New South Wales

Mineral Industry 1987 Review

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INDUSTRY REVIEW

The value of mineral production in New South Wales for 1986–87 exceeded **$3,285 million**, an increase of 8.4% over the previous year. Almost all major sectors of the mining industry recorded increases in the value of output.

The value of **coal** output rose by 7.0% to **$2,460 million** or almost 75% of the total value of all mineral production in New South Wales.

The value of production of **metallic minerals** improved substantially to **$439 million** (+ 25.8%) as did the value of output of **industrial minerals and rocks** (excluding construction materials) which rose to **$82.4 million** (+24.7%). The value of **construction materials** output declined by 3.9% to **$303.7** million.

Raw coal production increased by 14.7% to a record **88.5 million** tonnes while saleable coal production rose by 14.4% to 73.3 million tonnes. These increases were due mainly to the expansion of longwall mining in underground mines and a recovery in the growth of exports.

The value of coal exports from New South Wales rose 8.0% to a record **42.2 million** tonnes with expansion of both coking and steaming coal exports. Japan remained the chief market for New South Wales coal taking 35.8% of the State's steaming coal exports and 70.9% of coking coal exports (48.7% of overall coal exports). However the main growth area for New South Wales exports was in Europe to which shipments rose by 34.6% to 8.9 Mt.

The New South Wales coal industry, despite the record output, suffered another year of very poor profitability. This financial crisis became more evident in the latter half of 1987 when an appreciating Australian dollar on top of a further reduction of contract prices for both steaming and coking coals in April 1987 resulted in a sharp drop in Australian dollar returns. Thus, the average f.o.b. value/tonne of New South Wales coking and steaming coal exports fell in 1986/87. These conditions have led to the closure of a number of mines in the State and forced many producers to initiate or consider major rationalization of their operations.

The strong recovery in the value of New South Wales metallic minerals output was led by the major base metal mines. Overall mine production of lead actually fell by 10% and the level of zinc output increased only marginally but the sharp increase in both lead and zinc prices on world markets led to solid gains in profitability for base metal producers.

Towards the end of 1986 Australian Mining and Smelting Ltd (AM & S) amalgamated its two mines in Broken Hill—Zinc Corporation and New Broken Hill Consolidated—into one operation, ZC Mines. AM & S also commenced a major refurbishment of the NBHC shaft through which all ore will eventually be hoisted.

The value of copper production rose by almost 14% largely due to the significant increase in productivity at AM & S Ltd's C.S.A. mine near Cobar. In July 1987, the Woodlawn copper–lead–zinc mine south of Goulburn was purchased from AM & S by Denehurst Ltd. Open pit mining at Woodlawn finished in May, 1987 and the new owners will continue underground mining at the rate of 500,000 tonnes/year of ore. Denehurst's major interest, however, is in applying new treatment technology to recover minerals from the accumulated tailings at Woodlawn.

Gold production more than doubled to **2227 kg** with the coming on stream of Paragon Resources' Temora gold mine and the New Occidental tailings retreatment project operated by Ranger Resources which is now the largest of a number of tailings projects in the State.

With little or no recovery in the world tin market, tin production in the State dwindled to only a fraction of the previous year's output. However, Republic Resources, who recently purchased the Ardlethan tin mine from Aberfoyle Ltd, have announced plans to recommence alluvial tin mining in the area.

A continuation of high demand for titanium dioxide and zircon resulted in another strong year for the State's mineral sands industry. The value of production of heavy mineral sands in New South Wales rose 43% to $42.6 million mainly due to increased production of rutile concentrates.

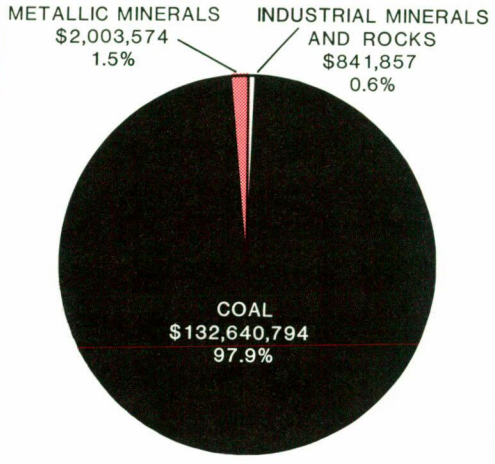
The value of industrial minerals and rocks (excluding construction materials), rose 24.6% to $82.4 million. This included significant increases in the value of production of gemstones (up 55.2% to $29.8 million), limestone (up 7.9% to $20.3 million), clays (up 21.5% to $19.8 million), and industrial sands for glass–making and foundrys (up 12.0% to $6.1 million).

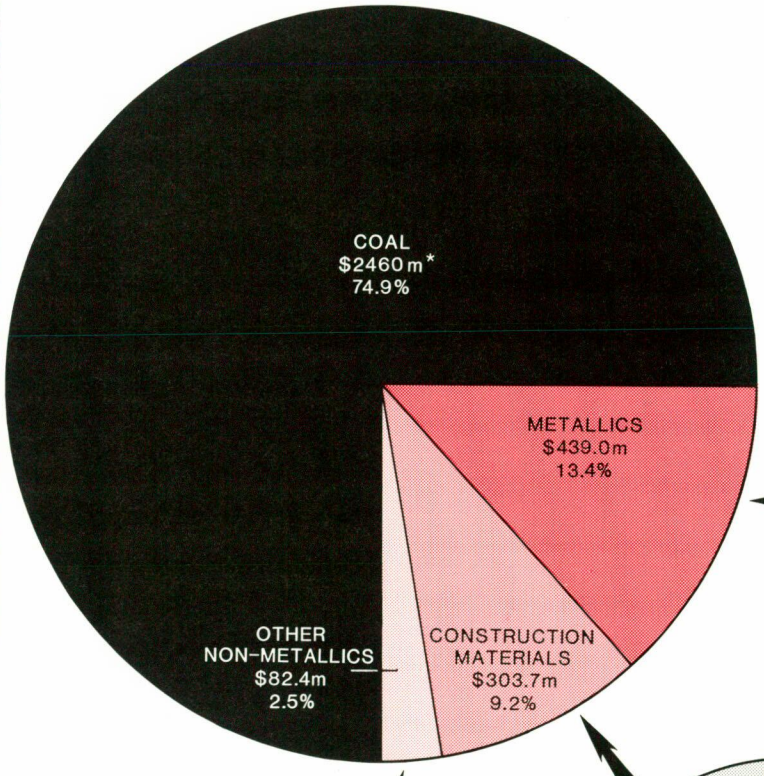
There was a slight decline in the value of production of construction materials as production of all major classifications (sand, gravel, crushed stone, and unprocessed materials) dropped roughly 8%.

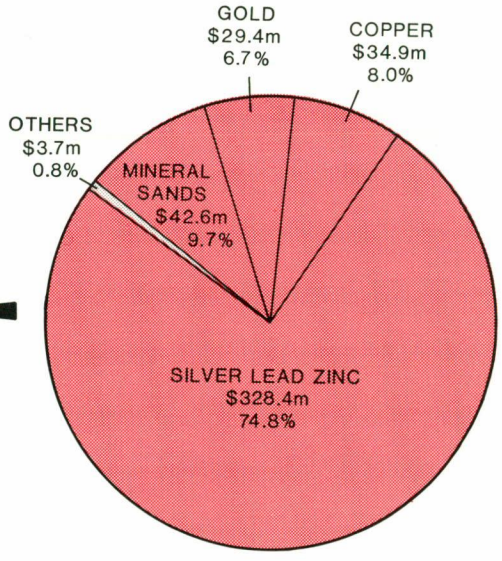
VALUE OF MINERALS PRODUCED IN NEW SOUTH WALES 1986-1987

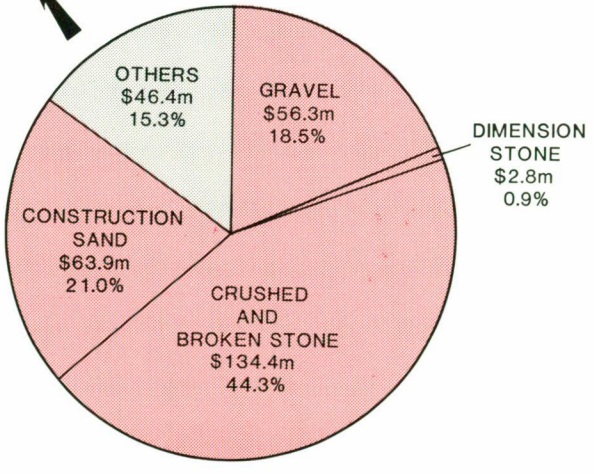
TOTAL $3,285m

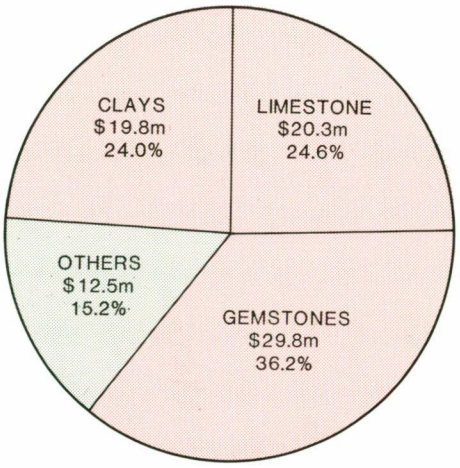
TOTAL VALUE OF ROYALTIES COLLECTED IN NEW SOUTH WALES $135,486,225











* estimated

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EXPLORATION

New South Wales has experienced a downturn in mineral exploration in 1986/87 with private sector expenditure down $4.2 million from the previous year. Total government and private exploration expenditure declined by 5.8% to $53.2 million.

There was a significant drop in expenditure on base metal exploration, from $17.1 million to $12.6 million, indicating the extent to which base metals have fallen out of favour in the wake of a prolonged slump in prices. In contrast, expenditure on gold exploration rose 3.5% to $18.1 million as the strong gold price continued to fuel interest in the old goldfields of New South Wales. Exploration for tin was almost non-existent reflecting the demise of the tin industry in this State following the price collapse in 1985.

The strong focus on gold exploration has been largely responsible for record numbers of exploration licence applications received by the Department. In areas of the Lachlan Fold Belt for example competition for prospective ground is quite fierce. The number of exploration licences in force reached almost 500 by the end of 1987.

Along with gold, the search for platinum has continued at a high level. A number of companies have obtained encouraging results from both hardrock and alluvial prospects on or near basic/ultrabasic intrusive complexes located in a belt between Derriwong (south of Fifield) and Nyngan. These areas of interest include the Tout, Owendale–Hylea, and Honeybugle Complexes. Golden Shamrock has indicated that it may begin an alluvial mining operation in 1988.

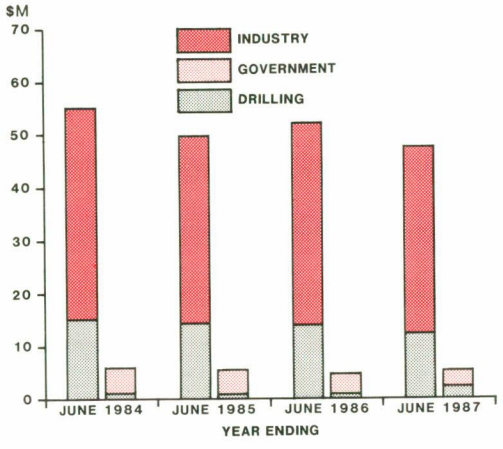
Exploration for heavy mineral sands has been stimulated by high overseas demand, particularly for zircon and also for rutile and monazite. Applications for exploration licences now cover virtually the entire near-shore coast of New South Wales north of Newcastle. Exploration is also being directed towards the Murray Basin and the Great Australian Basin following CRA Ltd's outstanding success in the Murray Basin of Victoria.

Recent research on both sapphire and opal genesis by the Department of Mineral Resources has stimulated exploration for these gemstones. New regulations regarding sapphire exploration announced by the Department in May, 1987 drew a strong response from industry and over 70 Exploration Licence applications have been lodged, mainly in the New England district.

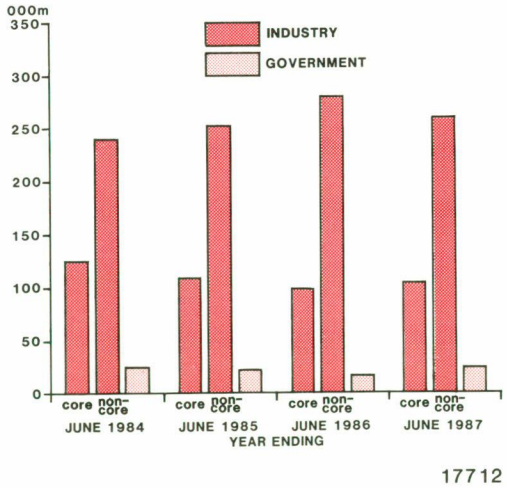
There is a growing awareness of the economic potential of the State's resources of industrial minerals and rocks particularly for those with export potential. Exploration has intensified for economic occurrences of dimension stone (especially granite) and for deposits of high-quality clays.

Petroleum exploration in New South Wales has continued at a reasonable level despite the general downturn in exploration in Australia. There was a decline in the number of kilometres of seismic surveys and the stock market crash in October, 1987 has exacerbated this downturn. The level of drilling also fell with just 3 exploration wells drilled (all in the Gunnedah/Surat Basin) for a total of 4134m.

EXPLORATION EXPENDITURE
BY INDUSTRY AND GOVERNMENT



EXPLORATION DRILLING
BY INDUSTRY AND GOVERNMENT



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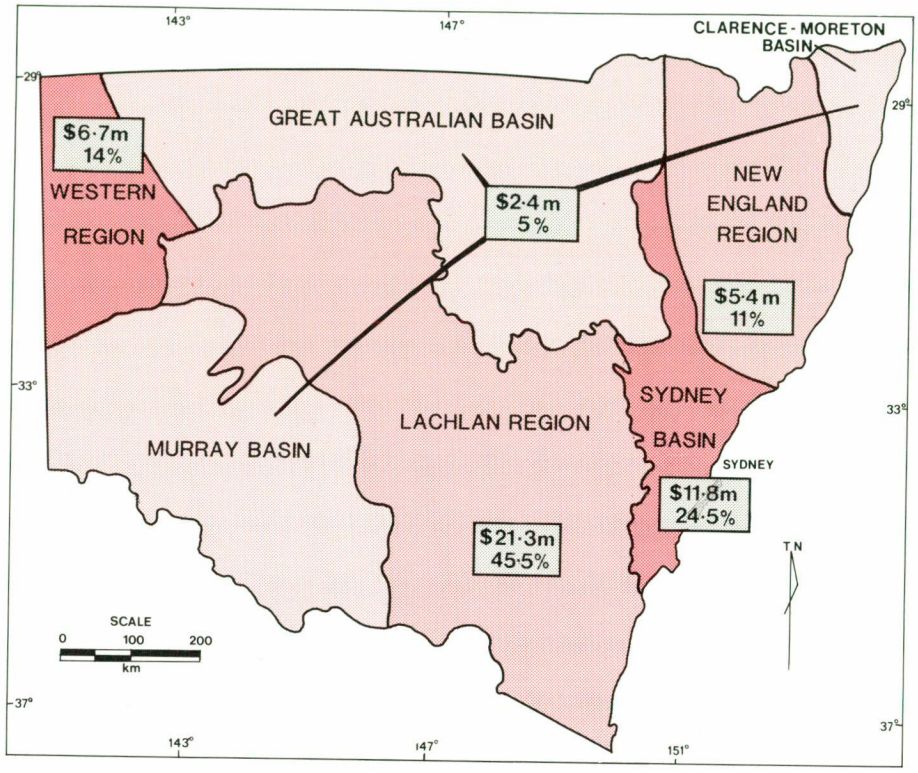
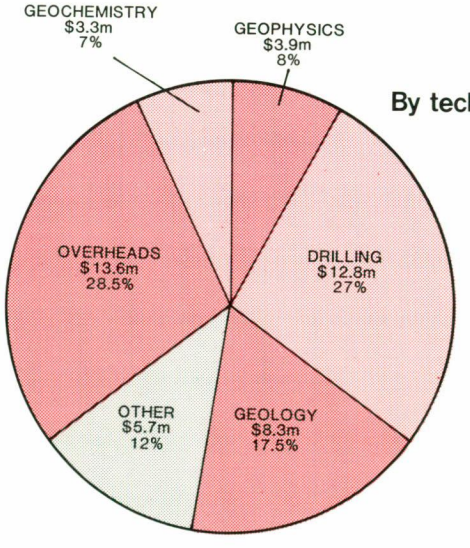
EXPLORATION EXPENDITURE IN NEW SOUTH WALES BY PRIVATE INDUSTRY IN 1986–87



By region



By technical activity

GEOPHYSICS (including airborne, surface and down-hole surveys)

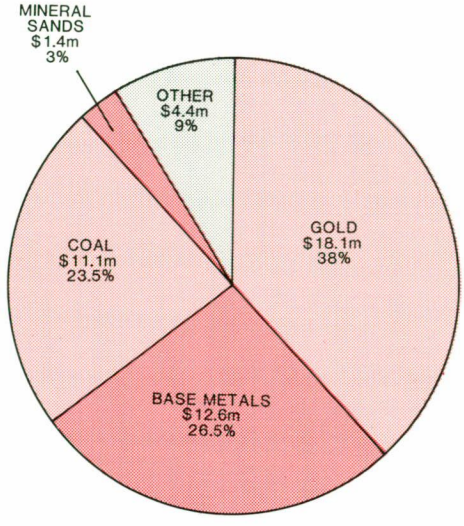
GEOLOGY (mapping, logging of drill core, photo interpretation, petrology)

OTHER TECHNICAL ACTIVITY (including metallurgical, engineering or related studies)

GEOCHEMISTRY (geochemical sampling, assaying and all costs associated with shallow augur and percussion drilling for geochemical purposes)

OVERHEADS (including regional and head office wages and salaries, travel and accommodation, property maintenance, drafting, telephone, etc.)

By mineral



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Outlook

The mineral industry will look towards 1988 with a degree of both apprehension and optimism.

The stock market crash of October 1987 has raised the spectre of a major recession which would have an adverse affect on demand for basic industrial commodities. However, there is no doubt that other factors such as the large trade and current account imbalances which exist in Australia and the major industralised economies are more serious threats to long–term economic stability. Also, because of the strong export–orientation of the mineral industry in Australia, movements in the exchange rate of the Australian dollar will continue to have a profound effect on the economic fortunes of most producers. Except for a brief period following the October fall in share prices the exchange rate generally has been rising. This trend if maintained, will reduce Australian dollar returns for our mineral exports and put further pressure on less efficient producers, particularly in the coal industry.

The coal industry in New South Wales will again be faced with a difficult year which could well lead to further cost–cutting rationalizations and additional closure of unprofitable mines. However there has been continued growth in coal exports (particularly of steaming coal) characterized by reduced dependence on the Japanese market and expansion of shipments to Western Europe and the industrializing countries of Southeast Asia (including the Republic of Korea and Taiwan). The problems associated with excess mine capacity and the poor investment climate will mean that progress on large coal development projects will proceed only very cautiously.

Base metal prices have made a strong comeback starting in late 1986 and returned New South Wales producers to a more profitable position. After a long period of reduced cash flows, during which time producers struggled to reduce costs, the higher price levels will permit the capital expenditure required to further improve productivity.

The base metal producers all have relatively long lives ahead of them, with the exception of the C.S.A. mine near Cobar and the Woodlawn mine near Goulburn where present underground reserves are limited (<10 years)

Most of the new mine developments in the State are open cut gold projects, small to medium–scale mines with less than 10 years of mineable reserves. The Temora and Browns Creek gold mines have identified reserves for about 9 years operation while the Cowarra and Sheahan–Grants mines have reserves for only 4–5 years.

Another five gold mines are due to come on stream in 1988: the Drake gold/silver project (Mt. Carrington Mines) in northern New South Wales; the Mineral Hill gold/copper project (Triako Resources/Cyprus Mines Corporation) north of Condobolin; the London–Victoria gold project (BHP Gold Ltd/Alkane Exploration N.L.) west of Parkes; and the Comet gold mine northeast of Armidale (Mt. Gipps Ltd).

There is good potential for the development of new heavy mineral sands projects in New South Wales provided that a fair resolution of land use conflicts secures prospective coastal areas for exploration and mining.

Within the industrial minerals sector there are excellent opportunities for import replacement (diatomite, peat, dimension stone, feldspar), and for the expansion of production for export markets (gemstones, dimension stone, kaolin). The State's zeolite resources also have good development potential. The Department's release of information on its Natural Zeolite Project in October, 1987 has sparked considerable interest in these minerals which have a diverse and expanding range of applications.

There are encouraging signs that, where opportunities exist, the mineral industry is seeking to add value to the State's resources by secondary processing. The production of mullite from silexite, heat treatment of sapphires, the production of rare earths from monazite, and the production of zeolite–based products are some of the processing opportunities currently being pursued within New South Wales. Continued investment in these projects represents a maturing of the State's mineral economy which will lead to a more stable and diverse mineral resource industry in the future.

ANTIMONY

New South Wales is the major producer of antimony concentrates in Australia. The principal ore material is stibnite (antimony sulphide).

Antimony's traditional use is as a strengthening agent in antimonial lead used in storage battery plates, sheets and pipe, sheathing for electrical cables, and foil. A large proportion of antimony in the world market is recycled.

Antimony compounds are used for flame–proofing, pigments, enamels, glass, vulcanizing and medicines. As much as 75% of the world's production of antimony goes into the making of antimony trioxide which is in increasing demand as a flame retardant, particularly in textiles, plastics, paints, and rubber.

Occurrence

Antimony deposits occur chiefly in the northeastern part of the state (New England Fold Belt). The most important areas include the Hillgrove district east of Armidale, and the Taylor's Arm Province further to the east.

Most of the occurrences are narrow, discontinuous, quartz–vein type deposits within Paleozoic metasediments and are considered to have formed from hydrothermal solutions related possibly to Permian granitic intrusives which crop out widely in these areas.

Several small antimony deposits have been worked in the past in the Central Tablelands, chiefly in the Sofala–Rylstone district, north of Bathurst (Lachlan Fold Belt).

Production

The Hillgrove gold–antimony mine (**New England Antimony Mines N.L.**) remains the only producing antimony mine in New South Wales. In addition to antimony concentrates the mine produces gold concentrates and doré bullion.

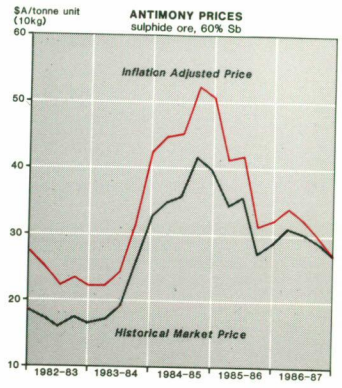
Poor ground conditions encountered when deepening the main access shaft to the Eleanora and Garibaldi lodes slowed production this year. Other mine development work concentrated on preparing access drives to extensions of the mineralization in the Freehold mine and an access drive under the Cosmopolitan workings. Future mine expansion to 65,000 tonnes/year will lead to the progressive opening of a number of old gold workings on the western side of the Bakers Creek gorge including the Black, Syndicate, Sunlight, and West Sunlight lodes.

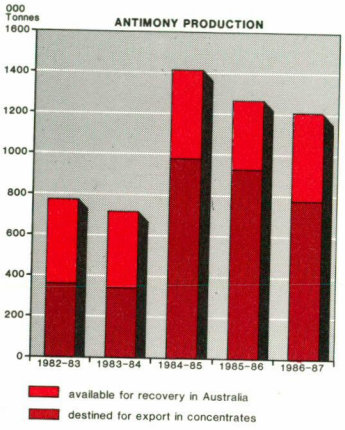
Antimony is also recovered as a by–product of base metal mining at Broken Hill following treatment of lead and lead–zinc concentrates at Port Pirie.

Outlook

The prospectivity for vein–type antimony deposits is considered to be excellent in northeastern New South Wales. However antimony prices have remained relatively static during the past year and exploration activity in the New England area has understandably been focussed on gold. The main antimony prospect, Bradleys No. 1 mine in the Taylor's Arm Province, obtained approval for a small operation in 1986 but development has been delayed pending further exploration by the joint owners, Chase Minerals and Minproc Mining and Processing Services Pty Ltd.

The future for antimony is very much dependent on continued growth in the use of antimony trioxide as a flame retardant rather than growth in its traditional markets.





