

Resource Centre  
Policy Branch  
Dept. of Minerals & Energy

ROYALTIES AND POLICY DEVELOPMENT DIVISION

STATISTICAL DIGEST OF  
MINERAL AND PETROLEUM PRODUCTION  
1990-91



DEPARTMENT OF MINES  
WESTERN AUSTRALIA



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**ROYALTIES AND POLICY  
DEVELOPMENT DIVISION**

**DEPARTMENT OF MINES  
OF WESTERN AUSTRALIA**

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**NOVEMBER 1991**

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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

	Metric Unit	Symbol	Imperial Unit	Conversion factors	
				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>			
	mega (M)	10 <sup>6</sup>			
	giga (G)	10 <sup>9</sup>			
	tera (T)	10 <sup>12</sup>			

## 1 OVERVIEW

### 1.1 Review of the World Economy

The pronounced slowing trend in the world economy, which became apparent in late 1990, continued to deepen during the first six months of 1991. 1990-91 saw the lowest annual aggregate growth rate for a decade.

Among the O.E.C.D. countries, the United States, United Kingdom and Canada have been those most severely affected by the recession. Despite enjoying the lowest European inflation rate and relative balance in its external accounts, France is enduring high unemployment and a general lack of economic growth. Germany's normally robust economy weakened somewhat during the period, while Japan recorded its 55th consecutive monthly expansion of GDP, albeit with growth at a more moderate level than has been that nation's norm.

Eastern European and the U.S.S.R.'s output continued to contract severely during the trading period. The social and political fallout from these developments has subsequently increased pressure on policy makers to slow the pace of economic reform. This has particularly been the case in Poland. Apart from the U.S.S.R., which has the most severe structural problems, most of Eastern Europe should begin to register positive economic growth during 1992.

The current Japanese fiscal year should see the economy expand by a relatively modest 3.8%. Last year the growth rate was 5.7%. This growth will be generated despite a spate of major financial scandals, political leadership problems and central bank concern over the underlying rate of inflation.

The Japanese economy's emerging capacity constraints, and associated inflationary pressure, are being countered by a tight monetary policy. The resulting higher interest rates are threatening to stall the consumer and investment spending which has been broadly

sustaining the domestic economy. Slower private fixed infrastructure investment is being progressively offset by funds mainly sourced from the public sector. Much of the investment in domestic social and capital infrastructure is as a direct result of the Structural Impediments Initiative whereby Japan has sought to address the current account imbalances between itself and the U.S. The program began in April 1991 and will impact over several years.

The first half of 1991 saw the powerful German economy begin to stagnate, principally under the effect of the reunification process of the last 18 months. Apart from the considerable fiscal pressure, which is ongoing and has necessitated tax rises, goods and services demand from the Eastern sector has levelled off as have exports to Germany's main trading partners. The total value of exports fell by 1.5% in real terms during the first six months of 1991. A push for a national equalisation of wage rates and sectoral unemployment have added to the economic malaise.

The German Central Bank is determined to restore and maintain price stability through a tough monetary policy, this in turn is pushing up interest rates. Because of the size of Germany's economy its slow-down is impacting negatively on France, the Benelux countries and Austria. As a result of its central role in the European Monetary System, Germany's high interest rate policy is limiting the flexibility of British policy makers to lower rates and boost their recessed economy.

Though signs of a pick-up in the U.S. economy are beginning to emerge, mainly housing starts and industrial production, it is occurring at a relatively slow pace. Growth in monetary and credit aggregates, as well as employment, remain weak. Policy makers have placed great reliance on expansions in the money supply, through discount rate easings, to boost the economy. The U.S. discount rate has fallen gradually from 7.0% in November 1990 to 5.5% in May 1991.

As the U.S. advances further into its electoral cycle there is a danger that political imperatives may subsume the administration's medium to longer term economic strategy, which is aimed at a steady increase in investment and job creation. A low rate of economic growth through the Northern winter could make short term 'pump priming' initiatives, such as tax cuts, more attractive, politically. Any dependence on a domestic consumption led recovery would, however, further increase the budget deficit, draw in more imports and make sustained economic growth more difficult.

The North and East Asian economies, apart from Japan, are experiencing moderating though still strong growth. In China the economic effect of the stagnating export sectors is being offset by a surge in domestic demand. Chinese economic growth was approximately 5.0% in 1990-91, and this should surge to 7.0% in 1992.

Despite some uncertainty, ABARE has forecast that the world economy is poised for a modest recovery during 1992. Overall inflation adjusted growth should reach 2.9%. Lower oil prices, the cutback in military expenditure (the 'peace dividend'), restocking and pent up demand should spur slowly rising consumer spending through 1992. The predicted modest emergence from the recession by the U.S. and U.K., and a steady growth in Europe is not expected to generate a resurgence of inflation.

A major structural factor which began to emerge in 1991 was the possibility of a shortage of capital through the first half of the decade. This imminent capital shortage, which has been focused upon by some analysts, reflects projected demands for funds from Eastern Europe, the U.S.S.R. and the Middle East. These calls on savings will be piled on top of the ongoing and increasing demands from traditional developed and developing countries. The alternative view is that it will be some years before projects in the former Communist Bloc nations can jump the required hurdle rates of return in such

numbers as to impose major additional demands on world capital markets.

## 1.2 Review of the Australian Economy

The cumulative economy wide fall in output during the March and June quarters was approximately 2.4%. This erosion of G.D.P. resulted in a 0.5% real fall in economic activity for 1990-91.

Key economic indicators have either continued to reflect the severity of the recession or to measure only a very small growth recovery. Business and consumer confidence both remain low, private sector fixed investment is set to fall by a further 10% and housing starts remain subdued. Private investment in the important area of plant and equipment declined by 11% in 1990-91.

The weakness in the real economy has, however, significantly slowed wages growth. This development has allowed continued progress in reducing inflation.

The June quarter Consumer Price Index showed that there has been negligible overall growth in consumer prices in the first half of 1991. Where increases in goods and services prices have occurred they have tended to be modest. Asset prices have been either flat or falling in real terms. Although consumer confidence has recovered a little from its trough, spending continues to be subdued, credit growth is low and the labour market remains weak.

The performance of the nation's balance of payments has given some cause for medium to longer term optimism for the economy. Better than forecast deficits on the current account have been aided by the recession though militated against by the external cycle. Weak commodity prices have sharply reduced receipts from exports. The return of the merchandise trade account to surplus has been achieved largely by a growth in export volumes. It is encouraging that manufactured goods have comprised a solid proportion of

these aggregates.

During 1991-92, domestic demand should remain weak overall with some growth in the housing sector. Net exports are projected to make a positive contribution to growth with non-commodity exports strong. The agricultural sector is expected to remain under pressure from falling prices, while minerals and energy should register a more subdued performance from the peak achieved in 1990-91.

### 1.3 Economic Factors Affecting the Mining Industry

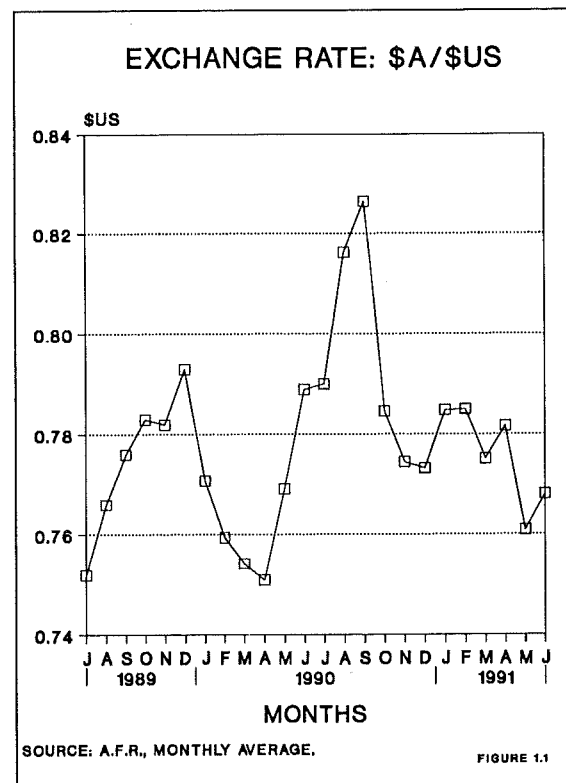
During 1990-91 most sectors of the minerals and energy industry were buffeted by a combination of falling demand on world markets, a related general softening of prices and a relatively strong \$A. While peaking production aggregates lifted almost all total values, iron ore was alone in registering a price increase. Despite a nominal 8 percentage point fall in interest rates, the sustained fall in the C.P.I. maintained real interest rates at a level higher than those of our main trading partners.

It is generally agreed among commodity analysts that most mineral's prices are near the trough of their cycles. Inasmuch that resource commodity demand broadly reflects conditions in the international economy the emergent recovery, though modest, should stabilise and then increase base metals and other mineral's prices. Such an outcome is contingent on a steady rebuilding of inventories by industrialised countries and no over production by the former Eastern Bloc nations.

The current protracted economic downturn is having another more damaging long term effect through its impact on mining investment. Access Economics has identified economic uncertainty as the principal reason for falling investment growth in the resource sector. The maintenance of real interest rates has also worked to limit overall investment by

sustaining a high risk adjusted rate of return for 'greenfields' mining projects.

The \$A generally weakened against the \$U.S. during 1990-91, falling from around 82 U.S. cents in the first quarter to approximately 76 U.S. cents in the June quarter (Figure 1.1). Some industry analysts have estimated that an exchange rate in the 71-72 cents would be optimal for most Australian miners. Gross returns to producers remain sensitive to fluctuations in the exchange rate. C.R.A. has estimated that for every one U.S. cent increase in the value of the \$A the resource group's annual gross earnings are reduced by \$22 million.



Having determined that the commodity cycle has bottomed, and that real domestic interest rates remain high, financial markets began to bid up the \$A at the beginning of 1991-92.

In addition to a difficult trading environment, Australian miners have had to address several complex structural and political changes in the last financial year.

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

Land access and related issues continued to be of central concern to the minerals and energy industry during 1990-91. Exploration and mining companies have also closely questioned aspects of the Aboriginal Heritage Act and the State's environmental protection legislation. The emergence of 'new federalism' and its implications for the pace and scope of microeconomic reform, is another area of industry interest.

The mining industry has taken every opportunity to stress its need for temporary access to relatively large exploration acreages. The economic importance of the industry and the quoted average success rate of one mining project for every one thousand exploration prospects provide the rationale for this position.

The prolongation and politicisation of the Coronation Hill (N.T.) decision made it the symbol to the industry of the whole agenda of land use issues. 'Sovereign risk' is the present catch-phrase of the mining industry. It means the risk mining investors run of having their enterprises damaged by government's legislative or administrative intervention.

