ROYALTIES AND POLICY DEVELOPMENT DIVISION

STATISTICAL DIGEST OF MINERAL AND PETROLEUM PRODUCTION 1990

DEPARTMENT OF MINES
WESTERN AUSTRALIA

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DEVELOPMENT DIVISION

DEPARTMENT OF MINES

OF WESTERN AUSTRALIA

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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	Conversion factors: 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^3)	1	
Energy	gigajoule	GJ	million million British Themal units (mmBTu)	1.055072	0.947803

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

1 OVERVIEW

1.1 Review of the World Economy

Overall economic growth among the OECD countries slowed significantly during the last half of 1990. Member countries continued to register sharply varying economic performances in response to a range of domestic and international factors. The major East and North Asian economies continued to expand moderately while, at the other extreme, Eastern Europe and the U.S.S.R. sank further into depression.

Japan, re-unified Germany and, to a lesser extent, France maintained relatively strong growth aggregates.

Despite historically high interest rates, a stagnant stock market and shrinking corporate profits, the powerful Japanese economy grew by a robust 5.6% during 1990. While domestic demand was buoyed through private sector investment in social infrastructure, by far the greatest stimulus was from corporate capital and research investment. This investment growth is predicted to slow in 1991, though not by enough to push Japan into a recession. Japan's GNP is forecast to increase by 3% this year as the country emerges from its slow-down to become an even tougher international competitor in the full range of traditional manufactured and high technology products.

A domestic demand surge and a solid export performance allowed the German economy to expand by 4.6% during 1990. Re-unification is, however, generating unforeseen political, fiscal and financial disruptions to the economy. These will continue to impact in the medium term. The relatively high interest rate regime, seen as necessary to maintain reasonable price stability, is a cause of friction with the U.S. and the U.K. Policy priorities in the latter two countries are to push rates lower and hence raise domestic economic activity.

The U.S. economy continued to be battered by the high 'twin' deficits, in the Federal Budget and current account, a collapse in asset values and a sluggish stock market. Economic growth in 1990 was only 1% as consumer and business confidence was further eroded. While the Gulf Crisis diverted public attention and a package of expenditure cuts and tax increases were put in place, the structural problems associated with the budget deficit remained. Considerable political pressure is being placed on the Federal Reserve Board to lower interest rates, but a fear of re-igniting inflation is causing resistance among policy makers. The U.S. economy is predicted to record zero growth in 1991, a development which will have severe implications for world trade.

Economic growth in East and North Asia's newly industrialised countries averaged a solid 6.9%. This was markedly higher than the OECD average of 2.5%.

The prospects for a 1991/92 rebound in world trade were further retarded by a breakdown of the GATT discussions in December. While these talks are rescheduled for early 1991, questions over protection and subsidy programmes are not likely to be quickly overcome. The key determining factor for a return to generalised positive economic growth is the health of the U.S. economy. Until the U.S. economy rebounds it seems probable that the demand for most traded manufactured goods will be sluggish and commodity prices will continue to soften.

1.2 Review of the Australian Economy

The sluggish economic growth of the first two quarters of 1990 gave way to recession as the economy contracted severely in the last half of the year. GDP declined and private sector activity remained weak in the September and December quarters.

The marked decline in domestic demand contributed both to the substantial fall in the current account deficit and the downward trend in inflation. The quarterly inflation rate did kick up to 2.7% in the December quarter, but this was discounted as being mainly attributable to higher oil prices.

The inflation rate is estimated to decline significantly in the first half of 1991 in response to weak economic activity in the private sector and falling oil prices.

The Reserve Bank announced the seventh consecutive easing of monetary policy on 18 December 1990. This response to the recessed economy, falling inflation and improvement in the current account was part of a cautious policy to give some small stimulus without re-igniting inflation. Even with these reductions, real interest rates in Australia remain high relative to our trading partners.

After a sharp downturn during 1990 in the international market prices of Australia's principal rural sector exports, the short term outlook remains grim. Across the board, prices are forecast to fall by a further 13% during 1991. With prices of farm sector inputs rising at approximately 7% p.a., the farmer's terms of trade will deteriorate further in a pattern similar to previous cyclical slumps.

As a commodity driven economy, Australia's export performance during 1990 was characterised by some variability between the rural and non-rural sectors. Despite generally falling real prices, a relatively strong result from the minerals and energy sector continued to underpin the wider economy.

1.3 Economic Factors Affecting the Mining Industry

The Western Australian minerals and petroleum industry is sensitive to international, and domestic, market and financial changes which are mainly beyond its control. This axiom continued to hold up in the last half of 1990 as the world economic slowdown began to impact on the demand for, and prices of, many of our mineral products. While a sustained nominal fall in domestic interest rates was welcomed by the industry, the resilience of the $A meant that returns to producers were not given an exchange rate boost.

The predicted tapering off in demand for mineral products has tended to be patchy. The degree of impact on particular sectors has been determined by the resilience of demand for final products, the supply flexibility of producers and the structure of individual consumer industries (ie size of inventories, just-in-time systems, etc). The downturn in demand did not show up in industry wide aggregates.

Interest rates were eased considerably during 1990 as the Reserve Bank attempted to simultaneously effect a mild stimulus to the domestic economy and aid in the primary policy initiative of substantially reducing structural inflation.

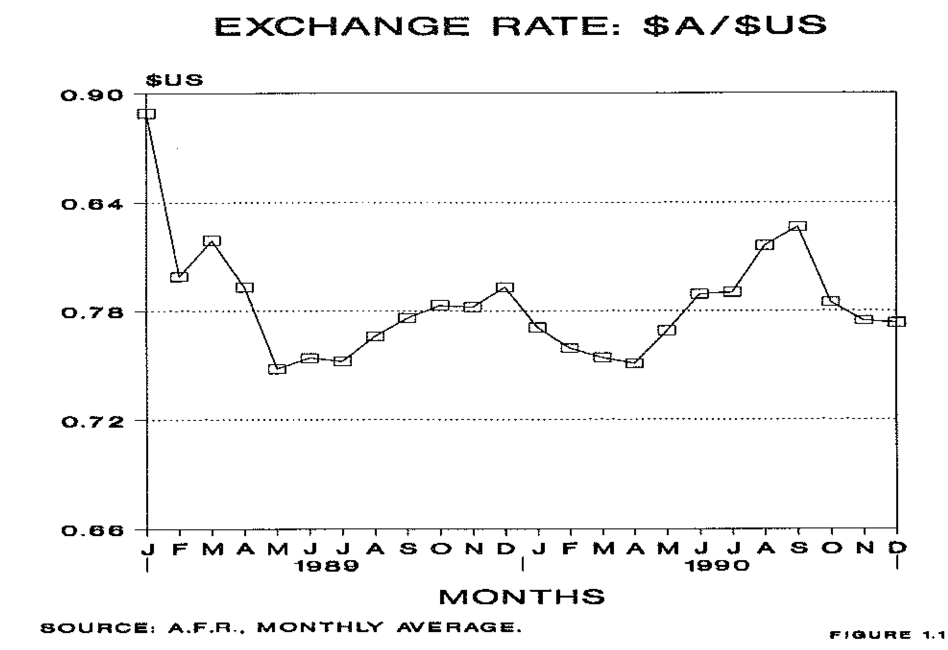
The interest rate trend was welcomed by mining investors as it reduced the costs of existing borrowings and made many potential projects viable by lowering the required risk adjusted rate of return.

Predicted lower domestic inflation levels will have many positive effects on the mining industry, these will include capital and operating cost reductions and more certainty in long term planning.

While obviously preferring a lower exchange rate, minerals producers have largely adjusted to an $A which has traded within a small band (US 76c - US 78c) during most of the year (Figure 1.1)

The currency has been underpinned by relatively high real interest rates and Australia's reputation as a commodity and energy exporter. Attempts by politicians and senior public servants to 'talk down' the $A have not succeeded.

Though returns would improve with a lower exchange rate, the mining industry has generally been more concerned with other, largely political, issues which determine its viability.



1.4 Social and Political Factors Affecting the Mining Industry

Mine safety and a wide range of issues associated with the environment have continued to generate debate and be the subjects of policy initiatives during 1990. The Industries Commission Report on Mining and Minerals Processing, published late in 1990, contained recommendations designed to improve the overall efficiency of the industry. Prominent among these recommendations were those related to land access and the development of a non distortionary royalties regime.

The wider microeconomic reform agenda is still mainly at the level of political debate and policy development. Resource access, long a concern of the mining industry, has during 1990 emerged as a major issue. The apparent lack of consistency in land access policy has generated considerable debate at a national and state level. Broadly, the industry has always sought to minimize the uncertainty associated with all aspects of exploration, development and production. Mining industry organisations have consistently pressed for universal regulations and guidelines for land access/use. The Commonwealth's decision making procedures, which include the use of the Resources Assessment Commission and Heritage legislation, have come under considerable criticism.

The Western Australian Government's 'Resolution of Conflict' policy document, released in November 1990, has set clear guidelines for exploration and mining in sensitive areas. The importance of exploration for future investment in mining and downstream processing is well recognised by the State Government.

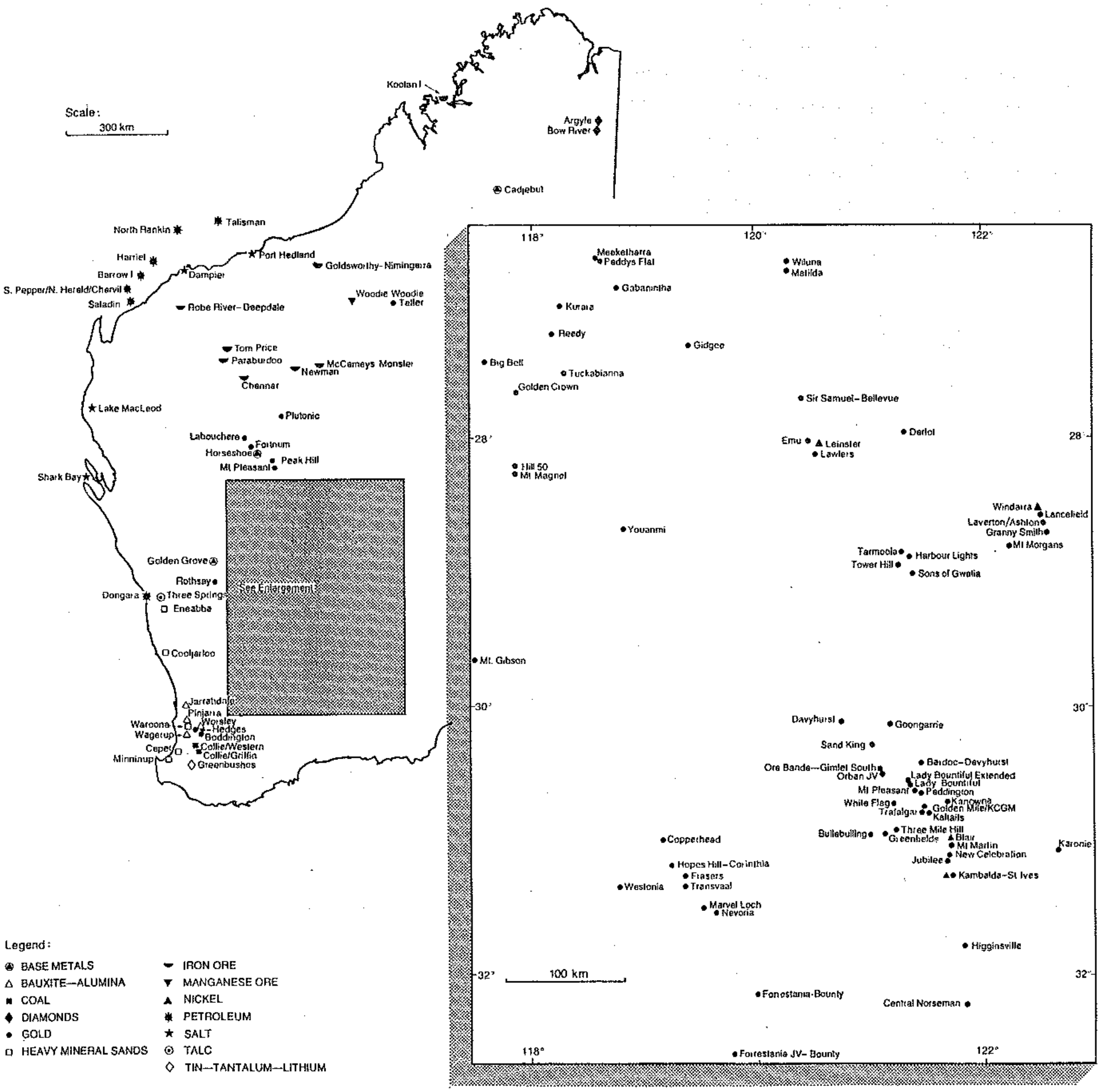
Although the Industry Commission Report came down on the side of a move towards a rent based system for all mineral royalties, debate is continuing at a State level. Western Australia has demonstrated flexibility on this issue and is willing to examine any system which is efficient and yields a fair return to the community for the transfer of mineral rights.

Mining is a complex industry, which is generating an increasing percentage of the national wealth. Because of its economic importance the issues associated with the sector are set to become even more central to the national debate over the appropriate use of our natural resources.

FIGURE 1.2

MAJOR MINERAL AND PETROLEUM PROJECTS IN WESTERN AUSTRALIA

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



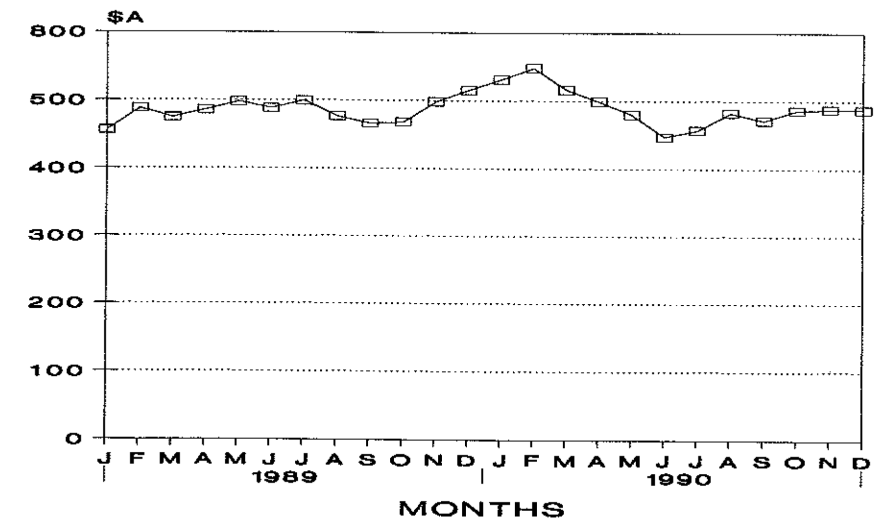
2 REVIEW OF MAJOR MINERALS AND PETROLEUM

2.1 Gold

1990 was yet another record year for the Western Australian gold mining industry as production surged by 20% to 176 tonnes (t). The estimated value of total output increased by 22% to $2.8 billion. Gold maintained its position as the leading mining industry sector, despite strong value of production performances by both alumina and iron ore.