Producer 1986/87

New England Antimony Mines Ltd
Hillgrove mine, Hillgrove

Ore mined and treated: 37 325 t
Antimony concentrate: **966 t** of 65.6% Sb
Gold/antimony concentrate: **305 t**
(50 g/t Au, 4.4% Sb)

COPPER

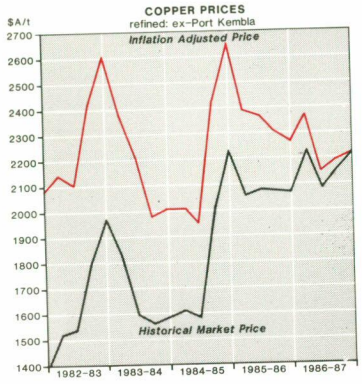
Australia is a small but important copper producer in world terms contributing about 3% of world mine production. In New South Wales the mining of copper actually preceded the mining of gold, with deposits at Copper Hill near Molong first being worked in 1845.

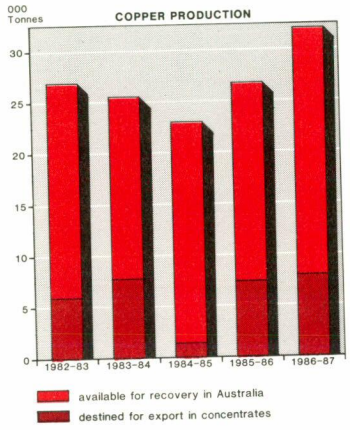
Today most of the copper produced in the State is associated with the massive lead–zinc–copper sulphide deposits near Cobar (CSA mine) and east of Lake George (Woodlawn).

Due to its unique properties, copper has long been an important industrial metal now used largely for the manufacture of electrical conductors in the electronics and communication industries.

Occurrence

The copper deposits in New South Wales are highly diverse in geological age, type of mineralization, and geographical distribution. However, most of the significant deposits occur within the Lachlan Fold Belt.





Producers 1986/87

Cobar Mines Pty Ltd
CSA mine, Cobar

Ore mined: 858 540 t
Ore treated: 858 960 t
Copper concentrate: **46 687 t** (26.4% Cu, 1.6% Pb, 5.1% Zn, 174 g/t Ag)
Lead concentrate: **7 033 t** (43.1% Pb, 1.2% Cu, 13.7% Zn, 371 g/t Ag)
Zinc concentrate: **60 691 t** (50.6% Zn, 0.5% Cu, 1.1% Pb, 33 g/t Ag)

Denehurst Ltd
Woodlawn mine, Tarago

Copper ore
Ore mined: 203 149 t
Ore treated: 389 772 t
Copper concentrate: **34 883 t** (20.9% Cu, 3.4% Pb, 4.2% Zn, 106 g/t Ag)
Zinc concentrate **9 740 t** (41.3% Zn, 6.4% Pb, 1.7% Cu, 95 g/t Ag)

Complex Ore
Ore mined: 469 811 t
Ore treated: 453 790 t
Copper concentrate: **34 022 t** (19.9% Cu, 4.0% Pb, 5.7% Zn, 138 g/t Ag)
Lead concentrate: **32 885 t** (35.7% Pb, 1.5% Cu, 21.9% Zn, 276 g/t Ag)
Zinc concentrate: **77 935 t** (49.2% Zn, 0.6% Cu, 3.0% Pb, 85 g/t Ag)

Porphyry copper systems, the most important in terms of world production, have been identified in the past at Yeoval, Cargo, and Copper Hill, and more recently near Goonumbla, about 25 km northwest of Parkes. The Goonumbla–Coradgery copper–gold deposits represent the first, potentially mineable, porphyry copper deposit in New South Wales.

Copper of economic significance is also found in exhalative massive sulphide deposits within Silurian volcanics of the Captains Flat Trough. The most significant examples of these are at Captains Flat (Lake George mine) and the Woodlawn deposit near Tarago.

The Cobar area has been the State's largest producer of copper ore. A distinct "Cobar–type" deposit has been described which is characterized by strongly sheared zones of sulphide mineralization generally within fine–grained sediments. Mineralization is evidently strongly controlled by structural features and gold is commonly associated with the copper sulphides.

Elsewhere in the Lachlan Fold Belt are copper–gold deposits at Cadia and Browns Creek, south of Orange, which display characteristics of several genetic styles. The Browns Creek deposit consists of gold, silver, and copper mineralization hosted by skarn and associated breccias although the current open cut operation there is exploiting only the gold.

The copper deposits of the New England Fold Belt are of equally diverse genetic type but are not as economically important.

Minor copper mineralization is widespread in the Adelaide and Kanmantoo Fold Belts in the far west of the state but by far the greatest production of copper has been as a by–product of treatment of the silver–lead–zinc ores from the Broken Hill lodes.

Production

New South Wales currently accounts for about 12% of Australian copper production. Apart from the minor by–product output of copper from Broken Hill concentrates (which historically makes Broken Hill the second largest copper producer in the State) current production is from the CSA mine 11 km north of Cobar and the Woodlawn mine south of Goulburn.

A major change in ownership occurred in July 1987 when the Woodlawn mine was bought from its parent, Australian Mining and Smelting Ltd (a wholly–owned subsidiary of CRA Ltd), by **Denehurst Ltd** for around $11 million. Denehurst Ltd was listed on the Australian Stock Exchange with an initial market capitalization of $30 m with the principal purpose of applying a radically new technological process to recover minerals from the partially oxidized ores and mineral tailings at Woodlawn. The fine–grained ore at Woodlawn has presented metallurgical problems, over the past ten years, that have impeded optimum mineral recoveries and led to the accumulation of a rich tailings resource. The new minerals processing technology has already proved successful in pilot plant trials on Woodlawn tailings carried out over the past several years.

The new owners have successfully completed the transition from open pit to underground mining and have made some improvements in the conventional flotation circuit. The mine is currently mining at its target rate of 500,000 tonnes/year and the company is projecting a healthy operating profit for the year given no adverse movements in metal prices. About $11.5 million will be spent on installing a 1 million tonne per year processing plant to treat the 6.3 million tonnes of tailings at Woodlawn.

CRA Ltd still operates the CSA mine in Cobar through its wholly–owned subsidiary, **Cobar Mines Pty Ltd**. Raw ore production was boosted dramatically during 1986/87 (up almost 70% to 858,000 tonnes) which follows from installation of crushing and ore handling facilities in the lower levels. Mineral grades in the Western lode are diminishing with depth but this has been compensated by the delineation of high copper grades in the QTS lode which is still open at depth.

Copper concentrates are smelted and refined at Port Kembla by the **Electrolytic Refining and Smelting Company of Australia Ltd**, a wholly–owned subsidiary of Australian Mining and Smelting Ltd (100% CRA Ltd).

Outlook

The persistent draw–down on inventories in world copper markets, in part due to the squeezing out of many of the high–cost copper operations in the past few years, appears to have had its effect. Copper prices began to show signs of recovery near the end of the financial year before really taking off towards the end of 1987. The supply/demand imbalance may only be temporary, however, as the surge in price may be strong enough to allow re–opening

of some of the unused capacity. In addition, a number of large, low–cost copper mines in Chile and North America are scheduled to come on–stream in the near future. Nevertheless, the significant price rise will enable both the CSA mine and Woodlawn mine to achieve more acceptable levels of profitability.

At Woodlawn, Denehurst Ltd expect to commission at least a portion of the new tailings retreatment plant by the end of 1988 and the company is very optimistic about Woodlawn's financial future.

Peko–Wallsend Ltd have reached an advanced stage of feasibility studies on the Goonumbla gold–copper deposits near Parkes (Parkes Project). The mineable reserve contained in the three largest deposits is approximately 56 million tonnes with average grades of just over 1% Cu and about .55 g/t Au.

It is expected that the deposits will be developed initially as an open cut gold operation to exploit the higher gold grades that occur close to surface.

GOLD

The almost continuous chain of gold discoveries spanning the latter half of the last century in New South Wales provided much of the early impetus for the State's economic and social development. However gold output declined rapidly after 1910 and, until very recently, production in the State was largely confined to gold recovered as a by–product from treatment of base metal sulphide concentrates.

Since 1985, the combined effect of Australian currency falls, rising world gold prices and new treatment technologies, has once more made gold mining in New South Wales an attractive enterprise.

Although officially demonetized gold remains for many the only true measure of wealth and is held by central banks of a large number of countries as part of their national reserves. Gold is also finding increased application in advanced technologies such as the computer, electronics and aerospace industries due to its high electrical conductivity and resistance to corrosion.

Occurrence

Gold is widely distributed in New South Wales both in primary and alluvial deposits.

Primary Gold Deposits: These form by hydrothermal processes related to igneous or metamorphic activity and are generally differentiated as vein or "reef" deposits, massive sulphide (commonly stratiform) deposits, or disseminated deposits. These deposits are hosted by a wide variety of rocks and are characterisically enriched in gold close to the surface as a result of surface weathering and oxidation processes.

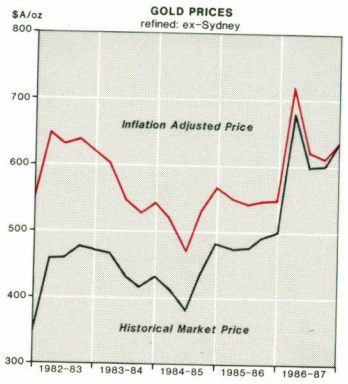
Gold associated with quartz reefs is the most common type of occurrence in New South Wales. Historically the most important examples are the gold fields at Hill End – Tambaroora, Hillgrove, Grenfell, Wyalong, Adelong, and the Forbes–Parkes area.

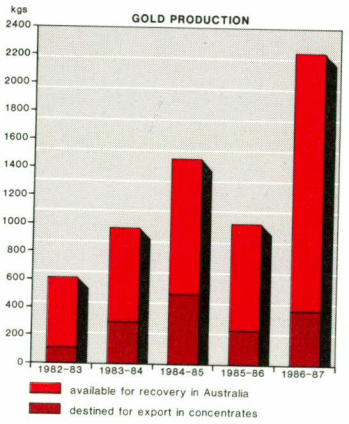
The Cobar region contains numerous examples of massive sulphide and stockwork type gold deposits. The mineralization is often localized in zones of intense shearing which obscures the primary association. The gold/base metal association is characteristic of the Cobar area and is exemplified by The Peak deposit which is potentially the most significant of the recent gold discoveries in the State.

Disseminated deposits, in which gold is widely dispersed in the host rocks or occurs in a series of closely–spaced veins or shears, have become the most important exploration target in recent years. Examples of occurrences of this type that were mined in the past are deposits in the Pambula gold field and at Peak Hill and Drake.

These deposits are generally much lower grade than vein–type deposits and the technologies for large scale extraction and treatment of the ores have only been developed in the last few decades. Low–grade, high–tonnage disseminated gold deposits characteristically form in near surface zones of hydrothermal activity associated with volcanism. The deposits are referred to as "epithermal" because the hydrothermal systems which produce them are relatively low–temperature. With increasing depth, epithermal deposits grade into porphyry copper deposits. The recent recognition of epithermal–type mineralization at Gidginbung near Temora has led to a resurgence of interest in low–grade, high–tonnage disseminated gold deposits in New South Wales.

Alluvial gold deposits: These are found mainly in ancient or present day river courses, on beaches, or in lakes. Many of the important reef deposits were discovered following the initial working of alluvial





Producers 1986/87

Paragon Gold Pty Ltd
Temora gold mine, n. Temora

Ore mined: 226 682 t (Feb-June, 1987)
Ore treated: 162 017 t
Dore bullion: **1274 kg** (449.2 kg Au, 799.3 kg Ag)

BHP Gold Mines Ltd
Brown's Creek gold mine, n. Blayney

Ore mined: 51 810 t (skarn ore only)
Ore treated: clay ore 29 438 t
skarn ore 26 878 t
combined ore 8 250 t

Concentrates
Dore bullion (from clay ore): **180.3 kg** (41.4% Au, 9.25% Ag)
Flotation concentrate (from skarn ore): **67.8 t** (322 g/t Au, 673 g/t Ag, 32.0% Cu)
Gravity concentrate (from combined ore): **8.6 t** (5931 g/t Au, 1673 g/t Ag, 11.4% Cu)

Horizon Pacific Ltd
Cowarra gold mine, n. Bredbo

Ore mined: 37 844 t
Ore treated: 38 862 t
Bullion: **215.5 kg** (92.5% Au)

New England Antimony Mines N.L.
Hillgrove gold/antimony mine, Hillgrove

Ore mined and treated: 37 325 t
Concentrates
Gold concentrates: **12 t** (4160 g/t Au) (July Dec. 1986)
Dore bullion: **74.3 kg** (83.2% Au) (Jan. June 1987)
Gold/antimony concentrate: **305 t** (50 g/t Au, 4.4% Sb)
Tailings treated: 2302 t yielding **462 t** of concentrate (124 g/t Au)

New Occidental Tailings Joint Venture
Ranger Exploration N.L. (operator)
New Occidental tailings project, Cobar

Tailings treated: 470 793 t (Jan. June '87)
Dore bullion: **627.6 kg** (65.5% Au, 12.7% Ag)

Epoch Mining N.L.
Canbelego tailings project, Canbelego

Tailings treated: 60 000 t
Dore bullion: **332 kg** (34.0% Au, 43.9% Ag)

Cluff Minerals (Aust) Pty Ltd

West Wyalong tailings project West Wyalong (JV between Cluff Resources Pacific Ltd and Alkane Exploration N.L.)

Tailings treated: 110 500 t (Jan. June '87)
Dore bullion: **71.0 kg** (61.4% Au, 19.6% Ag)

Mitchell's Creek tailings project, Bodangara

Tailings treated: 82 500 t
Dore bullion: **328.1 kg** (17.8% Au, 28.7% Ag)

Lachlan Valley Gold Mines Pty Ltd
Lachlan tailings project, Calarie

Tailings treated: 28 000 t
Dore bullion: **25.5 kg** (72.5% Au, 13.4% Ag)

TJ & PV Nunan Pty Ltd
Bingara mine (placer), Gouron Gouron Ck

Alluvial wash mined: 86 710 t
Wash treated: 97 119 t
Concentrate: **60.3 kg** (82.8% Au)

deposits. The ancient deep leads were worked in the Parkes–Forbes area and at Gulgong, Uralla, Grenfell, Temora, Adelong, Tibooburra, Tallawang and Tooloom–Pretty Gully.

Recent alluvial deposits have been worked along many of the river systems in New South Wales, the most productive being the Macquarie, Turon, and Shoalhaven Rivers.

Production

Gold output in New South Wales more than doubled this year (1986/87) reflecting the successes arising from the recent surge in gold exploration. Much of this increase is due to **Paragon Resources** open cut operation near Temora which came on stream early in 1987. The Temora mine is now the largest gold producer in the State. Further upgrading of the plant at a cost of $2 million is due to be completed in May 1988 which will increase capacity to 700,000 tpa, lifting gold output from 55,000 oz/year (1710 kg) to 60,000 oz/year (1870 kg).

The Brown's Creek gold mine near Blayney, operated by **BHP Gold Mines Ltd**, is a much smaller open cut which has been in operation since 1982. Expansion of the open pit followed purchase of the mining leases by BHP Gold Mines Ltd in September 1986. Recent drilling has doubled the reserves to 459,000 tonnes @ 6 g/t Au to a depth of 85 m. The mine produces doré bullion from mineralized calc–silicate (skarn) and gold concentrates from gravity separation of both skarn material and clay–altered breccias.

Also in the same area south of Orange, the Sheahan–Grants open cut gold mine is about to begin production. Most of the major plant for this project was commissioned in late 1987. This mine is a joint venture between **Climax Mining Ltd** (50%), **Cyprus Minerals Australia Co.** (25%) and **Arimco** (25%). A projected output of 43,000 ounces (1340 kg) of gold in the first year of operation will make it the second largest gold producer in the State. The carbon–in–pulp treatment plant has been designed to handle both the oxidized and primary (sulphide) ore. Proven reserves are 1.4 mt @ 4.1 g/t Au which will provide a mine life of four years.

The Hillgrove gold–antimony mine (**New England Antimony Mines N.L.** —wholly–owned by Vam Limited) is based on a number of underground workings that were first mined in the 1880's. Ore production at Hillgrove increased 25% from the previous year and mine expansion (reported under "Antimony") is planned to increase total mine production to 65,000 tpa by 1988/89.

Although traditionally a producer of antimony concentrates more than 60% of the company's revenue (1986/87) has come from the sale of gold concentrates. In early 1987, the company commissioned a plant to smelt bullion bars from the gold recovered in gravity concentrates and, following pilot plant tests, it is planned to install a circuit to produce gold bullion from gold leached from the antimony concentrates.

The only other underground gold mine currently operating in the State is the Cowarra gold mine (**Horizon Pacific Ltd**), north of Cooma, which started production in 1986 from underground workings at the old Victoria gold mine. The carbon–in–pulp treatment plant produces gold bullion bars. The company is testing for extensions to the mineralization to prolong the mine's life beyond the 3 or 4 years indicated by the current reserves.

A number of tailings retreatment projects have also contributed to the State's gold production. The most recent, and largest, of these is the New Occidental Joint Venture near Cobar operated by **Ranger Exploration N.L.** This project retreats tailings at the New Occidental mine which was the largest single producer of gold in New South Wales.

Cluff Minerals (Aust.) Pty Ltd produces doré bullion from treatment of tailings at Mitchell's Creek near Wellington and, in a joint venture with **Alkane Exploration N.L.**, from treatment of tailings at West Wyalong. **Epoch Mining N.L.'s** tailings retreatment project at Canbelego is nearing completion and the company has started a small open cut over the old Mount Boppy gold mine in a joint venture with Mount Boppy Mines Ltd.

Outlook

The continued strength of world gold prices has revitalized the mining sector in New South Wales. A strong nucleus of exploration and mining companies in the State have been persistent in proving up a reserve base sufficient to support mine development on their leases with at least a half dozen different projects likely to be approved in 1988.

Drake Project. After a series of false starts **Mt Carrington Mines Ltd** expect to start a series of open cuts on four discrete deposits north of Drake. Three of these, the Strauss, North Kylo, and Guy Bell deposits are grouped relatively close together while the Lady Hampden silver/gold deposit is 1.5 km northeast of this group. Total mineable reserves are 1.4 mt averaging 2.03 g/t gold. Mt Carrington Mines also plans to

New Occidental open cut and main shaft looking south. The mine produced 666,000 oz of gold and closed following an underground collapse in 1953. The tailings seen in the background are now the focus of the largest tailings retreatment project in New South Wales.

treat 20,000 t of waste rock grading 3.5 g/t Au from the Old Lady Jersey workings 8 km south of Drake. The company expects to treat 200,000 tonnes/year of gold ore and 100,000 tonnes/year of silver ore concurrently in the processing plant.

Mineral Hill. **Triako Resources Ltd** have boosted the reserves on their Mineral Hill prospect (70 km north of Condobolin) to 820,000 tonnes @ 4.6 g/t Au and expect to obtain development approval by March 1988. The company is planning an open cut operation which will provide 200,000 tpa to the carbon–in–pulp treatment plant giving a mine life of four years. The deposit also contains significant grades of copper and underground mining to develop the full potential of the combined resource has not been ruled out.

London–Victoria Project. **Alkane Exploration N.L./BHP Gold Mines Ltd.** The joint venture expects to obtain development approval in 1988 leading to full production in early 1989. BHP Gold Mines Ltd spent $600,000 to acquire its interest in the project and carried out a further program of drilling to expand mineable reserves to 2.4 million tonnes @ 1.86 g/t Au. The higher grade material (1.5 mt @ 3.5 g/t Au) will be treated by CIP methods at 300,000 tonnes/year while the lower grade ore (up to 1 mt @ .8 g/t Au) will be subjected to heap leaching. The joint venture expects to produce about 22,000 oz/year.

Peak Hill. **Alkane Exploration N.L./Molopo Australia Ltd.** The joint venture has announced intentions to develop this resource which has mineable reserves of 2.4 million tonnes @ 1.4 g/t in the oxidized zone. The Peak Hill deposit shares a similar geological setting with Geopeko Ltd's Goonumbla–Coradgery copper–gold deposits 30 km to the south. The recent withdrawal of Geopeko Ltd from the joint venture is likely to delay development of this project.

Lucky Draw. **Renison Goldfields Consolidated Ltd.** This deposit, at the southern end of the Hill End synclinorial zone near Burraga, has open cut reserves of 1.2 million tonnes @ 3.5 g/t. The company is in the process of completing an Environmental Impact Statement in the expectation of beginning construction of a treatment plant before the end of 1988.

The Peak. **AM & S Mining Ltd.** Although production will not commence until the early 1990's a major exploratory development of this large underground deposit south of Cobar is now under way. The ore body lies between 270 and 650 metres below surface and contains reserves of 4.5 million tonnes @ 6.5 g/t gold with significant base metal values. The contract to sink the 5 metre diameter shaft to provide access to the ore body is being carried out by Allied Construction Pty Ltd. The expected $17.5 million expenditure will cover two years work during which time the shaft could be pushed to a depth of 700 metres.

The Comet mine. This mine about 35 km northeast of Armidale, was last worked as a small underground operation in 1981. **Mount Gipps Ltd** have identified reserves of about 160 000 tonnes @ 9.4 g/t. The deposit is a banded quartz vein up to 1.5 m wide and dipping at 45°. The company is also negotiating to acquire the **Brackins Spur** deposit near Hillgrove from Omega Mines Ltd with the aim of developing it in conjunction with the Comet mine. Current exploration has identified a resource of about a half million tonnes of ore @ 6 g/t Au.

In addition there are a host of other prospects where drilling results have been extremely promising. These include **Broula King** (Lachlan Resources Ltd/Cluff Minerals Australia Ltd); **Dobroyde** (Little River Resources Pty Ltd) **Lake Cow** (Geopeko Ltd); Gilgunnia (Epoch Minerals Exploration N.L.); **Cullinga** (Freeport (Aust.) Ltd), the **Glendale–Forest Reefs–Burnt Yards** area (Cyprus Minerals Australia Co./Climax Mining Co. Ltd); and **Adelong** (Carpentaria Exploration Co. Pty Ltd/Pan Australian Mining Ltd).

Particularly encouraging is the growing recognition that the thermodynamic conditions that appear to have favoured the type of gold mineralization prevalent in Archean greenstone belts and the younger volcanic belts of the Pacific rim may also have given rise to deposits of economic dimensions within Paleozoic rocks of the Lachlan and New England Fold Belts.

The recent surge in investment for grass roots exploration, fueled by capital raised in the share market, has largely dried up since the October market crash. However, domestic gold prices in general have been rising (A$675/oz at the close of 1987) and, with miners enjoying an exclusive tax exemption on gold mining profits the emphasis on gold exploration is likely to increase. Projects that have come on stream recently are now providing cash flows for further exploration and gold production in New South Wales can be expected to provide an important source of export revenue in the medium term.

LEAD AND ZINC

Australia is the world's second largest mine producer of lead and third largest mine producer of zinc. Over half this production is from New South Wales which boasts the world's largest individual occurrence of lead–zinc–silver at Broken Hill.

The primary ore minerals, galena (PbS) and sphalerite (ZnS) are generally found together in the same orebody. Often the ore mineralogy of a base metal deposit is quite complex with economic concentrations of silver, gold, and copper commonly associated with the lead–zinc mineralization. Minor amounts of other metals such as cobalt and cadmium may also be produced as a by–product of mining.

Lead is an important industrial metal with a diversity of applications. Almost 60% of lead goes into the making of storage batteries. Other major uses are for pigments and compounds, alloys, electrical cable sheathing, and petrol additives.

Zinc is even more important than lead in terms of annual tonnage consumed on the world market. The main areas of usage are as zinc coatings on fabricated steel products to prevent corrosion, and in zinc and brass castings.

The applications for lead and zinc are suffering increased competition from other materials such as plastics. Also, as both lead and zinc are used in many basic industries, growth in consumption is largely dependent on growth in the world economy.

Occurence

There are three major areas of base metal mineralization in New South Wales —the Broken Hill Block within the Adelaide Fold Belt in the far west of the State (Proterozoic); Devonian Cobar Supergroup sediments within the Lachlan Fold Belt in the central part of the State; and Silurian sediments and volcanics of the Captain's Flat Trough, also within the Lachlan Fold Belt and in the southeast part of the State.

These areas contain the major economic concentrations of base metals but minor production has also been recorded from numerous other deposits in the Lachlan and New England Fold Belts.

