



1977

PARLIAMENT OF TASMANIA

# **DIRECTOR OF MINES**

## **REPORT FOR THE YEAR ENDED 31 DECEMBER 1976**

*Presented to both Houses of Parliament by His Excellency's Command*

By Authority:

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Exploratory drilling near Fingal—part of the Department's programme of investigation of the coal deposits of north-eastern Tasmania.

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# REPORT OF THE DIRECTOR OF MINES

Department of Mines,  
Hobart, 31 July 1977

THE MINISTER FOR RESOURCES AND ENERGY

SIR,

I present my report on the mining industry for the year ended 31 December 1976.

The value of metals and minerals produced from Tasmanian ores based on average Australian metal prices was \$228 466 800 as compared with \$173 317 865, representing an increase of almost 32%. In addition metallurgical production from ores and concentrates imported into the State was \$169 915 967 compared with \$135 013 109 for 1975, an increase of 26%. The total value of the industry is a new record.

The production of iron ore pellets, lead, rutile, tin and tungstic oxide recorded increases but the output of cadmium, copper, gold, silver, zinc and zircon was less than in 1975.

Details of production and value of all mining products are shown elsewhere in this report but particulars of the principal minerals are summarised below:—

<i>Commodity</i>	1975		1976	
	<i>Quantity</i>	<i>Value</i> \$	<i>Quantity</i>	<i>Value</i> \$
Copper (tonnes) ....	25 698	24 606 515	24 566	28 507 660
Gold (kilograms) ....	1 453	5 712 948	1 314	4 246 862
Iron ore pellets (tonnes) ....	2 054 522	25 829 883	2 221 805	40 616 387
Lead (tonnes) ....	11 380	3 524 700	12 070	4 415 664
Silver (kilograms) ....	55 853	6 110 155	54 421	6 341 438
Tin (tonnes) ....	5 494	30 093 128	6 853	46 834 677
Tungsten as tungstic oxide (tonnes)	1 744	11 910 827	2 204	20 768 806
Zinc (tonnes) ..	54 326	35 873 182	49 697	34 683 132

## DEVELOPMENTS

Work has continued on the zinc-lead discovery by Comalco Exploration Pty Ltd at Que River near Mt Charter on the West Coast. This was located during work on an exploration licence (E.L. 2/70). An exploration decline has been put down to investigate the ore body and feasibility studies are continuing on the viability of a mining operation.

The question of installation of a tin smelter by Renison Limited at Renison Bell has been the subject of a consultant's report but a final decision has been deferred.

At the King Island Scheelite mine work is in progress on further mine development to take advantage of the dramatic increase in the price of tungstic oxide. Work is in progress on the installation of a synthetic scheelite plant which will result in increased production.

Proposals for the establishment of a scheelite industry by Tasminex N.L. on the North-West Coast are under attention. At the Storeys Creek and Aberfoyle Mines efforts are to be concentrated on further exploration of the Lutwyche lode which could result in a considerable expansion of the known ore reserves.

The continued fall in the price of copper has had a serious effect on the operations of the Mt Lyell Mining and Railway Company Ltd at Queenstown which has been the mainstay of our mining industry for many years. Operations have been conducted at a loss and the planned development program was deferred including the commissioning of No. 1 shaft. Plans have been announced for a reduction in the number of employees to 750 with a consequent retrenchment in its existing staff of 1 033. A committee formed by the Commonwealth Government investigated possible schemes to assist the company to maintain full scale operations pending a recovery in the world copper price, but an announcement of a 17½% depreciation in our currency on 29 November 1976 was considered to be sufficient to enable operations to

be maintained. The 'floating' of the currency has resulted in frequent fluctuations in the rate of exchange which has to some extent diminished the apparent advantage to the company. The company has decided to adhere to its original proposal and reduce its staff to 750. This has generated industrial disputes which are still subject to settlement.

The quota system imposed on producers by the International Tin Council in April 1975 was lifted as from 1 July 1976. This, coupled with a satisfactory price should result in an increase in production. Output for 1976 was 6 853 tonnes, an increase of 1 359 tonnes compared with 1975.

Production of zinc at Rosebery was the lowest since 1971. The total of 49 697 tonnes for 1976 showed a decrease of over 8% on the 1975 figure of 54 326 tonnes. World prices for zinc continued to be poor. However, there was a significant rise in the output from the metallurgical plant at Risdon. This was achieved with a reduced labour force.

At the Temco plant at Bell Bay a ferro-silicon furnace was commissioned which will produce 27 000 tonnes of high grade ferro-silicon a year. Work on a furnace for manganese alloy production has also been completed. This furnace should be commissioned early in 1977. This makes the Temco operation one of the larger ferro-silicon plants in the world. The manganese ore and the coal and coke used in the process are imported but the quartzite which is an essential part of the production of the alloys is derived from Tasmanian sources. At present supplies are obtained from Beaconsfield but a vigorous search is in progress to locate further deposits in the State.

Tasmanian Carbide Products which took over the carbide works formerly operated by the Australian Commonwealth Carbide Co. has a new electric furnace on order which will replace the existing out-moded equipment at Electrona. The project requires tariff protection. In their report of 15 December the Industries Assistance Commission recommended that calcium carbide be dutiable until 30 April 1978 at 15% and thereafter at 10%.

The coal mining industry has received a stimulus by the reconversion to coal fuel for the works of the Goliath Portland Cement Company at Railton. Production increased from 161 922 tonnes in 1975 to 189 489 tonnes in 1976. Further expansion is likely.

Interest in the establishment of a red granite industry at Coles Bay has been approved but no steps have yet been taken to commence operations.

## PRODUCTION

### *Copper*

The major producer of copper is the Mt Lyell Mining and Railway Co. Ltd, Queenstown, but production from the Cleveland Mine at Luina and the Electrolytic Zinc Co. of Australasia Ltd add to the total output of this metal.

The Mt Lyell Company treated 2.3 million tonnes of ore for the production of 82 530 tonnes of copper concentrate containing 21 246 tonnes of copper, 3 916 kilograms of silver and 417 kilograms of gold. The copper concentrates are transported by road to Melba Siding and thence by rail to Burnie for shipment to Port Kembla and Japan. Pyrite concentrates amounting to 99 870 tonnes were processed by North-West Acid Pty Ltd at Burnie for the manufacture of sulphuric acid.

The fall in the price of copper caused the deferment of planned developmental operations and work on commissioning of No. 1 shaft was curtailed early in 1976. A higher percentage of ore has to be drawn from the lower grade upper sections of the Prince Lyell mine and this is being obtained from pillar extraction. This accounts for the fall in output. There has also been a fall in the number of employees and because of continued unprofitable operations, the company proposes to reduce output further and to limit its work force to about 750 men.

Diamond drilling was continued to consolidate information on known ore bodies and to further test probable reserves. Ore reserves have been assessed as 27.2 million tonnes of proved ore containing 1.45% copper, 3.10 g/tonne silver and 0.43 g/tonne of gold. Probable ore totals 10.06 million tonnes of an average grade of 1.41% copper, 2.11 g/tonne silver and 0.29 g/tonne of gold. Possible ore was assessed at nearly 5 million tonnes.

The Electrolytic Zinc Co. at Rosebery produced 2 709 tonnes of copper from the treatment of its zinc-lead ores and 612 tonnes were produced by Cleveland Tin N.L. at Luina as part of its tin mining operations.

#### *Iron Ore*

Pellets produced from iron ore mined at Savage River totalled 2 221 805 tonnes compared with 2 054 522 tonnes for the previous year. Shipment of pellets to Japan from Port Latta continued under contract.

The holder of the exploration licence covering the Savage River ore deposits outside the leases being mined by Savage River Mines has continued with active investigations with the object of establishing a further industry.

#### *Tin*

Total production was 6 853 tonnes, the principal producers being Renison Limited at Renison Bell, Cleveland Tin N.L. at Luina, Aberfoyle Tin Ltd at Rossarden and Ringarooma Mining Pty Ltd at Waratah.

Production by Renison Limited totalled 4 815 tonnes of tin from the mining of 517 142 tonnes of ore. The overall recovery of tin metal in concentrates was 64.8% as compared with 67.6% last year. Enlarging of the underground haulageways was commenced to accommodate modified haulage units. The heavy media plant was closed down until May because of tin quota restrictions.

Proved reserves were assessed at 6.2 million tonnes containing 1.28% tin and probable reserves were fixed at 3.65 million tonnes averaging 1.18% tin. Possible ore was estimated at 8.20 million tonnes expected to average 1.19% tin.

The company has maintained an active program of exploration outside the leases and is conducting investigations in three separate areas.

At the Cleveland mine at Luina, production consisted of 1 644 tonnes of tin and 612 tonnes of copper from the milling of 407 905 tonnes of ore. Exploration and drilling is planned. Indicated ore has been calculated at 1.7 million tonnes averaging 0.79% tin and 0.30% copper. The company, which is one of the Aberfoyle Group, is participating in joint venture arrangements covering exploration at three locations outside its leases.

At the Storeys Creek and Aberfoyle mines operated by Aberfoyle Tin Ltd, 39 606 tonnes of ore were treated for the recovery of 173 tonnes of tin and 186 tonnes of wolfram concentrate.

Ringarooma Mines Pty Ltd operating on alluvial deposits in Waratah Creek at Waratah treated 180 682 cubic metres of ground for the recovery of 110 tonnes of tin.

Tin mining remains an important industry in the north-east of the State, and seven of the larger operators produced an aggregate of 111 tonnes of tin, the principal producer being the BMI Mining Co., which had an output of 32 tonnes from operations at the Endurance mine.

#### *Tungsten*

The producers are King Island Scheelite who mine scheelite at King Island and the Storeys Creek and Aberfoyle mines who produce wolfram concentrates from the mining of wolfram-tin ores in the vicinity of Rossarden.

The King Island Scheelite mine treated 324 488 tonnes of ore for the production of 2 019 tonnes of tungstic oxide. Ore from the Storeys Creek mine and the Aberfoyle mine is treated at the Aberfoyle mill where 39 606 tonnes of ore were processed for the recovery of 186 tonnes of tungstic oxide and 173 tonnes of tin.

The favourable price which has ruled throughout the year has stimulated production. In addition to mine development work at King Island, work is also in progress on the construction of an artificial scheelite plant which will treat the present flotation concentrates and convert them into a molybdenum-free calcium tungstate product with a wide market acceptance while at the same time accomplishing an improved metal recovery.

Ore reserves have been estimated at 7 million tonnes of 0.8% tungstic oxide.

*Rutile-Zircon*

The production of rutile and zircon concentrates from treatment of beach sand deposits near Naracoopa on King Island has been maintained by Kibuka Mines Pty Ltd. A total of 6 685 tonnes of rutile concentrates and 6 313 tonnes of zircon concentrates were produced but the fall in the price of zircon has limited the profitability of the project. Exploration work is in hand to increase available reserves. The company is actively investigating several tin mining projects in the north-east so that its activities may be diversified and not confined to beach sand deposits. The interest in developing potential mineral sand deposits on the East Coast of Tasmania has waned with the fall in the price of zircon but other deposits which might contain higher rutile values are being examined.

*Zinc*

The Electrolytic Zinc Co. at Rosebery treated 603 491 tonnes of ore principally from the Rosebery mine for the recovery of 112 834 tonnes of zinc concentrates, 24 060 tonnes of copper concentrates and 10 888 tonnes of lead concentrates. Total production consisted of 49 697 tonnes of zinc, 12 070 tonnes of lead, 2 709 tonnes of copper, 50 087 kilograms of silver and 896 kilograms of gold. Pyrites aggregating 226 639 tonnes were treated by North-West Acid Pty Ltd for the production of sulphuric acid.

Ore reserves were assessed at 8.72 million tonnes comprising 8.3 million tonnes at the Rosebery mine, 326 649 tonnes at the Hercules mine and 70 998 tonnes at the Farrell mine. Ore reserve grades at the Rosebery mine average 16.9% zinc, 5% lead, 1.02% copper, 143 g/tonne silver and 219 g/tonne gold.

The zinc concentrate from the Rosebery mine and concentrates from the Broken Hill mines are treated at the Electrolytic Zinc Co.'s plant at Risdon. The production for 1976 was 163 575 tonnes which reflects the growth in the demand for zinc as a result of the improvement in world economic conditions.

**METAL PRICES**

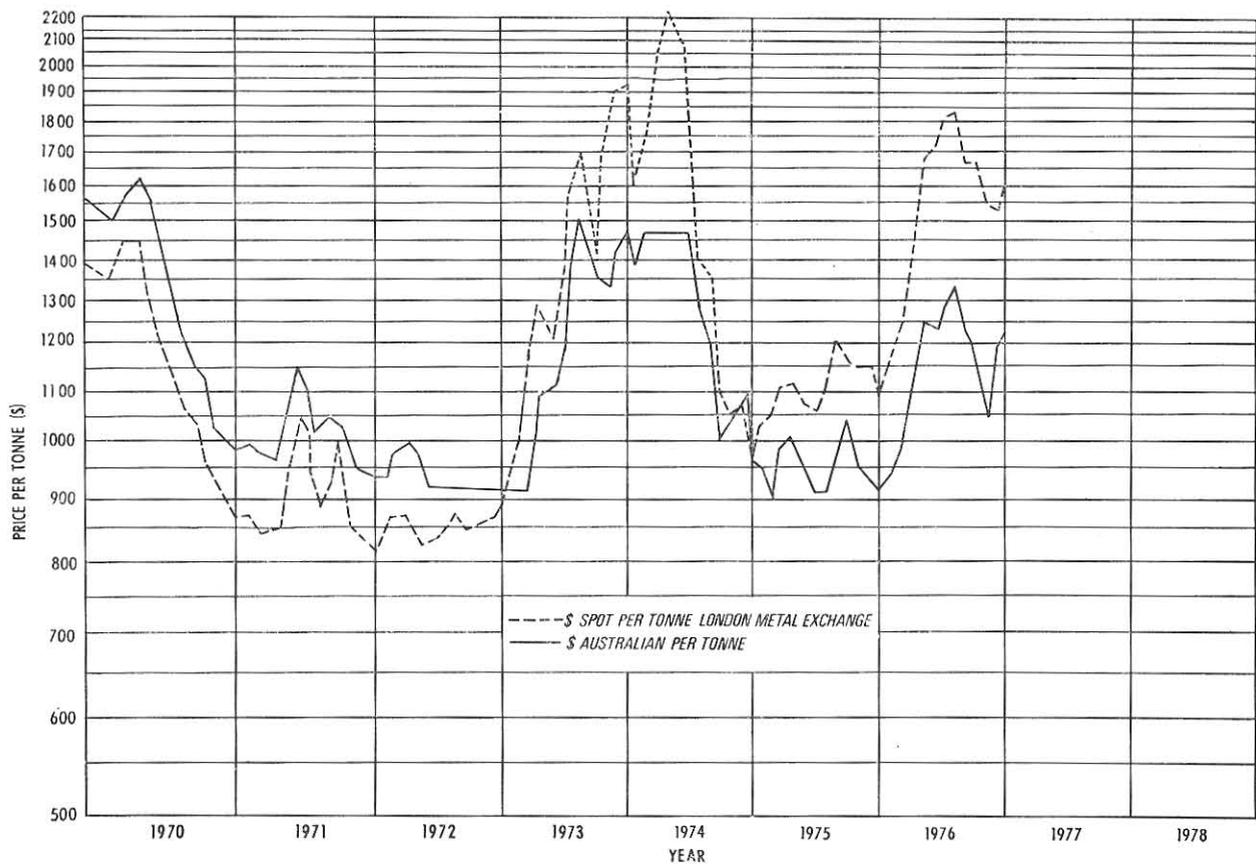
The following table shows the average Australian metal prices:—

<i>Commodity</i>	<i>Unit</i>	1974	1975	1976
		\$	\$	\$
Copper .....	tonne	1 273.33	958.25	1 166.67
Gold .....	kilogram	3 692.03	3 949.55	3 245.78
Lead .....	tonne	399.17	317.50	364.17
Rutile concentrates .....	tonne	229.17	290.00	290.00
Silver .....	kilogram	115.21	109.56	116.25
Tungsten oxide .....	unit	62.31	68.47	93.81
Tin .....	tonne	5 775.25	5 475.92	6 778.84
Zircon concentrates .....	tonne	206.25	242.50	140.00
Zinc .....	tonne	582.00	660.58	699.00

*Copper*

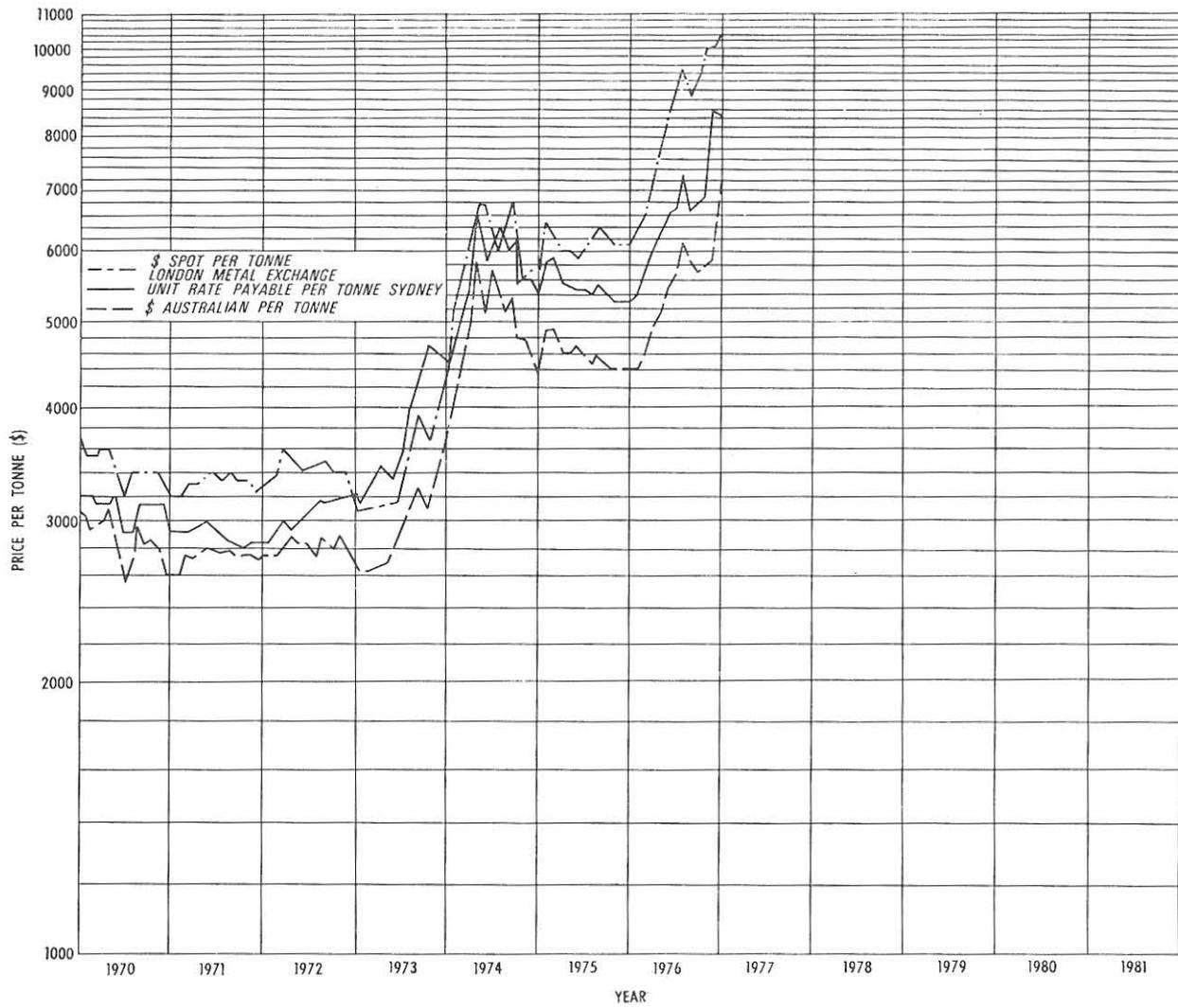
The Australian price of copper was quoted at \$A920 per tonne at the end of 1975. It rose slowly through January and February and was quoted at \$A1 000 per tonne in March. Increases of \$20 per tonne were recorded weekly until the price reached \$A1 180 per tonne in the third week of April. A rise to \$A1 260 per tonne was recorded in May and after a brief decline to \$A1 240 per tonne in June it rose to \$A1 280 per tonne at the end of the month. A high of \$A1 340 per tonne was reached by the end of July and a decline to a low of \$A1 020 per tonne was recorded in November. Devaluation of 17½% on 29 November 1976 increased the price to \$A1 180 per tonne and after reaching \$A1 240 per tonne in mid-December it was quoted at \$A1 220 per tonne at the end of December.

On the London Metal Exchange the price at the beginning of 1976 was £600 per tonne but it declined through January and early February and did not exceed £600 per tonne until 1 February 1976 when it was quoted at £609 per tonne. An upward trend then developed and £807 per tonne was reached in mid-April. This continued until a high of £930 per tonne was reached in mid-July. A fall then began and the price declined steadily and despite daily fluctuations the downward trend remained until the end of December when the London Metal Exchange price was quoted at £785 per tonne.

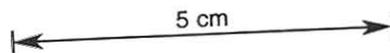


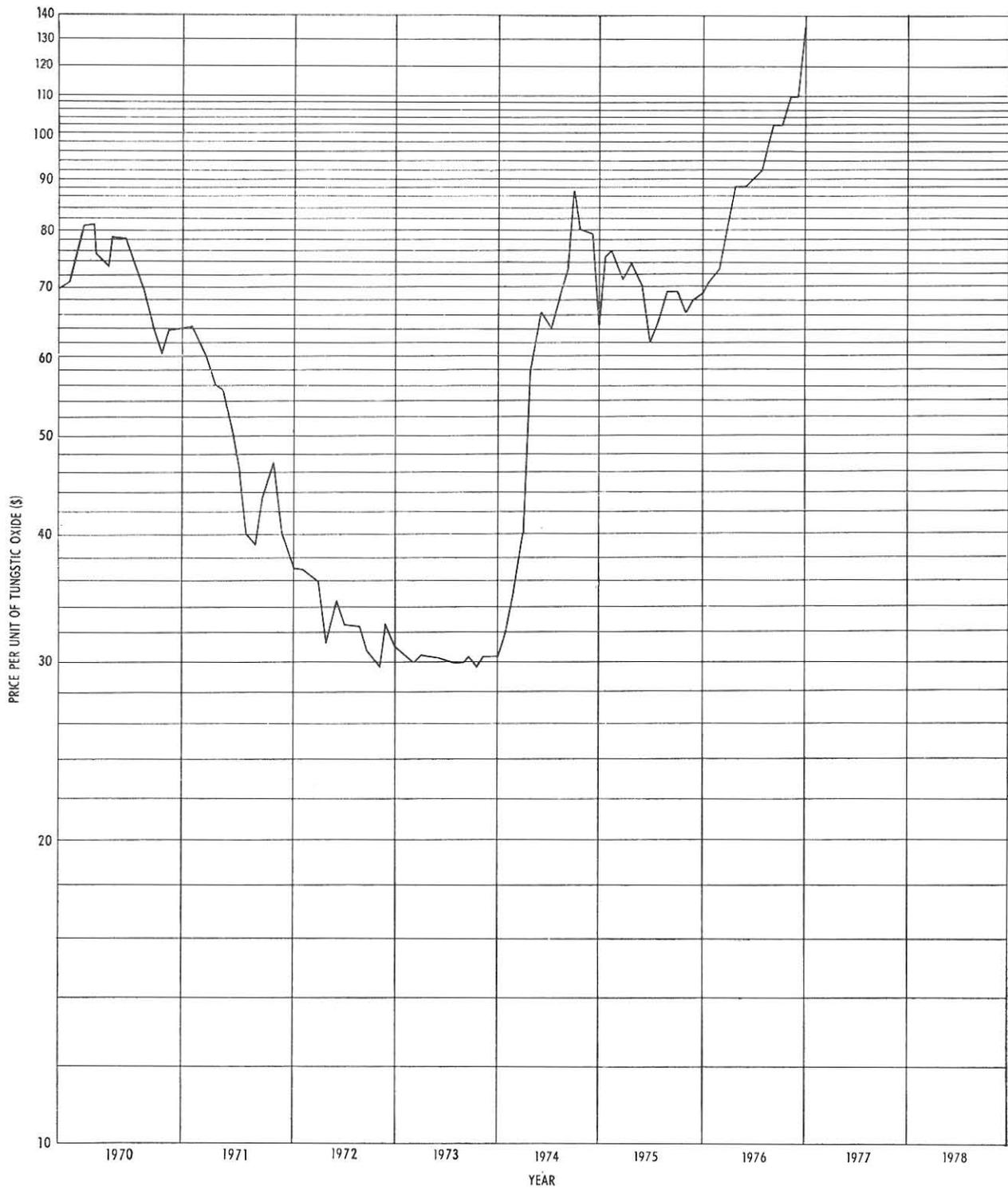
COPPER PRICES  
MONTHLY AVERAGES, 1970-1976

5 cm



TIN PRICES  
MONTHLY AVERAGES, 1970-1976





TUNGSTEN PRICES  
MONTHLY AVERAGES, 1970-1976

5 cm

The foregoing together with inflationary costs accounts for the problems faced by Australia's copper mining industry, notably by the Mt Lyell Co. to which reference has been made. The Australian price governs sales on the Australian market and whilst it is now related to the London Metal Exchange price, some stimulation in the demand for copper resulting from improved world economic conditions is necessary before Australian producers can again operate profitably. Market observers have made various forecasts but early improvements in the price structure are not apparent.

