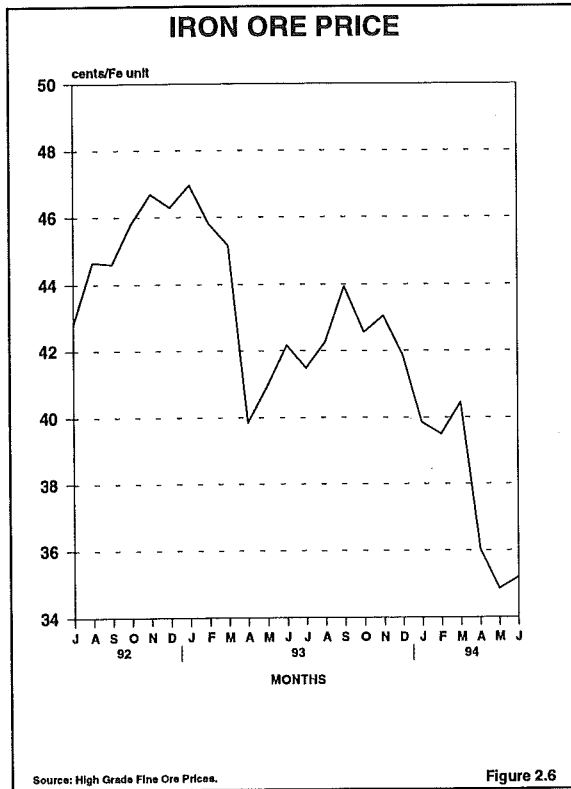
The main overseas buyer of Western Australian gold in 1993-94 was Japan, which accounted for over 20% of overseas exports. Other significant overseas export destinations were Singapore, United Kingdom, South Korea and Hong Kong,



These falls were partially offset by a 7%

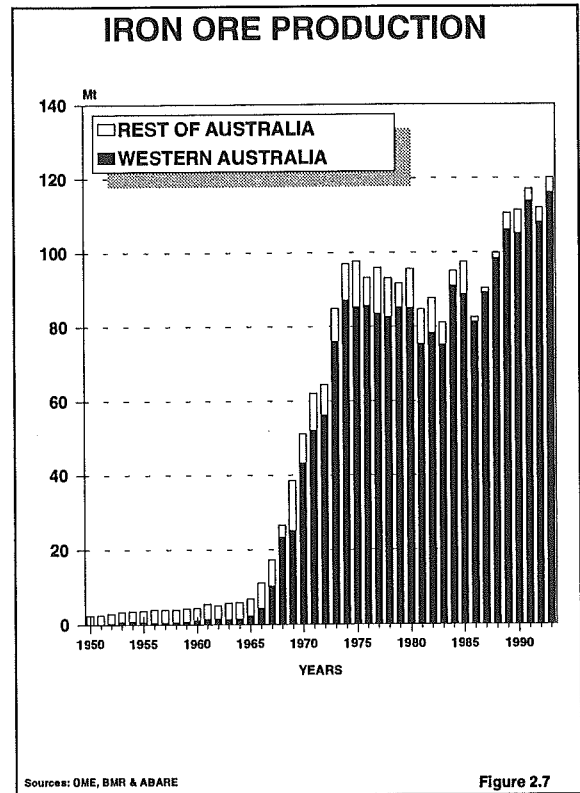
increase in production which reached a record 120 million tonnes, accounting for almost all of Australia's iron ore output (Figure 2.7).

Lower iron ore prices resulted from weak demand in the Japanese steel industry which accounted for 47% of Western Australia's overseas iron ore exports in 1993-94 (Figure 2.8). However, the overall effect of this on producers was offset to some degree by increased demand from steel producers in China, Korea and Taiwan. Iron ore exports to China increased during the year to account for 16% of the State's overseas sales. Western Australia currently supplies around 50% of China's iron ore imports.



Europe accounted for 14% of Western Australia's overseas iron ore exports (Figure 2.8). The degree to which this share can increase remains doubtful as weakness and rationalisation in the Western European steel industry is expected to continue. However, major changes in steel production affecting demand for iron ore from Western Australia will occur in Asia. Japanese imports of iron ore are expected to remain

subdued but this will be offset by growing demand from China, Korea and Taiwan where steel production is forecast to rise. Korea and Taiwan accounted for 16% and 6% respectively of Western Australia's sales (Figure 2.8). This is an increasingly significant market for the State's iron ore.

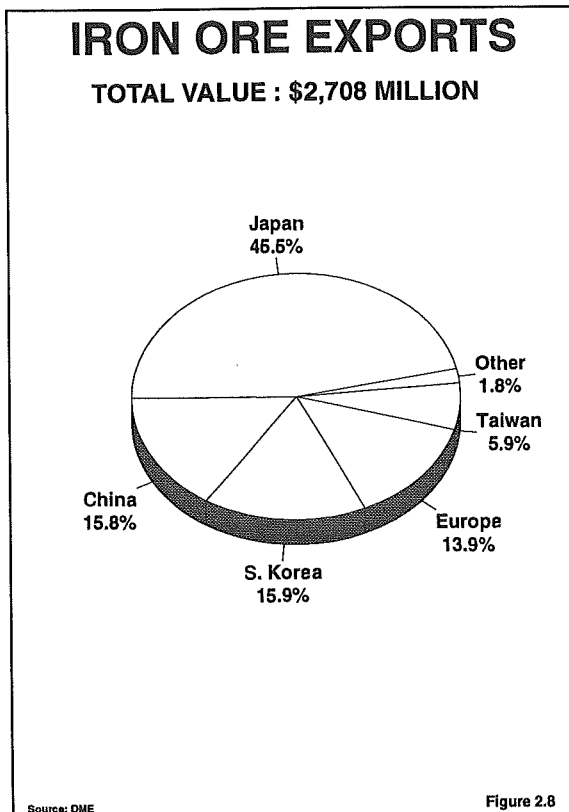


Despite a further average price reduction of 7% accepted by producers in early 1994, the value of iron ore production could rise slightly in 1994-95. This forecast is critically dependent on movements in the exchange rate. Nevertheless, Western Australian producers are expected to raise production to record levels with the expansion of a number of existing mines and the commencement of new projects late in 1994.

After 25 years of Western Australia exporting iron ore in its primary form, 1993-94 was significant in the proliferation of studies of downstream processing of the State's resources. Options under evaluation ranged from pelletising plants and direct reduced iron (DRI) production, through to steel manufacturing. This included the

commissioning in late 1993 of the pilot \$200 million alternative iron production plant - Hismelt. Hismelt is one of a number of processes designed to produce iron directly from ore in moderately sized, modular economic units with advantages over the large scale blast furnace process.

BHP has also announced that it should begin construction by the middle of 1995 of a DRI plant producing hot briquetted iron (HBI). The plan is to produce 2 million tonnes of HBI per annum using concentrated fine ore from BHP's existing operations.



HBI is an alternative feedstock for electric arc furnaces (or mini mills) which have depended largely on scrap metal. However, the rising price of scrap metal and its deteriorating quality has made HBI an attractive alternative. It has been forecast that electric arc furnace output is to grow from 30% of world steel production in 1994 to 35% by the year 2000.

A number of other downstream processing projects are being evaluated in the Pilbara,

Mid-West and South-West regions. These are largely based on new sources of iron ore supply.

In the immediate future, Western Australian iron ore production will be enhanced with output from Hamersley Iron's new Marandoo mine, although the development is to a large degree designed to offset a reduction in output from Tom Price. Marandoo is part of the second stage of the Pilbara iron ore industry's history, as the point is now being reached where some of the mines developed in the 1960s are either close to exhaustion or require augmenting. Marandoo is also the first major development of the Marra Mamba ore type, although BHP has been supplementing Newman output for many years with this type of ore from Orebody 29 near Mt Whaleback.

It is expected that construction should be complete by the end of 1994-95 of Hamersley Iron's Paraburdoo iron ore fines treatment plant. By removing the ultra fines portion, this facility is intended to improve the quality of iron ore fines produced at the Paraburdoo and Channar mines. Evaluation is also ongoing into the possible development of the company's large Yandicoogina Pisolitic ore deposit.

Since development of its Marillana Creek (Yandi) project in 1992, BHP has been successful in marketing its Robe-type Pisolitic fines product and consequently embarked on a series of expansions of the mine.

1994-95 will also see full year's production from BHP's new Yarrie mine which will replace the exhausted deposits of Nimingarra and Shay Gap in the North Pilbara. In addition, production increases will be facilitated with the recent completion of the upgrade of Port Hedland's Nelson Point processing and shipping complex. Production improvements are also expected from the planned linking of Nelson Point with the Finucane Island facility.

The Robe River Joint Venture is also studying plans to diversify its range of products by possibly redeveloping its pelletising facility at Cape Lambert.

On a smaller scale, production will commence in 1994-95 at Koolyanobbing and Cockatoo Island in Yampi Sound where dumps are to be treated.

2.4 Petroleum

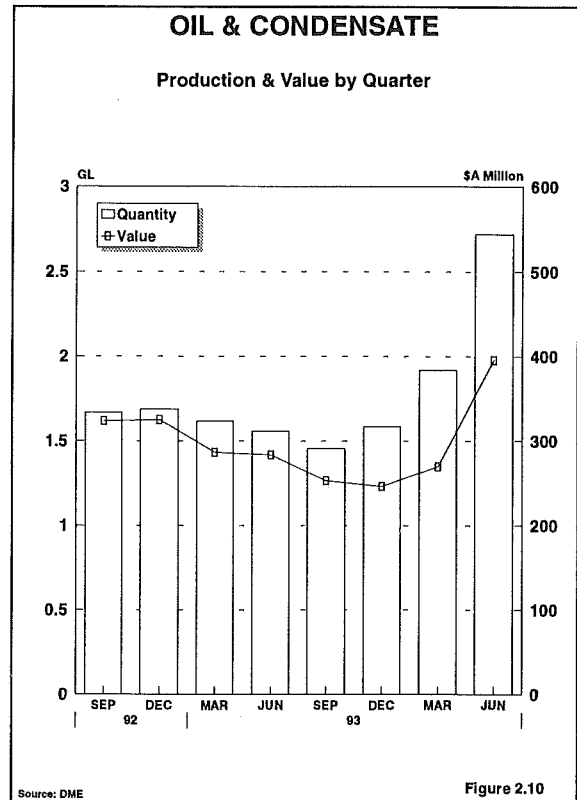
The overall value of petroleum production in 1993-94 was \$2,593 million. This was down by over 2% on the previous financial year. The decrease in sales value took place despite output increases in all petroleum products.

Production values were down due to very low world oil prices in the second quarter. Prices remained depressed in the third quarter in a weak and oversupplied market (Figure 2.9). The situation was aggravated by unauthorised increases from some OPEC producers.



Western Australia is the only State producing LNG, with its output representing 8% of the world's production. Although the bulk of LNG in 1993-94 continued to be exported to Japan (over 97%), there were minor sales to Spain during the year. Entry into other markets is limited by shipping constraints.

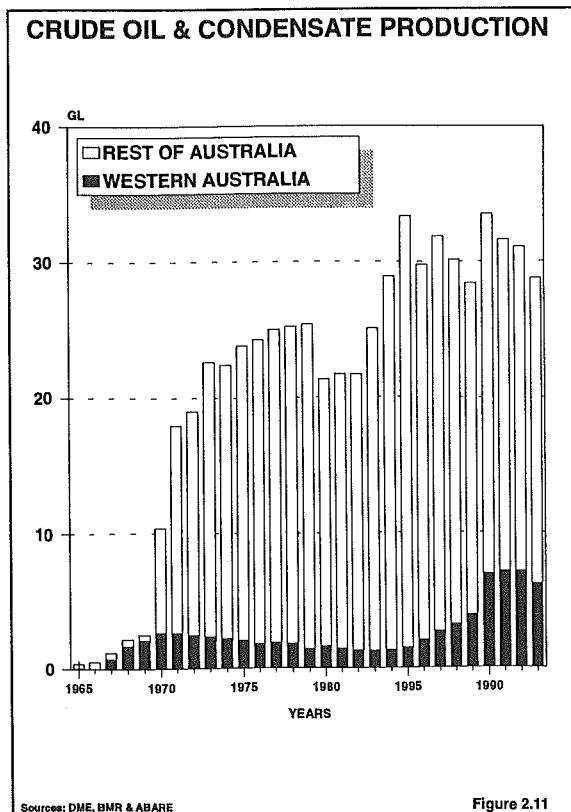
The volume of LNG production continued to rise during the year. However, the value of sales, at \$1,016 million, was down on last year's record. This was due to low oil prices, which are a major factor in the LNG price formula. Nevertheless, LNG production and commensurate exports from the North West Shelf are expected to further increase in 1994-95. This is based on the utilisation of additional capacity that will be available with the start up of the Goodwyn A offshore production platform and facilities scheduled for February 1995, now that remedial work on the platform's piles has been successfully completed.



However, plans to build a third offshore gas production facility were cancelled by the joint

participants in the North West Shelf project. The original strategy called for the development of the Angel field to supplement gas flow from the North Rankin and Goodwyn fields towards the end of the 20-year LNG contract with Japan. Instead, output from existing facilities is to be maximised by increasing gas production from North Rankin and Goodwyn and funnelling in reserves from new satellite fields in the immediate area.

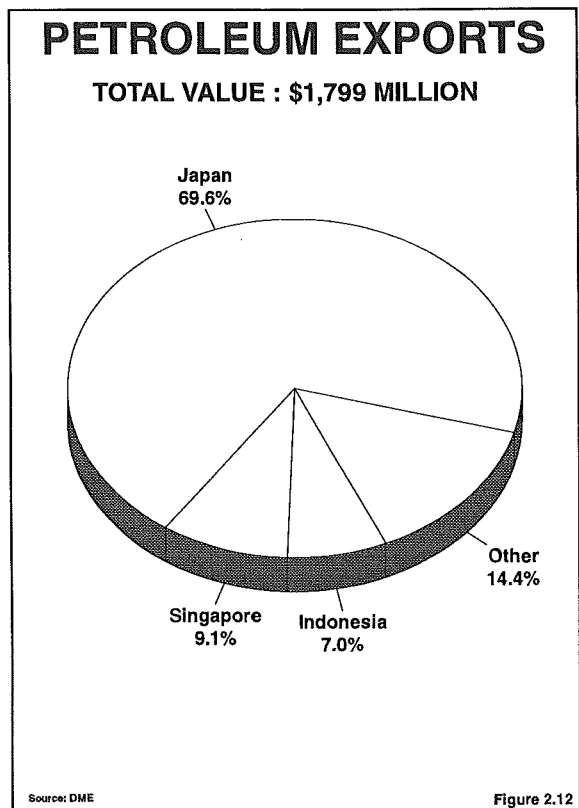
Despite closure of Talisman and decreased output from the Saladin and Harriet fields, the level of crude oil production in 1993-94 was up by over 17% on the previous financial year (Figure 2.10). This was due to the start of production from the Griffin-Chinook-Scindian fields in January 1994 and test production from Wandoo. After almost a year of extended production testing, Ampolex has announced a further \$480 million investment in the Wandoo oilfield from which full production is expected to start in 1997.