The major deposits differ considerably in their styles of mineralization. The deposits at Broken Hill have been affected by high–grade regional metamorphism and are generally coarse–grained ores. The "Cobar–type" deposits, in the main, are located in zones of intense shearing. The deposits of the Captains Flat Trough are more obviously associated with submarine acid volcanism. Both the Cobar and Captains Flat–type deposits are relatively fine–grained ores, characteristic of the deposits in the Lachlan Fold belt and one which poses metallurgical problems in their treatment.

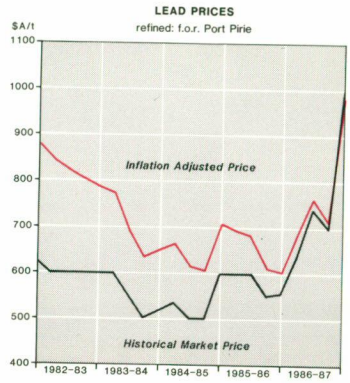
Production

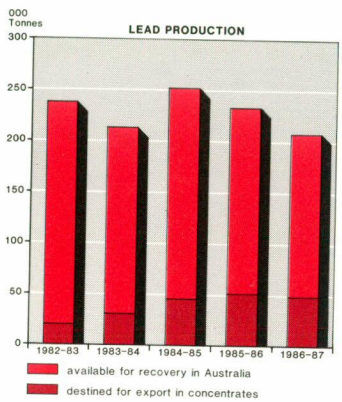
Two companies, **Conzinc Rio Tinto of Australia (CRA)** and **North Broken Hill Holdings Ltd,** account for most of the mine production of lead and zinc ores in New South Wales. CRA through its subsidiary, **Australian Mining and Smelting Ltd (AM & S),** runs the ZC mines at Broken Hill and the CSA mine at Cobar. In a major rationalization of its base metal operations, CRA sold the Woodlawn mine near Goulburn to **Denehurst Ltd** (see Copper). The purchase was completed in July 1987 and came at a time when the Woodlawn mine had just made a successful transition from open cut to underground mining. North Broken Hill Holdings Ltd operates the North mine at Broken Hill and the Elura mine northwest of Cobar.

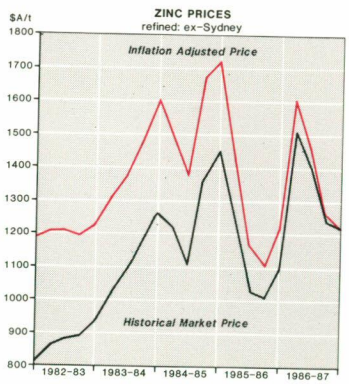
The only other producer of lead and zinc concentrates is the South mine at Broken Hill operated by **Minerals Mining and Metallurgy Ltd** (77% owned by Poseidon Ltd). M.M.M. mines the central part of the Broken Hill lode where the orebody is closest to the surface. Mining in the Blackwoods open cut, which has been the mine's main source of ore since 1976, is due to be completed by June 1988. A further 2.8 million tonnes of overburden has been stripped from the Kintore open cut in preparation for full production. The Kintore open cut will be the mine's main source of ore following the completion of the Blackwoods pit. M.M.M. also retreats material from the 1A tailings dump.

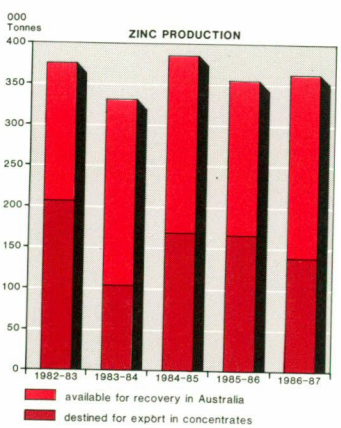
Time lost due to industrial disputes, which carried over into 1986/87, affected output from the underground mines at Broken Hill. However all base metal producers in New South Wales improved their profitability substantially in the past year mainly as a result of a rise in lead and zinc prices.

Following the upgrading of the NBHC concentrator in 1986, CRA has committed a further major expenditure to upgrade the NBHC shaft which will increase the haulage rate from 1.4 million tonnes/year to 2.9 million tonnes/year by June 1988. This continued investment represents a major effort by CRA towards lifting the productivity of the ZC mines.









BASE METAL ORE RESERVES IN NEW SOUTH WALES

		Recoverable ore reserves: Proved	Grade	Recoverable ore reserves: Probable	Grade
Broken Hill					
Z.C. Mines* AM & S Ltd (CRA Ltd)		28.9Mt	8.0% lead 10.5% zinc 70g/t silver	12.2 Mt	5.0% lead 10.0% zinc 50g/t silver
North mine † North Broken Hill Holdings Ltd		4.2Mt	12.1% lead 9.6% zinc 192g/t silver	2.1Mt	10.1% lead 7.7% zinc 140g/t silver
South mine + Minerals Mining & Metallurgy Ltd	Blackwoods pit			0.275Mt	3.9% lead 4.9% zinc 97g/t silver
	Kintore area (above 4 Level)			0.53Mt	5.2% lead 5.0% zinc 160g/t silver
				0.50Mt	200g/t silver
				55,000 t	10.6% lead 130 g/t silver
Cobar					
Elura mine † North Broken Hill Holdings Ltd	main orebody	20.0Mt	6.0% lead 8.7% zinc 150g/t silver	4.6Mt	6.5% lead 8.3% zinc 47g/t silver
	supergene zone	47,200t	9.9g/t gold 7.6% lead 0.1% zinc 3,290g/t silver	possible 16,300t	13.0% lead 3,000g/t silver 9.0%g/t gold 1.4% copper
C.S.A. mine * AM & S Ltd (CRA Ltd)		1.1Mt	2.6% copper 2.0% zinc 0.3% lead	0.7Mt	1.8% copper 3.2% zinc 1.5% lead
Woodlawn mine * Denehurst Ltd	copper ore	0.1Mt	2.7% copper 18g/t silver	0.03Mt	2.5% copper 20g/t silver
	complex ore	0.91Mt	1.5% copper 4.5% lead 11.2% zinc 93g/t silver	1.44Mt	1.4% copper 5.0% lead 12.2% zinc 110g/t silver
	tailings resource	6.3Mt	0.4% copper 1.3% lead 2.7% zinc 34g/t silver		

* CRA Ltd Annual Report 1986, 1987. CRA Ltd sold the Woodlawn mine to Denehurst Ltd in July 1987.
† North Broken Hill Holdings Ltd Annual Report 1987.
\+ Minerals Mining and Metallurgy Ltd Annual Report 1987.

At the North mine, development of the Fitzpatrick area by North Broken Hill Holdings Ltd has continued with an extensive program of raiseboring to improve the circulation of cool air, and further driving of the 36 level incline to improve access to primary stoping areas.

In addition to primary mining of new ore the company continued with remnant undercut and fill and timber stoping. North Broken Hill Holdings Ltd also mines oxidized ore from the No. 1 Shaft Area open pit.

At Cobar, CRA's extensive development of the lower levels at the CSA mine completed in 1985 has resulted in a substantial rise in production for 1986/87. North Broken Hill Holdings Ltd's Elura mine also achieved record production for the year and the mine's profitability was further boosted by continued mining of the silver–rich supergene zone capping the main orebody.

The Woodlawn mine near Goulburn entered its first year as an underground mine under the control of Denehurst Ltd whose chief objective is to apply new treatment technology to the 6 million tonnes of tailings at Woodlawn (see Copper). Underground operations are now producing ore at an annual rate of 500,000 tonnes/year.

Almost all the lead concentrates from the Broken Hill mines are railed to Port Pirie, S.A., where **Broken Hill Associated Smelters Pty Ltd** (70% AM & S Ltd, 30% North Broken Hill Holdings Ltd) operates

Australian Mining and Smelting Ltd's new tailings dam at Z. C. Mines, Broken Hill.

Producers 1986/87

Australian Mining and Smelting Ltd (AM&S Ltd)

ZC Mines, Broken Hill

Ore mined: 1 579 119 t
Ore treated: 1 524 026 t

Concentrates
Lead concentrate: **96 809 t** (69.1% Pb, 4.5% Zn, 584 g/t Ag)
Zinc concentrate: **239 073 t** (1.2% Pb, 50.5% Zn, 25 g/t Ag)

Tailings retreated: 48 676 t
Lead middlings: **2 607 t** (45.9% Pb, 10.7% Zn, 517 g/t Ag)
Zinc middlings: **7 116 t** (38.3% Zn, 13.6% Pb, 718 g/t Ag)

Cobar Mines Pty Ltd
(whollyowned subsidiary of AM&S Ltd)

CSA mine, Cobar
Production figures reported under "Copper"

North Broken Hill Holdings Ltd

North Broken Hill Ltd
North mine, Broken Hill

Ore mined: 417 187 t
Ore treated: 414 635 t
Concentrates
Lead concentrate: **61 662 t** (73.2% Pb, 4.9% Zn, 1104 g/t Ag)
Zinc concentrate: **64 067 t** (1.9% Pb, 52.2% Zn, 50 g/t Ag)
No. 1 Open Pit
Material treated: 44 248 t
Lead/silver concentrate: **2 235 t** (31.3% Pb, 19.6% Zn, 1325 g/t Ag)
Low grade zinc concentrate: **493 t** (32.8% Zn, 19.8% Pb, 461 g/t Ag)

Electrolytic Zinc Co. of Australia Ltd
(wholly owned subsidiary of North Broken Hill Holdings Ltd)
Elura mine, n. Cobar

Ore mined:
Lode ore: 1 233 069 t
Supergene ore: 30 384 t

Concentrates from lode ore
Lead concentrate: **107 042 t** (45.8% Pb, 5.1% Zn, 836 g/t Ag)
Zinc concentrate: **183 123 t** (48.2% Zn, 3.0% Pb, 102 g/t Ag)
Silver concentrate: **5 306 t** (16 700 g/t Ag, (from supergene ore) 18.4% Pb, 6.3% Cu)

Minerals Mining & Metallurgy Ltd
South mine, Broken Hill

Oxidized/sulphide ore mined: 290 949 t
Ore treated: 260 982 t

Concentrates
Lead middlings: **1 784 t** (28.3% Pb, 1.8% Zn, 366 g/t Ag)
Lead zinc middlings: **23 276 t** (32.1% Zn, 21.8% Pb, 505 g/t Ag)

Tailings retreated: 228 829 t
Zinc middlings: **24 799 t** (34.8% Zn, 17.3% Pb, 685 g/t Ag)

Denehurst Ltd
Woodlawn mine, Tarago

Production figures reported under "Copper"

the world's largest lead smelter and refinery and an electrolytic zinc refinery.

About 75% of the lead concentrates from the Elura mine are exported with the balance going to Port Pirie. Lead concentrates from Woodlawn and the CSA mine are railed to the Cockle Creek lead smelter near Newcastle operated by **Sulphide Corporation Pty Ltd** (100% AM &S Ltd). These concentrates are refined either at the BHAS refinery at Port Pirie or overseas. Approximately 60% of zinc concentrates from New South Wales mines are smelted and refined in Australia. Of these almost two–thirds were treated at North Broken Hill Holdings' Risdon works in Hobart and the remainder at the Cockle Creek zinc refinery.

Lead–zinc middlings from the South mine in Broken Hill are sold to the AM & S smelter in the U.K. or railed to the Cockle Creek lead smelter.

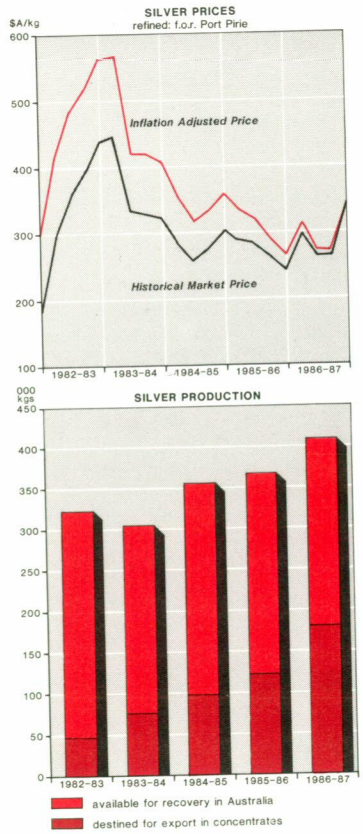
Outlook

Base metal prices on world markets quite accurately reflect the balance between supply and demand. The rise in both lead and zinc prices in 1986 was attributed to supply constraints due to industrial disputes or mine closures in some of the major producer countries (particularly the strike affecting Cominco's lead–zinc smelter in Trail B.C.) Zinc prices subsequently slumped following resumption of supply but lead prices continued to hold firm in 1987.

Demand for lead and zinc in their traditional applications has remained strong and prospects for expanding the range of useage are promising, particularly for zinc. However, the outlook for base metal markets has been made more unpredictable following the share markets crash of October, 1987. There are now very real fears of a worldwide recession or at least a slowing of economic growth which would undermine demand for industrial commodities such as base metals.

Nevertheless, the general improvement in prices has improved the financial position of the State's base metal producers and allowed companies to make the capital expenditures needed to improve productivity.

SILVER



Silver is one of the so–called precious metals because of its relative scarcity and aesthetic qualities. Silver's physical properties make it ideal for a variety of industrial applications, the most important of which are the photographic and electrical industries.

In New South Wales there are no significant mining operations based solely on silver. Silver is produced as a by–product of lead–zinc, copper, and gold mining.

Production

Silver output increased to over 400,000 kilograms in 1986/87 reflecting the increased production of lead and zinc concentrates. Historically, about half the total Australian production of silver has been mined from Broken Hill.

North Broken Hill Holdings' Elura mine near Cobar has continued to exploit the supergene enrichment zone capping the orebody which contains very high silver grades. In 1986/87 the Elura mine accounted for 48% of silver produced in New South Wales. The Broken Hill mines (Zinc Corporation, North and South mines) contributed 42% of the total with most of the remainder coming from the Woodlawn and CSA copper – lead – zinc mines.

Only a small amount of silver (.5%) is currently produced from gold mining and gold tailings retreatment projects.

Outlook

The rise in world silver prices have been steady if unspectacular since about the middle of 1986. Movements in the silver price over the past few years have corresponded roughly to movements in the gold price indicating a certain demand for silver as a hedge against inflation.

Future output of silver from New South Wales will be tied to production levels of the base metal mines. The development of the Drake gold–silver deposits has been delayed to accommodate changes made to the mine plan. Mt. Carrington Mines Ltd now plan to develop the Lady Hampden silver – gold deposit to the west (see Gold Outlook —Drake Project). The company expects to produce approximately 6.5 tonnes of silver during the first year of mining the Lady Hampden open cut.

TIN

Tin producers in New South Wales have not fared well following on from the drastic slump in tin prices which had resulted from the failure of the International Tin Council (ITC) to deal with the supply of tin flooding the market. With prices at little more than half of the pre–crash level, in mid–1985, the tin mining industry in New South Wales is virtually non–existent.

One of the factors contributing to the tin crisis has been the steady decline in demand for tinplate, traditionally the chief market for tin. Some of this decline has been taken up by an increase in the use of tin in solders, (now the most important end use in Japan and the United States), and tin–based chemicals.

Occurrence

The tin deposits of New South Wales occur in the central west and New England areas.

In the central west most of the production has come from three fields; Tallebung, Kikoira–Gibsonvale, and Ardlethan. Both primary and alluvial deposits are known from these areas, the primary deposits being genetically related to granitic intrusions and occuring generally as veins and pipes. With the exception of Ardlethan, the major proportion of tin production was derived from the alluvial deposits. Ardlethan was for many years the most important primary tin deposit in the State.

The main tin deposits of the New England area occur in the Torrington, Emmaville, Tingha, Stannifer, Stannum, and Wilsons Downfall districts. At most of these locations the production from alluvial deposits has far exceeded that from primary deposits.

Production

Output of tin in 1986/87 consisted solely of the tail–end of production from the Ardlethan tin mine which was closed by Aberfoyle Ltd in August 1986 and a minor amount of concentrates from alluvial wash mined by Metals Exploration Ltd at Gibsonvale.

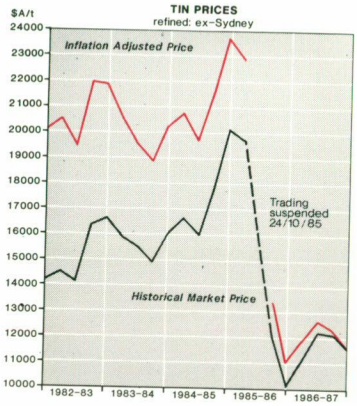
14 small alluvial mining operations, 11 of these in the New England area and in the central west had ceased operations by the middle of 1986. Only a substantial increase in the price of tin will allow these small miners to start operating again.

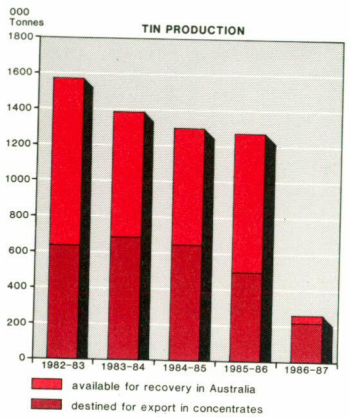
In November, 1987 Ardlethan Tin Ltd was purchased from Aberfoyle Ltd by **Republic Resources (Aust.) N.L.** The new owners plan to retreat the tailings at Ardlethan in conjunction with alluvial mining commencing in 1988.

Outlook

Until the surplus supplies of tin overhanging the market are reduced, little improvement can be expected in the tin price. The effects of the lower price have not yet resulted in any significant rise in the level of tin consumption indicating that it may take several years before equilibrium is established. Moreover the increase in efficiency to cut production costs achieved by those mines that have survived will mean that the long–term tin price is unlikely to return to the levels experienced in the early 1980's, even with the elimination of the stock overhang.

In the prevailing climate there are no near–future development plans for the two major hardrock tin prospects in New South Wales, at Taronga in the New England area of New South Wales and near Doradilla, southeast of Bourke.





Producers: 1986/87

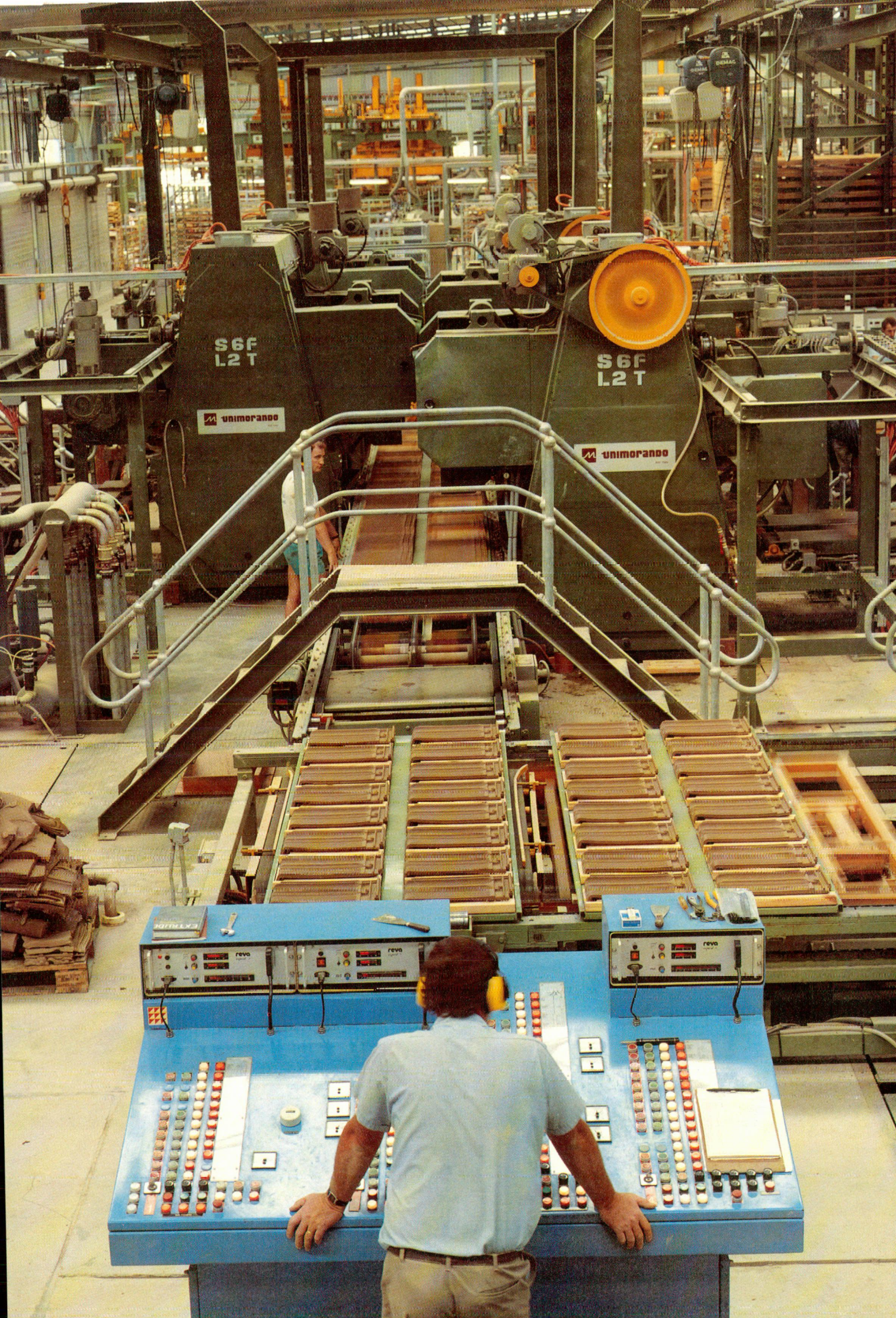
Ardlethan Tin Ltd
(Republic Resources (Aust) Ltd)
Ardlethan mine, Ardlethan

Ore mined: 47 976 t
Ore treated: 69 115 t
Concentrate: **449 t** (49.4% Sn)
(closed August, 1986)

Metals Exploration Ltd
Gibsonvale tin mine, Gibsonvale

Alluvial wash mined: 5 400 bm3
Wash treated: 6 100 bm3
Concentrate: **35 t** (76.0% Sn)
(mine in abeyance from July, 1986)

Small tin operations (10) in New England district are all in abeyance.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L2T
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DEMAG
DEMAG
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CLAYS

Low Cost Clays

Low cost clays (less than $10.00 per tonne, ex–pit) are used in the manufacture of structural clay products such as bricks, pipes, roofing tiles and some ceramic ware and low–grade refractories.

Deposits of low–cost clay occur in many areas of New South Wales. However, the low unit value of these materials mean that quarries and associated manufacturing plants must be located close to markets to minimize transport costs. For this reason the Triassic and Permian clays and shales of the Sydney Basin that supply the large urban markets of the central coast region are the most significant.

The greatest proportion of structural clay/shale supplied to the Sydney region is extracted from the Triassic Wianamatta Group (the Ashfield Shale and Bringelly Shale) and from the shale lenses within the Triassic Hawkesbury Sandstone which is used mainly for producing cream–burning bricks.

Large amounts of clay and shale are extracted from the Permian sequence in the Newcastle and Wollongong areas.

Kaolin

For industrial purposes, kaolin is defined as a soft, fine earthy material, generally white to off–white and composed essentially of clay materials of the kaolin group, mainly kaolinite.

Kaolin can be used for both fired and unfired products. Unfired kaolin is used mainly as a coater and filler in paper manufacture, as a filler and extender in natural and synthetic rubbers, paints, plastics and asbestos products and in a host of other products. Fired kaolin is mainly used in the manufacture of ceramic whiteware, pottery, tiles, insulators, and refractories. Specifications for kaolin may vary quite widely depending on its end use.

Kaolin deposits are of two types —residual deposits, in which the kaolin has been formed by hydrothermal alteration and/or leaching and weathering of rocks in situ, or transported deposits composed of detrital kaolin derived from residual deposits.

The main sources of high–quality kaolin in New South Wales are Tertiary transported clays in the Gulgong and Coorabin areas which are suitable for the manufacture of ceramic whiteware and refractories, but not for paper–coating or filling purposes.

Bentonite and Fullers Earth

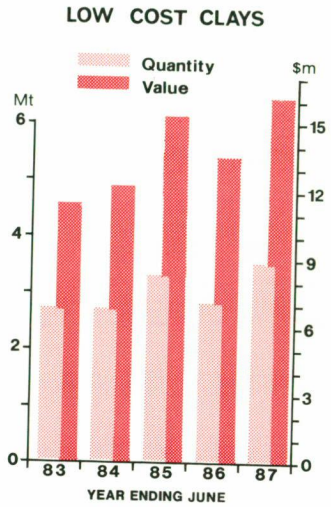
Bentonite is a highly plastic clay composed largely of montmorillonite (smectite) group minerals. Fullers earth is an industrial term used to describe any clay or clay–like mineral which has a high absorptive capacity.