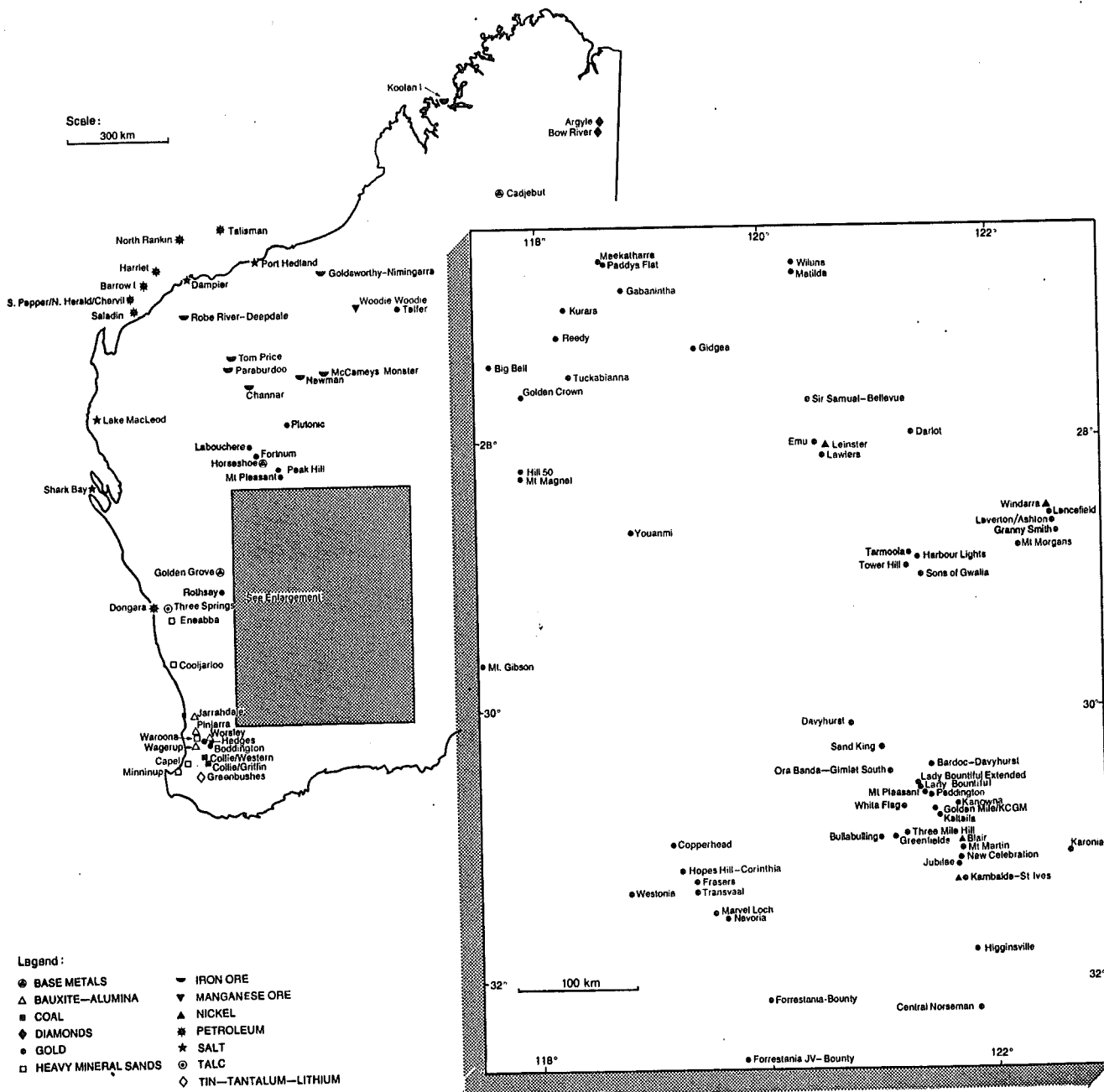
Discussions at this year's special Premiers' Conference focussed on a range of measures to increase national efficiency, international competitiveness and to move towards a singular national economy.

The microeconomic reform agenda, to which there is broad agreement among the States, has the potential to have many positive impacts on the mining industry. These will occur principally with the advance of reform in the areas of road/rail transport, shipping and power generation.

FIGURE 1.2

## MAJOR MINERAL AND PETROLEUM PROJECTS IN WESTERN AUSTRALIA

with an annual value of production in excess of \$10 million



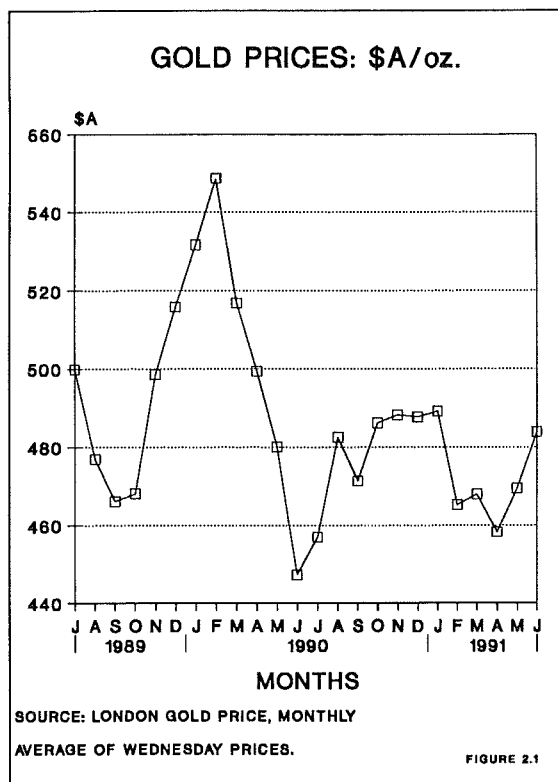
## 2. REVIEW OF MAJOR MINERALS AND PETROLEUM

### 2.1 GOLD

The strong production rise of recent years was sustained during 1990-91 with output from Western Australian mines exceeding 181 tonnes. This result was an overall 12%, or 19 tonne, increase on the record level of production achieved in 1989-90.

Based on the average monthly international gold price the value of State production for the period was \$2.9 billion. As much of the production was locked into forward sales contracts, at higher than the prevailing market price, nominal returns to producers probably exceeded \$3.0 billion.

Despite a sharp rise in prices for the precious metal, with the onset of the Gulf crisis in August 1990, most trade for the financial year was in a fairly narrow price band (Figure 2.1).



As the industrial nations' oil supplies proved to be fairly easily maintained, markets quickly discounted the long term effects of the conflict. During the trading period gold's limited role as

a store of value in times of economic dislocation was eroded by the growth of alternative investment instruments. The growing use of gold loans as a means of raising capital for project financing has accelerated supplies to the market and this is serving to put a ceiling on prices.

The international market price of the precious metal is coming under increasing downward pressure because of the uncertainty surrounding the political future of the U.S.S.R. It is feared that in the event of a severe liquidity crisis in that troubled nation up to 250 tonnes of current reserves could be dumped onto the market. Given the present state of the market, such a development could depress prices significantly.

In addition to a generally weakening real price, explorers and mine developers continued to be buffeted by difficulties in capital procurement, particularly in gaining access to equity markets.

Rising cost structures for existing producers, which have been exacerbated by stepped up pre-January 1991 production, will continue to impact on the viability of individual mines through 1991.

In the medium term, several demand factors should continue to place a floor price of around \$US 350 per ounce under gold sales. These factors include the seeming resilience of the jewellery fabrication industry, net purchases by central banks and some evidence of hoarding in the U.S.S.R. and east Asia. While the 1990-91 result posted by the Western Australian industry was strong, it is facing challenges from a range of structural, institutional and technical factors.

As real returns to producers have fallen the aggregate exploration budget has been reduced and the effect is now showing up across the industry. Although gold exploration expenditure for Western Australia was over \$200 million in 1990-91, a significant part of this amount was spent on proving up



significantly. It is fairly certain that existing contracts will soon be revised upwards to 7 million tonnes per annum by 1995. During the next few years South Korea and Taiwan will be seeking spot sales from the North West Shelf and will also be looking to conclude long term supply agreements. Woodside Petroleum Ltd is reported to be investigating the construction of a fourth and fifth LNG production trains at the Burrup Peninsula plant.

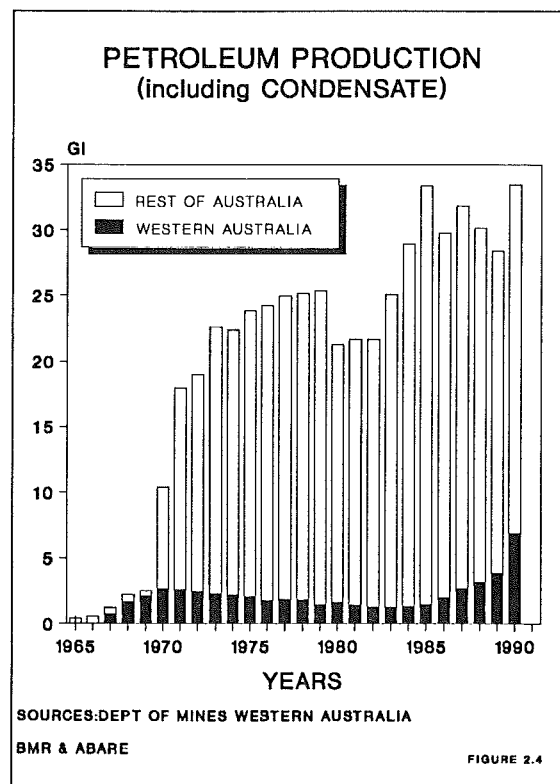
The Timor Gap treaty, which was concluded in late 1990, removed a long standing dispute over exploration and development in this highly prospective area. Indonesia and Australia are currently inviting bids for exploration rights to Zone A of the Timor Gap Zone of Cooperation. Over 60 oil companies are expected to place bids by October 1991, and the successful candidates will be announced in December 1991.

Recent discoveries, commitments to development and the coming onstream of two relatively small oil projects (Yammaderry and Cowle) have all confirmed the North West Shelf as Australia's principal future petroleum province. The most recent major project to receive approval to commence construction of floating production, storage and offloading facilities was the Cossack oil field. Approval for this \$320 million project was concluded in April 1991 and it is expected to come on stream in February 1993. Other major new fields which are under development review by proponents include Wanaea, Roller, Griffin and Ramillies. On present estimates these fields could yield up to 48 million kilolitres.

The Harriet gas gathering system, which will produce both natural gas and condensate from inshore fields, received the go ahead in December 1990. This \$150 million project is committed to supply 40-60 TJ of gas per day to SECWA for a 10 year period commencing in 1992.

Western Australia will attract a large proportion of the national exploration and

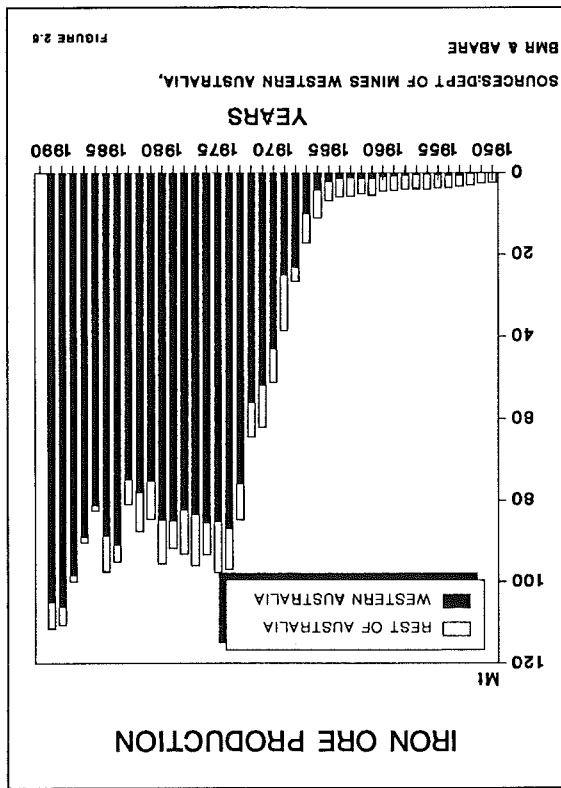
development investment in 1991. It is estimated that over \$250 million was spent on mainly offshore exploration during the last year. Statewide, a total of 33 exploration wells and 43 development wells were drilled. As a result of a string of promising discoveries in recent years, North West Shelf production should reverse the expected drop in the nation's level of oil self sufficiency. With the State's crude oil production still a small, though growing, proportion of the national output, the industry is looking forward to a bright future through the 1990s (Figure 2.4).



### 2.3 IRON ORE

Steady demand from Japan's steel mills and strengthening sales to the relatively new markets of China, the Republic of Korea and Taiwan buoyed Western Australia's iron ore industry during 1990-91. Low world iron ore stocks and expectations of steadily rising import demand from North Asia were the main factors underlying the strength of the wider world market.

At approximately 107 million tonnes, Western Australian production for domestic and export markets increased marginally from 1989-90.

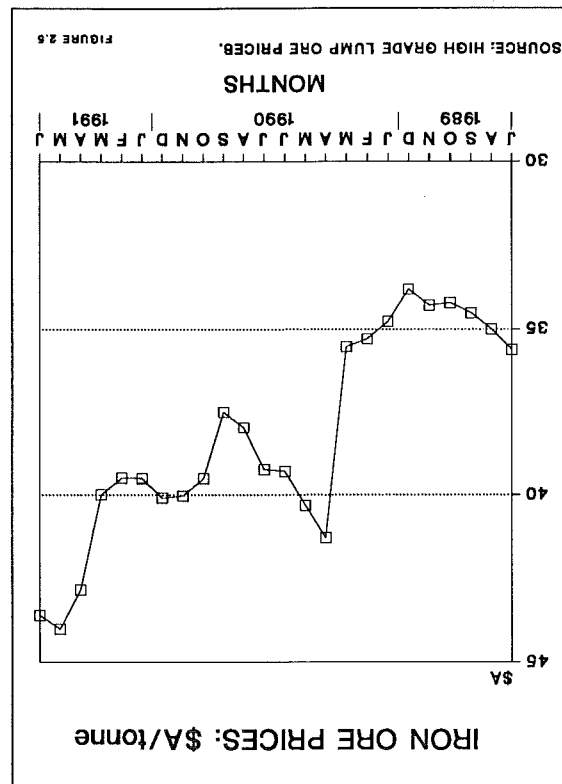


Western Australian iron ore exports are projected to rise steadily through the first half of the 1990s with production from this State continuing to dominate national output (Figure 2.6). The imminent entry of South Africa into the world market as a supplier of relatively low grade ore should not have any significant impact on prices or on Western Australia's market share.

