

Resource Centre  
Policy Branch  
Dept. of Minerals & Energy



ROYALTIES AND POLICY DEVELOPMENT DIVISION

STATISTICAL DIGEST OF  
MINERAL AND PETROLEUM PRODUCTION  
1991



DEPARTMENT OF  
**MINERALS AND ENERGY**  
WESTERN AUSTRALIA

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DEVELOPMENT DIVISION**

**DEPARTMENT OF MINERALS AND ENERGY  
WESTERN AUSTRALIA**

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**JULY 1992**

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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

### 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 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 the Gold Producers' Association.
(g)	Estimated f.o.t value.
(h)	Estimated f.o.b 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.

### UNITS AND CONVERSION FACTORS

				<u>Conversion factors</u>	
Metric Unit	Symbol	Imperial Unit		Multiply Imperial Unit by	Multiply Metric Unit by
Mass	gram	g	troy (fine) ounce (oz)	31.103522	0.032151
	kilogram	kg	pound (lb)	0.453592	2.204624
	tonne	t	long ton (2,240 lbs)	1.016046	0.984207
	tonne	t	short ton (2,000 lbs)	0.907185	1.102311
Volume	kilolitre	kl	barrel (bbl)	6.28981	0.158987
	kilolitre	kl	cubic metre (m <sup>3</sup> )	1	
Energy	gigajoule	GJ	million million British Thermal units (mmBTu)	1.055072	0.947803

Prefix	kilo (k)	10 <sup>3</sup>	<u>NW Shelf Gas</u>
	mega (M)	10 <sup>6</sup>	
	giga (G)	10 <sup>9</sup>	
	tera (T)	10 <sup>12</sup>	
	peta (P)	10 <sup>15</sup>	

1 TCF = 1082 petajoules  
1 Mt = 54 petajoules



## 1. OVERVIEW

### 1.1 Review of the World Economy

There was little respite from bad economic news for the main industrialised countries during 1991. The recession which largely impacted on the English speaking economies in 1990 has gradually affected the other OECD countries, and even some of the newly industrialised nations. World economic growth remained positive, albeit only marginally so, as output in the Commonwealth of Independent States (CIS) and the majority of the Eastern European nations contracted severely.

It is predicted that 1992 will be a year of consolidation and the emergence of solid growth for the major economies. Driven by pent up consumer demand and a resurgence in export trade activity, expansion should strengthen through 1993.

The US economy, while continuing to be buffeted by poor performances from its industrial sector, did manage to record some modest growth in retail sales, services and a reversal of inventory run-down. Financial and consumer confidence levels remained low, however, as debt levels and widespread unemployment overshadowed progressive interest rate cuts. Money supply increased only marginally during the review period.

Despite pressure from some political quarters to do something dramatic on the domestic economy front, policy makers have continued to opt for lower real interest rates combined with a mild fiscal stimulus to ensure a sustained recovery. At year's end the discount rate stood at 4.5%. Plagued as they are by bad debts, banks are taking a very cautious approach in credit expansion and in evaluating investment proposals. This has been a significant factor in the subdued nature of the recovery, which is predicted to result in the economy growing by 1.5% in 1992.

The slow-down in growth which emerged in

the Japanese economy during the first half of 1991 became more pronounced by year's end. Business investment programs, both domestically and off-shore, and production plans in key industries, such as steel, have generally been revised downwards. To date, the contraction in activity has been relatively mild and primarily caused by a tightening of monetary policy. The policy change was driven by fears over the emergence of inflation during a period of high capacity utilisation. The ongoing revelations of political and financial scandals, added to a collapse in equity and property markets, has not seriously impacted on the real economy. Interest rates were moved downwards during the last half of 1991, with two easings of the discount rate in November and December. Japan is predicted to recover, from what has been a relatively mild down-turn, to be stimulated by a late 1992 upturn in US economic activity.

Germany's Central Bank, the Bundesbank, reported that the economy contracted in the last two quarters of 1991. The slow-down was engineered by that authority sharply raising real interest rates and was in response to emerging inflationary pressures and uneven regional growth. The mixed economic performances of the Western and Eastern parts of the now unified state is placing massive political as well as fiscal pressures on the Federal Government. This pressure is coming during a period of profound structural change and uncertainty in Eastern Europe and the former Soviet Union. It is also a time when Germany is playing a central role in the development of an agenda for the European Community's economic and monetary union.

The overall weak growth, which is expected to continue well into 1992, should dampen inflation and maintain Germany's international competitiveness. This should allow a return to a modest growth rate of around 3% per annum by 1993.

A sound and sustained economic recovery by Germany is crucial to the emergence of France, the United Kingdom and other parts of



Western Europe from a protracted mixed recession, unemployment and relatively low levels of fixed capital investment.

The "strong growth" economies of South Korea, Taiwan and Thailand continued to live up to expectations in 1991 with 7% average rates of GDP increase. Although most are feeling some diminution of export demand as a result of Japan and the other OECD countries downturns, domestic demand and infrastructure spending are continuing to boost economic activity.

Analysts predict that the emergence from what has been a protracted and deep recession for some industrialised countries, and a shallow slow-down for others, will be relatively slow. Growth will strengthen during late 1992 and become more broad-based into 1993. The economic future of the now independent states of the former USSR, and other regions of political, social and ethnic conflict, remains quite uncertain.

## 1.2 Review of the Australian Economy

Following further contractions in real GDP during the first two quarters of 1991, the economy began to show some tentative signs of recovery in the second half of the year. Housing construction, and the sectors providing inputs to the industry, is expected to provide an initial impetus to the domestic economy which will broaden during late 1992 and into 1993.

Government policy makers have, apart from some relatively long term and mild fiscal stimulus packages, tended to rely upon reductions in nominal interest rates and future tax cuts to bring the national economy out of recession. Great emphasis has also been placed on the increased benefits which will flow from the ongoing program of microeconomic reform and improvements in other aspects of the investment environment. Inflation, and inflationary expectations, has been driven down by low wages growth and diminished consumer demand. Overall,

consumer prices rose only by approximately 1.5% during 1991 and, given an expected modest recovery in 1992, should not rebound with an upturn in economic activity.

Despite a general slow-down in international trade, and a marked fall in commodity prices, Australia's trade performance was relatively strong during 1991. Although deficits on the current account have persisted, due primarily to debt servicing, the merchandise trade account has remained in surplus. This has been due to a growth of export volumes, with manufactured goods accounting for much of the growth. Analysts have predicted that the structural changes of the last 5 years will allow the economy to avoid a strong import response from the pick up in demand traditionally associated with the end of a recession. Others point to a significant loss of productive capacity since 1990 which will result in the "normal" rise in imports relative to demand.

The trend towards a sustained lower level of prices growth has allowed the Reserve Bank to reduce nominal interest rates significantly, particularly during the past 12 months. Despite these incremental falls, real rates are relatively high for this stage of the economic cycle.

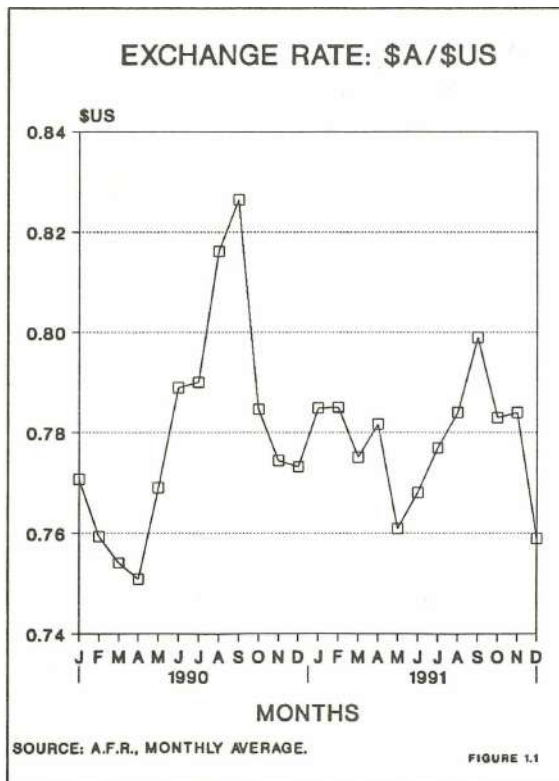
Despite Government initiatives on the fiscal, monetary policy and microeconomic agenda fronts, Australia's emergence from the current recession will be largely circumscribed by developments in the international economy. Some of the developments of 1991 which will determine the future environment for small trading nations like Australia include the slow down and redirection of investment flows, the growth of trade blocks, stalemate in the GATT talks and the relentless erosion in our terms of trade. While rural commodities are generally posting gains, albeit from low bases, minerals and energy prices are proving to be more intractable than usual.



### 1.3 Economic Factors Affecting the Mining Industry

Although the minerals and energy industry posted a relatively strong overall performance in 1991 it was a difficult trading period for most participants. The bulk of the economic determinants of activity, both external and internal, tended to work against the industry during the review period.

The world market prices of most of the major commodities fell during the first half of the year before stabilising and in some cases recovering slightly. Much of the final quarter increases can, however, be ascribed to a fall in Australia's exchange rate which moved from approximately 80 cents US in September to just over 75 cents by year's end (Figure 1.1).



Markets which were mainly in a situation of oversupply at the beginning of 1991 were further buffeted by falls in demand and inappropriate supply responses from some major producer countries. This was particularly the case in the former republics of the USSR where attempts to gain foreign exchange has resulted in large sales of minerals, drawn mainly from stockpiles or strategic reserves,

forcing down prices and adding to market uncertainty.

Uncertainty over the world economy and over the longer time frame associated with minerals and energy investments has, during the current recession, worked to reduce capital formation. The recession induced redirection of investment flows and the marked reduction in the availability of equity funding has particularly impacted on exploration companies and the small to medium sized mining companies.

The medium term outlook for the minerals and energy industry in terms of economic fundamentals is cautiously optimistic. There is widespread agreement that commodity prices have, in most sectors, begun a gradual recovery. Investment in a range of large projects is either committed or at advanced feasibility stage. In Western Australia such investment is strong in the petroleum, iron ore and nickel sectors. The economy looks set to experience a sustained period of low inflation, not rising above 3% per annum before the end of 1993. This will allow progressively lower real interest rates, with positive effects on investment growth and on business confidence. The National Australia Bank's business confidence index actually turned positive in the December quarter 1991 after a period of pronounced negatives which stretched back to January 1990. Finally a relatively slow, but steady, growth in commodity prices and low real interest rates should keep the \$A trading in a range around 75 cents US.

The trying economic environment in which the minerals and energy industry operated in during 1991 was complemented by a range of developments in the social and political landscape.

### 1.4 Social and Political Factors Affecting the Mining Industry

The perennial issues of land access, the interpretation of the Aboriginal Heritage Act



and the extent of environmental legislation loomed large for the industry during much of 1991. The broad embracing by the States of the Federal government's microeconomic reform agenda generally bodes well for the longer term prospects of the industry.

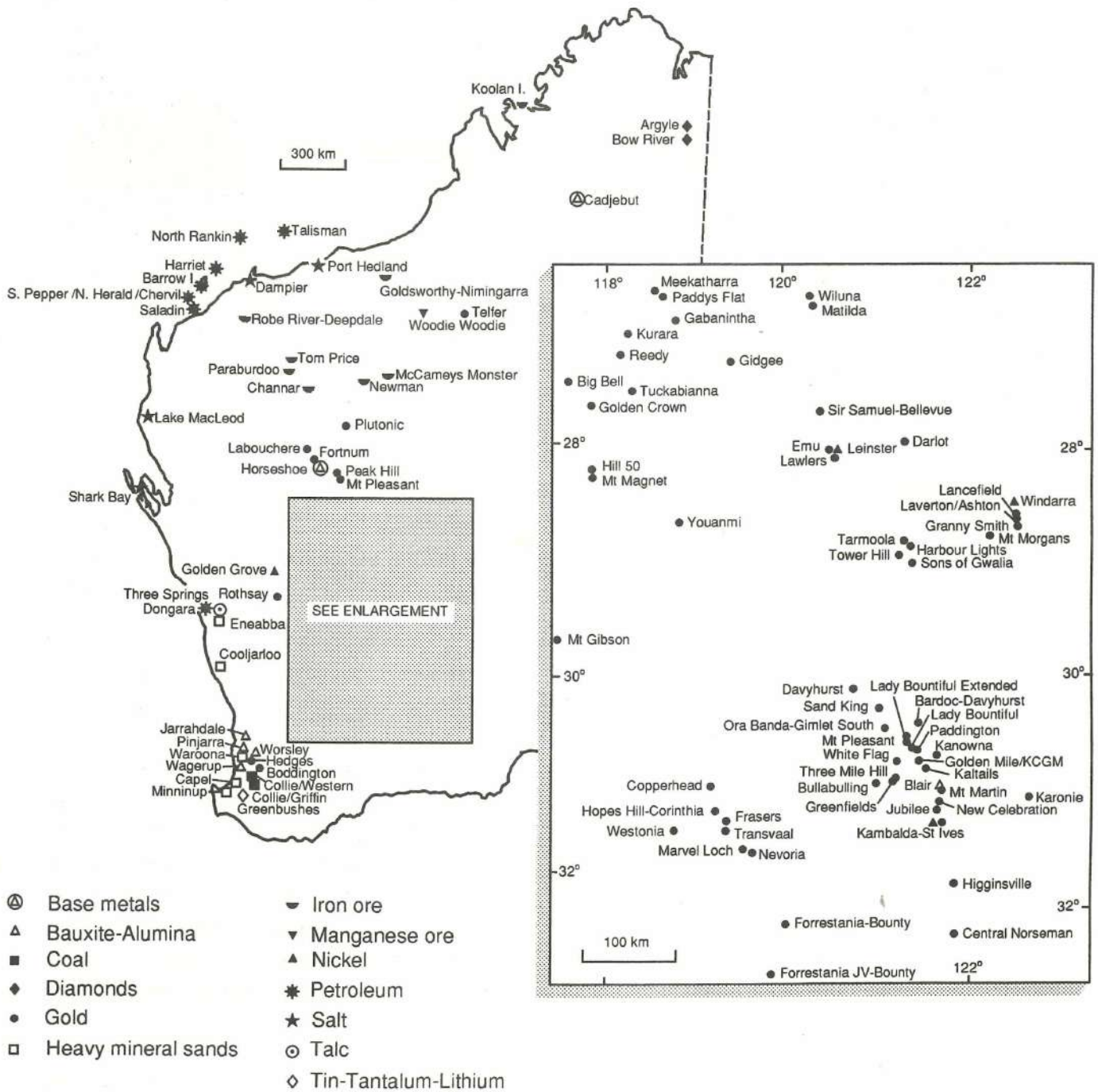
A major issue which seems set to emerge during the medium term concerns the land claim and pressure from the Wilderness Society to have large tracts of the Kimberley declared a wilderness zone. In this there are clear implications for the mining industry which concern sovereignty and lack of access.