The production of condensate increased by almost 18% in 1993-94. Again however, the

value of production was down due to substantial falls in prices (Figure 2.10).

In the short term, with the Griffin field coming into full year's production, crude oil output should be up again in 1994-95. The Griffin-Chinook-Scindian fields have also overtaken Saladin as Western Australia's most important source of crude oil, producing 80,000 barrels a day.



The start of production from Woodside's Goodwyn and WAPET's Roller/Skate oil and associated gas fields is also expected to further boost output of liquid petroleum products and gas in 1994-95. Longer term future production prospects are likewise very positive. For example, \$750 million has been committed to the development of the Cossack and Wanaea oil and associated gas fields, with oil and liquefied petroleum gas production expected to commence late in 1995. These fields will share a floating production and storage facility to tap 7 subsea wells containing an estimated 283 million barrels of oil. Production should peak at 115,000 barrels a

day. Gas from Goodwyn, Cossack and Wanaea will be combined with gas from the existing North Rankin field to produce petroleum products which will include LPG.

Increase in gas consumption from the deregulation of the State gas market, construction of the gas pipeline to the Goldfields and BHP's iron ore processing plans also augur well for the States' petroleum industry.

The value of production in 1994-95 will be affected by oil price and exchange rate movements. Oil prices in turn will be dominated by countervailing factors including strengthening world energy demand being offset by rising North Sea and Latin American production, possible return of Iraqi oil production to the market and excess OPEC capacity. OPEC ministers have agreed however, to a maintain current production levels with an intention to review their decision should oil prices not improve.

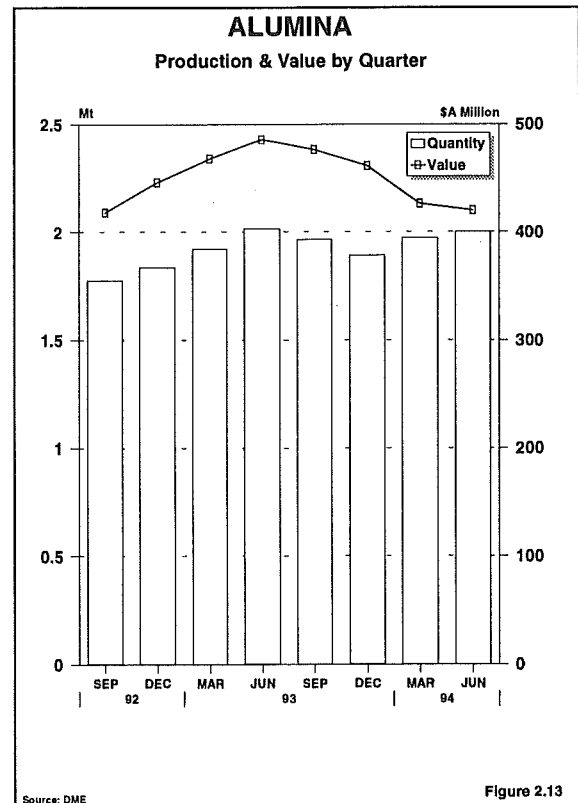
Western Australia currently contributes almost 30% of the nation's crude oil and condensate and based on the development of several new fields, is set to overtake Victoria as the premier oil producer by 1997 (Figure 2.11). In terms of sales by destination, aside from LNG, 28% of crude oil, 42% of condensate and all of Western Australia's natural gas production was sold domestically.

The main overseas market for crude oil was Singapore which accounted for 28% of overseas sales. Another 43% of crude oil sales was almost equally accounted for by Japan and Indonesia. Japan was also a significant customer for the State's condensate, with over 69% of sales going to that country.

In sum, in 1993-94, a total of \$1,799 million worth of Western Australian petroleum production was exported overseas. Figure 2.12 shows the export destinations.

2.5 Alumina

Western Australia produced 7.8 million tonnes of alumina in 1993-94. This was over 3% up on the previous financial year and represented 61% of national output (Figures 2.13 and 2.14). However, the value of that production was down slightly by 2%, reflecting poor world prices for aluminium metal (Figure 2.15).

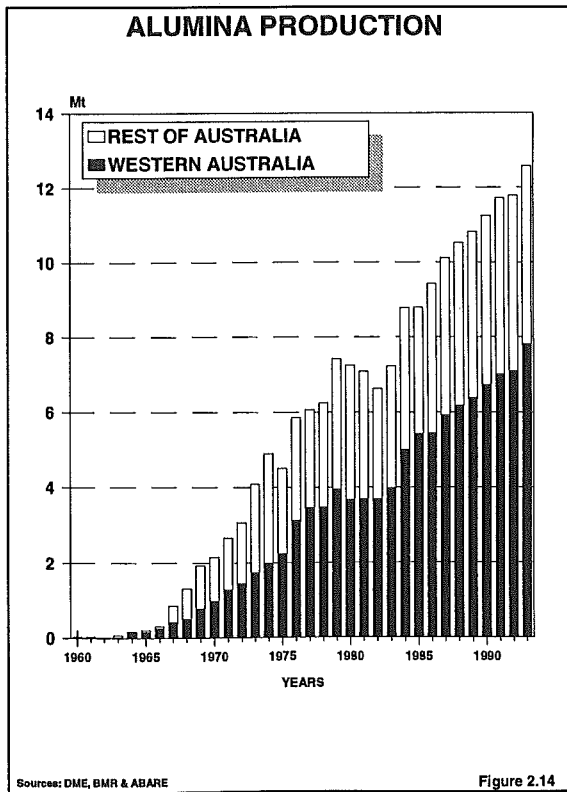


About 88% of the State's alumina production in 1993-94 was exported overseas, largely as smelter grade product (Figure 2.16). Of the portion exported overseas, the majority went to the US and China which accounted for 28% and 17% respectively. Other significant overseas consumers of the State's alumina output were Canada and Bahrain (13% each), United Arab Emirates (UAE) (7%), Indonesia (6%) and Egypt (5%).

In the first half of the financial year the ailing aluminium industry faced falling prices. Prices dropped to a historic low point in the last quarter of 1993. Factors responsible for this were recessions in key economies such as Japan and Germany and several years of

overproduction causing an excess of aluminium supply over demand. Problems were compounded with the dissolution of the former Soviet Union and collapse in its domestic aluminium demand. This forced an export surge from the CIS to coincide with an excessive build up in global inventory levels and it is apparent that until former Eastern Bloc consumption recovers, the world will have substantial excess aluminium stocks.

The bleak aluminium metal outlook at the start of 1994 prompted a memorandum of understanding between major producer countries to cut back aluminium production over the ensuing 18 month period by 1.5 million to 2 million tonnes. This was partially responsible for metal stocks stabilising in 1994. Stronger industrial activity signified by recovery in the US economy and signs of improvement in Europe also contributed to stabilising stocks.



The severity of the crisis afflicting the international aluminium industry materialised locally with Alcoa briefly cutting production from its three Western Australian alumina refineries in the final quarter of 1993. However, this was temporary and local production resumed full capacity in 1994. In summary, local producers were partially shielded from low aluminium prices through a combination of increased production, reduced raw material costs, higher productivity, a favourable exchange rate in the latter half of 1993 and the lag with which effects of price and quantity shifts in aluminium are transmitted to the alumina industry.

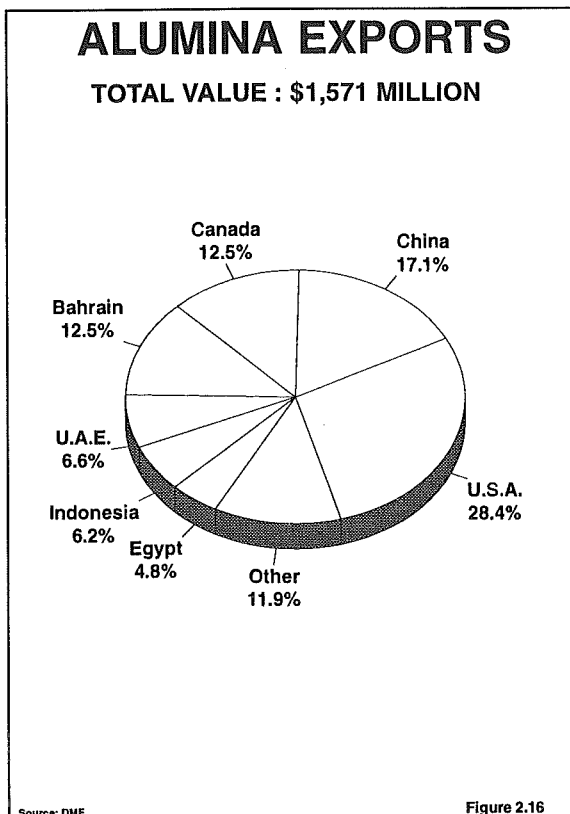
Aluminium prices recovered strongly over the second half of 1993-94. Although much of the increase was due to speculative activity based on the memorandum of understanding, it would appear to have been at least partially substantiated by the stabilising stock levels. Ironically, local alumina producers faced lower prices, partly due to a stronger Australian currency in the second half of 1993-94 and earlier lower aluminium prices finally filtering through to alumina.



Although cutbacks in aluminium production will depress world demand for alumina, this is not

expected to apply to low cost producers such as those in Australia. Production capacity in Western Australia is therefore expected to increase in 1994-95. This will be assisted in the short term by the incremental expansion of Alcoa's Wagerup refinery and increases in the market for hydrated alumina product.

The longer term potential for alumina production in the State has also been enhanced by Alcoa's announcement to study a doubling of annual capacity of the Wagerup refinery from 1.7 million tonnes to 3.3 million tonnes. This will involve the construction of a third production unit to be followed by output enhancement of all three units. The schedule for construction of the third unit is currently uncertain but preliminary site works could commence as early as February 1995. Completion of the development will make Wagerup the largest alumina refinery in the world.



The State's other producer, Worsley, is also studying the feasibility of a \$500 million expansion of its refinery. The Worsley plant is

one of the world's top three efficient alumina refineries and the expansion would add about 650,000 tonnes to its current capacity of 1.5 million tonnes per annum.

On a smaller scale, 1993-94 also saw work commence on a facility to produce speciality alumina tri-hydrate for chemical applications at Alcoa's Kwinana refinery. The first stage of the facility is to be completed by the end of 1994. Annual production of alumina tri-hydrate is to have a gross market value of over \$45 million per annum.

2.6 Diamonds

The volume of diamond sales increased by a significant 16% in 1993-94 to reach 29 million carats. However, the overall value of sales was down due to lower prices. As usual, almost all sales went overseas, with 77% going to the Central Selling Organisation (CSO) who are based in London. Remaining sales went to Belgium.

World demand for diamonds remained depressed, particularly for the lower quality and industrial grade stones. Demand for gem quality stones in Europe was weak but the US market grew and demand from Japan and other Asian countries was strong. This at least boosted diamond sales by the CSO in the second half of 1993-94. However, world supply exceeds current demand and inventories held by the CSO, merchants and producers continued to increase.

A poor outlook for diamond prices is attributable to high stocks and the performance of Russia in the market place. While the marketing agreements between the CSO and Russian producers appears to be holding, there is the threat of break outs and sale leakages outside the agreement. The CSO also established agreements with Angola and Zaire, but illicit production from those and other smaller African producers remains rampant.

Western Australia's production came from two projects - the large Argyle operation producing from the lamproite pipe and surrounding alluvial mine sites, and the smaller Bow River alluvial operation. By extending plant capacity, the Argyle operation continues to maintain production at approximately 40 million carats per annum. However, it is possible that output from Bow River will cease in 1995.

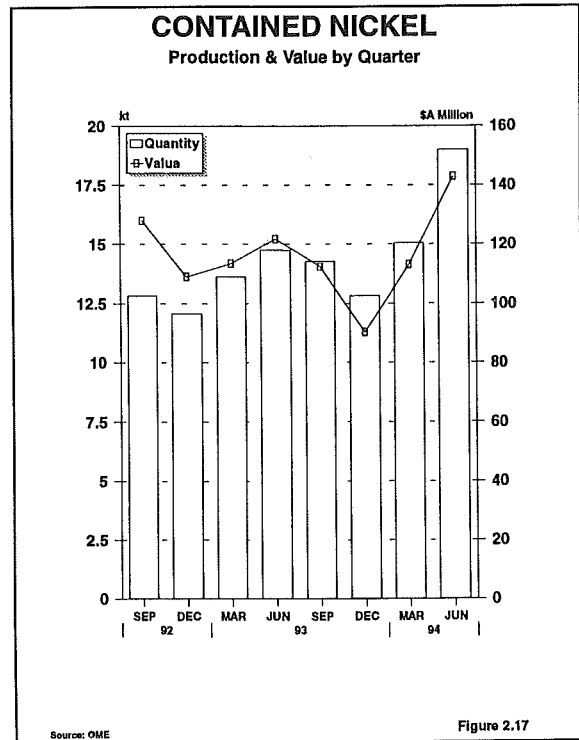
1993-94 also saw the first evaluation sales from the pilot plant operation at the Phillips Range (Aries Pipe) project. Of Australian diamond explorers, Diamin Resources NL, the project operator, is the closest to determining whether it has a commercial orebody. This prospect is significantly different from present State production by containing a high percentage of gem quality stones.

There was also a high level of activity among other diamond explorers in Western Australia with several programs in progress, mainly in the Kimberley and offshore in the Joseph Bonaparte and Cambridge Gulf areas.