The construction phase of Hamersley Iron's \$500 million Marandoo project, which will take 2 years, is scheduled to commence in early 1992. Ore mined from Marandoo will enable Hamersley to extend the life of the Mount Tom Price project and meet future market demands of up to 50 mtpa. The Marandoo mine has been planned to operate at a capacity of 10 to 15 mtpa depending on market demand.

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The medium to longer term demand for steel in North Asia, particularly from the construction and ship building industries, has encouraged the State's producers to look past the current economic downturn. This confidence is being manifested in industry wide investment. Capital spending on a range of infrastructure from mine capacity to port facilities should lift Robe River Mining Associates' annual production from the current level of approximately 23 million tonnes to over 32 million tonnes within the next few years. After a period of output shortfalls Mount Newman Mining should return to its normal production level of 35 mtpa during 1991. BHP Minerals' 5 mtpa Yandi-coogina project

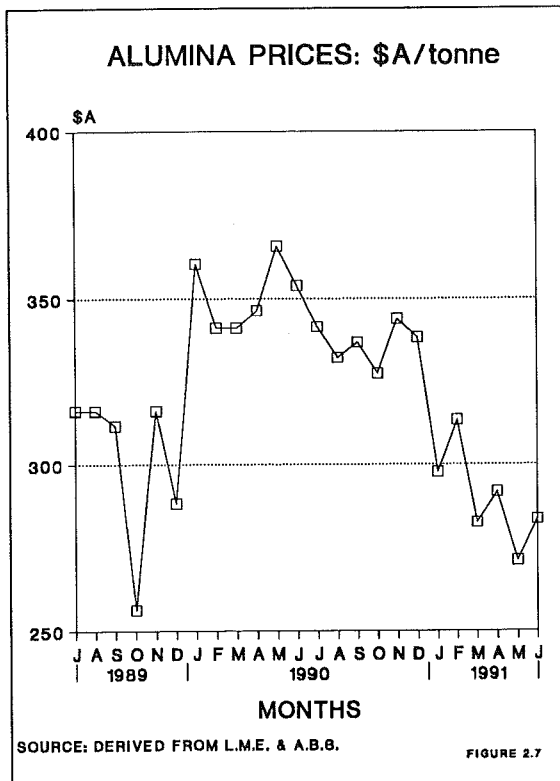


The value of output did, however, increase by a nominal 18% to over \$2.6 billion.

In early 1991, a third consecutive annual price rise was negotiated by the State's iron ore exporters. The nominal 7% increase (Figure 2.5) just kept pace with the rise in the consumer price index. This outcome reflected market conditions, which took into account some industry growth as well as the general uncertainty prevailing in the outlook for the world economy.

## 2.4 ALUMINA

State production eased by 150 000 tonnes to 6.8 million tonnes during 1990-91. Due to a softening of prices, which became more pronounced in the second half of the financial year (Figure 2.7), receipts from this production fell by 10% to \$2.1 billion. Despite the fall in prices the yearly average export unit value was a healthy \$310/tonne. This average is expected to drop further to around \$290/tonne in 1991-92 before recovering in early 1992-93.

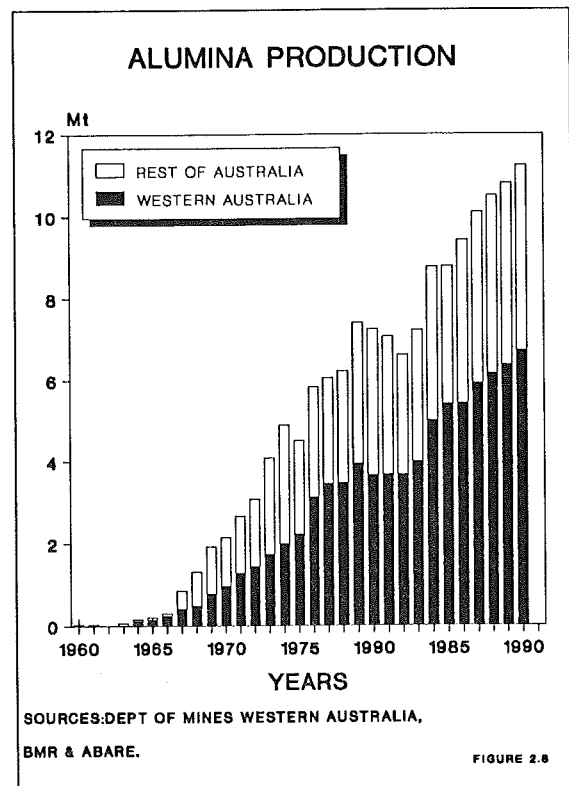


The supply/demand imbalance on world aluminium markets is the principal cause of the current erosion of the alumina price. A combination of fairly strong supply growth and stable demand for primary aluminium is adding to inventories. Thus, given the structural lag between aluminium and alumina markets, the downward pressure now being placed on alumina prices will only abate after a recovery in aluminium prices is well underway. The price recovery should begin by late 1992, and from then through to 1995-96 the real value of alumina exports should increase by 3% per annum. Even though current market conditions are far from buoyant, a medium to longer term outlook has

been taken in the investment decisions of Western Australia's producers. After operating at capacity for the past 3 years they are proceeding with significant capital works programmes.

The eighteen month undertaking to upgrade equipment and 'de bottleneck' the Worsley operation should be completed by the end of 1991. A feasibility study into constructing a third alumina train is also progressing. If that project comes to fruition it will involve \$500 million of investment to mine an additional 2.25 mtpa of bauxite which will in turn be processed to yield an extra 750 000 tpa of alumina.

In October 1990 after a lengthy process of proposal, environmental review and extensive feasibility studies, Alcoa began construction of the second stage of the Wagerup refinery. This second unit will involve over \$300 million in capital investment before it comes on stream in early 1993. As a result of this expansion Wagerup's capacity will increase from 850 000 tpa to 1.48 mtpa.



Being two of the world's most efficient alumina producers, the Western Australian based

A stabilisation and slight price improvement in the June quarter, driven mainly by supply uncertainties and historically low inventories, encouraged existing producers and potential market entrants. Analysts predict that strengthening demand from the major stainless steel producers will allow nickel prices to recover further during late 1991 and early 1992.

In addition to projected medium to longer term improvements in the demand for nickel, investors have been encouraged by local supply side factors. The State's ore resources are extensive, there is an adequate supply of trained labour, mining technology is the best available and infrastructure is good and improving. In light of recent events in the U.S.S.R., at present a major supplier of nickel onto world markets, the question of political and social stability has no doubt gained increased weight in investment decisions. A number of companies are in a position to contribute to an expansion of the current level of production essentially because of these factors which make up the total investment environment.

While the final ownership of the massive Mount Keith project (\$350 million) is yet to be decided, through negotiations with the Foreign Investment Review Board and by equity market manoeuvring, the developments overall economic feasibility is still being evaluated. The final go ahead decision has been delayed until early 1992.

Domion Mining's progress towards development of the large Yakabindie project (\$350 million) has slowed because of disputes over the presence of Aboriginal sacred sites in the mine area. Although the mine plan is being challenged before the State and Federal Supreme Court, both the State and Federal governments have strongly backed the development.

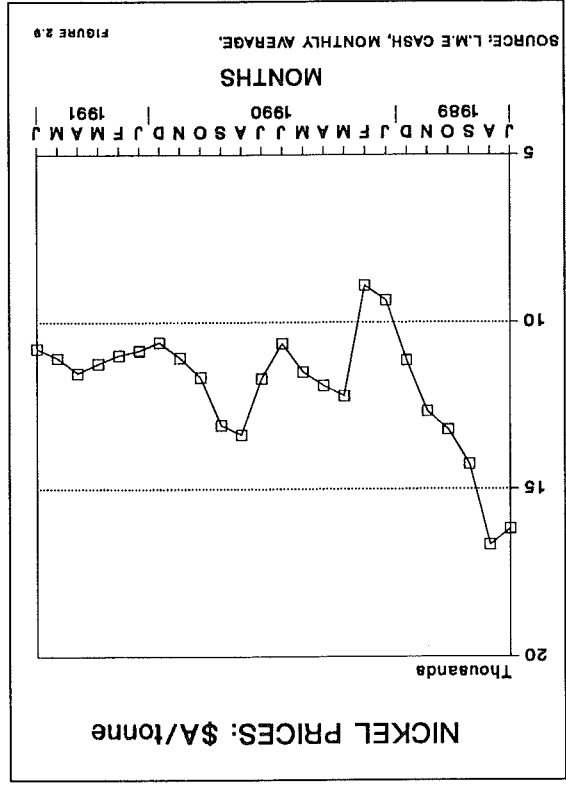
Western Mining Corporation has announced plans to spend \$127 million to expand its Leinster nickel operations. This investment will

companies are fairly well positioned to deal with the current market scenario and to gain from the upturn when it comes. This productive industry will continue to provide significant benefits to the Western Australian economy as it produces a significant part of the national (Figure 2.8) and world output.

**2.5 NICKEL**

During 1990-91 the amount of nickel metal produced from Western Australian mines increased by approximately 3% to over 54 000 tonnes. While Western Mining Corporation's mines in the Kambalda and Widgiemooltha areas continued to be the main sources of nickel ore, production from the Leinster operation accounted for most of the improvement in output.

As production rose, the total value of the sector's output also increased by approximately \$9 million to \$602 million.

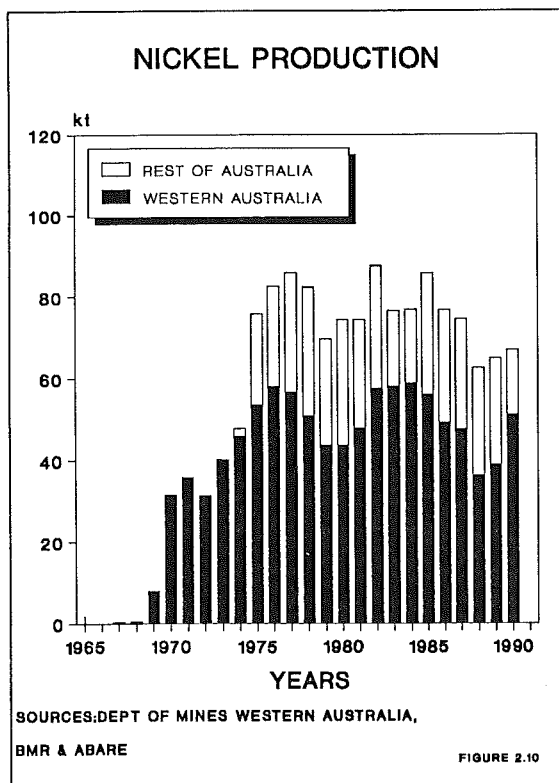


Notwithstanding the production and value rises which the State's nickel industry sustained in 1990-91, the steady price fall made for a difficult trading period (Figure 2.9).

be the first stage of company plans to spend up to \$400 million on expanding and upgrading its Western Australian nickel operations. Contingent factors; which include pollution emission standards, energy input costs and changes in work practices; have been negotiated and largely agreed upon.

Development work on the relatively small Radio Hill project in the Pilbara is substantially complete. The plant is scheduled to be commissioned by the beginning of October 1991 and concentrate sales should commence by the beginning of 1992.

The national output of nickel metal rose slightly in 1990-91 as Western Australian producers maintained their share of aggregate production (Figure 2.10).



Some increased export earnings from this industry are projected for 1991-92 as production rises and the metal price slowly strengthens.

## 2.6 DIAMONDS

Western Australia's two producers sold 29.9 million carats of diamonds into world markets in 1990-91. This marginal decrease in output was balanced by a small (5%) increase in the value of production to \$435 million.

After reaching record levels in early 1990 rough diamond prices, and the demand for near gem and gem quality diamonds, flattened considerably in the last half of the year. All three categories of diamonds, particularly gem quality which are considered to be luxury goods, proved sensitive to slowing growth in the major economies. Demand in Japan, a relatively strong growth market, and in the U.S. contracted noticeably. In the more traditional European market sales have only moderated slightly.

The De Beers group, which markets most of the world's diamonds, reported a 16% fall in its earnings for the trading period. During the year in an apparent contradiction to the uncertainty surrounding the diamond trade, marketing mechanisms became more stable. De Beers increased its capacity to maintain price and market stability by signing exclusive 5 year sales contracts with the Soviet and Angolan State diamond trading companies.

Due mainly to technical factors, Argyle Diamonds, Western Australia's principal producer, has recorded a sharp fall in output in the first half of 1991. Operations have been disrupted by heavy rains and most production is being sourced from low grade ore blocks in the AKI pipe.

