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Chapter 14

MINING

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Chapter 14

MINING

Commercial mining in Tasmania can be dated to 1834, although when coal was discovered at Mount Communication on the Tasman Peninsula, there had already been fourteen other coal discoveries in the State.

The French naturalist Labillardiere reported finding coal in the cliffs at South Cape Bay in 1793 and in 1803 James Meehan, on an exploratory expedition from Risdon Cove, discovered coal in a bank beside the Coal River downstream from the site of Richmond.

In 1804, the Reverend Knopwood is recorded as having collected coal from near the Coal River. Surface picking of brown coal was also undertaken at Macquarie Harbour on the West Coast in the 1820s.

Coal deposits were discovered in the Hobart suburb of New Town in May 1827, although commercial sales of this coal did not begin until 1851.

Tasmania's first commercial coal mining took place at the Government-run Saltwater River mines near Mount Communication in 1834 using convict labour; 61 tonnes of coal were produced by the Port Arthur convicts. The mine operated for 10 years before better quality coal was discovered elsewhere. The mine closed in 1877.

The first discovery of gold was near Lefroy in 1849. Three years later, a further discovery was made at Mangana near Fingal.

Tin oxide was first discovered near Mount Bischoff in 1871, silver-lead ore in the Zeehan-Dundas area in 1882. The discovery of the Iron

Blow ore outcrop in 1883 led to the opening of the Mount Lyell copper field. These, and later discoveries, led to the establishment of Tasmania's West Coast mining industry which has had a significant impact on the State's development and economy.

Iron ore deposits at Savage River have been known about since the 1870s and their commercial potential was first investigated by mining companies in the 1950s and 60s. The magnetite ore was considered to be of too low a grade and too difficult to concentrate to be worth mining commercially.

After a two-year exploration and feasibility study, Pickands Mather and Company announced in 1965 that the iron ore deposits would be developed by a joint venture of Japanese, American and Australian companies. At the time, it was the biggest and most costly industrial project undertaken in Tasmania. Costing \$80 million, it included a township, concentrating mill, 83-kilometre-long ore slurry pipeline to Port Latta, pelletising plant and offshore loader.

Production began in 1967 and since then, Savage River Mines has open-cut mined 286 million tonnes of material to produce 101 million tonnes of ore and 47 million tonnes of high-grade pellets.

14.1 MINERAL PRODUCTION

The Mining Census conducted for 1988-89 included only producers of metallic minerals and coal; previous censuses had included construction materials and other non-metallic minerals. In 1988-89, turnover for the metallic minerals and coal sectors of the industry was \$502.6 million, 20 per cent more than in 1987-88. Employment in these sectors at the end of June 1989 was 2500, a marginal increase on the figure of 2496 recorded the previous year. Wages and salaries paid were five per cent more than in 1987-88.

14.1.1 Metallic minerals

Mount Lyell

Development of the Mount Lyell Mining and Railway Company Ltd mine at Queenstown continued in 1988-89 with the opening of the new Prince Lyell 50 series of stopes. Work was started on a crusher station and on the overland conveyor between the Prince Lyell shaft and the mill. Mine production was 1.64 million tonnes of ore, with 1.63 million tonnes being processed at a grade of 1.24 per cent copper.

In 1989-90 production of ore fell to 1.3 million tonnes at a grade of 1.28 per cent copper. A delay in the opening of the 50 series stopes contributed to the drop in production. Work began on the 60 series decline. In the last quarter of 1989-90 the mine workforce was reduced by about 15 per cent and workforce restructuring was undertaken.

The Mount Lyell mine has operated for over 100 years and while there is still an ore reserve, most of it is well below the surface and difficult and expensive to mine. The mine faces closure unless there is a substantial surge in world copper prices, which would make mining of these fairly inaccessible copper reserves economically worthwhile.

Que River

In 1988-89, 276 400 tonnes of ore were recovered from the Aberfoyle Que River mine. 254 400 tonnes of ore were transported to the Pasminco mill at Rosebery for processing. Exploratory drilling led to only a minimal increase in the size of the ore reserves. Proved and probable reserves in November 1988 were 810 000

Mount Lyell

In 1991 the countdown to the 1995 shutdown of the Mount Lyell copper mine at Queenstown began. The workforce has been reduced to a record low of 450 and mining is being carried out at the deepest levels of the mine. Despite this, the mine has been producing at a record rate of about 1.5 million tonnes of ore a year, with about 2100 tonnes of copper being recovered.

The averaged grade of the ore from the lower levels of the Prince Lyell shaft is less than expected: about 1.6 per cent compared with an anticipated level of 1.9 per cent. The mine management have set an annual production target of 1.7 million tonnes of ore in order to achieve economic viability in the last years of the life of the mine.

The increases in production capacity have been achieved through a multi-million dollar development program which includes rehabilitation of the Prince Lyell shaft, installation of a new underground crushing and conveying system, and establishment of a 1.2 kilometre-long overland conveyor for transporting ore from the shaft to the concentrator.