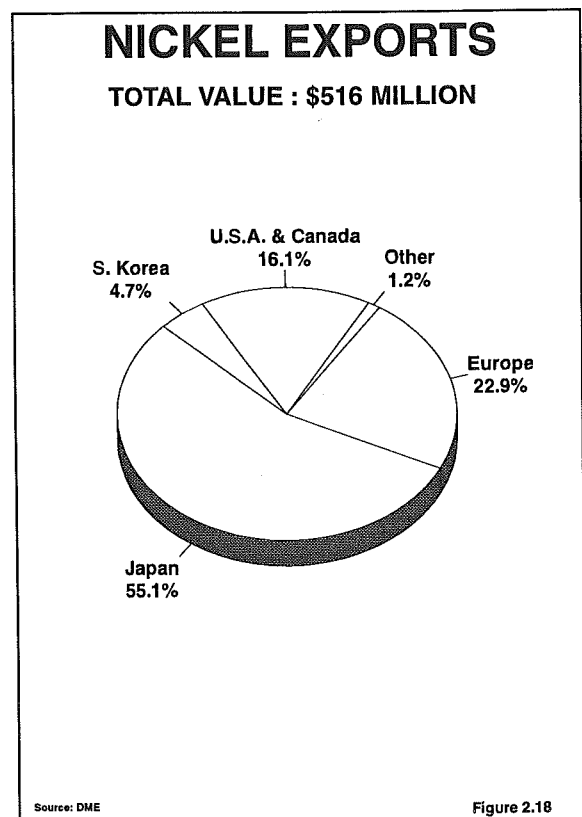
2.7 Nickel

Despite production disruptions associated with the upgrading of smelting and refining operations, Western Australia's nickel production increased by 15% in 1993-94 to reach 61,113 tonnes of contained nickel in matte, metal and concentrate products (Figure 2.17). However, the value of that production was down by almost 3%, reflecting lower average prices during the year.

The value of overseas nickel exports in 1993-94 was \$516 million. The chief export destination was Japan which accounted for over half the shipments. Other significant importers of the State's nickel output were Europe, US, Canada and South Korea (Figure 2.18).

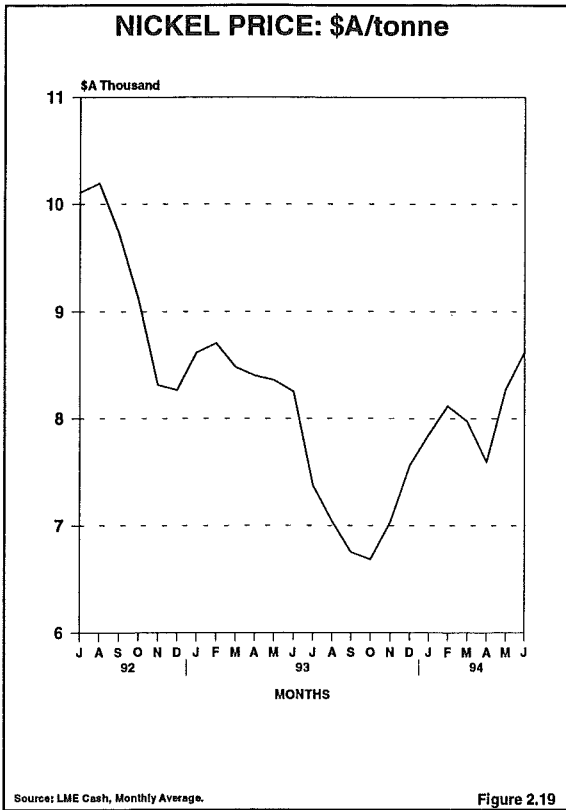


As for so many minerals, 1993-94 saw very low nickel prices in the first half of the year (Figure 2.19).



This was due to sluggish world demand from steel producers, particularly Germany and Japan, excess supply with producers

continuing to maintain output well in excess of demand, and significant exports, including nickel bearing scrap from the CIS.



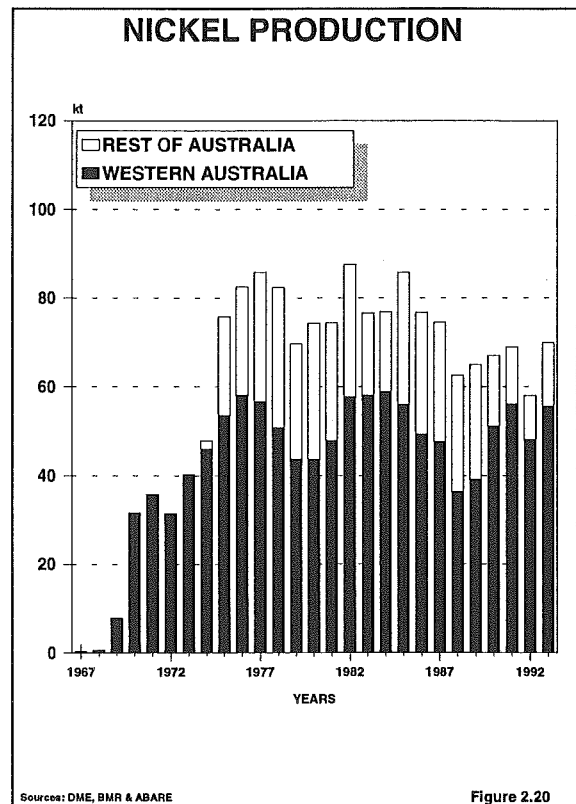
Although world nickel prices strengthened through the year, they remained volatile with investor uncertainty about future CIS nickel output. Certainly the strengthening of the world economy as characterised by the US and continued strong growth in South East Asia and China will increase the demand for nickel and support its price. However, any gains will be limited without a substantial decrease in the high level of world inventories.

Western Australia accounted for 97% of Australia's nickel production in 1993-94 (Figure 2.20) and despite low world prices, the State's nickel output is anticipated to rise significantly in 1994-95. Expanded facilities are also expected to make the State one of the world's lowest cost producers. Recent measures leading to this included a doubling of concentrate production capacity at the Leinster operation, developments to sustain capacity at Kambalda, expansion of the Kalgoorlie smelter

and Kwinana refinery and a move to underground operations at Forresteria. Of particular significance however, is the commissioning of the Mt Keith project in late 1994.

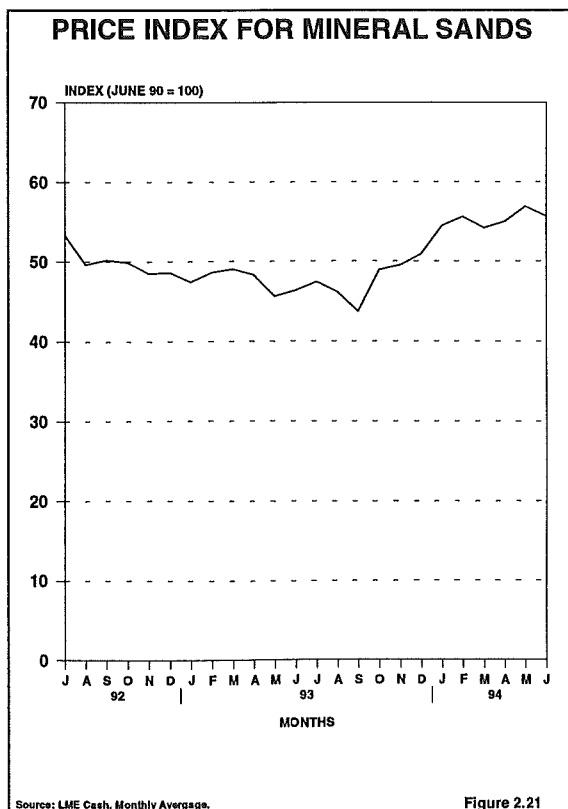
When the Mt Keith operation reaches peak output it will produce about 28,000 tonnes per annum of contained nickel in concentrate form. On development of the project and the above mentioned expansions, Western Australia's output capacity will have risen to around 100,000 tonnes per annum of contained nickel. This represents an increase of over 60% on current levels of output.

Also in the Northeastern Goldfields, north and south of Mt Keith, two other significant projects are currently being evaluated. Honeymoon Well, a joint venture between CRA and Outokumpu, has a resource of over 90 million tonnes of ore in five deposits and is at an early feasibility stage. Yakabindie has been fully evaluated at a feasibility level by Dominion Mining and is now being reappraised through a farm-in arrangement by North Ltd.



2.8 Heavy Mineral Sands

The heavy mineral sands sector continued to face weak demand for its product and weak prices during 1993-94, although marginal improvements were noticeable towards the end of the period (Figure 2.21). Nevertheless, the total value of sales in 1993-94, was over \$359 million, up by 2% on the previous year.

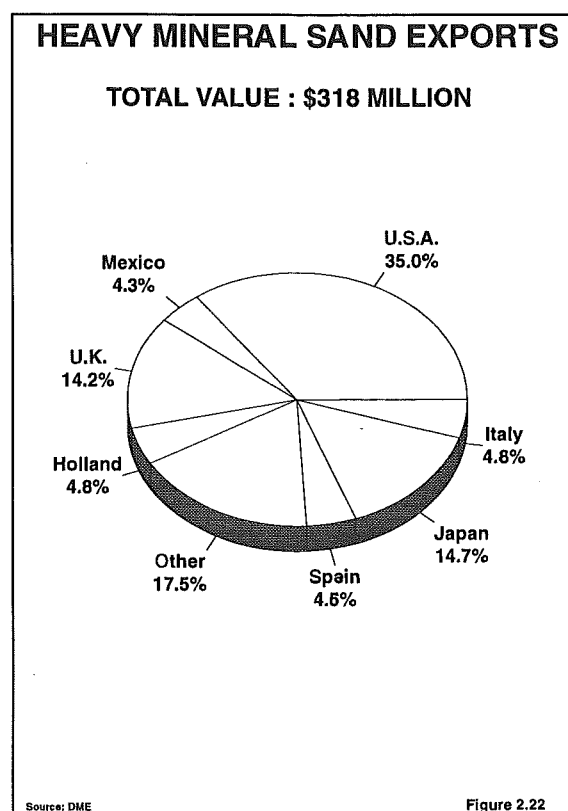


The value of heavy mineral sands exported overseas was \$318 million. The main export destination was the US which accounted for 35% of shipments. Japan and the United Kingdom both shared roughly equally in another 29%. The Netherlands, Italy and Spain each accounted for 5% respectively (Figure 2.22).

The value of sales of the titanium-based products (i.e. ilmenite, synthetic rutile, rutile and leucosene) was \$289 million, 3% down on 1992-93. Sales of ilmenite were over 1.1 million tonnes, 8% up on the previous year, with value increasing by 13% to reach \$92 million (Figures 2.23). This represented

87% of national ilmenite production (Figure 2.24).

Synthetic rutile sales amounted to \$154 million and again accounted for the largest share of this industry's output by value. However, the value of sales was down by 9% compared with 1992-93 as a result of production cutbacks. Rutile suffered a similar fate with production and sales value falling in 1993-94 by 9% and 15% respectively.

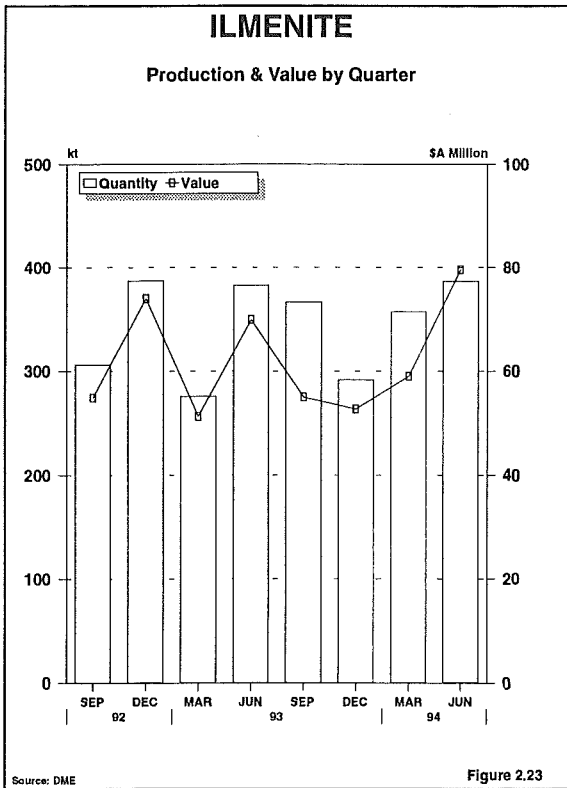


On the world market, heavy mineral sands prices did improve through the year, but the revival was not strong enough to prevent Tiwest's Chandala synthetic rutile plant from shutting down for six months in September 1993, and BHP placing the development of the proposed Beenup project on hold.

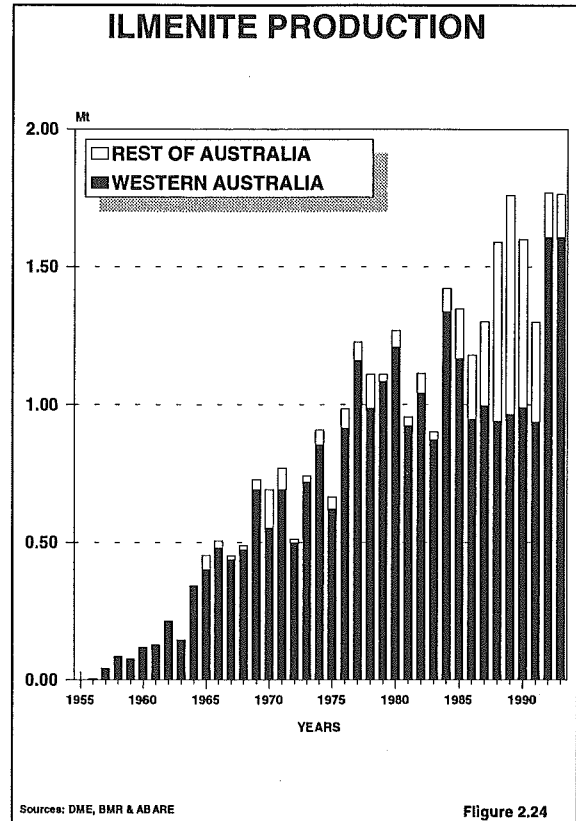
The recovery in the world mineral sands market is expected to continue and the prices for all titanium minerals are forecast to rise in 1994-95. This is dependent on a divergent market, where increased demand for titanium dioxide pigment from strengthening global

economic growth outstrips the faltering demand for titanium metal. Producers of titanium metal are currently experiencing decreased demand from the main consuming sector - the aerospace industry which is pruning production in response to defence budget cuts and poor performance of the civil airline industry. This weak demand situation is being aggravated by the CIS which is boosting supply with steady shipments of high quality titanium sponge, scrap and ferro-titanium.