Western Australian diamond producers are cautious, though optimistic, about the future of the industry. Much still depends on the depth of the general economic downturn and how soon consumer confidence and spending bounces back.

A high level of exploration is, however, ongoing in various parts of the state. Stockdale Prospecting's efforts in the

Murchison north of Meekatharra have recently been rewarded with some promising results.

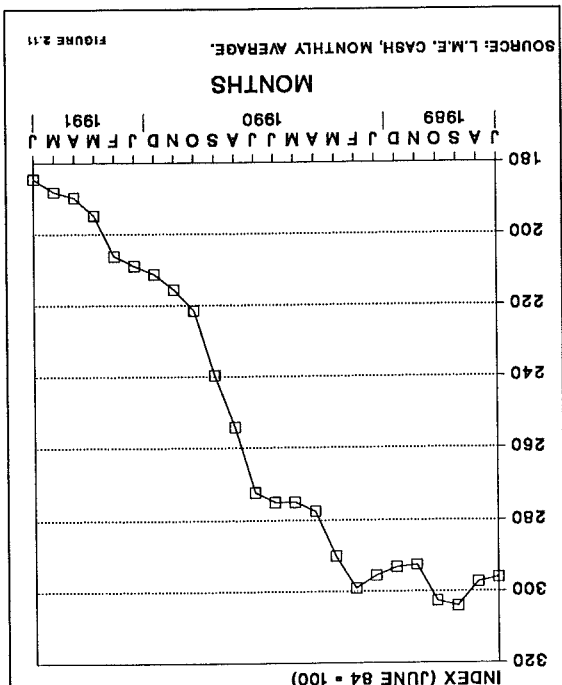
**2.7 HEAVY MINERAL SANDS**

currently being consumed by the pigment industry. In turn, this pigment is used extensively in the production of paint, paper and plastics, all of which are extremely sensitive to housing starts and the rate of manufacture of a range of consumer goods. The protracted downturn in economic activity among the OECD nations, particularly in the key U.S. market, has led to a build up in inventories of titaniferous feedstocks and pigment. The supply overhang has in turn forced down prices. The price surges of the late 1980s, though welcomed by the industry at that time, have indirectly reduced present demand by encouraging substitution in a wide range of products.

In the second half of 1990-91 Western Australia's heavy mineral sands producers cut output in response to sharply falling demand in world markets. The moderating demand has led to rising inventory levels. These developments are in contrast to the scarcity which prevailed over the past 5 years and which, during the period, drove up the prices of ilmenite, rutile and zircon.

Total receipts to the State's producers during 1990-91 were approximately \$388 million. This represented a significant fall of 18% on final figures for 1989-90. While the value of ilmenite produced fell by only 5% zircon, which had grown in value most during the recent past, slumped by 42%. The price index for mineral sands indicates the degree of contraction in the value of the industry's products (Figure 2.11).

**PRICE INDEX FOR MINERAL SANDS**



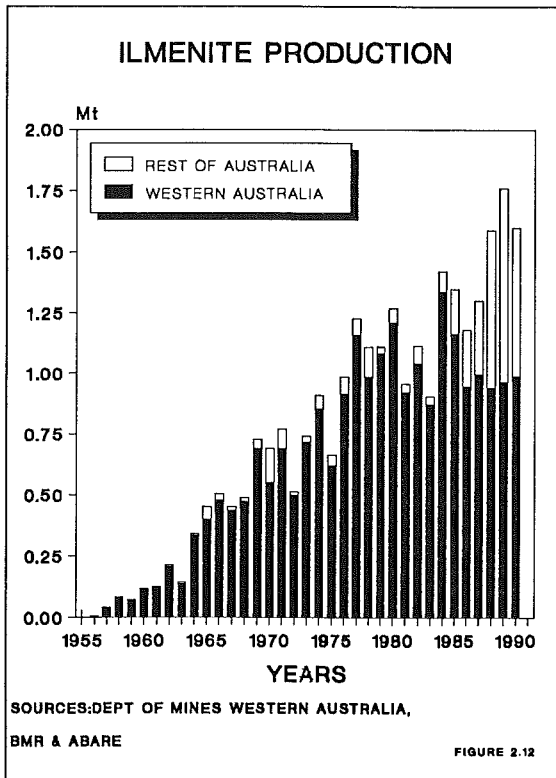
Over 90% of the world's production of titanium dioxide bearing mineral sands products are

During the medium term, the broad range of heavy mineral sands products are not predicted to recover to the price levels recorded in 1989-90. Market values are, however, predicted to stabilise in 1991-92 with the inevitable run down of inventories and the onset of an international economic recovery. In the longer term there is general optimism that the average growth rate for titanium dioxide pigment will be maintained at the 2.5% completion.

titanium pigment plant at Kwinana is nearing completion. The February 1991 commissioning of A.M.C.'s Eneabba West mine and Narngulu dry synthetic rutile plant is a tangible example of this investment direction and emphasis. The other major example is the TiWest joint venture commissioning of the Cooljarloo mine in August 1990 and Muchea synthetic rutile plant in November 1990. TiWest's titanium pigment plant at Kwinana is nearing completion.

Department of Mines

per annum level which prevailed during the 1980s. The outlook for the industry is thus generally promising.



Western Australia is well placed to maintain its world prominence as a mineral sands supplier (Figure 2.12). Although an increasing proportion of Western Australian produced ilmenite is having value added through upgrading to synthetic rutile, ilmenite tonnages sold still provide a good indicator of industry activity.

## 2.8 SUMMARY AND OUTLOOK

Overall, the Western Australian minerals and petroleum industry continued to post strong output and value results in 1990-91. This was achieved despite the uncertainty prevailing in the international trading environment, and was in sharp contrast to the severely recessed conditions of most other sectors of the State economy.

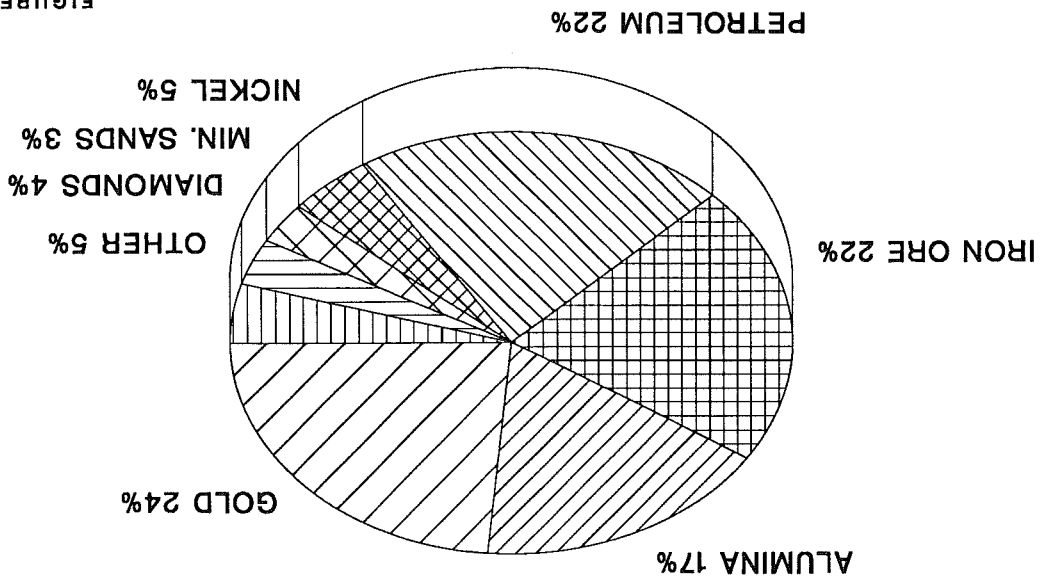
The financial year's result of \$12.2 billion represented a 15% improvement over the 1989-90 total. The industry wide aggregate rise in the value of production was sustained

by the major commodities of gold, petroleum and iron ore. Despite a contraction in price during the second half of the trading period the alumina industry continued to contribute significantly to the overall outcome. In the June quarter of 1991 the value of mineral exports generally fell, the largest contractions in earnings were in crude oil and gold.

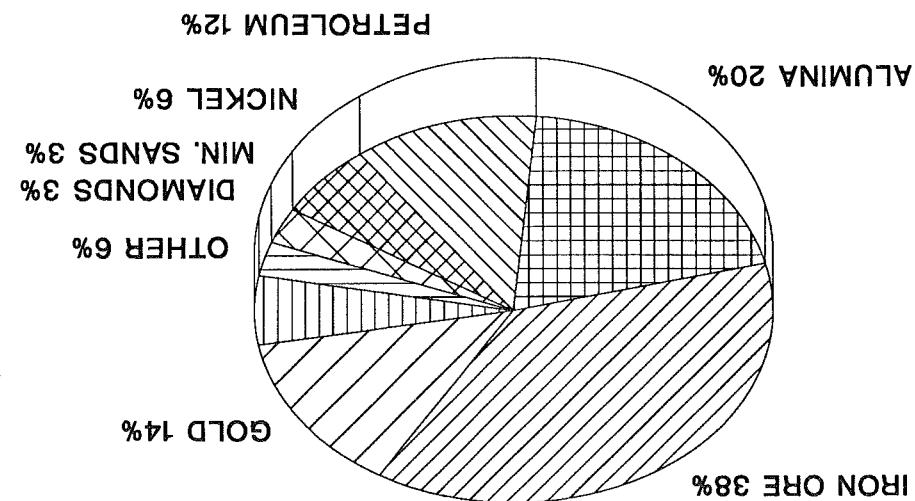
1991-92 should see the beginning of a gradual recovery for those sectors of the State's diversified minerals and petroleum industry which have been affected by the current downturn in economic activity. The most potent indicator of recovery comes from the firm commitments to future projects made by resource developers during 1990-91. In the period, over \$1.3 billion of capital investment was pledged to new projects which will come on stream through the early to mid 1990s. A further \$1.3 billion of investment is subject to advanced feasibility studies.

Although Australia's terms of trade are flat at the moment, the incipient emergence of the U.S. from recession and the influence of the resilient German and Japanese economies point to an improvement through 1992.

FIGURE 1.2



1990-91 VALUE OF PRODUCTION  
TOTAL: \$12,269 MILLION



COMPARATIVE VALUE OF PRODUCTION  
1985-86 VALUE OF PRODUCTION  
TOTAL : \$ 5,235 MILLION

TABLE 3.1

## QUANTITY AND VALUE OF MINERALS AND PETROLEUM 1989-90, 1990-91

MINERAL	UNIT	1989-90		1990-91	
		QUANTITY	VALUE(\$A)	QUANTITY	VALUE(\$A)
BARYTES	t	7 521	1 006 603	0	0
BASE METALS					
Copper	t	14 979	23 922 443	11 995	20 349 205
Lead	t	13 171	7 604 934	7 179	3 736 319
Zinc	t	45 878	59 754 974	57 330	60 461 840
TOTAL BASE METALS			91 282 351		84 547 364
BAUXITE-ALUMINA					
Alumina	t	6 651 028	2 335 697 184	6 800 451	2 099 125 726
CLAYS					
Attapulgit	t	28 137	3 988 107	15 403	3 914 836
Cement Clay	t	21 952	54 880	22 994	137 964
Fire Clay	t	279 538	511 780	620	744
Kaolin	t	7 701	472 291	0	0
White Clay	t	32 401	324 010	139 000	1 529 000
TOTAL CLAYS			5 351 068		5 743 262
COAL	t	4 160 646	183 698 442	5 218 176	232 915 908
CONSTRUCTION MATERIALS					
Aggregate	t	150 814	754 854	102 945	435 358
Gravel	t	44 981	213 086	30 952	152 200
Rock	t	108 198	800 585	43 135	454 534
Sand	t	729 863	2 693 633	548 673	2 327 258
TOTAL CONSTRUCTION MATERIALS			4 462 158		3 369 350
DIAMOND	ct	33 854 620	413 583 727	29 964 155	435 725 448
DIATOMITE	t	0	0	22	160
DIMENSION STONE					
Black Granite	t	1 239	1 789 485	249	76 706
Quartz Rock	t	994	43 341	430	19 302
Quartzite	t	59	2 360	0	0
Spongolite	t	2 280	145 354	115	9 430
TOTAL DIMENSION STONE			1 980 540		105 438
GEM, SEMI-PRECIOUS & ORNAMENTAL STONE					
Amethyst	kg	14 594	67 958	25	131 426

TABLE 3.1 (cont)