The body of ore now being mined could last until June 1996. However, the profitability of keeping the mine open depends on world copper prices and the effect of cost-control measures. The mine could be forced to close in June 1994, when all companies operating under environmental exemptions will have to operate without them. By June 1994 or 1995 the company will have mined out all ore bodies at the 50 and 60 series stopes. By July 1996 it will have met its site clean-up and rehabilitation objectives.

tonnes. The workforce size in 1988-89 was ninety eight.

In 1989-90 the amount of ore mined from underground sources had risen to 280 000 tonnes, but the 290 500 tonnes transported to Rosebery for processing was of a lower grade. Reserves at 4 November 1989 were 400 000 tonnes.

Half the workforce of the Que River mine was retrenched in March 1990 as a result of the

depletion of the ore body. Mining continued at a reduced scale using a workforce of about 15. It continued operating, on a restricted basis, for another 18 months before closing in November 1991.

Henty

Development of the Renison Goldfields Henty gold prospect has continued. The prospect is a joint venture between Renison Goldfields Consolidated Ltd and Little River (Resources) NL.

In 1988-89 the drilling program to estimate gold resources continued. Work began on declines to gain access to the gold-bearing deposits and on infrastructure, including sumps, loading bays and an electrical substation. Prospecting development work was completed in October 1989. An environmental management plan was released in December 1990.

King Island

Ore produced from underground sources in 1988-89 was 142 121 tonnes, a 58 per cent increase over production in 1987-88. The grade of the ore was 1.21 per cent tungstate, which was less than the concentration (1.26 per cent) in 1987-88. A total of 151 000 tonnes of ore was processed in 1988-89, compared with 128 900 tonnes in 1989-90 (from a total production of 132 059 tonnes at a grade of 1.23 per cent tungstate).

The King Island scheelite mine at Grassy ceased operations at the end of November 1990, resulting in the retrenchment of the workforce of almost 90. The closure was the result of falling world tungsten prices and the high value of the Australian dollar.

Savage River

A two-year wind-down of the mine began in October 1988. In 1988-89 concentrate production was over 2.3 million tonnes. A feasibility study was started to assess continuation of production on a reduced scale beyond September 1990. The mine workforce was reduced by 22 per cent through retrenchments and natural attrition, and the number of employees at the pelletising plant fell by six per cent.

In 1989-90 concentrate and pellet production were 2.31 and 2.26 million tonnes respectively. The workforce was reduced from 512 to 486. No exploration work was undertaken on mine leases.

Henty gold prospect

In June 1990, joint venturers Renison Goldfields Consolidated (Tasmania) Ltd and Little River (Resources) NL lodged a development proposal for a gold mining and processing operation at the Henty site, 30 km north of Queenstown. When the mine is approved it will be the only gold mine on the West Coast and could provide about 180 jobs 60 people directly in the mine operations and a further 120 indirectly. Most will come from mining communities on the West Coast.

The two companies have already invested about \$8.5 million on both shallow and surface-based deep drilling programs and on a relatively shallow underground development down to 70 metres. The mineralisation is mostly confined to quartz lenses with analyses indicating that over 90 per cent of the gold could be recovered.

The proposal is, initially, an exploration program which will consist of deep drilling from the surface. If successful, it would be followed by construction of 400 metre to 500 metre shafts, and associated lateral mine workings which could evaluate the deep zone of gold ore.

An environmental management plan (EMP) for the development was released in December 1990. Under the EMP, underground exploration works will be extended in the first year after the project has been approved. This would be followed by construction of up-graded roads to the mine site and the building of a processing plant and surface facilities for mine ventilation. In years two and three a 510 metre shaft, with associated drives and cross-cuts, would be excavated to allow for an intensive drilling program to confirm the gold ore reserves. The EMP proposed that 420 000 tonnes of ore would be produced by the mine in the first five years of operation.

The mining and processing of the gold ore will involve toxic products such as cyanide. Overflow water containing cyanide will be recycled at the mine plant and tailing containing cyanide will be concentrated and detoxified. When the effluent has been cleaned to State government standards much of it will be discharged into either the Henty River or into a tributary of Lake Newton.

Renison Bell

In 1988-89, 830 083 tonnes of ore were mined at the Renison mine at Renison Bell and 822 854 tonnes were processed. In 1989-90, 753 786 tonnes were mined at a grade of 1.34 per cent tin and 741 569 tonnes were processed. A substantial fall in the price of tin in early 1989 forced the mine management to adopt cost-cutting measures. In April 1990 the workforce was reduced by 50 and job restructuring was introduced to improve efficiency.

The mine underwent a period of closure in early 1991 as a result of falling world tin prices and an initial inability of mine management and mining unions to reach agreement on new mining practices and conditions.

Rosebery

Underground production by Pasmenco Metals-EZ at the Rosebery zinc, lead and silver mine in 1988-89 was 516 863 tonnes with a headgrade of 10.52 per cent zinc. A total of 766 746 tonnes of ore was milled, of which 506 236 tonnes originated from Rosebery. The workforce for the end of June 1989 was 488.

In 1989-90 the amount of ore mined was 482 876 (10.4 per cent zinc headgrade) and 782 273 tonnes were processed, 489 617 tonnes coming from Rosebery. Recovery was less than in 1988-89 because of lower headgrades and high iron content in the ore.