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The recovery in the world mineral sands market is expected to continue and the prices for all titanium minerals are forecast to rise in 1994-95. This is dependent on a divergent market, where increased demand for titanium dioxide pigment from strengthening global economic growth outstrips the faltering demand for titanium metal. Producers of titanium metal are currently experiencing decreased demand from the main consuming sector - the aerospace industry which is pruning production in response to defence budget cuts and poor performance of the civil airline industry. This weak demand situation is being aggravated by the CIS which is boosting



The production of most mineral sands products is expected to rise in 1994-95. This will occur through the higher utilisation of existing plant capacity in Western Australia and production from Cable Sands' new 'greenfields' development at Jangardup which began production in May 1994. This project is expected to produce 250 thousand tonnes per annum of concentrates and result in Cable Sands production increasing to about 30% of Western Australia's mineral sands output.

Outside the titanium-based minerals, the zircon market, after struggling with excess capacity and low demand in the Western World, finally had some relief with significant increases in zircon prices during 1993-94. Firmer prices assisted in the value of sales from Western Australia reaching \$63 million, up 28% on the previous year. The volume of production also increased, up 15% in 1993-94. Western Australia is a major producer of zircon

and the outlook for this mineral is highly favourable, with strong demand from China which is one of the world's largest zircon consumers. Although there is some uncertainty about the sustainability of the Chinese market, it is hoped that this will be nullified by the continued recovery of the world economy and increased use of zircon in the ceramics industry. However, there is a fine balance between sustained higher prices and the substitution of other products for zircon.

Monazite production volumes and sales were down by 6% and 8% respectively. With the difficulties experienced by Rhone Poulenc in France, the principle purchaser of monazite, the future for monazite sales is not good. Garnet however, saw a 32% increase in both production and sales value.

2.9 Other Minerals

Coal output was down by 5% in 1993-94, and there was a decrease in sales value to \$236 million. All coal now produced in the State comes from open cut operations following the closure of Western Collieries last underground operation. Future capacity will be enhanced with production from the new Premier Mine in Collie, the development of which is expected to start in mid 1995.

The State's salt industry suffered a 6% decrease in sales to reach \$149 million with tonnages down by 7%. Over half of the State's salt production was exported to Japan. South Korea and Taiwan were also significant customers. Despite strong growth in Asian (excluding Japanese) demand, 1993-94 was characterised by an oversupplied world market and low prices. Tough trading conditions led to producers implementing cost reductions. Coupled with recovery in the world economy, this should lead to a more promising outlook for the industry in 1994-95.

The value of base metal production fell by 16%

to \$116 million. This reflected lower average prices which bottomed in the first half of 1993-94. Prices have since strengthened although the benefit to local producers has been reduced by the stronger local currency. Copper output increased with the start of production from the Nifty project in the second quarter of 1993-94 and improvements in the Golden Grove operation. Horseshoe Lights however, ceased shipping copper. It is also expected that the Cadjebut zinc-lead resource will be exhausted in 1994-95. However, the feasibility of developing new replacement mines at Goongewa, Kapok and Blendevale in the vicinity of Cadjebut is currently under consideration. With improvement in world economic growth and strengthening base metal prices, a positive picture presents itself for the base metal industry in 1994-95.

Manganese output was up by 19% in 1993-94 but lower prices caused earnings to fall relative to the previous year. All of Western Australia's manganese production was exported to Asia, with the predominant importer being China. Poor prices also resulted in the suspension of operations at Woodie Woodie in late 1993-94. However, the start of production at the nearby Valiant Consolidated's Mike deposit, which although not likely to fully replace Woodie Woodie's output, will nevertheless continue manganese production in the State in 1994-95.

Although small in terms of overall value, Western Australia is the world's major supplier of tantalite and spodumene. Following expansion plans completed over the last year, an advanced stage proposal is in place to develop a lithium carbonate plant at Greenbushes.

3. Minerals and Petroleum Exploration

Western Australia recorded another year of strong exploration activity, with \$454 million spent in 1993-94 on mineral exploration. This was about \$100 million above 1992-93 and represented significant growth after four years of relatively static expenditure of around \$350 million in 1994 terms.

The State continued to attract the major share of Australian expenditure with over 57% of national mineral exploration dollars spent in 1993-94. Queensland, at under 18% of the total, was a distant second.

Gold and diamond exploration were the main sectors of increased activity in 1993-94. Expenditure on gold exploration was up almost 38% and diamond exploration expenditure was up by over 50%. Base metals (copper, lead, zinc and nickel) were the other major sector of activity.

Since the early 1980s gold exploration has dominated the State scene and in 1993-94 accounted for 68% of the total. Base metals attracted 14%, followed by diamonds at 10%. Nationally, Western Australia attracts the most exploration expenditure for gold, diamonds, iron ore and heavy mineral sands and about a third of the total on base metals (including nickel) and uranium. However, recent expenditure on uranium exploration in absolute terms, is minor.

The \$310 million expended on gold exploration was distributed throughout the State, although a major share was attracted to the Yilgarn and adjacent areas of the Glengarry Basin and Marymia Dome. However, two projects were at an advanced stage of development outside this region, namely Palm Springs in the Kimberley and Lynas Find in the Pilbara.

The Yandal belt of the Northeastern Goldfields continued to be the focus of activity. The northern area is proving to be of particular

prospectivity as the Jundee and Nimary prospects unfold significant gold mineralisation with preliminary resource estimates of 14 and 7 tonnes of contained gold respectively.

Other significant gold discoveries and resource announcements in 1993-94 included satellite deposits to the south of Granny Smith (Keringal and Sunrise), Cuddingwarra (near Cue), Chalice (near Higginsville) and others under and near Lake Lefroy in WMC's St Ives project area, where the continued success rate has promoted this area into one of the major gold regions of the State. Another major success story was the Plutonic deposit and surrounding Freshwater leases, in an area (Marymia Dome) which was very late in emerging during the current gold boom. This area now contains one of the major gold resource inventories in the State.

It is noteworthy that the cost of discovering gold in 1993 was estimated at \$12.50/oz. This is half the average cost over the 15 year period since the emergence of gold as a dominant sector during the 1979-80 price surge.

Improvements in techniques to find and exploit deposits below salt lakes and below old shallow open pit mines is also leading to the development of viable new operations. In addition to the long standing practice of searching for and developing satellite orebodies close to original mine sites, this will probably ensure continued high levels of exploration for gold in the near future.

At \$63 million for the year, the relatively high level of exploration expenditure on base metals has been sustained. However, except for further nickel resource delineation at Honeymoon Well and Maggie Hays and zinc-copper at Panorama, announcements of significant successes have been limited.

Renison Goldfields Consolidated did however, make an announcement of a large low grade lead deposit in the Glengarry Basin. This joins

Abra and Admiral Bay as large, base metals deposits which provide hope for further discoveries. Unfortunately, they do not in themselves produce economically viable prospects (because of grade and depth) that, at least in the medium term, can be developed.

The Glengarry, Patterson Province and Pilbara represented the major areas of exploration activity for copper, lead and zinc, while the Eastern Goldfields remained the focus of nickel activity. Exploration for zinc and lead in the Lennard Shelf area declined as BHP and Billiton reduced their activity in the region.

A number of ownership transfers took place in base metals, most notably Normandy-Poseidon's acquisition of Aztec (thereby increasing its ownership of the Golden Grove zinc-copper operation), Western Metals' takeover of the Cadjebut zinc-lead and surrounding prospects, North Ltd's \$88 million farm-in to Yakabindie nickel and Matlock Mining's entry into the possible Whim Creek copper re-development with Dominion Mining.

A major increase in diamond exploration took place in 1993-94 with \$47 million expended compared to under \$30 million in the previous year. Much of the activity was funded by new public floats. The speculative announcements and levels of stock market activity reached such high levels that two conferences were convened in Perth. The conferences provided a forum to explain the mystique or uniqueness of the diamond exploration process and the interpretation of results. The conferences also introduced the portfolios of the many new players in this sector.

A lot of diamond exploration is at an early stage with virtually all areas of kimberlite indication or alluvial potential being appraised. The intense effort in the Nabberu Basin in the first half of 1993-94 has eased and the Kimberley region remains the most prospective and active area. Offshore potential is still far

from being defined.

Detailed bulk testing by large diameter drilling on the Aries Pipe at Phillips Range is the most advanced project, while in the latter part of 1993-94 Striker Resources discovered the diamondiferous pipe/dyke source of its Beta Creek alluvial deposits.

Expenditure statistics on exploration effort in the iron ore sector continued to indicate a decline since the peak of 1991-92. At \$18 million in 1993-94, it was half the level of two years ago. Most exploration was carried out by the major iron ore mining companies in the Hamersley Basin. At least a similar and perhaps increased level of exploration activity is expected to continue in the near future to find orebodies that can replace depleting resources of high quality lump ore. Countering the decline in exploration effort has been a significant increase in the assessment of potential iron and/or steel making project developments.

Heavy mineral sands exploration remained at basic commitment levels in 1993-94 by the main producers as they plan their medium term production strategies.

At \$2.2 million for 1993-94, uranium exploration remained at an exceptionally low level, which is not surprising given the Commonwealth's policy of no new developments. However, the uranium exploration effort in Western Australia is still nearly 30% of the national total.

Exploration expenditure for offshore petroleum is estimated to have decreased slightly over 1993-94 to about \$195 million. Although onshore exploration expenditure increased, it remains at low levels in comparison with offshore expenditure.

Following the trend of recent years, the offshore Carnarvon Basin was the focus of petroleum exploration activity with 32 of the 38

offshore wells drilled in that area. A relatively low level of onshore drilling was maintained with a total of 20 wells drilled. To encourage onshore exploration, amendments were made to the Western Australian Petroleum Act 1967.

Continued analysis and integration of recent seismic survey work, combined with considerable new drilling data, have enhanced and refined geological interpretation. Consequently, the drilling program scheduled for 1994-95 of up to 32 offshore and 28 onshore wells should result in a significant expansion of recoverable reserves and an increase in new field discoveries.

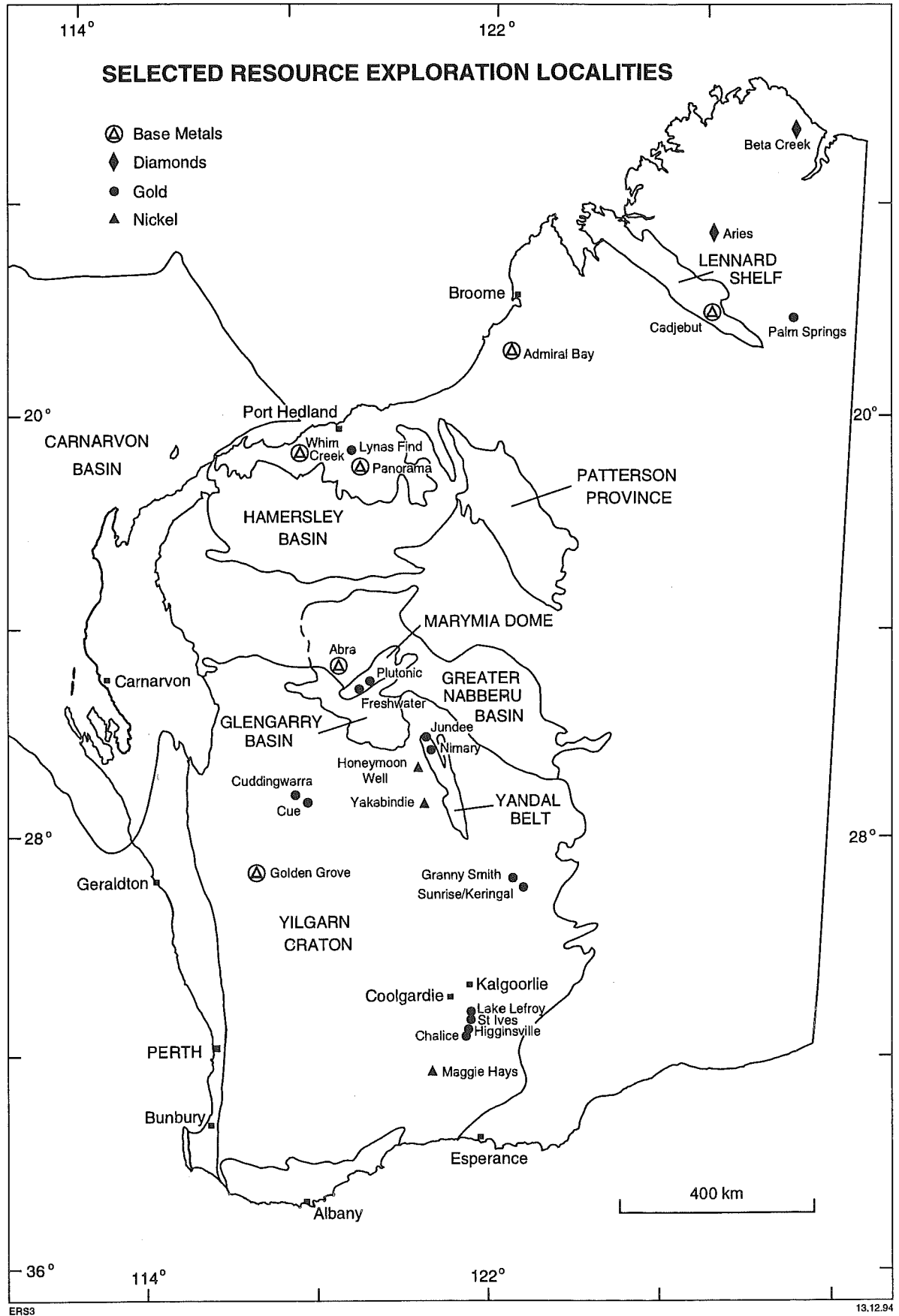


Figure 3.1

TABLE 4.1 QUANTITY AND VALUE OF MINERALS AND PETROLEUM 1992-93, 1993-94

MINERAL	UNIT	1992-93		1993-94	
		QUANTITY	VALUE(\$)	QUANTITY	VALUE(\$)
BASE METALS					
Copper Metal	t	22,915	27,438,799	28,819	33,409,998
Lead Metal	t	22,302	6,649,704	21,113	4,981,363
Zinc Metal	t	127,963	104,106,685	133,557	77,528,510
TOTAL BASE METALS			138,195,188		115,919,871
BAUXITE-ALUMINA					
Alumina	t	7,547,856	1,818,116,459	7,830,064	1,784,319,220
CLAYS					
Attapulgit	t	20,208	5,891,735	20,351	6,044,132
Clay Shale	t	0	0	66,483	132,966
Fire Clay	t	29,927	35,913	27,766	33,320
Kaolin	t	2,840	175,794	3,563	243,900
White Clay	t	22,984	249,946	33,189	318,018
TOTAL CLAYS			6,353,388		6,772,336
COAL	t	5,428,055	244,773,673 (r)	5,152,574	236,288,139
CONSTRUCTION MATERIALS					
Aggregate	t	298,943	1,791,423	51,434	226,475
Gravel	t	57,740	283,399	106,280	525,788
Rock	t	58,614	494,327	144,732	2,054,589
Sand	t	1,304,088	6,098,122	2,434,032	9,927,160
TOTAL CONSTRUCTION MATERIALS			8,667,271		12,734,012
DIAMOND	ct	24,827,163	519,981,370	28,864,319	476,747,331
DIATOMITE	t	445	5171	0	0
DIMENSION STONE					
Black Granite	t	1486	443200	1762	485,121
Quartz Rock	t	1002	45047	995	44,753
Spongolite	t	200	16400	0	0
TOTAL DIMENSION STONE			504647		529,874
GEM, SEMI-PRECIOUS & ORNAMENTAL STONE					
Agate	kg	28,384	22,012	23,236	16,741
Amethyst	kg	25,352	308,045	0	0
Chalcedony	kg	13,000	9,117	23,775	19,020
Chrysoprase	kg	27,773	1,450,587	102,362	663,201
Jasper	kg	70,819	45,116	0	0
Malachite	kg	88	17,138	285	977
Tourmaline	kg	1,960	7,415	0	0