### *Tin*

The tin production quota imposed by the International Tin Council in April 1975 was not lifted until 1 July 1976. Under the system the small producers were not affected but the larger producers were obliged to limit production or to stockpile output until sales could be arranged. In general, however, the industry did not suffer adversely but programs of expansion were necessarily curtailed. The London Metal Exchange price, which was £3 072 per tonne at the beginning of the year, ranged from £3 053 in January 1976 to £4 580 at the end of June 1976 and reached a high of £5 040 on 30 November 1976 following devaluation. It was quoted at £5 240 at the end of the year. The average price payable to consumers on the basis of tin containing a 70% concentrate ranged from a low of 43.64 cents per long tonne unit in January to a high of 75.57 cents per unit following devaluation in November 1976. This is equivalent to a range of \$4 364 to \$7 557 per tonne of 70% tin concentrates. The market is controlled by the Buffer Stock Manager's price ranges which had been fixed between an upper price of \$M1 325 Straits dollars per picul (1 picul = 133 lb) a middle range of \$M1 150 to \$M1 250 and a lower range of \$M1 075 per picul. Under the price control scheme the Manager sells when the price is at or above the upper limit, he may or may not sell in the middle range but must buy in the lower range. This has the effect of maintaining the price within reasonable limits. The Fifth International Tin Agreement has yet to be ratified and if agreement is not reached by 30 June 1977 it will lapse and could cause chaos in the market.

### *Tungsten*

The price of tungstic oxide which determines the value of scheelite from the King Island Scheelite mine and of wolfram from the Storeys Creek mine continued to rise and ranged from a low of £44 per 22.04 lb unit on the London Metal Exchange in January 1975 to a high of £89 per unit on 13 December 1976. It then took a dramatic leap forward and was quoted at £146 at the end of the year. Market observers report that the major factor causing the sudden upsurge is said to be a build-up in armaments by Russia. This has prompted the Chinese, who account for a major portion of the world's output, to cut back on their sales to Russia. The United States is also uncertain as to selling from its strategic stockpile. Further, both the United States and the Chinese have devised more orderly market procedures and the Chinese are now participating in United Nations meetings aimed at stabilising the price of tungsten. The unavailability of production information from China has always disrupted the possibility of establishing a relatively stable market because of the unpredicted dumping of material either by the Chinese or from USSR surpluses. If present attempts to create a more stable market are successful it will stimulate local production of both scheelite and wolfram. The program of expansion by King Island Scheelite mine which was deferred in 1974 is now proceeding rapidly. Proposals for establishment of a scheelite industry by Tasminex N.L. from deposits in the Natone-Hampshire area are also under close investigation.

### *Zinc*

The price of zinc has improved on 1975 values and a growth in world economic conditions has stimulated demand. The London Metal Exchange price per tonne ranged from a low of £336 per tonne in January 1976 to a high of £450 per tonne towards the end of April. An alteration in the world economy then set in and the price ranged up to about £412 per tonne until the beginning of October when a fall was recorded. The price at the end of December was £390 per tonne. During the same period the Australian domestic price ranged from \$649-\$663 per tonne until devaluation on 29 November 1976 lifted the price to \$772 per tonne.

### EXPLORATION

Exploration by both local companies and by exploration companies continued to be maintained at a satisfactory level. A total of eighty-eight exploration and special prospector's licences were in force at the end of the year, mostly in western and the north-western parts of the State. In addition local companies undertook programs on their leases to increase the reserves of ore on which the future of mining depends.

The Department has maintained its established program of regional geological mapping, economic geology, groundwater investigations and engineering geology. Maps and reports are issued regularly and professional staff are always available to assist and advise those engaged in the mining industry. Reports and other information lodged by former exploration licence holders are placed on 'open file' when licences are relinquished or cancelled. These, with departmental publications and maps, form the basis upon which further work is planned by other explorers. The Department's drilling plants are engaged in testing mineral and coal deposits and in the investigation and measurement of underground water in selected areas. The results of all departmental work are published and are available to assist interested parties.

### COAL

The Duncan mine at Fingal operated by the Cornwall Coal Company was the only producing coal mine. Output was increased (by 27 567 tonnes) from 161 922 tonnes to 189 489 tonnes to meet the increased demand from the Goliath Portland Cement Company at Railton. Progress with mine development has been delayed due to adverse mining conditions. Coal production was maintained by pillar extraction methods. Extensions were made to the washery and the stockpile facilities increased. Some prospecting work has been done in the Mount Nicholas area.

### OIL

The following licences continue to be held in Bass Strait:—

<i>Title</i>	<i>Holder</i>	<i>Blocks</i>	<i>Expiry Date</i>
T/3P	Hematite Petroleum Pty Ltd	85	16.7.79
T/4P	Hematite Petroleum Pty Ltd	42	16.7.79
T/5P	Hematite Petroleum Pty Ltd	65	16.7.79
T/6P	Hematite Petroleum Pty Ltd	64	16.7.79

Permit T/3P was reduced by eighty-six blocks, T/4P by forty-three blocks and T/6P by ninety blocks by voluntary surrender on 1 September 1976. Applications were invited for the surrendered blocks but none was lodged.

There have been no programs of work and the holder has been endeavouring to arrange a farm-in agreement but so far without success. Consideration is being given to a further test bore in 1977.

### LEGISLATION

The Explosives Act 1916 and the Inflammable Liquids Act 1929 which with amendments have served the requirements of the Department, have been repealed and replaced with a Dangerous Goods Act 1976, which is a re-codification of the two Acts in modern form. After years of discussion we in Australia have reached acceptance of a universal list of dangerous goods namely the International Maritime Dangerous Goods Code (IMCO Code) promulgated by the Inter-Governmental Maritime Consultative Organisation. As time has passed explosives have become safer and some dangerous goods are now more dangerous than explosives. The emphasis today is not so much on explosives but on other substances. The Act provides that all substances contained in the IMCO Code be declared dangerous although a relatively small portion of them would be present in Tasmania. However this arms our marine authorities to whom the Act applies, to be able to deal as necessary with any dangerous goods passing through our ports. The Act became law on 22 December 1976 and at the same time a set of

regulations under the Act (Statutory Rules 1976, No. 281) was proclaimed. The new Act applies to explosives and inflammable liquids as previously provided under the separate Act but now adds a comprehensive list of dangerous goods covered by the IMCO Code.

The Conference of Chief Inspectors of Mines has adopted a new set of electrical rules and an amendment to the regulations under the Mines Inspection Act 1968, has been necessary to give effect to the new rules. The regulations were also amended to provide for the application of SAA Scaffolding Code AS 1576 for scaffolding rigging and other construction. The Model Asbestos Regulations issued by the National Health and Medical Research Council have also been applied in places where asbestos is used at a mine or works. The amendments have been incorporated in Statutory Rules 1977, No. 12.

### **MINING AND THE ENVIRONMENT**

The mining industry has accepted the need to protect the environment as a normal procedure and this is an achievement which is not generally recognised and appreciated. There are instances with long established mines where the standard of improvement required has not yet been reached. However, these are under attention and improved conditions are evident. The cost of the measures taken is considerable but these have been accepted as a necessary part of mining and the producers concerned have met the cost.

I feel that the industry is somewhat hesitant to make known what is being done and some publicity should be given to the projects undertaken and planned so that the public generally will be aware of the ready co-operation given by the mining industry. No doubt after the lapse of some time it will be clear what steps have been taken to protect the environment but the proper use of informative data will add to the public image of the industry. The view has been expressed that mining leaves evidence of activity which later is of interest for tourists. Whilst this is certainly true, preservation of old mines can only be achieved with the approval of the Department of the Environment which has been authorised by the Environment Protection Act 1973, to give effect to the laws for the use of the environment that is conducive to human benefit, welfare, safety and health.

### **PLANNING LEGISLATION**

The draft planning legislation was referred to a Parliamentary Select Committee who are examining in detail the effect of the proposals. The result is awaited with interest since it should be the means by which a balance between development and conservation of our resources may be achieved. Basically it should be the link which controls what is the best use of land.

### **THE FUTURE OF MINING**

In my last Annual Report I directed attention to the constant need for exploration to replace the minerals which have been mined. Minerals are not regenerative and unless new ore bodies can be discovered then the industry ultimately must die. It is for this reason that this Department adopts a firm line to proposals which will result in areas being closed permanently to mining activity, and I refer specifically to State reserves. The National Parks and Wildlife Act makes provision for management plans of such areas and with the approval of both Houses of Parliament mining may be permitted subject to appropriate conditions of control. There are circumstances where the proclamation of a wilderness area, reserved for that purpose alone, can be justified, but the application of this principle to large areas can only be sustained to the detriment of the mining industry.

It must be understood that no-one is in a position to know the mineral potential of every area. Where geological conditions are favourable for mineral occurrences then the area should be open for exploration and, if necessary, mining operations on the basis of adequate controls. During the year evidence was presented to the Committee of Enquiry into the proposed South-West National Park, and whilst an area between Melaleuca Inlet and Cox Bight was excluded from the reserve for mining

purposes, much of the reservation contains land of potential value for the occurrence of mineral deposits. Unless these areas are made available for mining purposes, including initial exploration, then another large section of the State is lost to mining. Further enquiry is to be made by a committee into proposals to extend the State reserve further up the West Coast to embrace land upon which active exploration is in progress. This Department has presented evidence to the Committee and will urge that the right to mine should be preserved. The State cannot afford to disbar mining from every area where there is no current development. An industry of the importance of mining to our economy must be preserved and developed. It must further be understood that a mineral deposit which is worthless today because of markets, technology and costs may tomorrow become a valuable State asset. Again I refer to the iron ore industry at Savage River which had to wait from the turn of the century until 1965 before it became economic. Had this area been made part of a State reserve development would never have taken place. We cannot say that there are not other mineral deposits in the State which may later be developed. All that is required is the opportunity to search so that if the deposit is not economic today it will be recorded in the Department of Mines for reference when favourable conditions arise.

It will be of interest to note that the same restrictive conditions applied to State forests and Crown land leases in past times, but on the basis of some legislation, and with mutual co-operation with the Forestry Commission and the Lands Department these problems have disappeared. State forest and Crown land leases are now available for mining purposes.

The unfortunate position seems to have developed where the suggestion that mining may take place raises a storm of protest from some well intentioned, but inadequately informed persons. The attitude of this Department is to protect the mining industry and ensure its continued viability and this means preserving the right to explore and mine on State reserves. Subject to rigid conditions of control under which the mining industry now operates it should be possible for mining and State reserves to exist side by side.

#### AUSTRALIAN MINERALS COUNCIL

The Council has been reconstituted following a change in the Commonwealth Government and the title of the Council has been altered to the Australian Minerals and Energy Council. It is proposed that the administrative machinery should be less elaborate and will operate with part-time officers from the staff of the Commonwealth Department of Natural Resources who will arrange agendas, minutes of the meetings and such other matters which may arise. A meeting of Ministers is scheduled for early in 1977 which will be preceded by a meeting of permanent heads of departments from all the States. The opportunity to meet and exchange views between the Commonwealth and the States on matters of mutual concern is of the utmost value in the formulation of policy and in creating a general understanding of the problems of the industry and the principles upon which governments propose to act.

#### REVENUE

##### REVENUE COLLECTED DURING THE YEAR ENDED 31 DECEMBER 1976

<i>Heads of Revenue</i>	\$
Mines Department (Drilling) ....	57 197
Rent and Fees of Auriferous and Mineral Lands ..	135 657
Royalty on Iron Ore Pellets ....	301 341
Mineral Royalties ....	660 783
Survey Fees ....	1 528
Fees under the Dangerous Goods Act ....	46 054
	1 202 560

As this was the first full year in which mineral royalties became payable, a separate heading has been shown for this item. In addition the royalty payable on gravel and sand has been included under 'Mineral Royalties'. Such royalty was previously included with 'Rent and Fees of Auriferous and Mineral Lands'.

COMPARATIVE STATEMENT OF REVENUE FROM MINES BEING RENTS, FEES, STORAGE OF EXPLOSIVES, ETC., PAID TO THE TREASURY DURING THE YEARS 1971 to 1976

<i>Year</i>		\$	<i>Year</i>		\$
1971	....	597 937	1974	....	649 029
1972	....	563 816	1975	....	602 259
1973	....	641 380	1976	....	1 202 560

The above statement does not include Stamp Duties upon Transfer of Leases.

*Royalties*

In accordance with the provisions of Mining Amendment Regulations proclaimed last year the rate of royalty on sand and gravel is 30 cents per cubic metre and 2% of the proceeds from the sale of mining products or 5% of the net profits, whichever is the less. The amount of royalty collected in 1976 was \$660 782 consisting of \$20 972 from the mining of gravel and sand and \$639 810 from mining operations. In no case was royalty paid on proceeds and the net profit was used in every instance as the basis of payment. The rates became operative on 1 October 1975, so that the amount indicated represents a full year's payments.

LEASES AND LICENCES

NUMBER AND AREA OF NEW LEASES AND LICENCES ISSUED DURING THE YEAR ENDED 31 DECEMBER 1976

<i>Leases and Licences</i>	<i>Number</i>	<i>Area (ha)</i>	<i>Sluiceways</i>
Clay	1	32	....
Coal	1	4	....
Crocoite	1	4	....
Dolomite	1	4	....
Easements	4	35	....
Gemstones	2	16	....
Gold	4	88	....
Gravel	1	35	....
Iron ore	5	145	....
Minerals	4	4 970	....
Sand	1	4	....
Silica	1	400	....
Silver-lead-zinc	9	360	....
Stone	7	517	....
Tin	35	1 437	....
Uranium	1	81	....
Water licences	9	7	37
<b>TOTAL</b>	<b>87</b>	<b>8 139</b>	<b>37</b>

## TOTAL NUMBER OF LEASES AND LICENCES IN FORCE ON 31 DECEMBER 1976

<i>Leases and Licences</i>	<i>Number</i>	<i>Area (ha)</i>	<i>Sluiceheads</i>
Antimony	2	65	...
Bauxite	5	184	...
Clay	22	329	...
Coal	15	2 128	...
Copper	4	4 971	...
Dolomite	4	129	...
Gold	45	848	...
Granite	2	6	...
Iron ore	14	2 176	...
Kaolin	2	362	...
Limestone	13	524	...
Marble	2	32	...
Minerals	106	9 155	...
Osmiridium and chromite	5	214	...
Peat	2	92	...
Rutile	6	785	...
Sand and gravel	67	4 731	...
Silica	17	1 491	...
Slate	2	36	...
Stone	96	5 003	...
Tin	301	10 512	...
Uranium	1	81	...
Wolfram and tin	10	1 281	...
Water licences	87	...	977
Easements	123	1 663	...
<b>TOTAL</b>	<b>953</b>	<b>46 798</b>	<b>977</b>

NUMBER AND AREA OF LEASES AND LICENCES APPLIED FOR DURING THE YEAR ENDED  
31 DECEMBER 1976

<i>Leases and Licences</i>	<i>Number</i>	<i>Area (ha)</i>	<i>Sluiceheads</i>
Clay	1	53	...
Coal	3	228	...
Copper	3	26	...
Gold	5	101	...
Gravel and sand	32	1 320	...
Kaolin	2	366	...
Minerals	17	570	...
Silica	5	435	...
Stone	7	75	...
Tin	15	883	...
Uranium	1	81	...
Water and easements	3	7	1
<b>TOTAL</b>	<b>94</b>	<b>4 145</b>	<b>1</b>

TOTAL NUMBER OF ALL TYPES OF PROSPECTING RIGHTS HELD AS AT  
31 DECEMBER 1976

<i>Mining Tenement</i>	<i>Number</i>	<i>Area</i>
Permits to enter and search on private land, including owners' consents	5	516 ha
Exploration licences	79	12 490 km <sup>2</sup>
Special Prospector's licences	7	430 km <sup>2</sup>
Miners Rights	72	18 ha
Prospectors licences	148	3 700 ha
Authorities to prospect under the Aid to Mining Act 1927	1	23 km <sup>2</sup>
Permits to explore for petroleum under the Petroleum (Submerged Lands) Act 1967	4	256 graticular blocks (16 128 km <sup>2</sup> )

### MINES DRAFTING SECTION

This is the first report of the section following its transfer from the Lands Department on 24 July 1975. It is appropriate to list here the main functions of the section, which are as follows:—

- (1) The recording and charting of all forms of mining tenements, including mining leases, exploration and special prospector's licences, petroleum permits and licences, prospector's and miners right claims, permits to enter and owners rights.
- (2) The drawing of plans of mineral leases and of diagrams for lease documents.
- (3) The issue of instructions to, and supply of information for, survey.
- (4) The description of exploration and special prospector's licences and the drawing of plans of areas required to be exempted from the application of the Mining Act.
- (5) The maintenance of all mineral charts and transparencies.
- (6) The production of mineral topographic sheets and transparencies.
- (7) Title searching for current ownership of land and the mineral rights thereon. Liaison with other departments, in particular with the Forestry Commission, Lands Department, National Parks and Wildlife Service and Department of the Environment, regarding tenure of land.
- (8) Dealing with enquiries from the public regarding the availability of land and general information regarding the Mining Act.
- (9) Researching historical mining information.

During 1976 three 1:20 000 mineral topographic sheets (Coles Bay, Gowrie Park and Ben Lomond) were produced, together with fifteen special topographic sheets at various scales (including Weld, Hatfield and Belvoir) of areas not adequately covered by working plans. Twelve Hobart sheets were produced to cater for increased interest in areas of gravel deposits.

Seven sheets, including five in the Fingal area and two at Balfour, are on program for 1977.

Four hundred and forty working plans and transparencies are in use and are kept up to date.

Nine hundred and sixty dyeline prints were produced for office use and for sale to the public.

Thirty-three exploration and special prospectors licences were described and charted and ninety-five diagrams of mineral leases were drawn (fifty-eight subject to survey and thirty-seven from surveys). Lease document plans were prepared from these diagrams.

Ninety-four mineral lease applications were charted and numerous prospectors and miners rights claims recorded.

### WARDENS' COURT

*Tasmanian Conservation Trust and others (Stow and others) v. Mineral Holdings Australia Pty Ltd.* Objection to an application for a Special Prospectors Licence—New River. This case which was referred to the High Court for hearing was considered at a sitting in Hobart in February 1977. A decision was subsequently made dismissing the appeal with costs.

*Allstate (Tas.) Pty Ltd v. Estate of late H. D. Windred.* The Warden of Mines, Launceston, declared lease 1517/G forfeited and the company has applied for the area.

*A. O. Harris and others v. Louisa Mining Corp. N.L.* Objections to an application for an exploration licence at Bruny Island. Objections by A. Harris, J. M. Reid, W. H. Croft and P. Elias to the Supreme Court were not proceeded with.

*B. D. Bellette v. R. F. and M. E. Buckingham.* Forfeiture of lease 852P/M. This was withdrawn by the plaintiff.

*Ralph Taylor v. Harold Neil Thomas.* Forfeiture of lease 47M/74. The Warden of Mines, Launceston, upheld the application. Mr Taylor has been granted a lease.

*Tasmanian Conservation Trust Inc. v. Valley Explorations (Holdings) Pty Ltd.* Objection to exploration licence on West Coast. The Warden of Mines, Devonport, dismissed the case.

### MINE MANAGERS' CERTIFICATES

Metalliferous Mine Managers' Certificates were issued by the Board of Examiners under the Mines Inspection Act 1968 as follows:—

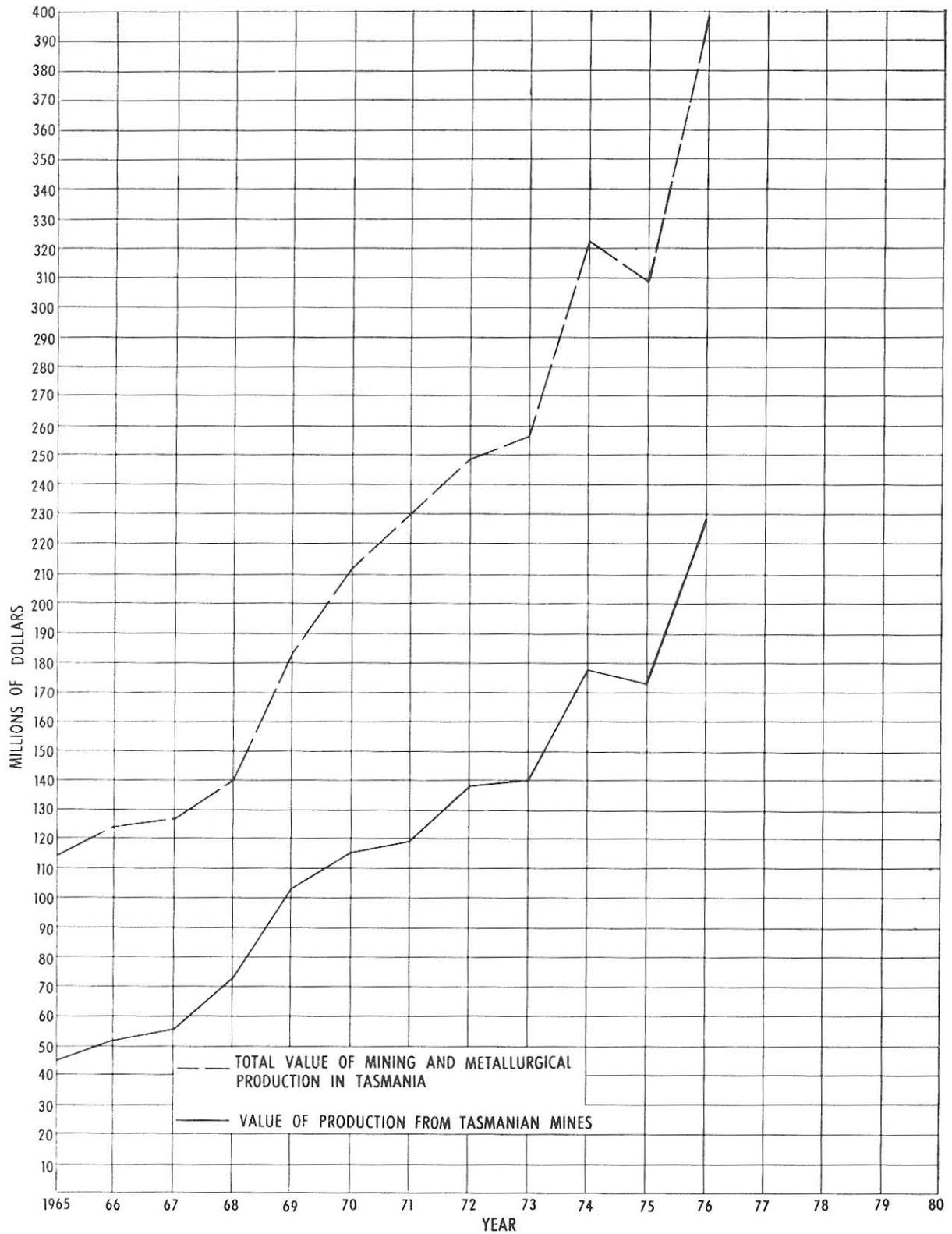
*By examination viva voce—*

*Certificate No.*

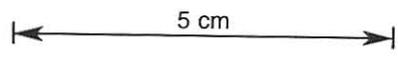
242/76	Franciscus Sibbel
243/76	Hew Gardner Richards
244/76	Garry Bruce Kremmer
245/76	George Douglas Rogers Zaremba
246/76	James Milne Torlach
247/76	David Jefferson Bedford.