A relatively recent Chamber of Mines and Energy initiative which deals with Aboriginal employment programmes, will have long term positive impacts on the community perception of the industry. The Chamber has developed a guide which provides information for companies that are involved in establishing training and employment programmes for the benefit of local Aboriginal communities. This is in line with a growing expectation in the wider community that mining companies accept some responsibility for their local community.

FIGURE 1.2

## MAJOR MINERAL AND PETROLEUM PROJECTS IN WESTERN AUSTRALIA

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



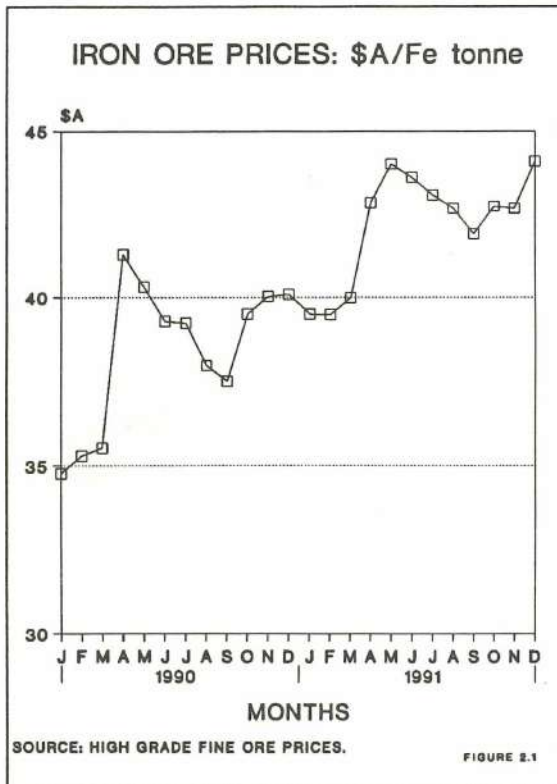


**2. REVIEW OF MAJOR MINERALS AND PETROLEUM**

**2.1 IRON ORE**

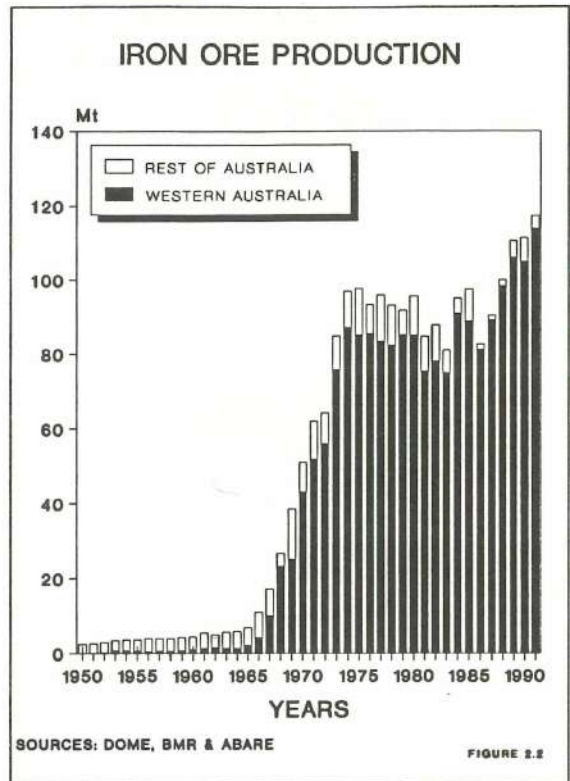
Western Australian production for domestic and export markets was approximately 114 million tonnes (Mt) in 1991, an all time record. This represented a 10% increase for the year. Total value of production rose by more than 22% to nearly \$2.98 billion.

As a direct effect of the world recession, the rate of demand growth for iron ore has decreased. The slippage in demand has been ameliorated to some extent by the long term contracts which are a feature of the State industry. While the State's producers were able to negotiate a nominal price rise for all ore contracted for delivery in 1991 (Figure 2.1), a fall in prices is scheduled to apply to sales in the Japanese 1992 fiscal year.



While Western Australian sales remain primarily underwritten by Japan's steel mills, most demand growth is coming from the buoyant Chinese, South Korean and Taiwanese markets. Despite a structural contraction in Japanese steel production, that

country remained Western Australia's major market taking 47% of all output (Figure 2.2).



As long term participants in the industry, the major Western Australian based iron ore companies are developing investment profiles which will allow production growth well into the next century.

BHP was able to commission its Yandicoogina iron ore project ahead of schedule in December 1991. The development is expected to deliver 5 million tonnes per annum (Mtpa) initially from a measured resource of 320 Mt. The company has also recently announced a \$240 million upgrading of its Port Hedland handling facilities. Hamersley Iron, which produced a record 50 Mt from its Pilbara operations in 1991, is on schedule to bringing the new \$50 million Brockman No.2 detritals project on line in May 1992.

Stage II of Hancock Mining's McCameys project commenced in July and was able to produce over 1.75 Mt of ore by year's end. The project has the capacity to produce 3 Mtpa. The giant Marandoo project is, despite some delays in the approval process, on schedule to commence construction in 1992.



This potential growth would further enhance the State's position of dominating the national output of iron ore, while contributing economically to the State's infrastructure and recovery.

A Western Australian steel task-force has concluded that with new technology, abundant coal reserves and extremely favourable overseas markets, the State has the potential for a major sustainable iron and steel industry. With these essential elements in place, it is feasible that in the near future we could see the construction of one or more steel mills with Western Australia establishing itself as an important supplier of steel products to Asia.

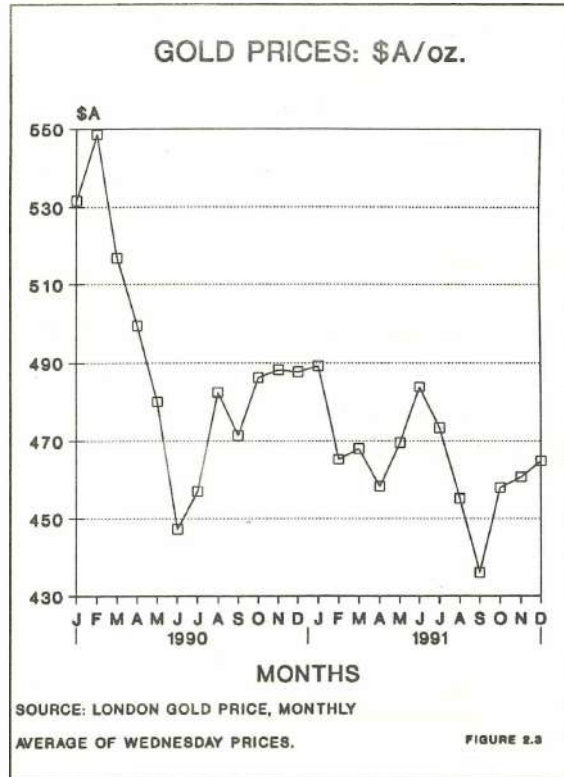
## 2.2 GOLD

Western Australian production rose marginally to nearly 179 tonnes in 1991. The value of this production was estimated at approximately \$2.67 billion, a small decrease on the record 1990 receipts. The slight rise in output was generally welcomed as a better than expected result, especially considering the economic environment in which the industry is currently operating with a relatively low price for the metal and a higher real cost of capital. 1991 was also the first full year in which company taxation was applied to profits from gold mining.

The average world market price during the trading period was \$480 per ounce, a slight fall on the 1990 average (Figure 2.3). The general unavailability of equity funding continued to force many of the smaller companies into a dependence on bank finance or other borrowing mechanisms. These structural factors have combined to ensure that the strong growth of the late 1980's will not be repeated in the first half of the present decade.

While the current recession is being manifested in the gold industry through sharply reduced profit margins and a general increase in merger activity, there has been no appreciable rise in the rate of mine closures. Australian companies are employing a broad

strategy of cost reduction through increasing their scale of operations. There is also a strong trend in seeking opportunities abroad through the export of expertise and the development of new mining ventures.



The gold industry is in a period of consolidation and restructuring with the emergence of new mining houses expected to continue. It is reasoned that these bigger operations will be better able to meet the needs of cost reductions, exploration programs and general operating efficiencies.

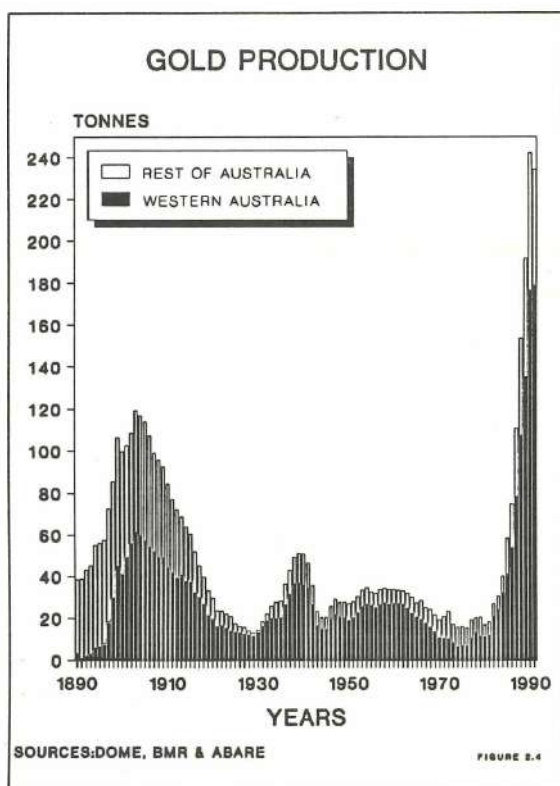
The limited response of the gold price to the Gulf War and its aftermath has confirmed the current view of many analysts that gold no longer fills its traditional role. That tradition being as a store of value and hedge against financial and political uncertainty. Longer-term investors are unlikely to return to the market in sufficient numbers to overcome the heavy selling pressure which has dampened most recent price rallies.

Despite the current period of malaise there are some good indications that market fundamentals may be turning in favour of the gold mining industry in the medium term.



On the supply side, world production from all sources is in a period of decline, a marked reversal of the trend which was sustained during most of the 1980's. Not only is production from South Africa predicted to contract slightly, but so too is output from the Commonwealth of Independent States. The threat of a huge supply overhang from the latter has also been largely eliminated as the extent of reserves have become known. Significant gold sales by central banks are not expected to be a feature of the market in the near future.

Total gold exports from Australia, sourced mainly from Western Australia production (Figure 2.4) is expected by ABARE to rise to over 260 tonnes during 1992.



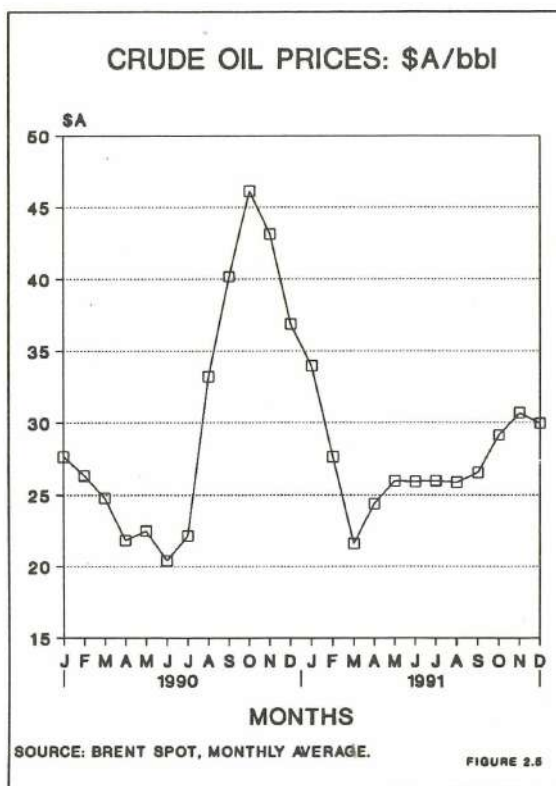
Demand from jewellery fabricators and promotional activity by producer associations is forecast to increase tonnage requirements by 5% in 1992 and onwards. 1991 demand in the area was fairly flat, though welcomed when the dampening effects of the recession are considered. The incipient economic recovery in the United States is expected to spur demand, and when added to the structural improvements is forecast to result in

a small price increase during 1992.

### 2.3 PETROLEUM

In 1991 the Western Australian sector reported a moderate increase in output for all products marketed and a strong overall value of production performance. The value of all sector products was in excess of \$2.5 billion, a 14% increase for the year.

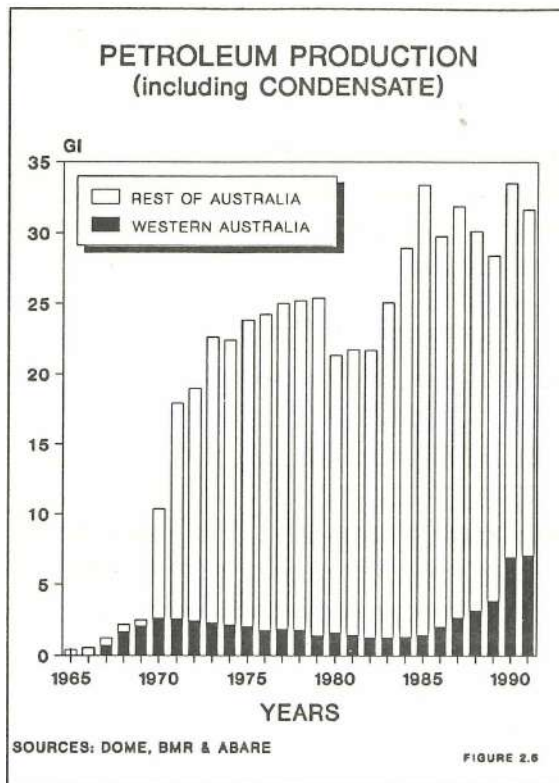
Condensate and crude oil receipts were down on the 1990 result, principally because of the absence of any price spike similar to that which occurred due to the onset of the Gulf crisis. The average crude oil price for the trading period was around \$25 per barrel (Figure 2.5).