QUANTITY AND VALUE OF MINERALS AND PETROLEUM 1989-90, 1990-91

MINERAL	1989-90		1990-91	
	UNIT	QUANTITY	VALUE(\$A)	QUANTITY
Emerald	g	550	2 020	0
TOTAL GEM, SEMI-PRECIOUS & ORNAMENTAL STONE			69 978	131 426
GOLD	kg	161 789 (r)	2 596 453 778 (r)	181 165 (e) 2 900 129 174 (e)
Gypsum	t	154 809	995 281	82 520
HEAVY MINERAL SANDS				
Garnet	t	27 768	1 152 128	22 141
Ilmenite	t	1 071 845	89 606 326	965 930
Upgraded Ilmenite (a)	t	284 109	131 107 248	263 408
Leucocoxene	t	15 023	7 902 766	23 836
Monazite	t	13 358	9 731 111	6 869
Rutile	t	82 232	58 541 710	65 446
Zircon	t	300 256	175 190 729	208 424
TOTAL HEAVY MINERAL SANDS			473 232 018	388 037 629
INDUSTRIAL PEGMATITE MINERALS				
Felspar	t	9 692	437 909	34 315
Mica	t	0	0	2 280
TOTAL INDUSTRIAL PEGMATITE MINERALS			437 909	1 459 726
IRON ORE				
Domestic	t	5 255 037	103 517 251	4 368 036
Exported	t	101 017 156	2 142 510 771	103 304 766
TOTAL IRON ORE			2 246 028 022	107 672 802
LIMESAND-LIMESTONE-DOLOMITE				
Dolomite	t	333	6 660	0
Limesand-Limestone	t	1 698 820	7 868 870	1 738 427
TOTAL LIMESAND-LIMESTONE-DOLOMITE			7 875 530	9 853 611
MANGANESE ORE	t	273 000	1 200 000	137 961
NICKEL INDUSTRY	t			
Cobalt by-product	t	268	4 600 916	222
Nickel Concentrate	t	446 453	565 370 341	510 320
Nickel Ore	t	37 084	20 598 342	8 666
Palladium by-product	kg	431	1 631 497	350
Platinum by-product	kg	66	1 049 022	89
TOTAL NICKEL INDUSTRY			593250118	602073639

TABLE 3.1 (cont)

## QUANTITY AND VALUE OF MINERALS AND PETROLEUM 1989-90, 1990-91

MINERAL	UNIT	1989-90		1990-91	
		QUANTITY	VALUE(\$A)	QUANTITY	VALUE(\$A)
PEAT	t	1 111	68 546	376	28 000
PETROLEUM					
Condensate	kl	1 601 163	235 653 383	1 867 892	370 948 987
Crude Oil	kl	3 962 739	601 471 936	5 136 529	1 054 073 043
LNG	MMBtu	104 167 480	336 091 222	184 930 679	836 400 762
Natural Gas	'000m3	3 847 731	356 846 939	3 613 720	379 228 944
TOTAL PETROLEUM			1 530 063 480		2 640 651 736
PIGMENTS					
Red Iron Oxide	t	0	0	5757	110531
RARE EARTHS					
Gallium	kg	42 986	1 454 998	8 481	267 377
SALT					
	t	5 924 943	124 110 422	6 413 163	136 973 045
SILICA-SILICA SAND					
Silica	t	32 544	325 435	80 147	822 975
Silica Sand	t	445 874	3 662 014	781 503	6 774 328
TOTAL SILICA-SILICA SAND			3 987 449		7 597 303
SILVER					
	kg	34 566 (r)	5 621 356	39 775	6 053 366
TALC					
	t	220 263	15 223 112	161 560	11 691 732
TIN-TANTULUM-LITHIUM					
Spodumene	t	47 428	8 305 325	40 376	7 079 333
Tantalite	t	439	16 169 644	702	22 767 073
Tin	t	237	1 298 492	262	1 229 162
TOTAL TIN-TANTULUM-LITHIUM			25 773 461		31 075 568
VERMICULITE					
	t	105	18 528	507	90 227
TOTAL VALUE			10 662 926 059 (r)	12 269 023 149 (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	Government Area	tonnes	Value (\$) Ref
		Quantity	Content
BASE METALS	Coolgardie	3 885,827	6 464 366 (a),(b)
	Cu Tonnes		
COPPER BY-PRODUCT	East Pilbara	2 777,780	3 042 254
	Meekeatharra	4 811,685	9 777 264
COPPER CONCENTRATES	Valgoe	2 599	1 065 321
	Yalgoo	519,886	1 065 321
TOTAL COPPER		11 995,178	20 349 205
	Pb Tonnes		
LEAD	Derby-West Kimberley	7 179,150	3 736 319 (a)
	Zn Tonnes		
ZINC	Derby-West Kimberley	43 055,630	47 382 370
	Yalgoo	14 275,022	13 079 470
TOTAL BASE METALS		121 979	60 461 840 (a)
		57 330,652	84 547 364
BAUXITE - ALUMINA	Boddington	1 372 028	438 871 893
	Harvey	863 328	263 331 797
ALUMINA	Murray	2 626 003	814 243 024
	Serpentine-Jarrahdale	1 939 092	582 679 012
CLAYS	Mullewa	15403	3 914 836 (a)
	Armadale	22994	137 964 (d)
CEMENT CLAY	Chittering	620	744 (d)
	Serpentine-Jarrahdale	139 000	1 529 000
WHITE CLAY	Swan	14 611	160 718
		153 611	1 689 718 (d)
TOTAL CLAYS		192 752	5 743 262
COAL	Collie	5 218 176	232 915 908 (e)
CONSTRUCTION MATERIALS	Derby-West Kimberley	1 386	5 266
	Kalgoorlie-Boulder	65 089	278 004
AGGREGATE	Port Hedland	28 226	120 233
	Wynndham-East Kimberley	8 244	31 855
		102 945	435 358

TABLE 4.1 (cont)	Local	Quantity	Metallic	
Mineral	Government Area	tonnes	Content	Value (\$) Ref
<b>CONSTRUCTION MATERIALS (cont)</b>				
GRAVEL	Broome	1 492		4 780
	Coolgardie	120		720
	Kalamunda	23 440		117 200
	Port Hedland	<u>5 900</u>		<u>29 500</u>
		30 952		152 200
ROCK	Broome	26 340		232 629
	Exmouth	6 170		104 575
	Roebourne	<u>10 625</u>		<u>117 330</u>
		43 135		454 534
SAND	Ashburton	23 382		67 458
	Canning	103 342		218 906
	Collie	41 682		244 794
	Coolgardie	45 452		223 960
	Dandaragan	3 615		18 650
	Derby-West Kimberley	3 000		15 000
	Gingin	6 511		39 059
	Leonora	4 136		20 680
	Meekatharra	20 749		107 008
	Menzies	1 815		9 075
	Northam	4 063		17 500
	Port Hedland	16 709		91 163
	Roebourne	215 534		1081 790
	Swan	<u>58 683</u>		<u>172 215</u>
		548 673		2 327 258
<b>TOTAL CONSTRUCTION MATERIALS</b>				<b>3 369 350 (d)</b>
DIAMOND		Carats		
	Wyndham-East Kimberley	29 964 155		435 725 448 (a)
DIATOMITE	Dandaragan	22		160 (e)
<b>DIMENSION STONE</b>				
BLACK GRANITE	Derby-West Kimberley	249		76 706 (a)
QUARTZ ROCK	Mukinbudin	430		19 302 (d)
SPONGOLITE	Plantagenet	<u>115</u>		<u>9 430 (e)</u>
TOTAL DIMENSION STONE		794		105 438
<b>GEM, SEMI-PRECIOUS AND ORNAMENTAL STONE</b>				
AMETHYST	Upper Gascoyne	25		131 426 (e)

TABLE 4.1 (cont)		Local	Government Area	Mineral
Quantity	Metallic Content	Value (\$) Fret	tonnes	
Au kg				
Ashburton	7,425	118 861		GOLD
Boddington	22 484,430	359 935 702		
Coolgardie	13 644,635	218 426 319		
Cue	12 034,784	192 655 470		
Dundas	3 803,390	60 885 504		
East Pilbara	12 041,254	192 759 043		
Halls Creek	59,359	950 232		
Kalgoorlie-Boulder	43 392,914	694 643 313		
Laverton	6 923,458	110 832 239		
Leonora	15 860,082	253 891 682		
Meekatharra	11 868,243	189 989 445		
Menzies	3 224,868	51 624 396		
Mt Magnet	7 457,231	119 376 994		
Perenjori	210,196	3 364 864		
Ravensthorpe	100,539	1 609 450		
Roebourne	13,973	223 683		
Sandstone	3 914,051	62 656 989		
Upper Gascoyne	5,691	91 103		
Westonia	2 226,449	35 641 485		
Willuna	4 572,363	73 195 393		
Yalgoo	3 227,251	51 662 544		
Yilgarn	14 092,414	225 594 463		
	181 165,000	2 900 129 174 (f)		
Carnamah	3 791	22 746 (e)		GYP SUM
Dalwallinu	26 375	317 832 (d)(e)		
Esperance	1 248	9 302 (e)		
Irwin	1 271	7 624 (e)		
Kellerberrin	1 243	7 000 (e)		
Lake Grace	11 205	49 307 (e)		
Merredin	408	2 448 (e)		
Nungarin	22 489	115 382 (e)		
Ravensthorpe	1 018	6 000 (e)		
Wyalkatchem	13 472	75 137 (e)		
	82 520	612 778		
Capel	1 165	78 495 (g)		HEAVY MINERAL SANDS
Northampton	20 976	1 992 683 (e)		GARNET SAND
	22 141	2 071 178		

Mineral	Local Government Area	Quantity tonnes	Metallic Content	Value (\$) Ref
HEAVY MINERAL SANDS (cont)			TiO <sub>2</sub> %	
ILMENITE	Capel	543 808	54.60)	
	Carnamah	149 048	60.00)	
	Dandaragan	213 411	62.92)	
	Waroona	<u>59 663</u>	54.48)	
		965 930		85 482 878
UPGRADED ILMENITE			TiO <sub>2</sub> %	
UPGRADED ILMENITE	Capel	155 620	92.00)	
	Carnamah	75 274	92.00)	
	Dandaragan	<u>32 514</u>	92.00)	
		263 408		131 710 093
TOTAL ILMENITE		1 229 338		217 192 971 (a)
LEUCOXENE			TiO <sub>2</sub> Tonnes	
LEUCOXENE	Capel	23 836	21 651	13 259 826
MONAZITE			ThO <sub>2</sub> Units	
MONAZITE	Capel	2 600	19 500	1 735 400
	Carnamah	<u>4 269</u>	<u>27 749</u>	<u>3 378 467</u>
		6 869	47 249	5 113 867 (a)
RUTILE			TiO <sub>2</sub> Tonnes	
RUTILE	Carnamah	55 434	51 999	42 084 879
	Dandaragan	<u>10 012</u>	<u>9 604</u>	<u>7 513 131</u>
		65 446	61 603	49 598 010 (a)
ZIRCON			ZrO <sub>2</sub> Tonnes	
ZIRCON	Capel	52 572	34 170	25 781 257
	Carnamah	140 349	91 545	68 459 882
	Dandaragan	11 759	7 760	5 508 055
	Waroona	<u>3 744</u>	<u>2 434</u>	<u>1 052 583</u>
		208 424	135 909	100 801 777 (a)
TOTAL HEAVY MINERAL SANDS				388 037 629
INDUSTRIAL PEGMATITE MINERALS				
FELSPAR	Mukinbudin	6 890		282 521
	Port Hedland	<u>27 425</u>		<u>1 063 608</u>
		34 315		1 346 129
MICA	East Pilbara	2 280		113 597
TOTAL INDUSTRIAL PEGMATITE MINERALS				1 459 726 (h)