The mine aims to produce 550 000 tonnes of ore in 1990-91. At its present rate of production the mine should have an operating life of at least 13 years. One hundred workers were retrenched in March 1991. The workforce has fallen from about 1100 in 1981 to 340 in April 1991.

Hellyer

The silver-lead-zinc ore body discovered at Hellyer in 1983 was commissioned as a large-scale mining and ore treatment operation by its owners (Aberfoyle Resources) in 1989. The ore body, estimated at about 15 million tonnes, can be mined at a rate of more than one million tonnes of ore a year. The on-site mill was completed in February 1989 and commissioned in March. Up until 30 June of that year, 423 096 tonnes of ore, at a headgrade of 14.3 per cent zinc, were mined. The workforce for 1988-89 was 177.

In 1989-90, 900 000 tonnes of ore (with a headgrade of 13.3 per cent zinc, 7.1 per cent lead and 166 g/t silver) were mined. Employment had increased to 239. The concentrator performance improved during the year to reach an annual ore throughput rate equivalent to one million tonnes of ore. An increase in flotation capacity, to allow for treatment of up to 1.25 million tonnes of ore, was undertaken.

Iron oxide pigments at Savage River

The Savage River iron ore mine on Tasmania's West Coast faced closure in 1990 after Japanese steel-mill customers decided not to renew contracts for iron ore pellets in August 1988. This would have led to retrenchment of the mine's workforce of 300.

The mining township has been saved by the discovery of a large deposit of fine-grained iron oxides. The oxides were found during a drilling program in the area in early 1990. Over 350 000 tonnes were discovered, although mine representatives estimate that this may be only ten per cent of the resource. The deposit has the potential to raise \$15 million per year in exports.

The 350 000 tonnes could maintain a mine for over 10 years with a projected average output of 10 000 tonnes per year. This could result in employment of 20 permanent staff and income for the mine of between \$10million and \$15 million per year.

The oxides exist in three colours: red, yellow and brown. These pigments can be used as colouring agents in paint, bricks and pavers, roofing tiles, plastics and wood stains for both the domestic and overseas manufacturing markets. The pigment can sell for \$1500 per tonne on the world market and demand was very strong. By comparison, regular iron ore sold for \$40 per tonne.

The mine is expected to open in a couple of years after a processing plant has been constructed in the township of Savage River. Transport of the pigment will either be by containerised road transport to Burnie or via the Emu Bay Railway.

CLOSURE OF KING ISLAND SCHEELITE MINE

The township of Grassy is the site of the North Broken Hill-Peko (NBH-P) scheelite mine which closed on 30 November 1990, throwing almost a fifth of King Island's workforce out of work. Closure of the mine has been likely since NBH-P unsuccessfully offered it for sale in July 1990.

Deteriorating tungsten prices on overseas markets had been the prime factor in prompting the decision to sell the mine. As well, efforts to secure a deal with potential overseas tungsten users, including Japanese buyers, had failed. A representative of NBH-P has blamed a Chinese monopoly of the international tungsten market for the failure of the mine.

The mine has faced closure on several occasions in the past. It began operations in 1917 but was closed three years later when tungsten prices fell. It remained closed between 1920 and 1937. The mine was revived in 1937 with the installation of a treatment plant and it was incorporated as King Island Scheelite Development Company Ltd NL. In 1947 the company was voluntarily wound up and reconstructed with its current name (King Island Scheelite Ltd).

The mine has been managed since 1947 by King Island Scheelite Ltd, a subsidiary of NBH-P. The company experienced a time of prosperity in the 1950s when the war in Korea created a large demand for tungsten for armour plating and weapons-grade steel. Tungsten, which has the highest melting point of all metals, is added to steel to make it harder and more elastic and able to be used in materials which have to be able to withstand high temperatures.

Once the war had passed, the market for tungsten declined and in 1958 it was closed for two years and placed on a care and maintenance program. In 1969 the mine became part of the Peko group.

Low tungsten prices in the 1980s forced a change in strategy for the mine with a need to either lift productivity or cease operations. The price of tungsten had dropped from \$US140 per tonne in 1980 to about \$US50 per tonne. The new planning and operating strategies were so successful that the mine was able



Photo: The Advocate

to lift productivity by 50 per cent in 18 months. At the peak of its profitability about 10 years ago, the mine had a workforce of over 500.

The tungsten was produced from scheelite in one of two processes: directly from calcium tungstate ore or in a chemically reconstructed form in the mine's artificial scheelite plant. The scheelite ore was originally bagged by hand until 1943 when the loading operation used shovels and six-tonne trucks.

Closure of the mine in 1990 saw the retrenchment of 89 workers. One hundred employees had been retrenched in 1982. The mine had accounted for twelve per cent of King Island's shipping revenue and the local council relied on its operation to provide \$80 000 in annual rates. The closure would take about \$3 million, and 200 to 300 people, out of the island's economy. Almost 20 per cent of King Island's population of 1700 residents will be directly affected by the closure.

The company has offered the township for sale. The 7000 hectares are estimated to be worth \$10 million and include 119 houses, seven shops, a water and sewage treatment plant, tennis and squash courts, and a golf course and clubhouse. Only 27 properties in the township are freehold. The bulk of the land holdings could be split up into smaller dairy farms and the township itself could provide the basis for a tourist complex.