A late 1989 price rally was not sustained and the gold price steadily drifted lower during the first half of 1990. The onset of the Gulf crisis, with the 2nd August invasion of Kuwait by Iraq, instantly pushed the price higher on world markets. The rise faded relatively quickly, as markets discounted the long run effects of the crisis on the world economy (Figure 2.1). Heavy generalised selling pressure above $US 420 per ounce and several large Middle Eastern sell orders were the other main causes of the price slump. In the short term, little movement in the gold price can be expected. The precious metal is likely to remain within its established trading range, of between $US 350 to $US 400, for most of this year.

GOLD PRICES: $A/oz.



SOURCE: LONDON GOLD PRICE. MONTHLY AVERAGE OF WEDNESDAY PRICES.

FIGURE 2.1

The continued strong growth of the jewellery fabrication industry, some increased hoarding and general economic uncertainty have served to place a floor of approximately $US 350 per ounce under gold. As the amount of the precious metal demanded by jewellery manufacturers has outpaced annual mine output for several years, analysts see this as one of the most important factors working to improve the current supply/demand configuration.

On the supply side, output is slowing in North America, South Africa and, after the current burst of tax generated activity, in Australia. North American mines are reacting to soft prices, while in South Africa the closure of marginal mines is not being fully offset by new production capacity. Over the past two years the need for hard currency has resulted in larger than normal sales by the U.S.S.R. Economic and political uncertainty in the U.S.S.R. have continued to make the country a 'wild card' as a medium term bullion supplier.

A wide divergence of opinion persists among industry analysts and economic commentators over the longer term outlook for gold. Pessimists have tended to predict a steady move away from gold by investors. This new view has been reinforced by recent North American and European divestments. The move away from gold is taking place in favour of a range of investment products available in this period of slow economic growth and relatively high real interest rates.

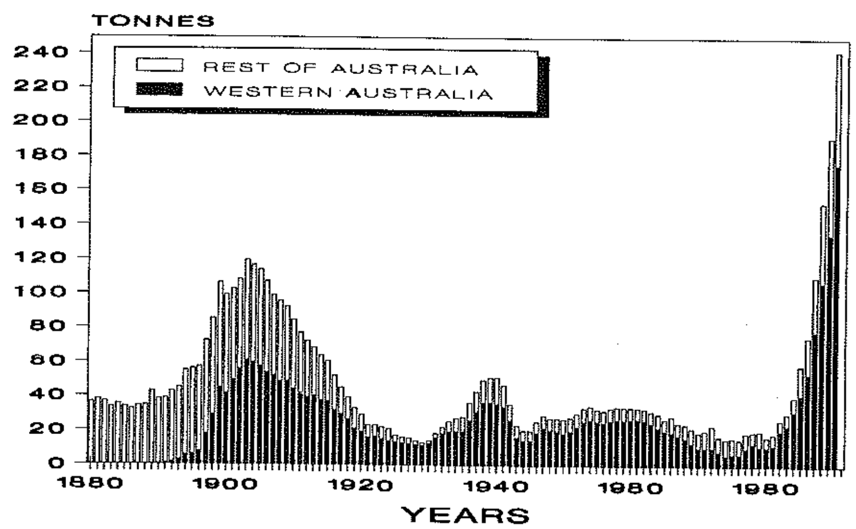
The gold 'bulls' envisage a decade of collapsing equity markets, a series of massive liquidity crises, wild currency fluctuations and a downward spiral in asset values. With the addition to this scenario of increasing political upheaval in Eastern Europe, U.S.S.R., and the Middle East, the return of gold as a 'safe haven' should become attractive.

It is more likely that the world economy and political structures will fall between these extremes, as will the outlook for gold.

The Western Australian gold mining industry, driven as it is by the level of real returns to producers, will come under some pressure from technical, structural and institutional factors over the next few years.

Producers will be forced to accommodate a slowly declining real gold price, a steady depletion of easily accessible reserves and a reduced average mine life. While the vagaries of world markets are obviously beyond the control of mining companies many other operational aspects can be influenced by companies. The marked reduction in exploration expenditure, the highly leveraged nature of many operations and the high grading associated with the January 1991 tax deadline will have medium to long term effects on the industry.

GOLD PRODUCTION



SOURCES:DEPT OF MINES WESTERN AUSTRALIA, BMR & ABARE

FIGURE 2.2

The industry's adjustment to these relatively more severe circumstances will probably be an extension of the strategy of rationalisation and concentration which has ensued over the past few years. It is already apparent that the Western Australian industry is being increasingly dominated by a smaller number of large producers.

Access to equity finance is essential for the higher capital requirements of open cut mining at even lower depths. The capital and operating costs associated with the treatment of the deeper sulphide ores will also necessitate even greater economies of scale.

Western Australian producers are displaying characteristic resourcefulness and flexibility in adjusting to market and technological challenges. Growth in production in the 1990s will come from the efficient existing projects, such as Boddington, Telfer and the open cuts on the Golden Mile, and new developments. Good examples of the latter are the Granny Smith project and the new gold mining province surrounding the Plutonic mine north of Meekatharra.

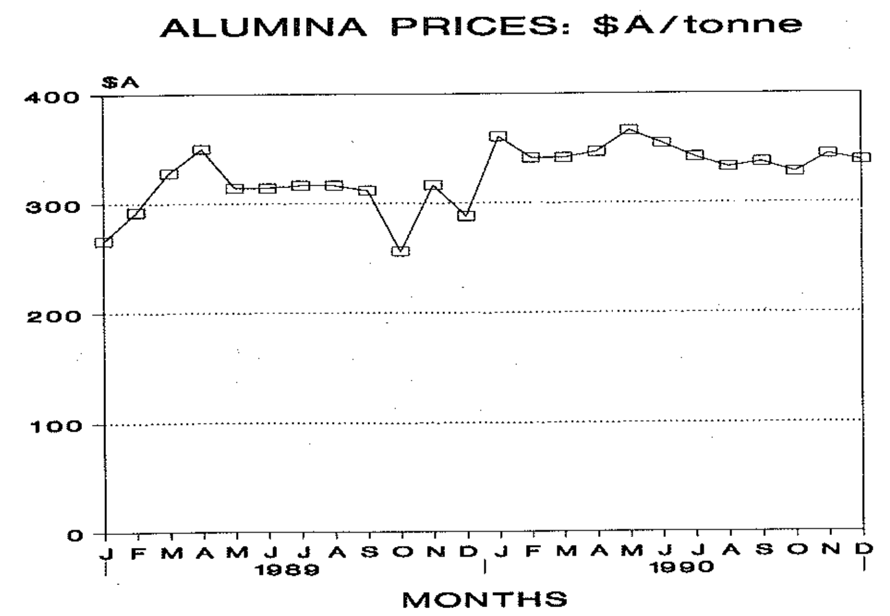
There is also considerable scope for increased development of Western Australian expertise in mine development and refining capacity. The State is already refining bullion from Papua-New Guinea and the South Pacific region. This value adding capacity is projected to grow into the 1990s.

Western Australia still dominates national output despite increased production from Olympic Dam and projects in the Northern Territory (Figure 2.2).

2.2 Alumina

Following the strong rises in output and value of production registered during 1989 the Western Australian industry performed soundly through 1990. The stabilising of prices at relatively high levels allowed production to increase by 5% to 6.7 million tonnes (Mt). The total value of output rose by 12% to $2.3 billion.

The alumina price (Figure 2.3) continues to be determined by the lagged effect of developments in the primary aluminium market. Given the structure of the market, the price of alumina is projected to fall slightly in 1991/92, and stabilise before growing into the mid 1990s.



SOURCE: DERIVED FROM L.M.E. & A.B.S.

FIGURE 2.3

Global demand is being sustained by the increasing use of aluminium in capital and social infrastructure, and in traditional manufactured products. This has particularly been the case in the developing East and North Asian economies.

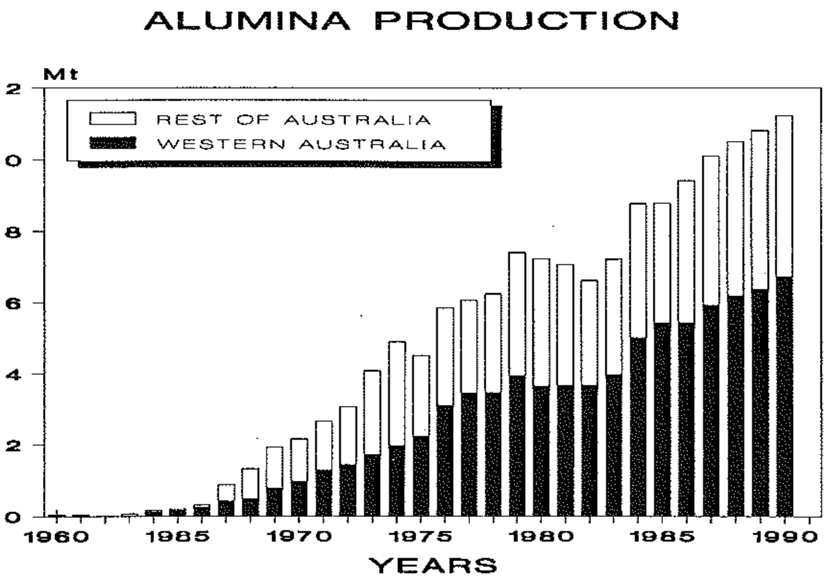
Among the traditional manufactured goods, the areas of greatest growth have been in packaging and in the production of automobiles. Japan's MITI is urging a target of 50% aluminium content for all automobiles by mid decade and a comprehensive vehicle weight reduction of 40% by the turn of the century.

Since 1988 the refining industry has operated near capacity and the world supply of primary aluminium has closely matched alumina production. Although consumption is expected to contract slightly under the impact of slower economic growth, the closure of several high cost plants in North America and Europe should keep global utilisation at 95% through at least the first half of this decade. Traditional sources of supply in Eastern Europe and the U.S.S.R. continue to be uncertain.

The outlook for the world aluminium, and hence alumina, market is for structural factors to limit supply growth. Stock levels of primary aluminium will not grow excessively during the next 5 years.

While new smelting capacity has recently been commissioned in Canada, Brazil and Norway, major greenfields projects in the Persian Gulf region are being reassessed, and are not expected to proceed before 1995. Analysts have factored a 30% increase in recycling, or secondary aluminium production, into medium term global supply/demand predictions.

After operating at capacity for the past several years Western Australian alumina producers are poised to complete significant expansions. Construction commenced on Stage 2 of ALCOA's Wagerup refinery in October 1990. The $300 million expansion will more than double capacity to 1.48 Mtpa. The $108 million eighteen month programme to expand and de-bottleneck Worsley Alumina's plant will be completed in late 1991. With continuing strong growth in the State's East Asian and North American markets, the existing and new production capacity looks set to be fully utilised well into the decade.



SOURCES:DEPT OF MINES WESTERN AUSTRALIA. SMR & ASARE.

FIGURE 2.4

Worsley Alumina is currently undertaking a feasibility study on a further 50% increase in alumina production capacity to 2.25 Mtpa. If the proposed expansion proves to be economically viable the project would necessitate investment of approximately $500 million.

Kemerton Aluminium has commissioned a feasibility study for the construction in the Pilbara of an aluminium potline of 235 000 tpa plus extensive associated infrastructure. The availability of relatively cheap North West Shelf gas is crucial in the calculations to determine the project's viability.

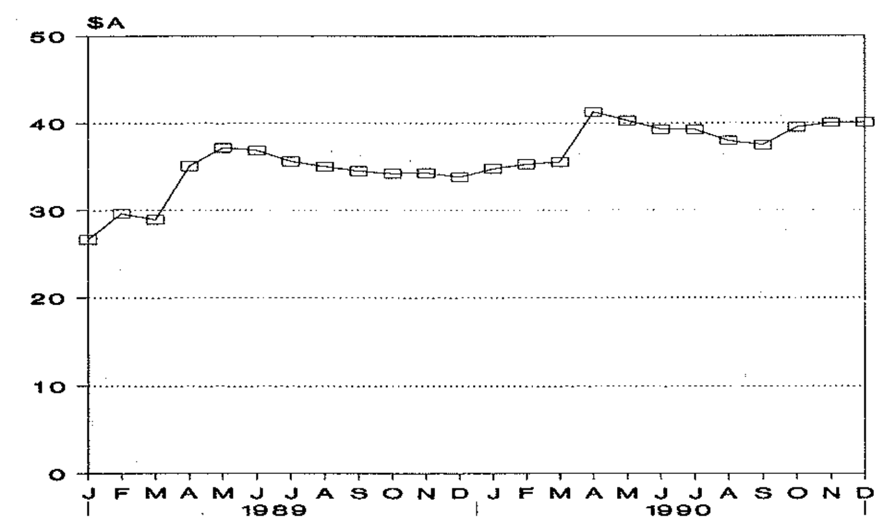
The two Western Australian producers operating at capacity have continued to supply a significant proportion of the national output (Figure 2.4).

2.3 Iron Ore

Total tonnages reported by Western Australian producers in 1990 were down marginally on the 1989 results. Despite a fall of approximately 3 million tonnes (Mt), to 103 Mt, the value of production rose during the year by a solid 14% to $2.4 billion.

Steady, if unspectacular, growth in world steel demand combined with no significant increase in iron ore production capacity has resulted in a continuing tight iron ore market. Consumption is steady, and likely to remain so for several years. Iron ore prices should gradually increase in real terms, through the first half of the decade. After the 1989 peak in world consumption and slight easing in 1990, the projected further marginal decline in 1991 will be as a result of lower levels of investment and economic growth.

IRON ORE PRICES: $A/tonne



SOURCE: HIGH GRADE LUMP ORE PRICES.