### VALUE OF TASMANIAN MINERALS IN RECENT YEARS WITH AUSTRALIAN METAL PRICES

<i>Year</i>		\$	<i>Year</i>		\$
1967	....	55 252 710	1972	....	136 847 182
1968	....	71 919 344	1973	....	139 557 052
1969	....	104 150 500	1974	....	177 327 923
1970	....	115 469 042	1975	....	173 317 865
1971	....	119 998 652	1976	....	228 466 800



VALUE OF MINING AND METALLURGICAL PRODUCTION, 1965-1976



## MINERAL PRODUCTION SINCE 1880

QUANTITY AND VALUE OF PRODUCTION AS AT 31 DECEMBER 1976

METALLIC MINERALS	Mineral	Unit	Total Quantity	Value \$
	Antimony .....	(tonne)	3	2 034
	Bismuth .....	(kilogram)	110 080	503 385
	Cadmium .....	(tonne)	2 644	9 834 096
	Cobalt oxide .....	(tonne)	105.9	518 754
	Copper (blister) to 1918 (now shown under Silver and Copper) .....	(tonne)	169 273	27 577 054
	Copper matte .....	(tonne)	6 326	267 472
	Copper ore to 1918 (now shown under Copper) .....	(tonne)	42 439	1 155 746
	Copper (from 1919) .....	(tonne)	704 248	428 874 214
	Crocoite .....	(specimens only)	....	30 028
	Gold .....	(kilogram)	97 217	61 217 729
	Ilmenite .....	(tonne)	558	2 512
	Iron ore pellets .....	(tonne)	18 115 778	232 587 832
	Iron oxide (including hematite, limonite and magnetite) .....	(tonne)	226 037	1 006 042
	Lead (from 1919) .....	(tonne)	512 445	85 180 923
	Manganese .....	(tonne)	1	6
	Manganese dioxide (from 1957) .....	(tonne)	10 634	395 193
	Mercury .....	(kilogram)	7 676	90 144
	Monazite .....	(tonne)	34	1 214
	Nickel .....	(tonne)	237	81 036
	Osmiridium .....	(kilogram)	881	1 418 771
	Pyrite (to 1971) .....	(tonne)	2 124 070	10 239 957
	Pyrite (from 1972) .....	(tonne)	1 117 437	....
	Rutile .....	(tonne)	1	36
	Rutile (concentrates) .....	(tonne)	39 257	8 082 702
	Scheelite .....	(tonne)	39 505	110 163 281
	Silica for silicon alloy production .....	(tonne)	94 662	1 150 649
	Silicon as silicon alloys .....	(tonne)	188 350	25 064 321
	Silver-lead ore to 1918 (now shown under Silver and Lead) .....	(tonne)	1 101 295	12 858 582
	Silver (from 1919) .....	(kilogram)	2 015 693	66 082 121
	Sulphur as sulphuric acid (from 1957) .....	(mono tonne)	3 176 225	51 860 672
	Tin .....	(tonne)	205 038	302 587 564
	Wolfram .....	(tonne)	21 369	39 216 876
	Zinc .....	(tonne)	1 330 197	341 909 886
	Zinc, sulphate (from 1957) .....	(tonne)	3 251	324 177
	Zircon (concentrates) .....	(tonne)	38 078	4 926 017
NON-METALLIC MINERALS				
	Asbestos .....	(tonne)	4 044	34 284
	Baryte .....	(tonne)	2 240	16 478
	Clay (from 1958)—			
	Brick .....	(metre <sup>3</sup> )	1 453 667	3 852 325
	Tile .....	(metre <sup>3</sup> )	60 503	138 612
	Other .....	(metre <sup>3</sup> )	490 790	1 875 889
	Dolomite .....	(tonne)	73 769	484 129
	Graphite .....	(tonne)	41	214
	Kaolin .....	(tonne)	124 452	1 910 326
	Limestone—			
	Agricultural and other .....	(tonne)	1 123 775	2 925 711
	Carbide .....	(tonne)	959 493	4 105 949
	Cement .....	(tonne)	9 213 169	15 425 524
	Chemical and metallurgical .....	(tonne)	4 748 014	7 660 062
	Ochre .....	(tonne)	2 949	23 483
	Pebbles (from 1957) .....	(tonne)	19 742	347 944
	Sand (moulding) .....	(tonne)	864	9 550
	Silica .....	(tonne)	393 460	992 807
	Talc .....	(tonne)	338	2 154

<i>Mineral</i>	<i>Unit</i>	<i>Total Quantity</i>	<i>Value \$</i>
<b>FUEL MINERALS</b>			
Coal .. .. .	(tonne)	10 824 553	31 184 907
Shale .. .. .	(tonne)	42 239	62 462
Peat .. .. .	(tonne)	5 616	180 395
<b>CONSTRUCTION MATERIALS</b>			
Building stone—			
Freestone .. .. .	(metre <sup>3</sup> )	12 922	560 499
Granite .. .. .	(metre <sup>3</sup> )	4 642	90 858
Other .. .. .	(metre <sup>3</sup> )	13 245	107 776
Crushed and broken stone (from 1958)—			
Basalt .. .. .	(metre <sup>3</sup> )	3 071 224	13 842 905
Dolerite .. .. .	(metre <sup>3</sup> )	8 877 366	39 033 955
Limestone .. .. .	(metre <sup>3</sup> )	355 812	1 415 698
Sandstone .. .. .	(metre <sup>3</sup> )	36 275	88 620
Other .. .. .	(metre <sup>3</sup> )	97 391	10 281 675
Gravel (from 1958) .. .. .	(metre <sup>3</sup> )	19 510 499	37 949 542
Sand (from 1958) .. .. .	(metre <sup>3</sup> )	2 192 441	5 765 201
Other road making material .. .. .	(metre <sup>3</sup> )	188 633	6 065 956
			\$2 011 646 916

### STATISTICS RELATING TO THE MINERAL INDUSTRY

<i>Mineral</i>	<i>Year Ended 31 December 1975</i>		<i>Year Ended 31 December 1976</i>	
	<i>Total Quantity</i>	<i>Value \$A</i>	<i>Total Quantity</i>	<i>Value \$A</i>
<b>METALLIC MINERALS</b>				
Bismuth .. .. . (kilogram)	....	....	....	....
Cadmium .. .. . (tonne)	155	784 240	118	554 810
Cobalt oxide .. .. . (tonne)	17.55	107 855	25.64	185 496
Copper .. .. . (tonne)	25 698	24 606 515	24 566	28 507 660
Crocoite .. .. . (specimens only)	....	7 724	....	5 057
Gold .. .. . (kilogram)	1 453	5 712 948	1 314	4 246 862
Iron ore pellets .. .. . (tonne)	2 054 522	25 829 883	2 221 805	40 616 387
Iron oxide .. .. . (tonne)	10 699	92 769	13 529	134 550
Lead .. .. . (tonne)	11 380	3 524 700	12 070	4 415 664
Manganese dioxide .. .. . (tonne)	392	16 346	232	6 106
Mercury .. .. . (kilogram)	210	1 200	140	363
Rutile (concentrates) .. .. . (tonne)	5 504	1 579 311	6 685	1 938 650
Silicon for silicon alloy production .. .. . (tonne)	5 742	57 420	16 837	420 925
Silicon as silicon alloys .. .. . (tonne)	12 310	1 929 021	23 162	6 017 896
Silver .. .. . (kilogram)	55 853	6 110 155	54 421	6 341 438
Sulphur—				
Pyrites .. .. . (tonne)	224 423	....	202 370	....
Sulphuric acid from pyrites .. .. . (mono tonne)	332 753	6 924 011	299 293	7 220 562
Sulphuric acid from zinc concentrates (mono tonne)	63 362	1 240 198	91 182	1 937 278
Tin .. .. . (tonne)	5 494	30 093 128	6 853	46 834 677
Tungsten as tungstic oxide .. .. . (tonne)	1 744	11 910 827	2 204	20 768 806
Zinc .. .. . (tonne)	54 326	35 873 182	49 697	34 683 132
Zircon (concentrates) .. .. . (tonne)	8 799	1 933 412	6 313	883 820
<i>Value of Metallic Minerals</i> .. .. .	....	158 334 845	....	205 720 139

<i>Mineral</i>	<i>Year Ended 31 December 1975</i>		<i>Year Ended 31 December 1976</i>		
	<i>Total Quantity</i>	<i>Value \$A</i>	<i>Total Quantity</i>	<i>Value \$A</i>	
<b>NON-METALLIC MINERALS</b>					
Clay—					
Brick .....	(metre <sup>3</sup> )	72 369	243 576	81 387	244 161
Tile .....	(metre <sup>3</sup> )	4 872	16 763	3 513	10 539
Other .....	(metre <sup>3</sup> )	35 046	311 891	16 026	80 130
Dolomite .....	(tonne)	5 042	40 543	10 335	96 392
Kaolin .....	(tonne)	....	....	9 527	857 170
Limestone—					
Agricultural .....	(tonne)	30 341	141 220	37 191	198 319
Carbide .....	(tonne)	18 865	269 704	20 696	310 440
Cement .....	(tonne)	417 615	810 173	488 441	1 465 323
Chemical and metallurgical .....	(tonne)	54 548	340 424	75 154	704 308
Other .....	(tonne)	24 111	44 549	15 299	58 797
Ochre .....	(tonne)	....	....	....	....
Pebbles .....	(tonne)	859	15 622	1 716	33 366
Silica .....	(tonne)	27 573	95 257	20 479	66 630
<i>Value of Non-Metallic Minerals</i> .....		....	2 329 722	....	4 125 575
<b>FUEL MINERALS</b>					
Coal .....	(tonne)	161 922	972 491	189 489	1 689 878
Peat .....	(tonne)	375	29 873	3 779	58 974
<i>Value of Fuel Minerals</i> .....		....	1 002 364	....	1 748 852
<b>CONSTRUCTION MATERIALS</b>					
Building stone—					
Freestone .....	(metre <sup>3</sup> )	866	67 789	920*	97 334†
Granite (red) .....	(metre <sup>3</sup> )	....	....	....	....
Other .....	(metre <sup>3</sup> )	260	21 150	269	29 171
Crushed and broken stone—					
Basalt .....	(metre <sup>3</sup> )	345 041	2 244 005	317 398	2 616 506
Dolerite .....	(metre <sup>3</sup> )	379 339	2 590 183	467 988	3 741 657
Limestone .....	(metre <sup>3</sup> )	16 575	104 055	19 038	133 266
Sandstone .....	(metre <sup>3</sup> )	....	....	....	....
Other .....	(metre <sup>3</sup> )	71 524	482 202	97 391	681 804
Gravel .....	(metre <sup>3</sup> )	1 393 842	4 919 143	1 408 346	7 074 740
Sand .....	(metre <sup>3</sup> )	108 675	530 019	292 409	1 554 236
Other road making material .....	(metre <sup>3</sup> )	196 011	692 388	188 633	943 520
<i>Value of Construction Materials</i> .....		....	11 650 934	....	16 872 234
<i>Total Value with Australian Metal Prices</i> .....		....	173 317 865	....	228 466 800
<b>METALLURGICAL PRODUCTION FROM OTHER THAN TASMANIAN ORES</b>					
Alumina .....	}	....	135 013 109	....	169 915 967
Aluminium .....					
Aluminium hydrates .....					
Aluminium sulphates .....					
Cadmium .....					
Cobalt oxide .....					
Ferro-manganese .....					
Titanium dioxide .....					
Zinc .....	....	....	....	....	....
<i>Value of Mining and Metallurgical Production</i> .....		....	308 330 974	....	398 382 767
Average number of Employees .....		....	9 163	....	9 345

\* Figure found to be overstated by 155 tonnes after annual figures published.

† Figure found to be overstated by \$28 441 after annual figures published.

### AID TO MINING

Four parties were granted financial assistance for the purchase of items of plant required in connection with alluvial tin mining operations at Coles Bay, Gladstone and Pioneer. The loans are secured by a registered Mortgage Deed and repayments are required at the rate of 7½% of the proceeds of minerals produced and sold. Interest at 6% per annum is charged.

Repayments of royalty received from various assisted parties totalled \$8 876 which is credited to the Mining Trust Fund and used to assist other parties.

Unfortunately two parties who previously received financial assistance ceased operations. Efforts to sell the plant held as security under mortgage have so far not been successful. Enquiries as to likely purchasers are continuing.

*Mt Bischoff tin mine.* The tribute parties at the old mine have virtually ceased operations and it is proposed to discontinue the tribute system and to open up the area for application for mining tenements under the Mining Act 1929. Comstaff Pty Ltd who have continued with an active program of exploration since 1 July 1967 propose to convert the existing Authority to Prospect into an exploration licence.

*Mining plant.* There was one application for the hire of a pump for use on a wolfram prospect at the old Devon mine at Dove River. This is the first application for some years for the use of the items of mining plant purchased for hire to small parties to test mineral prospects from shafts or other forms of underground mining.

#### STATEMENT OF RECEIPTS AND PAYMENTS OF THE MINING TRUST FUND FOR THE YEAR ENDED 31 DECEMBER 1976

<i>Receipts</i>	\$	<i>Payments</i>	\$
Balance at 1 January 1976	3 804·58	Assistance	10 940·25
Repayment of loans	8 876·51	Balance to next Account	3 573·92
Interest on loans	1 714·78		
Tribute royalty	....		
Hire of mining plant	39·00		
Authorities to prospect	79·30		
	\$14 514·17		\$14 514·17

### STAFF

The following staff changes occurred during the year:—

<i>Name</i>	<i>Position</i>	<i>Remarks</i>	
Buirski, E. R.	Laboratory Assistant	Resigned	21.1.76
Cusick, C. (Miss)	Records Clerk	Promoted	5.8.76
Donaldson, R. C.	Geologist	Appointed	5.4.76
Eastoe, R. J.	Laboratory Assistant	Resigned	27.5.76
Hill, M. R.	Assistant Draughtsman	Appointed	2.2.76
McManus, S. F.	Clerk	Appointed	1.4.76
Mackey, J. (Miss)	Technical Officer	Appointed	29.1.76
Murray, D.	Drilling Superintendent	Appointed	26.7.76
Murtagh, W. H. (Mrs)	Secretarial Assistant	Retired	19.7.76
Nielson, P. T.	Laboratory Assistant	Appointed	23.8.76
Philpott, T. G.	Laboratory Assistant	Appointed	7.6.76
Roddam, P. A. (Miss)	Records Clerk	Promoted	2.12.76
Shields, B. J. (Mrs)	Office Assistant	Resigned	2.12.76
Stanley, C. E.	Drilling Superintendent	Retired	11.4.76
Williams, K. G.	Field Assistant	Resigned	17.11.76

### SCHOLARSHIPS

A geological scholarship was awarded to Miss C. A. Bacon of Devonport. This is the first occasion the award has been made to a female applicant. Miss Bacon will study for the degree of Bachelor of Science.

Messrs R. H. Castleden and P. G. Lennox were granted extensions of their scholarships to enable them to study for honours degrees.

### CONCLUSION

Appreciation is recorded of the services rendered by officers of the Department, including officers of the Mines Draughting Section, Wardens of Mines and Registrar of Mines in the several mining districts.

A detailed review of operations and production, and the reports of the Geological Survey Branch, the Chemical and Metallurgical Branch, the Mines and Explosives Branch, the Mount Cameron Water Race Board and the Ringarooma and Cascade Water Board follow.

J. G. SYMONS, Director of Mines

# OPERATIONS AND PRODUCTION

## 1.—Metallic Minerals

### CADMIUM

#### QUANTITY AND VALUE OF PRODUCTION

Year	Tonnes		\$	Year	Tonnes		\$
1924-1971	1 929	6 050 256		1974	126	760 230	
1972	138	658 560		1975	155	784 240	
1973	178	1 026 000		1976	118	554 810	
				Total	2 644	9 834 096	

This is a by-product obtained by the Electrolytic Zinc Company of Australasia Limited at its Risdon Works from zinc concentrates produced from the Rosebery and Williamsford mines.

### COBALT OXIDE

The source of the 25.64 tonnes of cobalt oxide of value \$185 496 was the same as that of cadmium.

### COPPER

#### SOURCE, QUANTITY AND VALUE OF PRODUCTION

Year	From tin ores		From lead-zinc ores		In blister copper		From copper ores		Total	
	Tonnes	\$	Tonnes	\$	Tonnes	\$	Tonnes	\$	Tonnes	\$
1919-1971	2 794	3 138 731	21 487	16 498 205	501 143	208 564 870	46 984	53 317 959	572 408	281 519 765
1972	1 038	981 414	2 478	2 341 658	....	....	24 290	22 903 156	27 806	26 226 228
1973	750	941 501	1 746	2 256 020	....	....	22 833	28 979 109	25 329	32 176 630
1974	533	678 871	2 555	3 263 125	....	....	25 353	31 895 420	28 441	35 837 416
1975	570	545 487	2 174	2 080 831	....	....	22 954	21 980 197	25 698	24 606 515
1976	611	709 379	2 709	3 153 402	....	....	21 246	24 644 879	24 566	28 507 660
Total	6 296	6 995 383	33 149	29 593 241	501 143	208 564 870	163 660	183 720 720	704 248	428 874 214

### The Mount Lyell Mining and Railway Company Limited, Queenstown

#### Mining—

#### Ore mined—

	Tonnes
Prince Lyell .. .. .	1 219 856
West Lyell Stockpile .. .. .	174 397
Crown Lyell .. .. .	225 251
Cape Horn .. .. .	392 182
Lyell Tharsis .. .. .	136 473
Royal Tharsis .. .. .	2 434
Crown Three open cut .. .. .	79 187
'A' Lens .. .. .	63 730

2 293 510

Copper concentrate produced .. .. . 82 530

#### Containing—

Copper (tonnes) .. .. .	21 246
Silver (grams) .. .. .	3 916 681
Gold (grams) .. .. .	417 388
Pyrite concentrate produced .. .. .	99 870
Total value of production .. .. .	\$27 250 345

The average number of persons employed was 453 underground and 580 on the surface.

Metal production from the inception of the company to 31 December 1976 was:—

Copper	.....	826 985 tonnes
Silver	.....	539 892 340 grams
Gold	.....	23 381 958 grams

E. C. Leyland, Mining Engineer, Burnie, reports:—

MINE DEVELOPMENT

Mine Area	Driving and Cross-cutting (m)	Rising (m)	Diamond Drilling (m)
Prince Lyell	2 566	357	410
Cape Horn	1 139	208	129
Crown	287	182	....
'A' Lens	1 406	169	....
Royal Tharsis	74	5	328
Lyell Tharsis	....	4	....
Main Decline	116	....	....
Prince Lyell No. 1 Shaft	495	213	....
Other	....	....	2 346
	<hr/> 6 083	<hr/> 1 138	<hr/> 3 213

*No. 1 Shaft, Prince Lyell*

Ground movement in the shaft between 16 and 17 levels has again necessitated additional cable anchoring and the release and re-setting of the shaft steelwork. In addition, the brattice wall above 17 level has buckled in excess of 20 mm, with one concrete bunton being cracked and exhibiting evidence of crushing near the wall hitch. A reduction of the normal travelling speed of the cage is still mandatory for travel below 16 level. Further continuous movement of ground in a section of the main haulage drive on 17 level, in a faulted zone, has been temporarily arrested with steel supports and cable anchoring. The mullock pass from 17-18 levels was cable bolted and gunited to prevent further attrition. The crusher chamber excavation was substantially completed and the foundations for the machinery completed.

The contractors (RUC-Holland) continued with the driving of the Cape Horn haulage drive on 14 level. The moling proceeded at a good rate with the main problem encountered being the handling of the mole cuttings in the waste pass system and the skip loading pockets. This drive was advanced 472 m before this program was abandoned. At the end of the year all development and installation work ceased in No. 1 Shaft area, both underground and on the surface.

*Prince Lyell Mine*

The main development undertaken was directed to the horizontal development of the second block of ore for open stoping (92 m level to 182 m level). Due to the closure of the Prince Shaft as the means of hoisting any ore won from the block, the access decline from 195 m-92 m levels was stripped in several sections to provide passing bays for the enlarged haulage fleet. All ore and waste from this block is now trucked via this decline to the 224 m level where the ore is tipped in No. 1 pass for rail transport to the surface along 11 level (195 m). Towards the end of 1976 development of the Main Decline was resumed. This decline which was originally driven by contractors from the tunnel yard to connect to the Prince Shaft at 13 level plat, is now being advanced by the company to 14 level, in order to provide primary access and haulage facilities for the development of the third stoping section of the Prince Lyell ore body above 14 level. The excavation for the main pump station at the 92 m level was completed, installation of the pumps and necessary pipework will be undertaken in 1977.

Production from this mine failed to meet the budget targets in both tonnage and grade. Most of the ore won was from pillar blasts above the 195 m level. Stope 27, the first of the stopes to be brought into production from the 92 m level, was 80% mined. The firing of stope 7-8 pillar resulted in significant subsidence on the south-west face of the West Lyell open cut (hanging wall) and considerable dilution of the broken ore. The only unbroken ore remaining above the 195 m level in the Prince Lyell ore body is now contained in the draw-point apices. 'B' lens slot and two rings were fired and some production was obtained from the sub-level cave development of 'A' lens.

### *Cape Horn Mine*

Development has been concentrated on the 170 m level which is to be the extraction level for the block of ore between 170 m-223 m levels. This level development was 60% completed at the end of the year. In an attempt to improve ore recovery from the pillar blasts above 223 m level an intermediate level, 270 m, was developed and footwall draw points were driven on the 223 m level.

Production achieved the budget targets in tonnes and grade. No figures are available to compare the quantity of copper extracted from the open stope block (223 m-323 m) with either the ore reserve for the block, or the recovery from the sub-level caving method utilised in the mining of the block immediately below the open cut. The slot for the first stope in the 170 m block was cut, and with the exception of some footwalling ore in pillar 1-2 draw points on the 223 m level, production for 1977 will be confined to the 170 m level. Ore won from this level will be trucked up the decline to the ore pass on the 223 m level and then loaded on to the train at the 195 m level haulage system.

### *Crown Mine*

Development in this area was confined to cutting a gullet to form the 528 m bench of the Crown 3 open cut and to cross-cutting on Nos. 3 and 4 levels in order to develop footwall draw points for the recovery of broken pillar ore.

With the inclusion of the ore mined from the open cut, production exceeded budget targets in both tonnage and grade. The caving of the hanging wall, following the firing of pillar 4-5, resulted in very little ore from this firing reaching the available draw points in the old stope scam drifts. Dilution was severe and handling through the existing ore pass system of this slurried waste became impossible. New draw points were cut in the footwall and 2-yard diesel units were introduced. A planned even draw was instituted, and some clean ore was recovered. The Crown 2 ore body was mined out during the year with the tonnage and grade achieving the ore reserve figures.

### *Lyell Tharsis Mine*

Caving of the hanging wall through to the surface following each firing, caused severe dilution problems at the draw points. As all the stope rings had been previously bored the situation could not be improved without further development and ring drilling and the mine was closed down towards the end of the year.

### *Royal Tharsis*

Following further drilling which indicated a reduction in the dimensions of this ore lens, and necessitated a mining method other than the designed outline permitted, the block was abandoned.