Though there was little price growth, production of both crude and condensate increased marginally. Crude rose to just over 5.2 million kilolitres and condensate to nearly 1.9 million kilolitres (Figure 2.6).

The price of crude is not expected to recover significantly in the short term, although demand in the OECD countries should firm considerably during 1992 and into 1993.





Increased consumption is expected to be offset by Persian Gulf suppliers raising production rates and by the re-entry of Iraq and Kuwait into the market. Non-OPEC supply fell slightly in 1991, and is predicted to contract further in 1992, due mainly to industrial and technical problems in the Commonwealth of Independent States.

The domestic consumption of natural gas rose marginally while LNG sales continued to boom. Output increased by over 25% and the value of receipts from sales to Japanese utilities surged by nearly 90 percent to \$960 million. Earnings in 1992 are expected to well exceed \$1.0 billion. The construction of an eighth LNG carrier, scheduled for delivery in December 1994 at a cost of \$250 million, will allow exports to rise by 1 Mt above the project's design capacity of 6 Mt a year.

ABARE believes opportunities exist for Western Australian producers to expand involvement in the Asia-Pacific LNG trade and increase the State's share of production from its current level of 10% to around 25% by the first half of the next decade.

Despite a predicted steady price for crude, the Western Australian industry should continue to

record a strong rate of growth through the present decade. This is because net returns on investment are good, due to a sound fiscal and regulatory environment, and the demand for the local product is strong. Our light, low sulphur crude oil is attracting a premium on average world prices because demand for lighter quality oils is growing faster than the demand for heavier oils.

Projects in which development commenced during 1991 included Hadson Energy's gas gathering system, to take production from the Harriet, Sinbad, Campbell and Rosette fields. This pioneering gas gathering project will come on stream during 1992.

Woodside has commenced appraisal drilling for and implementation of the \$300 million Cossack oil project with production expected to commence in mid 1993. It is proposing to develop the Wanea field adjacent to Cossack in the off-shore Carnarvon Basin within 5 years.

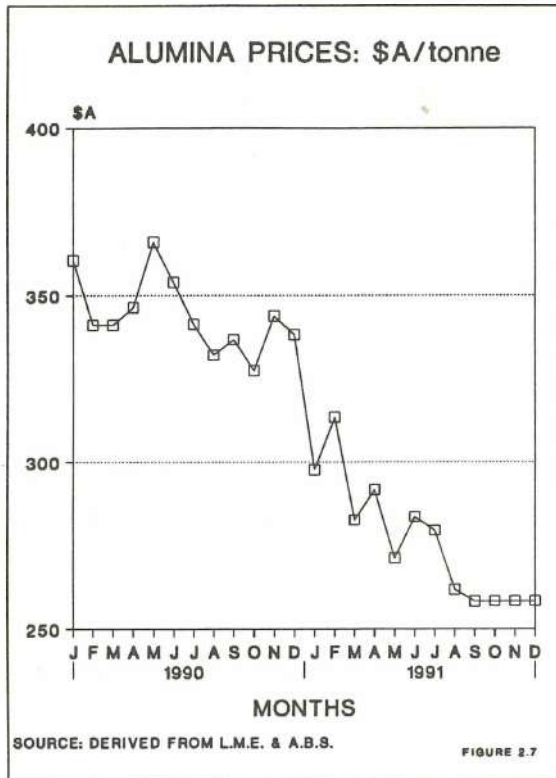
#### 2.4 ALUMINA

Annual State production of alumina increased by 287,000 tonnes to 7 Mt during 1991. This represented a 4% overall rise on total output for 1990.

Total value of production continued to be depressed by a steady deterioration in price. Receipts to Western Australia's producers fell by 22% to \$1.8 billion. During the review period the alumina price tested historic lows (Figure 2.7), while some stability returned to the market during the last quarter.

As the world's primary aluminium market is still being affected by a supply overhang, a sustained increase in demand from the principal consuming sectors of the main industrialised nations is a prerequisite to any price recovery. Consumption growth in the United States, Germany and Japan, while faltering at present, is hoped to start recovering by late 1992.





As the current recession has been quite deep and prolonged, and given the structural lag between aluminium and alumina markets, a price recovery for alumina is still some way off. It is expected that a recovery of demand will be based on stronger economic growth in the key sectors of construction, automobiles and packaging through late 1992 and 1993.

Despite the current poor market price the Western Australian industry continues to expand. With the completion of its \$300 million expansion at Wagerup in 1992, Alcoa will have an annual production capacity of 6.2 Mtpa. The company will have the resources and capacity to supply about 20% of the world's alumina market.

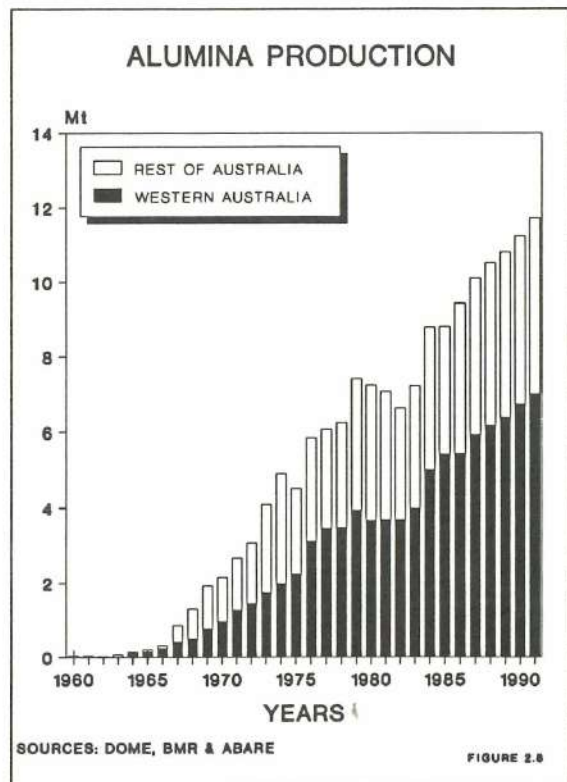
Alcoa also has under consideration the progressive conversion of capacity at its Kwinana refinery to allow production of chemical grade hydrated alumina to be raised from 260,000 tonnes per annum (tpa) to 800,000 tpa.

Worsley completed an 18 month program to expand and debottleneck its refinery in late 1991. This involved an \$108 million capital investment and has resulted in a 200,000

tonne increase in output during the calendar year.

The company has commenced a feasibility study into further expanding output from 1.5 Mtpa to 2.25 Mtpa. The capital cost of the extra capacity would be in the region of \$500 million.

Both Alcoa and Worsley are factoring in the ability to satisfy expanding spot markets in their future capacity expansions. Western Australia's cost efficient producers continue to contribute a significant proportion of the national output (Figure 2.8). With large low cost, modern operations and adequate capacity in place they are well placed to increase output, and in turn net receipts, in the medium to longer term.



## 2.5 NICKEL

During 1991 Western Australian mines produced ores containing approximately 56,000 tonnes of nickel. This was exported either as matte or as fully refined metal. The value of concentrates and ore produced was close to \$570 million. Total value of production by the nickel sector; which includes the cobalt,



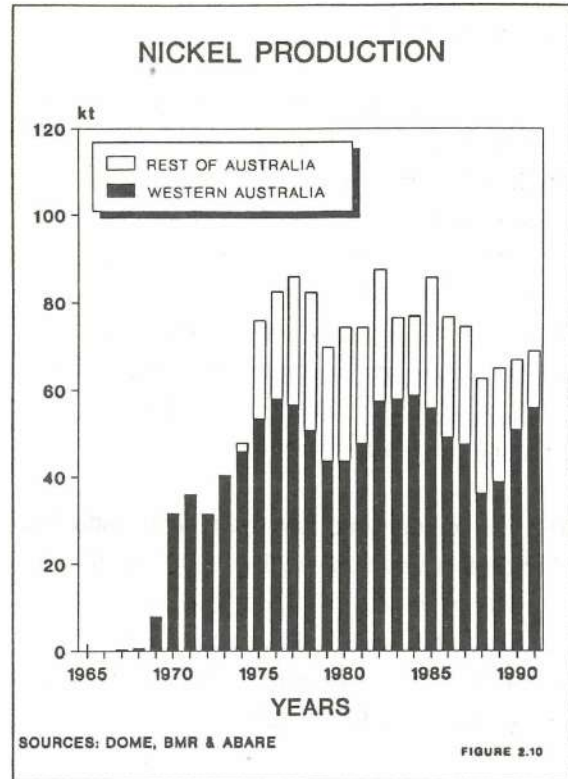
palladium and platinum by-products of mining; was approximately \$578 million. Despite a steady fall in nickel prices during the 1991 trading period (Figure 2.9) the State's industry registered a small upturn in production and in the overall value of that production.



In a generally difficult trading period nickel demand has remained sensitive to the fortunes of the industrial nation's construction and automotive sectors. As the world economy has failed to rebound from widespread recession the consumption of stainless steel has also faltered (Figure 2.10).

In the longer term, existing producers and potential market entrants are actively considering further investment because they recognise that the nickel industry will recover, and recover strongly, with any upturn in demand. The structural factors of a market, characterised as it is by low inventory levels and long lead times between development and delivery time, provides opportunities for the careful investor.

Western Mining Corporation (WMC) is conditionally committed to nearly \$350 million in new investment over the next several years.



This will involve a significant upgrade of the company's Kwinana nickel smelter and a capacity increase for the Kalgoorlie operation to raise matte output to 65,000 tpa contained nickel. Concentrate output from the Leinster project will double as a result of the \$200 million plant investment.

Detailed feasibility studies are also progressing for the giant Yakabindie and Mount Keith projects. Commitment by Dominion Mining is expected in late 1992 for a \$350 million development at Yakabindie. The company plans to produce over 120,000 tpa of 20% nickel concentrate through a calcining process.

Considerable interest is being shown in progressing the \$360 million Mount Keith project to development stage. The mine and processing plan being considered will result in the production of 150,000 tpa of 20% nickel concentrate.

New developments and significant upgrades will allow Western Australia to maintain, and possibly increase, its share of the aggregate national production (Figure 2.10).



## 2.6 DIAMONDS

Western Australia continues to supply more than a third of the world's rough diamonds marketed each year. In 1991 the State's diamond miners, Argyle & Bow River, sold a total of 33.4 million carats of diamonds. This relatively small increase of 2.12 million carats over the 1990 output was admirable in a difficult trading environment. The total value of sales was \$456 million, a \$27 million or 6% increase on 1990.

The world demand for gem and industrial diamonds remained weak in 1991 with sales remaining sensitive to the rate of economic growth in the industrialized economies. Rough diamond sales, a general indicator of market buoyancy fell by 6% in 1991.

The Central Selling Organisation (CSO) which markets around 80% of world rough diamond production, reported that sales were flat in the first half of 1991 and suffered a further decline in the second half of the year. The De Beers group was forced to increase its diamond stocks in 1991 to their highest level in 10 years due to a slump in the world diamond market. Inventories rose by approximately A\$462 million to over A\$4.00 billion as pressure was placed on operating profits. London analysts reported that diamond margins shrunk from 22% to approximately 20% in 1991 due to tough trading conditions.

The CSO moved to restrict supply, where possible, in order to maintain a stable market. Prices have not increased since March 1990 and the CSO is not considering any increase in 1992.

Argyle's production performance has been sustained by maintaining output levels in the face of declining grades. Output for the year was also effected by unusually heavy rains which delayed production during the first quarter. During 1991 the project which covers both hard rock and the current expansion into the exploitation of alluvial deposits processed a near-record 35 Mt of ore.

The 5 year marketing contract between the Argyle Diamond Mines Joint Venture and the CSO was renewed during the June Quarter 1991. Two of the keys to the new CSO contract relate to the further processing of gems and the enhanced marketing of the 'champagne' and 'cognac' style diamonds. Argyle's strong program of development work is continuing alongside routine production.

These developments go some considerable way towards ensuring that Western Australia's position as an important diamond centre is further enhanced.

Argyle Diamond's announcement that it has opened a diamond cutting and polishing factory in China as part of its commitment to downstream processing, bodes well for expansion into a vast new export market.

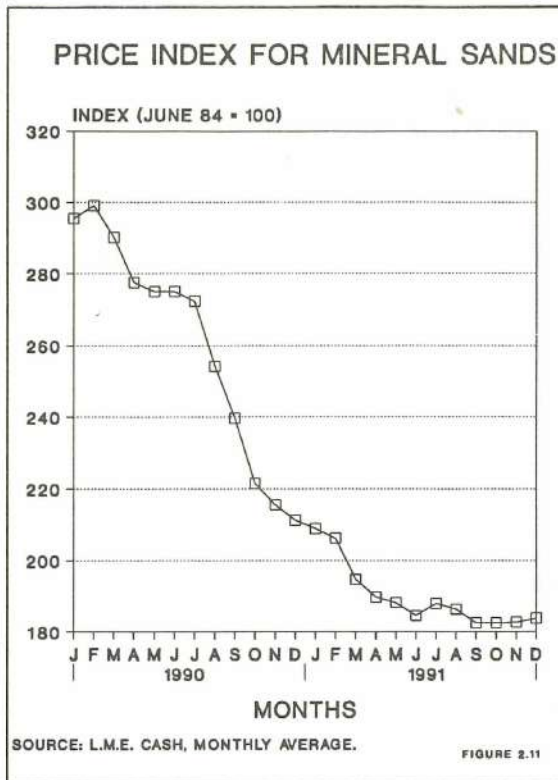
## 2.7 HEAVY MINERAL SANDS

During 1991 the State's extensive heavy mineral sands industry came under severe pressure from the weak demand and stagnant prices which continued to characterise world markets.

The total value of all reported industry output was approximately \$397 million. This represented a marginal fall of 4% on the sector's 1990 receipts. The expansion of capacity to upgrade ilmenite, and thereby market synthetic rutile, has resulted in some considerable growth in the production and total value of the product in 1991. The price of synthetic rutile has, however, fallen considerably during the trading period, a fate shared by the other main titanium dioxide bearing mineral sands products (Figure 2.11).

Tonnages sold and receipts from zircon, rutile, ilmenite, monazite and leucoxene have all dropped precipitously during one of the State industry's toughest years for more than a decade.





