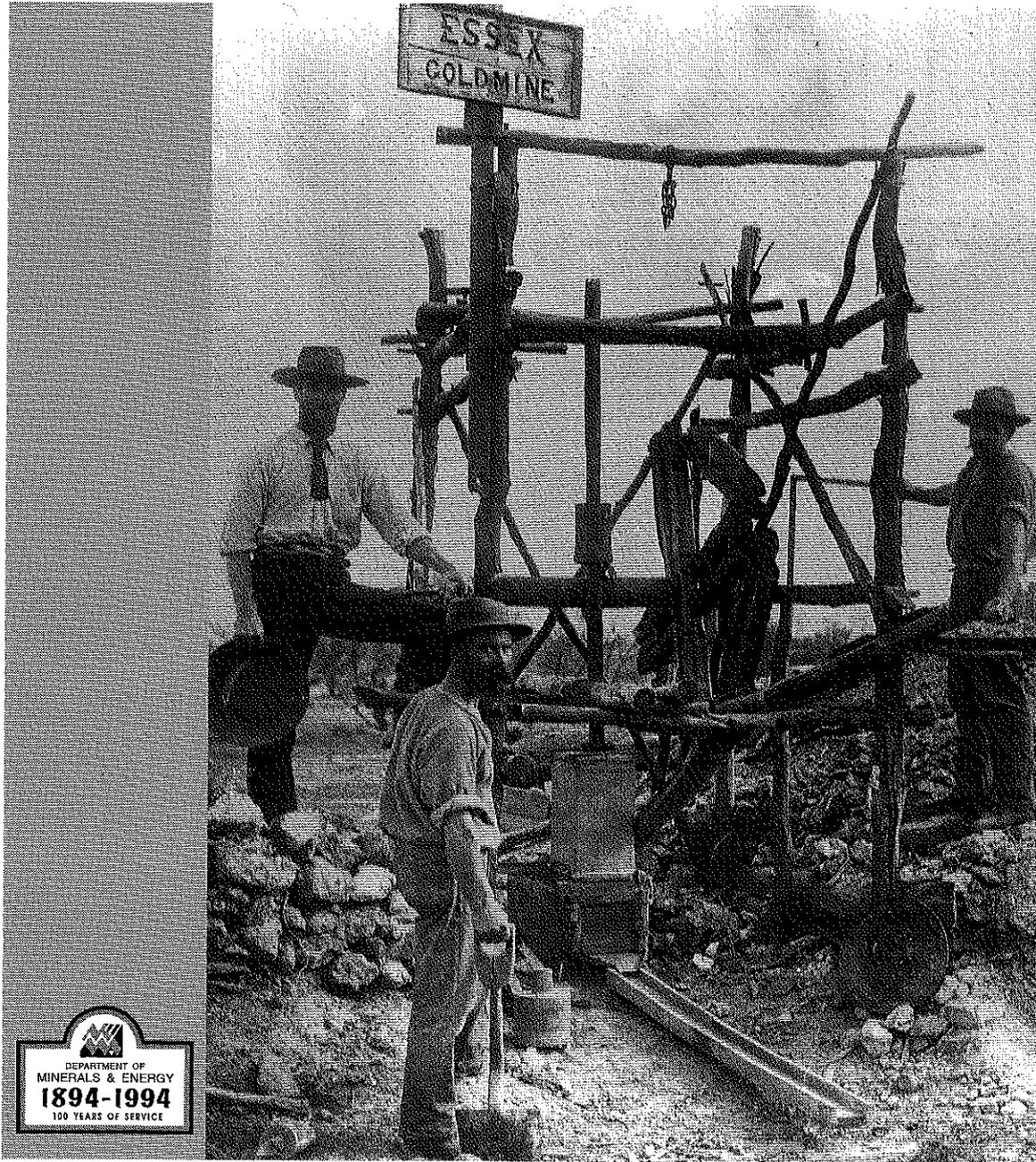


1993

MINERAL AND PETROLEUM PRODUCTION

STATISTICS DIGEST

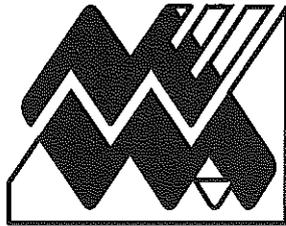
Resource Centre
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Dept. of Minerals & Energy



Royalties, Economic Policy and Public Affairs Division

DEPARTMENT OF MINERALS AND ENERGY

WESTERN AUSTRALIA



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MINERALS AND ENERGY
WESTERN AUSTRALIA

DIGEST OF MINERAL AND PETROLEUM STATISTICS

1993

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

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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 GoldCorp.
- (g) Estimated f.o.t value.
- (h) Estimated f.o.r value.
- (i) Estimated f.o.b value based on the current price of nickel containing products.
- (j) Delivered value.
- (k) Metallic by-product of copper mining.

UNITS AND CONVERSION FACTORS

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

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

North West Shelf Gas
 1 TCF = 1082 petajoules
 1 Mt = 54 petajoules

1 OVERVIEW

1.1 Review of the World Economy

It is estimated that during 1993 the global economy grew by 2.3%. Although the economy of the USA kept pace with growth of over 2.5%, that of Japan contracted by 0.3% and that of Western Europe contracted by 1.3%. The industrial sector of the US economy however grew by less than 2%, while that of Japan remained stagnant and that of Germany, the key economy of Western Europe, declined by over 5%. While predictions for 1994 include a turn-round in the pivotal economies of Japan and Western Europe, the general picture is one of slow growth in the major manufacturing economies, accompanied by structural adjustments. Predictions offer little hope of flow-on effects to the West Australian economy during 1994, although the outlook for 1995 is considerably brighter.

The United States' economy grew slowly during the first and second quarters of 1993, and by mid-year had already restored historical rates of employment and capacity utilisation. However the pace of growth increased in the third and fourth quarters. Continued growth has so far been achieved with relatively low inflation and a strong level of capital investment. The strong capital spending suggests that growth is likely to be sustained through the next year. This has been achieved without direct federal intervention, although a fiscal stimulus is likely if the pace of growth slows.

The North America Free Trade Association (NAFTA) was established and ratified during the last half of 1993. This has weakened the forces of protectionism and may help to sustain economic growth, at least in the short term. Trade with Mexico has increased substantially over the last two years, and the Agreement will encourage and facilitate that trade. The

Canadian economy, which is still in a two year recession, is likely to be strongly stimulated by tariff reductions, with reciprocal benefits to the US economy.

The stated aim of the Administration to control the huge public debt will be the focus of American economic policy over the next year. Associated reductions in public spending, especially spending on military and high-technology projects, as well as the determination of the Federal Reserve Bank to control inflation are already having deflationary effects, and likely to restrain growth. Present forecasts for the current year are that the economy of the USA will grow by about 3%.

The serious decline in the Japanese economy continued throughout 1993. Financial institutions have been severely affected by depreciating asset values, especially in commercial real estate. This has contributed to unsettled financial markets, while the privatising of the National Railway and the reweighting of the Nikkei Index provided additional and powerful instability. The Japanese Government tried to stimulate the economy in the first half of the year, but much of the liquidity available was absorbed in underpinning stock values and the measures were unsuccessful.

The election during the year of a factionalised and potentially unstable parliament has reduced the political priority placed on controlling the economy. The government appears to have exhausted its cohesion in passing measures of electoral reform, and although a new major package of stimulatory measures has been passed, its immediate effect on the economy is uncertain. Many of the measures are designed further to underpin land and stock values, and these are unlikely to promote productive growth. The standard consumer spending stimulus proposed is a reduction in levels of income tax. This is likely to be less effective than usual in raising consumer confidence while high domestic debt

levels and the continued erosion of values of household investment assets dominate the attitude of consumers. The reductions are in any case to be balanced by impending increases in consumer taxes, and may not result in the substantial increase in consumer spending they were designed to create. The direct effects on economic activity may therefore be diluted or delayed.

The forecast for growth in the Japanese economy for 1994 is 1.3%. This represents a substantial turn-round from 1993, and a lower figure may be more realistic.

The economies of the major countries of Western Europe continued to experience recession during the year. The German economy, recently the strongest in Europe, continues to be adversely affected by several persistent problems. It continues to maintain high interest rates and a strong exchange rate, at the expense of the international competitiveness of its manufacturing sector. It has undertaken the cost of supporting currencies in the European Exchange Rate Mechanism (ERM), and has to cope with the burden of substantial financial assistance to the Commonwealth of Independent States (CIS). It had significant exposure to the Council for Mutual Economic Assistance (COMECON) economies, most of which are now in severe depression. The economic burden of integrating the five eastern states, whose markets in Eastern Europe have shrunk considerably, into the national economy has also been much heavier and more extended than anticipated. Unemployment is high, by German standards, and has risen over the year. However employment in the eastern states is now rising and there are grounds for believing that the worst effects of unification are now receding.

The recession has placed pressure on heavy industry all over Germany. Substantial capacity in metals production and fabrication has closed or is making severe losses. Much

of this capacity is now expected to be abandoned, refitted or rationalised. The loss of production capacity will reduce the ability of industry to resume employment as demand improves, and recovery from recession may therefore be slower than anticipated.

The combination of these pressures has resulted in a contraction of activity in the German economy estimated at over 2% during 1993, and the prospects for a dramatic turnaround in 1994 are not good. The predicted growth rate of 0.8% may also be hard to achieve.

Economic conditions in Europe generally are also still weak. High unemployment is now a feature of most of the European economies. The conditions negotiated for economic union require member governments to keep inflation low and to reduce public sector deficits. These conditions constrain almost all Governments to some extent, and limit their ability to apply stimulatory measures, most of which are inflationary or deficit-driven. As well, several countries, notably Italy, intend to substantially reduce public sector ownership as one means of reducing their public deficits. Such measures are certain to be a further source of unemployment, inflating the costs of social security provisions. Structural adjustments, especially in heavy engineering, are likely to be another recessionary feature of many European economies during the year. Present forecasts are that the overall economy of the European Economic Community (EEC) will grow by 1.3% in 1994.

The extensive negotiations to liberalise trade under the General Agreement on Tariffs and Trade (GATT) reached a settlement during the last months of the year. Agreements limiting tariffs on, and Government subsidies to, agricultural production were of particular relevance to Australia. The degree of liberalisation was only partial, to be phased in over a 5 year period, and will still leave substantial market barriers. There will be long-

term benefits to the Australian rural sector, but little change in 1994. Other agreements should promote trade and economic growth in other areas, especially in financial services, but the effect on the world economy in 1994 will be limited. Again, prospects are brighter for 1995.

The CIS continues to be a constraint on regional economies. Fresh elections have deepened the political and economic impasse which delayed economic reform throughout 1993. Popular commitment to a market economy is partial and poorly informed, and the social and economic costs have been underestimated. The economic assistance provided to date by Western countries has been lost in the inflationary spiral of the rouble, and further economic assistance is unlikely in the short term. In fact, Western activity is now focussing on supporting the economies of some of the smaller republics which have shown stronger and more disciplined economic management. A direct consequence of the weak currency and stalled economy is that commodity producers are constrained to sell large volumes of primary commodities on Western markets. This has depressed the price of several commodities, particularly nickel and aluminium, which are of particular significance to the economy of Western Australia.

In contrast to the main industrialised nations, economic growth in the rest of East and North Asia was solid. Growth for the area for 1994 is expected to be about 6%, the lowest for several years. Several economies are continuing to expand production of basic engineering materials, and the demand for particular mineral and energy products remains strong. Australian producers, although well placed to benefit from expansion in these markets, face intense competition, and Asian regional growth will not be enough to offset weakness in the main established commodity markets.

These assessments suggest that the worst of

the recent economic downturn is over, and that medium term prospects are brighter than for some time. However the timing of recovery, especially as it affects the mineral sector, is less certain, and general prospects for 1994 are still subdued.

1.2 Review of the Australian Economy

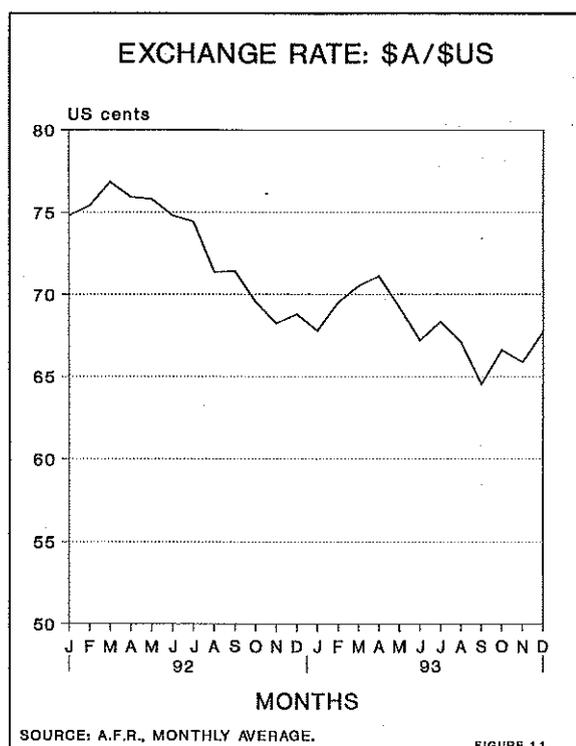
The national economy continued to show signs of recovery, strengthening through the year. The Commonwealth Government has been successful in maintaining the low rates of inflation achieved since 1991, and despite a surge in imports the rate for 1993 was 1.8%. Predictions for 1994 are for a small import-driven rise in inflation to a manageable level of about 3%.

Interest rates have also fallen to the lowest levels for 30 years although they remain higher than in most major economies. Predictions for 1994 are for interest rates to remain consistently low, without a need to increase rates as a means of curbing inflation. Although capital raising for new business has been tight, a strategic shift toward more equity raising and less direct borrowing by business may serve to dampen real interest rates. A sustained increase in the exchange rate can be expected to counter pressure for interest rate increases, and might even lead to further small decreases.

The Commonwealth Government continues to run a large budget deficit, and the balance of trade has also returned to deficit. As a result net foreign debt grew to over \$180 000 million during 1993. Lower interest rates will make management of this debt slightly easier in the short term, but a significant increase in exports during the next few years is required to produce a more permanent solution to the problems of public indebtedness.