## GENERAL

Underground mines provided 89% of the ore treated for the year. The recovered grade of this production was less than 65% of the ore reserve grade. With the mining of the stopes in the new blocks of both Prince Lyell and Cape Horn mines during 1977, a big improvement in grade is predicted. However, this ore will need to be loaded and then hauled up the declines instead of being loaded and tipped directly into ore passes. Three new Wagner MT4 25-30 trucks and five second-hand MTF trucks have been purchased to achieve the required tonnage. In the design of the new stope blocks considerable attention has been given to the design and layout of the undercut in order to improve the recovery from the pillar ore subsequent to the mining of the stope ore. A planned stope-pillar extraction sequence coupled with a designed draw control program should limit dilution to normal limits for this type of operation. Molanite, both in bulk and cartridges, was utilised in the larger pillar blasts. These tests gave promising results with better fragmentation and a consequent reduction in secondary blasting.

## ORE RESERVES AT 30 JUNE 1976

Mine	Tonnes	Copper (%)	Silver (g/t)	Gold (g/t)
<b>PROVED ORE—</b>				
Prince Lyell ....	24 343 000	1.43	3.00	0.40
Lyell Tharsis ....	180 000	1.00	1.53	0.24
Crown Three ....	1 218 000	1.78	3.98	0.37
Twelve West ....	29 000	9.50	30.61	0.15
Cape Horn ....	1 090 000	1.60	4.28	1.22
'A' Lens ....	354 000	1.63	1.58	0.33
Total ....	27 214 000	1.46	3.10	0.43
<b>PROBABLE ORE—</b>				
'A' Lens ....	4 273 000	1.31	1.53	0.24
Royal Tharsis ....	1 878 000	1.46	1.53	0.24
Cape Horn ....	1 214 000	1.75	3.06	0.31
Prince Lyell ....	2 223 000	1.38	3.00	0.40
Crown Three ....	283 000	1.61	3.98	0.37
Intermediate Lens ....	196 000	1.08	1.53	0.24
Total ....	10 067 000	1.41	2.11	0.29
<b>POSSIBLE ORE (not reserves)—</b>				
Cape Horn ....	1 939 000	1.28	3.06	0.31
Prince Lyell ....	3 000 000	1.30	3.00	0.40
Total ....	4 939 000	1.29	3.02	0.36

## MILLING

There were no major additions or modifications to the plant.

Concentrate	Tonnes	Copper (%)	Sulphur (%)
Copper .....	82 530	25.74	....
Pyrite .....	104 550	0.27	48.9

*General*

The mill operated for 359 days. The metallurgical research section continued their program from 1975 but their activity was curtailed towards the end of the year due to the current economic conditions.

It was confirmed that up to 30 000 tonnes of pyrite could be recovered from the rejected slimes fraction of the pyrite concentrate feed. No action will be taken on this result in the present economic situation.

Performance of the feed analysis probes in the copper section was satisfactory with accuracy falling within the predicted range. Action was deferred on the transfer of mill tailings to a new surface site.

*Effluents*

The monitoring of streams leaving the lease was continued. There was no great variation from the previously established pattern. A stainless steel flume with electronic measurement of flows was established in Haulage Creek.

## ENGINEERING

New installations and modifications to existing plant included:—

The southern exhaust airway was commissioned.

The West Lyell workshops were closed down with the transfer of many of the employees to new workshops in the Central Store area.

The new primary crusher for underground was purchased but remains stored with the manufacturers.

The sawmill was closed and the premises leased to a private contractor.

## CAPITAL EXPENDITURE

During the year the following capital items were purchased:—

- Four diesel trucks.
- Two 2-yard L.H.D. Wagner ST2B Scooptrams.
- One road grader.
- One 25-cwt hydraulic crane.
- Concentrate truck trailers.

## ACCIDENTS

Man hours exposure	....	....	....	....	....	....	....	....	....	2 166 490
Frequency rate	....	....	....	....	....	....	....	....	....	84.9
Severity rate	..	....	....	....	....	....	....	....	....	2 795.8
Mean duration (days)	..	....	....	....	....	....	....	....	....	13.2

These statistics for 1976 indicate considerable improvement in the accident record when compared with the two preceding years. Of the 184 accidents 16 were designated as serious and 168 as minor.

**Cleveland Tin N.L., Luina**

This company, reviewed under Tin, produced 2 863 tonnes of copper concentrates containing 611 tonnes of copper valued at \$709 279.

**Electrolytic Zinc Company of Australasia Limited, Rosebery**

This company, reviewed under Zinc, produced 24 060 tonnes of copper concentrates containing 2 709 tonnes of copper valued at \$3 153 402.

## GOLD

## QUANTITY AND VALUE OF PRODUCTION

<i>Year</i>	<i>Kilograms</i>	<i>Value</i> \$	<i>Year</i>	<i>Kilograms</i>	<i>Value</i> \$
Prior to 1972	89 965	40 278 102	1974	1 385	5 118 359
1972	1 781	2 873 567	1975	1 453	5 712 948
1973	1 319	2 987 891	1976	1 314	4 246 862
			Total	97 217	61 217 729

**The Mount Lyell Mining and Railway Company Limited, Queenstown**

This company recovered 417 kilograms, valued at \$1 366 664 from sludge in the electrolytic copper refinery.

**Electrolytic Zinc Company of Australasia Limited, Rosebery**

Concentrates produced by this company contained 896 kilograms, valued at \$2 877 043.

**BMI Mining Pty Ltd, South Mount Cameron**

Concentrates produced by this company contained 1 kilogram of gold valued at \$3 155.

## IRON ORE (PELLETS)

## Savage River Mines, Savage River and Port Latta

	<i>Tonnes</i>
Savage River—	
Overburden removed .....	8 815 308
Ore mined .....	5 834 780
Concentrate to Port Latta (dry) .....	2 227 778
Port Latta—	
Pellets produced (dry) .....	2 221 805
Value of production .....	\$40 616 387
Average number of persons employed—	
Mining .....	157
Other .....	528
	—
Total .....	685
	—

R. C. Thomas, Mining Engineer, Burnie, reports that at Savage River the pit bottom had reached 15 level at the year's end with the completion of the north access road to that level. The southern road to the crusher from the north side of the pit was also completed. The general improvement in the pit roads has contributed to the improved tyre life.

On the east face of the pit, work continued on pit stability and the program of drain holes and rock bolting of 6 level at its final outline was almost completed during the year. Work continued on excavating 7 and 8 levels to their final outline and these levels are also to be rock bolted and drained. As part of the pit stability program, two rows of pre-split holes are being drilled along the pit wall and are being fired ahead of the main blast to minimise back break.

Another improvement in the pit operation has been the increased sizes of the drilling pattern and the use of 676 aluminised slurry and a subsequent increase in broken ground ahead of the shovels.

In the concentrator, testing of alternate grinding media has warranted an extended full scale test and also a continuation of the grind control study. In November production was affected by repairs to one of the autogenous grinders due to extensive cracking in one of the trunnions. The repair was effected by fitting a machined sleeve to the trunnion.

At Port Latta, thirty shipments of pellets, averaging 73 497 tonnes per vessel, and six oil tankers, discharging a total of 33 791 tonnes of fuel oil, were handled through the port during the year. At the plant a preliminary test using Fingal coal as a partial substitute for fuel oil was carried out.

## CAPITAL EXPENDITURE

The main areas of capital and major expenditure for the year have been:—

Purchase of a new P & H dipper.

Leasing of three Caterpillar D8K bulldozers to replace the Terex 82/40 units.

Leasing of an additional Caterpillar 988 front-end loader.

A diamond drilling program to define ore reserves to assist future pit planning and also to assist in pit stability predictions.

A new ring gear and pinion for No. 1 autogenous mill, delivery of which is expected in May 1977.

A start was made on the painting of the offshore facility as Phase 1 in a three-phase corrosion rectification program.

## ACCIDENTS

Seventy reportable accidents occurred during the year, twenty-three of these at Port Latta, an increase of 44% and forty-seven at Savage River, a decrease of 22%. Accident statistics for the year were:—

	Accidents	Days Lost		Man Hours	Frequency Rate	Severity Rate	Mean Duration (Days)
		Working	Calendar				
Savage River ..	47	415	532	917 676	51.2	580	8.8
Port Latta ....	23	309	433	520 141	44.2	832	13.4
Combined ....	70	724	965	1 437 817	48.7	671	10.3

## IRON OXIDE

## QUANTITY AND VALUE OF PRODUCTION

Year	Tonnes	Value \$	Year	Tonnes	Value \$
Prior to 1972 .....	168 728	561 181	1974 .. .. .	11 005	73 192
1972 .....	9 783	61 956	1975 .. .. .	10 699	92 769
1973 .....	12 293	82 394	1976 .. .. .	13 529	134 550
			Total ....	226 037	1 006 042

## Iron Cliffs Mine, Penguin

A. Pearson continued to work the secondary ore at the Iron Cliffs mine and supplied a cement works with 13 529 tonnes of hematite valued at \$134 550. Employment averaged six men.

## LEAD

## QUANTITY AND VALUE OF PRODUCTION

Year	Tonnes	Value \$	Year	Tonnes	Value \$
1919 to 1971 .. .. .	441 693	63 149 545	1974 .. .. .	12 637	5 048 404
1972 .. .. .	20 303	4 951 450	1975 .. .. .	11 380	3 524 700
1973 .. .. .	14 362	4 091 160	1976 .. .. .	12 070	4 415 664
			Total ....	512 445	85 180 923

## Electrolytic Zinc Company of Australasia Limited, Rosebery

This company, reviewed under Zinc, produced 10 888 tonnes of lead concentrate and the total content of lead in the lead, zinc and copper concentrates was 12 070 tonnes valued at \$4 415 664.

## South Comet Mine, Dundas

During the year a parcel of 200 tonnes was mined at the open cut above No. 1 level. Bulk samples were submitted to E.Z. Co., Rosebery but no agreement could be reached on price, accordingly, this ore remains stockpiled. The partners are now considering establishing their own small plant and have to date installed one 20 h.p. diesel.

## SPECIMENS OF LEAD MINERALS

**Adelaide Mine, Dundas**

Production of mineral samples of crocoite for the year was valued at \$4 456. Most of this production was obtained from the floor of the No. 1 adit. A pump house was erected on the banks of the creek and a supply line for drilling water taken into No. 3 adit. The access road to the lease was improved during the summer months.

**Read Lead P.A., Dundas**

Production of mineral samples was valued at \$2 868. Fifty metres of cross-cutting in the upper adit, commenced last year, resulted in a break through to old workings. The area was bridged and the drive advanced until the lode cut out. In the lower adit continual bad ground conditions indicated that the old workings were extensive and had covered the extraction of the lode, consequently, it was abandoned.

Demand and price for good quality specimens remain firm, however, the 'moonlighting' activities of several parties have resulted in market saturation for other than the top grade.

## MANGANESE DIOXIDE

This is recovered as a sludge in the electrolysis of zinc sulphate at the Risdon Works of the Electrolytic Zinc Company of Australasia Limited, the original source being the ore in its West Coast mines. The production of 232 tonnes was valued at \$6 106.

## MERCURY

## QUANTITY AND VALUE OF PRODUCTION

<i>Year</i>	<i>Kilograms</i>	<i>Value</i> \$	<i>Year</i>	<i>Kilograms</i>	<i>Value</i> \$
1967 to 1971	6 118	81 408	1974	71	922
1972	593	2 986	1975	210	1 200
1973	544	3 265	1976	140	363
			<b>Total</b>	<b>7 676</b>	<b>90 144</b>

This is recovered at the Risdon Works of the Electrolytic Zinc Company of Australasia Limited from the roaster gases in the calcining of zinc concentrates. The ore containing the mercury is mined at the company's mine on the West Coast. Recovery was first made early in 1967. Production for the year was 140 kilograms, valued at \$363.

## OSMIRIDIUM

Total production to date is 881 kilograms, valued at \$1 418 771.

## PYRITE

## QUANTITY PRODUCED

<i>Year</i>	<i>Tonnes</i>	<i>Year</i>	<i>Tonnes</i>
1915 to 1971	2 124 070	1974	224 251
1972	221 595	1975	224 423
1973	244 798	1976	202 370
		<b>Total</b>	<b>3 241 507</b>

Since 1969 pyrite concentrates produced by the Mount Lyell Mining and Railway Company Limited, Queenstown and the Electrolytic Zinc Company of Australasia have been sent to the North-West Acid Pty Ltd treatment plant at Wivenhoe.

No value is reported for the pyrites as this is included in the value reported for sulphur as sulphuric acid.

### SILICA FOR SILICON ALLOY PRODUCTION

#### The Broken Hill Proprietary Company Limited, Beaconsfield

This company mined and supplied to the Tasmanian Electro-Metallurgical Company 16 837 tonnes of silica valued at \$420 925. A local contracting firm carried out the work.

### SILICON

#### Tasmanian Electro-Metallurgical Company Proprietary Limited, Bell Bay

In the production of silicon as silico-manganese this company smelted 20 184 tonnes of local Beaconsfield quartzite combined with slag from ferro-manganese production for a yield of 23 162 tonnes of silico-manganese valued at \$6 017 896. The average number of persons employed is shown under Ferro-Manganese.

### SILVER

Silver is nowhere mined for itself but is a valuable by-product from copper, lead and zinc ores.

#### PRODUCERS, SOURCE, QUANTITY AND VALUE OF PRODUCTION, 1976

<i>Producer</i>	<i>Source</i>	<i>Kilograms</i>	<i>\$</i>
EZ Co. of A/asia Ltd	Copper, lead and zinc concentrates	50 087	5 822 916
Mt Lyell M. & R. Co. Ltd	Refinery sludge	3 916	455 822

#### SOURCE, QUANTITY AND VALUE OF PRODUCTION

<i>Year</i>	<i>From tin and other ores</i>		<i>From silver-lead ore</i>		<i>From copper ore</i>		<i>From lead-zinc ore</i>		<i>Total</i>	
	<i>Kilograms</i>	<i>\$</i>	<i>Kilograms</i>	<i>\$</i>	<i>Kilograms</i>	<i>\$</i>	<i>Kilograms</i>	<i>\$</i>	<i>Kilograms</i>	<i>\$</i>
1919-1971 ..	3 788	101 764	550 239	5 749 634	133 046	2 309 554	1 016 951	31 079 995	1 704 024	39 240 947
1972 .. ....	2 572	123 722	....	....	4 174	191 595	72 476	3 350 980	79 222	3 666 297
1973 .. ....	663	38 686	....	....	3 944	231 726	55 473	3 283 151	60 080	3 553 563
1974 .. ....	445	51 273	9	1 045	5 217	602 181	56 422	6 515 222	62 093	7 169 721
1975 .. ....	....	....	....	....	4 402	479 039	51 451	5 631 116	55 853	6 110 155
1976 .. ....	418	62 700	....	....	3 916	455 822	50 087	5 822 916	54 421	6 341 438
Totals ....	7 886	378 145	550 248	5 750 679	154 699	4 269 917	1 302 860	55 683 380	2 015 693	66 082 121

### SULPHUR

Sulphuric acid is produced in the roasting at Risdon of the zinc concentrates from the West Coast mines of the Electrolytic Zinc Company of Australasia Limited, and from the treatment by North-West Acid Pty Ltd of pyrite concentrates produced by the Electrolytic Zinc Company and by the Mount Lyell Mining and Railway Company Limited.

## SULPHUR AS SULPHURIC ACID: SOURCE, QUANTITY AND VALUE OF PRODUCTION

Year	From zinc concentrates		From pyrite concentrates			Total	
			Pyrite	Acid			
	Mono tonnes	\$	Tonnes	Mono tonnes	\$	Mono tonnes	\$
1957-1971 .. ....	719 436	8 676 498	258 957	442 405	6 620 902	1 161 841	15 297 400
1972 .. ....	96 209	1 217 939	244 281	357 528	5 258 779	453 737	6 476 718
1973 .. ....	61 895	827 631	242 618	331 090	5 183 827	392 985	6 011 458
1974 .. ....	79 200	1 300 706	232 763	301 872	5 452 341	381 072	6 753 047
1975 .. ....	63 362	1 240 198	222 626	332 753	6 924 011	396 115	8 164 209
1976 .. ....	91 182	1 937 278	226 639	299 293	7 220 562	390 475	9 157 840
Totals ....	1 111 284	15 200 250	1 427 884	2 064 941	36 660 422	3 176 225	51 860 672

## North-West Acid Proprietary Limited, Wivenhoe

Production for the year was 299 293 tonnes of acid expressed at 100%. No new development was undertaken during the year, however the cut-back in Mt Lyell's operations will affect the future raw material supply. In an attempt to make good this deficit, the company is currently assessing the suitability of pyrrhotite from Renison Limited as an alternative material. Small scale in-plant tests carried out to date have been encouraging and further tests are planned for the coming year.

Annual production remains well below design capacity. As reported last year the downturn in the rural economy did not pick up in the first half of 1976 and production easily coped with this low demand. A major shut down, deferred for economic reasons in 1975, was completed in September-October 1976. The production rate has now been increased to meet a firmer product demand in 1977.

## Safety

The number of employees at the beginning of the year was 103 but had increased to 109 at 31 December. It is anticipated that a labour force of 105 persons will meet current requirements.

Twenty lost-time accidents occurred during the year, one of those being classified as serious.

Work injury statistics were:—

Man hours exposure .. .. .	266 608
Frequency rate .. .. .	75
Severity rate .. .. .	705.2
Mean duration (days) .. .. .	9.4

## TIN

## QUANTITY AND VALUE OF PRODUCTION

Year	Tonnes	Value \$	Year	Tonnes	Value \$
1873 to 1971 .. ....	174 241	148 776 800	1974 .. .. .	5 951	34 221 518
1972 .. .. .	6 825	22 439 882	1975 .. .. .	5 494	30 093 128
1973 .. .. .	5 674	20 221 559	1976 .. .. .	6 853	46 834 677
			Total .. .. .	205 038	302 587 564

**Aberfoyle Ltd, Rossarden**

## PRODUCTION

	<i>Ore Milled</i> (Tonnes)	<i>Cassiterite concentrates</i> (Tonnes)	<i>Tin in concentrates</i> (Tonnes)	<i>Value</i> (\$)	<i>Wolfram concentrates</i> (Tonnes)	<i>WO<sub>2</sub> in concentrates</i> (Tonnes)	<i>Value</i> (\$)
Aberfoyle .. ....	22 919	158	117	795 246	88	66	603 961
Storeys Creek .. ....	16 687	15	11	70 013	161	120	1 120 472
Aberfoyle Mill .. ....	39 606	173	128	865 259	249	186	1 724 433

## EMPLOYMENT AND DEVELOPMENT

<i>Mine</i>	<i>Average Number of Men</i>		<i>Driving and Cross-cutting</i> (Metres)	<i>Rising and Winzing</i> (Metres)
	<i>Underground</i>	<i>Surface</i>		
Aberfoyle .. ....	91	57	228	203
Storeys Creek .. ..			35	33

R. A. A. Seymour, Mining Engineer, Launceston, reports that operations continued on a reduced scale at both mines. Owing to the low price of tin, stoping was concentrated on blocks richer in wolfram. All ore was treated at the Aberfoyle mill, which ran for only five shifts per week for most of the year.

The following expenditure was incurred on capital works:—

	\$
Aberfoyle mill modifications .. .. .	6 000
Return water pump .. .. .	6 050
Storeys Creek head sheaves .. .. .	3 600
Front-end loader .. .. .	42 500
Two tray trucks .. .. .	8 500

In addition, \$16 000 was spent at Storeys Creek, mainly on addition of soda ash to mine drainage water and \$16 470 was spent on additions to the Aberfoyle slimes dam.

*Aberfoyle Mine*

Complaints were received about pollution from the mill and tailings dams. Upon inspection with the complainants, these were found to be largely unfounded. Later in the year, the height of the slimes dam was increased to cover the expected life of the mine and an additional pump was installed to return water to the mill.

*Storeys Creek Mine*

A winze was sunk from 11 level on the footwall vein to test it below the level. The vein is of good width and reasonable grade. This indicates a block of ore which despite having to be worked from the winze, will prolong the life of the mine.

During a change of ropes, it was noticed that one of the headsheaves had a cracked rim. An attempt was made to repair it by welding. However the mine had to be closed for two days until a spare sheave (of different size) could be fitted. Two sheaves were later obtained from Mt Lyell and fitted.

**BMI Mining Pty Ltd, South Mount Cameron**

Sluicing operations fed by scrapers from shallow surface wash continued in the Endurance and Post Office areas. A small diesel-electric jig plant was built and was put to work treating an old coarse tailings dump at the Blue Lake. Preparations were being made at the end of the year to put another jig plant together to work the Clifton Lead. Trial plantings of pines were made on worked-out areas.

A total of 193 834 cubic metres was treated during the year for a yield of 44·301 tonnes of concentrates containing 31·784 tonnes of tin valued at \$216 867. Employment averaged thirteen men.

**Cleveland Tin N.L., Luina**

E. C. Leyland, Mining Engineer, Burnie, reports that the tin quotas imposed by the International Tin Council on 18 April 1975 were lifted as from 30 June 1976. As a result, the mill operated on 319 days, an increase of thirteen days over the 1975 figure. A total of 407 905 tonnes with a head grade of 0·73% Sn (as cassiterite) and 0·27% Cu was processed. Recoveries for 1976 were as follows:—

	<i>Tonnes</i>
Tin concentrate .. .. .	2 679
Tin content .. .. .	1 644
Copper concentrate .. .. .	2 863
Copper content .. .. .	612
Tin content .. .. .	79

**DEVELOPMENT**

	<i>Ore</i> <i>(m)</i>	<i>Mullock</i> <i>(m)</i>
Driving and cross-cutting .. .. .	490	342
Decline advance .. .. .	286	185
Rising .. .. .	286	12
	<hr/>	<hr/>
	776	539
	<hr/>	<hr/>
Diamond drilling—		<i>(m)</i>
Surface .. .. .		1 597
Underground .. .. .		1 737
		<hr/>
		3 334
		<hr/>

This development advanced the decline to below the 16 level horizon, completed the development of 'B' and 'C' lenses on 14 level and 'D' lens on 15 level; advanced the drives on 15 level to the ore of 'B' and 'C' lenses and the drive on 16 level to the ore of 'B' lens; completed 'B' South development on 10 and 14 levels; established the service rise from 15 to 14 levels and completed the slot rises at the Qa rib pillar from 13 to 10 levels in lenses 'B' 'C' and 'D'. Access and slot rises were completed in the Khaki rib pillar.

### PRODUCTION

The mine continued the work pattern established in 1975 following the introduction of quotas, namely, a two-shift five-day week operation. Head grades of the ore being mined were below ore reserve grade at 0.73% tin (as cassiterite) and 0.27% copper. Some stope dilution in the lower Hall's lenses was assessed as the cause of this lower head grade. Ring drilling remained well ahead of current production requirements with 200 000 tonnes being ready for blasting. Haulage figures for the year were:—

Ore—	<i>Tonnes</i>
Hall's .. .. .	204 064
Khaki .. .. .	145 635
'B' South .. .. .	11 223
Henry's .. .. .	241
	<hr/>
	361 163
	<hr/>
Mullock—	
Development .. .. .	46 893
Stop .. .. .	32 896
	<hr/>
	79 789
	<hr/>
Total tonnes hauled .. .. .	440 952
	<hr/>

Ground conditions have been monitored by means of extensometers and surface levelling stations. Following advice from rock mechanics consultants, a rib pillar was formed in Hall's stopes from 10 to 13 levels at Qa section. This pillar was designed to stabilise the walls in the vicinity of Ratchet and Qa faults. A similar type of pillar was left in Khaki lens in 1975.

The mining method (MSOB), originally introduced at Cleveland mine, had as its major advantage that maximum extraction of the ore was possible. The introduction of rib pillars into the system will restrict the ore recovery of each block and will pose special problems if extraction of the pillars is contemplated at a later date.

Diamond drilling to assist level development and stope design continued throughout the year with 1 737 metres being drilled. Three diamond drill holes from the surface into the 'B' South ore body at depth gave disappointing results. However, with the completion of the exploration development of the 'B' South ore body at the 14 and 10 level horizons completed, close spaced diamond drilling to test the walls was undertaken. Results are not yet available to provide an ore reserve estimate for this block.