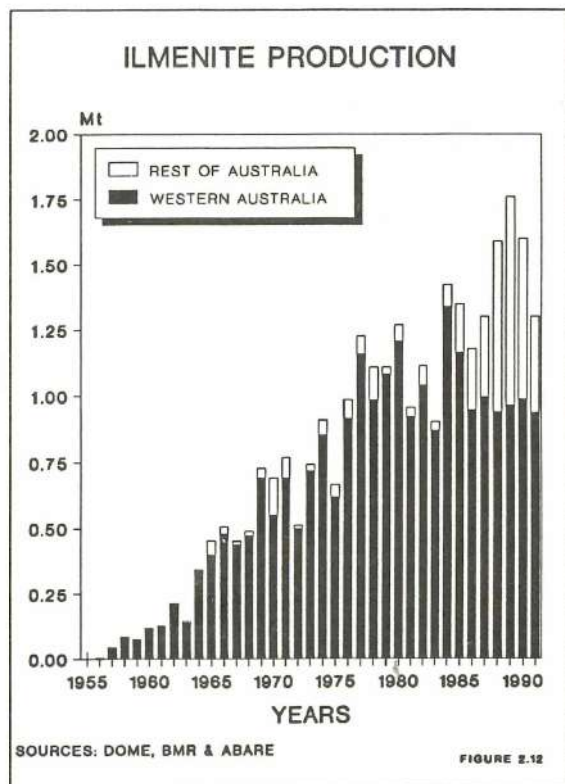
Producers continue to be affected by a market which is both extremely sensitive to general economic conditions and subject to a serious supply overhang. Excess capacity for all mineral sands products and the availability of relatively cheap substitutes, particularly for zircon, will tend to constrain the price increases which should flow from a general increase of demand in late 1992. Therefore, while ilmenite prices are now fairly stable, there may be some further erosion in the values of rutile or zircon before those products begin to recover.

While prices will be slow to respond, a forecast rise in demand for titanium dioxide pigment should, over the medium term, result in production increases. Synthetic rutile output will grow strongly reflecting an increasing preference for titanium dioxide pigment production via the chloride process. The continued diversification of the heavy mineral sands industry into downstream processing will work to insulate the industry from the worst of future market downturns.

Western Australian producers will have to depend on increased export volumes of further processed products to lift the total value of

exports in 1992 and into 1993. Capacity expansions already in the pipeline will result in a growth in ilmenite production of 45% by 1994.

Despite the prevailing low prices the planned Jangardup and Beenup projects are steadily progressing to the development stage. Both mines are due to come on stream in 1994 with annual capacities of 200,000 tonnes of ilmenite and 60,000 tonnes of zircon (Jangardup) and 500,000 of ilmenite and 27,000 tonnes of zircon (Beenup). Western Australian producers should continue, even in the face of the current downturn, to dominate national production into the 1990's (Figure 2.12). Heavy mineral sands producers which are associated with pigment producers will be best placed to gain from the market upturn as it begins to emerge.



## 2.8 SUMMARY AND OUTLOOK

1991 was a difficult trading year for the Western Australian minerals and energy industry. Economic recession has reduced consumption of raw material inputs and translated into stagnant or falling prices for most metals and minerals.

The State's minerals and petroleum producers posted a minimal improvement (2.3%) for a total value of production of \$12 billion in 1991. This subdued result comes at a time when there is uncertainty prevailing in the international trading environment due to a world-wide recession.

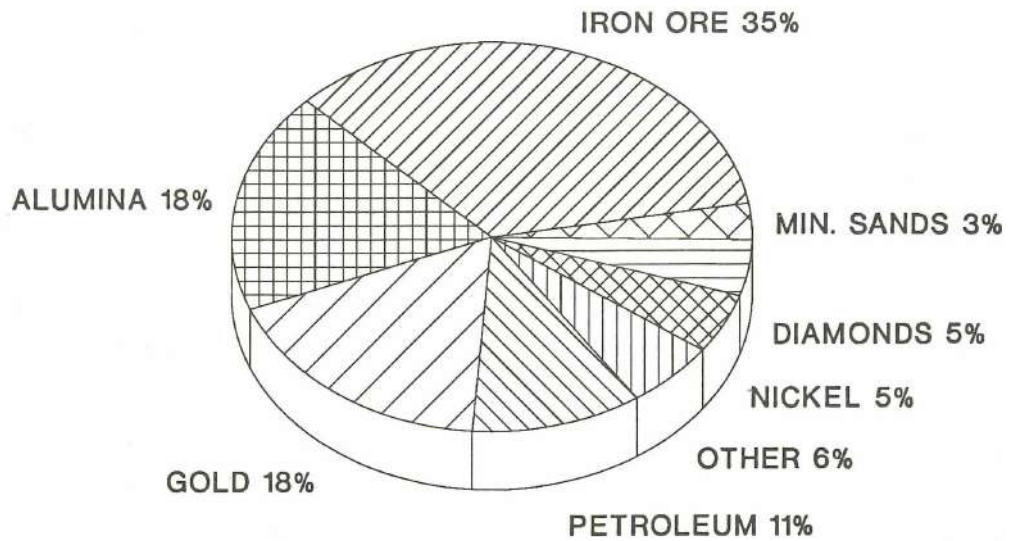
Iron ore and petroleum dominated the State's resources output during the trading period with export receipts from these sectors at about \$5.5 billion. This is set to increase significantly during the 1990's as the North West Shelf production dominates national output. Diversification of demand for iron ore to China, South Korea, Taiwan and Europe are offsetting any slight contraction from Japan.

Relatively small increases in output were recorded for alumina, nickel and diamonds. With a fall in world prices, heavy mineral sands and gold production fell.

At the end of the year the outlook remained gloomy with the majority of sectors anticipating a year in which the demand, and hence prices, would be low and varied.



**COMPARATIVE VALUE OF PRODUCTION**  
**1986 VALUE OF PRODUCTION**  
**TOTAL : \$5,486 MILLION**



**1991 VALUE OF PRODUCTION**  
**TOTAL: \$12,070 MILLION (est)**

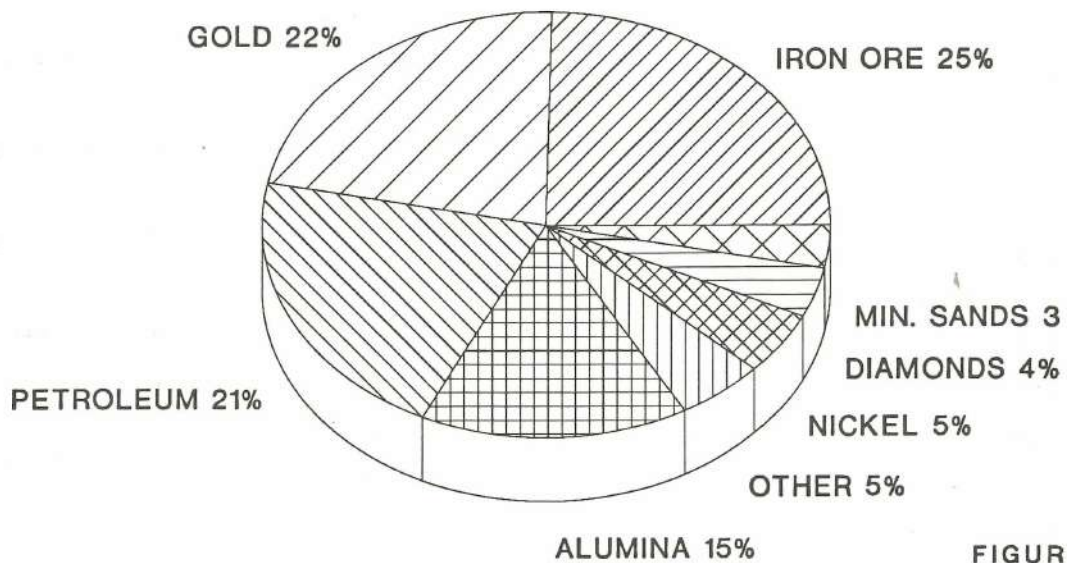


FIGURE 1.2



TABLE 3.1

## QUANTITY AND VALUE OF MINERALS AND PETROLEUM 1990, 1991

MINERAL	UNIT	1990		1991	
		QUANTITY	VALUE(\$A)	QUANTITY	VALUE(\$A)
BARYTES	t	7 521	1 006 603	0	0
BASE METALS					
Copper	t	14 959	22 547 870	11 793	17 918 620
Lead	t	13 606	7 176 456	10 698	4 348 109
Zinc	t	51 704 (r)	61 546 194	112 015	94 691 818
TOTAL BASE METALS			91 270 520		116 958 547
BAUXITE-ALUMINA					
Alumina	t	6 722 292	2 358 954 531	7 009 184	1 844 032 647
CLAYS					
Attapulgit	t	27 985	5 062 003	17 245	4 617 226
Cement Clay	t	11 020	27 550	32 795	234 039
Fire Clay	t	234 367	457 335	0	0
Kaolin	t	7 701	472 291	3 100	204 400
White Clay	t	171 401 (r)	1 853 010 (r)	14 611	160 718
TOTAL CLAYS			7 872 189		5 216 383
COAL	t	4 831 172	214 253 964	5 114 267	228 561 597
CONSTRUCTION MATERIALS					
Aggregate	t	78 303	300 542	133 683	719 267
Gravel	t	32 471	162 435	47 361	244 227
Rock	t	84 595	701 259	44 485	469 114
Sand	t	563 731	2 489 603	781 380	4 120 889
TOTAL CONSTRUCTION MATERIALS			3 653 839		5 553 497
DIAMOND	ct	31 182 964	429 928 200	33 354 537	456 926 660
DIATOMITE	t	0	0	22	160
DIMENSION STONE					
Black Granite	t	748	824 801	1 086	399 869
Quartz Rock	t	678	30 445	362	16 266
Spongolite	t	1 541	119 489	437	35 834
TOTAL DIMENSION STONE			974 735		451 969
GEM SEMI-PRECIOUS & ORNAMENTAL STONE					
Amethyst	kg	2 194	3 291	24 617	131 426
Chrysoprase	kg	0	0	1 800	32 500
TOTAL GEM SEMI-PRECIOUS & ORNAMENTAL STONE			3 291		163 926

MINERAL	UNIT	1990		1991	
		QUANTITY	VALUE(\$A)	QUANTITY	VALUE(\$A)
GOLD	kg	176 347 (r)	2 793 999 787 (r)	178 960 (e)	2 666 335 059 (e)
GYPSUM	t	146 811	1 061 190	75 750	635 499
HEAVY MINERAL SANDS					
Garnet	t	23 367	1 535 315	30 732	2 880 905
Ilmenite	t	988 251	86 203 153	936 778	81 499 514
Upgraded Ilmenite (a)	t	249 265	120 772 694	358 478	183 487 767
Leucoxene	t	20 839	11 511 265	12 944	8 064 715
Monazite	t	10 514	7 831 157	7 173	2 155 801
Rutile	t	76 065	57 906 645	59 134	39 661 379
Zircon	t	224 461	126 677 148	204 332	79 156 923
TOTAL HEAVY MINERAL SANDS			412 437 377		396 907 004
INDUSTRIAL PEGMATITE MINERALS					
Felspar	t	31 774	1 317 361	17 499	715 084
Mica	t	1 971	105 241	473	14 839
TOTAL INDUSTRIAL PEGMATITE MINERALS			1 422 602		729 923
IRON ORE					
Domestic	t	4 772 519	111 147 853	4 773 385	128 740 105
Exported	t	99 079 566	2 315 663 115	109 394 339	2 851 031 788
TOTAL IRON ORE		103 852 085	2 426 810 968	114 167 724	2 979 771 893
LIMESAND-LIMESTONE-DOLOMITE					
Dolomite	t	333	6 660	0	0
Limesand-Limestone	t	1 828 663	10 640 754	901 487	5 370 097
TOTAL LIMESAND-LIMESTONE-DOLOMITE			10 647 414		5 370 097
MANGANESE ORE	t	364 577	57 927 462	209 640	37 774 547
NICKEL INDUSTRY					
Cobalt by-product	t	268	4 264 988	288	6 062 266
Nickel Concentrate	t	486 225	543 077 506	521 511	567 874 813
Nickel Ore	t	28 649	14 892 472	2 318	1 368 276
Palladium by-product	kg	435	1 185 127	351	1 260 296
Platinum by-product	kg	96	1 235 806	633	1 494 173
TOTAL NICKEL INDUSTRY			564 655 899		578 059 824
PEAT	t	861	58 774	403	29 974
PETROLEUM					
Condensate	kl	1 719 444	333 903 937	1 869 768	313 744 896
Crude Oil	kl	5 200 749	1 023 216 415	5 214 637	901 415 578
LNG	MMBtu	153 141 420	508 103 078	204 799 068	957 953 276
Natural Gas	'000m3	3 698 843	366 425 052	3 738 455	372 203 226
TOTAL PETROLEUM			2 231 648 482		2 545 316 976



TABLE 3.1 (cont) MINERAL	UNIT	1990		1991	
		QUANTITY	VALUE(\$A)	QUANTITY	VALUE(\$A)
<b>PIGMENTS</b>					
Red Iron Oxide	t	5 757	110 531	0	0
<b>RARE EARTHS</b>					
Gallium	kg	31 375	1 025 196	0	0
SALT	t	6 123 511	130 774 588	6 827 230	149 355 769
<b>SILICA-SILICA SAND</b>					
Silica	t	69 021	703 953	76 612	782 017
Silica Sand	t	622 557	4 889 760	669 384	6 390 188
TOTAL SILICA-SILICA SAND			5 593 713		7 172 205
SILVER	kg	34 216 (r)	5 621 348	38 099	5 923 329
TALC	t	189 086	14 480 263	165 263	11 568 410
<b>TIN-TANTULUM-LITHIUM</b>					
Spodumene	t	50 576	7 525 463	43 281	7 619 341
Tantalite	t	573	19 216 316	668	18 726 310
Tin	t	212	1 085 179	272	1 268 035
TOTAL TIN-TANTULUM-LITHIUM			27 826 958		27 613 686
VERMICULITE	t	43	7 691	580	103 018
TOTAL VALUE			11 794 028 115 (r)		12 070 532 599 (e)