In 1991 Aberfoyle were mining and treating 1.25 million tonnes of ore a year using a workforce of 240. The estimated productive life of the mine is about 12 years.

Lottah

In 1988, Spectrum Resources started development of an underground tin mine at the former Anchor open-cut mine near Lottah. The mine is expected to have an annual production capacity of 400 tonnes of high-grade cassiterite from 100 000 tonnes of ore. In 1989-90, 43 000 tonnes of ore were mined, with an average head-grade of 0.44 per cent tin.

Kara

The scheelite mine operated by Tasmania Mines produced 129 260 tonnes of ore in 1988-89 at a grade of 0.77 per cent tungstate. During the year, 151 000 tonnes of ore were processed. In 1989-90, 208 000 tonnes of ore were mined, including 53 000 tonnes of marginal stockpile ore and 55 000 tonnes of waste.

The stockpile of magnetite waste discarded by the old Kara milling operation is being drilled, sampled and assessed with a view to potential sales for the treated magnetite.

Infrastructure

The Emu Bay Railway Company, a member of the Pasminco mining group, announced a \$4 million modernisation program for its engineering workshops in 1990. The railway,

14.1 MINERAL LEASES AND LICENCES, TASMANIA

	1988-89	1989-90
Number of leases & licences applied for	95	91
Area of leases & licences applied for (ha)	11 160	4 941
Number of leases & licences granted	63	78
Area of leases & licences granted (ha)	1 384	3 949
Total number of leases & licences in force	1 160	945
Total area of leases & licences in force (ha)	76 256	68 073

(Source: Div. of Mines & Mineral Resources, Annual Report).

Beaconsfield Gold Mine

Plans are underway to resume mining at the old Beaconsfield gold mine in northern Tasmania. Gold was first discovered on the eastern slope of Cabbage Tree Hill, west of Beaconsfield, in 1877. The mine operated from 1877 to 1914, producing 26 578 kilograms of gold from 1 085 000 tonnes of ore.

A number of shafts were sunk in the area, the main ones intercepting the original reef were the Main, Hart and Grubb shafts. During its working life the mine was subject to heavy water inflows and became known as one of the wettest mines in Australia.

An underground mining lease application has been made to the Director of Mines by a subsidiary of Beaconsfield Gold Mines Ltd. The application would involve mining at depth beneath private land. The main mining is planned to be done at a depth of 350 metres, with an additional area (at about 100 metres below the surface) around the old Hart shaft which the company is rehabilitating. The ore body is believed to be 350 metres wide and about 2 metres deep, dipping north-east at an angle of 55 degrees. After water is removed from the bottom of the old shaft (420 metres down) a sampling and rehabilitation program will start. If ore reserves are proven, the company plans to mine 75 000 tonnes of ore a year. About \$18 million will need to be spent in removing the water from the mine and in proving the extent of its reserves. A processing mill and tailings dam will be built about 2.5 km west of the mine site.

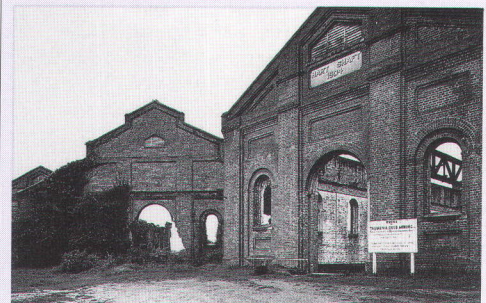


Photo: Tasphoto Services

14. 2 PRODUCTION OF METALLIC MINERALS, TASMANIA

<i>Mineral</i>	<i>Unit</i>	<i>1987-88</i>	<i>1988-89</i>
Copper concentrate	'000 tonnes	84	68
Gold bullion	kg	145	—
Iron ore pellets	'000 tonnes	2 260	2 295
Iron oxide	'000 tonnes	28	117
Lead concentrate	'000 tonnes	31	30
Lead-copper concentrate	'000 tonnes	33	31
Lead-zinc concentrate	'000 tonnes	53	57
Molybdenum concentrate	tonnes	19	32
Scheelite concentrate	tonnes	2 000	2 378
Tin concentrate	'000 tonnes	13	14
Zinc concentrate	'000 tonnes	152	157

(Source: ABS Catalogue No. 8401.6).

which runs from Emu Bay near Burnie to Zeehan on the West Coast, services several of the major mining sites in the West, including Mount Lyell, Rosebery and Aberfoyle. The company also provides general engineering services to the Pasminco Rosebery mines. Stage one of the project, the rebuilding of the company's fabrication workshop section, was to cost \$1.7 million with a completion date of January 1991. Stages two and three, to cost an additional two to three million dollars, were to involve rebuilding of the machine workshop, the paint shop and the general stores area.

Future prospects

Representatives of the mining industry have called upon the State Government to commit itself to a continuation of policies on land management and mining. These would include a moratorium on additions to Tasmania's World Heritage Area and National Parks, a clear set of environmental guidelines for development, and recognition that changes in technology and demand for minerals could make previously uneconomic mining sites more viable. While more than \$940 million in capital investment in mines and processing plants has been proposed for the next five years, only \$140 million has been firmly committed.