FIGURE 2.6

Low stocks of iron ore and the continuing importance of steel has rendered demand sensitive to economic conditions. This has particularly been the case in Western Australia's principal markets of Europe and Japan.

In Europe the main engine of growth is Germany, an iron ore market which is projected to expand due to demand for the steel being used in the expansion of capital and social infrastructure.

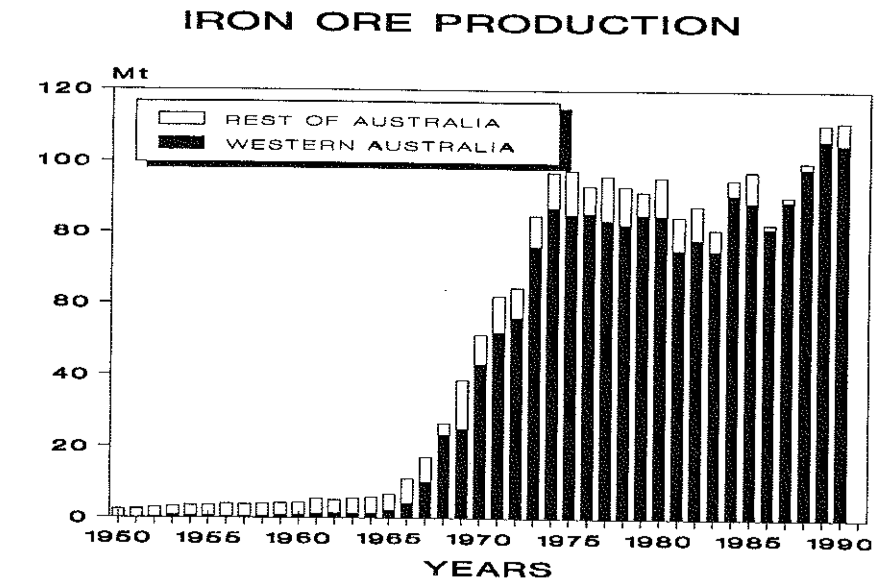
1990 Japanese steel production of 110 Mt was the highest output for 10 years. Demand is continuing to be underpinned by private construction and public sector infrastructure investment. Notwithstanding the resilience of Japan's economic performance, domestic steel production is projected to contract marginally through the first half of the decade.

Over the next five years, growth in Western Australia's relatively new iron ore markets in the Republic of Korea, China and Taiwan are projected to more than offset any small decline in Japanese demand. Construction and ship building are the main consumers of steel in these three growing markets.

The overall supply of iron ore onto world markets should remain stable in the medium term. This should prevent any repeat of the supply/demand imbalance which drove real iron ore prices down in the early 1980s. Falls in Indian, Eastern European and U.S.S.R. exports should be balanced by increases from Brazil and Western Australia.

Through comprehensive negotiations with Japanese mill owners, Western Australian producers won a third consecutive annual price increase in late 1990. The 7% rise did not represent a real price increase, and indicated a strengthening of the consuming companies bargaining power (Figure 2.5).

A steady rise is projected for Western Australian production from an estimated 106 Mt in 1990/91 to around 120 Mt by 1995/96. Of this estimated mid decade production, approximately 110 Mtpa will be exported. The capacity increases being put in place by local producers are as a result of the profitability generated through productivity improvements and higher real prices.



SOURCES:DEPT OF MINES WESTERN AUSTRALIA, BMR & ABARE

FIGURE 2.6

The CRA-CMIEC Channar joint venture, which commenced production at an annual rate of 3 Mt in 1990, will reach full capacity of 10 Mtpa within five years.

The massive Marandoo project, for which $400 million of capital investment will be required, is progressing slowly towards the commencement of the development stage. Hamersley Iron is treating the project as a progressive development which will gradually replace the depleting resources at Tom Price.

Construction has commenced on the BHP-Utah development at Yandicoogina, a project which will require $80 million of investment before coming on stream at 5 Mtpa in 1992. China's integrated Baoshan complex and several Japanese steelmakers are committed to purchasing all production.

The development phase of Hamersley Iron's Brockman No. 2 detritals project is set to commence in mid 1991. Approximately $50 million will be invested before production commences in early 1992.

Western Australian mines continue to dominate national production aggregates (Figure 2.6).

2.4 Petroleum

The total value of petroleum industry production rose strongly to $2.23 billion in 1990. This represented a two fold increase over 1989 receipts from condensate, crude oil, LNG and natural gas. While crude oil, condensate and LNG sales all increased spectacularly, natural gas receipts rose only marginally.

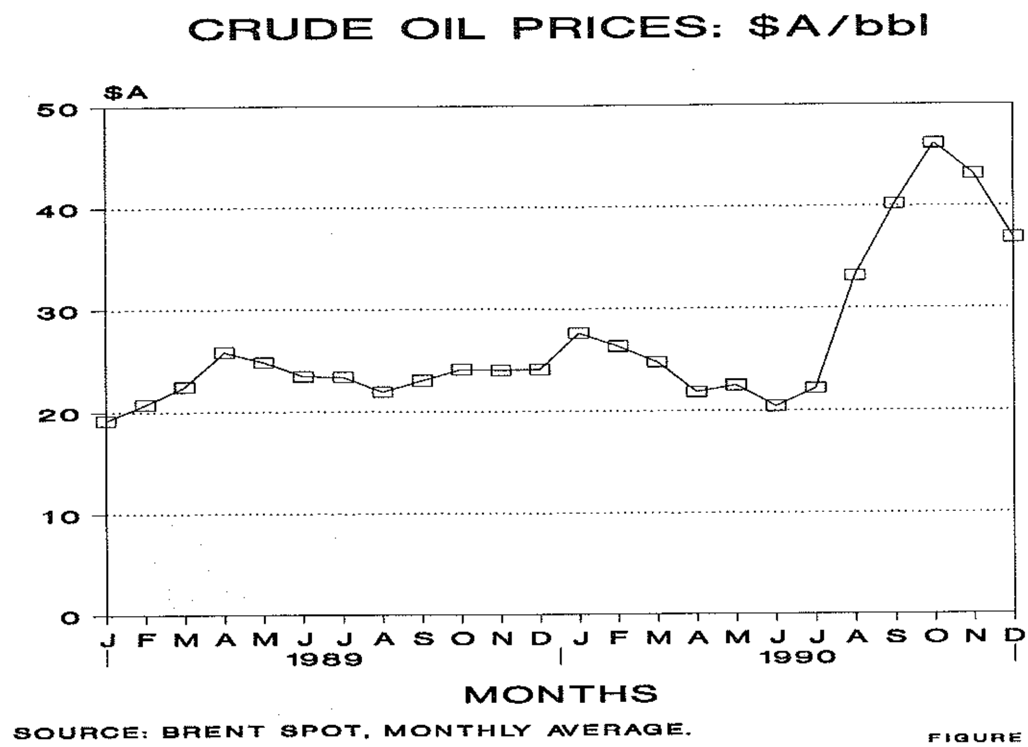
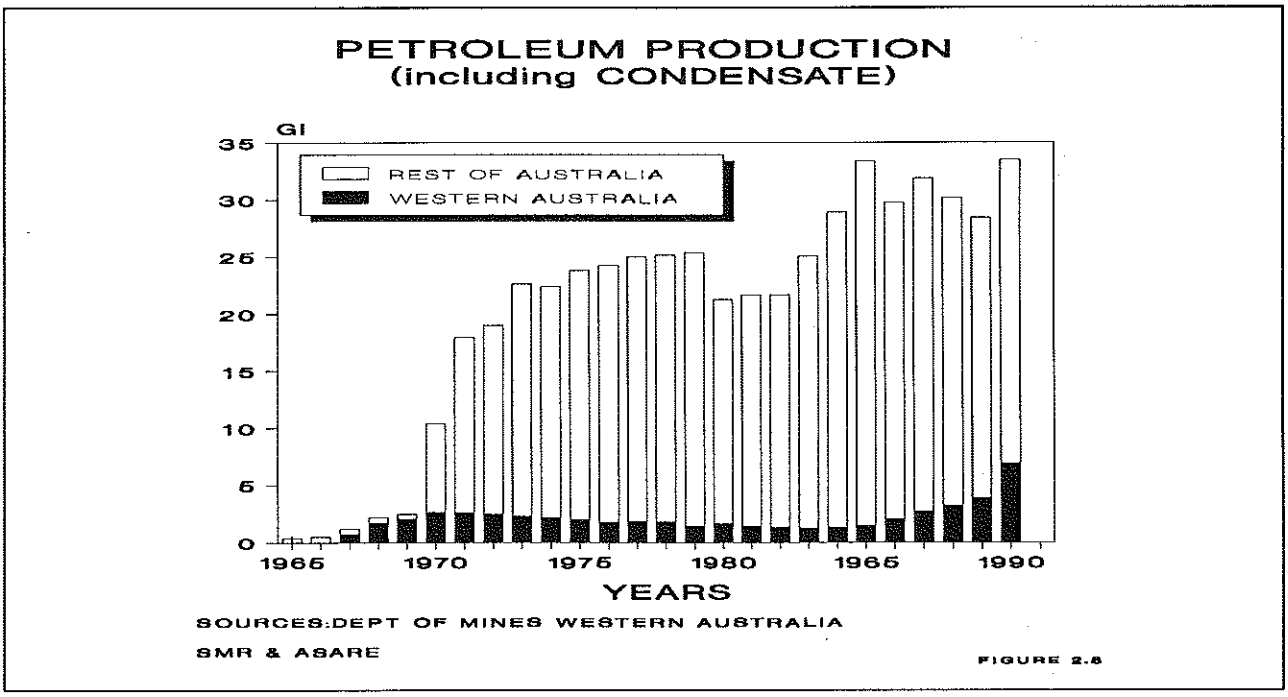


FIGURE 2.7

The world market price of crude rose precipitously in early August with the onset of the Gulf crisis (Figure 2.7). The West Texas intermediate price indicator peaked at over $A 45.00 per barrel in October. The average eased back to slightly more than $A 30.00 per barrel by the end of December, as markets discounted the supply effects of an outbreak of hostilities in Kuwait. In a market influenced by large stockpiles, subdued economic activity, a mild Northern winter and the International Energy Agency's coordination of the release of strategic reserves, Saudi Arabia was easily able to offset the loss of Kuwaiti and Iraqi production.

The medium term outlook for the world market supply/demand balance is fraught with some uncertainty. If, as projected, OPEC's supply share increases from 1991/92 onwards, prices should rise at an average rate of 2.5% p.a. in real terms through the mid 1990s. The effect of the predicted price rise, driven mainly by OPEC's market power, will be moderated by slow demand growth for petroleum products among OECD countries. The developing nations, particularly those of East and North Asia, should continue to be relatively large consumers of oil throughout the decade.

As the world's largest producer, the U.S.S.R. represents an area of double edged supply uncertainty. Output is currently being disrupted by political upheaval and by technical factors such as an under-investment in production capacity and delivery systems. This is having a profound effect on the industry's ability to supply domestic and traditional markets in COMECON countries. A medium term improvement in production, coupled with an increasing need for hard currency, could, however, see the U.S.S.R. dumping a large percentage of its crude oil output onto Western markets. This could result in chronic oversupply and a subsequent price fall. Other areas of non-OPEC supply are not expected to expand strongly enough to challenge the cartel's market power through the mid 1990s.



Although Australian production is in a period of downturn due to a contraction in Bass Strait output, the situation is predicted to be reversed after 1993/94. Recent significant discoveries on the North West Shelf should be developed and brought into production by the mid decade.

While national self sufficiency should increase from the current 60% level, the structure of domestic marketing arrangements will ensure that an increasing proportion of local crude is exported. Conversely, a rising percentage of feedstocks for Australian refineries will be imported.

1990 was a year in which the search for oil increased markedly in Western Australia. A total of 37 exploration wells were drilled during the period. Of this total wildcat wells comprised 14 of the offshore and 13 of the onshore undertakings.

As in 1989, most activity was in the northern offshore part of the highly prospective Carnarvon Basin. Over 30 development wells were drilled and 6 oil and 4 gas discoveries registered in what was one of the most successful years in the history of the State's petroleum industry.

Crude oil production doubled to 5.2 gigalitres (Gl), or over 32 million barrels, and the value of output trebled to over $1 billion. More than half the total output was from the Saladin field. The other major fields in the Carnarvon basin; Barrow Island, Harriet, Herald/Pepper and Talisman; produced most of the balance of State output.

The Cossack 1 discovery significantly extended Woodside's North West Shelf oil producing potential. The large BHP Petroleum find early in the year at Griffin 1 was subsequently upgraded by the success of delineation wells at Griffin 2 and Griffin 3. WAPET's successful producing wells of Saladin, Yammaderry and Cowle were added to by the discovery of an economic resource at Roller 1.

During calendar 1990, the first full year of production, over 153 MM Btus of LNG was exported from the Burrup Peninsula to markets in Japan. Contracts for Woodside's $2.6 billion investment in the Goodwyn A platform and third LNG train, will continue to be let through 1991. The significant local content in these contracts is providing a stimulus to the State economy.

Gas exploration in the Perth Basin, already strong because of market deregulation, has been stimulated by the release of the Harman Inquiry into power options for Western Australia. The report's strong recommendation for increased gas use in power generation has been manifested in the expansion of capacity at Pinjar. An exciting gas gathering project, under development by Hadson Energy, will collect gas from four fields adjoining the Harriet oil project. SECWA and the Harriet Joint Venturers announced the signing of a Heads of Agreement on 12 December 1990, under which 140 Petajoules of gas will be delivered from the North West Shelf over a period of 10 years.

Condensate production continued the spectacular increase of recent years. Total value of output was up by 70% on the 1989 result to over $333 million. Output from the principal field, Woodside's North Rankin, was up by 0.4 Gl to 1.7 Gl.

Western Australia will attract at least three quarters of the oil industry's offshore exploration budget in 1991 and nearly all of the development investment. In terms of exploration, development and production, the State's petroleum industry is looking to a very bright future in the 1990s.

Western Australian production increased as a proportion of the national output during the reporting period (Figure 2.8).

2.5 Nickel

The total value of nickel ore and concentrates produced from Western Australian mines in 1990 was $557.9 million, a 19% decrease on the 1989 outcome. This substantial fall was registered even though physical production rose by 28% overall. Apart from nickel metal and matte, sales in excesss of 28 kt of ore and 486 kt of concentrates were reported. Cobalt, paladium and platinum by-products of nickel mining added another $6.5 million to total industry value of production.