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

(a) Also known as synthetic rutile

(e) Estimate

(r) Revised from previous edition

TABLE 4.1

## QUANTITY AND VALUE OF MINERALS AND PETROLEUM BY LOCAL GOVERNMENT AREA

Mineral	Local Government Area	Quantity tonnes	Metallic Content	Value (\$)	Ref
<b>BASE METALS</b>			<b>Cu Tonnes</b>		
COPPER BY-PRODUCT	Coolgardie		4 539.948	5 840 246	(a),(b)
COPPER CONCENTRATES	Boddington	2 687	588.000	953 462	
	East Pilbara	12 770	2 661.089	3 605 119	
	Meekatharra	10 539	2 235.327	3 981 163	
	Yalgoo	8 841	1 768.886	3 538 630	
		<u>34 837</u>	7 253.302	12 078 374	(a)
<b>TOTAL COPPER</b>			11 793.250	17 918 620	
			<b>Pb Tonnes</b>		
LEAD	Derby-West Kimberley	14 543	10 697.570	4 348 109	(a)
			<b>Zn Tonnes</b>		
ZINC	Derby-West Kimberley	87 576	43 843.180	39 939 974	
	Yalgoo	162 079	68 171.800	54 751 844	
		<u>249 655</u>	112 014.980	94 691 818	(a)
<b>TOTAL BASE METALS</b>				116 958 547	
<b>BAUXITE - ALUMINA</b>					
ALUMINA	Boddington	1 485 420		418 859 028	
	Harvey	889 994		229 725 793	
	Murray	2 928 152		755 519 552	
	Serpentine-Jarrahdale	<u>1 705 618</u>		439 928 274	
		7 009 184		1 844 032 647	(c)
<b>CLAYS</b>					
ATTAPULGITE	Mullewa	17 245		4 617 226	(a)
CEMENT CLAY	Armadale	32 795		234 039	(d)
KAOLIN	Bridegetown-Greenbushes	3 100		204 400	(d)
WHITE CLAY	Swan	<u>14 611</u>		160 718	(d)
<b>TOTAL CLAYS</b>		67 751		5 216 383	
COAL	Collie	5 114 267		228 561 597	(e)
<b>CONSTRUCTION MATERIALS</b>					
AGGREGATE	Derby-West Kimberley	2 663		14 607	
	Kalgoorlie-Boulder	82 869		451 422	
	Port Hedland	128 530		693 856	
	Wyndham-East Kimberley	<u>2 490</u>		10 804	
		133 683		719 267	



TABLE 4.1 (cont)	Local	Quantity	Metallic	
Mineral	Government Area	tonnes	Content	Value (\$) Ref
<b>CONSTRUCTION MATERIALS (cont)</b>				
GRAVEL	Broome	670		670
	Coolgardie	640		3 320
	Kalamunda	20 051		110 237
	Port Hedland	<u>26 000</u>		<u>130 000</u>
		47 361		244 227
ROCK	Broome	19 013		194 026
	Exmouth	3 699		28 973
	Roebourne	<u>21 773</u>		<u>246 115</u>
		44 485		469 114
SAND	Ashburton	2 604		10 869
	Canning	44 782		166 170
	Collie	19 961		114 465
	Coolgardie	49 736		251 360
	Dandaragan	4 860		28 620
	Derby-West Kimberley	351		2 272
	Gingin	5 871		35 223
	Leonora	3 126		16 596
	Meekatharra	46 903		263 931
	Menzies	1 815		9 075
	Northam	6 998		26 305
	Port Hedland	21 658		114 509
	Roebourne	355 085		1 792 977
	Swan	217 560		1 288 097
	Wyndham	<u>70</u>		<u>420</u>
		781 380		4 120 889
<b>TOTAL CONSTRUCTION MATERIALS</b>				<b>5 553 497 (d)</b>
DIAMOND		Carats		34 944 437
	Wyndham-East Kimberley	33 354 537		456 926 660 (a)
DIATOMITE	Dandaragan	22		160
<b>DIMENSION STONE</b>				
BLACK GRANITE	Derby-West Kimberley	974		360 669
	Dundas	<u>112</u>		<u>39 200</u>
		1 086		399 869 (d)
QUARTZ ROCK	Mukinbudin	362		16 266 (d)

TABLE 4.1 (cont)	Local	Quantity	Metallic	
Mineral	Government Area	tonnes	Content	Value (\$) Ref
DIMENSION STONE (cont)				
SPONGOLITE	Plantagenet	437		35 834 (e)
TOTAL DIMENSION STONE		1 885		451 969
GEM, SEMI-PRECIOUS AND ORNAMENTAL STONE				
AMETHYST	Upper Gascoyne	24 617		131 426
CHRYSOPRASE	Laverton	1 800		32 500
TOTAL GEM SEMI-PRECIOUS AND ORNAMENTAL STONE				163 926 (e)
GOLD				
			Au kg	
	Ashburton		18.437	274 695
	Boddington		19 864.789	295 966 588
	Carnarvon		0.064	950
	Coolgardie		14 255.351	212 391 275
	Cue		9 741.389	145 137 506
	Dundas		2 810.764	41 877 731
	East Pilbara		9 397.440	140 012 979
	Halls Creek		12.591	187 599
	Derby-West Kimberley		43 293.702	645 035 283
	Laverton		15 208.640	226 594 381
	Leonora		15 596.344	232 370 806
	Meekatharra		16 907.984	251 913 004
	Menzies		2 333.218	34 762 748
	Mt Magnet		6 753.349	100 618 522
	Perenjori		619.396	9 228 414
	Roebourne		7.435	110 774
	Sandstone		3 656.695	54 481 309
	Westonia		1 416.392	21 102 907
	Wiluna		4 174.601	62 197 621
	Yalgoo		2 126.630	31 684 780
	Yilgarn		10 764.789	160 385 187
			178 960.000	2 666 335 059 (f)
GYPSUM				
	Dalwallinu	21 252		279 422 (d),(e)
	Esperance	1 248		9 302 (e)
	Irwin	8 242		112 229 (e)
	Kellerberrin	1 243		7 000 (e)
	Lake Grace	6 718		26 872 (e)
	Merredin	408		2 448 (e)



TABLE 4.1 (cont)	Local	Quantity	Metallic		
Mineral	Government Area	tonnes	Content	Value (\$)	Ref
GYPSUM (cont)	Nungarin	22 778		121 761	(e)
	Ravensthorpe	1 018		6 000	(e)
	Wyalkatchem	<u>12 843</u>		<u>70 465</u>	(e)
		75 750		635 499	
HEAVY MINERAL SANDS					
GARNET SAND	Capel	1 464		100 447	(g)
	Northampton	<u>29 268</u>		<u>2 780 458</u>	(e)
		30 732		2 880 905	
ILMENITE			TiO <sub>2</sub> %		
	Capel	508 935	54.61)		
	Carnamah	137 349	58.45)		
	Dandaragan	234 701	63.00)		
	Waroona	<u>55 793</u>	<u>54.27)</u>		
	936 778			81 499 514	
UPGRADED ILMENITE			TiO <sub>2</sub> %		
	Capel	155 364	92.00)		
	Carnamah	102 910	92.00)		
	Dandaragan	<u>100 204</u>	<u>92.00)</u>		
	358 478			183 487 767	
TOTAL ILMENITE		1 295 256		264 987 281	(a)
LEUCOXENE			TiO <sub>2</sub> Tonnes		
	Capel	12 595	11 490	7 894 228	
	Waroona	<u>349</u>	<u>314</u>	<u>170 487</u>	
	12 944	11 804	8 064 715	(a)	
MONAZITE			ThO <sub>2</sub> Units		
	Capel	2 380	18 070	833 689	
	Carnamah	<u>4 793</u>	<u>31 155</u>	<u>1 322 112</u>	
	7 173	49 225	2 155 801	(a)	
RUTILE			TiO <sub>2</sub> Tonnes		
	Carnamah	38 488	35 958	27 611 470	
	Dandaragan	<u>20 646</u>	<u>19 821</u>	<u>12 049 909</u>	
	59 134	55 779	39 661 379	(a)	

TABLE 4.1 (cont)	Local	Quantity	Metallic		
Mineral	Government Area	tonnes	Content	Value (\$)	Ref
HEAVY MINERAL SANDS (cont)			ZrO <sub>2</sub> Tonnes		
ZIRCON	Capel	48 184	31 320	19 014 221	
	Carnamah	115 115	75 112	46 726 851	
	Dandaragan	34 583	22 825	11 657 548	
	Warooka	<u>6 450</u>	<u>4 193</u>	<u>1 758 303</u>	
		204 332	133 450	79 156 923	(a)
TOTAL HEAVY MINERAL SANDS				396 907 004	
INDUSTRIAL PEGMATITE MINERALS					
FELSPAR	Mukinbudin	6 759		292 275	
	Port Hedland	<u>10 740</u>		<u>422 809</u>	
		17 499		715 084	
MICA	East Pilbara	473		14 839	
TOTAL INDUSTRIAL PEGMATITE MINERALS				729 923	(h)
IRON ORE			Fe%		
DOMESTIC ORE	Ashburton	885 296	61.37	23 172 741	
	Derby-West Kimberley	1 089 154	64.40	28 843 548	
	East Pilbara	<u>2 798 935</u>	<u>63.25</u>	<u>76 723 816</u>	
		4 773 385		128 740 105	
EXPORTED ORE	Ashburton	70 824 875	61.21	1 790 860 393	
	Derby-West Kimberley	2 100 395	59.54	50 897 054	
	East Pilbara	<u>36 469 069</u>	<u>63.19</u>	<u>1 009 274 341</u>	
		109 394 339		2 851 031 788	
TOTAL IRON ORE		114 167 724		2 979 771 893	(a)
LIMESAND - LIMESTONE					
	Cockburn	701 000		3 429 500	
	Dandaragan	601		3 005	
	Gingin	18 853		292 183	
	Irwin	8 352		16 775	
	Manjimup	1 612		16 120	
	Roebourne	915		4 891	
	Wanneroo	<u>170 154</u>		<u>1 607 623</u>	
		901 487		5 370 097	(d)
MANGANESE ORE	East Pilbara	209 640		37 774 547	(a)
NICKEL INDUSTRY			Co Tonnes		
COBALT BY-PRODUCT	Coolgardie		287.534	6 062 266	(a),(b)



TABLE 4.1 (cont)	Local	Quantity	Metallic		
Mineral	Government Area	tonnes	Content	Value (\$)	Ref
NICKEL INDUSTRY (cont)			Ni %		
NICKEL CONCENTRATES	Coolgardie	270 133	10.63	294 698 651	
	Kalgoorlie-Boulder	30 364	11.95	36 039 615	
	Laverton	23 508	8.75	21 960 048	
	Leonora	<u>197 506</u>	10.74	<u>215 176 499</u>	
		521 511		567 874 813	
NICKEL ORE	Leonora	2 318	6.38	1 368 276	
TOTAL NICKEL PRODUCTION				569 243 089	(i)
			Pd kg		
PALLADIUM BY-PRODUCT	Coolgardie		351.293	1 260 296	(a),(b)
			Pt kg		
PLATINUM BY-PRODUCT	Coolgardie		632.898	1 494 173	(a),(b)
PEAT	Manjimup	403		29 974	(d)
PETROLEUM		Kilolitres			
CONDENSATE	Carnamah	745		32 747	(d)
	Irwin	931		101 684	(d)
	Roebourne	<u>1 868 092</u>		<u>313 610 465</u>	(a)
		1 869 768		313 744 896	
CRUDE OIL	Derby-West Kimberley	19 669		2 678 199	
	Irwin	33 169		4 512 362	
	Roebourne	<u>5 161 799</u>		<u>894 225 017</u>	
		5 214 637		901 415 578	(a)
LIQUIFIED NATURAL GAS		MMBtu			
	Roebourne	204 799 068		957 953 276	(a)
NATURAL GAS		'000 m3			
	Ashburton	46 793		3 206 091	(j)
	Carnamah	79 542		8 950 176	(j)
	Irwin	102 743		12 524 614	(j)
	Roebourne	<u>3 509 377</u>		<u>347 522 345</u>	(d)
		3 738 455		372 203 226	
TOTAL PETROLEUM PRODUCTS				2 545 316 976	
SALT	Carnarvon	1 261 680		27 416 432	(a)
	Port Hedland	2 202 202		45 777 950	(a)

TABLE 4.1 (cont)	Local	Quantity	Metallic	
Mineral	Government Area	tonnes	Content	Value (\$) Ref
SALT (cont)	Roebourne	2 761 339		61 435 564 (a)
	Shark Bay	546 863		11 586 222 (a)
	Wyalkatchem	373		29 840 (e)
	Yilgarn	<u>54 773</u>		<u>3 109 761</u> (a)
		6 827 230		149 355 769
SILICA - SILICA SAND				
SILICA	Moora	76 612		782 017 (a)
SILICA SAND	Canning	199 824		2 198 064 (a)
	Cockburn	316 820		3 408 516 (a)
	Coolgardie	92 550		226 748 (a)
	Swan	36 812		404 932 (e)
	Wanneroo	<u>23 378</u>		<u>151 928</u> (a)
	TOTAL SILICA - SILICA SAND		745 996	
SILVER: BY-PRODUCT				
		Ag kg		
	Boddington	414.954		56 249 (a),(l)
	Coolgardie	219.499		38 253 (a),(b)
	East Pilbara	207.916		27 379 (a),(l)
	Meekatharra	3 515.932		348 525 (a),(k)
	State-Wide	23 584.522		3 790 960
	Yalgoo	<u>0 570.938</u>		<u>1 661 963</u> (a),(l)
		38 098.807		5 923 329
TALC	Three Springs	165 263		11 568 410 (e)
TIN - TANTALUM - LITHIUM				
		Li <sub>2</sub> O Tonnes		
SPODUMENE	Bridegetown-Greenbushes	43 281	2 323	7 619 341 (a)
		Ta <sub>2</sub> O <sub>5</sub> kg		
TANTALITE	Bridegetown-Greenbushes	540	141 030	13 051 184
	East Pilbara	<u>128</u>	<u>59 727</u>	<u>5 675 126</u>
		668	200 757	18 726 310 (a)
		Sn Tonnes		
TIN	East Pilbara	0	1	7 477
	Bridegetown-Greenbushes	<u>272</u>	<u>184</u>	<u>1 260 558</u>
		272	185	1 268 035 (a)
VERMICULITE	Ravensthorpe	580		103 018 (e)
VALUE OF MINERALS				6 858 880 564
VALUE OF PETROLEUM				2 545 316 976
VALUE OF GOLD				2 666 335 059
TOTAL VALUE				12 070 532 599