The combination of increased debt and low interest rates has further reduced the value of the currency compared with that of most of the

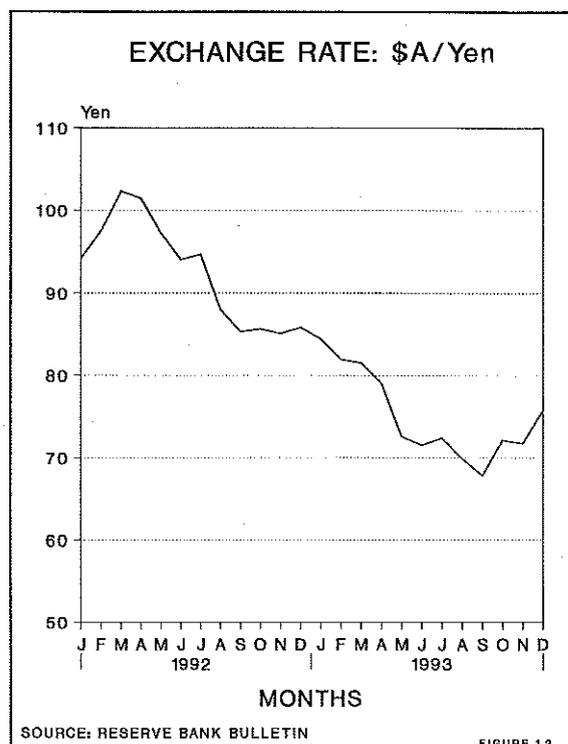
world's major economies. The exchange rate against the \$US is shown in Figure 1.1, with the long-term downward trend well in evidence. The overall decline in the exchange rate over the year was restricted to 2% by a strong resurgence of the exchange rate toward the end of 1993, mirrored by a significant rise in the exchange rate against the Yen, shown in Figure 1.2. Although the downward trend is still strong, a further rise in the currency might signal a change in the pattern to at least a more stable position.



Low prevailing commodity prices have contributed to the weakness of the currency. Expectations of increases in some commodity prices are believed to be driving the recent rate increases. Although progress has been made toward restoring a supply-demand balance for some commodities, the chances for general price rises for 1994 may not be enough to perpetuate the rate adjustment, and the future of the currency is therefore uncertain.

While most of the indicators of Australia's economic recovery were positive, the rate of growth continued to be slower than predicted. Business investment has been at a low level for several years, and declined further during

the year. A tight fiscal environment and continued weak consumer confidence ensured that unemployment remained high. There was some improvement in the employment market toward the end of the year, but although employment has risen, the unemployment rate has not fallen appreciably. It is likely that improvements in employment will be balanced by the reemergence of unregistered unemployed to the market. Changes to industrial relations laws have allowed employers to negotiate new agreements based on greater productivity, and this has helped slow employment growth. A decline in unemployment can be expected over 1994, but the rate should remain high. The present forecast by the Commonwealth Government predicts the persistence of rates of unemployment at about 10%.



The Commonwealth Government is also forecasting economic growth of about 4% for 1994, continuing into 1995. Although corporate profits are high enough to provide investment capital, the substantial investment spending required to maintain these high forecast growth rates is not yet apparent. The divestment of public corporations scheduled for 1994 is likely further to reduce the amount of

new equity capital available to Australian producers, compromising prospects for sustained economic growth, especially in the manufacturing sector. The outlook for mineral and petroleum producers is for another year of low prices and low but slowly rising demand for many commodities.

1.3 Economic Factors Affecting the Mineral Industry

Because many export contracts are written in US dollars, the exchange rate between the Australian and US currencies is one of the single most significant economic determinants affecting the Australian mineral industry. The \$A has been in a long-term downward trend against the \$US (Figure 1.1). Recent increases in the value of the \$A to nearly 72 cents US suggest that this trend has been broken. However the increase has been based on the expectation of a stronger economy driven by higher commodity prices; any faltering in the economy may see the downward trend renewed. Meanwhile a steady or rising \$A is an additional handicap for mineral producers still grappling with depressed markets and low prices.

Recent negotiations with Japanese buyers of major mineral commodities have seen continued and substantial erosion of revenue. Iron ore prices have fallen for the third successive year. In previous years producer income has been cushioned by compensating falls in the exchange rate, which this year are less likely to occur.

Demand in many Western economies, especially for basic raw materials, remains low. The extent and duration of the economic slowdown continued to be underestimated. Concerted attempts to deal with problems of oversupply only appeared late in the year. Producer country organisations have now reached agreements on limiting production of both raw and processed materials for several metal commodities, including tin (which

reached its lowest value in 30 years) and aluminium, as well as oil. The recent aluminium agreement is designed to cope with the continuing high level of exports from the CIS and includes economic assistance to CIS producers. The Organisation of Petroleum Exporting Countries (OPEC) has again been unable to control production enough to manipulate prices, and there is some doubt that the aluminium agreement will be effective. Even if it is, the reduced level of production is still higher than present demand, and the agreement is at best a palliative measure.

On the other hand continued low prices in the lead, zinc and nickel sectors has resulted in appreciable rationalisation in production at an operational level. Lead and Zinc prices have stabilised and are now expected to react rapidly to increased demand. Nickel prices remain weak, affected by continued exports from the CIS. Although the economic and political factors which drive nickel exports from the CIS now seem intractable, production is expected to fall rather as the result of low levels of capital investment than of direct closures. Nickel prices are unlikely to fall further despite the high level of metal in inventory. Significant rationalisation in other mineral sectors of significance to Western Australia has not occurred despite strong economic pressures.

In the context of low prices, activity in the area of micro economic reform is of particular benefit to industry. The pace of enterprise bargaining accelerated toward the end of the year. Several major mineral companies have negotiated agreements which include "multi-skilling" allied to the end of demarcation disputes, extended work shifts of up to 12 hours associated with fewer working days, the simplification of rosters with the abandonment of some penalty rate structures, and increasing use of contract staff. These agreements should also improve Australian industry's poor industrial relations image and in the long run

increase Australia's appeal as a reliable supplier of raw materials.

Some producers in the south of the State are benefiting from the deregulation of rail transport services and cuts in energy charges to industrial consumers. The proposed Pilbara-Kalgoorlie gas pipeline project, to be undertaken in the context of reforming energy production and distribution, will also benefit many producers in the North and east of the State. Further initiatives resulting from the Carnegie report are likely to benefit the mineral sector in the near future, and are eagerly awaited by industry.

The minerals industry in Australia has continued to see significant changes in ownership and disbursements of assets. The tendency of companies to curtail activities and divest what are no longer seen as core assets has continued. The process of rationalisation, especially in the gold industry, has continued through the year and further changes can be expected.

Stagnation in our major markets will limit significant expansion in the minerals industry during 1994, and the present period of austerity is expected to continue. Although most sectors of production in Western Australia will still be able to market production, sales will remain at the prevailing depressed prices. Unlike previous years there is less likelihood of a fall in the currency to provide relief for producers. Any further fall in prices is likely to damage many producers. However there are indications that in general commodity prices have bottomed, and producers who can survive through 1994 have better prospects for the coming year.

1.4 Social And Political Factors Affecting The Mineral Industry

In 1993 substantial political activity worldwide was directed at reducing barriers to international trade. NAFTA was established by

the USA, Mexico and Canada, the Uruguay Round of the GATT negotiations achieved some measure of success, the USA and Japan continued to negotiate to the huge imbalance of trade, and the European Community negotiated with other European states to reduce trade barriers. Australian diplomatic effort was directed at the GATT talks, and at establishing the Asia Pacific Economic Community (APEC) forum in an attempt to formalise and promote trade with the fast-growing economies of eastern Asia. The rationale for closer economic ties with those countries is strong, and progress in formalising APEC is of immediate interest to the mineral and petroleum sectors.

Recent sweeping political changes have also liberalised and opened the economies of many countries which were previously heavily state controlled. These countries now provide opportunities for exploration and investment for resource companies in WA as well as a potential market for mineral commodities. The changes also provide opportunities for WA companies to export technical know-how and expertise, an area which has the capability to provide increasing opportunities for initiative over the next few years.

In the CIS these changes have resulted in political and institutional impasse which continues to influence conditions in the mineral sector in WA. State control of industry has deteriorated, so that producers of some mineral commodities have elected to transfer to Western markets significant percentages of their production which would normally be consumed internally. Aluminium producing countries have concluded agreements to limit this trade, but with little confidence that the CIS can or will compel producers to comply. Nickel production, particularly affected by the decline in consumption by the military, is also heavily directed overseas, and has contributed strongly to the significant increase in inventories over the year. A speedy resolution to political fragmentation in the CIS, and a

return to some form of economic stability there, would greatly benefit the local producers of several vulnerable commodities.

State and Commonwealth government cooperation has resulted in considerable progress during the year on uniform gas pipeline legislation, aimed at promoting more open marketing of natural gas, especially from new discoveries. The major concerns are that the agreements, often legislative, which established the pipelines, may now act to control and limit access to markets by potential competitors. Consensus is being pursued through comprehensive negotiations. The State Government has announced its support for similar legislation, and "common carrier" provisions for the state-controlled gas pipelines in WA have been proposed.

A change in State Government has catalysed a reappraisal of community attitudes toward the balance between conservation and development. While providing for proper environmental safeguards, significant areas of the State have been made available for mineral and petroleum exploration. For further progress in this area, continued sound environmental practices and a strong public relations effort by mineral and petroleum exploration companies is seen as essential.

Community and Company attitudes to exploration in WA are crucial to the health of the industry. Community confidence in some commodities made 1993 an active year in speculative equity raising and exploration activity. However, despite the high degree of prospectivity in the State's mineral and petroleum provinces, and the liberalising of some environmental constraints, increasing exploration effort by WA companies was directed overseas during the year. The expansion of opportunities in some overseas areas has been a strong motivator, although the fear of sovereign risk within WA has been used to explain several decisions. Further exploration effort may be directed within WA as the industry slowly returns to a position of

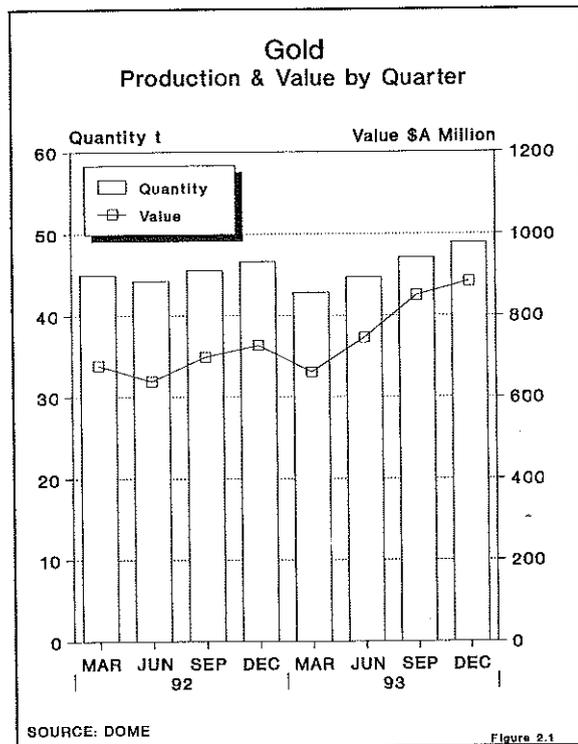
greater profitability.

2 REVIEW OF MAJOR MINERALS AND PETROLEUM

2.1 Gold

Gold regained the position of the State's most valuable resource commodity it last held in 1990. This is also the first time that the value of production of any commodity has exceeded \$3 000 million in any one year.

The total amount of gold produced in WA reach a new record (Figure 2.1). The quantity sold increased to 183 tonnes in 1993 from 181 tonnes in 1992, a rise of 1%. Unlike previous years, only one major new mine - the first stage of the Kanowna Belle operation - came on stream during the year. The increased production is mainly attributable to the expansion and optimisation of existing operations.

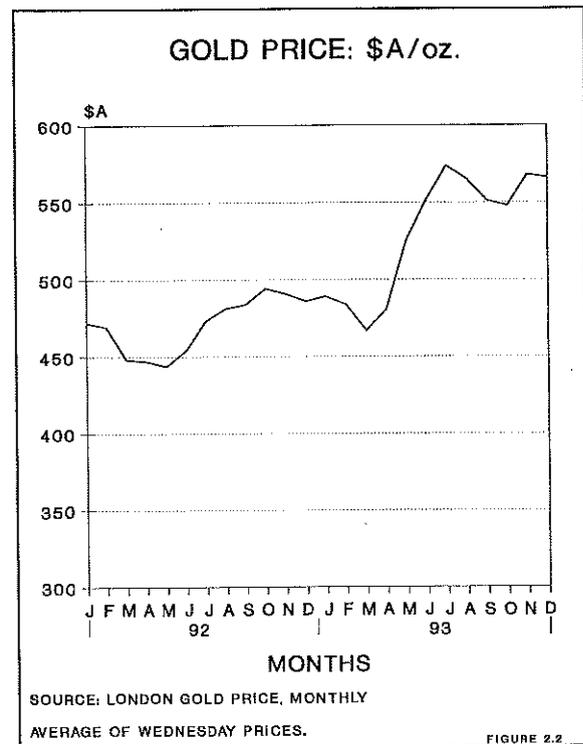


The traded value of gold mining stocks began a period of rapid growth at the end of the previous year. The increase provided a fillip both to explorers and to existing producers. It facilitated capital raising for exploration, and as a result exploration activity in Western

Australia was the highest for several years. It also assisted producers to invest in plant expansion and modification.

The \$80 million first stage of the major Kanowna Belle mine was brought on stream by September 1993. The \$130 million second and third stages should come into production during 1994. The major Bronzewing project may also reach production by the end of the year. While exploration in new areas was relatively subdued, there was extensive activity in proving up reserves for existing operations. As a result many companies announced expansions or extended mine lives.

The value of production continued to grow (Figure 2.1). Receipts increased to \$3 140 million in 1993 from \$2 739 million in 1992, a rise of 11%. Prices were much more volatile during 1993 than for the previous two years (Figure 2.2).



After several years of slowly declining prices which saw the price fall to \$US320 (per fine ounce) at the start of the year, the market price rose sharply to a peak of \$US420 which occurred at the start of the third quarter. Prices then slumped rapidly to under \$US350,

but by the end of the year had recovered through a series of rapid fluctuations to US\$390.

World demand for gold has outstripped mine production for several years. The total amount of physical gold traded in the first half of the year rose again by about 10%. South East and North Asia were again regions of particularly strong demand growth for gold. Demand increased for both 22 carat jewellery and in the hoarding of small gold bars. However the peak price pattern appears characteristic of over-reaction by traders to temporary market imbalances, and not a response to the fundamental imbalance between the rate of production of gold from primary sources and the much higher and rapidly increasing consumption of gold, especially for jewellery.