TABLE 4.1 (cont)		Local	Government Area	Quantity	Metallic Content	Value (\$)	Ref
IRON ORE				tonnes			
DOMESTIC ORE	Ashburton			333 251	63.00	9 243 979	
	Derby-West Kimberley			1 215 537	65.18	28 938 039	
	East Pilbara			2 819 248	63.25	75 773 019	
				4 368 036		113 955 037	
	F%						
EXPORTED ORE	Ashburton			65 127 539	60.72	1 521 835 795	
	Derby-West Kimberley			2 167 964	64.47	48 769 990	
	East Pilbara			36 009 263	64.80	964 125 749	
				103 304 766		2 534 731 534	
TOTAL IRON ORE				107 672 802		2 648 686 571	(a)
LIMESAND - LIMESTONE	Cockburn			1 498 834		7 541 838	
	Dandaragan			555		2 775	
	Exmouth			1 716		17 160	
	Gingin			18 015		323 271	
	Irwin			8 254		16 309	
	Manjimup			1 657		16 615	
	Roebourne			598		3 355	
	Wanneroo			208 798		1 932 288	
TOTAL LIMESAND-LIMESTONE				1 738 427		9 853 611	(d)
MANGANESE ORE	East Pilbara			137 961		21 967 054	(a)
NICKEL INDUSTRY					Co Tonnes		
COBALT BY-PRODUCT	Coolgardie			222.32		3 697 617(a),(b)	
	Ni %						
NICKEL CONCENTRATES	Coolgardie			284 306	10.53	327 582 740	
	Kalgoorlie-Boulder			23 058	12.55	31 685 641	
	Laverton			36 841	8.59	34 631 459	
	Leonora			166 115	10.88	197 403 141	
				510 320		591 302 981	
NICKEL ORE	Leonora			8 666	4.66	4 575 271	
TOTAL NICKEL PRODUCTION						595 878 252	(i)
PALLADIUM BY-PRODUCT	Coolgardie			350.34		1 229 183(a),(b)	
	Pd kg						
PLATINUM BY-PRODUCT	Coolgardie			89.16		1 268 587(a),(b)	
	Pt kg						
PEAT	Manjimup			376		28 000	(d)

TABLE 4.1 (cont)	Local	Quantity	Metallic	
Mineral	Government Area	tonnes	Content	Value (\$) Ref
PETROLEUM		Kilolitres		
CONDENSATE	Carnamah	889		38735 (d)
	Irwin	759		103 630 (d)
	Roebourne	<u>1 866 244</u>		<u>370 806 622</u> (a)
		1 867 892		370 948 987
CRUDE OIL	Derby-West Kimberley	19 357		3 527 671
	Irwin	37 898		6 469 173
	Roebourne	<u>5 079 274</u>		<u>1 044 076 199</u>
		5 136 529		1 054 073 043 (a)
		MMBtu		
LIQUIFIED NATURAL GAS	Roebourne	184 930 679		836 400 762 (a)
		'000 m3		
NATURAL GAS	Carnamah	102 203		11 473 635 (j)
	Irwin	111 215		12 738 394 (j)
	Roebourne	<u>3 400 302</u>		<u>355 016 915</u> (d)
		3 613 720		379 228 944
TOTAL PETROLEUM PRODUCTS				2 640 651 736
PIGMENTS				
RED IRON OXIDE	Cue	5 757		110 531 (e)
RARE EARTHS				
		Ga kg		
GALLIUM	Murray	8 481		267 377 (a)
SALT				
	Carnarvon	1 235 879		26 330 175 (a)
	Port Hedland	1 898 527		38 163 075 (a)
	Roebourne	2 860 025		62 517 075 (a)
	Shark Bay	400 924		8 317 980 (a)
	Wyalkatchem	191		15 280 (e)
	Yilgarn	<u>17 617</u>		<u>1 629 460</u> (a)
		6 413 163		136 973 045
SILICA - SILICA SAND				
SILICA	Moora	80 147		822 975 (a)
SILICA SAND	Canning	238 337		2 621 707 (a)
	Cockburn	415 430		3 590 858 (a)
	Coolgardie	82 603		202 378 (a)
	Swan	14 910		169 518 (a)(e)
	Wanneroo	<u>30 223</u>		<u>189 867</u> (a)
TOTAL SILICA - SILICA SAND		861 650		7 597 303

TABLE 4.1 (cont)		Local	Quantity	Metallic	Content	Value (\$) Ref
Mineral	Government Area	tonnes				
SILVER: BY-PRODUCT	By-Product Gold Mining	25 684.846	Ag kg.	4 055 095		
	Coolgardie	235.991		41 228 (a),(b)		
	Meekatharra	7 269.289		971 028 (a),(k)		
	Yalgoo	6 585.089		986 015 (a),(l)		
		39 775.215		6 053 366		
TALC	Meekatharra	20 067		1 787 222		
	Three Springs	141 493		9 904 510		(e)
TIN - TANTALUM - LITHIUM	Bridegetown-Greenbushes	40 376	Li <sub>2</sub> O <sub>2</sub> Tonnes	2 180	7 079 333	(a)
				SPOUMENE		
				TANTALITE		
TIN	Bridegetown-Greenbushes	260	Sn Tonnes	176.79	1209 545	
				East Pilbara		
				2	19 617	(a)
VERMICULITE	Ravensthorpe	507		90 227		(e)
				TOTAL VALUE		12 269 023 149
				VALUE OF MINERALS		6 728 242 239
		VALUE OF PETROLEUM		2 640 651 736		
		VALUE OF GOLD		2 900 129 174		

TABLE 5.1

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

Mineral	Mineral-field	Quantity tonnes	Metallic Content	Value (\$)	Ref
<b>BASE METALS</b>			<b>Cu Tonnes</b>		
COPPER BY-PRODUCT	Coolgardie		3 885.827	6 464 366	(a),(b)
COPPER CONCENTRATES	Peak Hill	22 563	4 811.685	9 777 264	
	Pilbara	11 765	2 777.780	3 042 254	
	Yalgoo	<u>2 599</u>	<u>519.886</u>	<u>1 065 321</u>	
		36 927	8 109.351	13 884 839	(a)
TOTAL COPPER			11 995.178	20 349 205	
			<b>Pb Tonnes</b>		
LEAD	West Kimberley	9 980	7 179.150	3 736 319	(a)
			<b>Zn Tonnes</b>		
ZINC	West Kimberley	87 072	43 055.630	47 382 370	
	Yalgoo	<u>34 907</u>	<u>14 275.022</u>	<u>13 079 470</u>	
		121 979	57 330.652	60 461 840	(a)
TOTAL BASE METALS				84 547 364	
<b>BAUXITE - ALUMINA</b>					
ALUMINA	South West	6 800 451		2 099 125 726	(c)
<b>CLAYS</b>					
ATTAPULGITE	South West	15 403		3 914 836	(a)
CEMENT CLAY	South West	22 994		137 964	(d)
FIRE CLAY	South West	620		744	(d)
WHITE CLAY	South West	<u>153 611</u>		<u>1 689 718</u>	(d)
TOTAL CLAYS		192 752		5 743 262	
COAL	Collie	5 218 176		232 915 908	(e)
<b>CONSTRUCTION MATERIALS</b>					
AGGREGATE	East Coolgardie	65 089		278 004	
	Kimberley	8 244		31 855	
	Pilbara	28 226		120 233	
	West Kimberley	<u>1 386</u>		<u>5 266</u>	
		102 945		435 358	
GRAVEL	Coolgardie	120		720	
	Pilbara	5 900		29 500	
	South West	23 440		117 200	
	West Kimberley	<u>1 492</u>		<u>4 780</u>	
		30 952		152 200	

TABLE 5.1 (cont)		Quantity	Content	Value (\$)	Ref
Mineral	Mineral-Field	tonnes	Metallic		
ROCK	Ashburton	6 170		104 575	
	West Kimberley	26 340		232 629	
	West Pilbara	10 625		117 330	
		43 135		454 534	
SAND	Ashburton	18 027		40 685	
	Coolgardie	45 452		223 960	
	East Murchison	2 077		10 797	
	Mt Margaret	4 136		20 680	
	North Coolgardie	1 815		9 075	
	Peak Hill	18 672		96 211	
	Pilbara	16 709		91 163	
	Roebourne	211 670		1 058 350	
	South West	217 896		711 124	
	West Kimberley	3 000		15 000	
	West Pilbara	9 219		50 213	
		548 673		2 327 258	
TOTAL CONSTRUCTION MATERIALS				3 369 350	(d)
DIAMOND	Kimberley	29 964 155	Carats	435 725 448	(a)
DIATOMITE	South West	22		160	
DIMENSION STONE	West Kimberley	249		76 706	(a)
BLACK GRANITE	South West	430		19 302	(d)
QUARTZ ROCK	South West	115		9 430	(e)
SPONGOLITE		794		105 438	
TOTAL DIMENSION STONE					
GEM, SEMI-PRECIOUS AND ORNAMENTAL STONE		kg			
AMETHYST	Gascoyne	25		131 426	(e)
GOLD			Au kg		
	Ashburton	7 425		118 869	
	Broad Arrow	15 531 495		248 631 588	
	Coolgardie	13 644 107		218 417 862	
	Dundas	3 803 390		60 885 511	
	East Coolgardie	26 565 884		425 272 523	
	East Murchison	17 006 881		272 249 896	
	Gascoyne	5 691		91 109	
	Kimberley	59 358		950 209	
	Mt Margaret	14 911 336		238 703 949	

TABLE 5.1 (cont)		Quantity	Metallic	
Mineral	Mineral-Field	tonnes	Content	Value (\$) Ref
GOLD (cont)	Murchison		26 764.278	428 448 445
	North Coolgardie		3 224.868	51 624 394
	North East Coolgardie		1 295.534	20 739 195
	Peak Hill		3 947.717	63 195 918
	Phillips River		100.539	1 609 447
	Pilbara		12 041.254	192 759 037
	South West		22 484.958	359 944 156
	West Pilbara		13.973	223 676
	Yalgoo		3 437.448	55 027 430
	Yilgarn		<u>16 318.864</u>	<u>261 235 960</u>
		181 165.000	2 900 129 174	(f)
GYPSUM	Dundas	1 248		9 302 (e)
	Phillips River	1 018		6 000 (e)
	South West	57 765		482 094 (d)(e)
	Yilgarn	<u>22 489</u>		<u>115 382</u> (e)
		82 520		612 778
HEAVY MINERAL SANDS				
GARNET SAND	South West	22 141		2 071 178 (e)(g)
ILMENITE	South West	965 930		85 482 878
UPGRADED ILMENITE	South West	<u>263 408</u>		<u>131 710 093</u>
TOTAL ILMENITE		1 229 338		217 192 971 (a)
LEUCOXENE	South West	23 836	TiO <sub>2</sub> Tonnes	13 259 826 (a)
			21 651	
MONAZITE	South West	6 869	ThO <sub>2</sub> Units	5 113 867 (a)
			47 249	
RUTILE	South West	65 446	TiO <sub>2</sub> Tonnes	49 598 010 (a)
			61 603	
ZIRCON	South West	208 424	ZrO <sub>2</sub> Tonnes	100 801 777 (a)
			135 909	
TOTAL HEAVY MINERAL SANDS				388 037 629
INDUSTRIAL PEGMATITE MINERALS				
FELSPAR	Pilbara	27 425		1 063 608
	South West	<u>6 890</u>		<u>282 521</u>
		34 315		1 346 129



TABLE 5.1 (cont)		Quantity	Metallic	Value (\$)	Ref
Mineral	Mineral-Field	tonnes	Content		
PETROLEUM	Basin	Kilolitres			
CONDENSATE	Carnarvon	1 866 244		370 806 622	(a)
	Perth	<u>1 648</u>		<u>142 365</u>	(d)
		1 867 892		370 948 987	
CRUDE OIL	Basin				
	Canning	19 357		3 527 671	
	Carnarvon	5 079 274		1 044 076 199	
	Perth	<u>37 898</u>		<u>6 469 173</u>	
		5 136 529		1 054 073 043	(a)
LIQUIFIED NATURAL GAS	Basin	MMBtu			
	Carnarvon	184 930 679		836 400 762	(a)
NATURAL GAS	Basin	'000 m3			
	Carnarvon	3 400 302		355 016 915	(d)
	Perth	<u>213 418</u>		<u>24 212 029</u>	(j)
		3 613 720		379 228 944	
TOTAL PETROLEUM PRODUCTS				2 640 651 736	
PIGMENTS					
RED IRON OXIDE	Murchison	5 757		110 531	(e)
RARE EARTHS					
GALLIUM	South West	8 481	Ga kg	267 377	(a)
SALT					
	Gascoyne	1 636 803		34 648 155	(a)
	Pilbara	1 898 527		38 163 075	(a)
	South West	191		15 280	(e)
	West Pilbara	2 860 025		62 517 075	(a)
	Yilgarn	<u>17 617</u>		<u>1 629 460</u>	(a)
		6 413 163		136 973 045	
SILICA - SILICA SAND					
SILICA	South West	80 147		822 975	(a)
SILICA SAND	Coolgardie	82 603		202 378	(a)
	South West	<u>698 900</u>		<u>6 571 950</u>	(a),(e)
TOTAL SILICA - SILICA SAND		861 650		7 597 303	
SILVER: BY-PRODUCT					
	By-product of Gold Mining	25 684.846	Ag kg	4 055 095	
	Coolgardie	235.991		41 228	(a),(b)
	Peak Hill	7 269.289		971 028	(a),(k)
	Yalgoo	<u>6 585.089</u>		<u>986 015</u>	(a),(l)
		39 775.215		6 053 366	