TABLE 5.1

## QUANTITY AND VALUE OF MINERALS AND PETROLEUM BY MINERAL-FIELD

Mineral	Mineral-field	Quantity tonnes	Metallic Content	Value (\$)	Ref
BASE METALS			Cu Tonnes		
COPPER BY-PRODUCT	Coolgardie		4 539.948	5 840 246	(a),(b)
COPPER CONCENTRATES	Peak Hill	10 539	2 235.327	3 981 163	
	Pilbara	12 770	2 661.089	3 605 119	
	South West	2 687	588.000	953 462	
	Yalgoo	8 841	1 768.886	3 538 630	
		34 837	7 253.302	12 078 374	(a)
TOTAL COPPER			11 793.250	17 918 620	
LEAD	West Kimberley		Pb Tonnes		
		14 543	10 697.570	4 348 109	(a)
ZINC	West Kimberley		Zn Tonnes		
	Yalgoo	87 576	43 843.180	39 939 974	
		162 079	68 171.800	54 751 844	
		249 655	112 014.980	94 691 818	(a)
TOTAL BASE METALS				116 958 547	
BAUXITE - ALUMINA					
ALUMINA	South West	7 009 184		1 844 032 647	(c)
CLAYS					
ATTAPULGITE	South West	17 245		4 617 226	(a)
CEMENT CLAY	South West	32 795		234 039	(d)
KAOLIN	Greenbushes	3 100		204 400	(d)
WHITE CLAY	South West	14 611		160 718	(d)
TOTAL CLAYS		67 751		5 216 383	
COAL	Collie	5 114 267		228 561 597	(e)
CONSTRUCTION MATERIALS					
AGGREGATE	Dundas	137		519	
	East Coolgardie	82 869		451 422	
	Kimberley	2 490		10 804	
	Pilbara	45 524		241 915	
	West Kimberley	2 663		14 607	
		133 683		719 267	

TABLE 5.1 (cont)		Quantity	Metallic	
Mineral	Mineral-Field	tonnes	Content	Value (\$) Ref
CONSTRUCTION MATERIALS (cont)				
GRAVEL	Coolgardie	640		3 320
	Pilbara	26 000		130 000
	South West	20 051		110 237
	West Kimberley	<u>670</u>		<u>670</u>
		47 361		244 227
ROCK	Ashburton	3 699		28 973
	West Kimberley	19 013		194 026
	West Pilbara	<u>21 773</u>		<u>246 115</u>
		44 485		469 114
SAND	Ashburton	849		2 094
	Coolgardie	49 736		251 360
	East Murchison	8 381		48 620
	Kimberley	70		420
	Mt Margaret	3 126		16 596
	North Coolgardie	1 815		9 075
	Peak Hill	38 522		215 311
	Pilbara	21 658		114 509
	Roebourne	345 598		1 727 990
	South West	300 032		1 658 880
	West Kimberley	351		2 272
	West Pilbara	<u>11 242</u>		<u>73 762</u>
		781 380		4 120 889
TOTAL CONSTRUCTION MATERIALS				5 553 497 (d)
		Carats		
DIAMOND	Kimberley	33 354 537		456 926 660 (a)
DIATOMITE	South West	22		160 (d)
DIMENSION STONE				
BLACK GRANITE	Dundas	112		39 200
	West Kimberley	<u>974</u>		<u>360 669</u>
		1 086		399 869 (d)
QUARTZ ROCK	South West	362		16 266 (d)
SPONGOLITE	South West	437		35 834 (e)
TOTAL DIMENSION STONE		1 885		451 969



TABLE 5.1 (cont)		Quantity	Metallic	Value (\$)	Ref
Mineral	Mineral-Field	tonnes	Content		
GEM SEMI-PRECIOUS AND ORNAMENTAL STONE		kg			
AMETHYST	Gascoyne	24 617		131 426	
		kg			
CHRYSOPRASE	Mt Margaret	1 800		32 500	
TOTAL GEM SEMI-PRECIOUS AND ORNAMENTAL STONE				163 926	(e)
GOLD			Au kg		
	Ashburton		0.064	954	
	Broad Arrow		14 491.881	215 915 346	
	Coolgardie		14 255.351	212 391 273	
	Dundas		2 810.764	41 877 730	
	East Coolgardie		26 946.575	401 478 529	
	East Murchison		16 627.276	247 730 716	
	Kimberley		12.591	187 594	
	Mt Margaret		22 782.121	339 432 095	
	Murchison		22 419.589	334 030 712	
	North Coolgardie		2 333.218	34 762 746	
	North EastCoolgardie		1 855.245	27 641 399	
	Peak Hill		10 210.018	152 119 630	
	Pilbara		9 397.440	140 012 985	
	South West		19 864.788	295 966 589	
	West Pilbara		25.872	385 468	
	Yalgoo		2 746.026	40 913 195	
	Yilgarn		12 181.181	181 488 098	
			178 960.000	2 666 335 059	(f)
GYPSUM					
	Dundas	1 248		9 302	(e)
	Phillips River	1 018		6 000	(e)
	South West	50 706		498 436	(d),(e)
	Yilgarn	22 778		121 761	(e)
		75 750		635 499	
HEAVY MINERAL SANDS					
GARNET SAND	South West	30 732		2 880 905	(e),(g)
ILMENITE	South West	936 778		81 499 514	
UPGRADED ILMENITE	South West	358 478		183 487 767	
TOTAL ILMENITE		1 295 256		264 987 281	(a)
			TiO <sub>2</sub> Tonnes		
LEUCOXENE	South West	12 944	11 804	8 064 715	(a)

TABLE 5.1 (cont)		Quantity	Metallic		
Mineral	Mineral-Field	tonnes	Content	Value (\$)	Ref
HEAVY MINERAL SANDS (cont)			ThO <sub>2</sub> Units		
MONAZITE	South West	7 173	49 225	2 155 801	(a)
			TiO <sub>2</sub> Tonnes		
RUTILE	South West	59 134	55 779	39 661 379	(a)
			ZrO <sub>2</sub> Tonnes		
ZIRCON	South West	204 332	133 450	79 156 923	(a)
TOTAL HEAVY MINERAL SANDS				396 907 004	
INDUSTRIAL PEGMATITE MINERALS					
FELSPAR	Pilbara	10 740		422 809	
	South West	<u>6 759</u>		<u>292 275</u>	
		17 499		715 084	
MICA	Pilbara	473		14 839	
TOTAL INDUSTRIAL PEGMATITE MINERALS				729 923	(h)
IRON ORE			Fe%		
DOMESTIC ORE	Peak Hill	2 291 321	63.21	62 053 261	
	Pilbara	507 614	63.40	14 670 555	
	West Kimberley	1 089 154	64.40	28 843 548	
	West Pilbara	<u>885 296</u>	<u>61.37</u>	<u>23 172 741</u>	
		4 773 385		128 740 105	
			Fe%		
EXPORTED ORE	Peak Hill	35 774 606	63.45	1 007 144 339	
	Pilbara	5 789 712	62.35	147 552 775	
	West Kimberley	2 100 395	59.54	50 897 054	
	West Pilbara	<u>65 729 626</u>	<u>60.99</u>	<u>1 645 437 620</u>	
		109 394 339		2 851 031 788	
TOTAL IRON ORE				114 167 724	2 979 771 893 (a)
LIMESAND - LIMESTONE					
	South West	900 572		5 365 206	
	West Pilbara	<u>915</u>		<u>4 891</u>	
		901 487		5 370 097	(d)
MANGANESE ORE	Pilbara	209 640		37 774 547	(a)
NICKEL INDUSTRY			Co Tonnes		
COBALT BY-PRODUCT	Coolgardie		287.534	6 062 266	(a) (b)



TABLE 5.1 (cont)		Quantity	Metallic	Value (\$)	Ref
Mineral	Mineral-Field	tonnes	Content		
NICKEL INDUSTRY (cont)			Ni %		
NICKEL CONCENTRATES	Coolgardie	270 133	10.63	294 698 651	
	East Coolgardie	30 364	11.95	36 039 615	
	East Murchison	197 506	10.74	215 176 499	
	Mt Margaret	<u>23 508</u>	8.75	<u>21 960 048</u>	
		521 511		567 874 813	
NICKEL ORE	East Murchison	2 318	6.38	1 368 276	
TOTAL NICKEL PRODUCTION				569 243 089	(i)
			Pd kg		
PALLADIUM BY-PRODUCT	Coolgardie		351.293	1 260 296 (a),(b)	
			Pt kg		
PLATINUM BY-PRODUCT	Coolgardie		632.898	1 494 173 (a),(b)	
PEAT	South West	403		29 974	(d)
PETROLEUM		Kilolitres			
CONDENSATE	Carnarvon	1 868 092		313 610 465	(a)
	Perth	<u>1 676</u>		<u>134 431</u>	(d)
		1 869 768		313 744 896	
CRUDE OIL	Basin				
	Canning	19 669		2 678 199	
	Carnarvon	5 161 799		894 225 017	
	Perth	<u>33 169</u>		<u>4 512 362</u>	
		5 214 637		901 415 578	(a)
		Basin	MMBtu		
LIQUIFIED NATURAL GAS	Carnarvon	204 799 068		957 953 276	(a)
		Basin	'000 m3		
NATURAL GAS	Carnarvon	3 556 170		350 728 436	(d)
	Perth	<u>182 285</u>		<u>21 474 790</u>	(j)
		3 738 455		372 203 226	
TOTAL PETROLEUM PRODUCTS				2 545 316 976	
SALT	Gascoyne	1 808 543		39 002 654	(a)
	Pilbara	2 202 202		45 777 950	(a)
	South West	373		29 840	(e)
	West Pilbara	2 761 339		61 435 564	(a)
	Yilgarn	<u>54 773</u>		<u>3 109 761</u>	(a)
		6 827 230		149 355 769	

TABLE 5.1 (cont)		Quantity	Metallic	Value (\$)	Ref
Mineral	Mineral-Field	tonnes	Content		
SILICA - SILICA SAND					
SILICA	South West	76 612		782 017	(a)
SILICA SAND	Coolgardie	92 550		226 748	(a)
	South West	<u>576 834</u>		<u>6 163 440</u>	(a),(e)
TOTAL SILICA - SILICA SAND		745 996		7 172 205	
SILVER: BY-PRODUCT					
		Ag kg			
	Coolgardie	219.499		38 253	(a),(b)
	Peak Hill	3 515.932		348 525	(a),(k)
	Pilbara	207.916		27 379	(a),(l)
	South West	414.954		56 249	(a),(l)
	State-Wide	23 584.522		3 790 960	
	Yalgoo	<u>10 570.938</u>		<u>1 661 963</u>	(a),(l)
		38 098.807		5 923 329	
TALC	South West	165 263		11 568 410	(e)
TIN - TANTALUM - LITHIUM					
			Li <sub>2</sub> O Tonnes		
SPODUMENE	Greenbushes	43 281	2 323	7 619 341	(a)
			Ta <sub>2</sub> O <sub>5</sub> kg		
TANTALITE	Greenbushes	540	141 030	13 051 184	
	Pilbara	<u>128</u>	<u>59 727</u>	<u>5 675 126</u>	
		668	200 757	18 726 310	(a)
			Sn Tonnes		
TIN	Greenbushes	272	184	1 260 558	
	Pilbara	<u>0</u>	<u>1</u>	<u>7 477</u>	
		272	185	1 268 035	(a)
VERMICULITE	Phillips River	580		103 018	(e)
VALUE OF MINERALS				6 858 880 564	
VALUE OF PETROLEUM				2 545 316 976	
VALUE OF GOLD				2 666 335 059	
TOTAL VALUE				12 070 532 599	



TABLE 6.1		ROYALTY RECEIPTS 1980, 1991			
Mineral	1980 \$A	1991 \$A	Value \$A Variance	%up (%down)	
BARYTES	50 330.15	0.00	(50 330.15)	(100)	
BASE METALS					
Copper	1 417 336.71	967 560.29	(449 776.42)	(32)	
Lead	383 128.65	249 837.03	(133 291.62)	(35)	
Zinc	2 999 071.13	4 420 146.83	1 421 075.70	47	
TOTAL BASE METALS	4 799 536.49	5 637 544.15	838 007.66	17	
BAUXITE-ALUMINA					
Alumina	34 945 117.94	30 697 525.82	(4 247 592.12)	(12)	
CLAYS	301 880.00	306 728.69	4 848.69	2	
COAL	3 387 235.80	6 885 678.01	3 498 442.21	103	
CONSTRUCTION MATERIALS					
Aggregate	28 599.60	23 153.90	(5 445.70)	(19)	
Gravel	10 400.10	8 422.80	(1 977.30)	(19)	
Rock	27 129.54	8 658.01	(18 471.53)	(68)	
Sand	190 795.95	273 612.84	82 816.89	43	
TOTAL CONSTRUCTION MATERIALS	256 925.19	313 847.55	56 922.36	22	
DIAMOND	31 173 757.05	20 363 022.21	(10 810 734.84)	(35)	
DIMENSION STONE	1 742.35	11 166.26	9 423.91	541	
GEM SEMI-PRECIOUS & ORNAMENTAL STONE	398.32	9 856.91	9 458.59	2 375	
GOLD	228 455.85	284 790.25	56 334.40	25	
GYPSUM	37 399.04	22 413.96	(14 985.08)	(40)	
HEAVY MINERAL SANDS					
Garnet	69 852.36	123 715.21	53 862.85	77	
Ilmenite	4 478 418.56	4 316 712.89	(161 705.67)	(4)	
Leucoxene	456 228.22	411 202.43	(45 025.79)	(10)	
Monazite	465 091.52	192 847.85	(272 243.67)	(59)	
Rutile	2 997 241.13	2 164 976.76	(832 264.37)	(28)	
Zircon	6 920 574.96	5 107 124.12	(1 813 450.84)	(26)	
TOTAL HEAVY MINERAL SANDS	15 387 406.75	12 316 579.26	(3 070 827.49)	(20)	
INDUSTRIAL PEGMATITE MINERALS					
Felspar	68 862.18	35 949.43	(32 912.75)	(48)	
Mica	5 262.09	1 380.00	(3 882.09)	(74)	
TOTAL INDUSTRIAL PEGMATITE MINERALS	74 124.27	37 329.43	(36 794.84)	(50)	
IRON ORE	111 801 379.55	144 741 902.09	32 940 522.54	29	