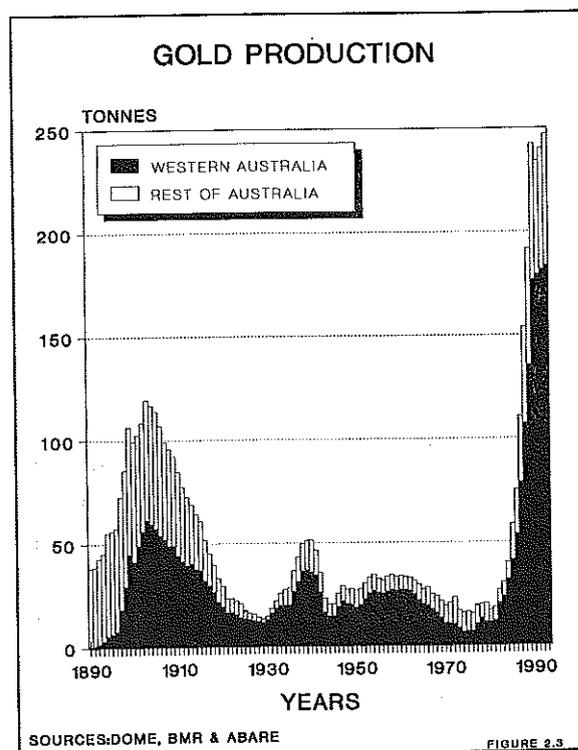
In the second half of the year there was a noticeable decline in demand from these markets. In part, this was due to uncertainty, the market behaving in a volatile fashion as traders reacted more forcefully than usual to economic and political developments. Weakness in demand was emphasised at prices approaching US\$390. This suggests that the supply/demand balance may be reaching a short term equilibrium, and that the market may become more stable at prices in the vicinity of US\$390.

Rationalisation of production units continued through the year. Significant ownership came on the market as companies continued to divest non-core assets as part of restructuring processes usually motivated by economic recession. As well, the industry continues a pattern of consolidating smaller or diverse operations into larger and more self-sustaining economic units. This is typified by an increase in the number of producers who control output of over 100 000 ounces a year.

Also typical for the year was the continued development of underground operations. At

year end, 10 new underground mines were in development, including the Bellevue and Mt McClure operations.

While gold production in WA may have peaked for the time being, WA is still the source of the majority of gold produced in Australia (Figure 2.3), with 183 out of a national figure of 248 tonnes. This position of dominance may decline slowly over the next few years with some expansion in gold provinces in the Eastern States predicted.

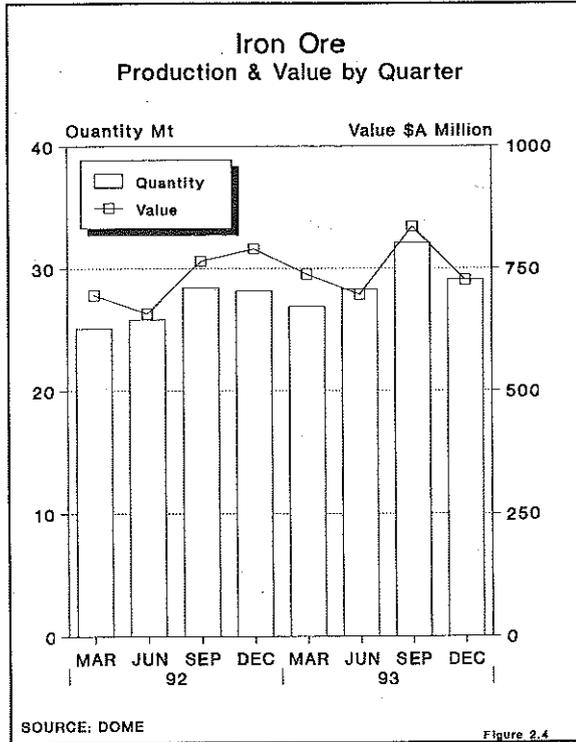


2.2 Iron Ore

The total amount of iron ore produced in WA was also the highest on record (Figure 2.4). The quantity sold increased to 116 million tonnes in 1993 from 108 million tonnes in 1992, a rise of 7%. Most operations exceeded the high production levels of the year before.

Notable was the contribution made by recently developed mines. Production from the Goldsworthy area is now sustained by the new Yarrie mine. BHP's Yandi/Marillana Creek operation reached its initial production target of 5 million tonnes. Increasing tonnages are also

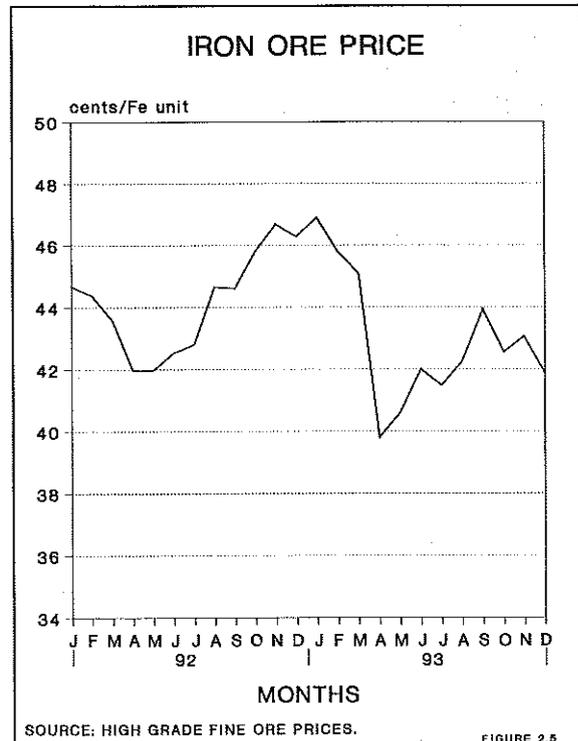
derived from the Brockman No 2, and McCamey's deposits.



Producers are steadily expanding the State's output capacity, pursuing a strategy of maintaining output to counteract the likelihood of further erosion of contract sales prices. Much of the investment has been in new capacity to provide new ores which could be blended with ores from, and extend the mine life of, the existing large higher grade deposits. The completion of Hamersley Iron's \$300 million Marandoo project later in 1994, will provide ore to complement production from Mount Tom Price. The \$200 million loading facility upgrade at Port Hedland will also be completed during 1994.

The year also saw the advance of plans to obtain further value from sites where production has ceased. A project which will reopen the now closed Koolyanobbing mines, beneficiate waste ore from the Cockatoo Island operation, and market a combined product to China's Anshan Steelworks, was finalised during the year. Production at the rate of 2 million tonnes a year of combined product is expected to begin in the second half of 1994.

The value of production continued to grow (Figure 2.4). Receipts increased from \$2 922 million in 1992 to \$2 997 million in 1993, a rise of 3%. Price changes (Figure 2.5) were dominated by the decision of producers to accept a second successive reduction in contract prices at the beginning of the year. For the rest of the year, the price paid to producers rose slightly as the currency declined in value against the \$US.



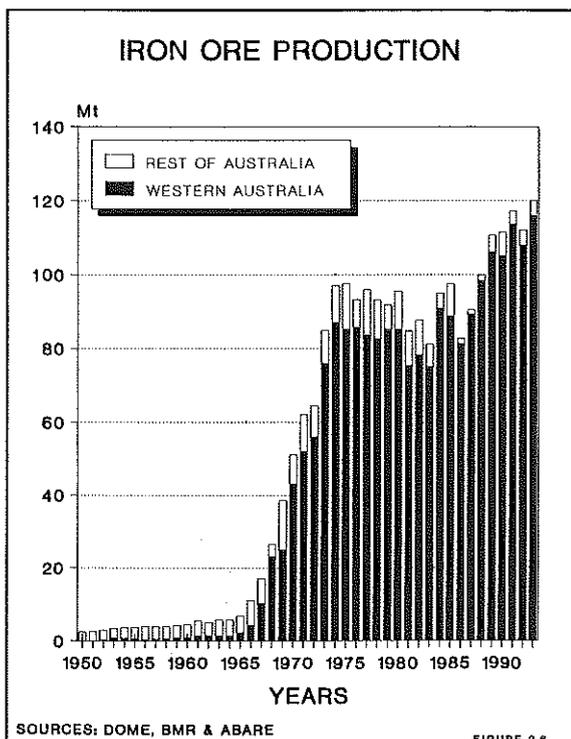
World steel production remained subdued. Output from western Europe fell, and in Japan rose only slightly from the relatively low levels of the previous year. Neither market is expected to expand during 1994. However continued significant expansion is expected in China, Korea and Taiwan, with the area expected to consume about 10 million tonnes of ore more than in 1993.

China's steel industry again expanded strongly, driven by a 10% economic growth rate, while South Korea and Taiwan continued to increase steel producing capacity by about 7%. Demand for iron ore from the east Asian area is expected to increase further in the medium term, and producers are expected to benefit from steady levels of growth,

cushioning the severe contraction which is developing in European markets. Total exports from Western Australia should be in the region of 115 million tonnes in 1994.

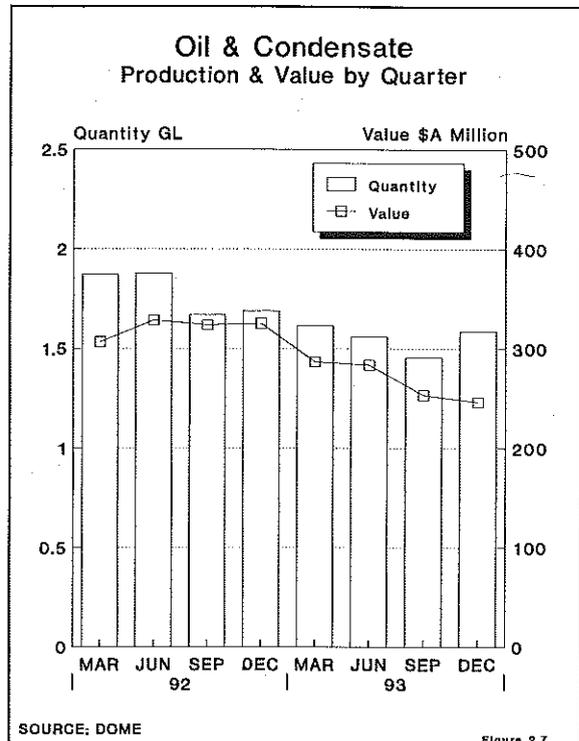
The year was also characterised by news of technical innovation. The \$200 million Hismelt research and development facility at Kwinana was commissioned in September 1993, and may operate for up to 18 months. Hismelt is one of a number of processes designed to produce iron directly from ore and coal, with economic advantages over the large scale and elaborate blast furnace process. Of these the COREX process, which has been in full scale development in South Africa for several years, achieved its first customer during the year when POSCO of South Korea announced a new 600 000 tonne facility using COREX technology. The adoption of new processes, especially in east and south east Asia, will result in a wider and more diverse market for Western Australian iron ore.

As well as continuing to expand production, Western Australia continues to be the only major iron ore producer and exporter in Australia (Figure 2.6). This position of dominance is unlikely to be challenged.



2.3 Petroleum

The energy value of petroleum products produced in WA continued to increase (Figure 2.7). The volume of oil and condensate sold decreased to 6.2 ML in 1193 from 7.1 ML in 1992, a fall of 13%. The volume of natural gas and LNG sold increased to the equivalent of 13 500 million cubic metres in 1993 from 11 200 million cubic metres in 1992, a rise of 16 %.



Oil production was lower as a result of the closure of the Talisman field, and slightly lower production from the Harriet and Saladin fields. However development of projects involving expenditure of over \$1 500 million on new offshore fields and plant upgrades progressed steadily during the year. The Wandoo project came on stream in the last quarter. Development continued on the Griffin field, scheduled to begin production early in 1994, and on the Roller/Skate field which is to begin production in the second half of 1994. Work also began on developing the Cossack/Wanaea field, due to begin production in 1995.

Production of LNG from the North West Shelf gas project reached the target capacity of 6.5

million tonnes a year as the third LNG train was completed at the beginning of the year. One of the earlier liquefaction units was retrofitted in the last quarter to increase capacity by a further 0.5 million tonnes, and the other unit will be refitted at the end of 1994. Output should therefore increase slightly in both 1994 and 1995. The North West Shelf project participants have begun to evaluate the possibility of installing two further trains some time in the future.

Natural gas production increased slightly, mainly from the North Rankin field. Production from the Goodwyn field was delayed while the main piles supporting the Goodwyn A offshore production platform, which were damaged during the initial installation, were repaired. The platform should become operational in mid 1994. Production of gas is expected to increase over the next few years as industrial consumption increases. More extensive use for electricity generation was foreshadowed at the end of the year.

Despite the increase in volumes, the value of production fell (Figure 2.7). Receipts decreased to \$2 490 million in 1993 from \$2 619 million in 1992, a fall of 5%. The fall was mainly due to decreased revenue from crude oil sales. Crude oil receipts contracted 17% to \$709 million, reflecting both lower production and lower average sale price. LNG receipts rose by only 3% to approximately \$1000 million, despite the rise in volume as the result of the commissioning of the third compression train. The benchmark price of oil on world markets continued to fall during the year. For the first three quarters this was offset by the continued weakness of the \$A (Figure 2.8), but in the last quarter the price plummeted in a weak and oversupplied market.

While weak final demand worldwide was the major constraint on oil sales, the market was disturbed by unauthorised increases in supply from some OPEC producers. The

Organisation called several meetings through the year in an attempt to reimpose quotas on output, but was not successful. The market also reacted adversely to moves in the UN to free the restrictions on Iraqi oil production, now timed for late in 1994.

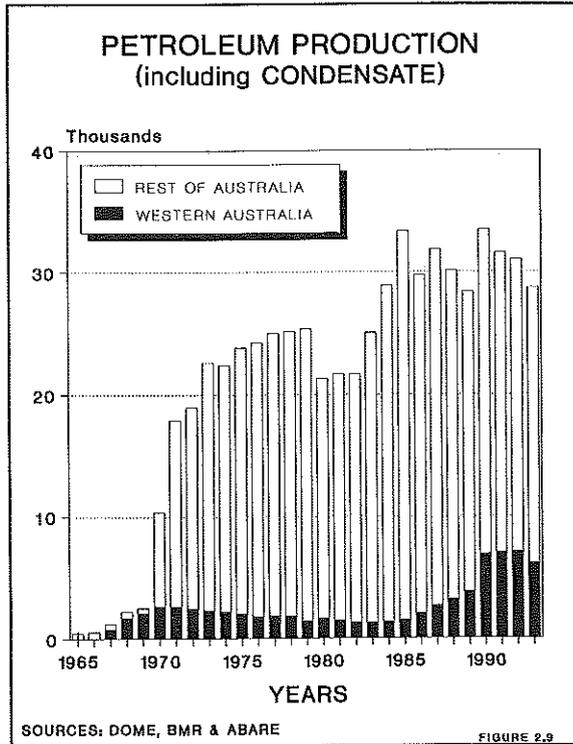


Demand is expected to grow more strongly in 1994. Most demand will come from the expanding economies of east and north Asia and Latin America, but some increase can be expected from all developed countries except Japan. were recorded by most Organisation of Economic Co-operation & Development (OECD) countries. A slight strengthening of world prices can be expected during the year. Further stronger price gains are predicted for the next two or three years.

The medium and long term outlook for the local industry is for a steady increase in investment and output. In this context, likely price rises will benefit local producers. However there is little likelihood that prices will rise to levels that would sustain production from some of the high-risk, high-cost fields which have been awaiting development for some time.