TABLE 5.1 (cont)		Quantity	Metallic Content	Value (\$) Ref	
Mineral	Mineral-Field	tonnes			
TALC	Peak Hill	20 067		1 787 222	
	South West	141 493		9 904 510	
		161 560		11 691 732 (e)	
TIN - TANTALUM - LITHIUM	Greenbushes	40 376	Li <sub>2</sub> O <sub>2</sub> Tonnes	2 180	7 079 333 (a)
SPODUMENE	Greenbushes	495	Ta <sub>2</sub> O <sub>5</sub> kg	132 117	12 980 913
TANTALITE	Pilbara	208		96 524	9 786 160
TIN	Greenbushes	260	Sn Tonnes	176.79	1 209 545
	Pilbara	2		2.21	19 617
		262		179.00	1 229 162 (a)
VERMICULITE	Phillips River	507			90 227 (e)
VALUE OF MINERALS					6 728 242 239
VALUE OF PETROLEUM					2 640 651 736
VALUE OF GOLD					2 900 129 174
TOTAL VALUE					12 269 023 149

TABLE 6.1

## ROYALTY RECEIPTS 1989-90, 1990-91

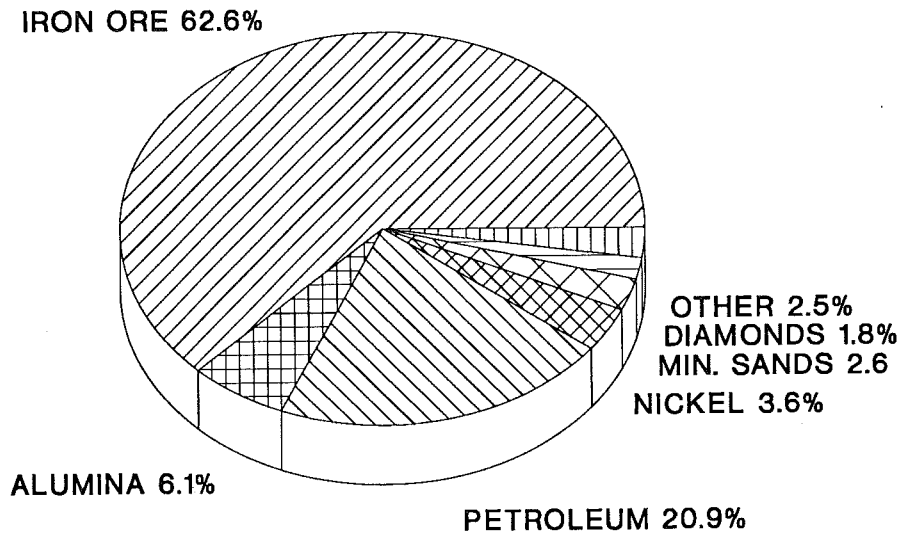
Mineral	1989-90 \$A	1990-91 \$A	Value \$A Variance	%up (%down)
BARYTES	0.00	50 330.15	50 330.15	n.ap.
<b>BASE METALS</b>				
Copper	1 116 113.23	1 490 425.64	374 312.41	34
Lead	227 916.33	334 491.55	106 575.22	47
Zinc	2 974 086.58	3 307 359.63	333 273.05	11
TOTAL BASE METALS	4 318 116.14	5 132 276.82	814 160.68	19
<b>BAUXITE-ALUMINA</b>				
Alumina	34 072 745.00	33 777 840.23	(294 904.77)	(1)
CLAYS	185 929.14	380 489.93	194 560.79	105
COAL	2 148 206.66	5 236 321.85	3 088 115.19	144
<b>CONSTRUCTION MATERIALS</b>				
Aggregate	50 214.90	23 274.30	(26 940.60)	(54)
Gravel	11 843.75	9 741.60	(2 102.15)	(18)
Rock	32 548.66	19 251.12	(13 297.54)	(41)
Sand	239 062.06	156 610.73	(82 451.33)	(34)
TOTAL CONSTRUCTION MATERIALS	333 669.37	208 877.75	(124 791.62)	(37)
DIAMOND	27 202 475.86	27 289 552.17	87 076.31	0
DIMENSION STONE	782.86	1 381.15	598.29	76
GEM, SEMI-PRECIOUS & ORNAMENTAL STONE	6 996.00	1 103.73	(5 892.27)	(84)
GOLD	199 362.36	291 690.92	92 328.56	46
GYPSUM	49 867.89	26 911.03	(22 956.86)	(46)
<b>HEAVY MINERAL SANDS</b>				
Garnet	52 912.63	102 079.57	49 166.94	93
Ilmenite	4 678 380.34	4 370 511.40	(307 868.94)	(7)
Leucoxene	500 469.64	555 141.31	54 671.67	11
Monazite	516 417.37	302 211.02	(214 206.35)	(41)
Rutile	3 101 789.38	3 140 086.21	38 296.83	1
Xenotime	5 292.00	0.00	(5 292.00)	(100)
Zircon	9 490 837.53	5 366 172.39	(4 124 665.14)	(43)
TOTAL HEAVY MINERAL SANDS	18 346 098.89	13 836 201.90	(4 509 896.99)	(25)
<b>INDUSTRIAL PEGMATITE MINERALS</b>				
Felspar	23 440.66	67 753.29	44 312.63	189
Mica	15 987.00	6 318.09	(9 668.91)	(60)
TOTAL INDUSTRIAL PEGMATITE MINERALS	39 427.66	74 071.38	34 643.72	88

ROYALTY RECEIPTS 1989-90, 1990-91		1989-90	1990-91	Value \$A	Variance (%down)
		\$A	\$A		%up
<b>TABLE 6.1 (cont)</b>					
<b>ROYALTY RECEIPTS 1989-90, 1990-91</b>					
IRON ORE		112 532 211.41	130 935 140.94	18 402 929.53	16
LIMESAND-LIMESTONE-DOLOMITE		99.90	0.00	(99.90)	(100)
DOLOMITE					
Limesand-Limestone		139 160.12	102 706.75	(36 453.37)	(26)
TOTAL LIMESAND-LIMESTONE-DOLOMITE		139 260.02	102 706.75	(36 553.27)	(26)
MANGANESE		90 000.00	939 488.38	849 488.38	944
NICKEL INDUSTRY		82 543.36	79 982.92	(2 560.44)	(3)
Cobalt by-product		9 978 061.91	10 597 322.76	619 260.85	6
Nickel		27 351.53	23 422.80	(3 928.73)	(14)
Palladium by-product		26 651.04	23 302.38	(3 348.66)	(13)
TOTAL NICKEL INDUSTRY		10 114 607.84	10 724 030.86	609 423.02	6
PEAT		2 602.21	958.62	(1 643.59)	(63)
PETROLEUM		2 068 390.85	2 970 781.49	902 390.64	44
Condensate		2 265 012.95	6 511 739.42	4 246 726.47	187
LNG		5 204 344.62	5 635 165.38	430 820.76	8
Natural gas		42 239 570.30	77 309 419.92	35 069 849.62	83
TOTAL PETROLEUM		51 777 318.72	92 427 106.21	40 649 787.49	79
PIGMENTS		0.00	5 526.55	5 526.55	n.ap.
Red Iron Oxide					
RARE EARTHS		276 769.61	116 950.60	(159 819.01)	(58)
Gallium		1 075 787.77	1 301 673.64	225 885.87	21
SALT		216 768.32	389 453.08	172 684.76	80
SILICA-SILICA SAND		145 976.57	115 630.15	(30 346.42)	(21)
SILVER		100 002.00	87 917.00	(12 085.00)	(12)
TALC		341 091.87	356 225.05	15 133.18	4
Spodumene		444 982.14	569 877.68	124 895.54	28
Tantalite		50 242.60	30 711.54	(19 531.06)	(39)
Tin		836 316.61	956 814.27	120 497.66	14
TOTAL TIN-TANTALUM-LITHIUM		10 696.95	1 246.69	(9 450.26)	(88)
VERMICULITE					
TOTAL ROYALTIES		264 221 995.86	324 411 692.75	60 189 696.89	24

# COMPARATIVE ROYALTY RECEIPTS

## 1985-86 ROYALTY RECEIPTS

TOTAL : \$ 140.8 MILLION



## 1990-91 ROYALTY RECEIPTS

TOTAL : \$ 324.4 MILLION

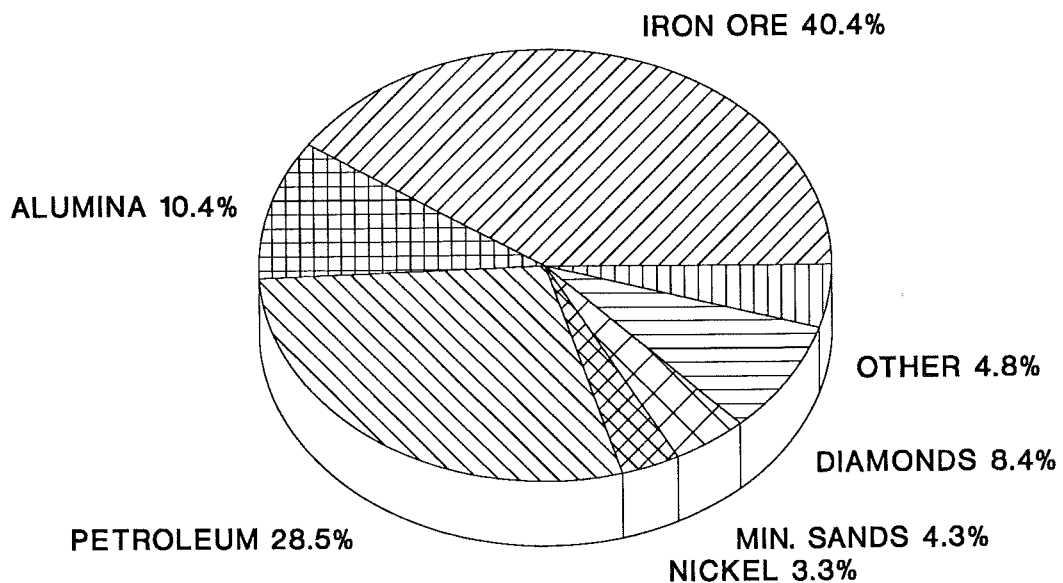


FIGURE 6.1

**7.1 Employment in the Minerals and Petroleum Industries**

There was only a marginal overall growth of direct employment in the minerals and petroleum industries during 1990-91. Employment returns to the Department of Mines revealed that the majority of industry sectors recorded a moderate contraction in the number of full time jobs. Total employment as of 30 June 1991 was 36 830.

Over 350 jobs were shed in the gold mining sector during the period, this occurred in spite of significant growth in some major projects. The fall in employment was in line with the sector wide contraction in output which became apparent during the first six months of 1991.

Heavy mineral sands producers also cut staff numbers as the market moved into oversupply and most operations suffered from an excess of capacity. The market for the industry's products is very sensitive to fluctuations in the world economy. Significant new projects in the south west and the industry's commitment to downstream processing will, however, generate employment growth through the 1990s. The Beenup project alone is expected to employ 200 people for the 2 year construction phase and 135 permanent employees when on production commences.

While most iron ore projects registered marginal falls in job numbers, the sector registered a slight overall growth due to the start up of BHP Minerals' Yandicoogina development. Despite some redundancies resulting from the streamlining of mining operations the longer term strength of the market demand for iron ore, and the prospects for large new developments, will continue to create employment opportunities in the Pilbara.

Employment growth was buoyant in all areas of the expanding petroleum industry.

Despite significant falls in the demand for primary aluminium, Western Australia's alumina producers have been able to maintain some relatively strong employment growth. Alcoa's massive Wagerup expansion, and other approved capital works, accounted for most of the new jobs generated during the period. Committed fixed investment will do much to sustain sectoral employment in advance of the market recovery which is expected in late 1992.

Although minerals and petroleum industry employment is currently under some pressure, mainly because of the demand factors associated with the economic downturn in the industrialised countries, there are some signs of medium term improvement. The State industry's broad base and the scale and long lead time of projects already in place, will ensure that employment numbers will be broadly maintained and again grow strongly with the recovery of commodity prices.