Despite two small rallies, in the first and third quarters, the price of nickel metal fell steadily during much of 1990 (Figure 2.9). The fall came about due to sharply moderating demand for stainless steel in the consuming countries.

As a major input to the construction and automotive industries, the demand for stainless steel is very sensitive to fluctuations in economic growth. Prices are forecast to fall further during 1991.

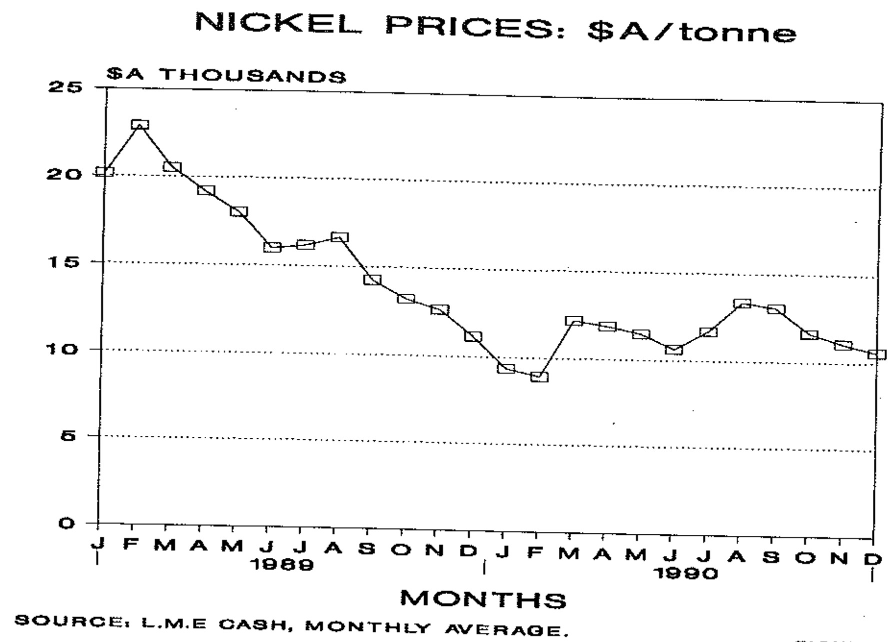


FIGURE 2.9

Western Mining Corporation (WMC) continues to be the State's only producer, with operating mines at Kambalda, Leinster and Windarra. Late in the year WMC conditionally committed itself to a 36 month-$300 million capital expenditure programme. The company intends to boost concentrate, and in turn matte and metal, production through an expansion of the Leinster project.

Although the price of nickel is continuing to moderate, there has been a lot of interest shown in new developments during 1990. Three projects are at the advanced feasibility stage and one, Radio Hill in the Pilbara, has commenced construction.

The developers of Mount Keith, the largest of the mine/concentrator projects under consideration, have arranged project finance and done some site engineering work. An announcement of the final go-ahead is expected in mid 1991. The joint venturers, Outokumpu Australia and Australian Consolidated Minerals, intend to produce 143 kt of 20% nickel concentrate per annum. The concentrate will be exported to Finland for further processing.

Despite a forecast easing in world nickel prices, export volume increases are expected to lift the value of State production in 1991.

Western Australia and Queensland remain the only nickel producing Australian States. As the Greenvale project (Q) winds down through the mid 1990s, Western Australia will further dominate the national output (Figure 2.10).

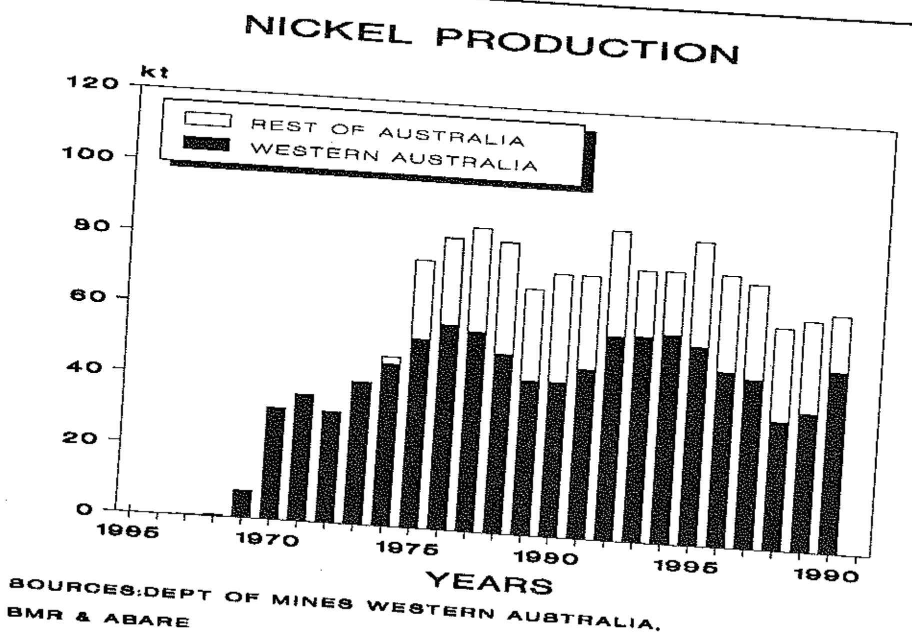


FIGURE 2.10

2.6 Diamonds

Total reported diamond production during 1990 was down approximately 17% on the amount won during 1989. While production fell to 31.1 million carats (Mcts), value rose marginally to $429.9 million.

The world market for high quality, near gem and industrial, diamonds was patchy during 1990. Demand in all categories continued to be broadly sensitive to economic growth in the O.E.C.D. countries. Some price growth was maintained through the Central Selling Organisation's power to control supply.

The mid year $US5 billion selling agreement between the U.S.S.R. and De Beers virtually ensured world market stability, and regular nominal price increases in the medium term.

Lower second half production at the Argyle project resulted from a decision to treat lower grade deposits from the AK1 pipe, and from technical problems associated with the rolls crusher circuit. The fall in production is likely to be only temporary, however, as the joint venturers have boosted treatment capacity to 6 mtpa.

While Argyle's production fell the State's other producer, Bow River, increased its output marginally and the value of carats won significantly. Bow River continued to mine a much higher percentage of gem quality diamonds. The company also had its potential reserves added to through receiving conditional E.P.A. approval to expand operations over 400 hectares of what was Lake Argyle.

During 1990 the Argyle joint venture partners again looked into the feasibility of opening the Ellendale deposit which is located in the West Kimberley 130km ESE of Derby. The project is still under consideration.

Despite some torpor in the market for gem and near gem diamonds, exploration activity was strong with a number of companies operating in regions not previously thought of as diamond prospects.

CRA Exploration, the principal of the Argyle joint venture, carried out exploration work in the Eastern Goldfields and the central lower Kimberley. Another company to gain notice in the search for diamonds was Cambridge Gulf Exploration NL. It was the first company to be offered an offshore waters mineral exploration permit under new federal legislation. The area being explored is 20 km off-shore from the mouth of the Ord River in 50 to 60m of water. If the company does discover a mineable deposit the plan is to exploit it by using dredges.

Analysts predict that, with the exception of high quality gems, the broad diamond sector will only register marginal growth during the next 12 months as the world economy begins to recover from the current downturn.

2.7 Heavy Mineral Sands

After 5 years of expansion, the Western Australian heavy mineral sands industry posted a small overall contraction in output and value of production during 1990.

Ilmenite production was up marginally while reported tonnages of all other products fell by between 5% (upgraded ilmenite) and 35% (zircon). After registering a relatively small output in 1989, xenotime production ceased altogether.

Total value of all heavy mineral sands products eased by 10% to $412.5 million during the trading period. Small value of output increases were posted for ilmenite, up-graded ilmenite and leucoxene. Receipts from zircon, rutile and monazite all decreased. The overall price index for mineral sands fell throughout 1990 (Figure 2.11).

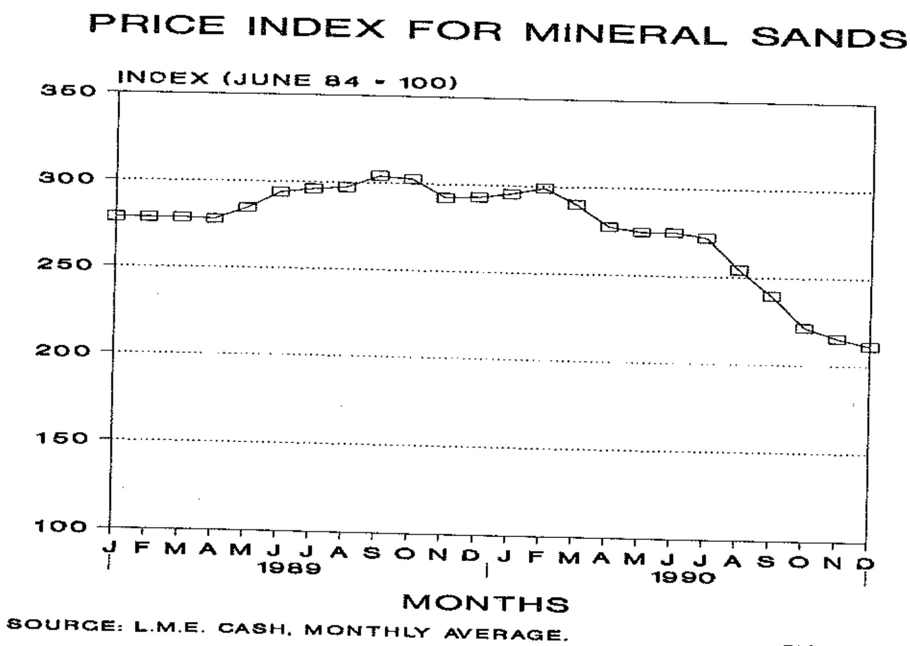


FIGURE 2.11

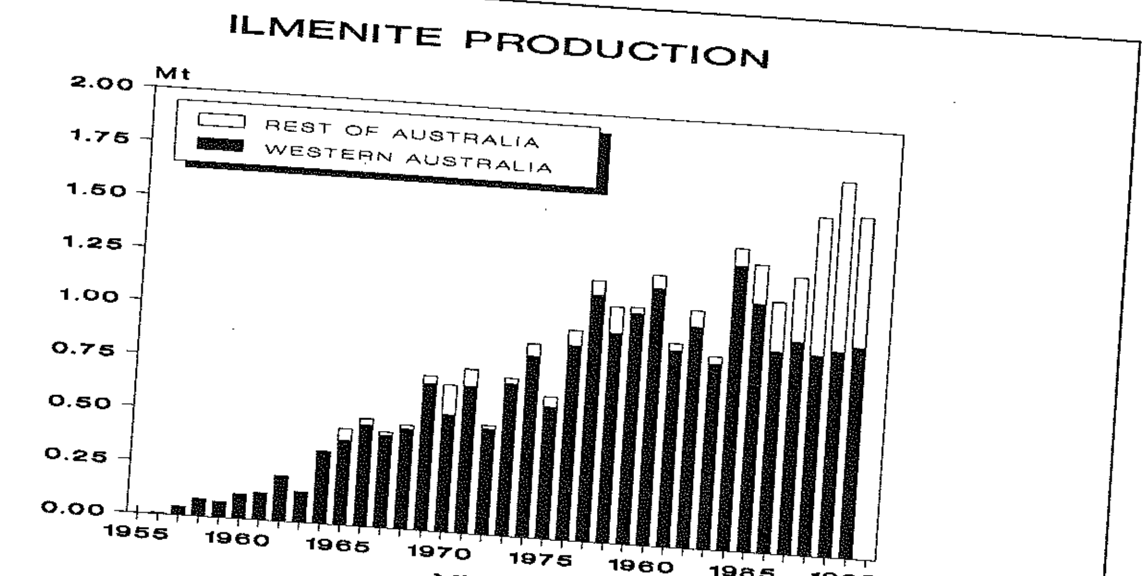
The global supply/demand imbalance for the main heavy mineral sands products became more pronounced during the second half of 1990. Demand for most of the titanium dioxide and zircon based products; such as paints, foundry bricks and chemical processing inputs; has proven to be particularly sensitive to economic fluctuations. A steady contraction of activity in key sectors of our major trading partner's economies reduced the demand pressure which drove the surge in prices over the past 5 years.

Demand for the relatively high value zircon has been eroded by the emergence of substitutes. Alumina bricks, chromite and silica sands, have all captured market share in the traditional industrial use areas of that mineral.

Mitigating against these areas of contraction has been the steady expansion of the specialist use of titanium metal and the demand for zircon products in the ceramics, electronics and nuclear power industries. The floor provided by these demand areas, and a predicted economic recovery through 1991/92, should see prices stabilise above those prevailing in the mid 1980s.

Through the 1990s monazite is forecast to be increasingly sought after as a source of rare earth oxides. Failing the discovery of large economically exploitable reserves, the price of monazite should rise gradually.

Recent capacity expansions by heavy mineral sands operators in Canada, South Africa and Sierra Leone will tend to moderate, at least in the medium term, any demand induced upward pressure on prices. The current softness of prices may also curtail development plans for new discoveries in the U.S. and several African countries.



SOURCES:DEPT OF MINES WESTERN AUSTRALIA. BMR & ABARE

FIGURE 2.12

Supply capacity in Western Australia was expanded considerably during 1990. Development is also progressing on several new projects which will come on stream over the next few years. Associated Minerals Consolidated's (AMC) new Eneabba West mine, and major extension to its dry processing plant at Narngulu, will increase the total value of company output by $90 million per annum. The mine will produce ilmenite, natural rutile, zircon and monazite. The increase in synthetic rutile production made possible by the Narngulu extension will strengthen A.M.C.'s position as the State's premier producer.

Cable Sands' Jangardup development, a project with estimated reserves similar in size to Eneabba West, has been given conditional approval to proceed. The development is subject to environmental and transport arrangements being satisfied. The Beenup project, near Augusta, should receive State government conditional approval during 1991.

Overall, the heavy mineral sands industry has continued to lead the nation's extractive industries in adding value through downstream processing.

The Tiwest joint venture, with its mining operation at Cooljarloo, is poised to complete its integrated mineral sands-to-titanium pigment scheme with the commissioning of the Kwinana pigment plant. At Kwinana, the joint venturers will employ about 180 people, a significant boost to local employment.

From the Cooljarloo mine commissioning in January 1990 to the coming on stream of the Muchea synthetic rutile plant in December 1990, the TiWest joint venturers have had a very busy year.