TABLE 4.1 (cont)		1992-93		1993-94	
MINERAL	UNIT	QUANTITY	VALUE(\$)	QUANTITY	VALUE(\$)
GEM, SEMI-PRECIOUS & ORNAMENTAL STONE (cont)					
Variscite	kg	1,863	7,550	0	0
TOTAL GEM, SEMI-PRECIOUS & ORNAMENTAL STONE			1,866,980	699,939	
GOLD	kg	179,800 (r)	2,834,190,199 (r)	193,599 (e)	3,415,060,358 (e)
GYPSUM	t	124,486	1,100,095	195,158	2,071,423
HEAVY MINERAL SANDS					
Garnet	t	42,517	4,038,822	55,962	5,320,446
Ilmenite	t	990,351 ✓	81,661,030	1,069,717	92,318,841
Upgraded Ilmenite (a)	t	361,421 ✓	168,546,726	332,994	153,940,432
Leucoxene	t	11,215	4,446,491	17,438	6,934,515
Monazite	t	6,211	1,813,910	5,848	1,667,044
Rutile	t	75,928 ✓	42,135,260	68,931	35,757,509
Zircon	t	302,463 ✓	49,191,977	349,134	63,098,512
TOTAL HEAVY MINERAL SANDS			351,834,216	359,037,299	
INDUSTRIAL PEGMATITE MINERALS					
Felspar	t	22,311	858,398	22,167	864,560
IRON ORE					
Domestic	t	5,037,380	144,446,749	6,049,806	156,792,953
Exported	t	106,692,763	2,846,693,812	113,640,430	2,708,362,762
TOTAL IRON ORE		111,730,143	2,991,140,561	119,690,236	2,865,155,715
LIMESAND-LIMESTONE-DOLOMITE					
Dolomite	t	0	0	2,500	25,000
Limesand-Limestone	t	2,103,555	13,587,083	2,147,271	14,764,597
TOTAL LIMESAND-LIMESTONE-DOLOMITE			13,587,083	14,789,597	
MANGANESE ORE	t	251,532	46,887,348 (r)	299,702	46,081,555
NICKEL INDUSTRY					
Cobalt by-product	t	287	12,109,563	370	19,954,659
Nickel Concentrate	t	521,030	470,435,536	563,025	458,620,550
Nickel Matte	t	835	1,737,236	0	0
Palladium by-product	kg	422	1,626,008	373	2,576,698
Platinum by-product	kg	112	1,246,898	63	987,882
TOTAL NICKEL INDUSTRY			487,155,241	482,139,789	
PEAT	t	1,134	84,432	813	60,380

TABLE 4.1 (cont)		1992-93		1993-94	
MINERAL	UNIT	QUANTITY	VALUE(\$)	QUANTITY	VALUE(\$)
PETROLEUM					
Condensate	kl	1,995,401	363,038,053	2,350,031	348,711,923
Crude Oil	kl	4,538,080	855,690,950	5,327,567	815,332,844
LNG	MMBtu	254,465,858	1,025,056,102	296361819	1,015,679,244
Natural Gas	'000m3	3,960,289	407,019,305	4456991	413,371,442
TOTAL PETROLEUM			2,650,804,410		2,593,095,453
SALT					
SALT	t	6632,911	158,377,590	6,155,387	149,179,209
SILICA-SILICA SAND					
Silica	t	61,263	652,157	78,235	788,096
Silica Sand	t	456,896	4,332,324	490,161	4,444,654
TOTAL SILICA-SILICA SAND			4,984,481		5,232,750
SILVER					
SILVER	kg	81,833	12,371,221	74,326	14,722,276
TALC					
TALC	t	158,789	11,525,240	141,057	10,043,030
TIN-TANTALUM-LITHIUM					
Spodumene	t	42,550	7,341,552	47,787	10,245,802
Tantalite	t	537	19,741,076	246	14,278,830
Tin Metal	t	150	1,139,902	104	790,621
TOTAL TIN-TANTALUM-LITHIUM			28,222,530		25,315,253
VERMICULITE					
VERMICULITE	t	199	35,293	0	0
TOTAL VALUE			12,331,622,485 (r)		12,616,859,369 (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, the Commonwealth Petroleum (Submerged Lands) Act 1967, the Commonwealth Petroleum Resource Rent Tax Assessment 1987, the Barrow Island Royalties Variation Agreement Act and relevant State Agreement Acts.

(a) Also known as synthetic rutile

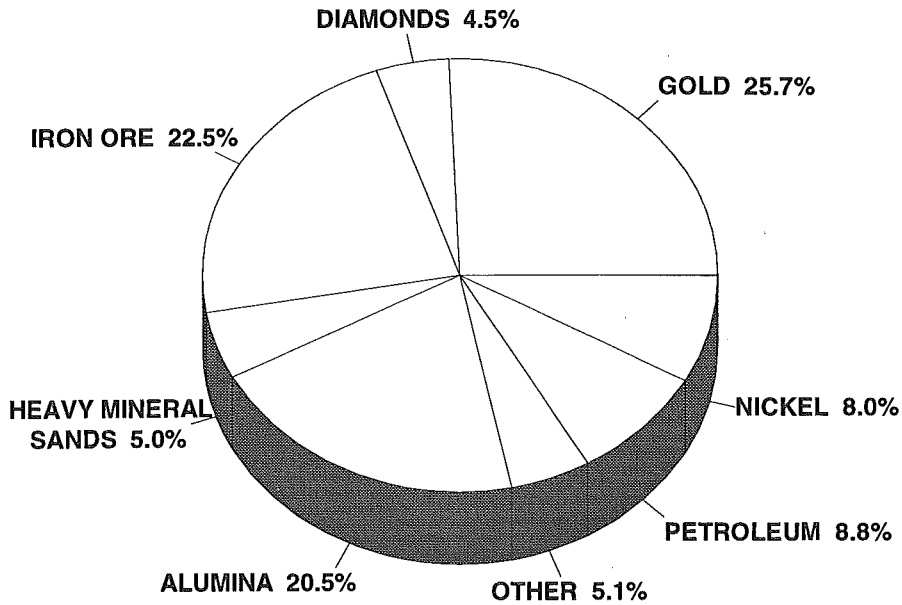
(e) Estimate

(r) Revised from previous edition

COMPARATIVE VALUE OF PRODUCTION

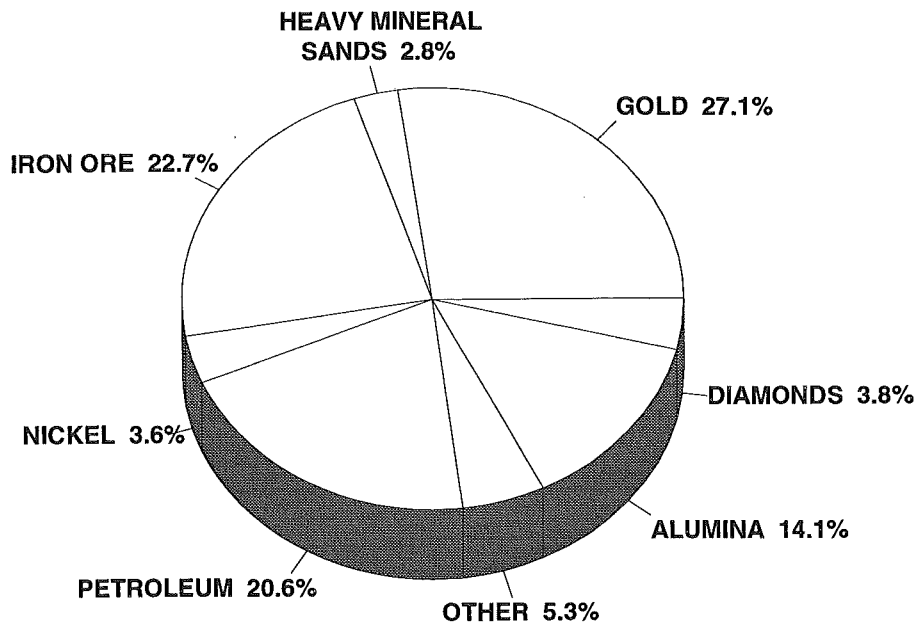
1988-89 VALUE OF PRODUCTION

TOTAL : \$7,904 MILLION



1993-94 VALUE OF PRODUCTION

TOTAL : \$12,617 MILLION



Source: DME

Figure 4.1

TABLE 5.1 QUANTITY AND VALUE OF MINERALS AND PETROLEUM BY LOCAL GOVERNMENT AREA					
Mineral	Local Government Area	Quantity tonnes	Metallic Content	Value (\$)	Ref
BASE METALS			Cu Tonnes		
Copper By-Product	Coolgardie		4,035.41	4,921,712	(a),(b)
			Cu %		
Copper Concentrates	Boddington	5,731	22.07	1,126,657	
	East Pilbara	16,009	14.85	1,874,161	
	Meekatharra	51,555	21.02	6,425,514	
	Yalgoo	<u>34,621</u>	<u>20.38</u>	<u>9,917,786</u>	
		107916		19344118	(a)
			Cu Tonnes		
Copper Cathode	East Pilbara		3,246.32	9,144,168	(a)
Total Copper				33,409,998	
			Pb %		
Lead	Derby-West Kimberley	25,941	81.39	4,981,363	(a)
			Zn %		
Zinc	Derby-West Kimberley	104,218	61.39	40,065,101	
	Yalgoo	<u>165,878</u>	<u>41.94</u>	<u>37,463,409</u>	
		270,096		77,528,510	(a)
TOTAL BASE METALS				115,919,871	
BAUXITE - ALUMINA					
Alumina	Boddington	1,666,016		406,461,479	
	Harvey	1,504,907		337,159,648	
	Murray	2,957,773		660,468,097	
	Serpentine-Jarrahdale	<u>1,701,368</u>		<u>380,229,996</u>	
		7,830,064		1,784,319,220	(c)
CLAYS					
Attapulgit	Mullewa	20,351		6,044,132	(a)
Clay Shale	Collie	66,483		132,966	(a)
Fire Clay	Chittering	27,766		33,320	(d)
Kaolin	Bridegetown-Greenbushes	3,563		243,900	(d)
White Clay	Swan	<u>33,189</u>		<u>318,018</u>	(d)
TOTAL CLAYS		151,352		6,772,336	
COAL	Collie	5,152,574		236,288,139	(e)
CONSTRUCTION MATERIALS					
Aggregate	Kalgoorlie-Boulder	38,972		157,147	
	Port Hedland	3,880		17,836	
	Wyndham-East Kimberley	<u>8,582</u>		<u>51,492</u>	
		51,434		226,475	

TABLE 5.1 (cont)		Local	Quantity	Metallic		
Mineral	Government Area		tonnes	Content	Value (\$)	Ref
CONSTRUCTION MATERIALS (cont)						
Gravel	Broome		12,033		56,927	
	Coolgardie		9,360		56,160	
	Coorow		665		3,990	
	East Pilbara		10,900		54,500	
	Kalamunda		68,656		343,280	
	Port Hedland		2,031		1,788	
	Shark Bay		431		2,155	
	Wyndham-East Kimberley		<u>2,204</u>		<u>6,988</u>	
			106,280		525,788	
Rock	Broome		75,830		1,207,044	
	Exmouth		3,592		25,144	
	Port Hedland Town		50		788	
	Roebourne		<u>65,260</u>		<u>821,613</u>	
			144,732		2,054,589	
Sand	Ashburton		33,664		178,815	
	Broome		25,589		111,757	
	Canning		1,576,537		6,306,148	
	Cockburn		61,572		246,294	
	Collie		32,707		187,348	
	Coolgardie		105,203		544,547	
	Coorow		6,417		38,502	
	Dandaragan		760		4,560	
	Derby-West Kimberley		1,615		11,305	
	East Pilbara		2,060		12,360	
	Gingin		3,631		21,787	
	Kalgoorlie-Boulder		56,744		288,150	
	Leonora		6,531		39,186	
	Meekatharra		7,189		43,134	
	Menzies		1,217		6,085	
	Port Hedland		39,502		254,656	
	Roebourne		254,683		1,287,333	
	Swan		213,161		319,743	
	Yilgarn		<u>5,250</u>		<u>25,450</u>	
			2,434,032		9,927,160	
TOTAL CONSTRUCTION MATERIALS					12,734,012	(d)
			Carats			
DIAMOND	Derby-West Kimberley		28,864,319		476,747,331	(a)