Ore reserves in tonnes are as follows:—

	<i>Tonnes</i>	<i>% Cassiterite</i>	<i>% Copper</i>
Indicated ....	1 722 113	0.79	0.30

This represents a depletion of 173 212 tonnes on the previous year's figure. A revision of geological interpretation in Hall's lode resulted in an increased tonnage being available on lower levels. The grade decrease, when compared with last year's figure, is due to the inclusion of the southern stoping areas of Khaki lode in these reserves.

### MILLING

The total tin and copper units produced were 10% higher than last year's production returns. With more operating mill days, a greater throughput rate, and an increase in the float rejection rate, the tonnage treated rose by 25% over the figure for 1975. Tin recovery from the ore treated declined to 56.9% with copper recovery increasing to 62.2%. As indicated in last year's report, the potential tin recovery is considerably reduced when the quantity of Khaki ore in the mill feed is increased. Although blending of the ore was carried out again in 1976, the proportions treated were 61% from Hall's lenses and 39% from Khaki lens.

Two modifications to the plant were made in order to permit a greater throughput and achieve economic results when treating Khaki ore:—

- (a) The heavy media feed preparation screens aperture size was changed from 11 mm to 6mm. Material of this order is now treated in the concentrator and by-passes the rod mill. Since this fraction of Khaki ore contains a high percentage of very hard chert it had resulted previously in very low rod mill throughput.
- (b) The density in the heavy media section was increased. This resulted in a float rejection rate of 29.7% containing 11.3% of the tin content of the mill feed.

During the year the primary ball mill was converted from an open discharge to a grate discharge. This has permitted improved density control. In addition, the rod mill was changed from manganese steel liners to rubber shell liners and lifter bars. The life of manganese liners has been established as eighteen months. To date, the rubber liners have been in operation eleven months, however, two new sets of lifters have been installed since the initial lining. A direct comparison of cost and efficiency should be available in 1977.

Modifications to the regrind section should be completed early in 1977. Research work by the CSIRO, AMDEL and the Mines Department, Launceston is continuing on the treatment of Khaki ore. The mine schedule is such that it will be necessary to treat Khaki ore exclusively for some periods of 1977.

#### CAPITAL EXPENDITURE

During the year the following capital projects were completed:—

	\$
Dravo space heater installed in the store .. .. .	4 555
Preparation for modular home sites—Waratah .. .. .	9 288
Underground transformer—15 level .. .. .	9 335
Upgrading of silicate regrind circuit .. .. .	63 252
Mine water to No. 2 tailings dam .. .. .	6 554
New weightometer No. 5 conveyor .. .. .	9 480
Four single-bedroom units—Luina .. .. .	41 120
Mascon lathe—workshop .. .. .	8 452
Twelve two-bedroom modular home units—Waratah .. .. .	168 144
	320 180

#### SAFETY

The following is the work injury record for the year:—

Man hours exposure .. .. .	450 041
Frequency rate .. .. .	80
Severity rate .. .. .	11 110.1
Mean duration rate .. .. .	11

There were thirty-six lost-time accidents of which four were classified as serious accidents. Employment figures for the year gave an average of 215 employees of whom forty-five were underground workers. Labour turnover in some categories remained high at 98%.

#### Minops Pty Ltd, Dundas

##### *Razorback Mine*

The company, as the figures below indicate, have completed a most difficult year.

### PRODUCTION

From a throughput of 50 053 tonnes 135.09 tonnes of concentrates containing 75 tonnes of tin valued at \$475 232 were produced. This output includes 12 000 tonnes containing 25.26 tonnes of concentrates containing 14 tonnes of tin valued at \$73 897 reported for the December 1975 quarter.

The concentrator was shut down for two periods, in September and in December, to permit the installation of equipment and for process flow alterations. The expansion of the secondary crushing section and the introduction of a third stage crushing should reduce the numerous stoppages due to blinding and packing of the wet 'sticky' ore. Sulphide flotation has been re-introduced into the circuit and the magnetic fractions are presently being stockpiled for future treatment. A sampling program in the open cut has been adopted and this should result in a higher grade mill feed.

### CAPITAL EXPENDITURE

A total of \$1 112 576 was outlaid in the calendar year on items of a capital nature. These included:—

- One 10.6 metre diameter thickener
- One 1.1 metre spiral classifier
- One 360 mm Gyrex crusher
- A workshop
- Office and assay laboratory.

### SAFETY

The accident statistics are detailed below and reflect the high labour turnover at 331%. There were eighteen lost-time accidents all classified as minor.

Man hours exposure ..	63 489
Frequency rate ..	283.5
Severity rate ..	1 212.8
Mean duration ..	4.3

The average number of employees was award sixteen, staff ten, a total of twenty-six.

### Renison Limited, Renison Bell

Ore hauled to the surface stockpile or delivered direct to the crusher totalled 529 387 tonnes. The sources of this production were as follows:—

	<i>Tonnes</i>
Bassett-Federal structure ..	78 252
Stebbins lode ..	153 809
Dreadnought lode ..	39 879
Murchison lode ..	93 597
Colebrook lode ..	65 007
Penzance lode ..	98 843
Concentrator plant—	
Ore treated ..	515 287
Assay (% Sn) ..	1.36

Tin concentrates produced—	<i>Tonnes</i>	<i>% Sn</i>	<i>Metallic tin content (Tonnes)</i>
High grade ..	7 219	52.5	3 793.6
Low grade ..	3 621.7	20.2	731.9
Overall metal recovery ..	.....	64.8	.....

R. C. Thomas, Mining Engineer, Burnie, reports that the Renison decline advanced 372.5 metres to 4 452.6 metres from and 487.1 metres below the portal. In addition 3 539.3 metres of driving and cross-cutting and 523.3 metres of rising were completed.

During the year a program of enlarging the underground haulageways was started to accommodate the modified Caterpillar 769 haulage units. The changeover to flat-back stoping is continuing. A hydraulic rock drill was evaluated during the year.

Ore treated in the concentrator amounted to 525 287 tonnes at 1.36% Sn compared to 482 213 tonnes at 1.18% treated in 1975. The increase in tonnage was mainly due to the lifting of tin production restrictions imposed by the International Tin Council during the first half of the year.

The heavy media plant was closed down during the first four months of the year in response to the tin quotas and since start up has operated at a more efficient level than during the previous year.

A Reichert cone was installed in the gravity circuit to scavenge the table tailings. The unit effected a considerable improvement in operating conditions throughout the mill.

The on-stream analysis system monitoring the sulphide flotation section operated at high availability and good accuracy during the year.

On the consolidated mining lease, exploration for extension of known strata-bound and fault infilled ore zones continued at a consistent rate and resulted both in the definition of substantial additional reserves and in an improvement in the understanding of more mineralogically complex ore bodies at depth in the mine area. Elsewhere on the lease drilling defined several zones of interest which justify further drilling in the future.

The search for hydrothermal ore deposits was continued on the company's West Coast exploration licence areas. At Mount Lindsay, where Renison is jointly exploring with Consolidated Goldfields and certain Cominco group companies, diamond drilling succeeded in outlining several stanniferous skarn zones which will be further drilled in 1977. Detailed ground surveys in the Argent Dam area outlined areas stratigraphically and structurally similar to the Renison mine area and will be further explored in 1977. Further work is also justifiable on the company's exploration areas near Trial Harbour.

A total of eighty-two diamond drillholes (totalling 10 838 metres) were drilled on the consolidated mining lease and five holes, totalling 1 955 metres, were drilled elsewhere.

After allowing for depletion by mining, the combined proved and probable ore reserves increased by 839 000 tonnes but the grade dropped from 1.34% Sn to 1.24% Sn, due to the new ore added to the reserves averaging only 1.05% Sn. The Bassett-Federal reserves were re-calculated to include some lower grade areas.

Ore reserves at September 1976 were as follows:—

Ore body	Probable		Proved		Possible (not reserves)	
	(Tonnes)	% Sn	(Tonnes)	% Sn	(Tonnes)	% Sn
Bassett-Federal .. ..	1 290 000	1.01	2 200 000	0.90	7 000 000	1.19
No. 2 Horizon .. ..	1 175 000	1.07	1 700 000	1.34	1 200 000	1.17
No. 3 Horizon .. ..	590 000	1.67	2 140 000	1.62	....	....
Other lodes .. ..	600 000	1.30	200 000	1.45	....	....
Totals .. ..	3 655 000	1.18	6 240 000	1.28	8 200 000	1.19

Capital expenditure for the year was as follows:—

	\$
Mine equipment .. .. .	904 000
Mobile equipment and vehicles .. .. .	453 000
Fixed plant .. .. .	711 000
Housing and welfare .. .. .	187 000
	<hr/>
	2 255 000
	<hr/>

## SAFETY

Ninety-eight lost-time accidents occurred during the year, compared with 165 accidents in 1975. Again there were no fatal accidents.

Accident statistics for the year were:—

Man hours exposure	....	....	....	....	....	....	....	825 784
Frequency rate	....	....	....	....	....	....	....	118.6
Severity rate	..	....	....	....	....	....	....	1 541
Working days lost per injury	....	....	....	....	....	....	....	9.9

Turnover of employees fell substantially compared with 1975. This was helped by the completion of new housing in Zeehan for some sixty families. At the year's end, the number of employees was 427 comprised of 138 staff and 289 award employees.

During the year the export restrictions imposed by the International Tin Council were lifted. The outlook for 1977 with the currently high tin prices is good although the cost per tonne of ore treated rose by 8.3% during 1976.

**Ringarooma Mining Pty Ltd**

This company, whilst operating during the period, produced 110 tonnes of tin from 180 682 cubic metres of gravel. An average of nine men was employed.

Areas to the south of the concentrator were finally worked out with wash petering out in mining lease 61M/71.

Operations were then transferred to areas to the north of the concentrator.

In the northern areas, the wash is deep and wide and the company ceased operations on 27 November 1976.

Northern Developments (Tas.) Pty Ltd took over certain leases from Ringarooma Mining as well as part of the treatment plant and all buildings.

To the end of the year no work had been done by the new company.

**V. Wood, Pioneer Mine, Pioneer**

Production from an estimated 110 000 m<sup>3</sup> of gravel treated was 21.4 tonnes of tin in concentrates containing 15.6 tonnes of tin valued at \$98 286. An average of seven men was employed.

**K. Kerrison, Ringarooma River Beaches**

Mr Kerrison continued operations with a front-end loader and jig, to produce 7.8 tonnes of tin in concentrates containing 5.3 tonnes of tin valued at \$35 044.

**Mount Cameron Tin Syndicate, Gladstone**

This syndicate operated in the Garfield area to produce 15.3 tonnes of tin in concentrates containing 11.1 tonnes of tin valued at \$75 374 from 24 775 m<sup>3</sup> of gravel.

**T. G. Rainbow, White Rock, Winnaleah**

Mr Rainbow sluiced 1 648 m<sup>3</sup> to recover 1 tonne of concentrates containing 0.75 tonne of tin valued at \$4 500.

**NSW Mining Co. Pty Ltd, Derby**

This company worked in the Ringarooma River below the Mutual Bridge using a jig and grizzly and a dragline and front-end loader to produce 6 tonnes of concentrates containing 3.9 tonnes of tin valued at \$25 203. Two men were employed.

**R C. Lawry, Gladstone**

Mr Lawry continued work in the Garfield area to obtain 3·3 tonnes of concentrates containing 2·3 tonnes of tin valued at \$16 091.

**C. D. King, Port Davey**

Mr King produced 2·03 tonnes of concentrates containing 1·5 tonnes of tin valued at \$9 284 from the Melaleuca mine.

**Production by Small Workers**

Many miners and prospectors throughout the State produce small quantities of concentrates by reason of either small-scale or part-time working. Their work is described under the headings of the various districts.

**EAST COAST**

*Miscellaneous.* Messrs D. B. Dwyer, T. H. Fitzallen, H. T. Moses, L. McRae and B. E. Pitchford produced individually 0·503 tonne of tin concentrates containing 0·334 tonne of tin valued at \$2 492.

**BRANXHOLM-DERBY**

*L. M. Barnett, Star of Peace mine, Branxholm,* produced 0·79 tonne of tin concentrates containing 0·54 tonne of tin valued at \$3 549.

*E. Jones, Derby,* produced 0·53 tonne of tin concentrates containing 0·38 tonne of tin valued at \$2 744.

*J. C. Mott, Wyniford River,* produced 0·265 tonne of tin concentrates containing 0·188 tonne of tin valued at \$1 252.

*P. Price, Derby,* produced 0·193 tonne of tin concentrates containing 0·136 tonne of tin valued at \$1 012.

*Miscellaneous.* Messrs K. Banks, Hodgetts and W. Kerrison produced individually 0·94 tonne of tin concentrates containing 0·120 tonne of tin valued at \$751.

**PIONEER-SOUTH MOUNT CAMERON-GLADSTONE**

*D. Dawe, Harden's Ravine,* produced 0·55 tonne of tin concentrate containing 0·40 tonne of tin valued at \$2 740.

*L. J. Groves, Eastern Lead, South Mount Cameron,* produced 0·58 tonne of tin concentrate containing 0·43 tonne of tin valued at \$3 316.

*R. J. Moore, Gladstone,* produced 2·091 tonnes of tin concentrate containing 1·464 tonnes of tin valued at \$9 627.

*K. M. Richardson, Swain Creek,* produced 1·141 tonnes of tin concentrate containing 0·806 tonne of tin valued at \$5 651.

*M. L. Watt, Gladstone,* produced 2·752 tonnes of tin concentrate containing 1·929 tonnes of tin valued at \$14 207.

*Miscellaneous.* Messrs W. Bartels and F. D. Richardson produced individually 0·067 tonne of tin concentrate containing 0·048 tonne of tin valued at \$909.

**WARATAH AND WEST COAST**

*M. Laan, Balfour,* produced 0·469 tonne of tin concentrate containing 0·321 tonne of tin valued at \$2 255.

*M. W. McKendrick, Cox's Bight*, produced 0·115 tonne of tin concentrate containing 0·081 tonne of tin valued at \$529.

*P. R. Wilson, Melaleuca*, produced 1·254 tonnes of tin concentrate containing 0·945 tonne of tin valued at \$6 869.

*Miscellaneous.* Messrs M. Glozier and D. R. Kenworthy produced individually 0·089 tonne of tin concentrate containing 0·049 tonne of tin valued at \$361.

## TITANIUM

### TITANIUM DIOXIDE: QUANTITY AND VALUE OF PRODUCTION

Year	Tonnes	Value \$	Year	Tonnes	Value \$
1969-71	18 729	3 113 480	1974	4 139	1 062 973
1972	....	....	1975	5 279	1 579 311
1973	2 846	388 288	1976	6 379	1 938 650
			Total	37 372	8 082 702

### Kibuka Mines Pty Ltd, Naracoopa

#### Mining

Extraction of the Llanherne Beach deposit was completed between the plant and the Fraser River and the worked out area filled with tailings. The area south of the plant was levelled for re-vegetation and extraction of the sea beach commenced using both the buried loader and the pot-holer. An average of forty-three men was employed.

#### Milling

The major addition to the plant was a zircon flour mill to produce a  $-75 \mu\text{m}$  flour and a  $-5 \mu\text{m}$  zircon dust. Both products are used in the ceramics industry to produce high quality glazes. The water shortage was eased by extensive use of sea water in the primary plant.

Plans to rebuild the power house were abandoned and a Caterpillar D399 generator was purchased to replace the Mirlees generators.

By the end of the year the zircon market had collapsed and stocks of rutile and zircon accumulated rapidly. Sales from King Island were disadvantaged by the high cost of shipping concentrates to the mainland.

Some 1 231 000 tonnes of sand were treated to produce 6 685 tonnes of rutile concentrates and 6 313 tonnes of zircon concentrates.

## TUNGSTEN (SCHEELITE)

### TUNGSTIC OXIDE: QUANTITY AND VALUE OF PRODUCTION

Year	Tonnes (Concentrates)	Tonnes (WO <sub>2</sub> )	Value \$
1917 to 1971	29 618	1 924	66 093 477
1972	1 837	1 355	4 193 860
1973	1 682	1 244	3 663 649
1974	1 588	1 143	6 800 473
1975	2 082	1 519	10 367 449
1976	2 698	2 019	19 044 373
Total	39 505	....	110 163 281

**King Island Scheelite Limited, Grassy***Production statistics—*

Ore mined (tonnes)—	
Bold Head	122 460
Dolphin	183 529
Mill throughput (tonnes)	324 488
Concentrate produced (tonnes)	2 698
Concentrate grade (WO <sub>3</sub> )	72·47%
Average number of persons employed—	
Underground	87
Other surface	327
	—
	414
	—

R. Billingham, Mining Engineer, Hobart, reports:—

**MINING***Bold Head Mine*

The main decline advanced 174 m to the +948·8 m level and will continue at an accelerated rate. Cross-cuts from the decline and other development driving amounted to 34·9 m. Only 38·8 m of rises were reamed by the raise borer before it was transferred to the Dolphin mine, but 139·3 m of hand rising was completed for ventilation, stope access and ore passes.

Stoping was carried out in 'A' lens using a cut and fill method with airlegs and a Cavo loader. 'B' lens main was stoped by slot stoping using airlegs and scraper winches. The ore along the Boundary Fault continued to be mined by cut and fill methods using jumbos and Cat 980B front-end loaders. Other ore was derived from stope development.

*Dolphin Mine*

The hanging wall and foot wall declines advanced a total of 428·1 m. These declines joined and advanced in the foot wall of the ore body and at the end of the year was 183·4 m below sea level. In two areas ground conditions were poor and steel sets were required.

Level development, including stope development, amounted to 492·8 m, and ramp development to 187·5 m. At the -160 m level, twin sumps were driven and rise boring to surface commenced to develop three shafts, one for a manway and two for pumping. These shafts will ultimately be extended to the bottom of the mine. Total rise boring amounted to 118·1 m and hand rising to 109 m.

Stoping was carried out above the 130 m level in the Wedge area by post pillar method and during the later part of the year the Central and Pit areas were developed on the -150 m level in preparation for stoping.

A sand fill plant was erected on surface and filling stopes through bore holes followed closely after mining. All post pillars were rock bolted before filling.

With the assistance of the CSIRO, the rock mechanics program continued. Thirteen extensometer stations were installed on the -75 m level to monitor ground movements above the Wedge and Central stoping areas, and two stations were installed to monitor the Pit stoping area. No significant ground movements were indicated.

**MILLING**

The plant was upgraded during the first six months of the year to take an annual throughput of 350 000 tonnes. A 1 m Mogensen sizer replaced the rod deck screen in the crushing section and a new 3 m x 3 m ball mill with associated Mogensen sizers was installed in the grinding section. An additional dryer and a concentrate handling system were installed.

At the end of the year further mill expansion had commenced which will include an additional fine ore bin, a new tailings system and additional spirals. This upgrading will increase throughput to 400 000 tonnes per year at a capital cost of almost \$2 000 000. Construction commenced for an artificial scheelite plant to upgrade the flotation concentrates from the mill.

#### CAPITAL EXPENDITURE

Major capital expenditure was for the fill plant and pumping services for underground and for increasing mill throughput.

Capital expenditure was as follows:—

	\$
Underground mines .. .. .	794 472
Concentrator .. .. .	832 065
Engineering .. .. .	43 500
Pastoral .. .. .	91 715
Miscellaneous .. .. .	10 474
	<hr/>
	1 772 226
	<hr/>

#### TUNGSTEN (WOLFRAM)

##### TUNGSTIC OXIDE: QUANTITY AND VALUE OF PRODUCTION

Year	Tonnes (Concentrates)	Tonnes (WO <sub>2</sub> )	Value \$
1899 to 1970 .. .. .	18 643	444	29 616 447
1971 .. .. .	813	592	2 695 463
1972 .. .. .	771	566	1 733 203
1973 .. .. .	375	278	828 102
1974 .. .. .	216	159	1 075 850
1975 .. .. .	303	225	1 543 378
1976 .. .. .	248	186	1 724 433
	<hr/>		<hr/>
Total .. .. .	21 369	....	39 216 876
	<hr/>		<hr/>

#### Aberfoyle Ltd, Rossarden

Production by this company, reviewed under Tin, was as follows:—

Mine	Concentrates (Tonnes)	WO <sub>2</sub> content (Tonnes)	Value \$
Aberfoyle .. .. .	88	66	603 961
Storeys Creek .. .. .	161	120	1 120 472

#### ZINC

##### QUANTITY AND VALUE OF PRODUCTION

Year	Tonnes	Value \$	Year	Tonnes	Value \$
1919-1971 .. .. .	1 053 411	193 060 068	1974 .. .. .	53 803	30 973 172
1972 .. .. .	66 811	24 869 254	1975 .. .. .	54 326	35 873 182
1973 .. .. .	52 149	22 451 078	1976 .. .. .	49 697	34 683 132
				<hr/>	<hr/>
			Total .. .. .	1 330 197	341 909 886
				<hr/>	<hr/>

## Electrolytic Zinc Company of Australasia Limited

## EXTRACTION FROM CONCENTRATES: RISDON

From other than Tasmanian ore—		<i>Tonnes</i>
Zinc	....	98 311
Cadmium	....	291
Cobalt oxide	..	5.28
Superphosphate	....	50 938
From Tasmanian ore—		
Zinc	....	65 264
Cadmium	....	149
Cobalt oxide	..	25.64
Manufactured products—		
Aluminium sulphate	....	3 443
Ammonium sulphate	..	5 113

The average number of men employed was 1 958

## WEST COAST DIVISION

Ore mined—	<i>Mine</i>	<i>Tonnes</i>	<i>Pb</i> %	<i>Zn</i> %	<i>Cu</i> %	<i>Ag</i> g/t	<i>Au</i> g/t	<i>Fe</i> %
Rosebery (underground)	..	457 074	3.7	12.4	0.9	152	2.9	17.3
Rosebery (open cut)	....	70 354	2.9	9.3	0.2	68	1.3	8.0
Hercules	....	54 392	3.9	9.8	0.2	104	2.1	6.2
Dumps	....	21 671	1.6	7.5	0.1	139	0.5	13.9
	Total	603 491	3.5	11.3	0.7	137	2.6	15.0

Concentrate produced—	<i>Tonnes</i>
Zinc concentrate	112 834
Lead concentrate	10 888
Copper concentrate	24 060
Pyrite concentrate	99 870

Recoverable quantity in ore mined—	<i>Tonnes</i>	<i>Kilograms</i>
Zinc	49 697	
Lead	12 070	
Copper	2 709	
Cadmium	118	
Silver		50 087
Gold		896
Cobalt oxide	26	
Manganese dioxide	232	
Mercury		140

Total value of production—\$46 825 373.

Average number of persons employed—	<i>Surface</i>	<i>Underground</i>	<i>Total</i>
Hercules mine	4	32	36
Rosebery mine	422	597	1 019
Farrell mine	....	2	2
Dumps	1	1	2
	Total	632	1 059

R. C. Thomas, Mining Engineer, Burnie, reports that operations were again confined to the Rosebery and Hercules mines and the Farrell mine at Tullah has remained on a care and maintenance basis.

#### *Development*

The majority of development work at the Rosebery mine was concentrated on the 15, 16 and 17 levels, preparing longhole and sub-level longhole blocks for production. Some 2 848 metres of driving and cross-cutting and 887 metres of rising were completed during the year. At the Hercules mine, Williamsford, 52 metres of driving and cross-cutting and 92 metres of rising were completed.

Total diamond drilling was 5 889 metres, comprising 5 803 metres at Rosebery, 27 metres at Hercules and 59 metres for other explorations.

#### *Production*

Ore mined from all sources increased by 42 791 tonnes to 603 491 tonnes.

The hanging wall and roof of all bulk stopes are now being cable-bolted ahead of mining. One conventional cut and fill stope has also been cable-bolted.

Isanol (a mixture of ANFO and polystyrene balls) is now being used in most cut and fill stopes to prevent overbreaking.

The recovery of the old Magnet mine tailings dump for treatment in the Rosebery concentrator has virtually been completed.

In No. 1 shaft work continues in replacing the old timber sets.

In No. 2 shaft the Mary Ann winder remains out of commission after an incident which resulted in a broken rope during acceptance trials.