Heavy mineral sands developers are taking a long view nationwide with 2 major mines planned for Queensland in the mid 1990s and C.R.A.'s massive Western Victorian operation (Wimmera) also due to come on stream at that time. Despite lower levels of production as miners attempt to reduce stockpiles, output from Western Australian operations still dominates the national aggregates. Gross annual tonnages of ilmenite provide an indication of industry activity (Figure 2.12). As the State's producers are world competitive, Western Australia should maintain, and expand in some products, its current high market share.

2.8 Summary Outlook

In most sectors production volumes increased markedly over the 1989 results. Relatively small decreases in output were recorded for iron ore, diamonds and the mineral sands products of upgraded ilmentite and zircon. Buoyed by relatively strong prices over most of the trading period the total value of minerals and petroleum production rose by 25% to an estimated $11.8 billion.

Gold, iron ore, alumina and petroleum dominated the State's resources output during the trading period. Export receipts from these sectors were in excess of $9.0 billion.

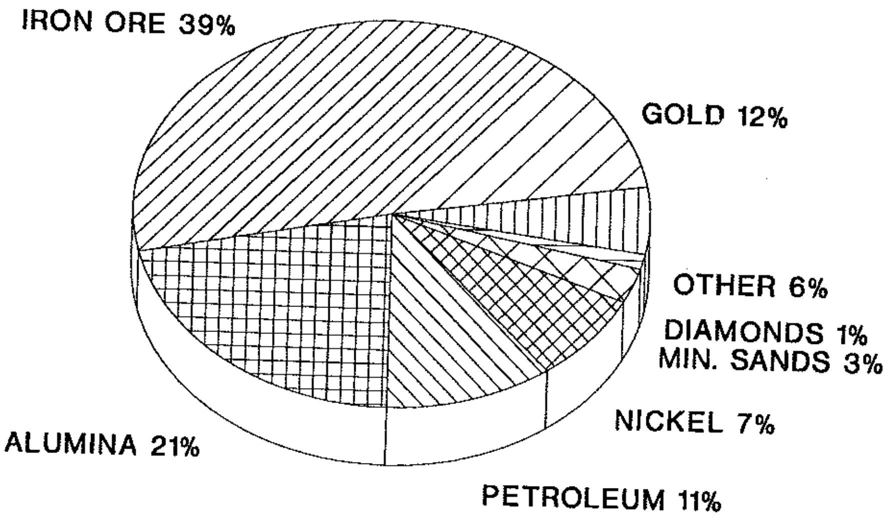
Compared with the spectacular gains of the past few years, overall growth in the minerals and petroleum industry will be subdued in the medium term. Due to several structural factors Western Australia's industry will be broadly shielded from the worst effects of the current recession. These mitigating factors are the broadly based nature of the industry, the coming on-stream of some long term developments and the ongoing activity at all levels of petroleum sector. While no price bonanzas are envisaged, prices, at least among the State's main mineral commodities, should remain stable in real terms.

It is projected that the State's minerals and petroleum industry should continue to post relatively strong results through 1991. While there are some reasons for concern over conditions prevailing in the international trading environment, the total value of Western Australia's resource exports should increase moderately. This result will be broadly contingent on some growth in export volumes.

COMPARATIVE VALUE OF PRODUCTION

1985 VALUE OF PRODUCTION

TOTAL : $ 5,169.9 MILLION



1990 VALUE OF PRODUCTION

TOTAL: $11,794 MILLION

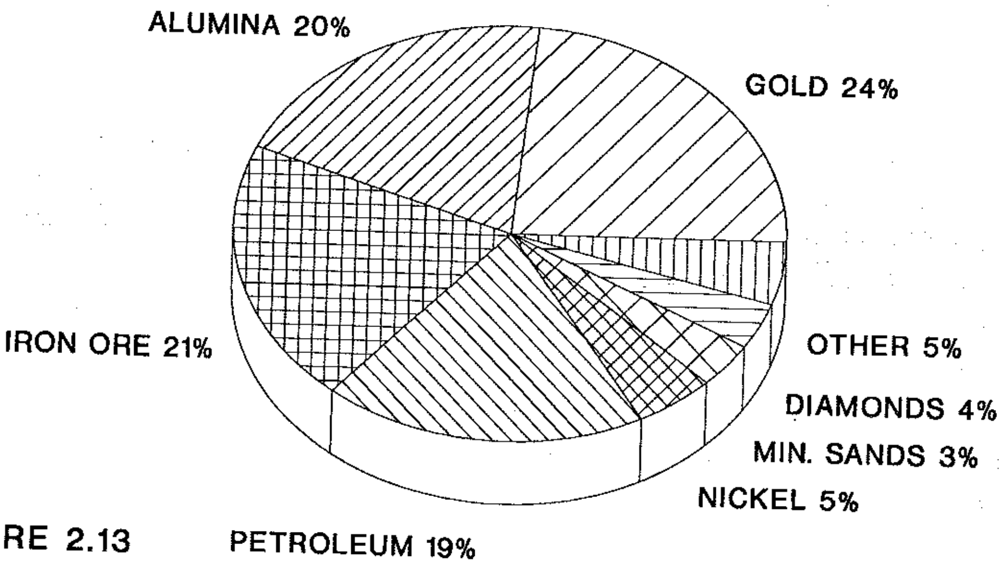


FIGURE 2.13

TABLE 3.1

QUANTITY AND VALUE OF MINERALS AND PETROLEUM 1989, 1990

MINERAL	UNIT	1989 QUANTITY	1989 VALUE($A)	1990 QUANTITY	1990 VALUE($A)
BARYTES	t	0	0	7 521	1 006 603
BASE METALS					
Copper	t	19 037(r)	40 695 473(r)	14 959	22 547 870
Lead	t	7 846	4 422 848	13 606	7 176 456
Zinc	t	38 064(r)	48 153 946(r)	62 805	61 546 194
TOTAL BASE METALS			93 272 267		91 270 520
BAUXITE-ALUMINA					
Alumina	t	6 384 796	2 096 790 010(r)	6 722 292	2 358 954 531
CLAYS					
Attapulgite	t	35 985	3 885 665	27 985	5 062 003
Cement Clay	t	23 025	57 564	11 020	27 550
Fire Clay	t	119 778	143 973	234 367	457 335
Kaolin	t	0	0	7 701	472 291
White Clay	t	1 709	20 503	139 000	1 529 000
TOTAL CLAYS			4 107 705	420073	7 872 189
COAL	t	3 830 472(r)	166 799 208(r)	4 831 172	214 253 964
CONSTRUCTION MATERIALS					
Aggregate	t	172 316	1 026 723	78 303	300 542
Gravel	t	31 123(r)	143 716(r)	32 471	162 435
Rock	t	134 927	1 260 593	84 595	701 259
Sand	t	759 955(r)	1 928 983(r)	563 731	2 489 603
TOTAL CONSTRUCTION MATERIALS			4 360 015		3 653 839
DIAMONDS	ct	37 505 444(r)	427 446 772(r)	31 182 964	429 928 200
DIMENSION STONE					
Black Granite	t	740(r)	1 041 390(r)	748	824 801
Quertz Rock	t	1 471(r)	64 842(r)	678	30 445
Quartzite	t	59(r)	2 360(r)	0	0
Spongolite	t	1 139(r)	101 365(r)	1 541	119 489
TOTAL DIMENSION STONE			1 209 957	2967	974 735

TABLE 3.1 (cont)

QUANTITY AND VALUE OF MINERALS AND PETROLEUM 1989, 1990

MINERAL	UNIT	1989 QUANTITY	1989 VALUE($A)	1990 QUANTITY	1990 VALUE($A)
GEM, SEMI-PRECIOUS & ORNAMENTAL STONE					
Amethyst	kg	34 000	172 667(r)	2 194	3 291
Emerald	g	550	2 020	0	0
Zebra Rock	kg	1 260	12 600	0	0
TOTAL GEM, SEMI-PRECIOUS & ORNAMENTAL STONE			187 287		3 291
GOLD	kg	147 281(r)	2 295 578 936(r)	176 347(e)	2 793 999 787(e)
GYPSUM	t	163 900(r)	1 147 662(r)	146 811	1 061 190
HEAVY MINERAL SANDS					
Garnet	t	29 905	1 211 433	23 367	1 535 315
Ilmenite	t	964 031(r)	77 073 056(r)	988 251	86 203 153
Upgraded Ilmenite (a)	t	261 603(r)	115 530 022(r)	249 265	120 772 694
Leucoxene	t	22 498	10 336 566	20 839	11 511 265
Monazite	t	11 767	8 802 975(r)	10 514	7 831 157
Rutile	t	88 972	58 363 779	76 065	57 906 645
Xenotime	t	20	105 840	0	0
Zircon	t	343 821(r)	187 953 682(r)	224 461	126 677 148
TOTAL HEAVY MINERAL SANDS			459 377 353		412 437 377
INDUSTRIAL PEGMATITE MINERALS					
Felspar	t	7 367(r)	328 732(r)	31 774	1 317 361
Mica	t	11 432(r)	66 104(r)	1 971	105 241
TOTAL INDUSTRIAL PEGMATITE MINERALS			394 836		1 422 602
IRON ORE					
Domestic	t	4 896 893(r)	85 248 528(r)	4 772 519	111 147 853
Exported	t	101 573 077(r)	2 036 817 396(r)	99 079 566	2 315 663 115
TOTAL IRON ORE		106 469 970	2 122 065 924	103 852 085	2 426 810 968
LIMESAND-LIMESTONE-DOLOMITE					
Dolomite	t	360(r)	7 200(r)	333	6 660
Limesand-Limestone	t	1 812 436(r)	7 795 442(r)	1 828 663	10 640 754
TOTAL LIMESAND-LIMESTONE-DOLOMITE			7 802 642		10 647 414
MANGANESE ORE	t	11 375	50 000	364 577	57 927 462

TABLE 3.1 (cont)

QUANTITY AND VALUE OF MINERALS AND PETROLEUM 1989, 1990

		1989		1990	
MINERAL	UNIT	QUANTITY	VALUE($A)	QUANTITY	VALUE($A)
NICKEL INDUSTRY					
Cobalt by-product	t	261	4 472 086	268	4 264 988
Nickel Concentrate	t	384 381(r)	678 568 855(r)	486 225	543 077 506
Nickel Ore	t	17 101	10 281 141	28 649	14 892 472
Palladium by-product	kg	323(r)	1 917 445	435	1 185 127
Platinum by-product	kg	61(r)	1 275 979	96	1 235 806
TOTAL NICKEL INDUSTRY			696 515 506		564 655 899
PEAT	t	1 212(r)	72 557(r)	861	58 774
PETROLEUM					
Condensate	kl	1 353 197(r)	197 155 951(r)	1 719 444	333 903 937
Crude Oil	kl	2 514 049	369 850 063(r)	5 200 749	1 023 216 415
LNG	MMBtu	37 683 100	113 427 505	153 141 420	508 103 078
Natural Gas	'000m3	3 742 658(r)	321 733 867(r)	3 698 843	366 425 052
TOTAL PETROLEUM			1 002 167 386		2 231 648 482
PIGMENTS					
Red Iron Oxide	t	0	0	5 757	110 531
RARE EARTHS					
Gallium	kg	21 859(r)	757 820(r)	31 375	1 025 196
SALT	t	5 904 404(r)	112 376 112(r)	6 123 511	130 774 588
SILICA-SILICA SAND					
Silica	t	6 197(r)	61 967(r)	69 021	703 953
Silica Sand	t	433 749(r)	3 632 098(r)	622 557	4 889 760
TOTAL SILICA-SILICA SAND		439946	3 694 065	691578	5 593 713
SILVER	kg	41 377(r)	6 058 576(r)	34 216	5 621 348
TALC	t	196 100	13 658 214(r)	189 086	14 480 263
TIN-TANTULUM-LITHIUM					
Spodumene	t	39 105	7 118 550	50 576	7 525 463
Tantalite	t	550(r)	17 931 656(r)	573	19 216 316
Tin	t	351(r)	2 122 155(r)	212	1 085 179
TOTAL TIN-TANTULUM-LITHIUM			27 172 361		27 826 957
VERMICULITE	t	306	54 268	43	7 691
TOTAL VALUE			9 543 117 439(r)		11 794 028 114(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
BARYTES	East Pilbara	7 521		1 006 603	(a)
BASE METALS					
Copper By- Product	Coolgardie		Cu Tonnes 5 332.056	6 165 855	(a),(b)
Copper Concentrates	East Pilbara	12 236	2 959.841	3 102 070	
	Meekatharra	27 283	5 739.038	11 781 785	
		39 519	8 698.879	14 883 855	(a)
Copper Ore	Meekatharra	5 271	927.700	1 498 160	(a)
TOTAL COPPER			14 958.635	22 547 870	
Lead	Derby-West Kimberley	19 014	Pb Tonnes 13 608.08	7 176 456	(a)
Zinc	Derby-West Kimberley	104 866	Zn Tonnes 51 703.99	61 546 194	(a)
TOTAL BASE METALS				91 270 520	
BAUXITE-ALUMINA					
Alumina	Boddington	1 285 803		454 435 875	
	Harvey	836 483		293 085 789	
	Murray	2 916 308		1 022 050 682	
	Serpentine-Jarrahdale	1 683 698		589 382 185	
TOTAL BAUXITE-ALUMINA		6 722 292		2 358 954 531	(c)
CLAY					
Attapulgite	Mullewa	27 985		5 062 003	(a)
Cement Clay	Armadale	11 020		27 550	(d)
Fire Clay	Chittering	234 367		457 335	(d)
Kaolin	Greenbushes	7701		472 291	(a)
White Clay	Serpentine-Jarrahdale	139 000		1 529 000	
	Swan	32 401		324 010	
		171 401		1 853 010	(d)
TOTAL CLAY				7 872 189	