Mineral	Local Government Area	Quantity tonnes	Metallic Content	Value (\$)	Ref
DIMENSION STONE					
Black Granite	Derby-West Kimberley	1,021		255,271	
	Dundas	<u>741</u>		<u>229,850</u>	
		1,762		485,121	(d)
Quartz Rock	Mukinbudin	995		44,753	(d)
TOTAL DIMENSION STONE		2,757		529,874	
GEM, SEMI-PRECIOUS AND ORNAMENTAL STONE		kg			
Agate	East Pilbara	23,236		16,741	
Chalcedony	Carnarvon	23,775		19,020	
Chrysoprase	Menzies	102,362		663,201	
Malachite	Meekatharra	285		977	
TOTAL GEM, SEMI-PRECIOUS AND ORNAMENTAL STONE				699,939	(e)
			Au kg		
GOLD	Boddington		16,730.521	294,955,797	
	Coolgardie		21,643.110	381,130,747	
	Cue		9,313.744	164,808,032	
	Dundas		2,459.364	43,410,782	
	East Pilbara		12,823.016	226,177,601	
	Kalg.-Boulder		46,819.449	825,973,464	
	Laverton		9,843.440	173,525,841	
	Leonora		23,996.849	423,336,733	
	Meekatharra		14,916.010	262,757,113	
	Menzies		757.621	13,280,709	
	Mt Magnet		6,661.392	117,406,005	
	Sandstone		2,596.550	45,808,383	
	Wiluna		3,453.763	60,909,348	
	Yalgoo		2,724.652	48,126,899	
Yilgarn		<u>18,859.709</u>	<u>333,452,904</u>		
			193,599.190	3,415,060,358	(f)
GYPSUM	Bruce Rock	2,719		13,595	(e)
	Dalwallinu	69,382		1,280,476	(d),(e)
	Esperance	3,660		22,900	(e)
	Lake Grace	19,875		139,840	(e)
	Nungarin	30,622		182,792	(e)
	Plantagenet	11,854		72,756	(e)
	Ravensthorpe	11,482		76,208	(e)
	Wyalkatchem	38,769		230,583	(e)
	Yilgarn	<u>6,795</u>		<u>52,273</u>	(e)
		195,158		2,071,423	

TABLE 5.1 (cont)		Local	Quantity	Metallic	Value (\$)	Ref
Mineral	Government Area	tonnes	Content	Value (\$)	Ref	
HEAVY MINERAL SANDS	Garnet Sand	Capel	161		19,390	(g)
		Northampton	55,801		5,301,056	(e)
			55,962		5,320,446	
	Ilmenite	Capel	699,726	54.82	62,647,925	
		Camamah	149,292	58.78	11,447,675	
		Dandaragan	220,699	61.45	18,223,241	
			1,069,717		92,318,841	
	Upgraded Ilmenite	Capel	160,667	92.00	74,398,766	
		Camamah	106,776	92.00	51,393,206	
		Dandaragan	65,551	92.00	28,148,460	
		332,994		153,940,432	(a)	
TOTAL ILMENITE		1,402,711		246,259,273	(a)	
TOTAL HEAVY MINERAL SANDS	Leucocoxene	Capel	13,874	12.686	5,184,027	
		Waroona	3,564	3.279	1,750,488	
			17,438	15.965	6,934,515	(a)
	Monazite	Capel	2,730	17.563	748,407	
		Camamah	3,118	20.270	918,637	
			5,848	37,833	1,667,044	(a)
			51,322	48,721	26,964,430	
	Rutile	Camamah	17,609	16.903	8,793,079	
		Dandaragan	68,931	65.624	35,757,509	(a)
			82,876	53,872	13,104,082	
Zircon	Capel	192,319	126,326	37,460,333		
	Camamah	73,939	48,800	12,534,097		
	Dandaragan	349,134	228,998	63,098,512	(a)	
		359,037,299				
INDUSTRIAL PEGMATITE MINERALS	Felspar	Mukinbudin	7,717		247,292	
		Port Hedland	14,450		617,268	
			22,167		864,560	(h)

TABLE 5.1 (cont)		Local	Quantity	Metallic		
Mineral	Government Area		tonnes	Content	Value (\$)	Ref
IRON ORE				Fe%		
Domestic Ore	Ashburton		523,430	59.80	12,111,722	
	Derby-West Kimberley		1,077,437	65.79	26,970,461	
	East Pilbara		<u>4,448,939</u>	62.32	<u>117,710,770</u>	
			6,049,806		156,792,953	
Exported Ore				Fe%		
Exported Ore	Ashburton		69,214,037	61.43	1,599,813,485	
	Derby-West Kimberley		1,189,468	64.17	23,336,856	
	East Pilbara		<u>43,236,925</u>	62.55	<u>1,085,212,421</u>	
			113,640,430		2,708,362,762	
TOTAL IRON ORE			119,690,236		2,865,155,715	(a)
LIMESAND - LIMESTONE-DOLOMITE						
Dolomite	Lake Grace		2,500		25,000	
Limesand - Limestone	Cockburn		1,610,200		8,329,800	
	Dandaragan		71,683		812,650	
	Dundas		83,063		1,114,495	
	Exmouth		340		6,120	
	Gingin		50,532		1,104,372	
	Irwin		2,997		11,069	
	Roebourne		350		22,750	
	Wanneroo		<u>328,106</u>		<u>3,363,341</u>	
TOTAL LIMESAND-LIMESTONE			2,149,771		14,789,597	(d)
MANGANESE ORE				Mn %		
	East Pilbara		299,702	49.52	46,081,555	(a)
NICKEL INDUSTRY				Co Tonnes		
Cobalt By-Product	Coolgardie			369.793	19,954,659	
Nickel Concentrates				Ni %		
Nickel Concentrates	Coolgardie		230,433	11.41	197,397,447	
	Kalgoorlie-Boulder		33,509	11.06	28,256,867	
	Leonora		260,446	10.31	205,230,622	
	Yilgarn		<u>38,637</u>	10.99	<u>27,735,614</u>	
			563,025		458,620,550	(i)
Palladium By-Product	Coolgardie			Pd kg 372.999	2,576,698	(a),(b)
Platinum By-Product	Coolgardie			Pt kg 63.834	987,882	(a),(b)
PEAT	Manjimup		813		60380	(d)

TABLE 5.1 (cont)		Local	Government Area	Quantity	Content	Value (\$)	Ref
		Quantity	tonnes	Content	Value (\$)	Ref	
PETROLEUM	Condensate	Camamah	Irwin	358		15,538	(a)
				4,043		498,546	(a)
		Roebourne		2,345,630		348,197,839	(d)
				2,350,031		348,711,923	
	Crude Oil	Derby-West Kimberley	Irwin	121,252		17,472,931	
			Roebourne	5,189,937		795,812,975	
				5,327,567		815,332,844	(a)
				MMBtu			
	Liquified Natural Gas	Roebourne		296,361,819		1,015,679,244	(a)
				'000 m³			
Natural Gas	Ashburton		76,405		5,322,667	(j)	
	Camamah		44,721		4,988,062	(j)	
	Irwin		319,212		38,257,537	(j)	
	Roebourne		4,016,653		364,803,176	(d),(j)	
			4,456,991		413,371,442		
				2,593,095,453			
TOTAL PETROLEUM			1,206,632		28,943,113		
		Camaron		11,003		281,000	
		Esperance		600		24,000	
		Lake Grace		2,074,344		48,370,206	
		Port Hedland		2,080,144		52,044,041	
		Shark Bay		687,328		15,901,649	
		Wyalkatchem		340		25,200	
		Yilgarn		94,996		3,590,000	
				6,155,387		149,179,209	(a)
SALT		Moora		78,235		788096	(a)
				100,863		1,109,493	(a)
		Cookburn		236,569		2,602,259	(a)
		Collie		2,146		23,606	(a)
		Coolgardie		98,166		240,508	(a)
		Swan		26,327		289,597	(a)
		Wanneroo		26,090		179,191	(a)
			568,396		5,232,750		
SILICA - SILICA SAND							
SILICA - SILICA SAND							

TABLE 5.1 (cont)	Local	Quantity	Metallic		
Mineral	Government Area	tonnes	Content	Value (\$)	Ref
		Ag kg			
SILVER: BY-PRODUCT	Boddington	502.93		91,546	(a),(l)
	Coolgardie	240.50		57,333	(a),(b)
	Meekatharra	16,851.39		2,779,545	(a),(k)
	State-Wide	36,680.89		7,224,201	
	Yalgoo	<u>20,050.16</u>		<u>4,569,651</u>	(a),(l)
		74,325.87		14,722,276	
TALC	Meekatharra	29,512		2,065,840	
	Three Springs	<u>111,545</u>		<u>7,977,190</u>	
		141,057		10,043,030	(e)
TIN - TANTALUM - LITHIUM			Li ₂ O %		
Spodumene	Bridegetown-Greenbushes	47,787	5.43	10,245,802	(a)
Tantalite	Bridegetown-Greenbushes	68	Ta ₂ O ₅ kg		
			22,539	4,591,626	
			<u>178</u>	<u>68,460</u>	<u>9,687,204</u>
		246	90,999	14,278,830	(a)
Tin	Bridegetown-Greenbushes		Sn Tonnes		
			94	764,879	
			<u>10</u>	<u>25,742</u>	
			104	790,621	(a)
VALUE OF MINERALS				6,608,703,558	
VALUE OF PETROLEUM				2,593,095,453	
VALUE OF GOLD				<u>3,415,060,358</u>	
TOTAL VALUE				12,616,859,369	

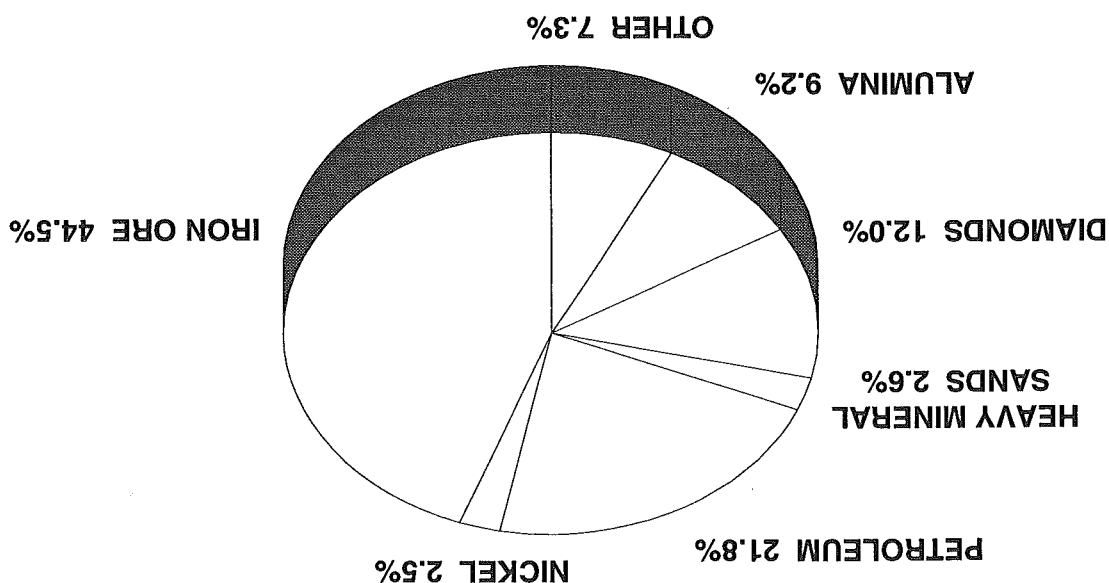
TABLE 6.1 ROYALTY RECEIPTS 1992-93, 1993-94

Mineral	1992-93	1993-94	1993-94 GROWTH
	\$A	\$A	%
BASE METALS			
Copper	1,081,742.27	1,219,422.40	13
Lead	425,963.28	230,893.97	(46)
Zinc	6,331,679.73	4,190,075.31	(34)
TOTAL BASE METALS	7,839,385.28	5,640,391.68	(28)
BAUXITE-ALUMINA			
Alumina	28,715,039.49	30,737,151.47	7
CLAYS	313,347.59	355,260.39	13
COAL	12,535,119.33	11,205,957.19	(11)
CONSTRUCTION MATERIALS			
Aggregate	43,614.84	60,515.10	39
Gravel	26,664.48	33,705.90	26
Rock	16,465.49	23,793.60	45
Sand	293,304.32	863,594.48	194
Sandstone	28.00	0.00	(100)
TOTAL CONSTRUCTION MATERIALS	380,077.13	981,609.08	158
DIAMOND	40,819,425.45	40,201,661.62	(2)
DIMENSION STONE	2,206.86	1,343.66	(39)
GEM, SEMI-PRECIOUS & ORNAMENTAL STONE	149,094.17	59,307.20	(60)
GOLD	254,114.81	286,514.68	13
GYPSUM	29,965.20	63,191.63	111
HEAVY MINERAL SANDS			
Garnet	194,763.16	237,941.44	22
Ilmenite	4,772,449.96	4,601,392.92	(4)
Leucoxene	146,634.20	231,170.10	58
Monazite	100,883.35	112,151.61	11
Rutile	2,220,911.78	1,488,829.23	(33)
Zircon	2,316,518.43	2,339,675.99	1
TOTAL HEAVY MINERAL SANDS	9,752,160.88	9,011,161.29	(8)
INDUSTRIAL PEGMATITE MINERALS			
Felspar	71,801.25	56,644.92	(21)