Five major mines (Mount Farrell, Cleveland, Rossarden, Hercules and King Island) have closed during the past 15 years. Other existing mines are expected to close over the next 20 years. Mining representatives believe that new mines need to be developed at a rate of one

every five years if the industry is to continue at its current level.

14.1.2 Fuel minerals

Since settlement, coal has been found at 134 places within Tasmania, and a total of 112 coal mines has at some time operated. Currently, three coal mines operate in the State.

Coal is the major fuel mineral mined in Tasmania. In the past minor quantities of shale have been quarried. Peat production continues on a small scale but this is used for horticultural applications rather than fuel.

In 1988-89, 3205 cubic metres of peat were extracted. This figure dropped to 1367 cubic metres in 1989-90.

The major coal producer in the State is the Cornwall Coal Company NL which operates Duncan Colliery at Fingal and Blackwood Colliery near St Marys, in Tasmania's North-East. The bulk of the production from these collieries is mined using underground mining methods.

Cornwall Coal Company

In 1988-89 the company produced 589 943 tonnes of run-of-mine coal and 356 282 tonnes of washed coal. In 1989-90, while run-of-mine production was lower (574 293 tonnes), washed coal production increased to 359 940 tonnes from the treatment of 596 576 tonnes of raw coal.

RENISON BELL: 100 YEARS

The Renison Limited mining company celebrated its centenary in 1990. The company, known as the Renison Bell Prospecting and Mining Company, based in the West Coast town of Zeehan, was first registered on 22 September 1890. The first reported discovery of cassiterite, a tin oxide ore, was made by Ringrose Nicholson who pegged an 80-acre lease in deposits along the Ring River in June 1890. A month earlier, prospector George Renison Bell had described deposits of 'silver-lead' from four 40-acre leases which stretched north from Renison Bell Hill across the Argent River.

Bell had formed the Renison Bell Prospecting Association in Hobart in the late 1880s as a means of financing his prospecting activities on the West Coast. He transferred the leases to the Renison Bell Mining and Prospecting Company which was listed on the Hobart Stock Exchange in October 1890.

Alluvial mining of cassiterite began soon after Nicholson's discoveries, with further ore discoveries in 1890 pointing to stanniferous gossans overlying large deposits of tin-bearing iron sulphides (mainly pyrrhotite).

Early production from the Renison tin field was patchy with at best 58 tonnes of tin being recovered from 7500 tonnes of ore. Early investors in the company suffered sizeable financial losses. Although the surface deposits had been rich in tin, the deeper iron sulphide ores were assayed at less than two per cent. Without the benefit of modern extraction methods, profitable recovery of the tin was almost impossible. The field was worked intermittently by up to 10 small companies but the deposits never became economically viable.

The area was further prospected by an Irish hotelier, Paddy O'Dea, who pegged out a 77-acre site and floated the Two Boulders Tin Mining Company NL to work the lease. The mine began operation in 1908, a concentrator having been built by the Boulder Mining Company in 1907. It was a time of high tin prices and for the first few years the mine showed a profit. However, as the mining operations went deeper, the quality of the ore declined. For the

next 20 years mining and treatment of tin at Renison was fairly unsuccessful.

In the early 1930s a sulphide flotation process to extract tin from the ores was developed by a metallurgist at the Zeehan School of Mines. This process was demonstrated to O'Dea who realised the potential of the process. He set about merging all the syndicates and companies with leases on the Renison fields. In 1936 he floated the Renison Associated Tin Mines NL.

While the potential of the mine was always suspected, it was not until diamond drilling operations were undertaken between 1955 and 1957 that a much greater potential for the field was realised. After the takeover of the mine in 1958 by the Mount Lyell Mining and Railway Company a comprehensive exploration program was begun. By 1962 the company was operating at a profit and further exploration located additional sizeable ore bodies.

In 1964 Consolidated Goldfields Australia Ltd, through its holding in the Mount Lyell Company, gained a controlling interest and the name of the company was changed to Renison Limited. The opening of what is now the Renison mine occurred in 1965 and involved a new mine and associated facilities. The new treatment pit which was installed had a capacity of 1000 tonnes of ore a day. In 1970 the addition of a cassiterite flotation process to the original sulphide flotation system led to improved tin recovery.

The introduction of a heavy-media separation plant in 1974 increased capacity to 1750 tonnes of ore a day. A \$20 million dollar expansion program was announced in 1978. It extended the company's ore reserves by 2.17 million tonnes while additions to the mine's milling plant lifted capacity to 850 000 tonnes a year, an increase of 35 per cent.

During periods of peak production the mine was producing slightly less than half of the total Australian tin production.

The mine has been subject to a series of industrial disputes and production problems, particularly during the later years of its operating life.

In May 1975, 150 men were laid off in a dispute over proposed use of contract labour. This dispute widened to include an additional 108 workers. There were further concerns that the mine could not produce enough tin to meet its quotas. This dispute cost the company an estimated \$300 000 a day for two weeks.