The major uses of bentonite in New South Wales are in civil engineering applications (seepage control), as a bond for foundry sands, and in drilling muds. A significant amount of natural sodium bentonite is imported from the USA into Australia for use in iron ore pelletizing and in drilling muds (where it has traditionally been preferred by consuming industries). Fullers earth is used mainly as an oil and grease absorbent, for bleaching oils, as a pet–waste absorbent, and in pesticides.

Most bentonitic clays have formed from the alteration of volcanic ash or tuff. In New South Wales the most economic occurrences are in the upper Hunter Valley. Other deposits occur in the Gunnedah Basin. A deposit of fullers earth occurs at Whylandra Creek, near Dubbo.

Production

Historically, **low–cost clay** pits and associated manufacturing plants have developed near the large urban markets of Sydney, Wollongong, and Newcastle. The Sydney Mining Division alone accounted for more than 80% of the State's production of brick clay and shale in 1986/87. Most of these mining and manufacturing operations are based on quarries within the Bringelly Shale on the western outskirts of Sydney.

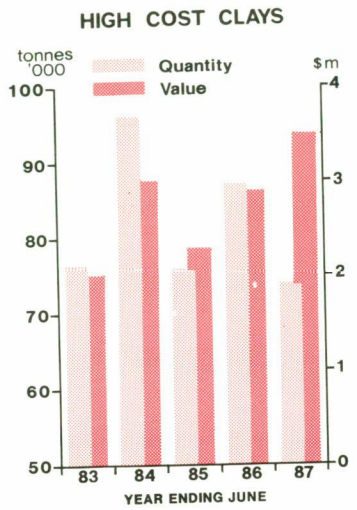


Producers 1986/87

Lowcost clays

Numerous producers throughout the State. 80% of lowcost clay production (brick and roofing tile manufacture) is from quarries in the Sydney Mining Division.

Interior view of the new clay roofing tile manufacturing plant at Wyee owned by Montoro Resources Ltd.



Refractory clay

Australian Industrial Refractories Ltd
Coorabin: 4 224 t (ball clay)
Black Springs 5 226 t (ball clay)
Merrygoen: 3 725 t (flint clay)
Marulan: 2 650 t (ball clay)
Warners Bay: 1 447 t (lowgrade refractory)

Commercial Minerals Ltd
Stubbo: 2 181 t (ball clay)
Wingen: 9 240 t (flint clay)

Kaolin (for ceramic ware)

Australian China Clays Ltd
Gulgong: 24 364 t

Puggoon Kaolin Co.
Puggoon: 4 500 t

Coorabin Clay Mines Ltd
Coorabin: 6 000 t

Kaolin (for fillers and extenders)

Commercial Minerals Ltd
Stubbo: 3 074 t
Swan Bay: 3 401 t

Bentonite

Commercial Minerals Ltd
Wingen: 2 190 t

Australian Clay Products Ltd (a subsidiary of Montoro Resources Ltd) has started production of high–quality roofing tiles using clay from their deposit at Wyee. The manufacturing plant at Wyee has the capacity to produce more than 2 million tiles per year.

Total production of low–cost structural clay in 1986/87 was 3,545,785 tonnes valued at $16,125,704.

In New South Wales the major producer of ceramic–grade **kaolin** is **Australian China Clays Ltd** (a subsidiary of Swan Resources Ltd) which operates four mines in the Gulgong area to supply its 25,000 tonnes/yr clay refinery near Gulgong.

Kaolin and ball clay used for refractories are produced by **Australian Industrial Refractories Ltd** from quarries in the Coorabin Oaklands area (northwest of Albury), and at Black Springs and Marulan.

Calcined, medium to high–alumina, refractory clays are currently being produced by **Commercial Minerals Ltd** from a deposit of flint clay (naturally calcined by a burning coal seam) near Wingen.

All of this State's **bentonite** production comes from Commercial Mineral Ltd's Cressfield deposit near Wingen. The calcium–magnesium bentonite mined here is upgraded by treatment with soda ash to convert it to sodium bentonite which has superior swelling and colloidal properties.

Total production of medium to high–cost clays in 1986/87 was 73,986 tonnes valued at $3,528,642.

Outlook

The Department of Mineral Resources has continued its investigations of the **clay/shale** resources of the Sydney region to ensure that Sydney's long–term demand for structural clay will be met. While there are adequate resources of structural clay and fire clay in the Sydney region, known secured resources of light–burning brick clay/shale are limited. The Department's efforts are mainly directed at further exploration in areas of the Bringelly Shale including investigation of the structural clay resources of the proposed Badgery's Creek airport site.

There is considerable potential for the economic development of known **kaolin** deposits in New South Wales. The Department of Mineral Resources has continued its research on the beneficiation potential of significant kaolin deposits in the State. No significant deposits of paper–coating grade kaolin have been discovered in New South Wales.

The Department of Environment and Planning has convened a working party to determine the need for a Regional Environmental Plan for the Newnes Plateau. This area is important not only for its vast reserves of friable sandstone but also as a potentially large source of kaolinitic clay, which is contained in the weathered sandstone. Currently this clay is being washed out and discarded.

There is still some potential to replace imports of natural sodium bentonite into Australia from the USA, although consumption in New South Wales is largely being met by production from Commercial Minerals Ltd's Cressfield deposit.

CONSTRUCTION MATERIALS

Construction materials are those low–cost minerals and rocks that are extracted in bulk, require little processing, and are used for construction purposes. These materials include coarse aggregate (crushed and broken stone, prepared road base, and gravel), fine aggregate (construction sand), and unprocessed materials (soil, loam, and ridge gravel).

The construction materials industry is very sensitive to a number of critical factors including the state of the economy, transport costs, and alternative land use pressures.

Coarse Aggregate

In New South Wales, basalts, various acid volcanics, microsyenite, and microgranite have been the traditional sources of coarse, dense aggregate. However, sandstone and other sedimentary rocks have also been used successfully as road base, rip–rap, and in low to medium–strength concrete.

Economically the most important deposits are those adjacent to the large population centres of Sydney, Newcastle, and Wollongong. Major sources include dolerite and basalt at Prospect, basalt in the Peats Ridge–Kulnura area, latite in the Illawarra area, granite from Queanbeyan, volcanic breccia from Wallgrove–Erskine Park and Hornsby, and gravel from the central coast region, particularly the floodplains of the Nepean–Hawkesbury River between Penrith and Pitt Town Bottoms.

Large resources of marine aggregate (unconsolidated marine sand and gravel) are known to occur at a number of localities on the continental shelf of New South Wales.

In 1986/87 production of coarse aggregate was 13 134 809 t of crushed and broken stone valued at $134,318,151, and 4 992 437 t of gravel valued at $56,296,470.

Fine Aggregate (Construction Sand)

Construction sand is primarily used in the production of concrete, mortar, sand–lime bricks, and in filling applications.

In New South Wales most construction sand is relatively clean quartz sand. Known deposits occur in past and present drainage systems, beaches, and dunes.

Large commercial operations are confined to deposits within economic haulage distance of major markets, particularly in the central coast region. These include the river terrace deposits in the Penrith area, coarse river sand in the Nepean–Hawkesbury River, high–level fluvial sand at Londonderry and Camden, marine/dune sand on Kurnell Peninsula, and friable (deeply weathered) sandstones on the Newnes and Somersby Plateaux. Large resources of construction sand are also contained in offshore deposits of marine aggregate.

In 1986/87 production of construction sand was 9 501 140 t valued at $63,892,775.

Unprocessed Materials

Unprocessed materials include weathered rock, ridge gravel, soil, and loam. Large quantities of unprocessed materials are used for road making and filling operations and they are usually obtained from locations that provide the shortest haulage distances. Significant qualities of loam from river banks and levees are used for top dressing and as garden soil.

Deposits of material suitable for use as unprocessed construction materials occur widely, but are only significant when located close to centres of demand.

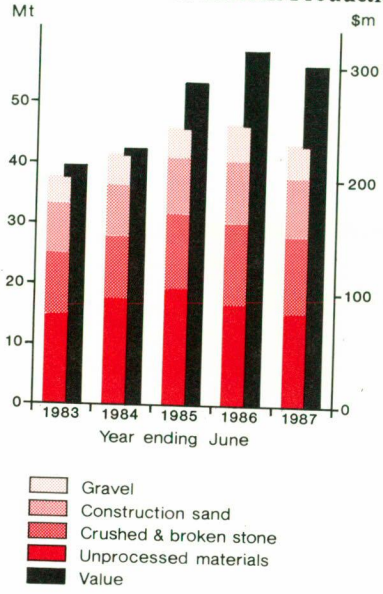
In 1986/87 production of unprocessed materials was 15 490 711 t valued at $46,438,159.

Outlook

There is currently a shortage of some types of **construction sand** in the large urban markets of the central coast despite the presence of large resources which could alleviate the shortfall. Urgent planning decisions will continue to be required to secure these resources against other competing land uses.

The fine dune sand on the Kurnell Peninsula remains a major source of construction sand but it is likely that production will be phased out over the next few years. No decision yet has been reached following the public forum held on sand mining of Kurnell. In anticipation of this phasing out a number of offshore Exploration Licences have been lodged covering the large resources of coarse marine aggregate that occur off the coast.

Construction Materials Production



Producers 1986/87

Numerous producers throughout the State. Coarse aggregate (crushed and broken stone and gravel) and construction sand production is dominated by the private sector Over 70% of this production is centred on the large urban markets of Sydney (42%), Wollongong (14%) and Newcastle (17%).

The production of unprocessed materials mainly for roadwork and fill is dominated (79%) by the public sector (Shire Councils, Forestry Commission, Department of Main Roads etc.).

There has also been no decision regarding Hooker Resources' proposal to stockpile some of the large reserves of marine aggregate in Botany Bay despite the go–ahead that has been given to deepen the port for the proposed oil tanker berth.

Urgent planning decisions are also required to secure the large reserves of construction and industrial sand contained in the friable sandstones of the Newnes Plateau, west of Sydney.

A major new quarrying operation will be developed on a deposit of microsyenite at **Mount Misery** near Mittagong. Following a Commission of Inquiry which ruled that the deposit should be protected for future production, Monier Ltd have been bulk testing the deposit and will develop it as a major source of coarse aggregate to supply the Sydney region.

DIATOMITE

Producer 1986/87

Australian Diatomite Mining Pty Ltd
Barraba mine: 7 358 t

Diatomite is a soft, chalk–like, silicious sediment composed of the sketetal remains of microscopic aquatic plants known as diatoms. There are both marine and freshwater diatoms, and these differ quite markedly in their morphology leading to pronounced textural differences in the resultant sediments.

The most important use for diatomite is as a filtration agent. This covers a wide range of industrial applications including the filtration of food products, beer, wine, juices, pharmaceuticals, dry–cleaning solvents, oils, chemicals, varnishes, and lacquers.

Other uses are in thermal and sound insulation; as a filler in paint, paper, plastics, and rubber; as an abrasive; in the manufacture of silica refractory bricks; and as an industrial liquid and pet waste absorbent.

Occurrence

New South Wales diatomite deposits are all freshwater in origin and most are associated spatially with Tertiary volcanics. The more important of these deposits occur in the Warrumbungle, Nandewar, and Mount Warning volcanic shields, at Bowan Park near Orange, and at Middle Flat near Cooma.

Production

Australian Diatomite Mining Pty Ltd (a subsidiary of Westralian Sands Ltd) remains the only producer of diatomite in New South Wales. The company has operated an open cut on its deposit at Bells Mountain near Barraba since 1982. Production has increased steadily to over 7,000 tonnes per annum with most sales to domestic markets as pet litter and industrial liquid absorbent.

The raw diatomite is processed on–site through a 7.5 tonnes/hr calcining kiln plant which dries the diatomite and removes any organic material.

Outlook

There is considerable potential for expansion of diatomite production in New South Wales provided further detailed studies are undertaken on the use of high–purity diatomite for filtration purposes.

Australia continues to import substantial tonnages (10,000 tonnes/yr) of diatomite for filtration purposes, mainly from the USA. Most imported diatomite is of marine origin; marine diatomite has been widely regarded by industry as superior to freshwater diatomite (such as mined at Barraba) for use as a filter aid. This is now known to be a misconception as high–purity freshwater diatomite from the USA and elsewhere has been successfully used as a filter aid

Recent evaluation of diatomite resources in New South Wales by the Department of Mineral Resources has indicated that there is good potential for locating and developing high–grade deposits in the Bells Mountain – Nandewar Range area that may be suitable for filtration applications.

DIMENSION STONE

Dimension stone is natural rock that is used as 'building stone', 'ornamental stone', and 'monumental stone'. It is generally quarried in blocks or slabs and marketed in a variety of consumer–specified sizes and finishes.

In the past, natural stone was commonly used as a load–bearing material, but in modern construction it is generally used for decorative purposes, as cladding.

Dimension stone is used in lesser quantities for special industrial uses including: liners in ball and tube mills; precision plates for mounting sensitive scientific instruments; panels in electrical switchboards; and precision heavy duty rollers.

Occurrence

The main varieties of dimension stone exploited in New South Wales are granite, sandstone, marble, and slate. Although most varieties of dimension stone are widespread in New South Wales, economic deposits that meet the required characteristics of uniformity, size and durability etc. are quite rare.

Production

The State's output of **sandstone** is centred in the Somersby area of the Central coast where two quarries account for more than 80% of the value of sandstone blocks produced in 1986/87. Over the last 10 years the State's output of sandstone has remained quite consistent, averaging about 10,000 tonnes/yr. One of the last available sources of "yellow block" sandstone, the Bondi quarry, finally closed down in 1986. This type of sandstone is found only in the Sydney area and is in high demand for restoration projects.

Production of **slate** has declined considerably from a peak of over 2000 tonnes in 1980/81, while production of **marble** has fluctuated widely probably in response to demand for specific projects.

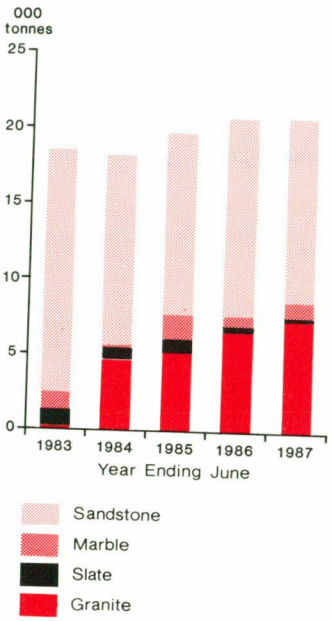
The main interest in dimension stone has been provided by the continued growth in the demand for **granite**. Production has increased from less than 1000 tonnes only five years ago to more than 7000 tonnes in 1986/87, and there are now more than a dozen quarries located throughout the State, with several new ones about to open. Five major processing plants have been either constructed or expanded to accomodate this increased output. The bulk of the granite production is from the central part of the State between Bathurst and Forbes with the largest quarry at Mulyandry which produced 4,500 tonnes of granite in 1986/87.

Outlook

The demand for dimension stone, and specifically granite, has increased significantly since the mid 1980's. Much of this demand can be attributed to improvements made in the efficiency with which granite is quarried and processed but there has also been a trend back to the use of natural materials. Competitively priced local stone is now capturing markets that have previously been dominated by imports, particularly from Italy.

With domestic demand continuing to increase many producers who have invested capital in expanding their processing capacity will be in an excellent position to penetrate export markets.

Dimension Stone Production



80% of sandstone production (blocks and slabs) in the State is from 7 quarries in the Gosford Somersby area of the central Coast (Newcastle Mining Division).

Production of granite centred on quarries near Eugowra (Orange Mining Division) and Tocumwal (Albury Mining Division)

Most of the State's production of marble is from the Melocco Pty Ltd quarry at Wombeyan.

Minor production of slate was recorded from quarries at Ulan (Dubbo Mining Division), Towrang (Goulburn Mining Division) and Newbridge (Orange Mining Division).

FELDSPAR

The feldspar minerals are silicates containing various amounts of sodium, potassium, and calcium, and form two substitution series, the alkali feldspars and the plagioclases.

Feldspar and feldspathic rocks (such as nepheline syenite and alaskite) are used primarily as a source of alumina and alkalis in glass and ceramic manufacture. In glassmaking, the alumina retards devitrification while in ceramics it provides durability and inertness. In both applications the alkalis act as a flux. Glassmaking consumes about 60 per cent of the world's feldspar production, and about 30 per cent is used in ceramics.

Occurrence

Feldspar is one of the commonest rock–forming minerals. Economic deposits however, are restricted to pegmatites and other granitic rocks, and alkaline igneous rocks such as nepheline syenite.

Producers 1986/87

Commercial Minerals Ltd: 1 111 t (2 quarries) Broken Hill Mining Division)

Consolidated Feldspar Pty Ltd: 86 t (2 quarries) Broken Hill Mining Division

Most of the mined deposits in New South Wales are pegmatitic in origin, the most significant being located at Thackaringa near Broken Hill. The mineralogical zoning in these pegmatites has led to the accumulation of large amounts of coarse, relatively pure feldspar which is easily extracted by selective mining.

Also in the Broken Hill district are economic deposits of sodium feldspar in albite pegmatites located near Silverton.

Minor pegmatitic deposits are known in other parts of the State such as near Hartley, and finer–grained, granitic rocks have been mined at Brewongle, near Bathurst.

Production

New South Wales produces only a minor amount of feldspar, all from the Broken Hill area. Of the 1200 tonnes produced, over 90% was from two quarries operated by **Commercial Minerals Ltd.**

Altered rhyolite at Lue–Havilah, southeast of Mudgee, is mined by **Industrial Minerals Australia Pty Ltd** chiefly for ceramic whiteware.

Outlook

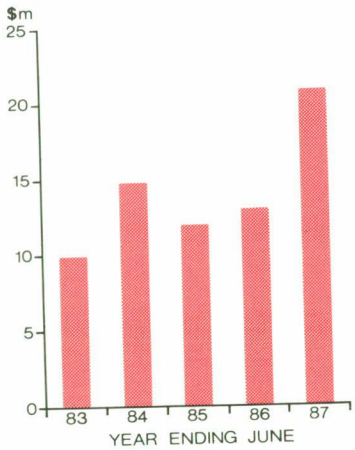
Production of feldspar increased this year from a very low base but the glass–making industry relies mainly on imports of nepheline syenite from Canada for its raw materials.

Feasibility studies carried out by Australian Feldspar Pty Ltd on their deposit of alaskite (feldspar–rich granite) near Oberon confirmed its economic potential. However no further action has taken place and future development of the deposit is uncertain.

In view of the import replacement potential of local sources there is some exploration interest in New South Wales for nepheline syenite. Deposits of nepheline syenite and related rocks are known to occur in the State but their suitability for producing glass and ceramic–grade feldspar have not been fully evaluated. A large deposit of nepheline syenite, comparable to that mined overseas, has recently been identified in the Southern Highlands. Unfortunately this deposit is entirely within a Nature Reserve and not available for extraction. However, its discovery indicates the potential for similar deposits elsewhere in the region.

GEMSTONES

Value of Opal Production



Minerals that are prized for their aesthetic qualities and used mainly in jewellery are known as gemstones. Gem minerals are generally hard, relatively free from cleavage, and occur as transparent crystals, although some, such as opals, do not conform to this definition.

In terms of value of production, opal and sapphires are by far the most significant gemstones in New South Wales.

Production figures in New South Wales are based on value and may be grossly underestimated due to the difficulty in obtaining accurate records. Opal claims are usually worked by individuals or small parties many of whom are itinerant workers. Some larger–scale commercial operations have exploited alluvial sapphires although fossicking for sapphires by individuals is also very popular.

Opal

Opal is a hydrated form of silica with a variable proportion of the water being chemically bonded. Precious opal is translucent to transparent and exhibits a characteristic play of spectral colours which result from the diffraction of white light by the internal structure of the opal.

There are many different types of opal ranging from highly valued black opal to poorer–quality, white and grey varieties.

Production

Virtually all opals mined in New South Wales are from the Lightning Ridge opal field including the outlying fields of Glengarry, Grawin, Carter's Rush, Coorcoran, New Corcooran, and Angledool (Mehi). A major new opal field "Sheepyard Rush", near Glengary, was discovered in late

1985 and is now the focus of most of the opal production and prospecting activity.

The value of opal (based on export data) increased by almost 60% in 1986/87 to almost $21 million, largely due to development of Sheepyard Rush. The true value of opals produced in the Lightning Ridge region is probably much higher than that figure.

The opal is mined from horizontal drives and stopes in opal–bearing claystone lenses, by working through old dumps, and more recently by open cut methods.

Outlook

Australia is the world's major opal producer. Overseas demand has remained strong particularly for the good quality opal. The development of the Sheepyard Rush field near Glengary confirms the potential for new discoveries in the Lightning Ridge region that had been indicated by recent studies carried out by the Department of Mineral Resources. In particular, the recognition of the structural control on opal deposition (particularly the presence of major faults and joints) and the demonstration of an effective geophysical exploration method (electromagnetic surveys using SIROTEM) for defining prospective geological areas, have assisted in the recent discovery of major new fields at Sheepyard Rush and Wyoming (northeast of Lightning Ridge).

These advances in the understanding of opal deposition indicated there is good potential for new discoveries within other areas of weathered Cretaceous beds in the Great Australian Basin.

Sapphire

Sapphire is the gem variety of the mineral corundum which is a crystalline form of aluminium oxide and has a hardness of 9 on Moh's scale.

Sapphires may be colourless, pale to dark blue, green, yellow, or commonly 'parti–coloured' (blue–green or blue–yellow).

Occurrence

Until recently, most sapphires in New South Wales were found in the alluvial gravels of the present day stream system draining the Tertiary basalts in the New England district, particularly in the Inverell – Glen Innes – Glencoe area. Virtually every creek in this area carries sapphire, the main producing streams being Frazers Creek, Horse Gully, and Reddestone and Wellingrove Creeks.

However, more significant deposits of sapphire are now being discovered in Tertiary volcaniclastic rocks also in the New England district. Recent work by the Department of Mineral Resources has demonstrated that the volcaniclastic rocks are the source of most of the alluvial sapphire, and possibly also of diamonds which have been produced from Tertiary deep leads in the same area.

Good quality sapphires have also been recovered in many other parts of the State including Nundle, Barrington Tops, the Oberon–Porters Retreat area, Mount Werong, the Crookwell area, the Berrima–Mittagong area, Hill End, the Cudgegong–Macquarie River system, the Tumbarumba area, Wee Jasper, the Nimmitabel area, and the Shoalhaven River.

Deep lead sapphire deposits occur in the Bingara–Narrabri area, the Mudgee area, at Airly Mountain, and near Crookwell.

Production

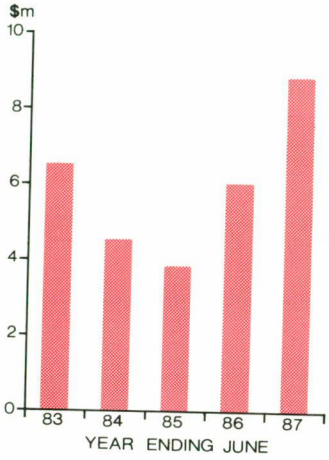
Australia is a major world producer of sapphires and dominates in the production of small to medium–sized stones. Queensland and New South Wales account for virtually all of Australian production. In the past few years, there has been significant growth in the sapphire industry in the New England district although the value of production, as with opals, is extremely difficult to estimate. Most of the stones are bought at the mine site by overseas buyers and then exported for processing and marketing. Thailand receives over 90% of the sapphires bought for export.

The State's sapphire industry is almost entirely based on alluvial and volcaniclastic–related deposits in the Inverell–Glen Innes area. Production is dominated by one major company, **T.J. and P.V. Nunan Pty Ltd.**

Outlook

There is good potential for increased sapphire production in the State over the next few years.

Value of Sapphire Production



A great deal of interest in sapphire exploration has been generated by the Department of Mineral Resources' Sapphire Seminar held in Sydney, May 1987. Results of the Department's work has demonstrated the link between Tertiary volcanism and sapphire deposits in the New England district and has provided industry with some promising concepts for exploration.

New regulations regarding sapphire exploration were also announced by the Department at the seminar and by the end of 1987 more than 70 Exploration Applications had been lodged, mainly in the New England district, but also in other areas in the State.

There remains the problem of processing and marketing of sapphires, still largely carried out overseas, which minimizes the potential return available to the State.

Several companies involved in sapphire mining and exploration in New South Wales have started planning for more integrated operations in the future which will see a much larger proportion of the State's sapphires processed and marketed in Australia.