TABLE 7.1

**NUMBER OF PERSONS EMPLOYED IN THE WESTERN AUSTRALIAN MINERALS & PETROLEUM INDUSTRIES  
AS AT JUNE 30, 1991**

<b>MINERAL</b>			
Company	LOCATION	1989-90	1990-91
<b>BASE METALS</b>			
BHP Minerals Ltd	Cadjebut	186	162
Murchison Zinc Co. Pty Ltd	Golden Grove	284	277
<b>TOTAL BASE METALS</b>		<b>470</b>	<b>439</b>
<b>BAUXITE - ALUMINA</b>			
Alcoa of Australia Ltd	Del Park-Huntley/Pinjarra	1 853	2 220
	Jarrahdale/Kwinana	1 620	1 748
	Wagerup/Willow Dale	558	911
Worsley Alumina Pty Ltd	Boddington/Worsley	1 110	1 198
<b>TOTAL BAUXITE - ALUMINA</b>		<b>5 141</b>	<b>6 077</b>
<b>COAL</b>			
Griffin Coal Mining Co. Ltd	Collie	558	551
Western Collieries Ltd	Collie	748	734
<b>TOTAL COAL</b>		<b>1 306</b>	<b>1 285</b>
<b>DIAMOND</b>			
Argyle Diamond Mines Pty Ltd	Lake Argyle	828	694
Poseidon Ltd	Bow River	119	102
<b>TOTAL DIAMOND</b>		<b>947</b>	<b>796</b>
<b>GOLD</b>			
Arimco NL	Gidgee	139	140
Asarco Australia Ltd	Wiluna	184	151
Ashton Gold	Cork Tree Well	124	149
Australian Consolidated Minerals Ltd	Golden Crown	91	76
	Westonia	60	19
Australian Mine Management Pty Ltd	Mt Pleasant	119	106
	Racetrack/Royal Standard	11	36
Australmin Pacific Ltd	Tuckabianna	81	111
Aztec Mining Co Ltd	Bounty	108	143
BHP Minerals Ltd	Gimlet South/Orban JV	111	151
Big Bell Mines Pty Ltd	Big Bell	275	208
Broken Hill Metals NL	Hopes Hill	144	95
Central Norseman Gold Corp. NL	Central Norseman	399	197
Consolidated Exploration Ltd	Davyhurst	44	44
	Lady Bountiful	89	62
Coolgardie Gold NL	Greenfield	101	123
Dominion Mining Ltd	Labourchere/Nathans	70	80
	Meekatharra	297	260
	Mt Morgans	163	174

TABLE 7.1 (cont)		NUMBER OF PERSONS EMPLOYED IN THE WESTERN AUSTRALIAN MINERALS & PETROLEUM INDUSTRIES	
MINERAL	LOCATION	1989-90	1990-91
		GOLD (cont)	
Dominion Mining Ltd (cont)	Tower Hill	81	89
Eastmet Ltd	Youanmi	79	113
Forsyth Pty Ltd	Lawlers	90	87
Hedges Gold Pty Ltd	Mt Gibson	277	134
Hill 50 Gold Mine NL	Hedges	113	124
Kalgoorlie Consolidated Gold Mines Pty Ltd	Mt Magnet	371	318
Metana Minerals	Kalgoorlie	1 507	1 446
Reedy	Reedy	144	118
Rothsay	Rothsay	77	-
Newcrest Mining Ltd	New Celebration	310	382
Teller	Teller	525	740
Pancontinental Pty Ltd	Kundana	21	80
Placer Pacific Pty Ltd	Paddington	184	176
Plutonic Operations Ltd	Granny Smith	157	193
Poseidon Ltd	Plutonic	-	126
Reynolds Yilgarn Gold Operations Ltd	Kathalis	289	136
	Karonie	60	61
Sons of Gwalla NL	Yilgarn	221	204
Spargos Mining Pty Ltd	Sons of Gwalla	152	121
St. Barbara Mines Ltd	Bellevue	178	227
Sundowner Minerals NL	Meekatharra	141	157
Western Mining Corporation Ltd	Dartot	96	107
	Emu	120	122
Worsley Alumina Pty Ltd	Kambalda	190	232
All Other Operators	Lancelfield	115	137
	Boddington	402	405
TOTAL GOLD		2 322	2 126
HEAVY MINERAL SANDS			
Allied Eneabba Pty Ltd	Eneabba	131	107
Associated Minerals Consolidated Ltd	Capel	237	178
Cable Sands Pty Ltd	Eneabba/Namgulu	610	450
ISK Minerals Pty Ltd	Capel	243	185
TiWest Pty Ltd	Picton	69	66
Westralian Sands Ltd	Cataby/Chandala	178	303
All Other Operators	Capel	530	434
TOTAL HEAVY MINERAL SANDS		2 037(r)	1 758

TABLE 7.1 (cont)

**NUMBER OF PERSONS EMPLOYED IN THE WESTERN AUSTRALIAN MINERALS & PETROLEUM INDUSTRIES  
AS AT JUNE 30, 1991**

MINERAL		1989-90	1990-91
Company	LOCATION		
<b>IRON ORE</b>			
BHP Iron Ore (Goldsworthy) Ltd	Pilbara/Port Hedland	906	1 001
BHP Minerals Ltd	Yampi	422	341
	Yandicoogina	-	230
Hamersley Iron Pty Ltd	Tom Price - Paraburdoo/Dampier/Channar	3 168	3 206
Hancock Mining Ltd	Ferro Gully	56	47
Mt Newman Mining Co. Ltd	Newman/Port Hedland	3 657	3 521
Robe River Mining Co. Pty Ltd	Pannawonica/Cape Lambert	981	897
<b>TOTAL IRON ORE</b>		<b>9 190</b>	<b>9 243</b>
<b>NICKEL</b>			
Agip Australia Pty Ltd	Radio Hill	-	153
Western Mining Corporation Ltd	Kalgoorlie	384	381
	Blair/Kambalda	1 810	1 617
	Kwinana Refinery	338	299
	Leinster	551	538
	Mt Windarra	344	249
All Other Operators		18	13
<b>TOTAL NICKEL</b>		<b>3 445</b>	<b>3 250</b>
<b>PETROLEUM PRODUCTS</b>			
Hadson Energy Pty Ltd	Harriet/Rosette	74	130
West Australian Petroleum Pty Ltd	Dongara	8	8
	North West Area	207	229
Western Mining Corporation Ltd	North Herald/South Pepper/Chervil	157	108
Woodside Offshore Petroleum Pty Ltd	North Rankin A/Burrup Peninsula	1 404	1550
All Other Operators		19	23
<b>TOTAL PETROLEUM PRODUCTS</b>		<b>1 869</b>	<b>2 048</b>
<b>SALT</b>			
Dampier Salt Ltd	Dampier	178	183
	Lake MacLeod	114	120
Leslie Salt Co.	Port Hedland	120	121
Shark Bay Salt JV	Useless Loop	86	79
<b>TOTAL SALT</b>		<b>498</b>	<b>503</b>
<b>ALL OTHER MATERIALS</b>			
(including Rock Quarries)		<b>841</b>	<b>945</b>
<b>TOTAL</b>		<b>36 576(r)</b>	<b>36 830</b>

(SOURCE: AXTAT REPORTING SYSTEM, MINING ENGINEERING DIVISION)

**8.1 PRINCIPAL MINERALS AND PETROLEUM PRODUCERS 1990-91, Head office postal address, telephone number: minesite.****BARYTES**

Dresser Minerals International Inc., 251 Adelaide Tce, Perth 6000, (09) 3254822: North Pole

**BASE METALS****Copper**

Horseshoe Lights Gold Pty Ltd, 614 Newcastle St, Leederville 6007, (09) 427 6222: Horseshoe.

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, 233 Adelaide Tce, Perth, 6000, (09) 325 7755: 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****Attapulgitite**

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

**Cement Clay**

Bell Basic Industries Ltd, 136 Great Eastern Hwy, South Guildford 6055, (09) 279 0000: Armadale.

**Fire Clay**

Midland Brick Co. Pty Ltd, Bassett Rd, Middle Swan 6056, (09) 274 5522: Bullsbrook.

**Kaolin**

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

**White Clay**

Bristle Ltd, 245 South Western Hwy, Armadale 6112. (09) 399 0399: Jarrahdale.

Pilsley Investments Pty Ltd, Military Rd, Midland 6056, (09) 250 2111: Middle Swan

**8.1 PRINCIPAL MINERALS AND PETROLEUM PRODUCERS 1990-91, Head office postal address, telephone number: minesite.****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: Boodarrie, 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/- 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: Mt Regal.

**Sand**

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

Bebich M, P & Y, 167 East Rd, Wanneroo 6055: Gnangarra.

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.

Tirad Pty Ltd, PO Box 126, Boulder 6432: Coolgardie.

**DIAMOND**

Argyle Diamond Mines, 2 Kings Park Rd, West Perth 6005, (09) 482 1188: Argyle.

Poseidon Ltd, 8 Kings Park Rd, West Perth 6005, (09) 480 3232: Lissadell.

**DIMENSION STONE****Black Granite**

City West Holdings Ltd, C/- 102 Railway Pde, West Perth 6005, (09) 481 5760: Lennard.

**Quartz rock**

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

**Spongolite**

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

**8.1 PRINCIPAL MINERALS AND PETROLEUM PRODUCERS 1990-91, Head office postal address, telephone number: minesite.****GEM, SEMI-PRECIOUS & ORNAMENTAL STONE****Amethyst**

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

**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.

Australmin Holdings Ltd, 44 St George's Tce Perth 6000, (09) 325 6955: Tuckabianna.

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

BHP Minerals Ltd, 240 Hay St, Kalgoorlie 6430, (090) 24 2060: Ora Banda - Gimlet South, Orban JV, Ora Banda Tailings.

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: Hopes Hill - Corinthia.

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 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.

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

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

Forsyth Pty Ltd, 221 St George's Tce, Perth 6000, (09) 322 7211: Lawlers, Mt Gibson.

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.

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: Reedy, Youanmi.

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, Telfer.

Nord Australex Nominees Pty Ltd, c/- 55 Macquarie St, Sydney NSW 2000, (02) 27 1341: Kurara.

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.

**8.1 PRINCIPAL MINERALS AND PETROLEUM PRODUCERS 1990-91**, Head office postal address, telephone number: minesite.**GOLD (cont)**

- 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, Sir Samuel - Bellevue.
- 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.
- Lake Hillman Mining Pty Ltd, PO Box 49, 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: Wyalkatchem

**HEAVY MINERAL SANDS**

- Allied Eneabba Pty Ltd, 45 Stirling Hwy, Nedlands 6009, (09) 389 1222: Eneabba.
- 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.
- Target Minerals NL, PO Box 188, Geraldton 6530, (099) 23 3644: Port Gregory.
- 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.

**8.1 PRINCIPAL MINERALS AND PETROLEUM PRODUCERS 1990-91, Head office postal address, telephone number: minesite.****IRON ORE**

BHP Iron Ore (Goldsworthy) Ltd, 197 St George's Tce, Perth 6000, (09) 322 1788: Shay Gap.  
 BHP Minerals Ltd, 200 St George's Tce, Perth 6000, (09) 320 4444: Koolan Island, Yandicoogina.  
 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.  
 Hancock Mining Ltd, 28 Ventnor Ave, West Perth 6005, (09) 481 3888: Ferro Gully.  
 Mt Newman Mining Co. Ltd, 200 St George's Tce, Perth 6000, (09) 320 4666: Newman.  
 Robe River Mining Co. Pty Ltd, 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**

Portman Mining Ltd, 12th Floor, Durack Centre, 263 Adelaide Tce, Perth 6000, (09) 325 7688: Woodie Woodie.  
 Boral Resources (WA) Ltd, 136-138 Great Eastern Hwy, South Guildford, 6055, (09) 279 0000: Woodie Woodie.

**NICKEL**

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

**PEAT**

Magnet Industries Pty Ltd, 665 Welshpool Rd, Wattle Grove 6107, (09) 453 6777: 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.  
 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.  
 Oil Company of Australia NL, GPO Box 148, Brisbane Qld 4001, (07) 858 0600: West Kora  
 Petroleum Securities Energy Ltd, c/- Ozco Pty Ltd, 15 Wheelk Place, Mullaloo 6025, (09) 307 1345: Blina, Lloyd, Sundown/West Terrace.

**8.1 PRINCIPAL MINERALS AND PETROLEUM PRODUCERS 1990-91**, Head office postal address, telephone number: minesite.**PETROLEUM (cont)**

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.

Western Mining Corp. Ltd, 28 Ventnor Ave, West Perth 6005, (09) 482 2444: Herald/Pepper.

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

**RARE EARTHS****Gallium**

Rhone Poulenc Chimie Aust. Pty Ltd, 200 Adelaide Tce, Perth 6000, (09) 325 8500: Del Park.

**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**

Barrack Silicon Pty Ltd, 262 St George's Tce, Perth 6000, (09) 322 2288: 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.

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, 38 Parliament Pl, West Perth 6005, (09) 481 0023: Mt Seabrook.

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

**8.1 PRINCIPAL MINERALS AND PETROLEUM PRODUCERS 1990-91**, Head office postal address, telephone number: minesite.

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