Output from Western Australia for the year

also fell as a percentage of total Australian production (Figure 2.9). The projects under development are expected to reverse the momentary decline, and to increase the state's production from 20% to 30% of national production over the next five years.



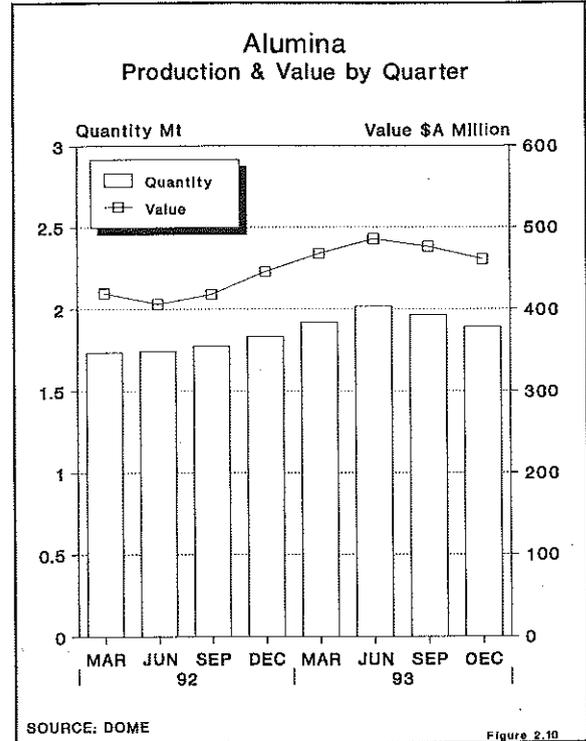
2.4 Alumina

The total amount of alumina produced in WA increased for the eighth year in a row. (Figure 2.10). The quantity sold increased to 7.8 tonnes in 1993 from 7.1 million tonnes in 1992, a rise of 10%. Producers continued efforts to maintain high levels of production to minimise unit costs. The increased production represents full production from expanded capacity at the Wagerup operation.

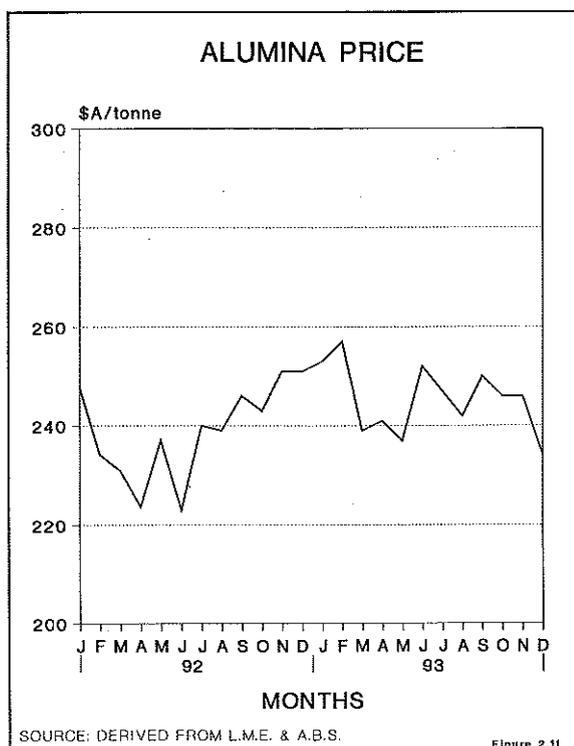
Additional investment to improve the performance of the new capacity at Wagerup is expected to be complete by the end of the third quarter of 1994. Small productivity gains can be expected through the year, but no further new capacity can be expected in the near future.

The value of production continued to grow (Figure 2.10). Receipts increased to \$1 892

million in 1993 from \$1 690 million in 1992, a rise of 12%. World prices continued to fall during the year, but the fall was matched by the fall in the \$A, so that prices to local producers remained at about A\$240 per tonne (Figure 2.11), the level of the low price which existed at the end of the previous year.



Despite several years of overproduction, increasing stock inventories - which rose to a level approaching 2.5 million tonnes by the end of the year - stagnant demand and falling prices, primary aluminium producers have been slow to implement plant closures and rationalisations. Continued high levels of exports from the CIS triggered import quotas imposed by the European Union in August after strong representations from European smelters. Similar action was foreshadowed by American producers as metal was diverted onto American and Japanese markets. The threat of further political intervention in the market mechanism resulted in a serious run on the market price at the end of the year, and prompted discussions between producer countries which were to lead to a multilateral Memorandum of Understanding by which producers agreed to close 1.6 million tonnes of annual production, at least for the short term.

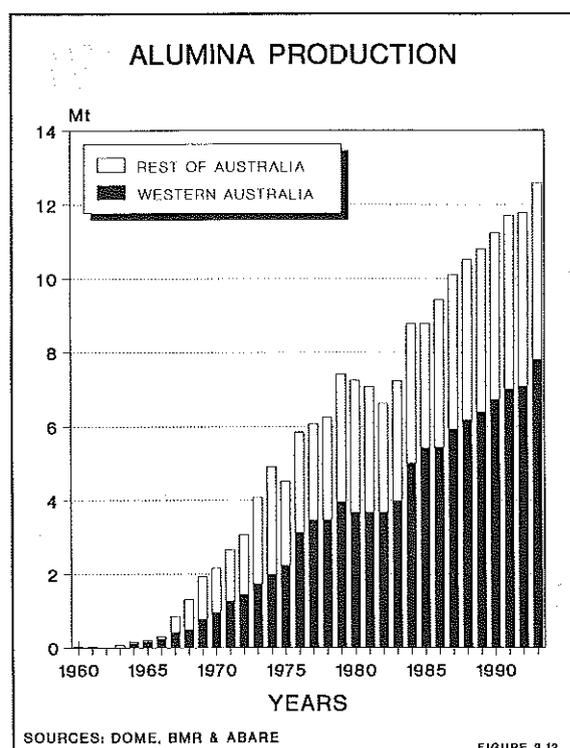


Western producers have completed most of these closures, but this may include some of the 500 000 tonnes of capacity already planned for closure in America in response to continued high operating costs. Meanwhile demand from the manufacturing sectors in America and parts of Western Europe is expected to grow strongly during 1994, leading to a reduction in stock inventories. As with most of the other metals, only a broad based economic recovery can provide the boost in demand necessary to reduce stockpiles and absorb current supply capacity. However there is little evidence so far that CIS production has been effectively curtailed, and continued high levels of exports may keep markets oversupplied, and prices low.

The year also saw other moves which may lead to industry restructuring in the near term. Suppliers of electricity, which is a major component of operating costs, have implemented or foreshadowed price increases. Producers on the American pacific seaboard had their prices increased in December 1993. Planned increases in Tasmania were instrumental in the decision by Comalco to close the Bell Bay smelter, part of which has already been closed under the Memorandum.

The Victorian Government is also negotiating with the Portland smelter to implement price increases. While these moves will not redress the problem of oversupply in the short term, they may enable the market to move closer to a supply balance as demand improves over the current year. Aluminium prices, now at a 6 year low, are likely to experience a partial recovery during the year.

The alumina sector in Western Australian has been producing for over 30 years, and is a mature industry. Recent expansions at the two southern refineries, together with continuing programs to increase efficiency, will ensure the State industry's position as a world class low cost producer through the 1990s, and will maintain the position of the State as Australia's major producer (Figure 2.12). However further expansion in production is now unlikely.



2.5 Diamonds

The total amount of diamonds produced in WA remained constrained by purchasing limits imposed by the Central Selling Organisation (CSO). The quantity sold decreased to 23 million carats in 1993 from 41 million carats in 1992, a fall of 44%. Except for the highest

quality stones, world demand remains severely depressed. The limits on purchases imposed by the CSO, which markets most of WA production, were altered to 80% of production early in the year, and later in the year to 85%.

The fall in sales also reflects the change in grade of the dominant Argyle operation as mining occurs at increasingly deeper levels. To compensate for grades which decline as the mine deepens, the Argyle operation is completing a \$100 million expansion of its hard rock treatment plant which will increase capacity from 6 million to 8.5 million tonnes, and will increase diamond production by 5 million carats to around 40 million carats a year. The company is continuing its marketing focus on coloured gems, and is especially promoting yellow and brown diamonds as well as the rare deep pink stones which typify the Argyle pipe. The relatively small Bow River operation had another solid year but has reserves to last only until 1995.

The year also saw the first sales from the pilot plant operation at the Mt Elizabeth project's Aries pipe, which is to continue through treatment of a substantial sample of the pipe rock. The prospect is significantly different from present production by containing a high percentage of quality stones. There is a high level of activity among diamond explorers in Western Australia with several programs going ahead mainly in the Kimberley, both on and off shore.

The value of production also fell, but less drastically. Receipts decreased to \$487 million in 1993 from \$565 million in 1992, a fall of 11%. The CSO changed their price structure early in 1993 to increase the price per carat of better quality stones, and reduce the price per carat of lower quality and industrial stones. Returns to WA producers reflect the increasing contribution of the value of quality stones to total revenue.

The world market for gem quality diamonds

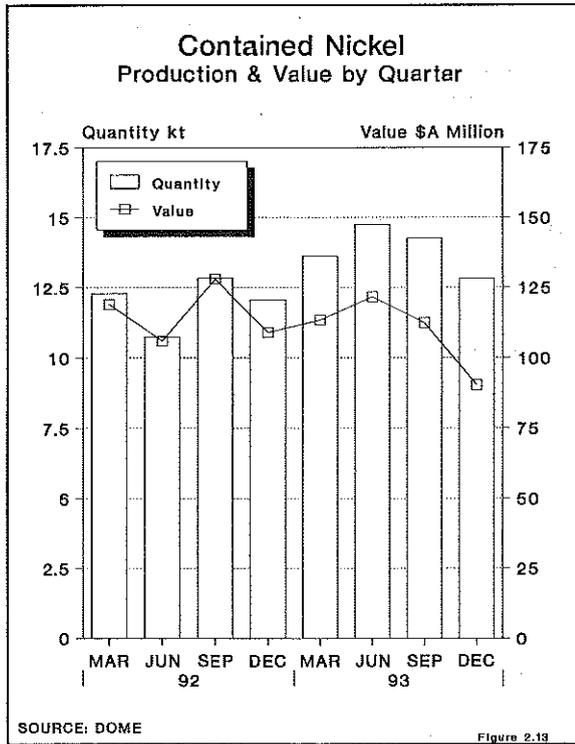
improved during the year. Demand in Europe has been weak, but the major North America market grew by 7%, and demand from Japan other Asian countries was strong. However world supply is believed to exceed current demand by about 20%, and inventories held by both the CSO and merchants, as well as producers, continue to increase. The marketing agreements between the CSO and producing cooperatives within the CIS. are holding, strongly backed by central and Federal governments which themselves hold significant stocks of quality goods. The CSO suggests that the market is now stable, and forecast a steady improvement during 94 with the resurgence of economic activity in most consuming areas. In the longer term, the size of the CSO stockpile is likely to limit price growth for several years.

The market for poorer quality and industrial stones is very weak. Although the CSO has established agreements with the Governments of Angola and Zaïre covering production from those countries, aimed at controlling and policing contraband export of diamonds from those countries, illicit production remains rampant, and is believed to exceed official production. Unauthorised production from most of the smaller African producer countries is also substantial. The CSO has been compelled to buy as much as possible of the illicit trade as it reaches the market to preserve market stability. Without a rapid increase in demand the market for lower value grades is expected to remain weak for at least the next two years. This will put further pressure on the ability of the CSO to maintain orderly marketing and sustain price levels for lower value grades.

Western Australia remains the only producer State, although there is an increased exploration effort in other States, especially NSW and the northern Territory.

2.6 Nickel

The total tonnage of contained nickel produced in WA rose significantly (Figure 2.13). The quantity sold increased to 55 000 tonnes in 1993 from 48 000 tonnes in 1992, a rise of 15%. Rationalisation of production in response to low world prices and increasing trade inventories which characterised production the previous year was essentially complete, and small gains were made in throughput at the Kambalda operations. The Forrestania operation also came on stream during the year.

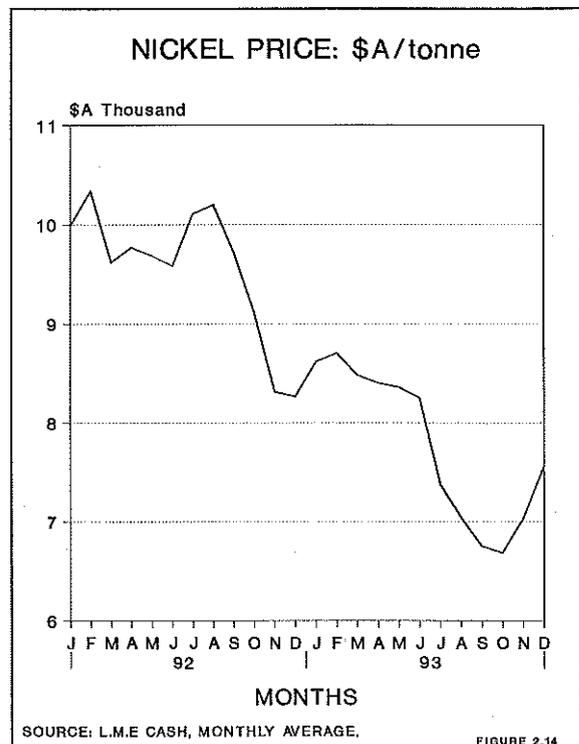


The year saw completion of expansions and improvements to the nickel smelter at Kambalda from 50 000 to 65 000 tonnes of yearly capacity, and expansion of the refinery at Kwinana from 28 000 to 42 000 tonnes of yearly capacity. Concentrate production capacity is being increased at both the Leinster and Kambalda operations to provide feed for the extra smelter capacity. The expanded facilities are expected to make WA one of the world's lowest cost producers, as well as to increase output significantly in the 1994 year. Construction on the \$450 million Mt. Keith project is proceeding, and the project is now

expected to become operational late in 1994. Output from the project will increase local production by about 50%. Half of this is to be exported in concentrate form, and half used to feed the expanded smelter capacity at Kambalda.

After substantial exploration, the Honeymoon Well project has reached the feasibility study stage. Sufficient reserves have been outlined for a large scale low-grade mining operation.