Diamond

Diamond exploration in the State is carried out only at a very low level. However the upsurge in sapphire exploration and the recognition of a possible genetic link between diamond and corundum may help revive an interest in diamond exploration in the State. Most of the State's diamond production in the past had come from the Copeton and Bingara areas in the New England district.

GYPSUM

Producer 1986/87

CSR Ltd
Bourke gypsum mine: 25 921 t (washed gypsum)

Production of crude gypsum amounted to 12 982 t, mostly from quarries in the Albury Mining Division.

Pure gypsum is hydrated calcium sulphate ($CaSO_4 2H_2O$) which is precipitated from aqueous solutions, usually under arid conditions.

The major commercial deposits of the world consist of rock gypsum formed from deposition in marine environments and include large deposits in South Australia which contain the bulk of Australia's reserves.

Gypsum is used in many industries either in crude or in calcined form. Crude gypsum is marketed for use in cement (to retard setting of the concrete), agriculture, and fillers. Most gypsum produced is calcined and used in the manufacture of plaster products, predominantly plasterboard for the construction industry.

Occurrence

In New South Wales significant deposits of gypsum occur in and around clay pans and salt lakes in the western half of the State. These deposits occur in three main areas: Trida–Menindee, Wentworth, and Bourke.

There are many small deposits of gypsum between Bourke and Wanaaring, the most important one being the Paka deposit. This is the State's major worked deposit and is located approximately 30 km west of Bourke.

Production

New South Wales production of gypsum is very minor compared to total Australian production of which over half is from the large deposits in South Australia.

CSR Ltd is the chief producer of gypsum in New South Wales. Washed gypsum from their Paka deposit is used as a retarder in Portland cement. Crude gypsum, mostly from the Albury Mining Division is produced for use as a soil conditioner.

Outlook

Much of the industrial demand for gypsum (plaster and cement) is supplied by the large deposits in South Australia. Although New South Wales has some sizeable gypsum deposits there is little potential for their development, mainly because of the remoteness of these deposits from markets.

HEAVY MINERAL SANDS

Heavy mineral sands incorporate all sand–sized concentrations of minerals of high specific gravity such as rutile, zircon, ilmenite, monazite, magnetite, cassiterite, gold, platinum, garnet, epidote, chromite, and pleonaste.

In New South Wales the most commercially significant of these are rutile, zircon, and monazite which form the basis of the beach sand mining industry.

Rutile and Ilmenite

Rutile is naturally occurring titanium dioxide (TiO_2). It is the richest ore of titanium having a titanium content of about 60%.

Ilmenite ($FeTiO_6$) contains 31.8% titanium and is also a major ore of this metal.

Approximately half of the world's rutile production and virtually all of the world's ilmenite output is used for the manufacture of titanium dioxide pigments in white paint.

Titanium dioxide is also used in paper, plastics, and textiles, and in inks used in the ceramics industry.

Because of its strength and resistance to corrosion, titanium metal is used in alloys in the aircraft and aerospace industry and also as an abrasive (with tungsten carbides). Other major uses for titanium metal are in chemical and desalination plants and in alloys for heat exchange tubing in power stations.

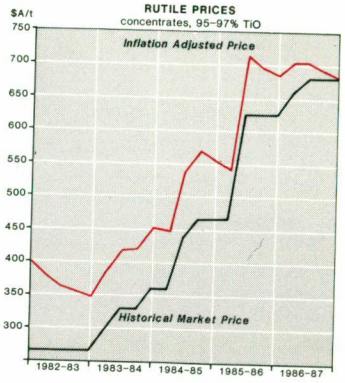
Commercial rutile concentrates contain at least 95% TiO_2 while ilmenite concentrates are lower grade. However various processes have been developed to beneficiate low–chromium ilmenite to produce a high–grade material (90–98% TiO_2).

Zircon

Zircon ($ZrSiO_4$) is the principal ore of zirconium. Zircon sand is used principally as a foundry sand, as a bonded refractory in aluminium and glass furnaces, and as ladle linings in the steel industry. Zircon sand and zircon flour are also important raw materials for the manufacture of zirconium metal, zirconium chemicals, and zirconia.

Zirconium metal is used in refractory and corrosion–resistant alloys, principally in nuclear reactor containers.

Zirconia (ZrO_2) is used in abrasives, refractories and ceramics. "Toughened" zirconia, developed by the CSIRO has outstanding refractory properties, and excellent potential for expanded use in new high technology markets such as advanced diesel engines.



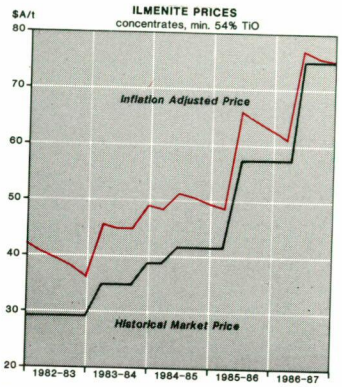
Monazite

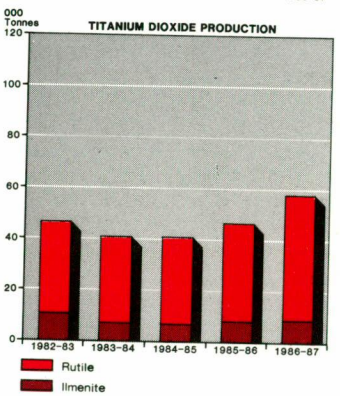
Monazite is the principal ore of thorium, containing up to 30 per cent thorium and variable amounts of the rare earths such as cerium, lanthanum, and yttrium. The major use of thorium is in the manufacture of incandescent mantles for gas lamps. Substantial amounts are alloyed with magnesium and zirconium to produce metals for the aerospace industry.

Demand for rare earth compounds, particularly in the United States and Japan, is increasing in response to new applications in the high technology field. Currently the major uses of rare earth compounds are as petroleum cracking catalysts, metallurgical additives, and polishing compounds in the ceramics and glass industries.

The main expanding markets are for individual rare earths such as neodymium in permanent magnets, which could potentially capture more than half the total magnet market, and yttrium and europium oxides in phosphors for colour televisions, intensifying screens, and fluorescent lamps.

Demand is particularly strong in Japan for heavy fraction rare earths including yttrium, for use in the large market for partially stabilized zirconia and new ceramics.





Occurrence

All of the State's heavy mineral sand production is derived from marine and aeolian sands in coastal areas. The most important deposits are between Broken Bay and the Queensland border, particularly from Tomago to Taree and in the Byron Bay – Cudgen area. In this region, zircon and rutile predominate in the heavy mineral fraction.

Producers 1986/87

R.Z. Mines (Newcastle) Ltd
Tomago

Concentrates
Rutile: 36 021 t (96% TiO_2)
Ilmenite: 9 182 t (47% TiO_2)
Zircon: 35 867 t

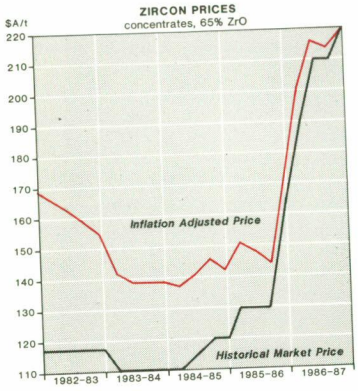
R.Z. Mines (Newc.) Ltd also produced a minor amount of rutile and zircon from Crowdy Head.

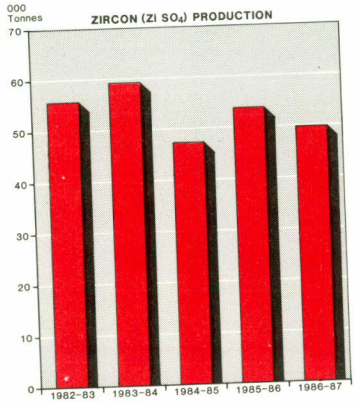
Mineral Deposits Ltd
Hawks Nest

Concentrates
Rutile: 13 648 t (95% TiO_2)
Ilmenite: 9 895 t (45% TiO_2)
Ziron: 12 186 t
Monazite: 485 t

Currumbin Minerals Pty Ltd
Kingscliff

Concentrates
Rutile: 1 381 t (96% TiO_2)
Ilmenite: 198 t (45% TiO_2)
Zircon: 1 949 t





Production

Australia is the world's major producer of heavy minerals from mineral sands. New South Wales production after a period of decline has made a strong resurgence spurred on by rising prices for heavy minerals.

Two companies account for almost all the heavy mineral concentrates produced in New South Wales. **Rutile and Zircon Mines (Newcastle) Ltd,** the largest producer of titanium dioxide and zircon in the State, mines in the Tomago area and also has a small operation at Crowdy Head on the north coast. **Mineral Deposits Ltd** is the other major producer with mining operations at Viney Creek and Stockton Bight.

Currumbin Minerals Pty Ltd mines minor amounts of zircon and rutile at Kingscliff on the north coast but has also been stockpiling monazite concentrates in preparation for a planned rare earth processing plant near Lismore.

Outlook

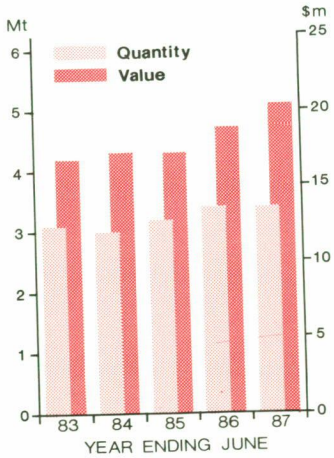
The outlook for mineral sands producers in New South Wales is for further growth given the continuation of high prices for rutile and zircon on world markets. Mineral Deposits Ltd, with their new mining operation at Viney Creek, is set to become the largest producer in the State but Rutile and Zircon Mines (Newcastle) Ltd, have also been expanding their capacity. Both companies have applied for offshore exploration licences to secure future reserves and a number of other companies have similarly expressed interest in exploring for mineral sands in coastal areas.

CRA Ltd's exploration efforts in the Murray Basin within New South Wales have shown some very encouraging results, which follows on from its discovery of enormous reserves of low–grade mineral sands in the Murray Basin of Victoria.

There is good potential in New South Wales for expansion of export earnings through secondary processing of its mineral sands resources. Currumbin Minerals Pty Ltd, through its subsidiary Deckhand Pty Ltd had proposed a processing plant at Tuncester, near Lismore to produce high–purity rare earth oxides from monazite concentrates. However, following a public hearing on the issue, the Local Council was advised to refuse the proposal and the company is now seeking an alternative site for its project.

LIMESTONE

Limestone Production



There are more than four hundred known occurrences of limestone in New South Wales, most of which are biohermal or biostromal deposits formed in shallow marine environments. These deposits are predominantly massive limestone sediments composed largely of calcium carbonate ($CaCO_3$), usually with small amounts of magnesium carbonate.

The main uses of limestone in New South Wales are for cement–making and as a flux in steelmaking, with lesser amounts used in the manufacture of lime (CaO), in agriculture, as construction material, and in glass making, fillers, and coal dusting.

Occurrence

The great majority of limestones are older Palaeozoic in age and are concentrated in the eastern part of the Lachlan Fold Belt and in the Tamworth Synclinorial zone.

Economically, the most important deposits are those located closest to the major markets in Sydney, Wollongong, and Newcastle. Current production of limestone in this State comes from two major areas —Bungonia–Marulan and Portland–Mudgee.

The Bungonia Limestone is, at present, the most important deposit in the State. It outcrops about 8 km southeast of Marulan and extends discontinuously southwards from South Marulan to east Bungonia.

A belt of limestone deposits extends north from Portland to Mudgee. These deposits are currently being mined at Portland and at Carwell Creek (west of Kandos).

Production

Limestone production in 1986/87 was 3,445,542 tonnes valued at $20,267,226. 64% of this total is used in the manufacture of cement with the other principal applications being: as a metallurgical flux (20%); dead–burnt lime for various applications (7%); in agriculture (1.8%); and miscellaneous applications (7.5%).

Limestone for cement manufacture is mined by **Blue Circle Southern Cement Ltd (BCSC)** at South Marulan (the largest limestone quarry in Australia) and at Portland. More than half of BCSC's production from South Marulan goes to its cement works at Berrima. Most of the balance (606,000 tonnes) was sold to Australian Iron and Steel at Port Kembla as metallurgical flux. The quarry at Portland supplies limestone for the company's nearby cement works and BCSC also operates a clinker grinding plant at Maldon. In 1987, BCSC was taken over by the large industrial conglomerate, Boral Ltd.

The other major cement manufacturer, **Australian Portland Cement Ltd** mines limestone at Kandos for its nearby cement works.

BCSC is also involved with the production of limestone for other industrial applications through an associated company, Southern Limestone Pty (jointly owned with Commercial Minerals Ltd). Southern Limestone Ltd operates a plant at Moss Vale to process limestone and marble from Southern Limestone's quarry at Wombeyan.

The product is sold in specialised markets such as in glass–making, abrasives, fillers, coal–dusting and agricultural applications.

Omya Minerals Pty Ltd uses limestone from a deposit at Cow Flat near Bathurst also to supply specialized markets. The company's 100,000 t/yr processing plant at Bathurst produces a range of superfine and modified limestone mainly for industrial fillers and agricultural applications.

David Mitchell–Melcann Pty Ltd mines limestone from a number of quarries, the largest at Attunga (north of Tamworth) where the company produces dead–burnt lime and ground limestone chiefly for agricultural use and coal dusting.

Outlook

Production of limestone has grown steadily over the last 10 years, particularly for cement manufacture, although in the last few years there has been a steady decline in the amount of limestone used in agriculture and as metallurgical flux in the iron and steel industry.

Future demand for limestone will be closely tied to the state of the construction and steel–making industries as these consumers account for more than 80% of the limestone mined in New South Wales.

The deposits of limestone in the Bungonia–Marulan region and the Portland–Kandos belt are estimated to contain at least 30 years of reserves at current mining rates.

Major Producers 1986/87

Blue Circle Southern Cement Ltd
South Marulan quarry: 2 491 276 t
Portland quarry: 105 781 t

Australian Portland Cement Ltd
Kandos quarry: 606 132 t

Omya Minerals Pty Ltd
Cow Flat quarry: 88 835 t

David MitchellMelcann Pty Ltd
Attunga quarry (Tamworth): 73 489 t
Sherwood quarry (Kempsey): 14 045 t

Southern Limestone Pty Ltd
Wombeyan quarry: 51 026 t

MAGNESITE

Magnesite or magnesium carbonate ($MgCO_3$) is one of the major sources of magnesium. It is marketed in three forms: **crude magnesite; dead–burned magnesite**, produced by calcining magnesite, magnesium carbonate, or other magnesia raw materials at more than 1450C; and **caustic–calcined magnesite**, made by calcining magnesium carbonate or magnesium hydroxide at between 700C and 1000C.

Crude magnesite is primarily used for producing dead–burned and caustic–calcined magnesite but is also marketed for agricultural use and glass making. Dead–burned magnesite is used mainly to make refractory bricks, mortars, and castables. Caustic–calcined magnesite is a high–purity, reactive magnesium oxide used as a raw material in a wide range of industrial applications. The building industry consumes large quantities of caustic–calcined magnesite for floorings and insulating wall boards. It is used also in paper processing, lubrication oil additives, electrical heating elements, and in the manufacture of neoprene rubber and rayon.

Occurrence

The most important commercial deposits in the world are either bedded sedimentary deposits or replacement deposits associated with dolomite or limestone. Of lesser importance are deposits formed from the alteration of basic or ultrabasic rocks by the action of carbonate solutions.

Producer 1986/87

Devex Ltd
Thuddungra quarry: 42 454 t
Fifield quarry: 4 229 t

The only significant deposits in New South Wales are alteration deposits. The most important of these are at Thuddungra (northwest of Young) where veins and nodules of magnesite are associated with serpentinized metasediments, amphibolites and ultrabasic rocks, and at Fifield (northwest of Condobolin) where magnesite occurs as nodules within the zone of alteration of basic intrusives and adjacent sediments.

Production

In New South Wales magnesite is produced by Young Mining Co. Pty Ltd at Thuddungra and Causmag International Ltd at Fifield, both wholly–owned subsidiaries of **Devex Ltd.**

Magnesite from Fifield is mined by open cut methods, crushed, washed, and screened before calcining to a dense form of dead–burned magnesium oxide which is used in the manufacture of refractories.

Magnesite from Thuddungra is processed in the company's caustic kiln at Young. The caustic–calcined magnesite is used for various industrial and agricultural applications.

The total magnesite mined at these two locations (1986/87) was 46,683 tonnes valued at $1,645,409.

Outlook

Production figures since 1980 have fallen due to the collapse of agricultural export markets to New Zealand and the United States and the contraction of the refractories industry.

Reserves of magnesite at Thuddungra are undefined, although exploratory drilling has indicated at least 2 million tonnes of high–grade magnesite ore, with potential for substantial additions to this figure. The reserves at Fifield are considered to be adequate to sustain operations at current production levels for many years.

There is good potential for the establishment of domestic and export markets for high–purity industrial products from these resources although the development of the huge magnesite resources at Kunwarara in Queensland is likely to impinge on future expansion of the industry in New South Wales.

PEAT

Producers 1986/87

Cheetham Salt Ltd
Wingecarribee peat mine: 3 472 t

Killarney Peat Ltd
Killarney peat mine: 990 t

Peat is partially decomposed plant matter that has accumulated under or in a water–saturated environment. It is the first stage in the formation of coal and its main constituent, besides water is carbon. Specific varieties of peat include sphagnum, or moss peat, and reed–sedge peat.

Peat is used in New South Wales as a soil conditioner and mulch, in preparing and maintaining lawns, shrubbery, and gardens; as a packaging material for shrubs and flowers; as a filter in mixed fertilization; and in mushroom and seed beds. Its primary use overseas is as a fossil fuel.

Occurrence

The climatic and topographical (cool and wet) conditions favouring the development of significant peat deposits in New South Wales are restricted to certain regions along the coastal strip and the highlands flanking the Great Dividing Range.

Recent field work by the Geological Survey (Department of Mineral Resources) has led to the discovery of a large number of peat occurrences, widely distributed within these regions of the State. The only deposits currently mined are at Wingecarribee Swamp, east of Moss Vale, and Killarney Swamp southeast of Bombala.

Production

The largest producer of peat in New South Wales is Cheetham Salt Ltd from their deposit at Wingecarribee Swamp. Killarney Peat Ltd mines peat from the Killarney Swamp, southeast of Bombala.

Production from the Killarney Swamp has not increased substantially but the company has been experimenting with microwave drying technology being developed by Hi–Tec Control Systems Pty Ltd. The prototype dryer with 16 magnetrons has demonstrated the potential of the method to dry large volumes of peat rapidly, thereby increasing throughput significantly.

Peat production in New South Wales (1986/87) was 4,462 t valued at $446,417.

Outlook

Demand for high–quality peat remains strong, but it is unlikely that any additional deposits will be developed in New South Wales in the immediate future. Expansion of production from the two operating mines will be sufficient to satisfy the current rate of growth in the market.

Some potential exists to replace imports of sphagnum peat from West Germany and New Zealand provided peat from the New South Wales deposits can be demonstrated to be of similar high quality.

PYROPHYLLITE

Pyrophyllite is a hydrated aluminium silicate with industrially important properties similar to those of talc. The main uses for pyrophyllite are in refractories, in whiteware ceramics and as a mineral filler, with each application requiring a different range of specifications.

Occurrence

Pyrophyllite is generally formed by the hydrothermal alteration of acid volcanic rocks (commonly rhyolitic lavas or tuffs). Significant deposits in New South Wales are located near Pambula on the far south coast, and at Lower Botobolar northeast of Mudgee.

Several pyrophyllite deposits have been worked in the area immediately south and west of Pambula, where they occur as irregular, lenticular bodies within Devonian acid volcanics (Eden Rhyolite). The most important deposit is at Back Creek which is the largest known in the State. Most of the pyrophyllite recovered from this deposit has been used for the manufacture of refractory bricks although there is a substantial amount of high–grade pyrophyllite suitable for use as mineral filler.

The Lower Botobolar deposit, about 16 km northeast of Mudgee occurs in Silurian acid volcanics. Much of the material extracted from this deposit has been used in foundry facings, but is also suitable for some industrial filler applications and possibly in ceramics. In places, the material mined appears to be mainly sericite.

Production

New South Wales is the sole producer of pyrophyllite in Australia. Almost all the production is from the Back Creek deposit near Pambula owned by Pyrophyllite Corporation Pty Ltd (a subsidiary of Commercial Minerals Ltd).

A small amount is produced from the Lower Botobolar deposit near Mudgee by Industrial Minerals Australia Pty Ltd.

Production of pyrophyllite in 1986/87 was 6,575 t valued at $400,975.

Producers 1986/87

Commercial Minerals Ltd
Back Creek quarry: 6 390 t
Industrial Minerals of Australia Ltd
Lower Botobolar quarry: 185 t

Outlook

Commercial Minerals Ltd has considerable reserves of pyrophyllite at its Back Creek deposit. Domestic markets for pyrophyllite are potentially diverse, but there is stiff competition for these markets from a number of other raw materials, some of which are imported. Mining and transportation costs are major factors which limit the market potential of medium–cost raw materials such as pyrophyllite. For these reasons pyrophyllite production will probably remain at the 7,000 – 10,000 t level in the near future.

SERPENTINE

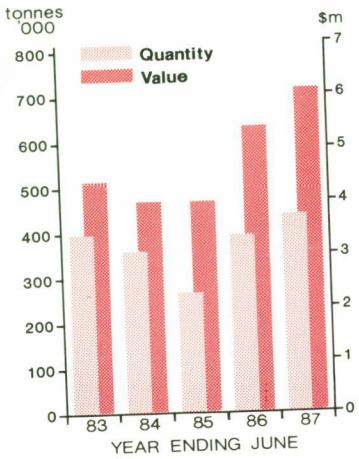
Serpentine is a secondary mineral derived from the alteration of magnesium–rich silicate minerals such as olivine. In New South Wales serpentine is used in the steel–making process by Australian Iron & Steel Pty Ltd, a subsidiary of BHP Ltd. The addition of MgO to the blast furnace slag provides significant technical and financial benefits. In 1978 BHP began receiving a regular supply of serpentine from Japan.

Hooker Industrial Sands and Minerals (a division of The Hooker Corporation Ltd), recognizing the opportunity to replace these serpentine imports, successfully located and brought into production the Somerset serpentine mine located in the Coolac ultramafic belt, northeast of Gundagai.

Production in 1986/87 was 58,452 t valued at $720,129. However the Somerset mine has now closed following the decision taken by BHP to once again backload serpentine from Japan, the argument being that it is more economical to do so.

SILICA (Industrial Sand)

Industrial Sands Production



Major Producers 1986/87

Hooker Corporation Ltd
Anna Bay: 40 232 t (export)
Kurnell: 33 473 t (foundry)
1 177 t (filtration)

P.B. White Minerals Pty Ltd
Saltash: 35 303 t (glass)
Londonderry: 79 295 t (glass)

A.C.I. Resources Ltd
Botany Bay: 92 437 t (glass)

Monier Ltd
Kurnell: 11 500 t (foundry)

Pearce Sand Processing Pty Ltd
Redhead: 28 344 t (foundry)

New South Wales Glass and Ceramic Silica Sand Users Association Ltd (A. C. I. Resources Ltd)
Tanilba Bay: 78 000 t (glass)

Quality Sand and Ceramics Pty Ltd
Williamtown: 13 780 t (foundry)
5 906 t (ceramics)

Silica (SiO_2) is one of the most ubiquitous materials in the earth's crust. It occurs as several polymorphs, most commonly as quartz which forms an essential constituent of most igneous, sedimentary, and metamorphic rocks.

For industrial purposes, the main sources of silica in New South Wales are quartz, quartzite, silica sand, sandstone, and silcrete. The primary uses for silica are in the manufacture of virtually all types of glass, and in ceramics and ceramic glasses. The metallurgical industry is also a major consumer of silica, mainly for refractory purposes, as a foundry sand, flux, and a source of silicon. Lesser amounts are used in the electronics, chemical, and construction industries, in the production of silicon carbide, and as a natural abrasive.

Occurrence

The central coast region contains the most important sources of industrial sand and sandstone. Glass–making sand is mainly won from coastal sands at Anna Bay and Tanilba Bay near Port Stephens, and from deposits near Penrith (Londonderry) and at Botany. The important construction sand resources of the Newnes Plateau east of Lithgow also have potential for beneficiation to a grade suitable for glass–making.

The Kurnell and Newcastle–Port Stephens (Tanilba Bay) areas are the major sources of foundry sand.