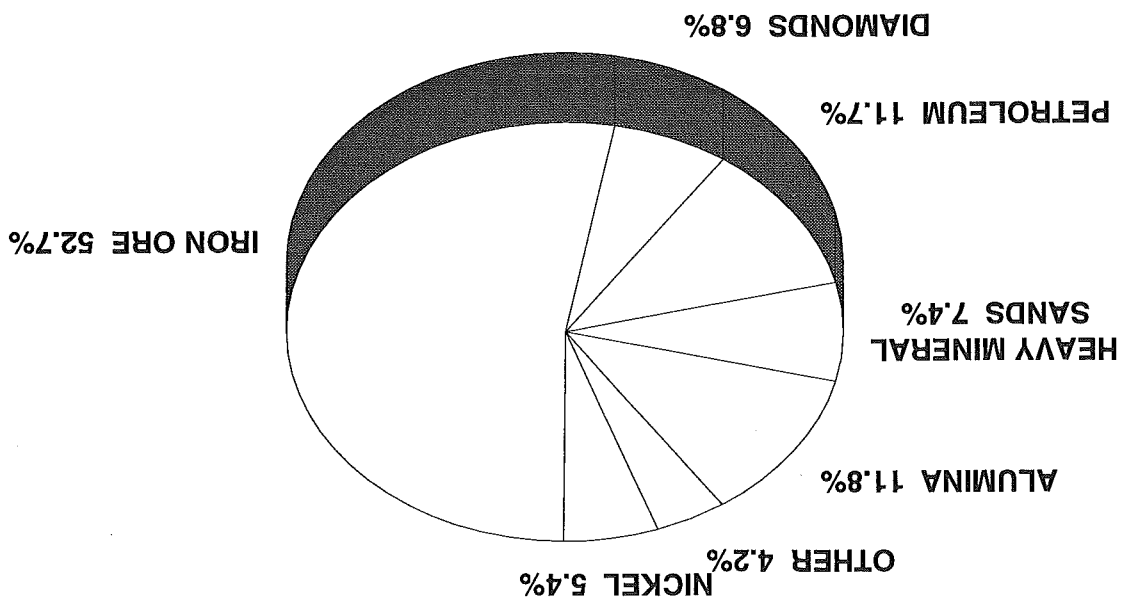
Mineral	1992-93	1993-94	1993-94 GROWTH	
	\$A	\$A	\$A	%
IRON ORE	152,674,073.14	148,674,163.04	(3,999,910.10)	(3)
LIMESAND-LIMESTONE	189,365.84	218,720.44	29,354.60	16
MANGANESE	2,874,157.00	2,585,181.00	(288,976.00)	(10)
NICKEL				
Cobalt by-product	307,949.77	328,938.71	20,988.94	7
Nickel	9,242,491.13	7,908,429.93	(1,334,061.20)	(14)
Palladium by-product	26,830.61	46,801.09	19,970.48	74
Platinum by-product	23,321.77	20,395.30	(2,926.47)	(13)
TOTAL NICKEL INDUSTRY	9,600,593.28	8,304,565.03	(1,296,028.25)	(13)
PEAT	2,395.28	1,919.08	(476.20)	(20)
PETROLEUM				
Condensate	3,395,641.06	6,362,978.09	2,967,337.03	87
Liquified Natural Gas	9,299,092.28	20,387,570.67	11,088,478.39	119
Natural gas	7,190,160.50	9,964,699.21	2,774,538.71	39
Oil	59,843,155.86	36,171,071.09	(23,672,084.77)	(40)
TOTAL PETROLEUM	79,728,049.70	72,886,319.06	(6,841,730.64)	(9)
SALT	1,426,492.87	1,349,803.55	(76,689.32)	(5)
SILICA SAND	258,582.40	279,142.27	20,559.87	8
SILVER	229,484.37	389,256.91	159,772.54	70
TALC	82,549.00	76,629.00	(5,920.00)	(7)
TIN-TANTALUM-LITHIUM				
Spodumene	422,861.97	413,569.72	(9,292.25)	(2)
Tantalite	698,767.71	278,015.95	(420,751.76)	(60)
Tin	33,570.15	21,229.84	(12,340.31)	(37)
TOTAL TIN-TANTALUM-LITHIUM	1,155,199.83	712,815.51	(442,384.32)	(38)
VERMICULITE	2,014.94	0.00	(2,014.94)	(100)
TOTAL ROYALTY RECEIPTS	349,084,695.09	334,078,709.71	(15,005,985.38)	(4)
IRON ORE ADDITIONAL RENTAL	24,253,176.79	25,225,946.18	972,769.39	4
TOTAL REVENUE	373,337,871.88	359,304,655.89	(14,033,215.99)	(4)

Source: WA Treasury

Figure 6.1



1993-94 ROYALTY RECEIPTS
TOTAL : \$334.1 MILLION



COMPARATIVE ROYALTY RECEIPTS
1988-89 ROYALTY RECEIPTS
TOTAL : \$176.0 MILLION

7 Employment in the Mineral and Petroleum Industries

Statistics compiled from industry returns showed that 35,592 people were employed in Western Australia's mineral and petroleum industries in 1993-94. This compares with 35,553 in 1992-93. The size of the workforce was therefore virtually static.

Significant employment decreases took place in the iron ore and coal sectors. The iron ore sector experienced a 21% (1,802 personnel) reduction in its workforce in 1993-94. Employment was significantly lower at the Nimingarra, Mt Newman, Tom Price and Port Hedland operations. These reductions have resulted from planned programs of staff rationalisation, increased reliance on contract labour and the introduction of more efficient work practices. The greatest fall (1,002 personnel) was at the Mt Newman/Port Hedland operation.

Employment in the coal mining sector dropped 26% in 1993-94 (283 personnel), chiefly due to closure of Western Collieries last underground operation. Following the closure, employment in the coal mining sector should now stabilise, to be followed by an increase with the development of new Premier Mine in Collie, expected to start in mid 1995.

Employment in the base metals sector 1993-94 fell by 99, or 16%. This was due to the closure of the Horseshoe Lights operation and workforce restructure at Golden Grove.

Offsetting the employment decreases were significant workforce rises in the gold and nickel sectors. The high level of activity in the gold mining industry saw employment in 1993-94 increase by 952 or 8.2%. Gold mining projects which underwent particularly significant employment increases were Big Bell, Granny Smith, Kambalda/St Ives and Bronzewing, which was being developed.

The nickel sector increased its employment by 27% (827 personnel). The main contributor to this was the development of the Mt Keith project. Expansion of Alcoa's Kwinana and Wagerup refineries also contributed significantly to the 6% increase in employment in the alumina sector.

The number of people employed in the petroleum industry increased to 1,245 in 1993-94. This was a 4% increase on the previous financial year.

TABLE 7.1 PERSONS EMPLOYED IN THE W.A. MINERALS & PETROLEUM INDUSTRIES AS AT JUNE 30, 1994		LOCATION	MINERAL/Company
1993-94	1992-93		
160	152	Cadjebut	BHP Minerals Ltd
231	318	Golden Grove	Murchison Zinc Co. Pty Ltd
-	98 (r)	Horseshoe Lights	Sabminco NL
130	52	Nifty	Western Mining Corporation Ltd
521	620 (r)		TOTAL BASE METALS
1 727	1 896	Del Park-Huntley/Pinjara	Alcoa of Australia Ltd
1 850	1 670	Jarrahdale/Kwinana	
941	664	Wagerup/Willow Dale	
34	30	East Rockingham	Australian Fused Materials Pty Ltd
1 205	1 175	Boddington/Worsley	Worsley Alumina Pty Ltd
5 757	5 435		TOTAL BAUXITE - ALUMINA
55	56	Chicken Creek	
396	425	Muja	Giffin Coal Mining Co. Ltd
29	75	Central Services	
4	118	Western #2	Western Collieries Ltd
336	292	Western #5	
-	137	Western #6	
820	1 103		TOTAL COAL
1 047	1 016	Lake Argyle	Argyle Diamond Mines Pty Ltd
103	98	Bow River	Posidon Ltd
1 150	1 114		TOTAL DIAMOND
137	148	Gidgee	Australian Resources & Mining Co. NL
145	138	Mt McLure	
332	270	Bounty	Aztec Mining Co Ltd
107	101	Copperhead	Burnine Ltd
258	207	Central Norseman	Central Norseman Gold Corp. NL
140	132	Greenfield	Coogardie Gold NL
99	128	Bannockburn	Domion Mining Ltd
-	108	Labourchere/Nathans	
183	183	Meekatharra	
165	194	Mt Morgans	
170	221	Three Mile Hill	Goldfan Ltd
174	-	Bronzewing	Great Central Mines NL
232	132	Jubilee	Hampton Australia Ltd
90	104	Hedges	Hedges Gold Pty Ltd
414	328	Mt Magnet	Hill 50 Gold Mine NL
1 313	1 362	Kalgoorlie	Kalgoorlie Consolidated Gold Mines Pty Ltd
82	127	Reedy	Gold Mines of Australia Ltd
88	23	Youarni	
225	144	Mt Pleasant	Mining Corporation of Australia Ltd

MINERAL\Company	LOCATION	1992-93	1993-94
GOLD (cont)			
Mt Burgess Goldmining Co. NL	Butcher Well	102	-
Newcrest Mining Ltd	Gimlet South	190	171
	New Celebration	458	359
	Telfer	707	810
	Tuckabianna	157	128
	Kundana	66	173
Pancontinental Pty Ltd	Paddington	174	239
	Peak Hill	78	80
Peko Gold Ltd	Kanowna Belle	141	127
	Granny Smith	199	338
Placer Pacific Pty Ltd	Bellevue	218	174
	Darlot	76	86
	Lawlers	118	132
	Plutonic	194	313
Poseidon Ltd	Big Bell	97	245
	Golden Crown	69	60
	Kaltails	82	119
Resolute Resources Ltd	Marymia	78	118
Reynolds Australia Metals Ltd	Mt Gibson	130	145
	Yilgarn	266	261
Samantha Gold NL	Higginsville	93	144
	Hopes Hill	109	77
Sons of Gwalia NL	Sons of Gwalia	145	193
St. Barbara Mines Ltd	Meekatharra	200	276
Western Mining Corporation Ltd	Emu	125	120
	Kambalda\St. Ives	614	768
	Lancefield	249	199
Wiluna Mines Ltd	Wiluna	136	176
Worsley Alumina Pty Ltd	Boddington	488	450
Yilgarn Star Pty Ltd	Yilgarn Star	98	139
All Other Operators		1 715 (r)	1 600
TOTAL GOLD		11 622 (r)	12 574
HEAVY MINERAL SANDS			
Cable Sands Pty Ltd	Capel	226	264
RGC Mineral Sands Pty Ltd	Capel	235	231
	Eneabba	268	338
	Narngulu	279	184
TiWest Pty Ltd	Cataby/Chandala	267	252
Westralian Sands Ltd	Capel	359	375
All Other Operators		1	30
TOTAL HEAVY MINERAL SANDS		1 635	1 674

MINERAL\Company	LOCATION	1992-93	1993-94
IRON ORE			
BHP Iron Ore (Goldsworthy) Ltd	Yarrie	105	157
BHP Iron Ore (Jimblebar) Ltd	Jimblebar	-	68
	Nimingarra/Port Hedland	732	328
BHP Iron Ore Ltd	Newman/Port Hedland	3 610	2 608
	Yandicoogina	87	95
BHP Minerals Ltd	Yampi	120	76
Hamersley Iron Pty Ltd	Tom Price - Paraburdoo/Dampier/Channar	2 824	2 384
	Hismelt - Kwinana	250	200
	Marandoo	-	115
Robe River Mining Co. Pty Ltd	Pannawonica/Cape Lambert	722	617
TOTAL IRON ORE		8 450	6 648
NICKEL			
Outokumpu Australia Ltd	Forrestania	183	204
Western Mining Corporation Ltd	Kalgoorlie	441	366
	Kambalda/Blair	1 174	1 303
	Kwinana Refinery	463	359
	Leinster	611	553
	Mt Keith	145	1 059
TOTAL NICKEL		3 017	3 844
PETROLEUM PRODUCTS			
Ampolex Ltd	Wandoo	-	61
BHP Petroleum (Australia) Pty Ltd	Griffin	-	59
Discovery Petroleum Ltd	Mt Horner	18	20
Hadson Energy Ltd	Harriet/Rosette	136	140
Minora Resources NL	Blina/Lloyd/Sundown/West Terrace	0	2
West Aust Petroleum Pty Ltd	North West Area/Dongara	242	250
Western Mining Corp. Ltd	North Herald/South Pepper/Chervil	102	27
Woodside Offshore Pet. Pty Ltd	North Rankin A/Burrup Peninsula	700 (r)	680
All Other Operators		2	6
TOTAL PETROLEUM PRODUCTS		1 200 (r)	1 245
SALT			
Cargill Salt Co.	Port Hedland	123	115
Dampier Salt Ltd	Dampier	159	197
	Lake MacLeod	114	105
Shark Bay Salt JV	Useless Loop	60	56
Other		6	6
TOTAL SALT		462	479
ALL OTHER MATERIALS (including Rock Quarries)		895	880
TOTAL		35 553 (r)	35 592

(Sources: Mining Operations Division; Royalties, Economic Policy & Public Affairs Division)

8.1 PRINCIPAL MINERAL & PETROLEUM PRODUCERS 1993-94, address, telephone number: minesite.**BASE METALS****Copper**

Murchison Zinc Co. Pty Ltd, c/o Normandy Poseidon Ltd, 100 Hutt St, Adelaide, S.A., (08) 303 1700: Golden Grove.

Newcrest Mining Ltd, 600 St Kilda Rd, Melbourne 3004, (03) 522 5333: Telfer.

Sabminco NL, 221 St George's tce, Perth 6000, (09) 321 1118: Horseshoe Lights.

Western Mining Corp. Ltd, 191 Great Eastern Hwy, Belmont 6104, (09) 479 0711: Nifty, Kambalda.

Worsely Alumina Pty Ltd, Gastaldo Rd, Worsely, WA 6225, (097) 34 8311: Boddington.

Lead - Zinc

BHP Minerals Ltd, 200 St Georges' Tce, Perth 6000, (09) 320 4444: Cadjebut.

Murchison Zinc Co. Pty Ltd, c/o Normandy Poseidon Ltd, 100 Hutt St, Adelaide, S.A., (08) 303 1700: Golden Grove.

BAUXITE - ALUMINA**Alumina**

Alcoa of Australia (WA) Ltd, cnr Davey & Marmion Sts Booragoon 6154, (09) 316 5111: Del Park, Jarrahdale, Willowdale.

Worsley Alumina Pty Ltd, PO Box 50, Boddington WA 6390, (098) 83 8005: Boddington.

CLAY**Attapulgit**

Mallina Holdings Ltd, 249 Stirling Hwy, Claremont 6010, (09) 384 7077: Lake Nerramyne.

Kaolin

Greenbushes Ltd, 16 Parliament Pl, West Perth 6005, (09) 481 1988: Greenbushes.

White Clay

Pilsley Investments Pty Ltd, Locked Bag 100, Midland 6056, (09) 250 2111: Middle Swan.

COAL

Griffin Coal Mining Co. Ltd, 28 The Esplanade, Perth 6000, (09) 325 8155: Collie.

Western Collieries Ltd, 40 The Esplanade, Perth 6000, (09) 327 4511: Collie.

CONSTRUCTION MATERIALS**Aggregate**

The Readymix Group (WA), 75 Canning Hwy, Victoria Park 6100, (09) 472 2000: Boodarie, Boulder, Oscar Range.

Gravel

Vinci and Sons Pty Ltd, Lot 3 Pickering Brook Rd, Pickering Brook 6076, (09) 293 8295: Pickering Brook.

Rock

County B.S., c/o Pioneer Concrete, 123 Burswood Rd, Victoria Park 6100, (09) 311 8811: Yeeda Station Learmonth, Mt Regal.

8.1 PRINCIPAL MINERAL & PETROLEUM PRODUCERS 1993-94, address, telephone number: minesite.**CONSTRUCTION MATERIALS (cont)****Sand**

Amatek Ltd, 1 Newburn Rd, Kewdale 6104, (09) 353 3030: Gnangarra, Jandakot.