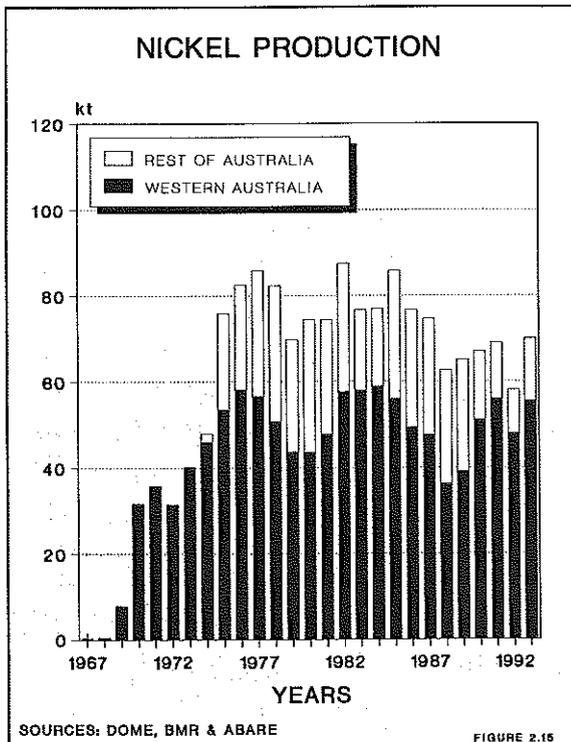
The value of production continued to fall (Figure 2.14). Receipts decreased to \$438 million in 1993 from \$460 million in 1992, a fall of 11%. Prices fell sharply during the second and third quarters of the year, but rose slightly during the last quarter to about \$7.50 per kilogram (Figure 2.14).



Throughout the world, despite some closures producers have continued to maintain capacity well in excess of current demand. The London Metals Exchange inventory increased by over 56 000 tonnes during the year - more than the entire rate of production from Western Australia. Some producers, especially those in the CIS, are still driven by a national requirement for foreign earnings in hard

currencies. Production in the CIS is expected to decline slowly as several mines require major investment to remain competitive. However the supply imbalance is now more likely to be rectified by increased demand than by further industry rationalisation.

Price gains toward the end of the year were driven by a continued high level of production of stainless steel, and the perception that while inventories were filling up with low-grade metal, high-grade metal was in increasing demand. Stainless steel consumption is customarily one of the earliest sectors to expand as economic growth enters a recovery phase, so continued high demand for stainless steel is cause for optimism. The North American market is particularly buoyant. Some price gains can be expected for 1994, but these will be limited without a more substantial decrease in the high level of inventories.

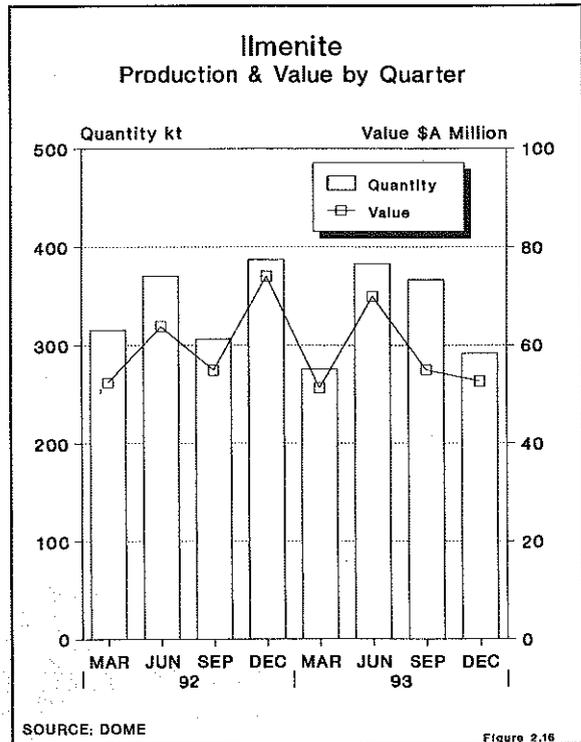


While production from Western Australia is expected to continue to increase over the next few years, other Australian production is severely affected by low commodity prices and largely dependent on imported raw materials. Even if the capacity remains operational,

expansions in WA will result in the State increasing substantially its share of total national export tonnages (now standing at nearly 80%) over the next few years (Figure 2.15).

2.7 Heavy Mineral Sands

The total tonnage of heavy mineral sands produced in WA was maintained at a high level (Figure 2.16). The quantity sold decreased to 1.9 million tonnes in 1993 from a record of nearly 2 million tonnes in 1992, a fall of 2%. Production of rutile and synthetic rutile decreased substantially, production of ilmenite, leucoxene and monazite remained steady, while there was a substantial increase in zircon production, mainly from the Cooljarloo operation.

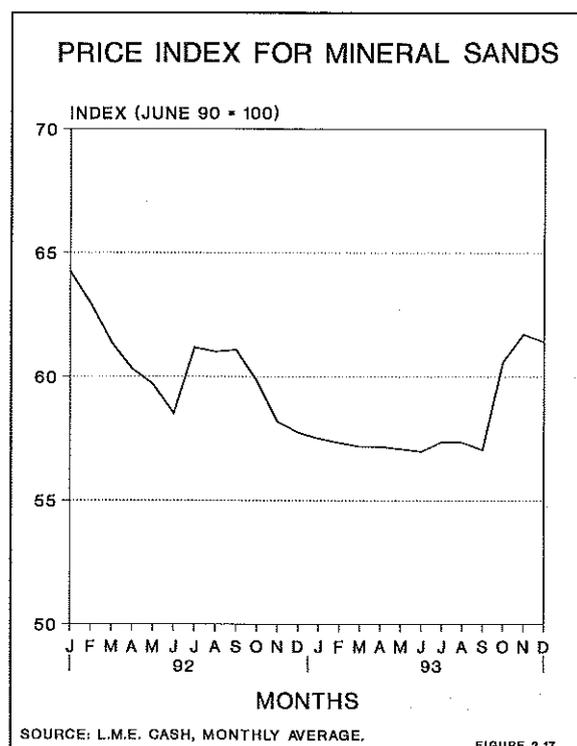


Sustained price erosion continued to have a profound effect on production decisions. Production of Synthetic Rutile (SR) from the Chandala operation was halted in September because of the accumulation of unsold product. Most of the recent development projects are also on hold, including the large Beenup project near the south west coast, and the proposed expansion of SR capacity at

Capel. Construction is, however, progressing at the Jangardup project which is expected to begin producing in late 1994. Output of zircon, rutile, synthetic rutile and ilmenite from current facilities should remain at the present high levels during 1994.

The value of production continued to decline. Receipts decreased to \$317 million in 1993 from \$346 million in 1992, a fall of 8% (Figure 2.16). In \$A terms, prices for most products remained at historically low levels through the first three quarters of the year, unrelieved by movements in the exchange rate.

The world heavy mineral sands industry experienced another year of weak product demand and historically low prices (Figure 2.17), but there was rapid improvement during the last quarter.



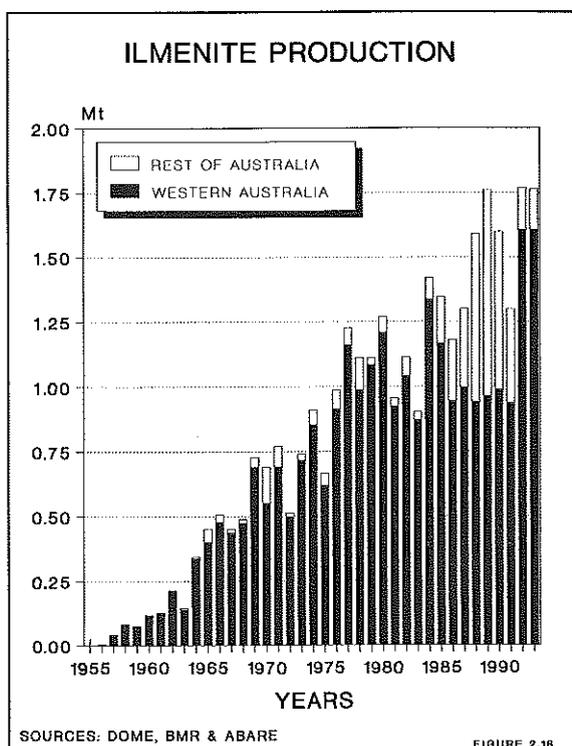
The year saw a gradual firming in the important titanium pigment market, with producers in the USA, and later in Europe, lodging welcome price increases. In keeping with its better economic performance, demand in the USA appeared to strengthen consistently. A significant part of the rise in the Mineral Sand Price Index (Figure 2.17) was a rise in the

synthetic rutile price, indicating that the pigment market appears to have recovered more rapidly than expected, and demand for pigment feedstock is likely to grow in the current year.

Recovery in the pigment market has so far been due to delay in bringing new efficient capacity on stream, rather than by closures of high cost production capacity. As yet, economic recovery has not been sufficient to create substantially increased demand, and prices may remain around present levels for the current year. The new capacity available is more than sufficient to supply any increase in demand expected during 1994. Even when pigment capacity becomes better utilised, it is likely that feedstock may still be in oversupply, especially as the major Namakwa (South Africa) project is scheduled to begin production at the end of 1994. Long term improvement in ilmenite and SR prices are therefore likely to be modest.

The market for zircon also rebounded strongly at the end of the year after trading at prices below the sustainable cost of production. The stronger market has been created by demand from new producers of ceramic products in the expanding Chinese economy. The prospect for further substantial gains in prices is limited by the potential of mineral sands producers rapidly to restore higher levels of production, and foreshadowed new capacity. However any indication that the zircon market may return to some form of stability will benefit local producers.

Action taken by the industry to overcome low world prices, including upgrading of existing plant and infrastructure, plus planned expansions, will ensure Western Australia's position as a major global titanium minerals producing region. Western Australia will continue to produce the bulk of the national output of heavy mineral sands (Figure 2.18).



2.8 Summary and Outlook

The total value of minerals and petroleum produced in the State was marginally higher than the previous year at \$12 434 million. Most commodity prices continued to fall. The long-term fall in the value of the \$A slowed during the year, and as a result was less effective in cushioning the effect of lower prices. Producers of most commodities experienced a hard year.

The causes of the low prices remained the same. The recession in economic activity, especially in the world's major manufacturing countries, was more extensive than many of the more optimistic forecasts had suggested. In fact recession deepened in the German economy, and remained well entrenched in the economy of Japan and many countries in Western Europe. Producers, especially high-cost producers, were over-slow to adjust output levels, and the supply of many minerals has exceeded demand for several years. The ensuing oversupply of several mineral commodities was magnified by the political and economic crisis in the CIS which resulted in a significant percentage of world production

being diverted from internal consumption to international markets.

Most sectors in Western Australia adjusted rapidly to the period of low demand and low prices for mineral commodities. These adjustments have made most sectors particularly competitive on an open world market. As a result producers in WA are generally well placed to profit from better market conditions. Markets for few commodities can be expected to recover significantly during 1994. However some recovery is expected this year, and stronger recovery, with real gains in prices, is predicted for 1995.

With economic recovery in sight, further closures of production capacity are now less likely. Increasing profitability therefore now depends on a resurgence in demand. Signs of economic recovery in the US are strong, including high levels of capital expenditure, and firm markets for commodities which presage growth such as stainless steel. There is still no real evidence for an immediate return to economic growth in the world's other major economies. However the situation is now unlikely to worsen, and slow improvements in commodities markets are predicted for 1994, accelerating in 1995.

Gold was the only sector where demand exceeded supply. Producers benefited from increased prices as the market struggled toward a new price equilibrium which would decrease demand while liberating supply from private and public inventories.

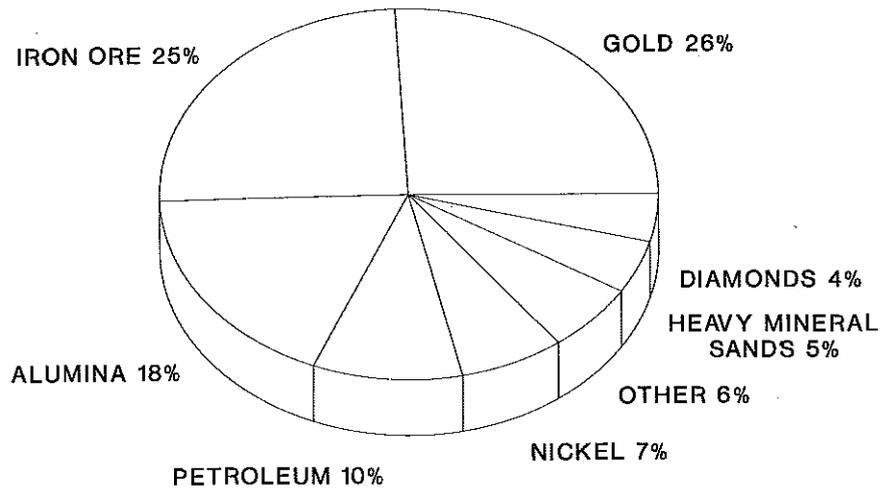
Western Australian producers of iron ore, alumina, nickel and heavy mineral sands have all responded to low prices by reducing unit costs through expanding output to maintain competitiveness. Producers in all sectors are now among the world's lowest cost operators. Improvements in workplace productivity have assisted this process. The outlook for these

commodities is for a slight improvement during the year.

Producers of other major commodities have been less able to react operationally to depressed markets. The petroleum sector was particularly depressed during the year as attempts to curtail OPEC production failed. However exploration and development activity has continued strongly, and further increases in production can be expected in the future.

Despite a strongly supported movement within the GATT process to liberate world trade, the year also saw several developments in mechanisms of production and price control. The OPEC cartel was unusually unsuccessful in controlling the petroleum market, while the CSO showed strong control of the diamond business. Aluminium producers and iron ore and coal consumers were also active in trying to control market prices. Australian producers generally are expected to profit most in open and deregulated international markets.