The principal quartzite–producing locality in New South Wales is at Marrangaroo near Lithgow. Vein quartz and pegmatitic deposits in the Broken Hill, Murwillumbah, Tenterfield, and Wellington areas are the main commercial sources of primary (coarse) silica. Exceptionally high–quality coarse silica deposits are located at Kingsgate (east of Glen Innes), Bolivia (south of Tenterfield), and near Cowra.

Production

Sand for glass–making is mined in the Sydney area by P.B. White Minerals Pty Ltd at Londonderry and by A.C.I. Resources Ltd at Botany. Both these sources are suitable for amber glass only. The main source of sand for clear glass is obtained at Tanilba Bay from leases held by a consortium of glass and ceramic manufacturers. P.B. White Minerals Pty Ltd mines sand for amber glass at Salt Ash, northeast of Newcastle.

Sand for foundries are supplied from the Kurnell Peninsula by Hooker Industrial Sands and Minerals (The Hooker Corporation Ltd) and Monier Ltd, and from the Newcastle area between Stockton and Point Stephens, chiefly by Quality Sand and Ceramics Pty Ltd at Williamtown and Pearce Sand Processing Pty Ltd at Redhead. The Hooker Corporation Ltd also mines sand in this area at Anna Bay which is exported to Japan for use as foundry sand. There are a number of other smaller producers in the Anna Bay area.

The total amount of sand used for industrial purposes in New South Wales (not including construction sand) was 434,157 t valued at $6,082,979 of which two–thirds was used for glass–making. Over the last two years strong growth in industrial sand production has been one of the bright spots in industrial minerals and rocks in the State.

Of the primary silica deposits in New South Wales there has only been small scale production from the white, quartz–plug deposit at Bolivia. A total of 3,675 tonnes was produced at a value of $184,276.

Outlook

As with construction sand resources, appropriate planning action is required to protect those resources of industrial sand that are within economic haulage distance of the major urban markets in New South Wales.

The major source of sand for clear glass, mined from leases at Tanilba Bay, will soon be exhausted and the consortium of sand producers and users holding those areas is currently seeking approval to continue its mining operations on adjacent leases to the north. As these proposed areas (Permissive Occupancies) conflict with leases held by Rutile and Zircon Mines (Newcastle) Ltd for heavy mineral sands, a suitable agreement must be reached to allow both resources to be utilized.

Aside from the quartz–vein deposit at Bolivia there has been no development of the other primary silica deposits in the State. The most promising of these is the quartz pebble deposit near Cowra. Hooker Resources has indicated an interest in establishing a silicon smelter based on this deposit.

COAL

Virtually all of Australia's largest, and economically most significant resources of black coal are concentrated in two states, New South Wales and Queensland. In New South Wales almost all coal deposits consist of bituminous and sub–bituminous coal and no economically workable deposits of lignite or brown coal have yet been found. The bulk of the State's coal reserves are found in the Sydney and Gunnedah Basins. Reserves also occur in the Ashford, Gloucester and Oaklands Basins. The total coal resources of the State are now estimated to be over 80 billion tonnes.

From this large resource base the coal industry in New South Wales has expanded to a position where it dominates the mining sector, accounting for roughly three quarters of the value of the State's mineral production. The relatively small domestic coal market, coupled with large reserves, has enabled both New South Wales and Queensland to become major exporters of steaming and coking coals. This success has been almost entirely due to accelerating industrial growth in Japan and, more recently, the expansion of export markets in Europe and the industralizing nations of Southeast Asia.

In 1986–87 New South Wales provided 44% of this country's coal exports and Australia maintained its position as the world's leading coal exporter.

Production

Statistics on the New South Wales coal production since 1982–83 are given below.

Raw coal production in New South Wales for 1986–87 was a record 88.5 million tonnes (Mt), an increase of 14.7% over the previous year. Total saleable coal production amounted to 73.3 Mt.

Production from underground mines increased by 15.4% to a record 51.9 million tonnes raw coal due mainly to the continued expansion of longwall mining which now accounts for 32.0% of underground production and 18.7% of total production.

There were other factors which contributed to this record of output including strong growth in coal exports and a decline in production lost due to industrial stoppages.

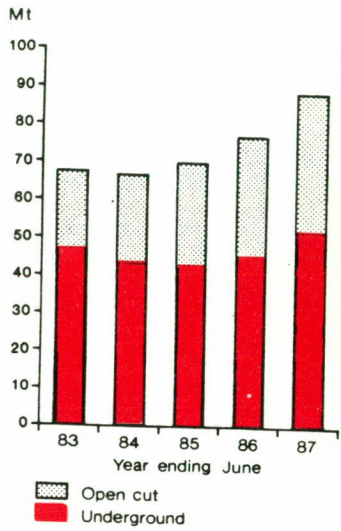
Most of the production increase took place in the Hunter and Newcastle Coalfields, particularly from the underground collieries of Liddell State, Newstan, and Wyee State, owned by the Electricity Commission of New South Wales, and from BHP's Stockton Borehole and Coal and Allied's Liddell mine. A number of large open cut mines also recorded substantial gains in production including Drayton, Howick/Foybrook, Hunter Valley No. 1, Mount Thorley and Saxonvale in the Hunter Valley and the Bloomfield open cut in the Newcastle coalfield. Open cut mining accounted for 41.4% of total raw coal production in New South Wales in 1986–87.

In the Southern Coalfield production was up 7.8% with Appin, Brimstone No. 1, Cordeaux, Nebo and Tahmoor Collieries recording significant increases in output.

In the Western Coalfield, production increased by 4.5%, mainly as a result of increased output from the Baal Bone, Clarence and Ulan No. 2 underground mines.

The recovery in capital expenditure recorded last year in the New South Wales coal industry was short–lived, declining by 8% in 1986–87, largely as a result of a substantial fall in expenditure at open cut mines. However, expenditure increased by 8% at underground operations mainly due to installation of production equipment at the face which included new longwall units

Raw Coal Production



Raw coal prodution 1982-83 to 1986-87
('000 tonnes)

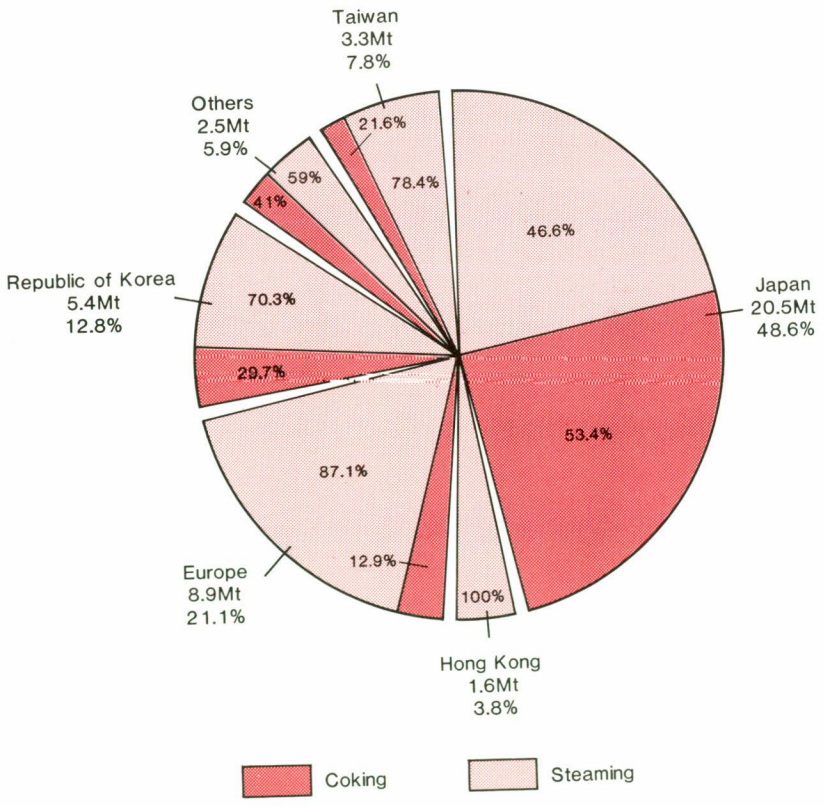
	1982-83	1983-84	1984-85	1985-86	1986-87
Newcastle Coalfield	18 709	18 040	17 447	17 918	21 191
Hunter and Gunnedah Coalfield	22 780	24 464	26 799	30 182	36 406
Western Coalfield	10 062	9 521	11 277	13 743	14 373
Southern Coalfield	15 905	14 508	14 511	15 343	16 537
Total New South Wales	67 456	66 533	70 034	77 186	88 507

at Liddell State, Wyee State, Ulan No. 2 and Tahmoor Collieries.

Several mines closed in New South Wales during 1986–87. Austen and Butta Ltd announced the closure of the Avon and Yellow Rock Collieries in the Southern Coalfield and the Grose Valley Colliery in the Western Coalfield. In the latter half of 1987 there were further closures of the Hazeldene (BP Coal Australia) and Lemington No. 2 (CSR Ltd/Esso Australia Ltd) underground mines in the Hunter Coalfield.

The closure of the Bulli Colliery in the Southern Coalfield by the Broken Hill Proprietary Co. Ltd (BHP) was part of a program of rationalization carried out by BHP during the year. BHP also sold its Metropolitan underground mine to Metropolitan Collieries Ltd and attempted to sell its Saxonvale open cut mine to Peko–Wallsend Ltd. However Peko–Wallsend Ltd withdrew its offer after failing to reach agreement with the State Government over conditions attached to the transfer of the mining lease.

As at June 1987, in New South Wales there were 61 underground mines and 18 open cut mines in operation.



New South Wales Coal Exports by Destination

Domestic Consumption

Consumption of coal in New South Wales rose by 2.5% in 1986–87 to 25.2 Mt. Coal consumed by power stations for electricity generation rose slightly to 18.56 Mt, more than half of which (11.0 Mt) was supplied by mines owned by the Electricity Commission of New South Wales. The remainder is supplied by sub–contracted mines (Ravensworth No. 2 and Swamp Creek open cuts) and from privately owned mines.

The Electricity Commission signed four major contracts this year to supply 7.1 Mt of coal to its Bayswater and Liddell power stations over a 15 year period. Costain Australia Ltd will supply 3.9 Mt per year from completion of the Ravensworth No. 2 open cut and mining of the Ravensworth South deposit. BP Coal Development Australia Pty Ltd will supply 2 Mt per year from the Howick open cut which replaces an earlier contract. Drayton Coal Pty Ltd will supply 1.2 Mt per year from the Drayton mine and Muswellbrook Coal Co. will supply 0.5 Mt/year from its underground and open cut operations. The last of four 660 MW generating units at the Bayswater Power Station was commissioned in 1987.

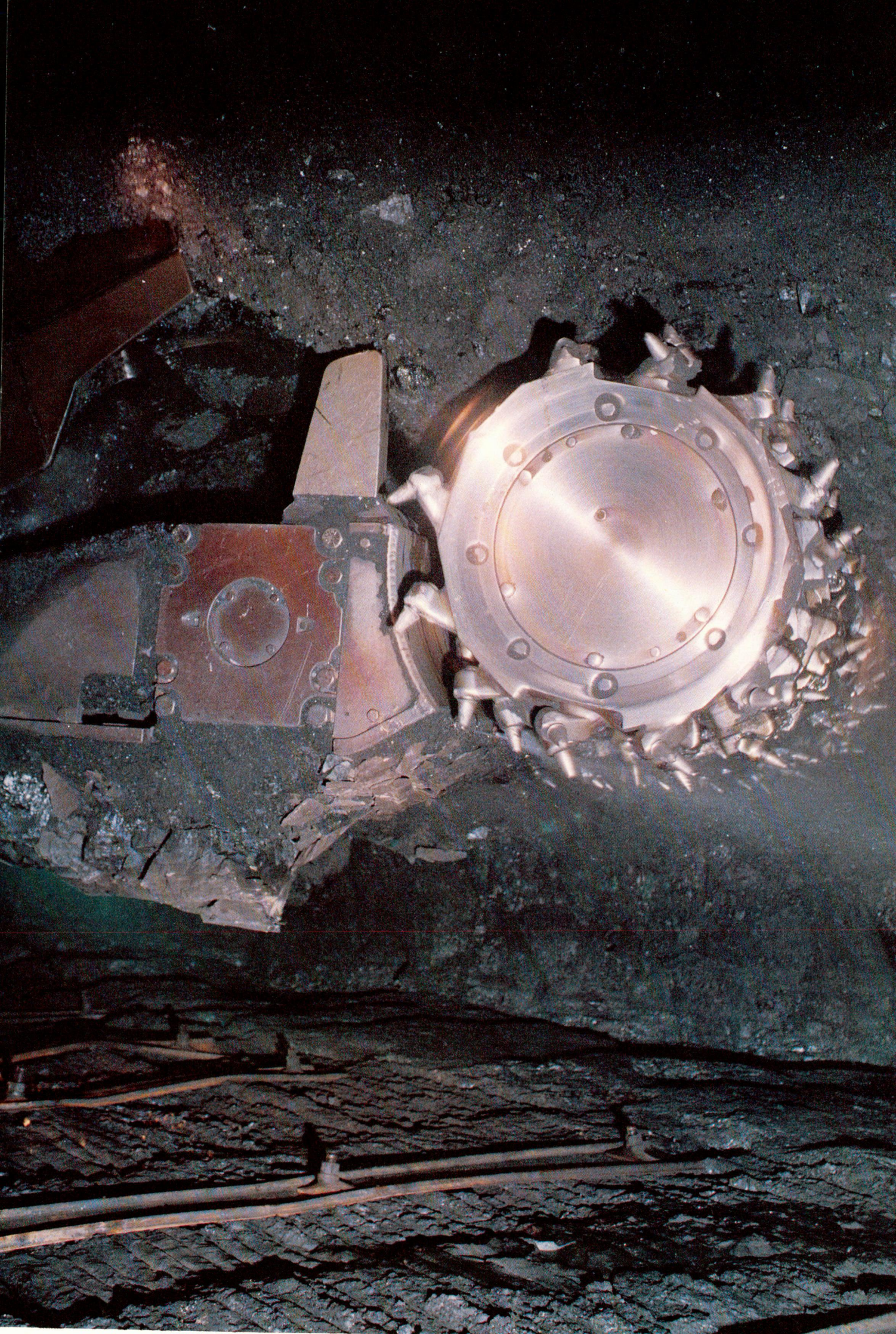
The other major coal consumer in New South Wales is the iron and steel industry based on the steelworks at Port Kembla and Newcastle both owned by the Broken Hill Co. Pty Ltd (BHP). Almost all the coal supplied to these steelworks is from BHP's own mine, the Illawarra and Macquarie Collieries (10 underground mines) and the Saxonvale open cut mines. Consumption of coal for the steelworks rose by 4.4% to 5.3 Mt in 1986–87.

Exports

Coal exports from New South Wales increased 7.9% in 1986–87 to 42.2 Mt, a remarkable performance given the strong competition in international coal markets. These shipments represented 44.1% of Australia's coal exports. Japan remained the major market for New South Wales coal, accounting for 48.7% of exports for the year. Exports to Japan improved to 20.5 Mt, 7.0% more than the previous year.

There was significant growth in sales to the European market with exports rising

Continuous miner ripping through a seam at the Bloomfield underground mine (Newcastle Coalfield). Continuous miners still account for almost 70% of total underground coal production in New South Wales (1986/87).



34.6% to 8.9 Mt while exports to other countries fell slightly to 12.7 Mt (down 4%).

Steaming coal exports rose by 9.0% to 26.7 Mt largely due to an increase in sales to the European market. Japan remained the largest market for New South Wales steaming coal, accounting for 9.6 Mt or 35.8% of exports in 1986–87. Shipments of steaming coal represented just over 63% of all coal exports from New South Wales.

Despite the general decline in the level of international trade for coking coals, exports of **coking coals** from New South Wales rose by 6.1% to 15.5 Mt. Although sales of the traditional hard and soft coking coals were lower this was more than compensated by an increase in exports to Japan of lower–quality coking coals. Sales to Japan rose 8.4% to 11 Mt, 71% of New South Wales coking coal exports.

Outlook

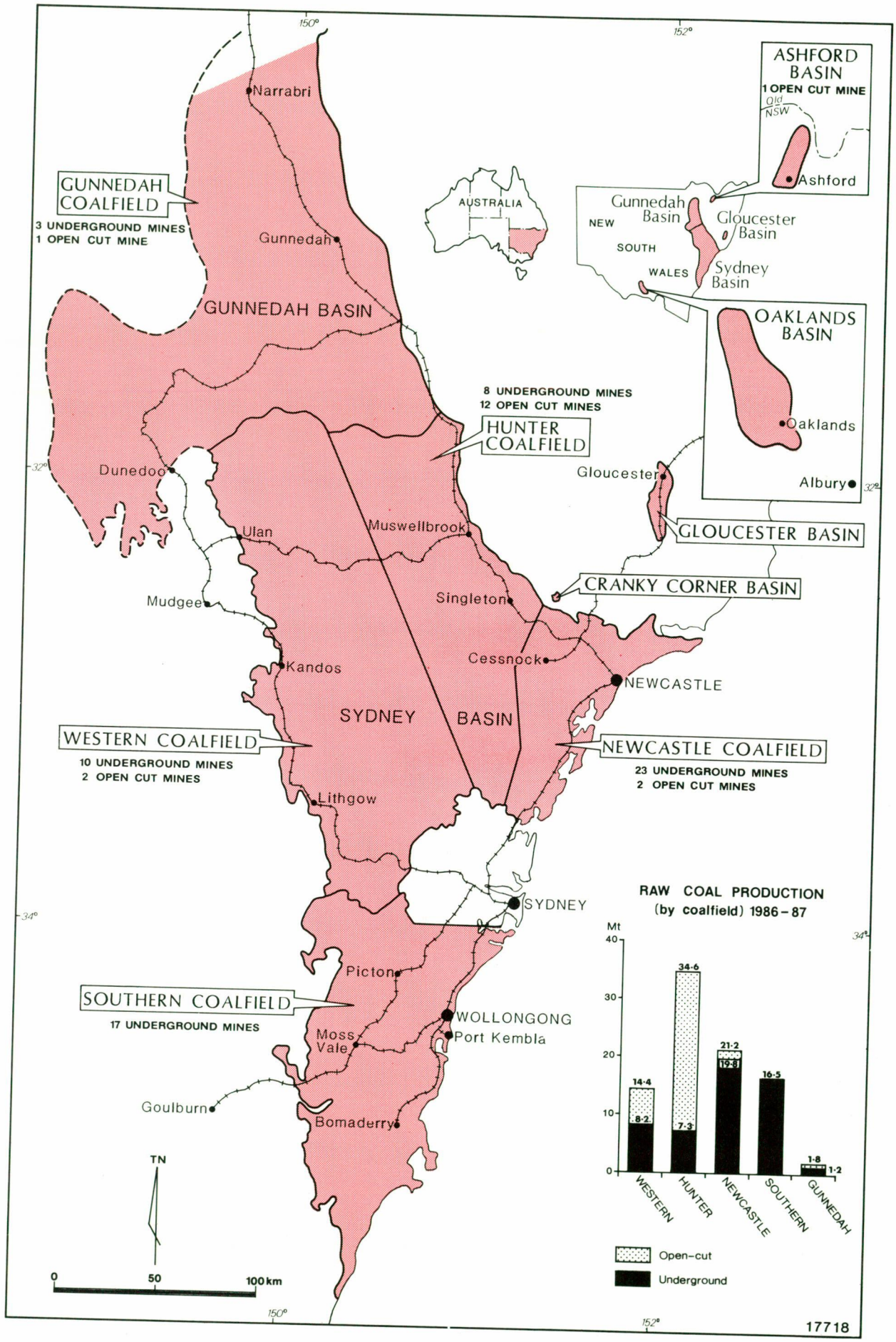
The record coal production figures are not an accurate measure of the state of the coal industry in New South Wales. Although the coal industry as a whole has not performed well financially for a number of years the situation has worsened following further reductions in export prices for both steaming and coking coals for the period April 1, 1987 to March 30, 1988. These reductions have been exacerbated by appreciation of the Australian dollar in the latter half of the financial year which has resulted in significant falls in Australian dollar returns for export coal.

It has not been surprising that a number of mines have closed although the reasons for closure were different in each instance and not always related to profitability. Nevertheless New South Wales coal producers will continue to rationalise their operations and reduce costs wherever possible in order to improve their competitive position. The New South Wales Government, in acknowledging the severity of the coal industry's problems, has made a number of significant concessions over the past year, including the freezing of coal freight rates and port loading charges, and cuts in both statutary and super royalties.

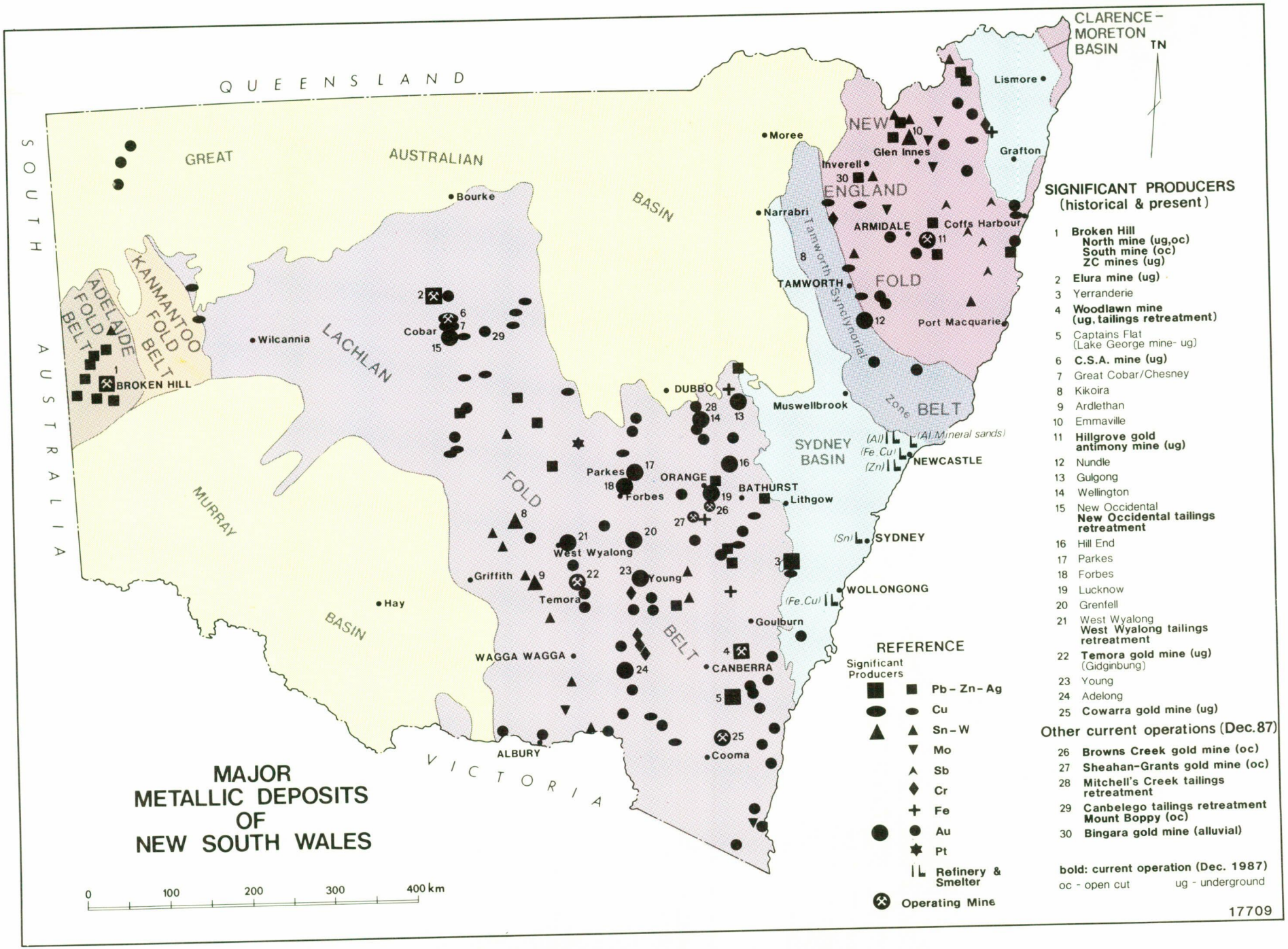
However, there is reason for optimism. World demand for both steaming coal and coking coals is forecast to increase, and the expanding economies of north Asia (Japan, Republic of Korea and Taiwan) which accounted for 2/3 of New South Wales coal exports, will continue to rely strongly on Australian coal. Expectations are that New South Wales coal producers will be in a good position to obtain price increases in this years negotiation for coking coal with the Japanese steel mills and prices for steaming coal are also expected to improve.