Ore reserves of all mines at 31 December 1976 amounted to 8 519 220 tonnes.

The number of lost-time accidents showed another decrease during the year but there was one fatal accident.

#### *Accidents*

Number of lost-time accidents	....	....	....	....	....	497
Lost days (working)	....	....	....	....	....	5 517
Man hours exposure	....	....	....	....	....	1 563 474
Frequency rate	....	....	....	....	....	317
Severity rate	....	....	....	....	....	11 696
Mean duration (days)	....	....	....	....	....	11

#### *Capital Expenditure*

Major capital expenditure during 1976 included the commencement, continuation or completion of the following projects:—

- Additional new housing and upgrading of old houses.
- Bobadil tailings dam.
- Underground pumping system at Rosebery mine.
- Addition to and replacement of rock drilling equipment.
- Upgrading of EDP installation.
- Upgrading Rosebery compressor station.
- Sealing plant roads.
- Ball mill discharge pumps.
- Triple-drum scrapers
- Additional ball mill.
- Axial flow ventilation fans.
- Electric locomotives and Granby trucks.
- Air tuggers and impact wrenches.

## RISDON WORKS

R. Billingham, Mining Engineer, Hobart, reports that major developments included:—

- Completion of a system for the collection, recovery and recycling of spillages and effluents in the zinc dust precipitate storage and reclamation area.
- Completion of a plant to treat acid plant wastower discards.
- Completion of a limestone grinding plant in the leaching division.
- Continuation of work on pilot plants for research into plant operations and treatment of residues.
- Commencement of a jarosite filtering installation designed to reduce metal values in plant residues.
- Commencement of a feasibility study into a water management project to collect, treat and recycle plant effluents and drainages.

**Aberfoyle Tin N.L., Que River**

E. C. Leyland, Mining Engineer, Burnie, reports that the exploration decline commenced last year was advanced 216 m. The top of the major lens 'P' South was reached at 30 m below the surface. The initial 20 m of advance within the ore reserve outline was located immediately east of the lens confirmed by four short horizontal diamond drill holes in the west wall. The drive was turned and the final 52 m of advance was driven along the lens. Ore grades were variable with sections averaging 50% combined lead and zinc. Faulting and shearing coupled with the necessity to keep the drive a minimum of 3 m wide, for the equipment being used, made it necessary to install roof support. In view of these ground conditions it was decided that the information gained did not match the high cost of this type of exploration. From this development 2 200 tonnes of ore at an estimated grade of 9% combined lead-zinc were stockpiled on the surface.

Further diamond drilling from the surface was carried out in order to confirm the grade in sections where the extreme divergence in metal values between two holes resulted in an arithmetic mean being used for the calculation of a large tonnage of reserves, and to test for extensions of the lenses.

A total of 9 741 m of diamond drilling was undertaken in this program. No increase in ore reserve tonnage was proved, however, significant changes in the grade of the reserves were made possible. Five trenches totalling 167 m in length were excavated to augment the drilling program. In the licence area surrounding the leases, soil geochemistry, IP surveys and geological mapping were continued.

Total expenditure on the joint venture was \$1 961 700. This figure includes the cost of 216 m of underground exploration development, the diamond drilling, geological field work and feasibility studies. The program of work for 1977 involves the sinking of a vertical shaft to a depth of 170 m with horizontal development in waste and ore on two sub-levels. A suitable site for the shaft was selected after consideration of all the available geological data of the area, with a diamond drill hole being drilled to confirm this location. A contract was negotiated with Thyssen Mining Construction of Aust. Pty Ltd for the sinking of a rectangular shaft 5 m x 2.5 m and it is planned to commence this undertaking early in 1977.

Although the main purpose of the shaft is to secure access to the lenses for metallurgical testing of the ore and to confirm the geological structure of the ore bodies, it has been planned that when production commences this shaft will, in all probability, serve as the main access and hoisting shaft.

**ZIRCON**

## ZIRCONIUM DIOXIDE: QUANTITY AND VALUE OF PRODUCTION

Year	Tonnes	Value		Year	Tonnes	Value	
		\$				\$	
1969-1971	12 562	890 965		1974	3 627	1 145 030	
1972	.....	.....		1975	5 818	1 933 412	
1973	817	72 790		1976	4 163	883 820	
				Total	26 987	4 926 017	

**Kibuka Mines Pty Ltd, Naracoopa**

This company, reviewed under Titanium, produced 6 313 tonnes of zircon concentrates.

## 2. – Non-Metallic Minerals

### CLAY

#### QUANTITY AND VALUE OF PRODUCTION

<i>Year</i>	<i>m<sup>3</sup></i>	<i>Value</i> \$	<i>Year</i>	<i>m<sup>3</sup></i>	<i>Value</i> \$
1958-1971	1 432 474	3 901 984	1974	111 487	388 069
1972	134 918	446 036	1975	112 287	572 230
1973	113 896	393 815	1976	100 926	334 830
			Total	2 005 988	6 036 964

#### DETAILS OF PRODUCTION

<i>Company</i>	<i>Clay</i> <i>m<sup>3</sup></i>	<i>Value</i> \$	<i>No. of</i> <i>men</i>	<i>Product</i>
Agripipe Pottery Pty Ltd, Relbia	....	....	4	Pipes
Clifton Bricks (Tas.) Pty Ltd, Kings Meadows	28 350	85 050	44	Bricks
H. L. Curran, Oyster Bay*	79	237	....	Bricks
Goliath Portland Cement Co., Railton	13 097	65 485	....	Cement
M. A. Grierson, Dodges Ferry*	9 304	27 912	1	Bricks
Hazell Brothers, Margate*	21 783	65 349	4	Bricks
Hobart Brick Co., Granton	8 730	26 190	28	Bricks
Hobart Brick Co., Kingston	4 619	13 857	1	Bricks
Humes Limited, Granton	1 780	8 900	15	Pipes
Humes Limited, Prospect Vale	1 149	5 745	11	Pipes
Wunderlich Ltd, Launceston	3 513	10 539	21	Tiles
Zolati & Son Pty Ltd, Dulverton	8 522	25 566	21	Bricks
Other	....	....	1	
Total	100 926	334 830	151	

\* Suppliers to Hobart Brick Company

### DOLOMITE

#### QUANTITY AND VALUE OF PRODUCTION

<i>Year</i>	<i>Tonnes</i>	<i>Value</i> \$	<i>Year</i>	<i>Tonnes</i>	<i>Value</i> \$
Prior to 1971	42 163	243 295	1974	6 434	47 444
1972	4 630	26 815	1975	5 042	40 543
1973	5 165	29 640	1976	10 335	96 392
			Total	73 769	484 129

#### Circular Head Dolomite and Trading Co. Pty Ltd, Smithton

This company, the sole producer, employed an average of five men and produced 10 335 tonnes, an increase of 5 293 tonnes. The stone is milled for top-dressing in agriculture.

## KAOLIN

## QUANTITY AND VALUE OF PRODUCTION

<i>Year</i>	<i>Tonnes</i>	<i>Value</i> \$
1940-1962 .. ....	112 869	883 018
1975 .. ....	2 056	170 138
1976 .. ....	9 527	857 170
<b>Total</b> ....	<b>124 452</b>	<b>1 910 326</b>

**Ballarat Clay Co. Pty Ltd, Tonganah**

Problems were encountered with clay settling out in the plastic bags used for rail transport to Burnie. Clay settled in the bags proved difficult to remove and repairs to the bags also became progressively more difficult. These problems were overcome by a changeover to conventional tank wagons made available from the Northern Territory. Some modifications were made to the treatment circuit, including the removal of the centrifuges. Additional drains, ponds and pumps were installed to cope with spillage and stormwater, and prevent possible pollution from this source.

## LIMESTONE

## QUANTITY, VALUE OF PRODUCTION AND USAGE

<i>Year</i>	<i>Manufacture of cement</i>		<i>Manufacture of carbide</i>		<i>Chemical and metallurgical</i>		<i>Agricultural and other</i>		<i>Totals</i>	
	<i>Tonnes</i>	\$	<i>Tonnes</i>	\$	<i>Tonnes</i>	\$	<i>Tonnes</i>	\$	<i>Tonnes</i>	\$
1919-1971	6 925 702	10 470 853	848 837	2 779 767	4 435 115	5 593 012	829 436	1 955 380	13 039 090	20 799 012
1972 ....	471 393	913 975	25 225	258 058	53 265	286 151	39 582	102 810	589 465	1 560 994
1973 ....	488 873	948 180	23 383	217 649	65 599	343 547	56 069	179 712	633 924	1 689 088
1974 ....	421 145	817 020	22 487	270 331	64 333	392 620	91 746	244 924	599 711	1 724 895
1975 ....	417 615	810 173	18 865	269 704	54 548	340 424	54 452	185 769	545 480	1 606 070
1976 ....	488 441	1 465 323	20 696	310 440	75 154	704 308	52 490	257 116	636 781	2 737 187
<b>Totals</b>	<b>9 213 169</b>	<b>15 425 524</b>	<b>959 493</b>	<b>4 105 949</b>	<b>4 748 014</b>	<b>7 660 062</b>	<b>1 123 775</b>	<b>2 925 711</b>	<b>16 044 451</b>	<b>30 117 246</b>

**Kemerton Pty Ltd and Tasmanian Carbide Products, Ida Bay and Electrona**

A change of ownership was effected in the year. These companies quarried 50 472 tonnes of limestone at Ida Bay valued at \$747 761. Of this 20 696 tonnes were used in the production of calcium carbide at the Electrona works and 27 421 tonnes were supplied to the Electrolytic Zinc Company at Risdon for metallurgical purposes.

Calcium carbide production was 10 424 tonnes valued at \$2 922 459 and acetylene black production was 282 tonnes valued at \$393 221. The average number of persons employed was 142.

**A. R. Beams, Flowery Gully**

From his quarry, crushing plant and lime kiln, Mr Beams produced—

	<i>Tonnes</i>	\$
Agricultural limestone .. ....	3 254	12 304
Limestone for chemical and metallurgical purposes ..	3 253	24 080
Burnt lime for various purposes .. ....	465	1 680
<b>Total</b> ....	<b>6 972</b>	<b>38 064</b>

Six men were employed.

**Goliath Portland Cement Co. Ltd, Railton**

A total of 488 441 tonnes of limestone with a cost value of \$1 465 323 was quarried and used in the manufacture of cement. An average of eighteen men was employed in the quarry, for this production.

In addition to the above, 17 307 tonnes of limestone, valued at \$63 701 was produced for sale.

Production of fine cement amounted to 353 728 tonnes valued at \$6 268 058. An average of 286 men was employed.

**Mole Creek Limestone Ltd, Mole Creek**

Production was 43 874 tonnes of limestone for chemical and metallurgical purposes and 11 614 tonnes for agricultural and other purposes, of total value \$308 732. Average employment was seventeen men.

**Railton Lime Works, Railton**

Two men were employed at this works to crush and mill 1 762 tonnes of limestone, valued at \$5 286 supplied by the Goliath Company.

**Wright Stephenson Pty Ltd, Pulbeena**

This company produced 14 530 tonnes of lime sand, valued at \$94 225 compared with 10 729 tonnes in the previous year. Average employment was three men.

**Addison & Coates, King Island**

Production was 765 tonnes valued at \$2 295 in the first half of the year.

**R. K. Sulzberger, Flowery Gully**

Using a mobile crushing plant Mr Sulzberger crushed a total of 100 tonnes valued at \$1 000.

**OCHRE****QUANTITY AND VALUE OF PRODUCTION**

<i>Year</i>	<i>Tonnes</i>	<i>Value</i> <i>\$</i>	<i>Year</i>	<i>Tonnes</i>	<i>Value</i> <i>\$</i>
1918-1971	2 801	21 131	1974	38	621
1972	48	721	1975	.....	.....
1973	62	1 010	1976	.....	.....
			<b>Total</b>	<b>2 949</b>	<b>23 483</b>

**PEBBLES****QUANTITY AND VALUE OF PRODUCTION**

<i>Year</i>	<i>Tonnes</i>	<i>Value</i> <i>\$</i>	<i>Year</i>	<i>Tonnes</i>	<i>Value</i> <i>\$</i>
1957-1971	13 201	216 635	1974	1 426	35 519
1972	1 716	28 714	1975	859	15 622
1973	824	18 088	1976	1 716	33 366
			<b>Total</b>	<b>19 742</b>	<b>347 944</b>

**Mineral Supplies, Ulverstone**

The collection of pebbles for grinding was continued on the beaches around Ulverstone. The output was 729 tonnes, valued at \$27 620. An average of six men was employed.

**G. R. Wise, Youngtown**

Production was 83 tonnes of pebbles valued at \$756.

**SILICA**

## QUANTITY AND VALUE OF PRODUCTION

<i>Year</i>	<i>Tonnes</i>	<i>Value</i>		<i>Year</i>	<i>Tonnes</i>	<i>Value</i>	
		<i>\$</i>				<i>\$</i>	
1936-1971	286 636	658 096		1974	25 410	74 828	
1972	16 261	45 317		1975	27 573	95 257	
1973	17 101	52 679		1976	20 479	66 630	
				Total	393 460	992 807	

**F. R. and C. M. Lazenby, South Arm**

A total of 12 000 tonnes of silica sand, valued at \$24 000 was produced for the manufacture of glass.

**Industrial Sands Pty Ltd, Eagle Point**

This company continued to refine silica sands for various industrial purposes, producing 8 188 tonnes of sands in various grades and sizings valued at \$40 054. An average of three men was employed.

**Mineral Supplies, Ulverstone**

This firm produced 61 tonnes valued at \$1 721.

### 3.—Construction Materials

#### BUILDING STONE

##### PRODUCERS, QUANTITY AND VALUE OF PRODUCTION

Stone	Producer	m <sup>3</sup>	Value (\$)	No. of men
Freestone	Etna Stone Pty Ltd. Pontville* ....	318	58 196	12
	L. G. Holloway, Round Hill ....	86	602	....
	Kingston Quarries ....	96	2 925	1
	Pontville Freestone, Molesworth ....	265	7 170	1
	Total ....	765	68 893	14

\* Amended after annual figures published

#### CRUSHED AND BROKEN STONE

##### Basalt

##### PRODUCERS, QUANTITY AND VALUE OF PRODUCTION

Quarry	Men	m <sup>3</sup>	Value (\$)
AFH, Surrey Hills ....	1	5 817	37 941
ANM, Maydena ....	5	5 324	37 268
Brambles, Calder ....	8	35 206	270 233
Brighton Municipal Council ....	....	760	5 320
Hobart Quarries, Bridgewater ....	13	147 546	1 312 819
Merseylea Quarries ....	2	6 600	46 200
Readymix Concrete, Merseylea ..	....	....	....
R. K. Sulzberger, Lilydale ....	2	1 710	11 970
Talisker Blue Metals, Relbia ....	7	56 430	442 543
Woodfield and French, Relbia ....	....	57 986	452 079
Others ....	2	19	133
Totals ....	40	317 398	2 616 506

##### Dolerite

##### PRODUCERS, QUANTITY AND VALUE OF PRODUCTION

Quarry	Men	m <sup>3</sup>	Value (\$)
Brighton Council, Brighton ....	....	906	6 342
Devon Metal Supplies ....	8	14 066	98 462
Electrolytic Zinc Co. ....	....*	12 674	88 718
Forestry Commission ..	....†	67 326	471 282
Glenorchy Quarries ....	8	41 531	291 577
Hobart Quarries ..	36	148 485	1 128 754
L. G. Holloway, Round Hill ....	....‡	4 490	31 430
Huon Council, Huonville ....	....	689	4 823
C. R. Johnson, Cambridge ....	....†	15 495	108 465
Launceston Quarries, Mowbray ....	13	57 178	511 741
Pioneer Quarries, Flagstaff Gully ....	22	99 488	960 443
A. J. Stone, Ulverstone ....	1	5 660	39 620
Others ....	1	....	....
Totals ....	89	467 988	3 741 657

\* See Zinc

† See Gravel

‡ See Crushed and Broken Stone (Other)

**Limestone**

## PRODUCER, QUANTITY AND VALUE OF PRODUCTION

<i>Quarry</i>	<i>Men</i>	<i>m<sup>3</sup></i>	<i>Value (\$)</i>
G. J. Weily, Glenorchy .....	7	19 038	133 266

**Other Stone**

## PRODUCERS, QUANTITY AND VALUE OF PRODUCTION

<i>Quarry</i>	<i>Men</i>	<i>m<sup>3</sup></i>	<i>Value (\$)</i>
APPM, Diddleum Plains .....	.....	491	3 437
Brighton Council, Brighton .....	.....*	5 230	36 610
Circular Head Dolomite, Circular Head .....	.....†	2 566	18 029
Forestry Commission .....	.....*	39 414	275 898
L. G. Holloway, Round Hill .....	2	6 040	42 280
Hydro-Electric Commission, Scotts Peak .....	4	8 596	60 172
Hydro-Electric Commission, Pieman River .....	13	3 795	26 565
Hydro-Electric Commission, Strathgordon .....	10	9 655	67 585
Public Works Department .....	.....*	1 072	7 504
Shields Quarries, Howrah .....	1	6 574	46 018
Sorell Council, Sorell .....	1	2 190	15 330
Transport Commission, Leith .....	5	10 414	72 898
Warman International, King Island .....	.....‡	1 106	7 742
Others .....	.....	248	1 736
Totals .....	36	97 391	681 804

\* See Gravel

† See Dolomite

‡ See Scheelite

## GRAVEL

## PRODUCERS, QUANTITY AND VALUE OF PRODUCTION

<i>Pit</i>	<i>Men</i>	<i>m<sup>3</sup></i>	<i>Value (\$)</i>
Associated Forest Holdings, Surrey Hills	6	32 033	160 165
Brambles Holdings, Burnie	7	53 277	266 385
Broken Hill Pty Co. Ltd, Beaconsfield	....*	19 943	99 715
Campbell Town Council	1	12 824	64 120
Circular Head Council	3	32 237	161 185
Devonport Council	2	36 101	180 505
Evandale Council	1	10 094	51 420
Fingal Council	1	11 099	55 495
Flinders Council	1	18 642	93 210
Forestry Commission	22	84 529	422 645
George Town Council	2	34 651	173 255
C. R. Johnson, Cambridge	3	10 895	54 475
Kentish Council	4	14 215	71 075
L. King Pty Ltd, Devonport	14	13 587	70 099
Lands Department	4	10 620	53 100
Latrobe Council	5	10 985	54 925
Lilydale Council	1	16 691	83 455
Longford Council	1	17 908	89 540
New Norfolk Council	1	15 927	79 635
Oatlands Council	5	21 076	105 380
Penguin Council	4	14 024	70 120
Port Cygnet Council	1	10 515	52 575
Portland Council	2	26 737	133 685
Public Works Department	100	590 816	2 954 080
Richmond Council	1	11 687	58 435
Ringarooma Council	2	22 376	111 880
Scottsdale Council	2	13 770	68 850
Sorell Council	1	16 185	80 925
Ulverstone Council	2	18 544	92 720
Westbury Council	1	19 552	97 760
Woodfield and French	50	51 090	268 818
Wynyard Council	....	27 257	136 285
Others	39	108 459	558 823
<b>Totals</b>	<b>289</b>	<b>1 408 346</b>	<b>7 074 740</b>

\* See Woodfield and French

## SAND

## PRODUCERS, QUANTITY AND VALUE OF PRODUCTION

<i>Pit</i>	<i>Men</i>	<i>m<sup>3</sup></i>	<i>Value (\$)</i>
A. A. Ashbolt, New Norfolk	1	15 059	75 295
Besser (Tasmania) Pty Ltd, Calder	3	21 518	162 532
P. and A. Calvert, Sandford	...	4 500	22 500
Cambridge Washed Sands, Cambridge	5	16 651	83 255
R. R. P. Cousins, Beauty Point	2	4 722	43 887
G. Gerke, Scottsdale	...	4 722	25 092
Hamilton Council, Hamilton	...	3 983	19 915
Hobart Quarries, South Arm	...†	61 522	307 610
Hydro-Electric Commission, Pieman River	1	36 146	180 730
Hydro-Electric Commission, Strathgordon	...‡	3 897	19 485
C. R. Johnson, Cambridge	...	3 519	17 595
L. King Pty Ltd, Devonport	...*	7 461	37 305
L. Klingberg, New Norfolk	...	11 072	55 360
Lands Department	...*	4 403	22 015
F. R. and C. M. Lazenby, Sandford	...	3 207	16 035
G. L. Males, South Arm	4	12 304	65 395
K. J. Millhouse, Bellerive	4	6 281	31 405
Stubbs Sand and Gravel, Devonport	1	16 194	83 917
L. A. Swain, Perth	1	15 533	77 665
Woodfield and French, West Tamar	...*	8 944	44 720
Others	8	30 771	162 523
<b>Totals</b>	<b>30</b>	<b>292 409</b>	<b>1 554 236</b>

\* See Gravel

† See Crushed and Broken Stone (Dolerite)

‡ See Crushed and Broken Stone (Other)

## OTHER ROAD MAKING MATERIAL

## PRODUCERS, QUANTITY AND VALUE OF PRODUCTION

<i>Pit</i>	<i>Men</i>	<i>m<sup>3</sup></i>	<i>Value (\$)</i>
Abminco N.L., Luina	...*	50 838	254 190
J. S. Barnett, Randalls Bay	...	6 829	34 145
Campbell Town Council, Campbell Town	...‡	978	4 890
Evandale Council, Evandale	...‡	2 760	13 800
Hydro-Electric Commission, Pieman River	...†	11 590	57 950
Hydro-Electric Commission, Strathgordon	...†	3 780	18 900
Longford Council, Longford	1	9 263	46 315
Mt Lyell Mining and Railway Co. Ltd, Queenstown	4	43 659	218 295
Public Works Department	...‡	4 274	21 370
Warman International, King Island	...§	3 505	17 525
G. R. Wise, Youngtown	...‡	1 155	6 130
Woodfield and French	...‡	45 218	226 090
Zeehan Council, Zeehan	...‡	3 480	17 400
Others	1	1 304	6 520
<b>Totals</b>	<b>6</b>	<b>188 633</b>	<b>943 520</b>

\* See Tin

† See Crushed and Broken Stone (Other)

‡ See Gravel

§ See Scheelite

## 4.—Fuel Materials

### COAL

#### QUANTITY AND VALUE OF PRODUCTION

<i>Year</i>	<i>Tonnes</i>	<i>Value</i> <i>\$</i>	<i>Year</i>	<i>Tonnes</i>	<i>Value</i> <i>\$</i>
Prior to 1972	10 098 852	26 723 983	1974	127 460	678 665
1972	132 242	589 015	1975	161 922	972 491
1973	114 588	530 875	1976	189 489	1 689 878
			Total	10 824 553	31 184 907

H. Murchie, Senior Mining Engineer, Hobart, reports that there has been an increase in production of 27 567 tonnes. The number of employees increased from seventy-one to eighty-two, of whom forty-five were employed underground. The production per man year decreased from 4 261 to 4 211 tonnes for underground employees, but increased from 2 281 to 2 311 overall.

#### Duncan Coal Mine, Fingal

Production increased by 27 567 tonnes and the number of men employed by eleven.

## 5.—Foreign Ores

The total value of the metallurgical products of four large works treating foreign ores imported into Tasmania was approximately \$169 915 967.

### ALUMINIUM

#### Comalco Aluminium (Bell Bay) Ltd, Bell Bay

In the production of 89 888 tonnes of aluminium, 175 644 tonnes of imported alumina were processed.

Another product was 51 tonnes of alumina. Average employment was 1 097 men.

The sales position improved slightly, with some aluminium being sent to China. Some further work was done on the new No. 4 potline.

### FERRO-MANGANESE

#### Tasmanian Electro-Metallurgical Co. Pty Ltd, Bell Bay

During the year 95 026 tonnes of manganese ore from Groote Eylandt were smelted to produce 73 555 tonnes of manganese alloys for the steel industry.

The alloys were 50 393 tonnes of high carbon ferro-manganese and 23 162 tonnes of silico-manganese reported under Silicon.