COMPARATIVE VALUE OF PRODUCTION
1988 VALUE OF PRODUCTION
TOTAL : \$7,132 MILLION



1993 VALUE OF PRODUCTION
TOTAL : \$12,434 MILLION

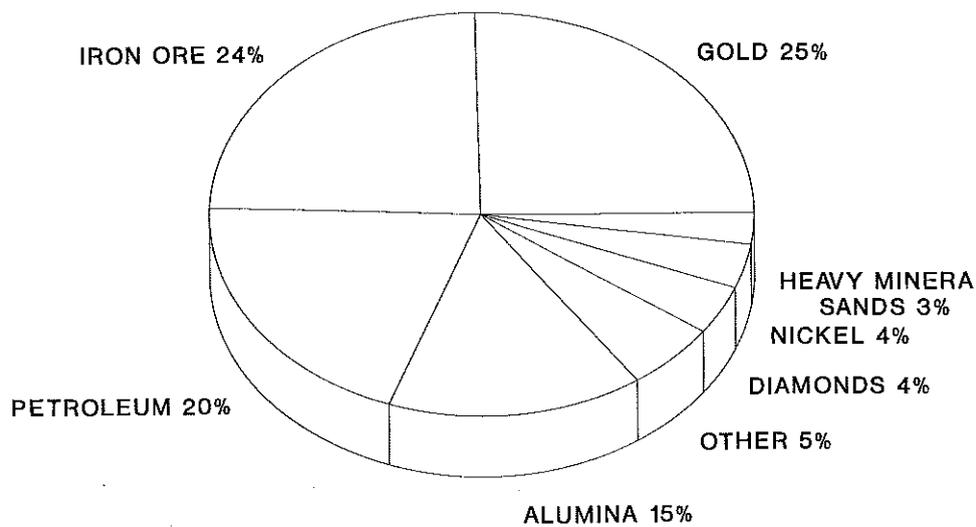


Figure 2.19

TABLE 3.1 QUANTITY AND VALUE OF MINERALS AND PETROLEUM 1992, 1993

MINERAL	UNIT	1992		1993	
		QUANTITY	VALUE(\$)	QUANTITY	VALUE(\$)
BASE METALS					
Copper Metal	t	12,093	18,677,215	22,347	25,552,162
Lead Metal	t	20,964	7,429,363	32,275	7,835,561
Zinc Metal	t	141,385	132,984,006	141,095	87,020,276
TOTAL BASE METALS			159,090,584		120,407,999
BAUXITE-ALUMINA					
Alumina	t	7,082,757	1,689,720,803	7,801,274	1,891,855,796
CLAYS					
Attapulgit	t	20,697	6,315,851	20,632	6,099,237
Cement Clay	t	6,970	74,168	0	0
Fire Clay	t	6,508	7,810	43,813	52,576
Kaolin	t	2,692	172,726	3,611	248,699
White Clay	t	22,575	225,745	22,984	249,946
TOTAL CLAYS			6,796,300		6650,458
COAL	t	5,655,459	251,762,799	5,452,875	247,611,413
CONSTRUCTION MATERIALS					
Aggregate	t	148,082	888,292	259,859	1,435,187
Gravel	t	121,884	605,423	79,338	393,168
Rock	t	140,597	428,656	94,634	927,877
Sand	t	1,025,359 (r)	5,201,858 (r)	2,443,888	10,258,211
TOTAL CONSTRUCTION MATERIALS			7,134,229 (r)		13,014,443
DIAMOND	ct	41,453,238	565,061,845	22,649,491	486,770,824
DIATOMITE	t	169	1,300	445	5,171
DIMENSION STONE					
Black Granite	t	5,358 (r)	1,757,075 (r)	2,034	559,171
Quartz Rock,	t	974	43,791	390	17,538
Spongolite	t	254	16,832	0	0
TOTAL DIMENSION STONE			1,817,698 (r)		576,709
GEM, SEMI-PRECIOUS & ORNAMENTAL STONE					
Agate	kg	10,260	11,286	41,360	27,467
Amethyst	kg	17,659	127,910	25,352	308,045
Chalcedony	kg	0	0	36,775	28,137
Chrysoprase	kg	37,048	1,163,695	27,344	795,872
Jasper	kg	8,844	7,499	70,819	45,116
Malachite	kg	0	0	2,245	8,392

TABLE 3.1 (cont)		1992		1993	
MINERAL	UNIT	QUANTITY	VALUE(\$)	QUANTITY	VALUE(\$)
GEM, SEMI-PRECIOUS & ORNAMENTAL STONE (cont)					
Tourmaline	kg	81	15,713	7	1,425
Variscite	kg	1,143	6,680	720	870
TOTAL, GEM, SEMI-PRECIOUS & ORNAMENTAL STONE			1,332,783		1,215,324
GOLD	kg	182,087 (r)	2,751,378,792 (r)	183,487 (e)	3,139,858,203 (e)
GYPSUM	t	102,105 (r)	1,008,920 (r)	145,205	1,329,400
HEAVY MINERAL SANDS					
Garnet	t	38,140	3,611,274	48,202	4,582,615
Ilmenite	t	1,044,856	87,296,010	1,008,377	85,398,002
Upgraded Ilmenite (e)	t	334,480	157,877,255	308,601	143,534,559
Leucoxene	t	11,463	5,204,073	12,689	4,860,531
Monazite	t	5,012	1,452,698	6,654	1,914,960
Rutile	t	68,964	39,051,843	56,596	29,974,170
Zircon	t	265,166	51,456,028	299,761	46,256,774
TOTAL HEAVY MINERAL SANDS			345,949,181		316,511,611
INDUSTRIAL PEGMATITE MINERALS					
Felspar	t	25,800	1,132,516	18,748	694,865
IRON ORE					
Domestic	t	5,638,929	159,029,485	5,475,700	152,105,587
Exported	t	102,508,204	2,762,946,127	110,863,008	2,844,629,286
TOTAL IRON ORE		108,147,133	2,921,975,612	116,338,708	2,996,734,873
LIMESAND-LIMESTONE-DOLOMITE					
Dolomite	t	280	1,120	0	0
Limesand-Limestone	t	2,083,846	13,055,973	2,099,107	14,189,487
TOTAL LIMESAND-LIMESTONE-DOLOMITE			13,057,093		14,189,487
MANGANESE ORE					
	t	402,844	72,200,142	247,858	43403053
NICKEL INDUSTRY					
Cobalt by-product	t	557 (r)	30,281,378 (r)	296	10,916,333
Nickel Concentrate	t	462,786	457,569,201	529,997	437,744,354
Nickel Matte	t	1,056	2,202,178	0	0
Nickel Ore	t	2,892	1,767,117	0	0
Palladium by-product	kg	539	1,372,039	405	2,035,430
Platinum by-product	kg	143	1,249,742	79	1,142,319
TOTAL NICKEL INDUSTRY			494,441,655 (r)		451,838,436

MINERAL	UNIT	1992		1993	
		QUANTITY	VALUE(\$)	QUANTITY	VALUE(\$)
PEAT	t	918	68,315	1,025	76,189
PETROLEUM					
Condensate	kl	2,060,353	366,702,321	2,168,549	359,859,020
Crude Oil	kl	5,046,694	917,363,371	4,048,865	709,321,378
LNG	MMBtu	237,642,529	966,473,640	264,749,780	997,875,786
Natural Gas	'000m3	3,776,068	368,955,578	4,210,826	422,956,897
TOTAL PETROLEUM			2,619,494,910		2,490,013,081
SALT	t	6,671,678	155,392,954	6,489,360	158,649,336
SILICA-SILICA SAND					
Silica	t	66,253	697,757	67,732	687,362
Silica Sand	t	519,642	4,973,830	459,797	4,309,802
TOTAL SILICA-SILICA SAND			5,671,587		4,997,164
SILVER	kg	65,929	10,224,887	66,293	13,235,607
TALC	t	166,574	11,712,450	165,310	12,054,570
TIN-TANTALUM-LITHIUM					
Spodumene	t	39,980	8,095,473	40,490	8,416,185
Tantalite	t	925	29,733,847	313	133,58,558
Tin	t	284	1,472,341	72	848,271
TOTAL TIN-TANTALUM-LITHIUM			39,301,661		22,623,014
VERMICULITE	t	308	54,754	0	0
TOTAL VALUE			12,125,783,770 (r)		12,434,317,027 (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
BASE METALS			Cu, Tonnes		
Copper By-Product	Coolgardie		4,953.102	5,870,240	(a),(b)
			Cu %		
Copper Concentrates	Boddington	11,476	24.02	3,256,341	
	East Pilbara	10,600	14.53	1,121,514	
	Meekatharra	39,608	20.07	8,102,049	
	Yalgoo	<u>24,997</u>	<u>20.59</u>	<u>7,202,018</u>	
		86,681		19,681,922	(a)
Total Copper				25,552,162	
			Pb %		
Lead	Derby-West Kimberley	39,791	81.11	7,835,561	(a)
			Zn %		
Zinc	Derby-West Kimberley	115,024	61.24	46,156,925	
	Yalgoo	<u>168,243</u>	<u>42.00</u>	<u>40,863,351</u>	
		283,267		87,020,276	(a)
TOTAL BASE METALS				120,407,999	
BAUXITE - ALUMINA					
Alumina	Boddington	1,617,927		392,550,952	
	Harvey	1,528,168		370,556,153	
	Murray	2,923,010		708,736,419	
	Serpentine-Jarrahdale	<u>1,732,169</u>		<u>420,012,272</u>	
		7,801,274		1,891,855,796	(c)
CLAYS					
Attapuligite	Mullewa	20,632		6,099,237	(a)
Fire Clay	Chittering	43,813		52,576	(d)
Kaolin	Bridegetown-Greenbushes	3,611		248,699	(d)
White Clay	Swan	<u>22,984</u>		<u>249,946</u>	(d)
TOTAL CLAYS		91,040		6,650,458	
COAL	Collie	5,452,875		247,611,413	(e)
CONSTRUCTION MATERIALS					
Aggregate	Derby-West Kimberley	2,534		15,204	
	Kalgoorlie-Boulder	165,290		916,312	
	Port Hedland Town	76,517		426,880	
	Roeboume	8,289		33,417	
	Wyndham-East Kimberley	<u>7,229</u>		<u>43,374</u>	
		259,859		1,435,187	

TABLE 4.1 (cont)		Local	Quantity	Metallic		
Mineral	Government Area		tonnes	Content	Value (\$)	Ref
CONSTRUCTION MATERIALS (cont)						
Gravel	Ashburton		162		972	
	Broome		9,581		52,260	
	Coolgardie		6,280		35,760	
	Kalamunda		58,940		294,700	
	Port Hedland Town		2,031		1,788	
	Shark Bay		140		700	
	Wyndham-East Kimberley		<u>2,204</u>		<u>6,988</u>	
			79,338		393,168	
Rock	Broome		39,979		517,163	
	Exmouth		12,870		89,799	
	Port Hedland Town		261		4,103	
	Roebourne		<u>41,524</u>		<u>316,812</u>	
			94,634		927,877	
Sand	Ashburton		34,035		170,175	
	Broome		31,214		138,838	
	Canning		1,378,116		5,512,464	
	Cockburn		17,669		70,678	
	Collie		14,460		82,404	
	Coolgardie		97,631		495,335	
	Danderagan		1,190		7,140	
	Derby-West Kimberley		924		6,246	
	East Pilbara		4,943		28,696	
	Gingin		2,831		16,988	
	Kalgoorlie-Boulder		25,760		128,800	
	Leonora		3,160		18,960	
	Meekatharra		135,051		810,306	
	Menzies		1,157		5,785	
	Northam		5,520		16,560	
	Port Hedland Town		32,365		196,465	
	Roebourne		428,827		2,188,450	
Swan		223,309		334,965		
Wyndham		2,026		12,156		
Yilgarn		<u>3,700</u>		<u>16,800</u>		
			2,443,888		10,258,211	
TOTAL CONSTRUCTION MATERIALS					13,014,443	(d)

Mineral	Local Government Area	Quantity tonnes	Metallic Content	Value (\$)	Ref
		Carats			
DIAMOND	Wyndham-East Kimberley	22,649,491		486,770,824	(a)
DIATOMITE	Dandaragan	445		5,171	(d)
DIMENSION STONE					
Black Granite	Darby-West Kimberley	1,021		255,271	
	Dundas	1,013		303,900	
		2,034		559,171	(d)
Quartz Rock	Mukinbudin	390		17,538	(d)
TOTAL DIMENSION STONE		2,424		576,709	
GEM, SEMI-PRECIOUS AND ORNAMENTAL STONE					
Agate	East Pilbara	kg			
		41,360		27,467	
Amethyst	Upper Gascoyne	kg			
		25,352		308,045	
Chalcedony	Carnarvon	kg			
		36,775		28,137	
Chrysoprase	Menzies	kg			
		27,344		795,872	
Jasper	East Pilbara	kg			
		70,819		45,116	
Malachite	Meekatharra	kg			
		2,245		8,392	
Tourmaline	Yilgarn	kg			
		7		1,425	
Variscite	Meekatharra	kg			
		720		870	
TOTAL GEM, SEMI-PRECIOUS AND ORNAMENTAL STONE				1,215,324	(e)
			Au kg		
GOLD	Ashburton		14.215	242,508	
	Boddington		16,045.111	832,320,945	
	Coolgardie		19,937.784	340,683,930	
	Cue		10,495.138	178,625,642	
	Dundas		2,346.269	40,153,917	
	East Pilbara		12,265.804	209,696,436	
	Kalg.-Boulder		43,696.314	748,973,706	
	Leverton		8,335.104	142,748,387	

TABLE 4.1 (cont)		Local	Quantity	Metallic	
Mineral	Government Area		tonnes	Content	Value (\$)
				Au kg	Ref
GOLD (cont)	Leonora		23,364.700		399,557,528
	Meekatharra		14,840.063		252,585,559
	Menzies		617.914		10,413,371
	Mt Megnet		5,510.149		94,978,479
	Roebourne		4.705		80,263
	Sandstone		2,782.582		47,142,258
	Wiluna		3,117.029		53,341,434
	Yalgoo		2,206.159		38,290,900
	Yilgarn		<u>17,907.261</u>		<u>308,022,940</u>
			183,487.022		3,139,858,203 (f)
GYPSUM	Dalwallinu		52,535		774,809 (d)(e)
	Esperance		2,925		17,020 (e)
	Lake Grace		6,014		36,670 (e)
	Merredin		2,025		16,200 (e)
	Nungarin		22,612		135,672 (e)
	Plantagenet		9,423		60,776 (e)
	Ravensthorpe		12,543		70,000 (e)
	Wyalkatchem		31,803		179,178 (e)
	Yilgarn		<u>5,325</u>		<u>39,075 (e)</u>
			145,205		1,329,400
HEAVY MINERAL SANDS					
Garnet Sand	Capel		487		49,734 (g)
	Northampton		<u>47,715</u>		<u>4,532,881 (e)</u>
			48,202		4,582,615
Ilmenite				TiO ₂ %	
	Capel		680,884	54.89	59,916,649
	Carnamah		104,554	62.55	7,626,189
	Dandaragan		215,807	62.25	17,270,335
	Waroone		<u>7,132</u>	<u>55.01</u>	<u>584,829</u>
			1,008,377		85,398,002
Upgraded Ilmenite				TiO ₂ %	
	Capel		148,244	92.00	68,493,099
	Carnamah		120,530	92.00	57,776,257
	Dandaragan		<u>39,827</u>	<u>92.00</u>	<u>17,265,203</u>
			308,601		143,534,559
TOTAL ILMENITE			1,316,978		228,932,561 (e)