Some indication of the difficulties facing the coal industry in New South Wales has been the deferment of major mine developments although there has been progress in a number of projects.

It is unlikely that there will be a rapid growth of new mine capacity in New South Wales in the next few years as this would only exacerbate the conditions that have led to current crisis.



Coalfields of New South Wales



MAJOR METALLIC DEPOSITS OF NEW SOUTH WALES

REFERENCE

Significant Producers

- Pb – Zn – Ag
- Cu
- Sn – W
- Mo
- Sb
- Cr
- Fe
- Au
- Pt
- Refinery & Smelter
- Operating Mine

SIGNIFICANT PRODUCERS (historical & present)

1. **Broken Hill**
   North mine (ug,oc)
   South mine (oc)
   ZC mines (ug)
2. **Elura mine (ug)**
3. Yerranderie
4. **Woodlawn mine (ug, tailings retreatment)**
5. Captains Flat (Lake George mine- ug)
6. **C.S.A. mine (ug)**
7. Great Cobar/Chesney
8. Kikoira
9. Ardlethan
10. Emmaville
11. **Hillgrove gold antimony mine (ug)**
12. Nundle
13. Gulgong
14. Wellington
15. New Occidental
    New Occidental tailings retreatment
16. Hill End
17. Parkes
18. Forbes
19. Lucknow
20. Grenfell
21. West Wyalong
    West Wyalong tailings retreatment
22. **Temora gold mine (ug)** (Gidginbung)
23. Young
24. Adelong
25. **Cowarra gold mine (ug)**

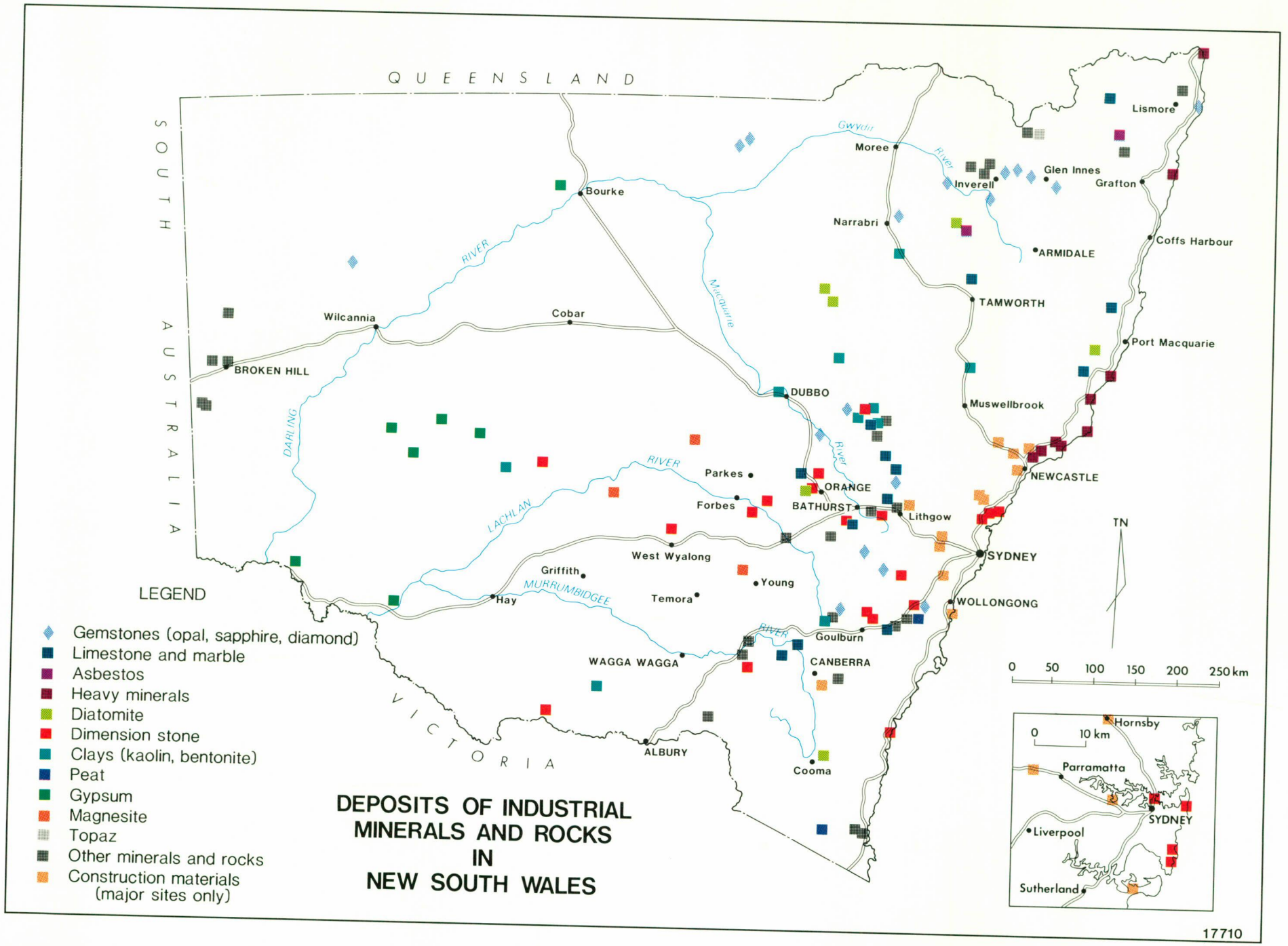
Other current operations (Dec.87)

26. **Browns Creek gold mine (oc)**
27. **Sheahan-Grants gold mine (oc)**
28. **Mitchell's Creek tailings retreatment**
29. **Canbelego tailings retreatment**
    Mount Boppy (oc)
30. **Bingara gold mine (alluvial)**

bold: current operation (Dec. 1987)

oc - open cut ug - underground

17709


QUEENSLAND
SOUTH AUSTRALIA
VICTORIA
Gwydir River
Macquarie River
DARLING RIVER
LACHLAN RIVER
MURRUMBIDGEE RIVER
Lismore
Moree
Glen Innes
Inverell
Grafton
Bourke
Narrabri
ARMIDALE
Coffs Harbour
TAMWORTH
Wilcannia
Cobar
Port Macquarie
BROKEN HILL
DUBBO
Muswellbrook
Parkes
ORANGE
NEWCASTLE
Forbes
BATHURST
Lithgow
West Wyalong
SYDNEY
Griffith
Young
Hay
Temora
WOLLONGONG
Goulburn
WAGGA WAGGA
CANBERRA
ALBURY
Cooma
TN
0 50 100 150 200 250 km
LEGEND
Gemstones (opal, sapphire, diamond)
Limestone and marble
Asbestos
Heavy minerals
Diatomite
Dimension stone
Clays (kaolin, bentonite)
Peat
Gypsum
Magnesite
Topaz
Other minerals and rocks
Construction materials (major sites only)
DEPOSITS OF INDUSTRIAL MINERALS AND ROCKS IN NEW SOUTH WALES
0 10 km
Hornsby
Parramatta
SYDNEY
Liverpool
Sutherland
17710

PETROLEUM

New South Wales has no producing oil or gas fields except for methane drainage from coal at Appin and Westcliff Collieries for on–site electricity generation. Since no oil or gas had been found during earlier cycles of exploration in New South Wales the hydrocarbon potential of the State's sedimentary basins was downgraded by the oil industry. This lack of confidence resulted in very low levels of exploration, not only in the 1970's (a decade of reduced exploration expenditure in Australia) but also in the early 1980's when exploration activity rose sharply in other areas of Australia. However, following the State Government's package of incentives announced in 1984 there has been a significant rise in the level of exploration and this was supported, at least initially, by a program of stratigraphic drilling and seismic surveying carried out by the Department of Mineral Resources.

Over the past several years a number of companies have initiated a more systematic approach to their exploration programs than had previously been attempted. Although the collapse in world oil prices in 1986 had a considerable dampening effect on exploration within Australia, exploration activity in New South Wales has continued at a reasonable level. During 1987, 597km of data were acquired from five seismic surveys and three exploration wells were drilled for a total of 4134 metres. These are detailed opposite.

The most significant of the seismic surveys was carried out by AGEX Pty Ltd (The Australian Gas Light Co.) with the completion of the first phase of the Camden CD87 vibroseis survey in the Sydney Basin southwest of Sydney. A second phase to focus on areas of interest generated by Phase I is planned in 1988. During this program AGEX has also been reprocessing old seismic records (1962–65) using modern seismic recording techniques.

Although most of the basic prerequisites for hydrocarbon reservoirs have been known to exist in the Sydney Basin, the recent exploration by AGEX, in conjunction with a reservoir study on the Narrabeen Group, has proven the existence of suitably porous reservoir horizons. (The Sydney Basin Reservoir Study was funded by AGEX and conducted by the Earth Resources Foundation of Sydney). AGEX's current program of seismic surveying is designed to delineate suitable structural traps for future drill targets within these reservoir horizons.

Applications received for the vacant offshore Sydney Basin area are currently being assessed by the State and Commonwealth Governments.

Methane Drainage

In the Southern Coalfield, methane drainage and associated power production continued at the Appin and West Cliff Collieries. Methane Drainage Pty Ltd (a wholly–owned subsidiary of the Australian Gas Light Co.) has withdrawn from further development of a drainage program at the Tower Colliery near Appin due to poor gas flows. This program entailed the collection of methane from horizontal holes drilled into the Bulli and Wongawilli seams. The methane was being injected into the nearby Moomba-Sydney pipeline.

NEW SOUTH WALES PETROLEUM EXPLORATION 1987

SEISMIC SURVEYS

Seismic survey	Basin	PEL(s)	Length	Start	End
Clarence River	Clarence–Moreton	259	49 km	15/1/87	20/1/87
Angledool Extension	Surat	227, 218, 223	37 km	14/1/87	17/1/87
Camden CD87 (Phase I)	Sydney	260	418 km	6/3/87	15/5/87
Alecs Tank	Bancannia Trough	268	51 km	30/5/87	2/6/87
S87	Surat	182	42 km	5/10/87	9/11/87
			597 km		

WELLS

Well name	Basin	Well type	Status	Pel(s)	Depth	Spud	End
Chester–1	Surat	Exploration	P&A	182	2136 m	28/10/87	21/11/87
Nyora–1	Surat/Gunnedah	Exploration	P&A, water well	238	813 m	31/10/87	10/11/87
Collyblue–1	Surat	Exploration	P&A, water well	223	1185 m	14/11/87	20/11/87
					4134 m		

PEL = Petroleum Exploration Licence

P & A =plugged and abandoned

NEW SOUTH WALES MINERAL INDUSTRY, 1986—87

List of Tables

EXPLANATORY NOTES

Statistical data in this bulletin have been derived primarily from the annual census returns supplied by mineral producers in New South Wales.

The figures for previous years have been revised where necessary and as a consequence may not agree with similar data shown in previous issues of this publication.

Principles for measuring output of minerals

In presenting statistics of minerals produced in New South Wales, minerals are divided into four major groups — metallic minerals, fuel minerals, construction materials, and other non-metallic minerals.

The quantities and values of individual minerals produced are recorded, in general, in the form in which the minerals are despatched from the mine or from associated treatment works in the locality of the mine. Thus for metallic minerals, the output is recorded as ore if no treatment is undertaken at or near the mine, and as concentrate if ore-dressing operations are carried out in associated works in the locality of the mine. In the case of coal produced in New South Wales, the quantity of coal shown in these tables is the raw coal equivalent of the quantity of raw and washed coal produced, while the value of coal produced is the value of the coal in the form (i.e. raw and washed coal) in which the coal was sold or transferred from the mining industry.

For particular minerals (e.g. those which do not have a marketable value until they are sold or despatched from a mine),despatches (or sales) are used as the most appropriate quantitative measure of production. (These minerals are indentified by footnote in Table1.

Mine production of metals, etc.

The quantities of the principal metals etc. contained in the metallic ores and concentrates produced are also recorded. (In the case of some metals, etc. — e.g. aluminium — contents are expressed in terms of the appropriate metallic compound). Quantities derived in this way are known as the mine production of the various metals, etc. They represent gross contents as determined by assay, excluding contents which are not recoverable or for which penalties are imposed because of difficulties in refining. No allowance has been made for losses in smelting and refining,, and the quantities shown are therefore, in general, greater than the contents actually recoverable.

The contents of metallic minerals produced in the State (as shown in Table 1 of this bulletin) are re-assembled in Table 2 to show the total quantity of the principal metals, etc. contained in the metallic ores and concentrates produced. The total quantity of copper shown in Table 2, for example, is the aggregate copper content of all copper-bearing minerals produced (copper concentates, lead concentrates, zinc concentrates, etc.). the isssection between contents "Available for recovery in Australia" and those "Destined for export in ores, etc." as shown in Table 2, is based on adivice from mineral producers, ore buyers, etc. concerning the intended disposition of the mineral.

Method of valuation of minerals produced

The output of individual minerals is valued at the mine or at the associated treatment works in the locality of the mine. This valuation is derived, in general, by valuing the quantity produced during the year at the unit selling value of the mineral sold during the year (including any subsidy) less any transport costs incurred in transporting the mineral from the mine (or associated treatment works) to the point of sale. (Special values of output, based on actual realisations for the year's production are supplied by certain large mineral producers).

Classification by mining activity

In Tables 4 to 6 in this review, each mine has been classified to a particular mining activity on the basis of its principal mineral product — and all employment and minerals produced at the mine (or associated treatment works in the locality of the mine) have been attributed to that mining activity. Tables 5 and 6 also show the extent to which mining activities were undertaken within the scope of the mining industries, as defined in terms of the Australian Standard Industrial Classification.

Rounding. Where figures have been rounded, discrepancies may occur between sums of the component items and the totals shown.

Symbols

r Figure or series revised since previous issue
.. Not applicable
– Nil or rounded to zero

Coal stockpiles at the Port Waratah coal loader in Newcastle.

TABLE 1. QUANTITY, VALUE, AND CONTENTS OF MINERALS PRODUCED IN N.S.W.

Mineral	Unit of Quantity	Quantity		Value ($)	
		1985–86	1986–87	1985–86	1986–87
METALLIC MINERALS					
ANTIMONY CONCENTRATES(a)	Tonne	1 146	968	1,910,000	1,448,000
Antimony content	Tonne	760	634		
ANTIMONY — GOLD CONCENTRATES (a)	Tonne	120	—	65,000	—
Antimony content	Tonne	16	—		
Gold content	Kilogram	8	—		
COPPER CONCENTRATES	Tonne	97 110	115 592	30,634,094	34,889,824
Copper content	Tonne	20 786	26 382		
Lead content	Tonne	3 335	3 268		
Silver content	Kilogram	12 685	16 516		
Zinc content	Tonne	5 814	5 787		
GOLD CONCENTRATES(a)	Tonne	25	50	2,353,209	1,009,000
Gold content	Kilogram	171	61		
Silver content	Kilogram	6	25		
Copper content	Tonne	—	11		
GOLD ORE (a)	Tonne	154	—	8,169	—
Gold content	Kilogram	1			
GOLD — OTHER FORMS(a)(b)	Kilogram	680	2 842	3,925,737	28,025,732
Gold content	Kilogram	252	1 411		
Silver content	Kilogram	161	893		
GOLD FROM TAILINGS DUMPS	Tonne	754	462	882,000	354,000
Gold content	Kilogram	113	57		
Silver content	Kilogram	—	—		
ILMENITE CONCENTRATES(a)(c)	Tonne	17 929	19 275	309,384	376,418
Titanium dioxide content	Tonne	8 256	8 859		
IRON OXIDE — For cement manufacture(a)	Tonne	7 279	9 996	84,381	88,338
LEAD CONCENTRATES FROM NEWLY WON ORE	Tonne	329 413	307 215	108,373,916	124,594,194
Lead content	Tonne	198 425	176 350		
Antimony content	Tonne	466	552		
Cadmium content	Tonne	81	81		
Copper content	Tonne	3 367	3 449		
Gold content	Kilogram	298	252		
Silver content	Kilogram	268 597	226 441		
Sulphur content	Tonne	46 320	56 364		
Zinc content	Tonne	22 228	21 045		
LEAD CONCENTRATES, LOW GRADE	Tonne	—	2 319	—	1,307,011
Lead content	Tonne	—	710		
Copper content	Tonne	—	45		
Gold content	Kilogram	—	3		
Silver content	Kilogram	—	3 116		
Sulphur content	Tonne	—	422		
Zinc content	Tonne	—	443		
LEAD CONCENTRATES FROM SLIME DUMPS	Tonne	13 403	2 607	1,816,401	518,741
Lead content	Tonne	5 561	1 197		
Antimony content	Tonne	6	—		
Cadmium content	Tonne	10	2		
Copper content	Tonne	32	7		
Gold content	Kilogram	6	2		
Silver content	Kilogram	6 805	1 348		
Sulphur content	Tonne	1 597	365		
Zinc content	Tonne	1 615	280		
LEAD—ZINC CONCENTRATES FROM NEWLY WON ORE (d)	Tonne	20 881	23 276	3,919,990	6,013,587
Lead content	Tonne	4 486	5 074		
Antimony content	Tonne	16	16		
Cadmium content	Tonne	38	42		
Copper content	Tonne	110	125		
Gold content	Kilogram	6	7		
Silver content	Kilogram	10 037	11 754		
Sulphur content	Tonne	5 526	6 314		
Zinc content	Tonne	7 104	7 472		

TABLE 1. QUANTITY, VALUE, AND CONTENTS OF MINERALS PRODUCED IN N.S.W. (continued)

Mineral	Unit of Quantity	Quantity		Value ($)	
		1985–86	1986–87	1985–86	1986–87
METALLIC MINERALS (continued)					
MONAZITE CONCENTRATES (a)	Tonne	495	485	257,421	323,180
Monazite content	Tonne	446	437		
RUTILE CONCENTRATES (c)	Tonne	40 696	51 399	20,739,713	30,220,585
Titanium dioxide content	Tonne	38 984	49 207		
SILVER — LEAD ORE (a)	Tonne	1 126	1 130	152,464	92,151
Lead content	Tonne	130	99		
Silver content	Kilogram	642	365		
Zinc content	Tonne	—	—		
SILVER CONCENTRATES (a)	Tonne	9	5 306	49,345	28 168,760
Silver content	Kilogram	167	88 610		
Lead content	Tonne	1	996		
Copper content	Tonne	—	334		
Gold content	Kilogram	—	213		
TIN CONCENTRATES (e)	Tonne	2 479	486	13,758,299	2,191,293
Tin content	Tonne	1 280	249		
WOLFRAM CONCENTRATES (a)	Tonne	5	3	24,051	10,868
Tungstic oxide content	Tonne	3	2		
ZINC CONCENTRATES FROM NEWLY WON ORE	Tonne	623 819	634 899	143,665,165	158,463,385
Zinc content	Tonne	305 689	315 636		
Cadmium content	Tonne	1 014	923		
Cobalt content	Tonne	55	55		
Copper content	Tonne	2 149	1 182		
Gold content	Kilogram	134	197		
Lead content	Tonne	14 588	13 090		
Manganese content	Tonne	3 815	3 858		
Silver content	Kilogram	44 902	37 437		
Sulphur content	Tonne	190 886	193 054		
ZINC CONCENTRATES, LOW GRADE	Tonne	—	493	—	76,908
Zinc content	Tonne	—	162		
Lead content	Tonne	—	97		
Silver content	Kilogram	—	227		
ZINC CONCENTRATES FROM SLIME DUMPS	Tonne	37 846	31 965	7,490,488	9,198,550
Zinc content	Tonne	12 993	11 355		
Cadmium content	Tonne	73	65		
Cobalt	Tonne	—	—		
Copper content	Tonne	289	235		
Gold content	Kilogram	26	24		
Lead content	Tonne	6 744	5 258		
Manganese content	Tonne	82	—		
Silver content	Kilogram	23 749	22 097		
Sulphur content	Tonne	9 471	8 112		
ZIRCON CONCENTRATES (c)	Tonne	54 149	50 741	8,475,842	11,654,225
Zircon content ($ZrSiO_4$)	Tonne	53 607	50 234		
Total, metallic minerals		..	..	348,895,069	439,024,750
FUEL MINERALS					
Coal, black	Tonne	77 186 000	88 057 000	2,299,591,640	2,460,000,000*
Total, fuel minerals		..	..	2,299,591,640	2,460,000,000*

TABLE 1. QUANTITY, VALUE, AND CONTENTS OF MINERALS PRODUCED IN N.S.W. (continued)

Mineral	Unit of Quantity	Quantity		Value ($)	
		1985–86	1986–87	1985–86	1986–87
CONSTRUCTION MATERIALS					
DIMENSION STONE (building, Ornamental, monumental)(f)					
Granite	Tonne	6 601	2 688	893,871	395,563
Marble (including limestone)	Tonne	718	1 030	48,880	61,760
Sandstone (including quartzite)	Tonne	13 026	12 263	1,640,052	1,991,954
Other	Tonne	870	4 910	99,161	359,369
CRUSHED AND BROKEN STONE (g)					
Basalt (including dolerite)	Tonne	8 105 814	7 344 866	88,589,713	81,091,449
Breccia	Tonne	697 871	682 567	8,294,720	8,850,991
Granite	Tonne	853 785	1 011,884	7,402,575	8,301,514
Limestone (including marble)	Tonne	113 466	121 354	1,013,991	880,526
Porphyry (including rhyolite)	Tonne	572 080	278 029	5,141,516	3,285,502
Sandstone (including quartzite)	Tonne	1 242 051	1 350 560	7,304,356	7,567,833
Other	Tonne	2 233 785	2 345 549	17,225,060	24,340,336
GRAVEL (h)	Tonne	5 461 197	4 992 437	58,391,142	56,296,470
SAND (i)	Tonne	10 238 715	9 501 140	69,468,282	63,892,775
OTHER MATERIALS (j)	Tonne	16 872 395	15 490 711	50,719,385	46,438,159
Total, construction materials		..	..	316,232,704	303,754,201
OTHER NON—METALLIC MINERALS					
BARITE	Tonne	1 385	984	15,235	11,477
CLAYS (k) —					
Brick clay and shale dark firing	Tonne	1 322 315	2 151 105	5,915,948	9,713,145
light firing	Tonne	995 147	1 064 896	4,979,708	5,064,000
fired colour unknown	Tonne	268 441	54 183	1,535,772	271,376
Terra Cotta Ware clay —					
for roofing tiles	Tonne	84 972	115 180	592,664	826,210
for other purposes	Tonne	—	70	—	315
Vitrified pipe clay and shale	Tonne	21 994	21 006	126,723	120,994
Refractory clay					
kaolin	Tonne	6 895	5 130	398,900	269,066
ball clay	Tonne	8 259	10 097	309,584	387,347
flint clay	Tonne	16 603	12 965	827,000	867,335
low grade refractory	Tonne	5 753	2 145	126,094	39,966
Other kaolin and ball clay					
for ceramic ware	Tonne	32 597	34 984	799,890	1,769,246
for fillers and extenders	Tonne	6 044	6 475	101,431	129,982
for other purposes	Tonne	263	—	3,890	—
Bentonitic clay	Tonne	10 804	2 190	324,120	65,700
Fullers Earth	Tonne	—	—	—	—
Cement Clay and Shale	Tonne	81 382	135,789	244,571	269,840
All other clays	Tonne	1 764	3 556	6,995	5,624
Total, clays		..	..	16,293,290	19,800,146
DIATOMITE	Tonne	7 014	7 358	1,461,898	1,567,400
DOLOMITE (l)	Tonne	2 259	2 936	141,437	170,250
FELDSPAR (including cornish stone)	Tonne	302	1 197	11,189	56,566
GEMS —					
Garnet	Tonne	..	..	450	500
Nephrite	Tonne	..	..	140	78
Opal (m)	Tonne	..	..	13,130,000	20,853,000
Rhodonite	Tonne	..	..	145,40	59,000
Sapphire	Tonne	..	..	6,066,262	8,904,885

TABLE 1. QUANTITY, VALUE, AND CONTENTS OF MINERALS PRODUCED IN N.S.W. (continued)

Mineral	Unit of Quantity	Quantity		Value ($)	
		1985–86	1986–87	1985–86	1986–87
OTHER NON—METALLIC MINERALS (continued)					
GYPSUM —					
Crude	Tonne	18 402	12 982	105,784	80,127
Washed	Tonne	28 186	26 072	729,549	698,325
LIMESTONE (l)	Tonne	3 404 983	3 445 542	18,789,942	20,267,226
MAGNESITE, crude	Tonne	35 193	46 683	2,207,206	1,645,409
PEAT, horticultural	Tonne	3 142	4 462	306,393	446,417
PYROPHYLLITE	Tonne	8 684	6 575	470,147	400,975
QUARTZ (l)	Tonne	383	4 755	15,519	184,276
QUARTZITE (l)					
For ferro alloys	Tonne	15 441	19 243	229,900	298,220
For silica bricks	Tonne	—	—	—	—
RHODONITE (n)	Tonne	2	12	844	3,000
RHYOLITE (l)					
For ceramics	Tonne	1 526	1 562	91,559	81,756
SAND (l) —					
Foundry sand	Tonne	104 084	97 377	1,551,280	1,264,558
Glass sand	Tonne	256 096	289 465	3,755,519	4,395,418
Other sand	Tonne	29 478	47 315	122,620	423,003
SANDSTONE					
For foundry sand	Tonne	25	—	450	—
SEA SHELLS	Tonne	4	11	550	1,425
SERPENTINE	Tonne	42 779	58 452	497,923	720,129
SHALE ASH	Tonne	6 814	6 616	53,384	59,582
TALC (including steatite)	Tonne	81	90	1,633	2,256
Total, other non—metallic minerals		..	..	66,064,643	82,395,404
ALL MINING AND QUARRYING					
TOTAL		..	..	3,030,783,056	3,285,173,000

(a) Despatches from the mine (or sales) as distinct from production.
(b) Bullion, alluvial, retorted gold, etc.
(c) Includes concentration finally separated in Queensland from zircon —rutile concentrates recovered in N.S.W.; excludes concentrates recovered in Queensland and finally separated in N.S.W.
(d) A composite lead —zinc concentrate containing variable contents of lead and zinc.
(e) Production by large producers; despatches from the mine by small producers.
(f) Comprises stone, quarried in blocks or slabs.
(g) Includes prepared road base and fine ——— crushed rock, and excludes gravel.
(h) Washed, screened under/or crushed gravel (including river gravel).
(i) Comprises "processed" and "unprocessed" sand. Excludes sand for industrial use.
(j) Includes "unprocessed" materials (ridge gravel, shale, loam, etc.) used for roads and/or for fill.
(k) A new classification of clay minerals was adopted in 1985–86.
(l) Excludes materials used directly in building or road making ——— see "Construction material".
(m) Estimated.
(n) Excludes rhodonite as gems.
* preliminary

TABLE 2. CONTENTS OF METALLIC MINERALS PRODUCED IN N.S.W.