The \$42 million expansion program was almost completed. In addition to the two existing furnaces, a 55 000 tonne/year ferro-manganese furnace (No. 3), a 27 000 tonne/year ferro-silicon furnace (No. 5), and a sinter plant have been constructed. The ferro-manganese furnace should be commissioned early in 1977. The other two additions were in use at the end of the year. The sinter plant provides feed for the furnaces and is capable of producing 2 250 tonne/week of feed for ferro-manganese or 1 600 tonne/week for ferro-silicon. The new furnaces are equipped with extensive dust-catching and anti-pollution installations. The new capacity will enable some exports to be made after satisfying Australian demand.

## TITANIUM DIOXIDE

## Tioxide Australia Pty Ltd, Heybridge

Production of titanium dioxide from Western Australian ilmenite was comparable to that of last year.

Capital expenditure increased by 66% and included expenditure on the replacement and extension of the effluent line, No. 2 sludge dam, installation of digester gas scrubbing equipment, an additional concentrator, wet treatment modifications, re-location of the raw materials store, 95% acid dilution plant and a number of minor items.

Capital expenditure for the year amounted to \$2 577 764 and included expenditure on the nuclei preparation area, additional digester gas scrubbing equipment, an additional superheater, an additional ring roller mill, development of the Minna Road works entrance, further work on the Minna Road dump and a number of minor items to improve production.

The number of persons employed increased by two to 461 and the turnover rate decreased from 14.6% to 11.9%.

*Accident Statistics*

Accidents	.....	9
Days lost—		
Calendar	.....	147
Working	.....	105
Man hours	.....	877 439
Frequency rate	.....	10.3
Severity rate	.....	168
Mean duration (days)	.....	11.7

## ZINC, CADMIUM, COBALT OXIDE AND SUPERPHOSPHATE

## Electrolytic Zinc Company of Australasia Limited, Risdon

This company, described under Zinc, produced zinc from Broken Hill concentrates together with small quantities of cadmium and cobalt oxide as by-products. The sulphuric acid derived from roasting the concentrates was used in making superphosphate fertilisers from phosphate rock imported from Nauru, Ocean and Christmas Islands.

## GEOLOGICAL SURVEY BRANCH

### Report of the Chief Geologist, I. B. Jennings, B.Sc. (Hons.), A.M.Aust.I.M.M.

During the year satisfactory progress has been made in the many fields of interest with which the Geological Survey Branch is involved. A highlight of the year's activities was the 25th International Geological Congress held in Sydney during August. Several geologists from the Branch attended and participated in the Congress and its associated excursions, one of which was conducted in Tasmania.

The regional geological mapping program was maintained, a new State geological map at a scale of 1 : 500 000 was produced together with a tectonic map of the Pre-Carboniferous rocks of the State at the same scale. The compilation of the final 1 : 250 000 series maps of the State was completed and further progress made on the standard 1 : 50 000 mapping program.

The program to prove sufficient indigenous coal reserves to support the State industries was continued. In addition to drilling and gravity surveys which are being conducted, seismic reflection equipment, especially designed for coal exploration has been acquired and when initial teething problems have been overcome it is expected to be a powerful tool in this investigation.

In continuation of a trend reported over the past few years the Branch has been required to spend a significant amount of time dealing with questions arising from the conflict for land use by the developing industries and by the policy of creating widespread national parks. In order to make proper value judgments in such matters it is necessary that the decisions made should be based as far as possible on facts and on consideration of the future of the State from both a developmental and aesthetic viewpoint. It is self-evident that it is not in the long-term interest of the State to allow large potentially mineral-bearing areas to be irrevocably locked away in parks. Mining and a policy of creation of parks can be compatible with the technology available today, an appreciation of that fact by all parties, together with proper restraints and goodwill are the necessary ingredients for such compromise. The Branch will continue to offer its best advice on these matters but it must be appreciated that many of the areas in question are remote and little known geologically.

### REGIONAL GEOLOGY

#### Supervising Geologist E. Williams reports—

Progress during the year was as follows:—

##### 1 : 250 000 Map Series—

Oatlands Sheet has been published. Port Davey and King Island-Flinders Island are being draughted for publication.

##### 1 : 500 000 Map Series—

The geological map of Tasmania and a structural map of the Pre-Carboniferous rocks of Tasmania with accompanying explanatory notes have been published.

##### 1 : 50 000 Map Series—

Oatlands Sheet will be published early in 1977.

Ringarooma, Strahan and Kingborough Sheets are being draughted for publication.

Sorell Sheet: Senior Geologist A. B. Gulline continued work in this region.

Huntley Sheet: Geologists M. McClenaghan, A. V. Brown, N. J. Turner and P. W. Baillie continued mapping.

Pedder Sheet: Geologists M. McClenaghan and N. J. Turner mapped in this area.

Boobyalla Sheet: Geologists P. W. Baillie and N. J. Turner continued mapping.

Blue Tier Sheet: Geologist M. McClenaghan continued mapping.

Interlaken Sheet: Geologist S. Forsyth continued mapping.

Davey Sheet: Geologist P. R. Williams commenced mapping.

Dover Sheet: Senior Geologist N. Farmer commenced mapping.

Explanatory notes for the Hobart 1 : 50 000 Sheet have been published. Explanatory notes of the 1-mile Burnie and Sheffield Sheets and for the 1 : 50 000 Brighton Sheet have been prepared. Reports for 1-mile Mackintosh, Frankford and Pieman Head Sheets and 1 : 50 000 Oatlands and Kingborough Sheets are being prepared.

## ECONOMIC GEOLOGY

### Supervising Geologist A. J. Noldart reports—

The staff of the section comprised a supervising geologist, two senior geologists and three geologists. Geologist P. L. F. Collins continued Ph.D studies at the University of Tasmania.

The following activities were carried out during the year:—

#### METALLICS

- (a) Continued investigation of detrital tin deposits in the north-east generally, and in particular commencement of seismic studies to determine potential in-filled valley/basin structures in little known areas.
- (b) Continuation of drilling and economic appraisal of Surrey Lagoon, Herrick, in above program.
- (c) Completion of exploration drilling program at Oliver Hill and completion of drilling at Claude Road.
- (d) Continuation of geological, geochemical and geophysical investigation of reported and potential mineralisation Big Ben Creek area, Zeehan district.
- (e) Examination of mineral prospects and small mines throughout the State. Examination of mineral potential of areas under application to purchase from the Crown. Advice to prospectors and general public.

#### FUEL MINERALS

- (a) Continuation of exploratory diamond drilling in the north-east coal fields.
- (b) Continuation of studies in the Duncan coal mine, Fingal.
- (c) Continuation of X-ray diffraction studies of dirt bands in coal horizons intersected in exploration drilling program.
- (d) Continuation of compilation of interim report on north-east coal fields.

#### NON-METALLICS

- (a) Continuation of construction materials survey and register from records of Government departments, municipal councils and private industry.
- (b) Field investigations to complete the above records.
- (c) Continuation of compilation of data from the Flowerdale-Calder River gravel sampling.
- (d) Completion of report on the extractive industry for the Tamar Regional Planning Authority.
- (e) Miscellaneous investigation on behalf of governmental and semi-governmental authorities and general advice to the extractive industry throughout Tasmania.

#### GENERAL

- (a) Continuation of studies of the Cambrian succession of the Mt Darwin-Rosebery mineralised belt and of mineral relationships.
- (b) Completion of field work and compilation of the economic appendix for the Mackintosh map sheet explanatory notes and completion of the Burnie metallic section.
- (c) Continuation of compilation of data on the Furneaux Group for the 1 : 250 000 and 1 : 500 000 map sheets.

- (d) Completion of economic appendix for the Brighton Map Sheet explanatory notes.
- (e) Completion of data on the Eddystone Pt-Mt William explanatory program.
- (f) Supervision of field trips for the Tasmanian section of the 25th International Geological Congress field excursion and associated literature.
- (g) Liaison was maintained with mineral exploration companies throughout Tasmania and investigations of works in progress carried out in association with company staff.

## ENGINEERING GEOLOGY

### Supervising Geologist P. C. Stevenson reports—

The section began the year with a supervising geologist, two senior geologists and three geologists. Geologist R. C. Donaldson joined the section in April.

Groundwater work has consisted of regional surveys as well as a number of smaller projects. Reports on the Scottsdale and Devonport areas are being prepared, while north-east field work is almost complete. Some drilling remains to be done at Sorell. A well and bore survey is being undertaken at Oatlands. The coastal sands survey continues with particular attention being made in response to requests from Greens Beach, Badger Beach, Seven Mile Beach, Carlton and South Arm. Smaller surveys have been at Port Arthur, Gladstone and Mortimer Bay. Numerous enquiries from land owners have been dealt with.

A short computer program for standardising water analysis has been added to the library and a paper was prepared and presented to the ANZAAS Congress on 'Groundwater in the Tasmanian Economy'.

The section has contributed to the work being carried out by the Geography Department of the University of Tasmania on the geomorphology and hydrology of shallow sand aquifers in the north-east of Tasmania. This project is funded by the Australian Water Resources Council.

Dr P. A. Worthington from the Geological Survey of South Africa at Pretoria was a visitor for two days during the year.

Slope stability work has been intense both in hard and soft rocks. A continual flow of subdivision enquiries for opinions on stability has occupied much time. A major study of Beauty Point township is in progress and detailed studies have also been made at McEwans Road, Deviot, Bradys Lookout and White Hills in the Tamar, at Elderslie, Collinsvale, Taroon and Casuarina Crescent, Glenorchy in the Hobart area and at Stanley and Parklands in the north-west. Regional studies are being pursued in the north-west and in Kingborough. Work continues on the identification of clay minerals. A paper was contributed to the 25th International Geological Congress on the subject of Tamar Valley landslips and another on geophysical methods in site investigations was published in the Quarterly Journal of Engineering Geology.

Dr Robinda Chowdhung of Wollongong University visited the State for two days and was shown some of our landslip studies in the field.

There is an increasing demand on the section for hard rock stability studies and rock faces have been examined in detail at Round Hill, Burnie, as part of a rehabilitation scheme, at Cam River for road reconstruction, in several quarries in Hobart and Burnie and in road cuttings in the Hobart area. A cliff section beneath a new subdivision at Lindisfarne has been evaluated.

Road routes have been examined and described in the Fingal-St Marys area.

General engineering geology has included core logging from Macquarie Wharf and the second Derwent crossing, vibration studies at Inveresk, ground drainage investigations at Freshwater Point, bridge foundations at Apsley, urban planning studies in the Brighton municipality and mapping at Port Arthur.

The Supervising Geologist attended a symposium on Urban Geology held at the Bureau of Mineral Resources in Canberra and a meeting in Hobart on possible amendments to the Local Government Act as it affects landslip area proclamations.

The staff of the section, in common with a large part of the survey, attended a five-day St John Ambulance first aid course and were awarded certificates.

## GEOPHYSICS

### Geophysicist D. E. Leaman reports—

Although the general level of geophysical activity remained constant throughout 1976 some new equipment was acquired which should both revitalise and extend the potential of geophysical methods as applied to key local problems.

#### ORE DEPOSITS

Only one magnetic and electrical survey was undertaken, west of Zeehan, due to full lease occupancy of areas suitable for testing or research. However, much advice has been offered to companies and individuals exploring western and north-eastern areas.

#### OTHER DEPOSITS

Evaluation of quarry sites and clay deposits continues as requested by owners and land holders. Various sites have been examined or discussed with members of the Economic and Engineering Branches of the survey. Examples include sites at Bridgewater and Ida Bay.

The primary project continues to be the coal resources evaluation of the central east coast. A very large area has now been covered by a gravity survey and an end to the survey is now in sight. Access has been a major difficulty in some areas. Newly acquired reflection seismic equipment should, in association with the gravity coverage, not only locate coal bearing areas but allow depth and structural evaluation. The equipment to hand is technically advanced but basic. Extra recording, processing and computing facilities will be required before optimum value can be obtained.

#### REGIONAL PROJECTS

Sampling of dolerite for age determination and extension of the Hobart gravity survey to Betsey Island were undertaken to assist regional projects.

#### ENGINEERING AND GROUNDWATER

Most geophysical work related to this subject is done by the Engineering Geology Section and only specialist, research or problem matters are referred to me.

However, materials in zones of land subsidence at Claremont and Tarooma were inspected and hydrophon refraction surveys were undertaken on the alignment of the new Leven and Apsley bridges.

#### GENERAL AND DEVELOPMENTAL

Gravity methods have been tested as a means of defining large scale landslips on steep slopes in the Tamar region and magnetic assessment of Tasmania's ubiquitous dolerite has been resumed. Both problems are major and of economic importance.

In addition a new rapid resistivity interpretation procedure has been developed which will make the method accessible to all staff.

Inspection of progress on the second Derwent crossing investigation has been required and summary comments have been provided.

## MAPPING AND ENGINEERING DRAUGHTING

### Senior Draughtsman D. M. Hardy reports—

The early part of the year saw preparations for the Chief Draughtsman's Conference, which was held in Tasmania for the first time. Representatives from all State Mines Departments and the Bureau of Mineral Resources attended.

This conference was most informative with many ideas being exchanged and a great number of subjects related to mapping in all aspects being discussed.

The following progress was made on colour map productions:—

#### The 1 : 50 000 Series

Oatlands Sheet No. 68: Completed and will be printed early in 1977.

Ringarooma Sheet No. 32: Near completion, should be printed early in 1977.

Strahan Sheet No. 57: Fair drawing proceeding.

## The 1 : 250 000 Series

Oatlands SK55-6: Printed in fourteen colours. This now only leaves the Port Davey Sheet and the Bass Strait Islands to complete this series. Drawing had commenced on both of these sheets but had to stop because of pressure of other work.

The 1 : 500 000 Geology of Tasmania was printed in twenty-one colours.

The structural map of the Pre-Carboniferous Rocks of Tasmania at a scale of 1 : 500 000 was printed in five colours.

A six-colour map showing the geology of the River Derwent between Austins Ferry and John Garrow Light was produced at a scale of 1 : 50 000 and printed using the silk screen process.

The balance of time was used in producing 160 geophysical, geological, palaeontological and engineering plans and diagrams technical reports, geological survey bulletins and normal field services.

The end of the year saw the drawing office move into more spacious and better suited accommodation.

## SURVEYING

## Surveyor G. Benn reports—

The following surveys were carried out during the year:—

- (a) Continuation of surveying and levelling of diamond drill holes at Fingal.
- (b) Continuation of levelling in the Duncan mine, Fingal.
- (c) Continuation of surveying and levelling of landslips in the St Leonards and Tamar Valley district.
- (d) One drill hole at Oliver Hill surveyed.
- (e) Slip investigation survey at Casuarina Crescent, Hobart, carried out.
- (f) Survey carried out at Ida Bay limestone quarry.
- (g) Survey carried out on bore hole position at Herrick.
- (h) Subdivision block at Upper Scamander located for potential site stability.
- (i) Survey carried out on a landslip at Elderslie.
- (j) Survey carried out at Leedway, Bridport.
- (k) A bore hole at Williamsford surveyed and levelled.
- (l) Survey carried out of a seismic investigation survey at Cascade Road, Burnie.
- (m) Plans prepared of all surveys.

## MINERALOGY AND PETROLOGY

## Mineralogist and Petrologist G. Everard reports—

Point counts were made of a number of thin sections from drill cores from Fingal to determine the cause of variations in density in terms of the proportions of essential minerals present. This investigation had to be interrupted while repairs were made to the point counter.

Samples from bore holes 1-5 and 7-10, Surrey Lagoon and bore hole 13, Herrick, were examined for cassiterite and other heavy minerals. Detrital samples from Three Hummock Island were examined for heavy minerals.

Core from DDH 9, Stanley, was examined in thin section and found to consist of lapilli tuff throughout.

Bore samples from an area between Perth and Breadalbane were examined under the microscope to assess the quality of the dolerite.

Pieces of heavy material found in Cleveland tin concentrates were examined and found to consist of a dense rock with disseminated magnetite.

Air samples and samples of material lining a kiln, obtained by Special Duties Inspector P. Allan, were examined to determine the content of injurious asbestos.

Material used for aboriginal artifacts was examined and found to consist of a hornfels containing cordierite.

Various rock samples were examined in thin section from different localities including Crockers Bore, Telita, Marion Bay, Dunalley, Great Musselroe Bay, Carlton River bridge, King River Gorge, Clark Valley and Mount Tor.

A sample, reported to come from Paradise, was found to consist of precious opal. There is some doubt regarding the authenticity of this report and no similar specimens have yet been obtained from the area.

About fifty rock and mineral specimens, concentrates, clays and black sands submitted by members of the general public were identified. Items in mineral collections were determined and some mineral collections assembled for educational purposes.

The departmental rock and mineral collection was increased by 898 registered specimens during the year.

## GEOCHEMISTRY

### Geochemist W. E. Baker reports—

Some 3 500 element analyses were carried out mainly on soils and stream sediments for iron, manganese, copper, lead and zinc. Other analyses were made of a variety of associations of humic acid with metals.

Plans to make more critical evaluation of the copper anomaly on the slopes of Mt Roland had to be abandoned because the properties to which the Department had access were sold. The new owners have objected to further sampling being undertaken.

Preliminary investigations have commenced in the Lisle goldfield area and these will be continued during 1977. Study of the geochemical landscape in the Balfour area has also been undertaken but little progress with this is expected before the summer of 1977-78.

Laboratory studies of the activity of humic substances continues and sufficient information has been accumulated to begin to understand the role of these substances in the geochemical cycle. It has become obvious that their presence is likely to make the application of geochemical prospecting more difficult when this is based upon secondary dispersion.

The X-ray diffraction and atomic absorption equipment have developed only minor faults during the year. Additions to the atomic absorption equipment have made this a safer and more reliable plant. As the laboratory is poorly sited and equipped, a number of useful investigations will have to await relocation and provision of electrochemical equipment.

## PALAEONTOLOGY

### Palaeontologist M. J. Clarke reports—

Work has again progressed well in several areas. The major investigations have closely followed the systematic regional mapping program in the Kingborough, Brighton, Oatlands, Interlaken, Sorell, Eddystone and Huntley Quadrangles.

Palaeontological suites of Permian fossils from the Huntley Quadrangle indicate that the succession there is virtually complete. In contrast, assemblages from Great Musselroe Bay (Eddystone Quadrangle) indicate that rocks of Tamarian and Lymingtonian age are present in the extreme north-eastern

parts of the State, but the Permian sequence developed there is otherwise condensed and very much incomplete. Elsewhere, new collections of Permian fossils from various localities are in accord with the recently published Tasmanian biostratigraphic nomenclature.

Considerable time has been allocated to making collections of Late Ordovician-Early Silurian faunas from the Florentine Valley-Tiger Range area (Huntley Quadrangle). As mentioned in last year's report, these faunas include well-preserved brachiopods, trilobites and graptolites. Preliminary identifications indicate that these faunas, and more particularly the graptolites, are of great significance, not only in Tasmania, but also internationally. Dr M. R. Banks, University of Tasmania, who is currently on study leave at the Sedgwick Museum, Cambridge, UK, is investigating the trilobites, and Dr R. B. Rickards, University of Cambridge, is investigating the graptolites. Their results should add considerable refinement to the dating of Early Palaeozoic rocks in Tasmania.

Mr R. W. Gallois, Institute of Geological Sciences, London, visited Tasmania for one week in August in connection with his visit to Australia to attend the International Geological Congress. He was shown some of the more typical and important Permo-Carboniferous glacial and glaciomarine sequences which are developed in south-east Tasmania. Many of his comments were most informative in view of his knowledge of recently discovered glaciomarine Pleistocene sequences in the North Sea Basin of Western Europe.

Dr E. M. Kemp (Bureau of Mineral Resources, Canberra) continues her studies of Tasmanian Permo-Carboniferous assemblages. She has prepared two manuscripts, one to be presented at the forthcoming International Palynological Congress at Lucknow, India, and a second, more detailed summary of the Tasmanian data which will be published by this Department. Dr J. B. Jago (South Australia) continues his identifications and age assessments of Tasmanian Cambrian trilobite faunas.

Annual and long service leave commenced in December. Whilst in London I shall take the opportunity to examine the type material of certain important Tasmanian Permian brachiopod genera which is housed at the British Museum (Natural History). In particular, the exact nature of the spiriferid *Trigonotreta stokesi* Koenig 1825 has proved a source of continued confusion in the literature. It is hoped that this species will be placed on a sound basis.

## LIBRARY

### Librarian M. Bennett reports—

During 1976 additional space was made available to the library through the acquisition of what was formerly the geological draughting room. Additional library shelving is being obtained, and this room will be used as a storage area for less frequently used library materials, especially those which are presently stored in the basement, as well as for maps and open file reports. It is also proposed to set up the Termatrix in this room and to commence indexing the Department's own reports and the open file reports. The provision of this extra storage area will enable more reading space to be made available in the main library.

The librarian attended a workshop course on geoscience information which was sponsored by the Australian Mineral Foundation and held in Adelaide from 30 August to 3 September. The course was conducted by Graham Lea of Geosystems (London) and dealt with the nature of geoscience information; the development history and growth of primary geoscience literature; secondary services; the designing of a specific data base including retrieval techniques; and a workshop session giving practical experience in the indexing of literature and retrieval from a computerised data base.

## STAFF

The present staff comprises a librarian, student-librarian, and a part-time clerical assistant. Mrs W. Grubb who currently holds the position of student-librarian has now qualified as a librarian and will be transferred to the State Library as a librarian grade I in the near future. Mrs B. Shields who was clerical assistant in the library from June 1965, left the Department in May and was replaced temporarily by Mrs S. Gunn who later resigned on 15 December.

## COLLECTIONS

Cataloguing and listing of all serials held by the library has been completed. Duplicates have been sorted out and a list of these will be prepared in the near future for distributing to Australian libraries which may be interested in receiving them. Subscriptions for British and European journals have been transferred from the Agent-General to W. H. Everett and Son (London), and in the case of some American journals from Ellison Hawker to Ebsco Subscription Services (Birmingham, Alabama).

Additions to collections during 1976:—

Monographs 118; subscription journals 5.

Present holdings:—

Monographs 2 100; serials 529.

Of the 529 serials currently received, 73 are by subscription, 382 are via exchange and 74 are donations.

## REFERENCE AND INFORMATION SERVICES

The weekly accession list has been continued, however, since 18 June the format has been changed so that now items are listed under broad subject categories rather than by title as was the case previously.

During 1976, 286 inter-library loan requests were received from staff, while 391 items (excluding publications circulated on a regular basis, or issued on semi-permanent loan) were issued on loan. A total of 299 reference queries were received by the library and, of these, 285 were readily answerable queries, while the other fourteen required extensive searches to be carried out and in some cases bibliographies to be prepared.

## PUBLICATIONS

**Publications Officer E. L. Martin reports—**

The following publications were printed during the year:—

Tasman Fold Belt System in Tasmania (Explanatory Notes for the 1 : 500 000 Structural Map of Pre-Carboniferous Rocks of Tasmania), by Emyr Williams.

Geological Survey Explanatory Report 1 : 250 000 Series. Sheet SK-55/5, Queenstown, by K. D. Corbett and A. V. Brown.

Geological Survey Explanatory Report 1 : 50 000 Series. Sheet 82 (8312S), Hobart, by D. E. Leaman, with contributions by F. L. Sutherland, V. M. Threader and G. B. Everard.

The editing of Geological Survey Bulletin 55 (The Blue Tier Batholith), the Burnie 1-Mile Series Explanatory Report and Technical Reports No. 20 was substantially completed by the end of the year.

Seventy-two unpublished reports were edited and issued and subject indexes to the 1975 reports were prepared. Details of unpublished reports are supplied to the Australian Mineral Foundation for inclusion in AESIS (Australian Earth Sciences Information System).

In addition to routine photographic work, a complete overlapping coverage on colour negative film was made of both faces of the Sugarloaf Hill cutting on the Lindisfarne Main Road, and of sections of the Tunnel Hill cutting on the Eastern Outlet road. It is hoped to repeat the photography at a later date to provide information for stability analysis.

Several programs for the Wang 700/702 were compiled, including one for a sand and gravel resource classification based on the percentages of sand, gravel and clay; for the plotting of ternary diagrams; for the plotting of particle size distribution diagrams; for nth order regression analysis; and for the use of IBM Composer type elements on the Wang 702.