Another major problem occurred in March 1986 when the mine reported its first operating loss. The world price for tin dropped from \$17 000 per tonne in October 1985 to \$8500 per tonne in March 1986. The fall in prices was attributed to a number of factors; including the lifting of protective controlling measures by the International Tin Council, the operation of cheap tin mining operations in Brazil, and the stockpiling of large amounts of tin worldwide.

In July 1987 the mine was hit by further industrial action when 180 miners walked out in sympathy with a fellow worker over a pay dispute. In September there was an additional mass walkout which cost the company \$200 000 a day.

Although the mine was producing record amounts of tin, losses continued. In March 1990 the mine management announced that it would be retrenching 80 workers out of its workforce of 450 in order to try to contain its losses. In April the numbers in the workforce had been reduced from about 450 to 362.

The reduction in the size of the workforce saw the introduction of a new system of production. Workers were to be placed in multi-disciplined teams which involved rationalisation of work tasks from the management level down. Each team would be multiskilled and responsible for a complete process, not just their area of expertise. The aim of the restructuring was to continue to produce at the same rate for the first six months of the financial year (3700 tonnes of tin) but with about 80 fewer workers.

In February 1991 Renison Goldfields Consolidated told a hearing of the Industrial Relations Commission that the price of tin on world markets had fallen from about \$16 000 per tonne in 1985 to \$6958 at present and that this represented a reduction in annual earnings of \$68 million.

The company sought a five-day working week, a closure of the mine over the

Christmas-New Year period, a ban on all overtime and a withdrawal of the present underground mining agreements. All of these changes to conditions were rejected by the unions. At the time production costs in Brazilian tin mines were cut to below \$6000 per tonne.

On 6 March 1991 the Renison mine closed after five weeks of union-management talks failed to reach agreement on how to increase productivity and reduce costs. The announcement was made by Renison Goldfields Consolidated from its head office in Sydney. The mine was placed on a care and maintenance program.

Negotiations between the mine management, State Government and unions followed the closure. In late March, a target date of 2 April 1991 was set for the re-opening of the mine. This would give the taskforce, set up between mine management and the union, time to work out a program which would allow the mine to be run with a reduced workforce of 250. One objective of the plan was to reduce annual production from 800 000 tonnes to 525 000 tonnes in order to help counter the big fall in world tin prices which had led to the original plan to close the mine.

The plan to re-open the mine, which was eventually accepted by the workers, included substantial cuts in income (of between 20 and 50 per cent) and the imposition of a five-day week. Underground workers could then expect to receive between \$20 000 and \$40 000 a year.

In all, about 150 workers had left the mine, the remainder accepting the new terms of employment. This left a workforce of 207, which was 43 fewer than the number which was first proposed by Renison Goldfields Consolidated. The shortfall in the number of workers has meant that the company had to recruit workers from interstate: boilermakers, fitters and turners, and electricians.

World tin prices in late 1990 and early 1991 dropped to their lowest level since late 1985. The main causes of the slump in prices were rising production, leading to a 60 per cent rise in world stocks during 1990, coupled with stagnant consumption.

The company's Duncan Colliery produced 220 330 tonnes of coal in 1988-89 and 214 950 tonnes in 1989-90.

The Blackwood Colliery produced 321 399 tonnes of coal from underground methods in 1988-89 and 90 371 tonnes from open-cut sites. In 1989-90 it produced 342 532 tonnes from its

14.3 PRODUCTION OF COAL, TASMANIA ('000 tonnes)

Type	1987-88	1988-89
Raw coal	581	632
Washed coal	405	356

(Source: ABS Catalogue No. 8401.6).

collieries (326 275 tonnes from No 1 Colliery and 16 257 tonnes from No 2 Colliery) and 16 811 tonnes from open-cut methods.

Merrywood Coal Company

The Merrywood Coal Company, a division of the Avoca Transport Company Pty Ltd, recommenced operations at its mine at Royal George in July 1989. Pillars left by a previous underground mining operation are being extracted by open-cut operations. The company is also investigating a new mining prospect at Hamilton.

All of the coal mined in Tasmania is used as a boiler fuel by local manufacturers such as the paper mills, the cement works and fish canneries. Tasmanian coal is satisfactory as a boiler fuel but it is unsuitable for export because of its relatively high ash content.

14.1.3 Construction materials

The production of construction materials is basic to all building activity and consequently affects most parts of the economy. Whilst buildings, roads and most services depend on the availability of construction materials, control of costs depends on their being produced locally.

14.1.4 Other non-metallic minerals

The quarrying of limestone is the earliest recorded mining activity in Tasmania for non-metallic minerals other than coal. It rose from 826 000 tonnes in 1987-88 to 920 000 tonnes in

1988-89. Silica occurs in a number of locations in Tasmania, both as a deposit of silica sand and as high quality quartzite.

Large quantities of high grade silica were used for production of silicon metal by the silicon metal smelter which was operated by Pioneer Industries at Electrona.

In 1988-89, 8024 tonnes of silicon metal were produced from lump silica mined from around the State. In 1989-90 this figure rose to 9700 tonnes, from 20 000 tonnes of raw silica.