Mineral in which contained	1985–86			1986–87		
	Available for recovery in Australia	Destined for export in ores etc	Total	Available for recovery in Australia	Destined for export in ores etc	Total
ANTIMONY (Tonnes)						
Antimony concentrates	—	760	760	—	634	634
Antimony—Gold concentrates	16	—	16	—	—	—
Lead concentrates from newly won ore	317	149	466	389	163	552
Lead concentrates from slime dumps	1	5	6	—	—	—
Lead—zinc concentrates from newly won ore	—	16	16	4	12	16
Total, antimony	334	930	1 264	393	809	1 202
CADMIUM (Tonnes)						
Lead concentrates from newly won ore	71	10	81	72	9	81
Lead concentrates from slime dumps	3	7	10	2	—	2
Lead—zinc concentrates from newly won ore	—	38	38	12	30	42
Zinc concentrates from newly won ore	507	507	1 014	497	426	923
Zinc concentrates from slime dumps	59	14	73	65	—	65
Total, cadmium	640	576	1 216	648	465	1 113
COBALT (Tonnes)						
Zinc concentrates from newly won ore	15	40	55	15	40	55
Zinc concentrates from slime dumps	—	—	—	—	—	—
Total, cobalt	15	40	55	15	40	55
COPPER (Tonnes)						
Copper concentrates	14 614	6 172	20 786	19 612	6 770	26 382
Gold concentrates	—	—	—	11	—	11
Lead concentrates from newly won ore	3 105	262	3 367	2 925	524	3 449
Lead concentrates, low grade	—	—	—	45	—	45
Lead concentrates from slime dumps	9	23	32	7	—	7
Lead—zinc concentrates from newly won ore	—	110	110	34	91	125
Silver concentrates	—	—	—	—	334	334
Zinc concentrates from newly won ore	1 321	828	2 149	1 251	561	1 812
Zinc concentrates from slime dumps	240	49	289	235	—	235
Total, copper	19 289	7 444	26 733	24 120	8 280	32 400
GOLD (Kilograms)						
Antimony—gold concentrates	8	—	8	—	—	—
Gold concentrates	171	—	171	61	—	—
Gold ore	1	—	1	—	—	—
Gold: other forms (a)	252	—	252	1 411	—	1 411
Gold from tailings dumps	—	113	113	—	57	57
Lead concentrates from newly won ore	228	69	298	176	76	252
Lead concentrates, low grade	—	—	—	3	—	3
Lead concentrates from slime dumps	2	4	6	2	—	2
Lead—zinc concentrates from newly won ore	—	6	6	2	5	7
Silver concentrates	—	—	—	—	213	213
Zinc concentrates from newly won ore	83	51	134	155	42	197
Zinc concentrates from slime dumps	21	5	26	24	—	24
Total, gold	766	248	1 015	1 834	393	2 227

TABLE 2. CONTENTS OF METALLIC MINERALS PRODUCED IN N.S.W. (continued)

Mineral in which contained	1985–86			1986–87		
	Available for recovery in Australia	Destined for export in ores etc	Total	Available for recovery in Australia	Destined for export in ores etc	Total
LEAD (Tonnes)						
Copper concentrates	2 028	1 307	3 335	1 907	1 361	3 268
Lead concentrates from newly won ore	163 511	34 914	198 425	138 846	37 504	176 350
Lead concentrates, low grade	—	—	—	710	—	710
Lead concentrates from slime dumps	1 730	3 831	5 561	1 197	—	1 197
Lead—zinc concentrates from newly won ore	—	4 486	4 486	1 390	3 684	5 074
Silver—lead ore	130	—	130	99	—	99
Silver concentrates	1	—	1	—	996	996
Zinc concentrates from newly won ore	9 071	5 517	14 588	9 325	3 765	13 090
Zinc concentrates, low grade	—	—	—	—	97	97
Zinc concentrates from slime dumps	5 320	1 424	6 744	5 258	—	5 258
Total, lead	181 791	51 479	233 270	158 732	47 407	206 139
MANGANESE (Tonnes)						
Zinc concentrates from newly won ore	1 576	2 251	3 815	1 584	2 274	3 850
Zinc concentrates from slime dumps	—	82	82	—	—	—
Total, manganese	1 576	2 333	3 897	1 584	2 274	3 858
MONAZITE (Tonnes)						
Monazite concentrates	(b)	(b)	446	(b)	(b)	437
SILVER (Kilograms)						
Copper concentrates	9 043	3 642	12 685	11 821	4 695	16 516
Gold concentrates	6	—	6	25	—	25
Gold: other forms (b)	161	—	161	893	—	893
Gold from tailings dumps	—	—	—	—	—	—
Lead concentrates from newly won ore	184 572	84 025	268 597	157 984	68 458	226 441
Lead concentrates, low grade	—	—	—	3 116	—	3 116
Lead concentrates from slime dumps	2 955	3 850	6 805	1 348	—	1 348
Lead—zinc concentrates from newly won ore	—	10 037	10 037	3 221	8 534	11 754
Silver—lead ore	642	—	642365	—	365	
Silver concentrates	167	—	167	—	88 610	88 610
Zinc concentrates from newly won ore	30 688	14 215	44 902	28 380	9 056	37 437
Zinc concentrates, low grade	—	—	—	—	227	227
Zinc concentrates from slime dumps	18 407	5 341	23 749	22 097	—	22 097
Total, silver	246 641	121 110	367,751	229 250	179 580	408 829
SULPHUR (Tonnes)						
Lead concentrates from newly won ore	39 251	7 069	46 320	39 576	16 788	56 364
Lead concentrates, low grade	—	—	—	422	—	422
Lead concentrates from slime dumps	509	1 088	1 597	365	—	365
Lead—zinc concentrates from newly won ore	—	5 526	5 526	1 730	4 584	6 314
Zinc concentrates from newly won ore	95 180	95 706	190 886	112 478	80 576	193 054
Zinc concentrates from slime dumps	7 569	1 902	9 471	8 112	—	8 112
Total, sulphur	142 509	111,291	253 800	162 683	101 948	264 631
TIN (Tonnes)						
Tin concentrates	781	499	1 280	27	222	249
Total, tin	781	499	1 280	27	222	249
TITANIUM DIOXIDE (b) (TiO_2) (Tonnes)						
Ilmenite concentrates	(d)	(d)	8 256	9d)	(d)	8 859
Rutile concentrates	(b)	(b)	38 984	(b)	(b)	49 207
Total, titanium dioxide	(b)	(b)	47 240	(b)	(b)	58 066

TABLE 2. CONTENTS OF METALLIC MINERALS PRODUCED IN N.S.W. (continued)

Mineral in which contained	1985–86			1986–87		
	Available for recovery in Australia	Destined for export in ores etc	Total	Available for recovery in Australia	Destined for export in ores etc	Total
TUNGSTIC OXIDE (WO_3) (Tonnes)						
Wolfram concentrates	—	3	3	—	2	2
Total, tungstic oxide	—	3	3	—	2	2
ZINC (Tonnes)						
Copper concentrates	4 310	1 504	5 814	3 848	1 939	5 787
Lead concentrates from newly won ore	18 406	3 822	22 228	16 869	4 176	21 045
Lead concentrates, low grade	—	—	—	443	—	443
Lead concentrates from slime dumps	523	1 092	1 615	280	—	280
Lead—zinc concentrates from newly won ore	—	7 104	7 104	2 047	5 425	7 472
Silver—lead ore	—	—	—	—	—	—
Zinc concentrates from newly won ore	154 699	150 990	305 689	186 320	129 316	315 636
Zinc concentrates, low grade	—	—	—	—	162	162
Zinc concentrates from slime dumps	10 134	2 859	12 993	11 355	—	11 355
Zinc ore	—	—	—			
Total, zinc	188 072	167 371	355 443	221 162	141 018	362 180
ZIRCON (b) ($ZrSi0_4$) (Tonnes)						
Zircon concentrates	(d)	(d)	53 607	(d)	(d)	50 234

(a) Bullion, alluvial, retorted gold etc.
(b) See footnote (a), Table 3.
(c) Not available — mainly "Available for recovery in Australia".
(d) Not available — mainly "Destined for export".

TABLE 3. MINE PRODUCTION OF PRINCIPAL METALS, SULPHUR, AND COAL IN N.S.W.

Year	Sb	Cd	Co	Cu	Au (b)	Pb	Mineral Sands: Titanium dioxide (a)	Mineral Sands: Zircon (a) ($ZrSiO_4$)	Ag (b)	S	Sn	Zn	Coal, black: Underground	Coal, black: Open cut	Coal, black: Total
	t	t	t	t	kg	t	t	t	t	t	t	t	t	'000t	000
1976–77	1 572	975	109	10 788	474	225 134	180 270	171 900	269 337	210 512	1 413	282 722	36 396	9 589	45 986
1977–78	1 486	953	108	12 285	380	232 029	144 779	131 337	278 614	211 609	2 209	282 252	38 112	11 423	49 534
1978–79	1 588	1 053	86	17 675	469	244 665	142 192	141 275	314 925	223 952	2 588	297 454	38 205	12 312	50 517
1979–80	1 435	1 174	84	19 043	518	237 189	111 057	106 477	291 016	243 217	2 424	322 173	35 560	13 415	48 975
1980–81	1 207	1 156	74	17 162	572	224 938	111 021	113 009	283 667	236 244	2 053	309 181	43 465	15 084	58 549
1981–82	1 218	1 378	57	22 915	612	253 031	80 454	88 479	307 508	273 956	1 668	357 185	45 092	14 954	60 045
1982–83	769	1 424	92	26 878	606	237 437	47 612	55 588	322 390	298 850	1 576	374 783	45 462	20 835	66 297
1983–84	718	1 339	60	25 541	966	213 154	41 392	59 181	304 314	220 203	1 388	330 940	42 822	24 001	66 823
1984–85	1 409	1 725	66	23 038	1 464	251 595	41 283	47 113	355 827	248 681	1 306	385 075	42 058	27 976	70 034
1985–86	1 264	1 216	55	26 733	1 015	233 270	47 240	53 607	367 751	253 800	1 280	355 443	44 918	32 268	77 186
1986–87	1 202	1 113	55	32 400	2 227	206 139	58 066	50 234	408 829	264 631	249	362 180	51 844	36 663	88 507

(a) Includes the metallic contents (when finally separated) of zircon—rutile concentrates recovered in N.S.W. and finally separated in Queensland. The metallic contents of zircon—rutile concentrates recovered in Queensland and finally separated in N.S.W. are excluded in all years (nil during 1985–86). In 1985–86, no zircon—rutile concentrates were recovered in N.S.W. for final separation in Queensland. (b) Content of fine metal.

TABLE 4. MINING ACTIVITIES IN N.S.W.: (a) AVERAGE EMPLOYMENT (b) DURING WHOLE YEAR
(Persons)

Mining Activities (a)	Mining Industries (c)		Mining activities in other industries (d)		Itinerant, etc. mining activities (e)		Total all mining activities	
	1985–86	1986–87	1985–86	1986–87	1985–86	1986–87	1985–86	1986–87
METALLIC MINERALS								
Antimony	–	–	–	–	–	–	–	–
Copper	313	293	–	–	–	–	313	293
Gold	136	208	–	–	13	16	149	224
Iron oxide	4	4	–	–	–	–	4	4
Mineral sands	295	384	–	–	–	–	295	384
Silver–lead–zinc	3,781	2,674	–	–	–	–	3,781	2,674
Tin	149	12	–	–	38	2	187	14
Tungsten	2	2	–	–	–	–	2	2
Total	4,680	3,577	–	–	51	18	4,731	3,595
COAL	19,594	19,895*	–	–	–	–	19,594	19,895*
CONSTRUCTION MATERIALS								
Dimension stone	32	46	9	–	–	–	41	46
Crushed and broken stone	711	707	40	30	–	–	751	737
Sand and gravel	649	648	76	54	–	–	725	702
Other (unprocessed materials)	86	82	243	220	–	–	329	302
Total	1,478	1,483	368	304	–	–	1,846	1,787
OTHER NON–METALLIC MINERALS								
Barite	2	1	–	–	–	–	2	1
Clays	129	104	55	37	–	–	184	141
Diatomite	23	25	–	–	–	–	23	25
Dolomite	1	2	–	–	–	–	1	2
Feldspar	1	2	–	–	–	–	1	2
Gems (f)	66	80	–	–	700	900	766	980
Gypsum	12	7	1	–	–	–	13	7
Limestone	226	222	22	22	–	–	248	244
Magnesite	57	38	–	–	–	–	57	38
Peat	9	10	–	–	–	–	9	10
Pyrophyllite	7	3	–	–	–	–	7	3
Rhodonite	–	1	–	–	–	–	–	1
Rhyolite	2	1	–	–	–	–	2	1
Sea shells for shellgrit	–	–	–	–	–	–	–	–
Serpentine	3	3	–	–	–	–	3	3
Shale ash	–	–	–	–	2	–	2	–
Silica:								
Quartz	–	1	–	–	–	–	–	1
Quartzite	–	–	–	–	–	–	–	–
Sand, Industrial	28	31	–	–	–	–	28	31
Sandstone,Industrial	–	–	–	–	–	–	–	–
Talc (including steatite)	–	–	–	–	–	–	–	–
Total	568	531	78	59	700	900	1,346	1,490
TOTAL, ALL MINERALS	26,320	25,486	446	363	751	918	27,517*	26,767

(a) See Explanatory Notes. (b) Excludes employment in separately located administrative offices and ancilliary units. (c) Mining industries as covered in the Australian Standard Industrial Classification. (d) Mining activities undertaken by establishments classified to the manufacturing, construction, and other non–mining industries specified in the Australian Standard Industrial Classification. (e) Itinerant, etc. miners classifiable to a mining industry (as covered by the Australian Standard Industrial Classification), but excluded from the scope of the annual mining census because of their limited scale of operations and consequent difficulties in collecting complete census data for them. Average employment is on a 'period of operation' basis, as an average on a 'whole–year' basis cannot be calculated for these activities. (f) Estimated; coverage known to be incomplete.
* preliminary

TABLE 5. MINING ACTIVITIES (a) IN N.S.W.: VALUE OF MINERALS PRODUCED
($'000)

Mining activities (a)	Mining Industries (b)		Mining activities in other industries (c)		Itinerant, etc. mining activities (d)		Total all mining activities	
	1985–86	1986–87	1985–86	1986–87	1985–86	1986–87	1985–86	1986–87
METALLIC MINERALS —								
Antimony	—	—	—	—	—	—	—	—
Copper	18,493	33,591	—	—	—	—	18,493	33,591
Gold	9,113	30,766	—	—	39	79	9,152	30,845
Iron oxide	84	88	—	—	—	—	84	88
Mineral sands (e)	29,782	42,574	—	—	—	—	29,782	42,574
Silver—lead—zinc	277,618	329,732	—	—	—	—	277,618	329,732
Tin	13,532	2,185	—	—	223	6	13,756	2,191
Tungsten	27	11	—	—	—	—	27	11
Total	348,649	438,947	—	—	262	85	348,912	439,033
COAL	2,299,591	2,460,000*	—	—	—	—	2,299,591	2,460,000*
CONSTRUCTION MATERIALS—								
Dimension stone	1,192	2,771	623	—	—	—	2,616	2,771
Crushed and broken stone	126,844	126,328	9,681	7,718	—	—	136,525	134,046
Sand and gravel	120,565	117,635	8,022	4,326	—	—	128,587	121,962
Other (unprocessed materials	7,700	6,251	14,632	39,815	—	—	49,331	46,066
Total	257,101	252,985	59,958	51,859	—	—	317,059	304,845
OTHER NON-METALLIC MINERALS—								
Barite	15	11	—	—	—	—	15	11
Clays	10,332	13,891	6,030	5,953	—	—	16,362	19,843
Diatomite	1,462	1,567	—	—	—	—	1,462	1,567
Dolomite	140	169	—	—	—	—	140	169
Feldspar	11	57	—	—	—	—	11	57
Gems (f)	6,082	8,964	—	—	13,130	20,853	19,212	29,817
Gypsum	828	778	7	—	—	—	835	778
Limestone	18,296	19,851	641	497	—	—	18,936	20,347
Magnesite	2,207	1,645	—	—	—	—	2,207	1,645
Peat	306	446	—	—	—	—	306	446
Pyrophyillite	506	471	—	—	—	—	506	471
Rhodonite	—	3	—	—	—	—	—	3
Rhyolite	92	82	—	—	—	—	92	82
Sea Shells for shellgrit	1	1	—	—	—	—	1	1
Serpentine	498	720	—	—	—	—	498	720
Shale ash	53	60	—	—	—	—	53	60
Silica: Quartz	16	184	—	—	—	—	16	184
Quartzite	—	—	—	—	—	—	—	—
Sand, Industrial	4,566	5,091	—	—	—	—	4,566	5,091
Sandstone, Industrial —	—	—	—	—	—	—	—	
Talc (including steatite)	2	2	—	—	—	—	2	2
Total	45,413	53,992	6,678	6,450	13,130	20,853	65,220	81,295
TOTAL, ALL MINERALS	2,950,754	3,205,926*	66,636	58,309	13,392	20,938	3,030,782	3,285,173*

(a) See Explanatory Notes, page 45. (b) Mining industries as covered in the Australian Standard Industrial Classification. (c) Mining activities undertaken by establishments classified to the manufacturing, construction, and other non—mining industries specified in the Australian Standard Industrial Classification. (d) Itinerant, etc. miners classifiable to a mining industry (as covered by the Australian Standard Industrial Classification), but excluded from the scope of the annual mining census because of their limited scale of operations and consequent difficulties in collecting complete census data for them. (e) Includes the value of concentrates finally separated in Queensland from mineral sands recovered in N.S.W.; excludes the value of concentrates recovered in Queensland and finally seperated in N.S.W. (f) Estimated; coverage known to be incomplete.
* preliminary

TABLE 6. PRINCIPAL MINING ACTIVITIES (a) IN N.S.W. : AVERAGE EMPLOYMENT AND VALUE OF MINERALS PRODUCED

Year	Coal	Silver lead—zinc	Mineral sands	Clays	Limestone	Construction materials	Other mining activities	Total, all mining activities
				PERSONS EMPLOYED (b)				
1976–77	15,787	3,928	1,198	226	247	1,949	2,671	26,006
1977–78	16,063	4,150	843	222	250	1,740	2,802	26,070
1978–79	16,343	4,281	730	217	257	1,789	2,977	26,594
1979–80	17,124	4,458	762	268	257	1,997	2,923	27,789
1980–81	19,669	4,352	720	262	253	2,153	2,988	30,407
1981–82	21,284	4,472	532	255	255	2,093	2,473	31,364
1982–83	20,985	4,296	274	170	238	1,973	2,038	29,974
1983–84	19,833	4,022	221	183	252	1,868	1,654	28,033
1984–85	19,290	3,892	232	206	252	2,058	1,662	27,592
1985–86	19,820	3,781	295	184	248	1,846	1,569	27,743
1986–87	19,885*	,2674	384	141	244	1,787	1,642	26,767*
				VALUE OF MINERALS PRODUCED ($ '000)				
1976–77	757,898	149,091	(c) 56,585	6,727	7,217	91,904	56,714	1,126,136
1977–78	859,912	151,196	(c) 32,031	7,347	7,259	104,242	68,840	1,230,827
1978–79	908,823	233,684	(c) 35,449	8,568	8,413	126,631	86,003	1,407,571
1979–80	880,776	387,021	(c) 37,263	15,254	9,959	171,807	102,168	1,604,247
1980–81	1,318,104	267,291	(c) 39,187	17,064	11,153	197,990	87,021	1,937,811
1981–82	1,585,023	241,591	(c) 27,029	18,894	16,860	232,136	75,353	2,196,886
1982–83	1,906,970	273,345	(c) 16,228	13,497	16,744	212,514	65,086	2,504,384
1983–84	1,733,358	267,753	(c) 16,452	15,513	17,223	229,466	65,028	2,344,792
1984–85	1,948,608	324,208	(c) 19,576	17,620	17,267	287,523	68,802	2,683,604
1985–86	2,250,000	277,618	(c) 29,782	16,362	18,936	317,059	71,434	2,981,191
1986–87	2,460,000*	329,732	(c) 42,574	19,843	20,347	304,845	107,832	3,285,173*

(a) See Explanatory Notes. (b) For all mining activities (other than itinerant, etc. mining activities component — see footnote (e) Table 4, the average is on a "whole—year" basis. For itinerant, etc. mining activities, the average is on a "period of operation" basis in all years (an average on a "whole—year" basis cannot be calculated for those activities). Excludes employment in separately located administrative offices and ancilliary units. (c) See footnote (e), Table 5.
* Preliminary.

TABLE 7
VALUE OF NET MINERAL ROYALTIES COLLECTED IN NEW SOUTH WALES

	1984/1985 $	1985/1986 $	1986/1987 $
METALLIC MINERALS			
Antimony	124	36,264	37,232
Copper	65,859	657,463	93
Gold	9,952	53,147	133,311
Ironore	3,940	1,124	2,395
Mineral sands	665,830	811,934	1,153,882
Silver—lead—zinc	467,097	134,328	479,178
Tin	397,527	508,557	197,482
Others	1,445	2,424	2,363
Total	1,611,774	2,205,240	2,005,936
COAL	106,555,870	115,437,595	132,640,794
CONSTRUCTION MATERIALS			
Granite	60,174	53,458	55,197
Quartzite	80,361	61,766	44,525
Slate	3,087	1,565	1,728
Total	143,622	116,789	101,450
OTHER NON–METALLIC			
Asbestos	59,040	Nil	
Clays	119,648	142,829	94,514
Diatomite	—	—	3,520
Gypsum	8,215	9,407	11,222
Limestone	559,754	451,071	464,918
Magnesite	(5,491)	11,148	2,021
Peat	1,269	2,504	2,219
Pyrophyllite	12,216	8,552	10,294
Sapphire	94,249	144,517	116,118
Shale ash	14,125	20,664	2,385
Chitter	—	—	23,793
Others	7,818	12,049	7,044
Total	902,211	807,234	738,045
TOTAL all minerals	109,213,478	118,566,859	135,486,225

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