TABLE 4.1 (cont) Mineral	Local Government Area	Quantity tonnes	Metallic Content	Value ($)	Ref
Coal	Collie	4 831 172		214 253 964	(e)
CONSTRUCTION MATERIALS					
Aggregate	Derby-West Kimberley	1 252		4 801	
	Kalgoorlie-Boulder	50 922		195 354	
	Port Hedland	18 063		69 348	
	Wyndham-East Kimberley	8 066		31 039	
Total Aggregate		78 303		300 542	
Gravel	Broome	2 667		13 335	
	Coolgardie	1 280		6 480	
	Kalamunda	23 984		119 920	
	Port Hedland	4 540		22 700	
Total Gravel		32 471		162 435	
Rock	Broome	44 482		343 598	
	Exmouth	25 024		214 650	
	Roebourne	15 089		143 011	
Total Rock		84 595		701 259	
Sand	Ashburton	42 882		176 233	
	Canning	239 337		1 074 375	
	Carnarvon	48		192	
	Collie	39 128		165 296	
	Coolgardie	44 797		229 686	
	Dandaragan	4 265		23 090	
	Derby-West Kimberley	4 487		22 028	
	East Pilbara	478		2 868	
	Gingin	12 878		77 264	
	Leonora	1 976		9 880	
	Meekatharra	20 835		117 125	
	Northam	3 324		8 604	
	Port Hedland	10 829		71 048	
	Roebourne	70 958		394 198	
	Swan	63 919		96 476	
	Wyndham-East Kimberley	3 590		21 240	
Total Sand		563 731		2 489 603	
TOTAL CONSTRUCTION MATERIALS				3 653 839	(d)

TABLE 4.1 (cont) Mineral	Local Government Area	Quantity tonnes	Metallic Content	Value ($)	Ref
		Carats			
DIAMOND	Wyndham-East Kimberley	31 182 964		429 928 200	(a)
DIMENSION STONE					
Black Granite	Derby-West Kimberley	748		824 801	(a)
Quartz Rock	Mukinbudin	678		30 445	(d)
Spongolite	Plantagenet	1 541		119 489	(e)
TOTAL DIMENSION STONE				974 735	
GEM, SEMI-PRECIOUS STONES		Kg			
Amethyst	Upper-Gascoyne	2 194		3 291	(e)
GOLD		Au Kg			
	Ashburton	7.228		114 519	
	Boddington	21 886.467		346 763 960	
	Coolgardie	13 281.762		210 433 068	
	Cue	11 714.724		185 605 292	
	Dundas	3 702.241		58 657 423	
	East Pilbara	11 721.022		185 705 076	
	Halls Creek	57.780		915 452	
	Kalgoorlie-Boulder	42 238.899		669 223 036	
	Laverton	6 739.332		106 776 368	
	Leonora	15 438.290		244 600 583	
	Meekatharra	11 552.613		183 036 843	
	Menzies	3 139.104		49 735 215	
	Mt. Magnet	7 258.909		115 008 422	
	Perenjori	204.606		3 241 729	
	Ravensthorpe	97.865		1 550 550	
	Roebourne	13.601		215 491	
	Sandstone	3 809.959		60 364 081	
	Upper Gascoyne	5.540		87 774	
	Westonia	2 167.238		34 337 202	
	Wiluna	4 450.763		70 516 827	
	Yalgoo	3 141.424		49 771 972	
	Yilgarn	13 717.633		217 338 904	
TOTAL GOLD		176 347.000		2 793 999 787	(f)

TABLE 4.1 (cont) Mineral	Local Government Area	Quantity tonnes	Metallic Content	Value ($)	Ref
GYPSUM	Carnamah	3 791		22 746	(e),(d)
	Dalwallinu	38 692		407 507	(e)
	Esperance	11 738		79 819	(e)
	Irwin	210		3 150	(e)
	Kellerberrin	8 450		58 050	(e)
	Lake Grace	9 987		61 435	(e)
	Merredin	3 686		22 116	(e)
	Nungarin	30 940		175 239	(e)
	Ravensthorpe	5 500		22 000	(e)
	Wyalkatchem	33 817		209 128	(e)
TOTAL GYPSUM		146 811		1 061 190	
HEAVY MINERAL SANDS					
Garnet Sand	Capel	1 095		64 561	(g)
	Northampton	22 272		1 470 754	(e)
Total Garnet Sand		23 367		1 535 315	
			TiO_2%		
Ilmenite	Capel	664 192	55.00)		
	Carnamah	177 354	60.00)		
	Dandaragan	97 702	62.82)		
	Waroona	49 003	55.00)		
Total Ilmenite		988 251		86 203 153	(a)
			TiO_2%		
Upgraded Ilmenite	Capel	153 516	92.00)		
	Carnamah	95 749	92.00)		
Total Upgraded Ilmenite		249 265		120 772 694	(a)
Total Ilmenite and Upgraded Ilmenite				206 975 847	
			TiO_2 Tonnes		
Leucoxene	Capel	20 839	18 868	11 511 265	(a)
			ThO_2 Units		
Monazite	Capel	3 500	22 750	2 582 636	
	Carnamah	7 014	45 592	5 248 521	
Total Monazite		10 514	68 342	7 831 157	(a)

TABLE 4.1 (cont) Mineral	Local Government Area	Quantity tonnes	Metallic Content	Value ($)	Ref
HEAVY MINERAL SANDS (cont)					
			TiO_2 Tonnes		
Rutile	Carnamah	71 054	67 501	54 069 249	
	Dandaragan	5 011	4 803	3 837 396	
Total Rutile		76 065	72 304	57 906 645	(a)
			ZrO_2 Tonnes		
Zircon	Capel	58 346	37 924	32 637 761	
	Carnamah	156 321	101 981	88 929 115	
	Dandaragan	7 974	5 262	4 079 420	
	Waroona	1 820	1 183	1 030 852	
Total Zircon		224 461	146 350	126 677 148	(a)
TOTAL HEAVY MINERAL SANDS				412 437 377	
INDUSTRIAL PEGMATITE MINERALS					
Felspar	Mukinbudin	9 899		441 246	
	Port Hedland	21 875		876 115	
Total Felspar		31 774		1 317 361	
Mica	Pilbara	1 971		105 241	
TOTAL INDUSTRIAL PEGMATITE MINERALS				1 422 602	(h)
IRON ORE			Fe%		
Export Ore	Ashburton	63 881 913	60.46	1 441 364 411	
	Derby-West Kimberley	2 111 654	64.68	45 366 523	
	East Pilbara	33 085 999	64.70	828 932 181	
Total Export Ore		99 079 566		2 315 663 115	
			Fe%		
Domestic Ore	Ashburton	356 135	57.15	5 423 326	
	Derby-West Kimberley	1 566 960	65.37	34 673 069	
	East Pilbara	2 849 424	63.28	71 051 458	
Total Domestic Ore		4 772 519		111 147 853	
TOTAL IRON ORE		103 852 085		2 426 810 968	(a)
LIMESAND-LIMESTONE-DOLOMITE					
Dolomite	Lake Grace	333		6660	(e)

TABLE 4.1 (cont) Mineral	Local Government Area	Quantity tonnes	Metallic Content	Value ($)	Ref
LIMESAND-LIMESTONE-DOLOMITE (cont)					
Limesand- Limestone	Cockburn	1 533 834		7 671 838	(d)
	Dandaragan	3 290		21 592	(d)
	Exmouth	1 716		17 160	(d)
	Gingin	24 235		445 302	(d)
	Irwin	980		6 402	(d)
	Manjimup	45		495	(d)
	Roebourne	108		589	(d)
	Wanneroo	264 455		2 477 376	(d)
TOTAL LIMESAND-LIMESTONE-DOLOMITE		1 828 663		10 640 754	
Manganese Ore	East Pilbara	364 577		57 927 462	(a)
NICKEL INDUSTRY					
			Co Tonnes		
by-product Cobalt	Coolgardie		268.223	4 264 988	(a)(b)
			Pd Kg		
by-product Palladium	Coolgardie		434.925	1 185 127	(a)(b)
			Pt Kg		
by-product Platinum	Coolgardie		95.827	1 235 806	(a)(b)
			Ni%		
Nickel Concentrates	Coolgardie	258 550	10.38	289 919 806	
	Kalgoorlie-Boulder	28 656	12.43	38 505 104	
	Laverton	47 309	8.63	43 598 756	
	Leonora	151 710	9.93	171 053 840	
Total Nickel Concentrates		486 225		543 077 506	
			Ni%		
Nickel Ore	Leonora	28 649	4.73	14 892 472	
Total Nickel Production				557 969 978	(i)
TOTAL NICKEL INDUSTRY PRODUCTION				564 655 899	
PEAT	Manjimup	861		58 774	(d)

TABLE 4.1 (cont) Mineral	Local Government Area	Quantity tonnes	Metallic Content	Value ($)	Ref
PETROLEUM		Kilolitres			
Condensate	Carnamah	393		65 890	(d)
	Irwin	1 214		52 814	(d)
	Roebourne	1 717 837		333 785 233	(a)
Total Condensate		1 719 444		333 903 937	
Crude Oil	Derby-West-Kimberley	24 623		4 381 319	
	Irwin	38 990		6 510 322	
	Roebourne	5 137 136		1 012 324 774	
Total Crude Oil		5 200 749		1 023 216 415	(a)
		MMBtu			
L.N.G.	Roebourne	153 141 420		508 103 078	(a)
		'000 M3			
Natural Gas	Carnamah	126 067		13 972 277	(j)
	Irwin	129 685		14 443 229	(j)
	Roebourne	3 443 091		338 009 546	(d)
Total Natural Gas		3 698 843		366 425 052	
TOTAL PETROLEUM PRODUCTION				2 231 648 482	
PIGMENTS					
Red Iron Oxide	Cue	5 757		110 531	(e)
RARE EARTHS		Ga Kg			
Gallium	Pinjarra	31 375		1 025 196	(a)
SALT	Carnarvon	1 195 422		26 987 850	(a)
	Port Hedland	1 711 972		31 715 766	(a)
	Roebourne	2 751 867		62 275 238	(a)
	Shark Bay	464 001		9 775 814	(a)
	Wyalkatchem	249		19 920	(e)
TOTAL SALT		6 123 511		130 774 588	
SILICA - SILICA SAND					
Silica	Moora	69 021		703 953	(a)
Silica Sand	Canning	233 112		2 564 232	(a)
	Cockburn	286 818		1 908 792	(a)
	Coolgardie	66 933		188 131	(a),(e)

TABLE 4.1 (cont) Mineral	Local Government Area	Quantity tonnes	Metallic Content	Value ($)	Ref
SILICA - SILICA SAND (cont)					
Silica Sand (cont)	Swan	900		18 000	(a)
	Wanneroo	34 794		210 605	(a)
		622 557		4 889 760	
TOTAL SILICA-SILICA SAND				5 593 713	
SILVER		Ag Kg			
by-Product	State-wide	25 710.072		4 212 327	
	Coolgardie	255.671		51 249	(a),(k)
	East Pilbara	58.511		12 117	(a),(k)
	Meekatharra	8 191.647		1 345 655	(a),(b)
		8 505.829		1 409 021	
TOTAL SILVER		34 215.901		5 621 348	
TALC	Meekatharra	45 765		4 447 793	
	Three Springs	143 321		10 032 470	
TOTAL TALC		189 086		14 480 263	(e)
TIN-TANTALUM-LITHIUM					
			LiO_2 Tonnes		
Spodumene	Bridgetown-Greenbushes	50 576	2 693	7 525 463	(a)
			Ta_2O_5 Kg		
Tantalite	Bridgetown-Greenbushes	406	107 652	11 594 042	
	East Pilbara	168	77 955	7 622 274	
Total Tantalite		573	185 607	19 216 316	(a)
			Sn Tonnes		
Tin	Bridgetown-Greenbushes	208	142.790	1 055 539	
	East Pilbara	4	2.410	29 640	
Total Tin		212	145.200	1 085 179	(a)
TOTAL TIN-TANTALUM-LITHIUM				2 7826 958	
VERMICULITE	Ravensthorpe	43		7 691	(e)
	Total Value of Minerals ($)			6 768 379 846	
	Total Value of Petroleum ($)			2 231 648 482	
	Total Value of Gold ($)			2 793 999 787	
	Total Value of Production ($)			11 794 028 115	

TABLE 5.1

QUANTITY AND VALUE OF MINERALS AND PETROLEUM BY MINERAL-FIELD

Mineral	Mineral-field	Quantity tonnes	Metallic Content	Value ($)	Ref
Barytes	Pilbara	7 521		1 006 603	(a)
BASE METALS					
			Cu Tonnes		
Copper By-Product	Coolgardie		5 332.056	6 165 855	(a),(b)
Copper Concentrates	Peak Hill	27 283	5 739.038	11 781 785	
	Pilbara	12 236	2 959.841	3 102 070	
Total Copper Concentrates		39 519	8 698.879	14 883 855	(a)
Copper Ore	Peak Hill	5 271	927.700	1 498 160	(a)
TOTAL COPPER			14 958.635	22 547 870	
			Pb Tonnes		
Lead	West Kimberley	19 014	13 606.080	7 176 456	(a)
			Zn Tonnes		
Zinc	West Kimberley	104 866	51 703.990	61 546 194	(a)
TOTAL BASE METALS				91 270 520	
BAUXITE-ALUMINA					
Alumina	South West	6 722 292		2 358 954 531	(c)
CLAY					
Attapulgite	South West	27 985		5 062 003	(a)
Cement Clay	South West	11 020		27 550	(d)
Fire clay	South West	234 367		457 335	(d)
Kaolin	Greenbushes	7 701		472 291	(a)
White Clay	South West	171 401		1 853 010	(d)
TOTAL CLAY				7 872 189	
COAL	Collie	4 831 172		214 253 964	(e)

TABLE 5.1 (cont)

Mineral	Mineral-field	Quantity tonnes	Metallic Content	Value ($)	Ref
CONSTRUCTION MATERIALS					
Aggregate	East Coolgardie	50 922		195 354	
	Kimberley	8 066		31 039	
	Pilbara	18 063		69 348	
	West Kimberley	1 252		4 801	
Total Aggregate		78 303		300 542	
Gravel	Coolgardie	1 280		6 480	
	Pilbara	4 540		22 700	
	South West	23 984		119 920	
	West Kimberley	2 667		13 335	
		32 471		162 435	
Rock	Ashburton	25 024		214 650	
	West Kimberley	44 482		343 598	
	West Pilbara	15 089		143 011	
		84 595		701 259	
Sand	Ashburton	16 133		32 265	
	Coolgardie	44 797		229 686	
	East Murchison	1 671		10 027	
	Gascoyne	48		192	
	Kimberley	3 590		21 240	
	Mt Margaret	1 976		9 880	
	Peak Hill	19 164		107 098	
	Pilbara	11 307		73 916	
	Roebourne	67 399		373 904	
	South West	362 851		1 445 105	
	West Kimberley	4 487		22 028	
	West Pilbara	30 308		164 262	
Total Sand		563 731		2 489 603	
TOTAL CONSTRUCTION MATERIALS				3 653 839	(d)
		Carats			
DIAMOND	Kimberley	31 182 964		429 928 200	(a)