MK Silica at Heybridge commissioned a silica flour plant in July 1988, with regular production beginning in November of that year. Two mining programs were carried out at a lease near Corinna on the West Coast to extract about 11 500 tonnes of silica flour.

14.4 PRODUCTION OF CONSTRUCTION MATERIALS (a), TASMANIA ('000 tonnes)

Mineral	1987-88	1988-89
Dimension stone	2	1
Crushed and broken stone	2 361	2 441
Gravel (b)	314	101
Sand	713	518
Other	(b) 745	866

(a) Excludes quantities quarried by Government or semi-government authorities (e.g. HEC, Department of Construction, etc.) but includes quantities quarried by local government authorities for road material. (b) Mainly decomposed rock for road material (reclassified as other road material from 1987-88).

(Source: ABS Catalogue No. 8401.6).

Total production of processed flour for 1988-89 was 4076 tonnes. In 1989-90, 19 300 tonnes of silica flour were mined from the Corinna leases. A total of 10 300 tonnes of refined flour was produced.

14.1.5 Value of Production

The value of minerals produced from Tasmanian mines in 1988-89 was \$393.4 million, three per cent more than in 1987-88.

The largest contribution to total production came from the production of metallic minerals and coal (91 per cent).

14.5 PRODUCTION OF OTHER NON-METALLIC MINERALS, TASMANIA (^{'000 tonnes})

Mineral	1987-88	1988-89
Clays and shale-		
Brick	87	71
Other	73	92
Dolomite	11	38
Limestone (a)	826	920
Peat moss	1	3
Pebbles	—	—
Silica	78	150

(a) Excludes quantities used directly as a building or road material.

(Source: ABS Catalogue No. 8401.6).

14.2 EXPLORATION

14.2.1 Mineral Exploration

Ongoing exploration is necessary to establish new mines, to maintain a skilled labour force and to extend the productive life of capital equipment.

Although the more mineralised regions of the State, such as the Queenstown-Zeehan-Rosebery area in Western Tasmania, have been extensively explored on the surface, much of

14.6 MINERAL EXPLORATION EXPENDITURE, TASMANIA(\$m)

	1987-88	1988-89
Copper, lead, zinc, silver, nickel and cobalt	4.4	6.1
Gold	2.8	5.0
Iron ore	n.p.	n.p.
Mineral sands	0.2	0.6
Tin, tungsten, scheelite, wolfram	0.2	0.4
Other metallic	1.8	—
Coal	n.p.	n.p.
Construction materials	n.p.	—
Other non-metallic	1.0	0.9
Total	10.4	13.1

(Source: ABS Catalogue No. 8401.6).

Tasmania remains relatively unexplored. The search for 'blind' mineral deposits is still in its infancy.

Mineral exploration today is aimed primarily at discovering 'blind' ore bodies that are concealed either by superficial overburden or overlying rocks that have not been removed by erosion. Modern mineral exploration programs demand a combination of many geological, geo-physical and geochemical techniques and appli-

14.7 VALUE OF MINERALS PRODUCED, TASMANIA (\$m)

Mineral	1987-88	1988-89
Metallic minerals and coal	339.4	358.0
Construction materials	27.6	22.5
Other non-metallic minerals	15.6	12.9
Total	382.6	393.4

(Source: ABS Catalogue No. 8401.6).

cations and may take up to 15 years to come to fruition. Only a very small proportion of mineral exploration programs are successful. Expenditure on private mineral exploration peaked in 1981-82. Exploration funding declined substantially to a low of \$10.4 million in 1987-88, rising to \$131.1 million in 1988-89. Major exploration interests are centred on four main areas:

- The Mt Read Volcanics region from Elliott Bay to Que River, where there are excellent prospects for more zinc-lead-copper-gold-silver deposits;
- The Mt Bischoff-Savage River-Pieman River-Zeehan region, where prospects are high for tin, tungsten, lead, zinc, silver, gold, nickel, osmiridium, iron, copper, asbestos and chromium;
- The Hampshire-Sheffield region, where the attractions are tungsten, tin, zinc, silver, gold, iron and molybdenum; and
- North-eastern Tasmania, bounded by Scamander-Avoca-Lefroy, which has long been prospected for gold, tin, tungsten, silver and lead.

ABORIGINAL 'MINING'

Mining and quarrying of materials in Tasmania go back well beyond European settlement. The Tasmanian Aborigines are known to have quarried and extracted stone and ochre from numerous sites around the island.

Hand stencils, using red ochre as a pigment, have been found on the walls of caves in the Southwest and have been dated at more than 11 000 years. The stencils were sprayed on by mouth using a mixture of blood, animal fat and ochre. The Aborigines mined ochre extensively from sites around Tasmania and transported the substance, as well as other prized materials such as Darwin glass, throughout the island.

Ochre is a friable, earthy, iron-based pigment which exists in a variety of colours ranging from yellow to reddish brown. The colour is determined by the amount of water in the compound: yellow ochre or limonite is a hydrated iron oxide; red ochre or haematite is the dehydrated version. Heating or roasting of yellow ochre can alter its colour to red or brown.