TABLE 4.1 (cont)	Local	Quantity	Metallic		
Mineral	Government Area	tonnes	Content	Value (\$)	Ref
HEAVY MINERAL SANDS (cont)					
			TiO ₂ Tonnes		
Leucoxene	Capel	12,139	11,064	4,685,531	
	Waroona	550	506	165,000	
		12,689	11,570	4,850,531	(a)
			ThO ₂ Units		
Monazite	Capel	2,859	18,329	778,894	
	Camamah	3,795	24,226	1,136,066	
		6,654	42,555	1,914,960	(a)
			TiO ₂ Tonnes		
Rutile	Camamah	37,864	35,802	20,527,706	
	Dandaragan	18,732	17,981	9,446,464	
		56,596	53,783	29,974,170	(a)
			ZrO ₂ Tonnes		
Zircon	Capel	82,791	53,816	12,364,309	
	Camamah	134,777	88,395	21,576,691	
	Dandaragan	80,561	53,170	12,070,974	
	Waroona	1,632	1,060	244,800	
		299,761	196,441	46,256,774	(a)
TOTAL HEAVY MINERAL SANDS				316,511,611	
INDUSTRIAL PEGMATITE MINERALS					
Felspar	Mukinbudin	6,948		233,371	
	Port Hedland Town	11,800		461,494	
		18,748		694,865	(h)
IRON ORE					
			Fe%		
Domestic Ore	Ashburton	558,664	60.98	14,896,232	
	Derby-West Kimberley	1,075,232	65.42	30,010,443	
	East Pilbara	3,841,804	62.13	107,198,912	
		5,475,700		152,105,587	
			Fe%		
Exported Ore	Ashburton	67,524,045	61.51	1,687,814,188	
	Derby-West Kimberley	1,825,794	62.11	41,584,772	
	East Pilbara	41,513,169	62.76	1,115,230,326	
		110,863,008		2,844,629,286	
TOTAL IRON ORE		116,338,708		2,996,734,873	(a)
LIMESAND - LIMESTONE					
	Cockburn	1,639,000		8,505,000	
	Dandaragan	35,120		416,408	
	Dundas	59,526		815,414	

TABLE 4.1 (cont)	Local	Quantity	Metallic		
Mineral	Government Area	tonnes	Content	Value (\$)	Ref
LIMESAND - LIMESTONE (cont)	Exmouth	340		6,120	
	Gingin	50,028		1,207,809	
	Irwin	3,585		10,858	
	Roebourne	350		22,750	
	Wanneroo	311,158		3,205,128	
TOTAL LIMESAND-LIMESTONE		2,099,107		14,189,487	(d)
			Mn %		
MANGANESE ORE	East Pilbara	247,858	49.18	43,403,053	(a)
NICKEL INDUSTRY			Co Tonnes		
Cobalt By-Product	Coolgardie		296.689	10,916,333	
			Ni %		
Nickel Concentrates	Coolgardie	225,919	10.51	190,317,958	
	Kalgoorlie-Boulder	38,470	10.45	31,907,616	
	Leonora	240,807	10.49	200,039,008	
	Yilgarn	24,801	9.83	15,479,772	
		529,997		437,744,354	(i)
			Pd kg		
Palladium By-Product	Coolgardie		404.877	2,035,430	(a),(b)
			Pt kg		
Platinum By-Product	Coolgardie		79.164	1,142,319	(a),(b)
PEAT	Manjimup	1,025		76,189	(d)
PETROLEUM		Kilolitres			
Condensate	Camamah	429		18,613	(d)
	Irwin	3,517		506,284	(d)
	Roebourne	2,164,603		359,334,123	(a)
		2,168,549		359,859,020	
		Kilolitres			
Crude Oil	Derby-West Kimberley	16,121		2,423,210	
	Irwin	41,241		41,241	
	Roebourne	3,991,503		701,059,579	
		4,048,865		709,321,378	(a)
		MMBtu			
Liquefied Natural Gas	Roebourne	264,749,780		997,875,786	(a)

TABLE 4.1 (cont)					
Mineral	Local Government Area	Quantity tonnes	Metallic Content	Value (\$)	Ref
PETROLEUM (cont)		'000 m3			
Natural Gas	Ashburton	95,031		8,099,719	(j)
	Carnamah	60,180		6,823,831	(j)
	Irwin	269,970		33,214,951	(j)(f)
	Roebourne	<u>3,785,644</u>		<u>374,818,396</u>	(d)(f)
		4,210,825		422,956,897	
TOTAL PETROLEUM PRODUCTS				2,490,013,081	
SALT	Carnarvon	1,309,994		33,583,480	
	Esperance	10,565		322,000	
	Lake Grace	40		3,200	
	Port Hedland Town	2,076,578		48,944,030	
	Roebourne	2,331,768		56,363,821	
	Shark Bay	665,288		15,798,445	
	Wyalkatchem	242		19,360	
	Yilgarn	<u>94,885</u>		<u>3,615,000</u>	
		6,489,360		158,649,336	(a)
SILICA - SILICA SAND					
Silica	Moora	67,732		687,362	
Silica Sand	Canning	143,105		1,574,155	
	Cockburn	216,308		2,379,388	
	Coolgardie	73,843		180,918	
	Wanneroo	<u>26,541</u>		<u>175,341</u>	
TOTAL SILICA - SILICA SAND		527,529		4,997,164	(a)
SILVER: BY-PRODUCT					
		Ag kg			
	State Wide	33,934.903		7,275,476	
	Boddington	1,061.230		168,694	(a),(l)
	Coolgardie	165.459		35,679	(a),(b)
	Meekatharra	15,361.976		2,311,626	(a),(k)
	Yalgoo	<u>15,770.213</u>		<u>3,444,132</u>	(a),(l)
		66,293.781		13,235,607	
TALC					
	Meekatharra	24,899		1,746,800	
	Three Springs	<u>140,411</u>		<u>10,307,770</u>	
		165,310		12,054,570	(e)
TIN - TANTALUM - LITHIUM					
			Li ₂ O %		
Spodumene	Bridegetown-Greenbushes	40,490	5.71	8,416,185	(a)

TABLE 4.1 (cont)	Local	Quantity	Metallic		
Mineral	Government Area	tonnes	Content	Value (\$)	Ref
TIN - TANTALUM - LITHIUM (cont)			Ta ₂ O ₅ kg		
Tantalite	Bridegetown-Greenbushes	148	44,559	5,253,274	
	East Pilbara	<u>165</u>	<u>86,888</u>	<u>8,105,284</u>	
		313	131,447	13,358,558	(a)
Tin			Sn Tonnes		
	Bridegetown-Greenbushes	73	98	805,826	
	East Pilbara	<u>n.ap.</u>	<u>12</u>	<u>42,445</u>	
		73	110	848,271	(a)
VALUE OF MINERALS				6,804,445,742	
VALUE OF PETROLEUM				2,490,013,081	
VALUE OF GOLD				<u>3,139,858,203</u>	
TOTAL VALUE				12,434,317,027	

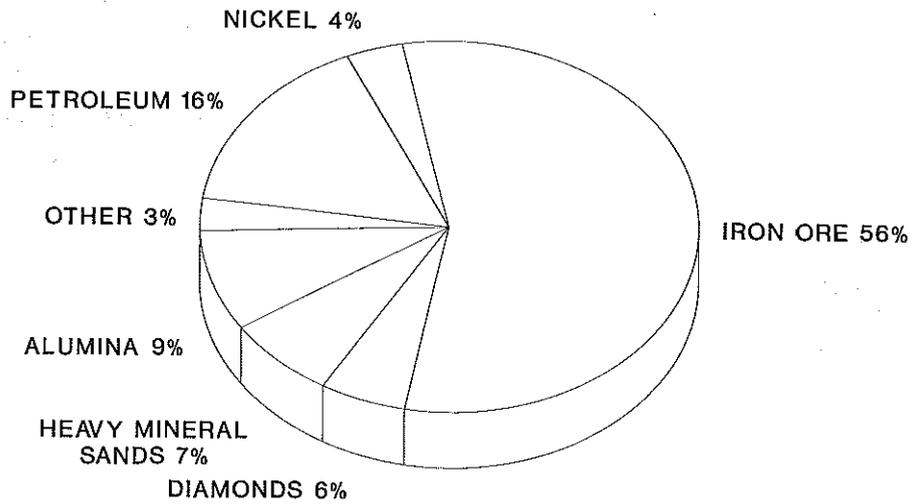
TABLE 5.1 ROYALTY RECEIPTS 1992, 1993				
Mineral	1992 \$A	1993 \$A	Value \$A Variance	%up (%down)
BASE METALS				
Copper	578,052.51	1,031,689.57	453,637.06	78
Lead	317,505.14	261,486.64	(56,018.50)	(18)
Zinc	5,144,406.96	4,109,595.93	(1,034,811.03)	(20)
TOTAL BASE METALS	6,039,964.61	5,402,772.14	(637,192.47)	(11)
BAUXITE-ALUMINA				
Alumina	28,084,011.51	30,723,077.11	2,639,065.60	9
CLAYS	307,685.09	354,211.22	46,526.13	15
COAL	10,905,731.88	12,267,136.05	1,361,404.17	12
CONSTRUCTION MATERIALS				
Aggregate	32,643.84	68,160.60	35,516.76	109
Gravel	42,337.02	29,816.08	(12,520.94)	(30)
Rock	40,921.88	19,806.89	(21,114.99)	(52)
Sand	241,167.76	668,237.58	427,069.82	177
Sandstone	0.00	28.00	28.00	n.ap.
TOTAL CONSTRUCTION MATERIALS	357,070.50	786,049.15	428,978.65	120
DIAMOND	42,342,417.43	40,152,290.21	(2,190,127.22)	(5)
DIMENSION STONE	12,453.17	1,701.28	(10,751.89)	(86)
GEM, SEMI-PRECIOUS & ORNAMENTAL STONE	151,822.86	93,053.94	(58,768.92)	(39)
GOLD	212,908.33	274,016.12	61,107.79	29
GYPSUM	27,188.65	44,830.34	17,641.69	65
HEAVY MINERAL SANDS				
Garnet	174,534.51	229,093.79	54,559.28	31
Ilmenite	5,158,819.13	4,960,192.46	(198,626.67)	(4)
Leucoxene	192,234.49	177,876.94	(14,357.55)	(7)
Monazite	133,355.51	127,096.38	(6,259.13)	(5)
Rutile	2,191,318.58	1,488,178.91	(703,139.67)	(32)
Zircon	2,462,308.99	2,335,068.43	(127,240.56)	(5)
TOTAL HEAVY MINERAL SANDS	10,312,571.21	9,317,506.91	(995,064.30)	(10)
INDUSTRIAL PEGMATITE MINERALS				
Felspar	58,558.77	45,806.43	(12,752.34)	(22)
IRON ORE	151,445,144.37	157,695,037.63	6,249,893.26	4

TABLE 5.1 (cont)	1992	1993	Value \$A	%up
Mineral	\$A	\$A	Variance	(%down)
LIMESAND-LIMESTONE-DOLOMITE				
Dolomite	84.00	0.00	(84.00)	(100)
Limesand-Limestone	168,173.13	208,204.90	40,031.77	24
TOTAL LIMESAND-LIMESTONE-DOLOMITE	168,257.13	208,204.90	39,947.77	24
MANGANESE	4,072,364.00	1,864,582.00	(2,207,782.00)	(54)
NICKEL				
Cobalt by-product	597,484.96	239,568.04	(357,916.92)	(60)
Nickel	10,846,182.10	8,157,046.09	(2,689,136.01)	(25)
Palladium by-product	30,054.44	29,207.72	(846.72)	(3)
Platinum by-product	40,442.19	22,490.47	(17,951.72)	(44)
TOTAL NICKEL INDUSTRY	11,514,163.69	8,448,312.32	(3,065,851.37)	(27)
PEAT	1,663.34	2,406.17	742.83	45
PETROLEUM				
Condensate	3,234,149.45	4,176,998.90	942,849.45	29
Liquified Natural Gas	7,979,894.86	11,793,657.02	3,813,762.16	48
Natural gas	5,014,083.88	8,078,800.51	3,064,716.63	61
Oil	66,634,282.69	53,836,100.43	(12,798,182.26)	(19)
TOTAL PETROLEUM	82,862,410.88	77,885,556.86	(4,976,854.02)	(6)
SALT	1,399,048.10	1,459,270.37	60,222.27	4
SILICA SAND	341,534.60	239,602.26	(101,932.34)	(30)
SILVER	144,368.49	302,284.26	157,915.77	109
TALC	78,213.00	76,792.50	(1,420.50)	(2)
TIN-TANTALUM-LITHIUM				
Spodumene	415,793.00	451,044.24	35,251.24	8
Tantalite	605,907.00	508,921.06	(96,985.94)	(16)
Tin	33,089.56	26,407.04	(6,682.52)	(20)
TOTAL TIN-TANTALUM-LITHIUM	1,054,789.56	986,372.34	(68,417.22)	(6)
VERMICULITE	1,642.25	931.72	(710.53)	(43)
TOTAL ROYALTY RECEIPTS	351,895,983.42	348,631,804.23	(3,264,179.19)	(1)
IRON ORE ADDITIONAL RENTAL	19,919,831.08	25,164,840.85	5,245,009.77	26
TOTAL REVENUE	371,815,814.50	373,796,645.08	1,980,830.58	1

COMPARATIVE ROYALTY RECEIPTS

1988 ROYALTY RECEIPTS

TOTAL : \$178.5 MILLION



1993 ROYALTY RECEIPTS

TOTAL : \$348.6 MILLION

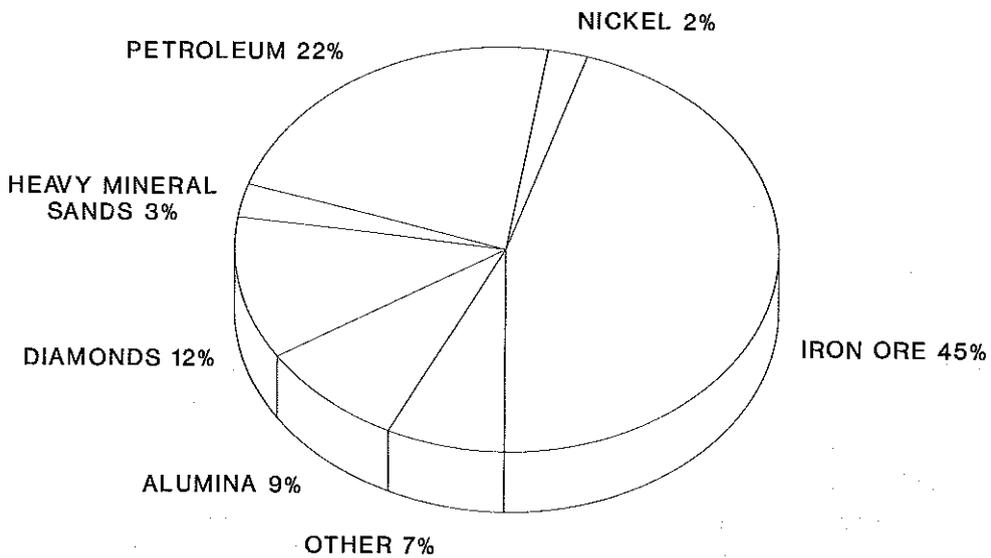


Figure 5.1

6.1 Employment in the Mineral and Petroleum Industries

The Western Australian mineral and petroleum industries increased employment during 1993. Statistics compiled from industry returns showed that 35,398 people were employed at the end of the year, the equivalent of 4 % more than at the end of 1992 (see explanatory footnote).