TABLE 5.1 (cont) Mineral	Mineral-field	Quantity tonnes	Metallic Content	Value ($)	Ref
DIMENSION STONE					
Black Granite	West Kimberley	748		824 801	(a)
Quartz Rock	South West	678		30 445	(d)
Spongolite	South West	1 541		119 489	(e)
TOTAL DIMENSION STONE				974 735	
GEM, SEMI-PRECIOUS STONES					
		Kg			
Amethyst	Gascoyne	2 194		3 291	(e)
GOLD		Au Kg			
	Ashburton	7.228		114 519	
	Broad Arrow	15 118.442		239 532 987	
	Coolgardie	13 281.248		210 424 924	
	Dundas	3 702.241		58 657 423	
	East Coolgardie	25 859.377		409 709 798	
	East Murchison	16 554.591		262 286 989	
	Gascoyne	5.540		87 774	
	Kimberley	57.779		915 437	
	Mt. Margaret	14 514.776		229 968 647	
	Murchison	26 052.494		412 769 498	
	North Coolgardie	3 139.104		49 735 215	
	North East Coolgardie	1 261.080		19 980 251	
	Peak Hill	3 842.729		60 883 281	
	Phillips River	97.865		1 550 550	
	Pilbara	11 721.022		185 705 076	
	South West	21 886.981		346 772 104	
	West Pilbara	13.601		215 491	
	Yalgoo	3 346.031		53 013 717	
	Yilgarn	15 884.871		251 676 106	
TOTAL GOLD		176 347.000		2 793 999 787	(f)
GYPSUM	Dundas	11 378		79 819	(d),(e)
	Phillips River	5 500		22 000	(e)
	South West	102 353		804 292	(e)
	Yilgarn	27 580		155 079	(e)
TOTAL GYPSUM		146 811		1 061 190	
HEAVY MINERAL SANDS					
Garnet Sand	South West	23 367		1 535 315	(e),(g)

TABLE 5.1 (cont)

Mineral	Mineral-field	Quantity tonnes	Metallic Content	Value ($)	Ref
HEAVY MINERAL SANDS (cont)					
Ilmenite	South West	988 251		86 203 153	
Upgraded Ilmenite	South West	249 265		120 772 694	
Total Ilmenite		1 237 516		206 975 847	(a)
			TiO_2 Tonnes		
Leucoxene	South West	20 839	18 868	11 511 265	(a)
			ThO_2 Units		
Monazite	South West	10 514	68 342	7 831 157	(a)
			TiO_2 Tonnes		
Rutile	South West	76 065	72 304	57 906 645	(a)
			ZrO_2 Tonnes		
Zircon	South West	224 461	146 350	126 677 148	(a)
TOTAL HEAVY MINERAL SANDS				412 437 377	
INDUSTRIAL PEGMATITE MINERALS					
Felspar	Pilbara	21 875		876 115	
	South West	9 899		441 246	
Total Felspar		31 774		1 317 361	
Mica	Pilbara	1 971		105 241	
TOTAL INDUSTRIAL PEGMATITE MINERALS				1 422 602	(h)
IRON ORE			Fe%		
Export Ore	Peak Hill	29 924 260	65.21	763 951 558	
	Pilbara	6 490 680	62.02	146 573 909	
	West Kimberley	2 111 654	64.68	45 366 523	
	West Pilbara	60 552 972	60.27	1 359 771 125	
Total Export Ore		99 079 566		2 315 663 115	
			Fe%		
Domestic Ore	Peak Hill	2 748 872	63.28	68 435 375	
	Pilbara	100 552	63.30	2 616 083	
	West Kimberley	1 566 960	65.37	34 673 069	
	West Pilbara	356 135	57.15	5 423 326	
Total Domestic Ore		4 772 519		111 147 853	
TOTAL IRON ORE		103 852 085		2 426 810 968	(a)

TABLE 5.1 (cont)

Mineral	Mineral-field	Quantity tonnes	Metallic Content	Value ($)	Ref
LIMESAND-LIMESTONE-DOLOMITE					
Dolomite	South West	333		6 660	(e)
Limesand-Limestone	Ashburton	1 828 038		10 500	(d)
	South West	517		8 794	(d)
	West Pilbara	108		17 160	(d)
		1 828 663		10 640 754	
MANGANESE ORE	Pilbara	364 577		57 927 462	(a)
NICKEL INDUSTRY					
			Co Tonnes		
by-product Cobalt	Coolgardie		268.223	4 264 988	(a),(b)
			Pt Kg		
by-product Platinum	Coolgardie		95.827	1 235 806	(a),(b)
			Pd Kg		
by-product Palladium	Coolgardie		434.925	1 185 127	(a),(b)
			Ni%		
Nickel Concentrates	Coolgardie	258 550	10.38	289 919 806	
	East Coolgardie	28 656	12.43	38 505 104	
	East Murchison	151 710	9.93	171 053 840	
	Mt. Margaret	47 309	8.63	43 598 756	
Total Nickel Concentrates		486 225		543 077 506	
Nickel Ore	East Murchison	28 649	4.73	14 892 472	
Total Nickel				557 969 978	(i)
TOTAL NICKEL INDUSTRY				564 655 899	
PEAT	South West	861		58 774	(d)
PETROLEUM		Kilolitres			
Condensate	Carnarvon	1 717 837		333 785 233	(d)
	Perth	1 607		118 704	(a)
Total Condensate		1 719 444		333 903 937	
Crude Oil	Canning	24 623		4 381 319	
	Carnarvon	5 137 136		1 012 324 774	
	Perth	38 990		6 510 322	
Total Crude Oil		5 200 749		1 023 216 415	(a)

TABLE 5.1 (cont) Mineral	Mineral-field	Quantity tonnes	Metallic Content	Value ($)	Ref
PETROLEUM (cont)					
		MMBtu			
L.N.G.	Carnarvon	153 141 420		508 103 078	(a)
		'000 m3			
Natural Gas	Carnarvon	3 443 091		338 009 546	(j)
	Perth	255 752		28 415 506	(d)
Total Natural Gas		3 698 843		366 425 052	
TOTAL PETROLEUM				2 231 648 482	
PIGMENTS					
Red Iron Oxide	Murchison	5 757		110 531	(e)
RARE EARTHS		Ga Kg			
Gallium	South West	31 375		1 025 196	(a)
SALT	Gascoyne	1 659 423		36 763 664	(a)
	Pilbara	1 711 972		31 715 766	(a)
	South West	249		19 920	(a)
	West Pilbara	2 751 867		62 275 238	(e)
TOTAL SALT		6 123 511		130 774 588	
SILICA-SILICA SAND					
Silica	South West	69 021		703 953	(a)
SILICA SAND	Coolgardie	555 624		4 701 629	(a)
	South West	66 933		188 131	(a)
		622 557		4 889 760	
TOTAL SILICA-SILICA SAND				5 593 713	
SILVER		Ag Kg			
by-product	State-wide	25 710.072		4 212 327	
	Peak Hill	8 191.647		1 345 655	(a),(k)
	Pilbara	58.511		12 117	(a),(k)
	Coolgardie	255.671		51 249	(a),(k)
TOTAL SILVER		34 215.901		5 621 348	
TALC	Peak Hill	143 321		10 032 470	
	South West	45 765		4 447 793	
TOTAL TALC		189 086		14 480 263	(e)
TIN-TANTALUM-LITHIUM			LiO_2 Tonnes		
Spodumene	Greenbushes	50 576	2 693	7 525 463	(a)

TABLE 5.1 (cont) Mineral	Mineral-field	Quantity tonnes	Metallic Content	Value ($)	Ref
TIN-TANTALUM-LITHIUM (cont)					
			Ta_2O_5 Tonnes		
Tantalite	Greenbushes	406	107.652	11 594 042	
	Pilbara	168	77.955	7 622 274	
Total Tantalite		574	185.607	19 216 316	(a)
			Sn Tonnes		
Tin	Greenbushes	208	142.790	1 055 539	
	Pilbara	4	2.410	29 640	
Total Tin		212	145.200	1 085 179	(a)
TOTAL TIN-TANTALUM-LITHIUM				27 826 958	
VERMICULITE	Phillips River	43		7 691	(e)
	Total Value of Minerals ($)			6 768 379 846	
	Total Value of Petroleum ($)			**2 231 648 482**	
	Total Value of Gold ($)			**2 793 999 787**	
	Total Value of Production ($)			**11 794 028 115**	

TABLE 6.1

ROYALTY RECEIPTS 1989, 1990

Mineral	1989 $A	1990 $A	Value $A Variance	%up (%down)
BARYTES	0.00	50 330.15	50 330.15	n.ap.
BASE METALS				
Copper	1 927 053.83	1 417 336.71	(509 717.12)	(26)
Lead	38 855.30	383 128.65	344 273.35	886
Zinc	2 222 822.27	2 999 071.13	776 248.86	35
TOTAL BASE METALS	4 188 731.40	4 799 536.49	610 805.09	15
BAUXITE-ALUMINA				
Alumina	28 799 883.39	34 945 117.94	6 145 234.55	21
CLAYS	128 374.64	301 880.00	173 505.36	135
COAL	1 876 931.37	3 387 235.80	1 510 304.43	80
CONSTRUCTION MATERIALS				
Aggregate	54 979.20	28 599.60	(26 379.60)	(48)
Gravel	7 330.25	10 400.10	3 069.85	42
Rock	66 961.27	27 129.54	(39 831.73)	(59)
Sand	242 562.81	190 795.95	(51 766.86)	(21)
TOTAL CONSTRUCTION MATERIALS	371 833.53	256 925.19	(114 908.34)	(31)
DIAMOND	17 415 031.73	31 173 757.05	13 758 725.32	79
DIMENSION STONE	526.91	1 742.35	1 215.44	231
GEM, SEMI-PRECIOUS & ORNAMENTAL STONE	20 289.50	398.32	(19 891.18)	(98)
GOLD	212 373.86	228 455.85	16 081.99	8
GYPSUM	51 389.98	37 399.04	(13 990.94)	(27)
HEAVY MINERAL SANDS				
Garnet	55 357.81	69 852.36	14 494.55	26
Ilmenite	4 190 993.46	4 478 418.56	287 425.10	7
Leucoxene	373 269.98	456 228.22	82 958.24	22
Monazite	424 612.64	465 091.52	40 478.88	10
Rutile	2 628 348.69	2 997 241.13	368 892.44	14
Xenotime	5 292.00	0.00	(5 292.00)	(100)
Zircon	8 891 463.10	6 920 574.96	(1 970 888.14)	(22)
TOTAL HEAVY MINERAL SANDS	16 569 337.68	15 387 406.75	(1 181 930.93)	(7)
INDUSTRIAL PEGMATITE MINERALS				
Felspar	32 135.95	68 862.18	36 726.23	114
Mica	34 116.46	5 262.09	(28 854.37)	(85)
TOTAL INDUSTRIAL PEGMATITE MINERALS	66 252.41	74 124.27	7 871.86	12

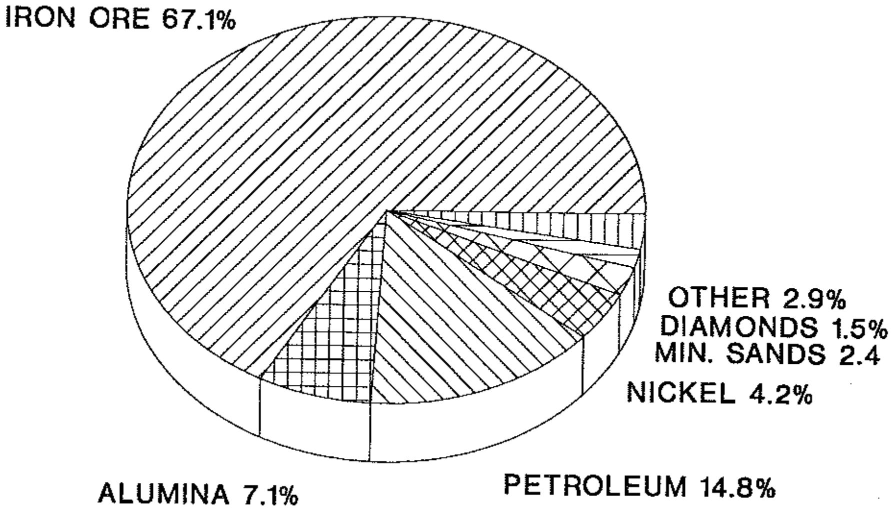
TABLE 6.1 (cont)

ROYALTY RECEIPTS 1989, 1990

Mineral	1989 $A	1990 $A	Value $A Variance	%up (%down)
IRON ORE	102 392 765.15	**111 801 379.55**	9 408 614.40	9
LIMESAND-LIMESTONE-DOLOMITE				
Dolomite	0.00	**99.90**	99.90	n.ap.
Limesand-Limestone	125 440.75	**141 237.31**	15 796.56	13
TOTAL LIMESAND-LIMESTONE-DOLOMITE	125 440.75	**141 337.21**	15 896.46	13
MANGANESE	3 750.00	**322 483.00**	318 733.00	8 500
NICKEL INDUSTRY				
Cobalt by-product	55 703.83	**83 460.64**	27 756.81	50
Nickel	10 694 293.59	**9 909 231.82**	(785 061.77)	(7)
Palladium by-product	21 984.00	**24 544.79**	2 560.79	12
Platinum by-product	21 984.00	**24 900.27**	2 916.27	13
TOTAL NICKEL INDUSTRY	10 793 965.42	**10 042 137.52**	(75 1827.90)	(7)
PEAT	2 687.14	**1 895.50**	(791.64)	(29)
PETROLEUM				
Condensate	1 475 678.98	**2 597 097.79**	1 121 418.81	76
LNG	532 542.97	**3 607 120.05**	3 074 577.08	577
Natural gas	4 020 966.38	**5 668 530.34**	1 647 563.96	41
Oil	19 362 387.57	**73 935 113.50**	54 572 725.93	282
TOTAL PETROLEUM	25 391 575.90	**85 807 861.68**	60 416 285.78	238
PIGMENTS				
Red Iron Oxide	0.00	**5 526.55**	5 526.55	n.ap.
RARE EARTHS				
Gallium	94 811.78	**298 908.43**	204 096.65	215
SALT	1 082 142.76	**1 210 954.37**	128 811.61	12
SILICA SAND	223 771.78	**331 095.86**	107 324.08	48
SILVER	198 373.60	**114 920.49**	(83 453.11)	(42)
TALC	72 098.50	**102 335.00**	30 236.50	42
TIN-TANTALUM-LITHIUM				
Spodumene	348 895.82	**386 386.55**	37 490.73	11
Tantalite	305 152.56	**536 469.92**	231 317.36	76
Tin	65 317.53	**34 488.64**	(30 828.89)	(47)
TOTAL TIN-TANTALUM-LITHIUM	719 365.91	**957 345.11**	237 979.20	33
VERMICULITE	22 185.46	**567.80**	(21 617.66)	(97)
TOTAL ROYALTIES	210 823 890.55	**301 783 057.27**	90 959 166.72	43