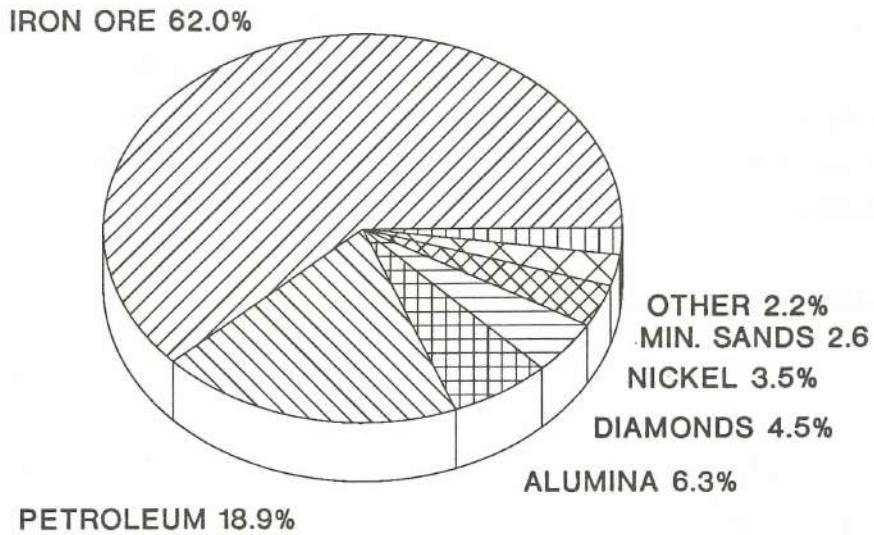
TABLE 6.1 (cont)	1990	1991	Value \$A	%up
Mineral	\$A	\$A	Variance	(%down)
<b>LIMESAND-LIMESTONE-DOLOMITE</b>				
Dolomite	99.90	0.00	(99.90)	(100)
Limesand-Limestone	141 237.31	79 082.54	(62 154.77)	(44)
<b>TOTAL LIMESAND-LIMESTONE-DOLOMITE</b>	<b>141 337.21</b>	<b>79 082.54</b>	<b>(62 254.67)</b>	<b>(44)</b>
<b>MANGANESE</b>	<b>322 483.00</b>	<b>3 138 440.83</b>	<b>2 815 957.83</b>	<b>873</b>
<b>NICKEL INDUSTRY</b>				
Cobalt by-product	83 460.64	70 309.07	(13 151.57)	(16)
Nickel	9 909 231.82	10 082 057.87	172 826.05	2
Palladium by-product	24 544.79	21 328.93	(3 215.86)	(13)
Platinum by-product	24 900.27	19 204.60	(5 695.67)	(23)
<b>TOTAL NICKEL INDUSTRY</b>	<b>10 042 137.52</b>	<b>10 192 900.47</b>	<b>150 762.95</b>	<b>2</b>
<b>PEAT</b>	<b>1 895.50</b>	<b>1 015.28</b>	<b>(880.22)</b>	<b>(46)</b>
<b>PETROLEUM</b>				
Condensate	2 597 097.79	2 892 857.35	295 759.56	11
LNG	3 607 120.05	7 994 621.24	4 387 501.19	122
Natural gas	5 668 530.34	6 059 350.04	390 819.70	7
Oil	73 935 113.50	71 344 950.90	(2 590 162.60)	(4)
<b>TOTAL PETROLEUM</b>	<b>85 807 861.68</b>	<b>88 291 779.53</b>	<b>2 483 917.85</b>	<b>3</b>
<b>PIGMENTS</b>				
Red Iron Oxide	5 526.55	0.00	(5 526.55)	(100)
<b>RARE EARTHS</b>				
Gallium	298 908.43	0.00	(298 908.43)	(100)
<b>SALT</b>	<b>1 210 954.37</b>	<b>1 313 369.99</b>	<b>102 415.62</b>	<b>8</b>
<b>SILICA SAND</b>	<b>331 095.86</b>	<b>335 758.77</b>	<b>4 662.91</b>	<b>1</b>
<b>SILVER</b>	<b>114 920.49</b>	<b>126 323.26</b>	<b>11 402.77</b>	<b>10</b>
<b>TALC</b>	<b>102 335.00</b>	<b>105 300.50</b>	<b>2 965.50</b>	<b>3</b>
<b>TIN-TANTALUM-LITHIUM</b>				
Spodumene	386 386.55	328 117.34	(58 269.21)	(15)
Tantalite	536 469.92	491 799.65	(44 670.27)	(8)
Tin	34 488.64	32 144.38	(2 344.26)	(7)
<b>TOTAL TIN-TANTALUM-LITHIUM</b>	<b>957 345.11</b>	<b>852 061.37</b>	<b>(105 283.74)</b>	<b>(11)</b>
<b>VERMICULITE</b>	<b>567.80</b>	<b>2 232.17</b>	<b>1 664.37</b>	<b>293</b>
<b>TOTAL ROYALTIES</b>	<b>301 783 057.27</b>	<b>326 066 649.30</b>	<b>24 283 592.03</b>	<b>8</b>



# COMPARATIVE ROYALTY RECEIPTS

## 1986 ROYALTY RECEIPTS

TOTAL : \$165.3 MILLION



## 1991 ROYALTY RECEIPTS

TOTAL : \$326.1 MILLION

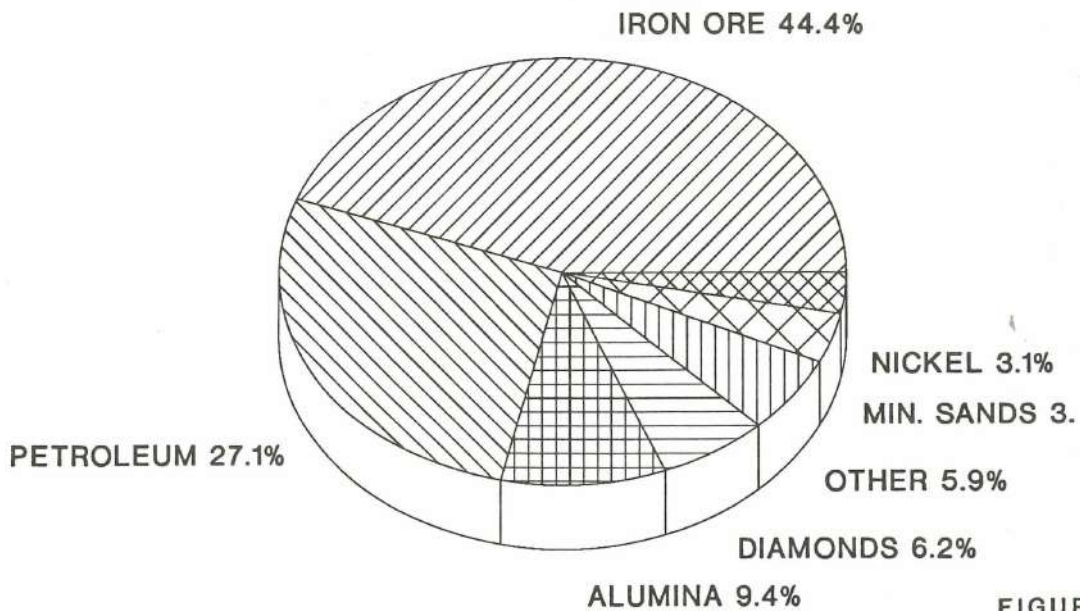


FIGURE 6.1

### 7.1 Employment in the Minerals and Petroleum Industries

The Western Australian minerals and petroleum industry recorded a significant decline in employment growth during 1991. Overall direct employment in exploration, development and production contracted by 7%. At year's end the total of 34,398 people employed in all sectors reflected a sharp decrease over the December 1990 total of 36,757. The reversal of the growth trend of recent years is directly associated with the downturn on world markets and the sharp contraction in the demand for most of the major commodities.

Despite a small increase in output, in what was a difficult year for gold producers, over 1250 full time jobs were shed in the sector. Apart from some significant falls in Kalgoorlie, the overall job losses were fairly evenly spread across the industry and can be mainly attributed to some merging of companies and restructuring of operations. Employment aggregates could come under further pressure in 1992 as the rationalisation of underground operations continues.

The iron ore industry, another traditionally large employer, experienced a marginal fall in job numbers. This occurred despite a solid rise in output. The new steel markets emerging in S.E Asia will continue to increase prospects for West Australian's. The potential Yandicoogina and Marandoo projects will generate employment growth long term.

The high productivity levels of the petroleum industry experienced during the year enabled a 8% increase in employment. Significant new projects operated by Hadson and Woodside produced 120 new jobs. Opportunities for the industry to expand in the near future lies in the Asia-Pacific LNG market.

Heavy mineral sands producers reduced their staff by a substantial 14.7% (279) in line with reduced consumption from industrial nations. Employment opportunities can be expected

from the movement by companies into downstream processing while the world markets are contracted.



TABLE 7.1

**NUMBER OF PERSONS EMPLOYED IN THE WESTERN AUSTRALIAN MINERALS & PETROLEUM INDUSTRIES  
AS AT DECEMBER 31, 1991**

MINERAL/Company	LOCATION	1990	1991
<b>BASE METALS</b>			
BHP Minerals Ltd	Cadjebut	193	140
Murchison Zinc Co. Pty Ltd	Golden Grove	258	345
<b>TOTAL BASE METALS</b>		<b>451</b>	<b>485</b>
<b>BAUXITE - ALUMINA</b>			
Alcoa of Australia Ltd	Del Park-Huntley/Pinjarra	1 777	1 885
	Jarrahdale/Kwinana	1 643	1 632
	Wagerup/Willow Dale	969	585
Australian Fused Materials Pty Ltd	East Rockingham	-	25
Worsley Alumina Pty Ltd	Boddington/Worsley	1 146	1 057
<b>TOTAL BAUXITE - ALUMINA</b>		<b>5 535</b>	<b>5 184</b>
<b>COAL</b>			
Griffin Coal Mining Co. Ltd	Collie	563	479
Western Collieries Ltd	Collie	746	673
<b>TOTAL COAL</b>		<b>1 309</b>	<b>1 152</b>
<b>DIAMOND</b>			
Argyle Diamond Mines Pty Ltd	Lake Argyle	857	887
Poseidon Ltd	Bow River	93	106
<b>TOTAL DIAMOND</b>		<b>950</b>	<b>993</b>
<b>GOLD</b>			
Arimco NL	Gidgee	127	106
	Mt McLure	-	42
Asarco Australia Ltd	Wiluna	174	204
Ashton Gold	Cork Tree Well	156	163
Australian Mine Management Pty Ltd	Mt Pleasant	122	109
	Racetrack/Royal Standard	55	-
Aztec Mining Co Ltd	Bounty	104	162
Big Bell Mines Pty Ltd	Big Bell	216	207
Broken Hill Metals NL	Hopes Hill	116	126
Central Norseman Gold Corp. NL	Central Norseman	217	206
Coolgardie Gold NL	Greenfield	134	114
Dominion Mining Ltd	Bannockburn	-	105
	Labourchere/Nathans	78	64
	Meekatharra	253	291
	Mt Morgans	96	191
	Tower Hill	133	65
Eastmet Ltd	Youanmi	93	117

<b>TABLE 7.1 (cont)</b>			
<b>MINERAL/Company</b>	<b>LOCATION</b>	<b>1990</b>	<b>1991</b>
<b>GOLD (cont)</b>			
Eon Metals NL	Matilda	-	191
Goldfan Ltd	Three Mile Hill	120	144
Harbour Lights Mining	Harbour Lights	72	143
	Mertondale	33	-
Hedges Gold Pty Ltd	Hedges	121	129
Hill 50 Gold Mine NL	Mt Magnet	325	281
Kalgoorlie Consolidated Gold Mines Pty Ltd	Kalgoorlie	1 717	1 174
Metana Minerals	Reedy	155	136
	Rothsay	92	-
Mt Gibson Management Pty Ltd	Lawlers	62	99
	Mt Gibson	111	87
Newcrest Mining Ltd	Gimlet South	116	159
	New Celebration	408	420
	Telfer	654	671
	Tuckabianna	96	122
Pancontinental Pty Ltd	Kundana	79	67
	Paddington	191	175
Placer Pacific Pty Ltd	Granny Smith	171	172
Plutonic Operations Ltd	Plutonic	94	116
Poseidon Ltd	Kaltails	90	95
	Karonie	53	63
Reynolds Yilgarn Gold Operations Ltd	Yilgarn	269	211
Sons of Gwalia NL	Sons of Gwalia	134	126
Spargos Mining Pty Ltd	Bellevue	234	196
St. Barbara Mines Ltd	Meekatharra	118	186
Sundowner Minerals NL	Darlot	121	119
Western Mining Corporation Ltd	Emu	124	146
	Kambalda	294	238
	Lancefield	116	88
Worsley Alumina Pty Ltd	Boddington	641	410
All Other Operators		2 045(r)	2 023
<b>TOTAL GOLD</b>		<b>10 930</b>	<b>9 679</b>
<b>HEAVY MINERAL SANDS</b>			
Allied Eneabba Pty Ltd	Eneabba	447	301
Associated Minerals Consolidated Ltd	Capel	180	171
	Eneabba/Narngulu	260	204
Cable Sands Pty Ltd	Capel	226	202
ISK Minerals Pty Ltd	Picton	57	63
TiWest Pty Ltd	Cataby/Chandala	241	264
Westralian Sands Ltd	Capel	453	377
All Other Operators		34(r)	37
<b>TOTAL HEAVY MINERAL SANDS</b>		<b>1 898(r)</b>	<b>1 619</b>



<b>TABLE 7.1 (cont)</b>				
<b>MINERAL/Company</b>	<b>LOCATION</b>	<b>1990</b>	<b>1991</b>	
<b>IRON ORE</b>				
BHP Iron Ore (Goldsworthy) Ltd	Pilbara/Port Hedland	948	982	
BHP Iron Ore Ltd	Newman/Port Hedland	3 636	3 415	
	Yandicoogina	-	30	
BHP Minerals Ltd	Yampi	402	302	
Hamersley Iron Pty Ltd	Tom Price - Paraburdoo/Dampier/Channar	3 207	3 134	
Portman Mining Ltd	Ferro Gully	31	51	
Robe River Mining Co. Pty Ltd	Pannawonica/Cape Lambert	959	903	
<b>TOTAL IRON ORE</b>		<b>9 183</b>	<b>8 817</b>	
<b>NICKEL</b>				
Agip Australia Pty Ltd	Radio Hill	28(r)	89	
Western Mining Corporation Ltd	Kalgoorlie	384	408	
	Blair/Kambalda	1 680	1 351	
	Kwinana Refinery	265	323	
	Leinster	559	559	
	Mt Windarra	337	247	
All Other Operators		9(r)	6	
<b>TOTAL NICKEL</b>		<b>3 262</b>	<b>2 983</b>	
<b>PETROLEUM PRODUCTS</b>				
Hadson Energy Pty Ltd	Harriet/Rosette	102	130	
West Australian Petroleum Pty Ltd	Dongara	8	8	
	North West Area	206	236	
Western Mining Corporation Ltd	North Herald/South Pepper/Chervil	105	108	
Woodside Offshore Petroleum Pty Ltd	North Rankin A/Burrup Peninsula	1 485	1 577	
All Other Operators		19	24	
<b>TOTAL PETROLEUM PRODUCTS</b>		<b>1 925</b>	<b>2 083</b>	
<b>SALT</b>				
Dampier Salt Ltd	Dampier	192	179	
	Lake MacLeod	116	116	
Leslie Salt Co.	Port Hedland	120	123	
Shark Bay Salt JV	Useless Loop	66	73	
Other		-	9	
<b>TOTAL SALT</b>		<b>494</b>	<b>500</b>	
<b>ALL OTHER MATERIALS</b>				
(including Rock Quarries)		820	903	
<b>TOTAL</b>		<b>36 757(r)</b>	<b>34 398</b>	

(SOURCE: AXTAT REPORTING SYSTEM, MINING ENGINEERING DIVISION)

**8.1 PRINCIPAL MINERAL AND PETROLEUM PRODUCERS 1991**, Head office postal address, telephone number: minesite.

## **BASE METALS**

### **Copper**

Murchison Zinc Co. Pty Ltd, 8 Kings Park Rd, West Perth 6872, (09) 480 3232: Golden Grove.  
Newcrest Mining Ltd, 600 St Kilda Rd, Melbourne 3004, (03) 522 5333: New Celebration, Telfer.  
Western Mining Corp. Ltd, 191 Great Eastern Hwy, Belmont 6104, (09) 478 0711: Kambalda.