Pioneer Concrete, 123 Burswood Rd, Victoria Park 6100, (09) 311 8811: Coolgardie.

The Readymix Group (WA), 75 Canning Hwy, Victoria Park 6100, (09) 472 2000: Comet Vale, Maitland, Nickol Bay, Pinnacles, Rocklea, Sandy Creek, Sullivan's Creek, Turner River, Warrawanda Creek, Widgiemooltha.

DIAMOND

Argyle Diamond Mines, 2 Kings Park Rd, West Perth 6005, (09) 482 1166: Argyle.

Poseidon Bow River Diamond Mines Ltd, 100 Hutt St, Adelaide, S.A., (08) 303 1700: Bow River.

DIMENSION STONE**Black Granite**

Fraser Range Granite NL, 164 Burswood Rd., Victoria Park 6010, (09) 470 4487: Mt Malcolm.

Quartz rock

Commercial Minerals Ltd, 26 Tomlinson Rd, Welshpool 6106, (09) 362 1411: Mukinbudin.

GEM, SEMI-PRECIOUS & ORNAMENTAL STONE**Chrysoprase**

Goddard & Hill Ltd, 158 Mill Point Rd, South Perth 6151, (09) 474 3165: Boyce Creek.

GOLD

Aurora Gold Ltd, 24 Outram St, West Perth 6005, (09) 476 2666: Bardoc-Davyhurst, Harbour Lights-Mertondale, Laverton.

Australian Resources & Mining Co. NL, 20 Berry St, North Sydney, NSW 2060, (02) 955 1722: Gidgee, Mt McClure.

Bounty Gold Mine Pty Ltd, Forrestania via Southern Cross 6426, (090) 39 4422: Forrestania-Bounty.

Burmine Ltd, Copperhead Mine, Bullfinch 6484, (090) 49 5066: Frasers, Copperhead.

Centaur Mining and Exploration Ltd, 580 St Kilda Rd, Melbourne Vic. 3004, (03) 276 7888: Lady Bountiful Extended.

Central Norseman Gold Corp. NL, PO Box 56, Norseman 6443, (090) 39 1101: Central Norseman.

Coolgardie Gold NL, 56b Bayley St, Coolgardie 6429, (090) 26 6132: Bayley's Reward-Greenfields.

Croesus Mining NL, 39 Porter St, Kalgoorlie 6430, (090) 91 2222: Binduli, Hannan South, Mystery Mint.

Delta Gold NL, Yarri Rd Kanowna via Kalgoorlie 6430, (090) 91 4922: Kanowna Belle.

Dominion Mining Ltd, 10 Richardson St, West Perth 6005, (09) 426 6400: Bannockburn, Gabanintha, Jupiter, Labouchere - Nathans, Meekatharra, Mt Morgans.

Eltin Minerals Pty Ltd, PMB 31, Kalgoorlie 6430, (090) 21 4844: Grosmont.

Gold Mines of Australia Ltd, 161 Great Eastern Hwy, Belmont 6104, (09) 479 0222: Reedy, Youanmi.

Gold Mines of Kalgoorlie Ltd, 100 Hutt St, Adelaide, S.A., (08) 236 1700: Jubilee.

Hedges Gold Pty Ltd, Williams Rd, Boddington 6390, (09) 538 4512: Hedges.

Herald Resources Ltd, 45 Richardson St, West Perth 6005, (09) 322 2788: Gum Creek-Montague, Sandstone, Three Mile Hill.

Kalgoorlie Consolidated Gold Mines Pty Ltd, Fimiston, Kalgoorlie 6430, (090) 22 1100: Super Pit, Mt Charlotte, Mt Percy.

8.1 PRINCIPAL MINERAL & PETROLEUM PRODUCERS 1993-94, address, telephone number: minesite.**GOLD (cont)**

- Metall Mining Corp of Aust Pty Ltd, cnr Throssell & Forrest Sts. Kalgoorlie 6430, (090) 21 1766: Round Dam, West Black Flag.
- Mining Corporation of Australia Ltd, 32 Lane St, Kalgoorlie 6430, (090) 21 5144: Mt Pleasant-Golden Kilometre.
- Mt Edon Gold Mines (Aust) NL, 30 Ledger Rd, Balcatta 6021, (09) 345 1588: Tarmoola-King Of The Hills.
- Mt Burgess Gold Mining Co NL, 533 Hay St Perth 6000, (09) 221 1777, Butcher Well - Yundamindera.
- Newcrest Mining Ltd, 179 Gt Eastern Hwy, Belmont 6401, (09) 270 7070: New Celebration, Ora Banda, Orban JV, Telfer.
- North Broken Hill-Peko Ltd, 476 St Kilda Rd, Melbourne Vic 3004, (03) 829 0000: Peak Hill.
- Orion Resources NL, 42 Ardross St, Applecross 6153, (09) 364 8355: Burbidge-Great Victoria, Yilgarn Star.
- Pancontinental Mining Ltd, PO Box 1161, Kalgoorlie 6430, (090) 24 2000: Kundana, Paddington.
- Placer Pacific Ltd, PO Box 33, Laverton WA 6440, (090) 31 3111: Granny Smith.
- Plutonic Resources Ltd, PMB 46 Meekatharra 6642, (09) 370 8201: Darlot, Lawlers, Plutonic, Sir Samuel-Bellevue.
- Poseidon Gold Ltd, 100 Hutt St, Adelaide S.A., (08) 303 1700: Big Bell, Golden Crown, Kaltails.
- Ramsgate Resources Ltd, 229 Stirling Highway, Claremont 6010, (09) 383 4321: Grace Darling, Mt Monger-Randalls.
- Resolute Resources Ltd, 28 The Esplanade, Perth 6000, (09) 321 4011: Marymia Hill.
- Reynolds Australia Metals Ltd, 28 The Esplanade, Perth 6000, (09) 322 2313: Cornishman, Frances Furness, Marvel Loch-Southern Cross, Mt Gibson.
- Samantha Gold NL, 28 The Esplanade, Perth 6000, (09) 481 5288: Glendower, Higginsville, Hopes Hill-Corinthia.
- St Barbara Mines Ltd, Gt Northern Highway, Meekatharra 6642, (099) 81 8111: Bluebird.
- Sons of Gwalia NL, 16 Parliament Pl, West Perth 6005, (09) 481 1988: Barnicoat, Sons of Gwalia.
- Western Mining Corp. Ltd, 191 Great Eastern Hwy, Belmont 6104, (09) 479 0711: Emu-Leinster, Hill 50-Mt Magnet, Kambalda-St Ives, Lancefield.
- Westgold Resources NL, 108 St Georges' Tce, Perth 6000, (09) 324 2877: Tuckabianna.
- Wiluna Mines Ltd, 10 Ord St West Perth 6005, (09) 481 2050: Jundee, Wiluna.
- Worsley Alumina Pty Ltd, PO Box 48, Boddington 6390, (098) 83 8260: Boddington.

GYPSUM

- H.B. Brady & Co. Pty Ltd, PO Box 42, Bayswater 6053, (09) 279 4422: Lake Brown.
- Lake Hillman Mining Pty Ltd, Kalannie 6468, (096) 66 2045: Lake Hillman.
- Swan Portland Cement Ltd, Burswood Rd, Rivervale 6103, (09) 361 8822: Lake Hillman.
- Westdeen Holdings Pty Ltd, 7 Armstrong Rd, Applecross 6153, (09) 364 4951: Lake Cowcowing.

HEAVY MINERAL SANDS**Garnet Sand**

- Target Minerals NL, PO Box 188, Geraldton 6530, (099) 23 3644: Port Gregory.

Ilmenite, Rutile, Zircon, Leucoxene & Monazite

- Cable Sands (WA) Pty Ltd, PO Box 133, Bunbury 6230, (097) 21 4111: Capel.
- RGC Mineral Sands, PO Box 62, Geraldton 6530, (090) 64 2245: Capel, Eneabba North, Eneabba West
- TiWest Pty Ltd, 1 Brodie Hall Dve, Bentley 6102, (09) 365 1390: Cooljarloo.
- Westralian Sands Ltd, PO Box 96, Capel 6271, (097) 27 2002: Yoganup.

8.1 PRINCIPAL MINERAL & PETROLEUM PRODUCERS 1993-94, address, telephone number: minesite.**INDUSTRIAL PEGMATITE MINERALS****Felspar**

Commercial Minerals Ltd, 26 Tomlinson Rd, Welshpool 6106, (09) 362 1411: Mukinbudin, Pippingarra.

IRON ORE

BHP Iron Ore (Goldsworthy) Ltd, 200 St George's Tce, Perth 6000, (09) 320 4444: Shay Gap.

BHP Iron Ore (Jimblebar) Ltd, 200 St George's Tce, Perth 6000, (09) 320 4444: McCamey's.

BHP Iron Ore Ltd, 200 St George's Tce, Perth 6000, (09) 320 4444: Newman, Yandicoogina.

BHP Minerals Ltd, P.O Koolan Island 6733, (091) 910 575: Koolan Island.

Channar Mining Pty Ltd, 191 St George's Tce, Perth 6000, (09) 327 2327: Channar.

Hammersley Iron Pty Ltd, 152 St George's Tce, Perth 6000, (09) 327 2327: Tom Price, Paraburdoo, Brockman.

Robe River Iron Associates, 12 St George's Tce, Perth 6000, (09) 421 4747: Pannawonica.

LIMESAND - LIMESTONE

Cockburn Cement Ltd, Russell Rd, South Coogee 6166, (09) 411 1000: Cockburn Sound, Coogee.

Limestone Building Blocks Co. Pty Ltd, Hopkins Rd, Carabooda 6033, (09) 407 5005: Nowerup.

Loongana Lime Pty Ltd, PO Box 808, Kalgoorlie 6430, (090) 21 8055: Loongana.

Swan Portland Cement Ltd, Burswood Rd, Rivervale 6103, (09) 361 8822: Wanneroo.

Westdeen Holdings Pty Ltd, 7 Armstrong Rd, Applecross 6153, (09) 364 4951: Dandaragan, Gingin, Irwin, Yanchep.

NICKEL

Outokumpu Australia Pty Ltd, 141 Burswood Rd., Burswood 6100, (09) 472 3144: Forrestania

Western Mining Corp. Ltd, 191 Great Eastern Hwy, Belmont 6104, (09) 478 0711: Blair, Carnilya Hill, Kambalda, Leinster.

PEAT

Peat Resources of Australia Pty Ltd, 665 Welshpool Rd, Wattle Grove 6107, (09) 453 7777: Manjimup.

PETROLEUM

Ampolex Ltd, 250 St George's Tce, Perth 6000, (09) 429 3200: Wandoo

BHP Petroleum Pty Ltd, 221 St Georges Tce, Perth 6000, (09) 426 5600: Griffin

Consolidated Gas Pty Ltd, 174 Hamden Rd, Nedlands 6009, (09) 389 8344: Woodada.

Discovery Petroleum NL, 99 Shepparton Rd, Victoria Park 6100, (09) 470 0400: Mt Horner.

Doral Resources NL, 250 St George's Tce, Perth 6000, (09) 481 5866: Tubridgi.

Hadson Energy Ltd, 35 Ventnor Ave, West Perth 6005, (09) 481 8555: Campbell, Harriet, Rosette, Sinbad & Tanami.

Minora Resources NL, 263 Adelaide Tce, Perth 6000, (09) 325 3188: Blina, Boundary, Lloyd, Sundown, West Terrace.

Sagasco Holdings Ltd, 60 Hindmarsh Sq, Adelaide SA 5000, (08) 235 3737: Beharra Springs.

West Aust. Petroleum Pty Ltd (WAPET), QV1, 250 St Georges Tce, Perth 6000, (09) 263 6000: Barrow Island, Cowle, Crest,

Dongara, Mondara, Roller-Skate, Saladin, Yammaderry.

Western Mining Corp. Ltd, 28 Ventnor Ave, West Perth 6005, (09) 482 2444: Chervil, North Herald, South Pepper, Airlie Island.

Woodside Offshore Pet. Pty Ltd, 1 Adelaide Tce, Perth 6000, (09) 224 4111: Cossak/Wanea, Goodwyn, North Rankin.

8.1 PRINCIPAL MINERAL & PETROLEUM PRODUCERS 1993-94, address, telephone number: minesite.**SALT**

Cargill Australia Ltd, PO Box 420, Port Hedland 6721, (091) 40 1255: Port Hedland.

Dampier Salt (Operations) Pty Ltd, 177A St George's Tce, Perth 6000, (09) 327 2299: Dampier, Lake Macleod.

Shark Bay Salt Joint Venture, 22 Mount St, Perth 6000, (09) 322 4811: Useless Loop.

WA Salt Koolyanobbing Pty Ltd, Cockburn Rd, Hamilton Hill 6163, (09) 430 5495: Lake Deborah East, Pink Lake.

SILICA - SILICA SAND**Silica**

Simoca Operations Pty Ltd, P.O Box 1389, Bunbury 6230, (097) 912 588: Dalaroo.

Silica Sand

ACI Operations Pty Ltd, 35 Baille Rd, Canning Vale 6155, (09) 455 1111: Lake Gngangara.

Amatek Ltd, 1 Newburn Rd, Kewdale 6104, (09) 353 3030: Jandakot, Gngangara.

Boral Resources WA Ltd, 136-138 Gt Eastern Hwy, South Guildford 6055, (09) 279 0000: Jandakot.

The Readymix Group (WA), 75 Canning Hwy, Victoria Park 6100, (09) 472 2000: Jandakot.

Western Mining Corp. Ltd, 191 Great Eastern Hwy, Belmont 6104, (09) 478 0711: Mt Burgess.

TALC

Gwalia Minerals NL, 16 Parliament Pl, West Perth 6005, (09) 481 1988: Mt Seabrook.

Western Mining Corp. Ltd, PO Box 116, Three Springs 6519, (099) 54 5047: Three Springs.

TIN - TANTALUM - LITHIUM**Spodumene**

Lithium Australia Ltd, 16 Parliament Pl, West Perth 6005, (09) 481 1988: Greenbushes.

Tantalite - Tin

Goldrim Mining Australia Ltd, 317 Hunter St, Newcastle NSW 2300, (049) 29 2433: Wodgina.

Greenbushes Ltd, 16 Parliament Place, West Perth 6005, (09) 481 1988: Greenbushes.

Pan West Tantalum Pty Ltd, Gateway, 1 Macquarie Place, Sydney NSW 2000, (02) 256 2000: Wodgina.