Most sectors reported little change in employee numbers, generally signalling the end of the contraction of employee numbers forced on employers by the drive for economy during a prolonged period of low prices. The only sector where a significant drop in employment was registered was the iron ore sector, where employment fell by 20%, despite record production levels. Employment was significantly lower at the Goldsworthy, Mt. Newman and Tom Price operations as the result of planned programs of staff rationalisation, increased reliance on contract labour and the introduction, through the enterprise bargaining system, of more efficient and less restrictive work practices. The greatest falls were at the Mt Newman operation where employment declined by 25% during the year. There is no sign that pressure on iron ore prices has eased, so the pressure persists for further rationalisation of the workforce.

The diamond and heavy mineral sands sectors, which have both been severely affected by protracted low demand, maintained employment levels during the year after rationalising employment during the previous year. There is some longer-term scope for expanded employment through the development of new projects, but in the short term employment should remain static. Other sectors such as coal, salt and other materials where price is less subject to international market fluctuations also maintained the employment levels of the previous year.

The base metals, alumina and petroleum sectors all recorded rises in employment associated with new projects or expanded production. The Nifty copper project and the reopened Horseshoe Lights operation boosted the base metals sector, while the Wagerup expansions supported the alumina sector. Employment in the petroleum sector increased with the Wandoo field coming on stream, and development work progressing on the Griffin, Roller/Skate Goodwyn and Wanaea fields. The operations due to be commissioned in 1994 and later years will see a sustained rise in production-based employment.

The largest increase in employment was in the nickel sector where numbers increased by 35%. This reflects the expansion of capacity in primary production at Kambalda and Leinster, and in the smelting and refining operations. It also includes the construction phase of the Mt Keith project, allowing that the operating workforce will be fewer than the construction workforce. Employment may be further increased if any of the proposed new projects are realised over the next few years.

Most sectors are faced with a year of depressed but slowly rising commodity prices and mixed demand. Producers therefore remain under pressure to continue to increase productivity and seek even further economies in employment. The scope for further efficiencies is now small. However the success of productivity-based enterprise agreements in improving market competitiveness, and the increased willingness of employees to accept wages gains for significant productivity-based rationalisation, suggest that enterprise agreements will find increasing application, and that further employment cuts in existing operations are possible. This is consistent with a significant long term industry-wide investment in training, associated with moves to multi-skilling and general skills development.

Note on statistics. In keeping with the purpose of this publication, the basis for the employment statistics reported in this issue has changed from previous issues. Statistics for mineral producers used to be based solely on production sites, and therefore only represented employment in the operational side of the resources industry. Statistics for petroleum producers excluded many employees in exploration and general administration.

Statistics are still based on production sites, but now include employees in administration and

exploration. These figures have been collected directly from employers where possible, and are estimates based on figures from the Australian Bureau of Statistics where direct collection was not possible.

The format of presentation has also changed. Statistics have been condensed to show employment by major commodity groups only. This presentation makes the tabulation more convenient and easier to read, and facilitates the transition from the old format to the new.

TABLE 6.1 PERSONS EMPLOYED IN THE W.A. MINERALS & PETROLEUM INDUSTRIES AS AT DECEMBER 31, 1993

MINERAL	1992		1993	
	PRODUCTION	ADMINISTRATION	PRODUCTION	TOTAL
BASE METALS	620 (r)	133	632	765
BAUXITE - ALUMINA	5,278	1,197	5,702	6,899
COAL	1,091	227	1,080	1,307
DIAMOND	1,116	250	1,190	1,440
GOLD	10,013 (r)	2,492	11,865	14,357
HEAVY MINERAL SANDS	1,741	344	1,640	1,984
IRON ORE	8,196	1,408	6,703	8,111
NICKEL	2,841	810	3,858	4,668
PETROLEUM PRODUCTS	2,009 (r)	1,317	1,355	2,672
SALT	498	96	457	553
ALL OTHER MATERIALS	860	192	916	1,108
SUB - TOTAL PRODUCTION	34,263 (r)	8,466	35,398	43,864
EXPLORATION - MINERALS				3,370
- PETROLEUM				446
- SERVICES				6,931
SUB - TOTAL EXPLORATION				10,747
INDUSTRY TOTAL				54,611

(Sources: Royalties, Economic Policy & Public Affairs Division; Mining Operations Division & Australian Bureau of Statistics)

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

Murchison Zinc Co. Pty Ltd, ^{C/-} Normandy Poseidon Ltd, 100 Hutt St, Adelaide, S.A., (08) 303 1700: Golden Grove.
 Newcrest Mining Ltd, 600 St Kilda Rd, Melbourne 3004, (03) 522 5333: New Celebration, Talfar.
 Sabminco NL, 221 St George's tce, Perth 6000, (09) 321 1118: Horseshoe Lights
 Western Mining Corp. Ltd, 191 Great Eastern Hwy, Belmont 6104, (09) 479 0711: Nifty, Kambalda.

Lead - Zinc

BHP Minerals Ltd, 250 St Georges' Tce, Perth 6000, (09) 320 4444: Cadjabut.
 Murchison Zinc Co. Pty Ltd, ^{C/-} Normandy Poseidon Ltd, 100 Hutt St, Adelaide, S.A., (08) 303 1700: Golden Grove

BAUXITE - ALUMINA**Alumina**

Alcoa of Australia (WA) Ltd, cnr Davey & Marmion sts Booragoon 6154, (09) 316 5111: Dal Park, Jerrahdale, Willowdale.
 Worsley Alumina Pty Ltd, PO Box 344, Collie 6225, (097) 34 8311: Boddington.

CLAY**Attapulgit**

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

Kaolin

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

White Clay

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

COAL

Griffin Coal Mining Co. Ltd, 28 The Esplanade, Perth 6000, (09) 325 8155: Collie.
 Western Collieries Ltd, 40 The Esplanade, Perth 6000, (09) 327 4511: Collie.

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: Learmonth, Mt Regal.

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

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

Quinton Pty Ltd, Lot 117 Cnr Great Eastern Hwy Coolgardie Rd, Kalgoorlie 6430, (090) 213 961: Coolgardie.

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

DIAMOND

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

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

DIMENSION STONE**Black Granite**

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

Quartz rock

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

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

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

Chrysoprase

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

GOLD

Asarco Australia Ltd, 10 Ord St West Perth 6005, (09) 481 2050: Jundee, Wiluna.

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

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

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

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

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

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

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

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

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

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

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

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

Hedges Gold Pty Ltd, ^{C/} Alcoa of Australia Ltd, cnr Davy and Marmion Sts, Booragoon 6153, (09) 364 0111: Hedges.

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

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

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

Metal Mining Corp of Aust Pty Ltd, cnr Throssell & Forrest Sts. Kalgoorlie 6430, (090) 21 1766: Broad Arrow, Round Dam, West Black Flag-Broads Dam.

Mining Corporation of Australia Ltd, 32 Lane St, Kalgoorlie 6430, (090) 21 5144: John West, Mt Pleasant-Golden Kilometre.

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

Mt Burgess Gold Mining Co NL, 533 Hay St Perth 6000, (09) 221 1777, Butcher Well - Yundamindera.

Newcrest Mining Ltd, 179 Gt Eastern Hwy, Belmont 6401, (09) 270 7070: Comet-Pinnacles, New Celebration, Ora Banda-Gimlet South, Orban JV, Telfer.

North Broken Hill-Peko Ltd, 476 St Kilda Rd, Melbourne Vic 3004, (03) 829 0000: Kanowna - Golden Valley, Peak Hill.

Orion Resources NL, 42 Ardross St, Applecross 6153, (09) 364 8355: Burbidge-Great Victoria, Yilgarn Star.

Pancontinental Mining Ltd, PO Box 1161, Kalgoorlie 6430, (090) 24 2000: Kundana, Paddington.

Placer Pacific Ltd, PO Box 33, Laverton WA 6440, (090) 31 3111: Granny Smith.

Plutonic Resources Ltd, PMB 46 Meekatharra 6642, (09) 370 8201: Darlot, Lawlers, Mt Fisher, Plutonic, Sir Samuel-Bellevue.

Poseidon Gold Ltd, 100 Hutt St, Adelaide S.A., (08) 303 1700: Big Bell, Golden Crown, Kaltails.

Ramsgate Resources Ltd, 229 Stirling Highway, Claremont 6010, (09) 383 4321: Grace Darling, Mt Monger, Randalls.

Resolute Resources Ltd, 28 The Esplanade, Perth 6000, (09) 321 4011: Marymia Hill.

Reynolds Australia Metals Ltd, 28 The Esplanade, Perth 6000, (09) 322 2313: Cornishman, Marvel Loch-Southern Cross, Mt Gibson.

Sabre Resources NL, 45 Labouchere Rd, South Perth 6151, (09) 471 1700: Mt Monger - Mirror Magic.

Samantha Gold NL, 28 The Esplanade, Perth 6000, (09) 481 5288: Bullabulling, Glendower - Evelyn Molly, Higgingsville, Hopes Hill-Corinthia.

St Barbara Mines Ltd, Gt Northern Highway, Meekatharra 6642, (099) 81 8111: Bluebird.

Sons of Gwalia NL, 16 Parliament Pl, West Perth 6005, (09) 481 1988: Barnicoat, Sons of Gwalia.

Western Mining Corp. Ltd, 191 Great Eastern Hwy, Belmont 6104, (09) 479 0711: Emu-Leinster, Hill 50-Mt Magnet, Kambalda-St Ives, Lancefield.

Westgold Resources NL, 108 St Georges' Tce, Perth 6000, (09) 324 2877: Tuckabianna

Worsley Alumina Pty Ltd, PO Box 48, Boddington 6390, (098) 83 8260: Boddington.

GYPSUM

H.B. Brady & Co. Pty Ltd, PO Box 42, Bayswater 6053, (09) 279 4422: Lake Brown.

Lake Hillman Mining Pty Ltd, Kalannie 6468, (096) 66 2045: Lake Hillman.

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

Westdeen Holdings Pty Ltd, 7 Armstrong Rd, Applecross 6153, (09) 364 4951: Wyalkatchem

HEAVY MINERAL SANDS**Garnet Sand**

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

7.1 PRINCIPAL MINERAL & PETROLEUM PRODUCERS 1993, address, telephone number: minesite.**HEAVY MINERAL SANDS (cont)****Ilmenite, Rutile, Zircon, Leucoxene & Monazite**

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

RGC Mineral Sands, PO Box 62, Geraldton 6530, (090) 64 2245: Capel, Eneabba North, Eneabba West

TiWest Pty Ltd, 1 Brodie Hall Dve, Bentley 6102, (09) 365 1390: Cooljarloo.

Westralian Sands Ltd, PO Box 96, Capel 6271, (097) 27 2002: Yoganup.

INDUSTRIAL PEGMATITE MINERALS**Felspar**

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

IRON ORE

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

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

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

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

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

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

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

LIMESAND - LIMESTONE

Cockburn Cement Ltd, Russell Rd, South Coogee 6166, (09) 410 1988: Cockburn Sound, Coogee.

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

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

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

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

MANGANESE ORE

Portman Mining Ltd, Level 13, 256 Adelaide Tce, Perth 6000, (09) 268 3333: Woodie Woodie.

NICKEL

Outokumpu Australia Pty Ltd, 141 Burswood Rd., Victoria Park 6010, (09) 472 3144:

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

PEAT

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

PETROLEUM

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

BHP Petroleum Pty Ltd, 120 Collins St, Melbourne 3000, (03) 652 6666: Griffin

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

7.1 PRINCIPAL MINERAL & PETROLEUM PRODUCERS 1993, address, telephone number: minesite.**PETROLEUM (cont)**

- Discovery Petroleum NL, 99 Shepparton Rd, Victoria Park 6010, (09) 470 0400: Mt Horner.
- Doral Resources NL, 250 St George's Tce, Perth 6000, (09) 481 5866: Tubridgi.
- Hadson Energy Ltd, 35 Ventnor Ave, West Perth 6005, (09) 481 8555: Campbell, Harriet, Rosetta, Sinbad & Tanami.
- Minora Resources NL, 263 Adelaide Tce, Perth 6000, (09) 307 1345: Blina, Boundary, Lloyd, Sundown, West Terrace.
- Sagasco Holdings Ltd, 60 Hindmarsh Sq, Adelaide SA 5000, (08) 235 3700: Beharra Springs.
- West Aust. Petroleum Pty Ltd (WAPET), QV1, 250 St Georges Tce, Perth 6000, (09) 263 6000: Barrow Island, Cowle, Crast, Dongara, Mondara, Rollerskata, Saladin, Yammaderry.
- Western Mining Corp. Ltd, 28 Ventnor Ave, West Perth 6005, (09) 482 2444: Chervil, North Herald, South Pepper.
- Woodside Offshore Pet. Pty Ltd, 1 Adelaide Tce, Perth 6000, (09) 224 4111: Cossak/Wanea, Goodwyn, North Rankin.

SALT

- Cargill Australia Ltd, PO Box 420, Port Hedland 6721, (091) 40 1255: Port Hedland.
- Dampier Salt (Operations) Pty Ltd, 177A St George's Tce, Perth 6000, (09) 327 2299: Dampier, Lake Macleod.
- Shark Bay Salt Joint Venture, 22 Mount St, Perth 6000, (09) 322 4811: Useless Loop.
- WA Salt Koolyanobbing Pty Ltd, Cockburn Rd, Hamilton Hill 6163, (09) 430 5495: Lake Deborah East, Pink Lake.

SILICA - SILICA SAND**Silica**

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

Silica Sand

- ACI Operations Pty Ltd, 35 Baille Rd, Canning Vale 6155, (09) 455 1111: Lake Gngalara.
- Amatek Ltd, 1 Newburn Rd, Kewdale 6104, (09) 353 3030: Jandakot, Gngalara.
- Boral Resources WA Ltd, 136-138 Gt Eastern Hwy, South Guildford 6055, (09) 279 0000: Jandakot.
- The Readymix Group (WA), 75 Canning Hwy, Victoria Park 6100, (09) 472 2000: Jandakot.
- Western Mining Corp. Ltd, 191 Great Eastern Hwy, Belmont 6104, (09) 478 0711: Mt Burgess.

TALC

- Gwalia Minerals NL, 16 Parliament Pl, West Perth 6005, (09) 481 1988: Mt Seabrook.
- Western Mining Corp. Ltd, PO Box 116, Three Springs 6519, (099) 54 5047: Three Springs.

TIN - TANTALUM - LITHIUM**Spodumene**

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

Tantalite - Tin

- Goldrim Mining Australia Ltd, 317 Hunter St, Newcastle NSW 2300, (049) 29 2433: Wodgina.
- Greenbushes Ltd, 16 Parliament Place, West Perth 6005, (09) 481 1988: Greenbushes.
- Pan West Tantalum Pty Ltd, Gateway, 1 Macquarie Place, Sydney NSW 2000, (02) 256 2000: Wodgina.