COMPARATIVE ROYALTY RECEIPTS

1985 ROYALTY RECEIPTS
TOTAL : $ 140.8 MILLION



1990 ROYALTY RECEIPTS
TOTAL : $ 301.8 MILLION

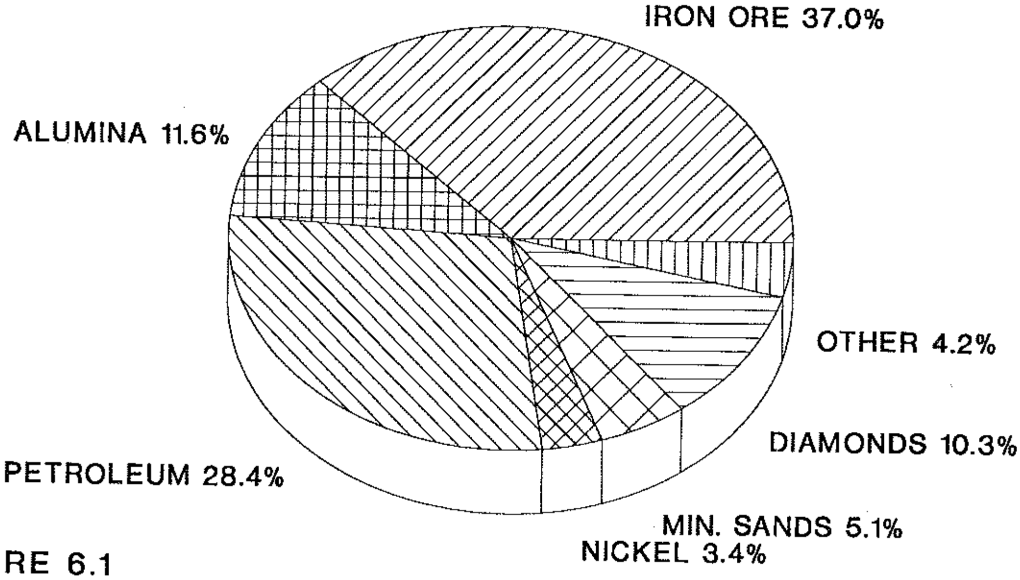


FIGURE 6.1

7.1 Employment In the Minerals and Petroleum Industries

Overall, direct employment in the minerals and petroleum industry grew moderately in 1990. Returns to the Department of Mines from all producing projects show that the number of persons employed grew by 6% during the period.

Most sectors reported small increases in the number of full time employees. As at 31 December 1990 the total stood at 36, 837. Gold mining had the highest absolute increase as production expanded strongly. During 1991 employment in this sector is predicted to contract somewhat as output falls. The commencement of full scale operations at the copper-zinc project at Golden Grove gave a significant boost to regional employment opportunities. The alumina producers increased their workforces by approximately 500 persons overall. Most of the extra jobs were generated by the expansion of Alcoa's Wagerup operation. Petroleum related employment is projected to expand considerably during 1991.

The Scuddles copper-zinc project at Golden Grove, which was commissioned in November 1990, represents a break with the traditional concepts of mine operations. The project managers have, with the support of mine industry unions, introduced a radical scheme that is resulting in the employment and comprehensive training of local people with no background or familiarity with underground mining. This successful multi-skilling of a novice workforce is providing a model for the wider mining industry that may in time encourage more regional development.

1991 could see an easing in minerals and petroleum industry employment growth. Regional and overall state employment will continue, however, to be underwritten directly and indirectly by the mining industry.

TABLE 7.1

NUMBER OF PERSONS EMPLOYED IN THE WESTERN AUSTRALIAN MINERALS & PETROLEUM INDUSTRIES

AS AT DECEMBER 31, 1990

MINERAL Company	LOCATION	1989	1990
BASE METALS			
BHP Minerals Ltd	Cadjebut	173	193
Murchison Zinc Co. Pty Ltd	Golden Grove	76	258
TOTAL BASE METALS		**249**	**451**
BAUXITE - ALUMINA			
Alcoa of Australia Ltd	Del Park-Huntley/Pinjarra	1 782	1 777
	Jarrahdale/Kwinana	1 644	1 643
	Wagerup/Willow Dale	608	969
Worsley Alumina Pty Ltd	Boddington/Worsley	1 026	1 146
TOTAL BAUXITE - ALUMINA		**5 060**	**5 535**
COAL			
Griffin Coal Mining Co. Ltd	Collie	520	563
Western Collieries Ltd	Collie	729	746
TOTAL COAL		**1 249**	**1 309**
DIAMOND			
Argyle Diamond Mines Pty Ltd	Lake Argyle	808	857
Poseidon Ltd	Bow River	96	93
TOTAL DIAMOND		904	**950**
GOLD			
Arimco NL	Gidgee	97	127
Ashton Gold	Cork Tree Well	102	156
Australian Consolidated Minerals Ltd	Golden Crown	80	60
	Westonia	108	49
Australian Mine Management Pty Ltd	Mt Pleasant	119	122
	Racetrack/Royal Standard	41	55
Aztec Mining Co Ltd	Bounty	95	104
Barrack Mine Management	Horseshoe Lights	156	44
	Wiluna	172	174
BHP Minerals Ltd	Gimlet South/Orban JV	173	116
Big Bell Mines Pty Ltd	Big Bell	269	216
Broken Hill Metals NL	Hopes Hill	186	116

TABLE 7.1 (cont)

NUMBER OF PERSONS EMPLOYED IN THE WESTERN AUSTRALIAN MINERALS & PETROLEUM INDUSTRIES AS AT DECEMBER 31, 1990

MINERAL Company	LOCATION	1989	1990
GOLD (cont)			
Central Norseman Gold Corp. NL	Central Norseman	395	217
Consolidated Exploration Ltd	Davyhurst	20	47
	Lady Bountiful	66	67
Coolgardie Gold NL	Greenfield	87	134
Dominion Mining Ltd	Labourchere/Nathans	56	78
	Meekatharra	284	253
	Mt Morgans	120	96
	Tower Hill	94	133
Eastmet Ltd	Youanmi	105	93
Forsayth Pty Ltd	Lawlers	35	62
	Mt Gibson	145	111
Goldfan Ltd	Three Mile Hill	14	120
Hedges Gold Pty Ltd	Hedges	108	121
Hill 50 Gold Mine NL	Mt Magnet	263	325
Kalgoorlie Consolidated Gold Mines Pty Ltd	Kalgoorlie	1 543	1 717
Mawson Pacific Ltd	Yilgarn	247	269
Metana Minerals	Mt Magnet	146	-
	Reedy	123	155
	Rothsay	86	92
Newmont Holdings Pty Ltd	New Celebration	281	408
	Telfer	444	654
Pancontinental Pty Ltd	Kundana	38	79
	Paddington	205	191
Placer Pacific Pty Ltd	Granny Smith	91	171
Poseidon Ltd	Kaltails	140	90
	Karonie	64	53
Ross Atkins Mining	Ingliston	139	118
Sons of Gwalia NL	Sons of Gwalia	116	134
Spargos Mining Pty Ltd	Bellevue	199	234
Sundowner Minerals NL	Darlot	73	121
Western Mining Corporation Ltd	Emu	115	124
	Kambalda	185	294
	Lancefield	112	116
Worsley Alumina Pty Ltd	Boddington	330	641

TABLE 7.1 (cont)

NUMBER OF PERSONS EMPLOYED IN THE WESTERN AUSTRALIAN MINERALS & PETROLEUM INDUSTRIES

AS AT DECEMBER 31, 1990

MINERAL Company	LOCATION	1989	1990
GOLD (cont)			
ALL OTHER OPERATORS		2 247	2 383
TOTAL GOLD		**10 314**	**10 930**
HEAVY MINERAL SANDS			
Allied Eneabba Pty Ltd	Eneabba	142	447
Associated Minerals Consolidated Ltd	Capel	192	180
	Eneabba/Narngulu	556	260
Australia Operations Ltd	Rockingham Ceramics Plant	-	20
Cable Sands Pty Ltd	Capel	208	226
ISK Minerals Pty Ltd	Picton	70	57
Target Minerals NL	Port Gregory/Narngulu	15	14
TiWest Pty Ltd	Cataby/Chandala	79	241
Westralian Sands Ltd	Capel	466	453
TOTAL HEAVY MINERAL SANDS		**1 728**	**1 898**
IRON ORE			
BHP Minerals Ltd	Yampi	410	402
Goldsworthy Mining Ltd	Pilbara/Port Hedland	881	948
Hamersley Iron Pty Ltd	Tom Price - Paraburdoo/Dampier/Channar	3 054	3 207
Hancock Mining Ltd	McCamey's	41	31
Mt Newman Mining Co. Ltd	Newman/Port Hedland	3 619	3 636
Robe River Mining Co. Pty Ltd	Pannawonica/Cape Lambert	940	959
TOTAL IRON ORE		**8 945**	**9 183**
NICKEL			
Western Mining Corporation Ltd	Kalgoorlie	394	384
	Blair/Kambalda	1 806	1 680
	Kwinana Refinery	321	265
	Leinster	478	559
	Mt Windarra	405	337
All Other Operators		-	37
TOTAL NICKEL		3 404	3 262

TABLE 7.1 (cont)

NUMBER OF PERSONS EMPLOYED IN THE WESTERN AUSTRALIAN MINERALS & PETROLEUM INDUSTRIES

AS AT DECEMBER 31, 1990

MINERAL Company	LOCATION	1989	1990
PETROLEUM PRODUCTS			
Barrack Energy Ltd	Mt Horner	3	3
Consolidated Gas Pty ltd	Woodada	6	6
Hadson Energy Pty Ltd	Harriet/Rosette	82	102
Marathon Petroleum Australia Ltd	Talisman	4	4
Oil Company of Australia NL	West Kora	4	4
Petroleum Securities Energy Ltd	Blina/Sundown/Lloyd	2	2
West Australian Petroleum Pty Ltd	Dongara	8	8
	North West Area	205	206
Western Mining Corporation Ltd	North Herald/South Pepper/Chervil	32	105
Woodside Offshore Petroleum Pty Ltd	North Rankin A/Burrup Peninsula	1 392	1 485
TOTAL PETROLEUM PRODUCTS		**1 738**	**1 925**
SALT			
Dampier Salt Ltd	Dampier	189	192
	Lake MacLeod	111	116
Leslie Salt Co.	Port Hedland	110	120
Shark Bay Salt JV	Useless Loop	90	66
TOTAL SALT		**500**	**494**
ALL OTHER MATERIALS			
(including Rock Quarries)		863	820
TOTAL		**34 954**	**36 837**

(SOURCE: AXTAT REPORTING SYSTEM, MINING ENGINEERING DIVISION)

8.1 PRINCIPAL MINERAL PRODUCERS 1990, 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.

Newmont Australia Ltd, Level 18 AMP Tower, 535 Bourke St, Melbourne Victoria 3000, (03) 629 5191: 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.

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

Attapulgite

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

Bristile 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 MINERAL PRODUCERS 1990, Head office postal address, telephone number:minesite.

COAL

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

Western Colleries 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

Ametek 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 MINERAL PRODUCERS 1990, 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.

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

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

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

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

Barrack Mine Management, 183 Great Eastern Hwy, Belmont 6104, (09) 479 9799: Horseshoe Lights, Wiluna.

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.

Carr Boyd Minerals Ltd, 24 Outram St West Perth 6005,(09) 481 3466: Harbour Lights, Mertondale.

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.

Clogau (Australia) Ltd, Cnr Throssell and Forrests Sts Kalgoorlie 6430, (090) 21 1766: Callion.

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.

Forsayth 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 Cons. Gold Mines Pty Ltd, Boulder Block Rd, Boulder 6432, (090) 93 1000: Kalgoorlie/Boulder.

Mawson Pacific Ltd, 11 Ventnor Ave, West Perth 6005, (09) 321 8778: Edwards Find, Marvel Loch, Transvaal.

Metana Minerals, 191 Great Eastern Hwy, Belmont 6104, (09) 277 9944: Mt Magnet, Reedy, Rothsay, Youanmi.

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

Newmont Holdings Pty Ltd, 535 Bourke St, Melbourne 3000, (03) 62 5191: 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.

8.1 PRINCIPAL MINERAL PRODUCERS 1990, Head office postal address, telephone number:minesite.

GOLD (cont)

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

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

Ross Atkins Mining c\- PO Meekatharra 6642, (099) 81 1064: Paddy's Flat.

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

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

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: Nevoria.

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.

Hillerman W, Wandel N, Sime K & A, PO Box 165, Esperance 6450: Esperance.

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 Armstromg 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 MINERAL PRODUCERS 1990, Head office postal address, telephone number:minesite.

IRON ORE

BHP Minerals Ltd, 200 St George's Tce, Perth 6000, (09) 320 4444: Koolan Island.

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

Goldsworthy Mining Ltd, 197 St George's Tce, Perth 6000, (09) 322 1788: Shay Gap.

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: McCameys.

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 - DOLOMITE

Dolomite

Green K & P, PO Box 31, Newdegate 6355, (098)71 1547: Lake Magenta.

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 Armstromg 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.

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

Barrack Energy Ltd, 30 Ord St, West Perth 6005, (09) 320 1777: 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

8.1 PRINCIPAL MINERAL PRODUCERS 1990, Head office postal address, telephone number:minesite.

PETROLEUM (cont)

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 Whelk Place, Mullaloo 6025, (09) 307 1345: Blina, Lloyd, Sundown/West Terrace.

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: Harald/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.

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 Bailla Rd, Canning Vale 6155, (09) 455 1111: Lake Gnangara.

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 MINERAL PRODUCERS 1990, Head office postal address, telephone number:minesite.

TIN - TANTALUM - LITHIUM

Spodumena

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.