Of the 13 known ochre sites, those in the North-West of the State at Mount Gog, Mount Housetop and Mount Vandyke formed the most important sources of the pigment. These sites were in the 'country' of the North Tribe. The sites were connected by a well defined system of 'roads' of communication which were kept open by firing.

Recent archaeological excavations at the Mount Gog site have uncovered a network of trenches, holes and tunnels. The best preserved trench is about 35 metres in length and 1.5 metres at its deepest point. The trenches mark the positions where women miners (men did not mine for ochre at this site) have excavated the ground in search of the valuable pigment.

The miners used short sticks, shaped and pointed like a chisel, to dig the ochre. A stone was used as a mallet to drive the digging stick. The ochre was then roasted and ground on ballywinne stones; disc-shaped riverine stones which were used as palettes to grind the ochre.

Other known ochre sites were at Welcome River, Queenstown and Point Hibbs on the West coast; Louisa Bay, Melaleuca Lagoon

and Randalls Bay Rocks on the South coast; Ouse in the Derwent Valley; Russel Plains and Swan Island in the north; and Sandford and Maria Island on the East Coast.

A study of Aboriginal stone materials and their sites of extraction has indicated that a wide variety of mainly siliceous materials were used. These materials were usually derived locally from outcrops, but sometimes prized materials could be carried over considerable distances.

The main materials used included hornfelsic rocks, quartzites, quartz chalcedony, opal, cherts, spongolite and silicified breccias.

In his 1972 study of Aboriginal flaked stone implements, F.L. Sutherland described 180 known and probable stone sources around the State.

Most of these sites were in the east, south-east, south and Midlands areas of the State, with relatively few sites on the West Coast and no recordings, at that time, from the denser western rainforest areas although recent work



*An Aboriginal ochre mining trench.
Photo: Dr Antonio Sagona*

by archaeologists and the State Department of Parks, Wildlife and Heritage has extended the number and geographical range of the sites.

On the south-east coast and in the southern Midlands most of the sites are found in hornfelsic and quartzite rocks at Jurassic dolerite-Triassic strata contacts. Quarries are particularly abundant in the Swanston and Oatlands areas which are on the major Aboriginal migratory route inland from the Little Swanport River valley to the Midlands and Central Plateau. Areas of cherty hornfels, up to one kilometre across, were worked with rounded hand-size dolerite hammer stones. These hammer stones, showing impact scars, occur sporadically among the flaked debris in these sites and were brought up from nearby river beds.

The distribution of the quarry and outcrop sites described by Sutherland are:

- West Coast (North Mt Cameron West to south of Port Davey) - 21 sites;
- North Coast (Rocky Cape to East Cape Portland) - 19 sites;
- North and Central (Tamar River to Mt Rufus) - 17 sites;
- East Coast (Eddystone Pt to Middle Peak) - 31 sites;

- Midlands and Eastern (Cranbrook to Lake Tiberias) - 35 sites;
- Southern (Bluff River to Ellendale) - 16 sites; and
- South Coast (Remarkable Cave to Huon Point) - 41 sites.

The extraction and transport of Darwin glass by the Aborigines is less well documented. The glass was prized by the Aborigines for both its ornamental properties and its sharpness (for use as thumbnail scrapers etc). Fragments of it have been found at sites far from the original impact site near Mt Darwin including the Weld river valley in southern Tasmania. Other fragments have been found in sites in the Gordon, Franklin and Maxwell river valleys.

It is not known whether the original fragments of glass were mined or simply extracted from the material which had been turned over by tree roots. Like spongelite, another valuable lithic material excavated from a single site on the West Coast, pieces of Darwin glass were constantly reworked and transported by their owners from site to site. As a result, examples of this material are relatively rare in Aboriginal sites, appearing as pieces which are only a small fraction of their original size or only as worked flakes of the material.



An assortment of Aboriginal ochre processing stone tools found at Mt Gog, including discoid riverine stones (known as Ballywinne stones in certain Tasmanian Aboriginal languages) and their lunate fragments, a pestle and a wedge.
Photo: Dr Antonio Sagona

14.2.2 Petroleum exploration

Offshore

There was a very low level of exploration for petroleum in 1988-89 and no new seismic surveys were undertaken in this period. During the year a marine geochemical 'sniffer' survey was conducted by Amoco and partners in the Bass Basin and 2000 line kilometres of new data were acquired.

In April 1989 four Tasmanian offshore areas were made available for exploration tender.

In 1989-90 two additional offshore permits were granted, one to the Shell Company of Australia (Bass Basin) and one to the Maxus Energy Corporation of Dallas (Sorell Basin).

In June 1991 the Department of Resources and Energy released a report on the potential supply of natural gas from the Yolla and Dunoon Basins. Estimated levels of recoverable gas were as high as 28 billion cubic metres from the two basins. The South Australian petroleum exploration company, Sagasco Holdings Ltd., is proceeding with a proposal to develop the Yolla Basin.

Onshore

Conga Oil continued their exploration activities for Ordovician-sourced hydrocarbons beneath the Tasmania Basin during 1988-89 and 1989-90.

The University of Tasmania and the CSIRO Division of Oceanography applied for a NERDDEC grant to further explore Tasmanian hydrocarbon potential.

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