### **Lead - Zinc**

BHP Minerals Ltd, 44 Hamersley St, Broome 6725, (091) 92 2006: Cadjebut.  
Murchison Zinc Co. Pty Ltd, 8 Kings Park Rd, West Perth, 6872, (09) 480 3232: Golden Grove

## **BAUXITE - ALUMINA**

### **Alumina**

Alcoa of Australia (WA) Ltd, PO Box 252, Applecross 6153, (09) 364 0111: Del Park, Jarrahdale, Willowdale.  
Worsley Alumina Pty Ltd, PO Box 344, Collie 6225, (097) 34 3022: Boddington.

## **CLAY**

### **Attapulgit**

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

### **Cement Clay**

Boral Resources Ltd, 136 Great Eastern Hwy, South Guildford 6055, (09) 279 0000: Armadale.

### **Kaolin**

Greenbushes Ltd, 91 Kensington St, East Perth 6004, (09) 325 1966: Greenbushes.

### **White Clay**

Pilsley Investments Pty Ltd, Military Rd, 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.



**8.1 (cont) PRINCIPAL MINERALS AND PETROLEUM PRODUCERS 1991**, Head office address, telephone number: minesite.

## **CONSTRUCTION MATERIALS**

### **Aggregate**

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

### **Gravel**

Leslie Salt Company (Inc), 225 St Georges Tce, Perth 6000, (09) 321 1668: Port Hedland.  
Vinci and Sons Pty Ltd, Lot 3 Pickering Brook Rd, Pickering Brook 6076, (09) 293 8295: Pickering Brook.

### **Rock**

County B.S., C/- Specified Services, 123 Burswood Rd, Victoria Park 6100, (09) 362 1100: Yeeda Station.  
Specified Services Pty Ltd, 123 Burswood Rd, Victoria Park 6100, (09) 362 1100: Learmonth, Mt Regal.

### **Sand**

Amatek Ltd, 1 Newburn Rd, Kewdale 6104, (09) 353 3030: Gnangarra, Jandakot.  
B & J Catalano Pty Ltd, Southwest Hwy, Brunswick Junction 6224, (097) 261247: Wellington.  
Quinton Pty Ltd, Lot 117 Cnr Great Eastern Hwy Coolgardie Rd, Kalgoorlie 6430, (090) 213 961: Coolgardie.  
The Readymix Group (WA), 75 Canning Hwy, Victoria Park 6100, (09) 472 2000: Boodarrie Station, Christmas Creek,  
Comet Vale, Karratha, Newman, Rocklea, Sullivan's Creek, Turner River, Warrawanda Creek, Widgiemooltha.  
Tuma Holdings Pty Ltd, 42 Noel Rd, Gooseberry Hill 6076, (09) 293 3948: Chidlow.

## **DIAMOND**

Argyle Diamond Mines, 2 Kings Park Rd, West Perth 6005, (09) 482 1188: Argyle.  
Poseidon Bow River Diamond Mines Ltd, 100 Hutt St, Adelaide, S.A., (08) 236 1700: Bow River.

## **DIMENSION STONE**

### **Black Granite**

City West Holdings Ltd, C/- 102 Railway Pde, West Perth 6005, (09) 481 5760: Lennard.  
De Biasi D, P.O Box 351, Broome 6725, (091) 935 562: Lennard.  
Fraser Range Granite NL, 164 Burswood Rd, Victoria Park 6100, (09) 4704487: Mt Malcom.

### **Quartz rock**

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

**8.1 (cont) PRINCIPAL MINERALS AND PETROLEUM PRODUCERS 1991**, Head office postal address, telephone number: minesite.

### **Spongolite**

Woodbridge Investments Pty Ltd, PO Box 591, South Perth 6151: Mt Barker

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

#### **Amethyst**

Soklich F, Lot 326 Dale Pl, Orange Grove 6109, (09) 459 1449: Gascoyne.

#### **Chrysoprase**

Aplo Pty Ltd, 132 Broome St, Cottesloe 6011, (09) 3832551: Marshall Creek.

### **GOLD**

Arimco NL, 19-29 Martin Pl, Sydney NSW 2000 (02) 235 3644: Gidgee.

Asarco Australia Ltd, 10 Ord St West Perth 6005, (09) 484 2050: Wiluna.

Ashton Mining Ltd, 441 St Kilda Rd, Melbourne Vic 3004, (03) 267 5500: Bardoc - Davyhurst, Harbour Lights, Laverton.

Australian Consolidated Minerals Ltd, 233 Adelaide Tce, Perth 6000, (09) 325 7755: Golden Crown, Westonia.

Aztec Mining Company Ltd, 99 Shepperton Rd, Victoria Park 6100, (09) 470 1444: Bounty.

Bellevue Project, c/- Forsayth NL, 221 St Georges Tce, Perth 6000, (09) 322 7211: Bellevue:

Big Bell Mines Ltd, PO Box 2135, Geraldton 6530, (099) 64 1366: Big Bell.

Broken Hill Metals Ltd, 44 St George's Tce, Perth 6000, (09) 221 3032: Corinthia, Hopes Hill.

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

Centaur Mining and Exploration Ltd, 468 St Kilda Rd, Melbourne Vic 3004, (03) 267 6633: Lady Bountiful Extended.

Central Kalgoorlie Gold Mines NL, 47 Stirling Hwy, Nedlands 6009, (09) 381 1311: Bullabulling.

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

Consolidated Exploration Ltd, 47 Colin St, West Perth 6005, (09) 481 5870: Davyhurst, Lady Bountiful.

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

Dominion Mining Ltd, 10 Ord St, West Perth 6005, (09) 322 4617: Labourchere, Meekatharra, Mt Morgans, Redcastle, Tower Hill.

Eon Metals NL, 214 St Georges Tce, Perth 6000, (09) 321 4880: Matilda

Golden Kilometre Mines JV, 4/100 Hay St, Subiaco 6008, (09) 382 3300: Mt Pleasant, Racetrack/Royal Standard.

Golden Valley Mines NL, 174 Hampden Rd, Nedlands 6009, (09) 389 1999: Frasers.

Hampton Australia Ltd, 120 Hutt St, Adelaide SA 5000 (08) 223 7438: Jubilee.

Hannans Gold Ltd, 49 Stirling Hwy, Nedlands 6009, (09) 389 1311: Comet - Pinnacles.

Hedges Gold Pty Ltd, Cnr Davy and Marmion Sts, Booragoon 6153, (09) 364 0111: Hedges.

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

Hill 50 Gold Mine NL, PO Box 83, Mt Magnet 6638, (09) 63 4104: Mt Magnet, Reedy.



**8.1 (cont) PRINCIPAL MINERALS AND PETROLEUM PRODUCERS 1991**, Head office postal address, telephone number: minesite.

**GOLD (cont)**

Homestake Gold of Australia Ltd, 191 Fullarton Rd, Dulwich SA 5065, (08) 332 7811: Fortnum.

Kalgoorlie Consolidated Gold Mines Pty Ltd, Boulder Block Rd, Boulder 6432, (090) 93 1000:

Kalgoorlie/Boulder.

Metana Minerals, 191 Great Eastern Hwy, Belmont 6104, (09) 277 9944: Kurara, Penny West.

Youanmi.

Mt Edon Gold Mines (Aust) NL, 30 Ledger Rd, Balcatta 6021, (09) 345 1588: Tarmoola.

Mt Gibson Management Pty Ltd, 28 The Esplanade, Perth 6000, (09) 322 2313: Lawlers, Mt Gibson.

Mt Martin Gold Mines NL, 9 Bowman St, South Perth 6151, (09) 368 2011: Mt Martin.

Newcrest Mining Ltd, 600 St Kilda Rd, Melbourne 3004, (03) 522 5333: New Celebration, Orban JV,

Ora Banda - Gimlet South, Telfer, Tuckabianna.

North Broken Hill - Peko Ltd, 476 St Kilda Rd, Melbourne Vic 3004, (03) 829 0000: Bottle Creek,

Kanowna, Peak Hill.

Pancontinental Goldmining Areas Pty Ltd, PO Box 1161, Kalgoorlie 6430, (090) 24 2000: Paddington,

White Flag.

Placer Pacific Ltd, 1 Alfred St, Sydney NSW 2000, (02) 241 1873: Granny Smith.

Plutonic Resources Ltd, 580 George St Sydney 2000, (02) 364 4150: Plutonic.

Poseidon Ltd, PO Box 1143, West Perth 6005, (09) 384 5155: Kaltails, Karonie.

Reynolds Yilgarn Gold Operations Ltd, 28 The Esplanade, Perth 6000, (09) 322 2313: Edwards Find,

Marvel Loch, Transvaal.

St Barbara Mines Ltd, c/- PO Meekatharra 6642, (099) 81 1064: Paddy's Flat.

Samantha Gold NL, 28 The Esplanade, Perth 6000, (09) 481 5288: Higginsville.

Sandhurst Mining NL, c/- 15 William St, Perth 6000, (09) 327 5777: Trafalgar.

Sons of Gwalia NL, 38 Parliament Pl, West Perth 6005, (09) 481 1988: Sons of Gwalia.

Southern Goldfields Ltd, 50 Colin St, West Perth 6005, (09) 321 3277: Nevorla.

Sundowner Minerals NL, c/- Forsayth Pty Ltd, 221 St George's Tce, Perth 6000, (09) 322 7211:

Darlot.

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

Lancefield, Sand King - Goongarrie, Thiel Well.

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.

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: Wyalkatchem

**HEAVY MINERAL SANDS**

**Garnet Sand**

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

**8.1 (cont) PRINCIPAL MINERALS AND PETROLEUM PRODUCERS 1991**, Head office postal address, telephone number: minesite.

### HEAVY MINERAL SANDS (cont)

#### Ilmenite

Associated Minerals Cons. Ltd, 45 Stirling Hwy, Nedlands 6009, (09) 389 1222: Capel, Eneabba.

Cable Sands (WA) Pty Ltd, PO Box 133, Bunbury 6230, (097) 21 4111: Capel.

ISK Minerals Pty Ltd, PO Picton 6229, (097) 25 4899: Waroona.

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.

### INDUSTRIAL PEGMATITE MINERALS

#### Felspar

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

#### Mica

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

### IRON ORE

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

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.

Hamersley Iron Pty Ltd, 191 St George's Tce, Perth 6000, (09) 327 2327: Tom Price.

Portman Mining Ltd, Level 12 263 Adelaide Tce, Perth 6000, (09) 325 7688: McCameys.

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) 410 1988: Cockburn Sound, Coogee.

Henderson Nominees Pty Ltd, 19 Rangeview Road, Lansdale 6065, (09) 342 9988: Moore River.

Limestone Building Blocks Co. Pty Ltd, 41 Spearwood Ave, Bibra Lake 6163, (09) 418 4440:

Nowerup.

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.

### MANGANESE ORE

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

Woodie Woodie.

Portman Mining Ltd, 12th Floor, Durack Centre, 263 Adelaide Tce, Perth 6000, (09) 325 7688:

Woodie Woodie.



**8.1 (cont) PRINCIPAL MINERALS AND PETROLEUM PRODUCERS 1991**, Head office postal address, telephone number: minesite.

#### **NICKEL**

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

#### **PEAT**

Peat Resources of Australia Pty Ltd, P.O Box 203, Bentley 6102, (09) 453 3388: Manjimup.

#### **PETROLEUM**

Arrow Petroleum Ltd, 99 Shepparton Rd, Victoria Park 6010, (09) 470 0400: Mt Horner

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

Doral Resources, 31 Ventnor Ave, West Perth 6005, (09) 481 5866: Tubridgi.

Hadson Energy Ltd, 35 Ventnor Ave, West Perth 6008, (09) 481 8555: Harriet

Marathon Petroleum Aust. Ltd, PO Box 6192, East Perth 6004, (09) 325 1988: Talisman.

Petroleum Securities Energy Ltd, c/- Ozco Pty Ltd, 15 Whelk Place, Mullaloo 6025, (09) 307 1345: Blina, Lloyd, Sundown/West Terrace.

Sagasco Resources Ltd, 60 Hindmarsh Square, Adelaide SA 5001, (08) 223 4711: Beharra Springs.

West Aust. Petroleum Pty Ltd, 233 Adelaide Tce, Perth 6000, (09) 325 0181: Barrow Island, Dongara, Saladin.

Dongara, Saladin.

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

Woodside Offshore Pet. Pty Ltd, 1 Adelaide Tce, Perth 6000, (09) 244 4111: North Rankin.

#### **SALT**

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

Leslie Salt Company (Inc), 225 St George's Tce, Perth 6000, (09) 325 4888: Port Hedland.

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.

#### **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 Gnangara.

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

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.

**8.1 (cont) PRINCIPAL MINERALS AND PETROLEUM PRODUCERS 1991**, Head office postal address, telephone number: minesite.

**TALC**

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

**TIN - TANTALUM - LITHIUM**

**Spodumene**

Lithium Australia Ltd, 91 Kensington St, East Perth 6004, (09) 325 1966: 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.

**VERMICULITE**

Vermiculite Industries Pty Ltd, 15 Spencer St, Jandakot 6164, (09) 417 9900: Young River.