The Publications Officer attended the Fourth Australian Geoscience Information Association Working Party Meeting in Canberra on 27 April and the Inaugural Meeting in Sydney held during the International Geological Congress.

## LIST OF UNPUBLISHED REPORTS, 1976

<i>No.</i>	<i>Title</i>	<i>Author</i>	<i>Date</i>
1976/1	Rock conditions in the Lake Dobson area, Mount Field National Park.	P. C. Stevenson	15.1.76
1976/2	Groundwater prospects near Dunalley.	W. C. Cromer	16.1.76
1976/3	Test pits on T. E. Atkinson's property, Don.	W. L. Matthews	30.1.76
1976/4	An occurrence of turquoise and wavellite, Arthur River area.	W. L. Matthews	2.2.76
1976/5	Groundwater prospects near Legana.	D. J. Sloane	4.2.76
1976/6	Inspection of a landslip on D. J. Squibbs' property, Spreyton.	W. L. Matthews	17.2.76
1976/7	Computer programs for the production of triangular variation diagrams.	E. L. Martin	3.3.76
1976/8	Investigation of a site for a pond, Alanvale Matriculation College, Launceston.	W. L. Matthews	5.3.76
1976/9	Determination of aquifer parameters in unconsolidated coastal sands.	W. C. Cromer	18.3.76
1976/10	The hydrology of Seven Mile Beach.	W. C. Cromer D. J. Sloane	30.3.76
1976/11	Groundwater prospects near South Arm.	W. C. Cromer	12.3.76
1976/12	Ground stability at Taroona High School.	P. C. Stevenson	16.3.76
1976/13	Groundwater prospects at Opossum and Half Moon Bays, South Arm.	W. C. Cromer	18.3.76
1976/14	Diamond drilling for coal in the Fingal area.	V. M. Threader	22.3.76
1976/15	Geology of the Bells Lagoon and Gavin Tier area.	S. M. Forsyth	23.3.76
1976/16	Ground movements at Casuarina Crescent, Glenorchy.	P. C. Stevenson	24.3.76
1976/17	Damage to a house at Dilston, East Tamar.	C. J. Knights	26.3.76
1976/18	Further groundwater investigations at Woodbridge.	D. J. Sloane	2.4.76
1976/19	Test pits on land at Sutton Street, Burnie.	W. L. Matthews	8.4.76
1976/20	Inspection of a farm dam site at Hagley.	W. L. Matthews	21.4.76
1976/21	Investigation of proposed Forestry Commission roads near St Marys.	D. J. Sloane W. C. Cromer	22.4.76
1976/22	Groundwater investigation at Adventure Bay, Bruny Island.	D. J. Sloane	23.4.76
1976/23	Investigation of a proposed building site at Lebrina.	W. R. Moore	19.5.76
1976/24	Geology and hydrology of the Tertiary and Quaternary sediments near Greens Beach, northern Tasmania.	W. C. Cromer D. J. Sloane	14.5.76
1976/25	Groundwater investigations near Mortimer Bay.	W. C. Cromer	19.5.76
1976/26	Waste materials from Cleveland mine.	V. M. Threader	24.5.76
1976/27	Subsurface conditions at Inveresk, Launceston.	C. J. Knights	28.5.76
1976/28	A computer program for water analyses.	W. C. Cromer	25.5.76
1976/29	Examination of landslip areas near Elderslie Main Road.	R. C. Donaldson	1.6.76
1976/30	Groundwater investigations near South Arm.	W. C. Cromer	31.5.76
1976/31	Engineering geology and slope stability analyses of Round Hill quarries, Burnie.	W. R. Moore	1.6.76
1976/32	Test pits on R. Ambrose's property.	W. L. Matthews	2.6.76

<i>No.</i>	<i>Title</i>	<i>Author</i>	<i>Date</i>
1976/33	Investigation of gravel deposits near Evandale.	V. M. Threader	3.6.76
1976/34	Investigation of manganese oxide sands near Railton.	V. M. Threader	3.6.76
1976/35	Shingle deposits near Leith.	V. M. Threader	9.6.76
1976/36	Geology of Port Arthur.	W. C. Cromer V. M. Threader C. J. Knights	9.6.76
1976/37	Instability near the Bass Highway, Parklands, Burnie.	W. L. Matthews	3.6.76
1976/38	Noise: an appraisal of its measurement and effects.	W. R. Tindal	25.6.76
1976/39	Groundwater prospects near Kettering.	W. C. Cromer	25.6.76
1976/40	Further investigation of proposed roads near St Marys.	D. J. Sloane	29.6.76
1976/41	Preliminary comments on Early Palaeozoic (Late Ordovician-Early Silurian) rocks and fossils in the Huntley Quadrangle.	P. W. Baillie M. J. Clarke	3.5.76
1976/42	Drilling at Casuarina Crescent, Glenorchy.	R. C. Donaldson	16.7.76
1976/43	Representative basin study Peak Rivulet, southern Tasmania.	C. J. Knights	26.7.76
1976/44	Volcanic stratigraphy and Cambro-Ordovician relationships in the South Darwin Peak-Mt Sorell area: a preliminary report.	K. D. Corbett	5.8.76
1976/45	The possible use of pine trees as an aid to stability: Groom's slip, Penguin.	W. L. Matthews	30.7.76
1976/46	Vibrational effects to be expected within the boundaries of the Housing Commission development at Bridgewater resulting from the operation of Hobart Quarries Ltd's Bridgewater quarry.	P. Allan	24.6.76
1976/47	Further inspection of road routes near St Marys.	D. J. Sloane	9.8.76
1976/48	Diamond drilling at Macquarie Point sewerage treatment plant.	W. C. Cromer	11.8.76
1976/49	Notes on the volcanic stratigraphy and Cambro-Ordovician relationships in the Mt Jukes area.	K. D. Corbett	12.8.76
1976/50	The effect of a water bore on a nearby dam at Hagley.	W. L. Matthews	17.8.76
1976/51	Groundwater prospects near Don Heads, northern Tasmania.	W. C. Cromer	19.8.76
1976/52	The Mt Read Volcanics sequence in the King River Gorge below Crotty.	K. D. Corbett	23.8.76
1976/53	Subsurface conditions of a property at Freshwater Point, West Tamar.	R. C. Donaldson	24.8.76
1976/54	Investigation of a proposed reservoir site at Legana.	W. C. Cromer	31.8.76
1976/55	Investigation of a proposed reservoir site at Taroona.	W. C. Cromer	31.8.76
1976/56	The geology of Three Hummock Island.	D. J. Jennings	16.9.76
1976/57	Interpretation program for split spread seismic refraction data.	D. E. Leaman	6.9.76

No.	Title	Author	Date
1976/58	Investigation of limestone deposits at Ida Bay.	S. M. Forsyth G. R. Green	21.9.76
1976/59	Groundwater investigations near Hamilton.	W. C. Cromer	10.9.76
1976/60	Investigation of proposed subdivision, Bonnet Hill.	R. C. Donaldson	14.9.76
1976/61	Investigation of a landslip at Deviot.	C. J. Knights	21.9.76
1976/62	Investigation of a proposed subdivision at Upper Scamander.	D. J. Sloane	23.9.76
1976/63	Landslips in the Glenlusk valley.	C. J. Knights	15.10.76
1976/64	Investigation of a large landslip near Bradys Lookout, West Tamar.	C. J. Knights	3.11.76
1976/65	Investigation of a landslip at Alexander Terrace, Stanley.	W. L. Matthews	10.11.76
1976/66	Resistivity interpretation using the filter transform method program for the Wang 700B.	D. E. Leaman	12.11.76
1976/67	Groundwater investigation near Railton.	W. C. Cromer	16.11.76
1976/68	Marine erosion at Taroona.	D. E. Leaman W. C. Cromer	19.11.76
1976/69	Sources of building stone at Port Arthur.	W. C. Cromer	25.11.76
1976/70	Distribution of syenite in the Oyster Cove-Woodbridge area.	N. Farmer	9.12.76
1976/71	Engineering geology investigation of a proposed cutting on the Murchison Highway at Somerset.	W. R. Moore	20.12.76
1976/72	Seismic survey at Leven Bridge, Ulverstone by-pass.	D. E. Leaman	13.12.76

## NON-DEPARTMENTAL PUBLICATIONS

The following articles by (or co-authored by) members of the Geological Survey Staff were published during the year:—

- CLARK, M. J.; FARMER, N. 1976. Biostratigraphic nomenclature for late Palaeozoic rocks in Tasmania. *Pap.Proc.R.Soc.Tasm.* 110:91-109.
- CLARK, M. J.; FARMER, N.; GULLINE, A. B. 1976. Tasmania Basin—Parmeener Supergroup. *Monogr.Ser.australas.Inst.Min.Metall.* 7:438-443.
- CLARKE, M. J.; FARMER, N.; GULLINE, A. B. 1976. Oil shale in Tasmania. *Monogr.Ser.australas.Inst.Min.Metall.* 7:524.
- GREEN, G. R. 1976. The environment of massive sulphide ore deposition at Rosebery, Tasmania. *Abstr.25th int.geol.Congr.* 1:163.
- GREEN, G. R. 1976. Sundry mineralization in Tasmania. *Monogr.Ser.australas.Inst.Min.Metall.* 5:632-635.
- JENNINGS, D. J. 1976. Alluvial tin deposits of Tasmania. *Monogr.Ser.australas.Inst.Min.Metall.* 5:1053-1054.
- KNIGHTS, C. J.; MATTHEWS, W. L. 1976. A landslip study in Tertiary sediments, Tasmania. *Abstr.25th int.geol.Congr.* 2:534-535.
- KNIGHTS, C. J.; MATTHEWS, W. L. 1976. A landslip study in Tertiary sediments, northern Tasmania. *Bull.int.Ass.engng Geol.* 14:17-22.
- MATTHEWS, W. L. 1976. Bauxite in Tasmania. *Monogr.Ser.australas.Inst.Min.Metall.* 5:992-993.

- NOLDART, A. J. 1976. Beaconsfield lateritic nickel deposits, T. *Monogr.Ser.australas.Inst. Min.Metall.* 5:1006-1008.
- SOLOMON, M.; GREEN, G. R. 1976. Ore deposits of Western Tasmania. *Excur.Guide 25th int.geol.Congr.* 31AC.
- STEVENSON, P. C.; MOORE, W. R. 1976. A logical loop for the investigation of dam sites. *Q.J.engng Geol.* 9:65-71.
- THREADER, V. M. 1976. Asbestos—Tasmania. *Monogr.Ser.australas.Inst.Min.Metall.* 8:12.
- THREADER, V. M. 1976. Barite—Tasmania. *Monogr.Ser.australas.Inst.Min.Metall.* 8:26-27.
- THREADER, V. M. 1976. Structural clay—Tasmania. *Monogr.Ser.australas.Inst.Min.Metall.* 8:56-57.
- THREADER, V. M. 1976. Kaolinitic clay—Tasmania. *Monogr.Ser.australas.Inst.Min.Metall.* 8:57.
- THREADER, V. M. 1976. Construction materials—Tasmania. *Monogr.Ser.australas.Inst.Min. Metall.* 8:85-87.
- THREADER, V. M. 1976. Dolomite—Tasmania. *Monogr.Ser.australas.Inst.Min.Metall.* 8:120-121.
- THREADER, V. M. 1976. Fluorite—Tasmania. *Monogr.Ser.australas.Inst.Min.Metall.* 8:141.
- THREADER, V. M. 1976. Limestone—Tasmania. *Monogr.Ser.australas.Inst.Min.Metall.* 8:201-202.
- THREADER, V. M. 1976. Magnesite—Tasmania. *Monogr.Ser.australas.Inst.Min.Metall.* 8:218-219.
- THREADER, V. M. 1976. Pegmatite minerals (mica)—Tasmania. *Monogr.Ser.australas.Inst. Min.Metall.* 8:233.
- THREADER, V. M. 1976. Pigments (mineral)—Tasmania. *Monogr.Ser.australas.Inst.Min. Metall.* 8:294.
- THREADER, V. M. 1976. Sapphire and ruby—Tasmania. *Monogr.Ser.australas.Inst.Min.Metall.* 8:316.
- THREADER, V. M. 1976. Semi-precious stones—Tasmania. *Monogr.Ser.australas.Inst.Min. Metall.* 8:351-352.
- THREADER, V. M. 1976. Silica—Tasmania. *Monogr.Ser.australas.Inst.Min.Metall.* 2:363-365.
- THREADER, V. M. 1976. Talc—Tasmania. *Monogr.Ser.australas.Inst.Min.Metall.* 8:394.
- WILLIAMS, E. 1976. Tasman fold belt system: Tasmanian segment. *Abstr. 25th int.geol. Cong.* 3:713-714.
- WILLIAMS, E.; SOLOMON, M.; GREEN, G. R. 1976. The geological setting of metalliferous ore deposits in Tasmania. *Monogr.Ser.australas.Inst.Min.Metall.* 5:567-581.

## CHEMICAL AND METALLURGICAL BRANCH

Report of the Chief Chemist and Metallurgist, H. K. Wellington, B.E., F.S.A.S.M., Am.Aust.IM.M.

There was an increase in the number of samples registered and determinations made but the position was much the same as in 1975. The number of determinations per sample registered at 2.9 was again high.

Metallurgical activity was greater, with a number of uncompleted projects deferred and hence not summarised here.

TYPE AND NUMBER OF TESTS			
<i>Type of Test</i>	<i>Number</i>	<i>Type of Test</i>	<i>Number</i>
<b>I. QUANTITATIVE—</b>			
Elements—			
Aluminium .....	102	Waters—	
Antimony .....	20	Complete analysis ....	326
Arsenic .....	128	Partial analysis ....	240
Barium .....	14	Deposit gauges ....	36
Bismuth .....	12		—
Boron .....	17	Miscellaneous—	602
Cadmium .....	2	Ash (coals) ....	265
Calcium .....	332	Base exchange capacity	137
Carbon (including CO <sub>2</sub> )	384	Calorific value ....	5
Chlorine .....	75	Cation exchange cap-	
Chromium .....	125	acity .....	71
Cobalt .....	83	Combined water ....	129
Copper .....	98	Cyanide .....	8
Fluorine .....	114	Ignition loss ....	141
Gold .....	62	Insoluble ....	110
Hydrogen .....	1	Moisture ....	379
Iron (ferric) ....	453	pH solids ....	71
Iron (ferrous) ....	38	Soluble salts in bricks	17
Lead .....	180	Specific gravity ....	1
Lithium .....	8	Volatiles (coals) ..	249
Magnesium .....	321		—
Manganese .....	74		1 583
Mercury .....	3	<b>II. QUALITATIVE</b> .....	23
Molybdenum .....	11	<b>III. CERAMIC—</b>	
Nickel .....	40	Sand determinations ....	275
Niobium .....	8	Moisture ....	86
Nitrogen .....	76	Screenings ....	137
Phosphorus .....	110	Fusion Point ....	3
Potassium .....	196		—
Rubidium .....	17		501
Scandium .....	42	<b>IV. METALLURGICAL—</b>	
Selenium .....	3	Cassiterite grain sizing	10
Silicon .....	122	Crushing and grinding	4
Silver .....	20	Density .....	10
Sodium .....	199	Flotation .....	1
Strontium .....	17	Heavy liquid separa-	
Sulphur (including SO <sub>2</sub>		tion .....	97
and SO <sub>3</sub> ) .....	175	Magnetic separation ..	9
Tin .....	769	pH .....	12
Tellurium .....	1	Sizing (including cyclo-	
Titanium .....	113	sizing) .....	835
Tungsten .....	168	Tabling .....	2
Vanadium .....	58	Leaching .....	2
Yttrium .....	16	Settling tests ....	19
Zinc .....	59		—
Zirconium .....	47		1 001
	—	Total ....	8 623
	4 913		—

## RESEARCH INVESTIGATIONS

Tin	5	Fluorite	1
Tungsten/iron	2	Beach sand	3
Tungsten	1	Oil shale	1
Gold	2	Pollution	2
Copper/lead/zinc	1	Utilisation of waste	1
Copper	1	Ceramics	1
		Total	21

## SUMMARY OF INVESTIGATIONS

## Tin

**R.698**—Cleveland Tin N.L., Luina Mill products

Jones magnetic separations were made on a number of products from the mill by Cleveland personnel working in the Department's laboratory.

**R.706**—Cleveland Tin N.L., silicate regrind mill feed

A sample of this material was requested by this laboratory as part of an investigation into poor results when milling Khaki lode material.

The investigation showed an undesirably high free cassiterite content in the mill feed. The high siderite content found was not unexpected. The high pyrrhotite content indicated that sulphide flotation was not up to expectations.

The investigation pointed the need for a widespread investigation of mill performance.

**R.713**—Cleveland Tin N.L., grindability of ore types

The company requested that grindabilities be done on samples from Hall's and Khaki lodes to see if grindability was a factor in the poor mill performance on Khaki ore.

In addition the head samples of R482 (Hall's) and R701 (Khaki) were also included.

The results were inconclusive possibly due to poor sampling in the mine. The R701 sample was harder to grind than R482.

**R.719**—Minops Pty Ltd, Razorback tin concentrate

The company requested an investigation into the occurrence and possible elimination of lead from their tin concentrate.

Identification of the lead minerals present by solvent extraction showed galena and crocoite to be the principal lead minerals identified but about half the lead could not be assigned to a mineral.

There appears to be lead associated with iron and manganese and possibly chromium oxides. This lead can be removed by magnetic separation.

Test work shows that wet magnetic separation, then froth flotation and finally dry magnetic separation will reduce the lead content to about 0.1% Pb.

**R.722**—Ringarooma Mining Pty Ltd, North Valley stamp batteries

Two stamp batteries were being used to treat middlings that had hitherto not been treated to recover tin.

The battery feeds and products were sampled to provide data on how this machine performs on Mt Bischoff ore.

### Tungsten/Iron

#### R.726—Tasminex N.L., Kara ore

A sample of scheelite/magnetite ore was submitted for the production of a scheelite concentrate. The sample submitted was very rich, assaying 8%  $WO_3$  and 63% Fe.

#### R.732—Tasminex N.L., Kara ore

A further sample stated to represent a scheelite-rich part of the ore body was submitted for examination after crushing to a size similar to that of R726.

The sample assayed only 0.3%  $WO_3$ . Magnetic separation at 10 mm yielded a magnetic product containing 95% of the iron, 47% of the tungsten and assaying 60% Fe. The non-magnetic product contained 53% of the tungsten and assayed 1.5%  $WO_3$ . Jig and table concentration of this product yielded a 46%  $WO_3$  grade concentrate containing 40% of the tungsten in the original sample.

### Gold

#### R.717—BMI Mining Pty Ltd, Middle Arm tailings

This project involved a comparison of two samples of tailings tested with saline water and with Launceston tap water and, in the latter water, after grinding and after washing.

There was little difference between behaviour in tap water and saline water for the two samples. Washing enhanced recovery and grinding enhanced it further on both samples. However the 'stockpile' sample showed a lower recovery than the sample used in R697.

#### R.718—Warne's Lookout, Jane River Syndicate

Two samples were taken by a departmental geologist and a larger one (1.2 t) was submitted by the syndicate.

Each sample was similarly treated, the treatment being mixing to break up the lumps then screening. The coarsest material was not treated. The intermediate fraction was passed over a sluice box, the concentrate from which was jigged, and the screen undersize cycloned the cyclone overflow being discarded and the underflow jigged.

The gold recovered was less than 300 mg/t in all samples.

### Copper/Lead/Zinc

#### R.703—Aberfoyle Management Pty Ltd, Que River

Test work was done on core from DDH QR31 which was lower grade than ore reserves, namely 0.2% Cu, 4% Pb and 6% Zn.

A satisfactory recovery of copper in a copper concentrate was achieved but further work was felt necessary to achieve optimum lead and zinc recoveries in their respective concentrates.

### Beach Sand

#### R.714—H. J. Wright, Cloudy Bay, Bruny Island

Core from four bore holes was subjected to heavy liquid separation and magnetic separation.

Rutile, zircon and tin were not found in economic quantities. The ilmenite present varied widely between holes and with depth in each hole.

#### R.729—H. J. Wright, Cloudy Bay/Cloudy Lagoon spit

Core from nineteen bores across the spit was submitted. The samples were screened on 710  $\mu\text{m}$ , the undersize tabled and the table concentrates magnetically separated.

The major heavy mineral was a magnetic yellow brown ferro-manganese mineral of no economic significance. Rutile, zircon, cassiterite and ilmenite were found in each hole but in very minor quantities.

**R.733**—S. R. M. Harvey, Gordon River and Little Henty River mouths

The samples were heavy liquid separated. Very little heavy mineral was found.

#### **Tungsten**

**R.727**—D. J. Holness, Interview River

Two samples contained practically no tungsten but significant arsenopyrite.

The third sample assayed 1.5% WO<sub>3</sub>. The tungsten was present as scheelite (20%) and the remainder as wolframite.

#### **Copper**

**R.728**—D. J. Holness, Interview River

This sample, which assayed 21% Cu, responded readily to copper flotation giving high copper recoveries and grades in concentrates.

#### **Oil Shale**

**R.694**—Endeavour Oil Co. N.L., China Flat, Latrobe

The sample submitted came from surface dumps. Grinding to pass 600 μm followed by flotation readily yielded a high kerogen recovery.

An approximate relationship between percentage ash in a shale product and the oil content was established.

#### **Fluorite**

**R.731**—Comalco Ltd, Moina wriggite ore

This was a scout testing program aimed at obtaining information about a complex and difficult ore to treat.

Magnetic separation, gravity separation and flotation were applied to the ore after grinding to nominally 95% through 600 μm, 150 μm and 38 μm.

#### **Pollution**

**R.680**—Department of Mines, oxidation of mine wastes

Results after two years of testing were issued.

**R.715**—Aberfoyle Management Pty Ltd, Que River

Tailings produced during flotation tests in R703 were subjected to alternate wetting and aeration by recycling solution to ascertain some measure of the dissolution rates to be expected from residue dumps of this material. The addition of limestone to the tailings was also studied.

#### **Utilisation of Waste**

**R.724**—Department of Mines, Tonganah clay mine waste

Three products were examined. From the log washer reject a silica product assaying >99% SiO<sub>2</sub> and sizing between 1 and 10 mm was produced.

#### **Ceramics**

**R.720**—Department of Mines, survey of brick production

The annual survey of brick production was made in December 1975.

# MINES AND EXPLOSIVES BRANCH

Report of the Deputy State Mining Engineer and Deputy Chief Inspector of Mines and Explosives,  
P. M. Johnstone, B.E., M.Aust.I.M.M.  
*The Mines Inspection Act 1968*

## EMPLOYMENT

The average number of persons employed in the mining, metallurgical and quarrying industry was 9 345, a decrease of 268. The overall decrease reflects the reduction in the work force at Mount Lyell Mining and Railway Co. Ltd.

## ACCIDENTS

Accidents were reported and recorded in accordance with Australian Standard CZ6, Recording and Measuring Work Injury Experience. By this practice all disabling injuries causing the loss of one shift or more are recorded.

### ACCIDENT STATISTICS (AS CZ6)

<i>Employer</i>	<i>Man hours exposure</i>	<i>No. of injuries</i>	<i>Frequency rate</i>	<i>Days charged</i>	<i>Severity rate</i>	<i>Mean duration (days)</i>
Aberfoyle ....	273 620	53	193.7	978	3 574	13
BMI ....	22 641	....	....	....	....	....
Cleveland Tin ....	450 041	36	80.0	4 857	11 110	11
EZ, Rosebery ....	1 563 474	497	317.8	18 287	11 696	11
Kibuka ..	76 794	7	91.2	143	1 862	15
King Island Schee- lite ....	801 072	92	114.8	1 134	1 415	9
Minops ....	63 489	18	283.5	77	1 213	4
Mt Lyell ....	2 166 490	184	84.9	6 057	2 796	13
Que River ..	36 213	3	82.8	44	1 701	15
Renison ....	825 784	98	118.6	1 273	1 541	10
Ringarooma ....	44 631	1	22.4	57	1 277	57
Savage River ....	917 676	47	51.2	532	579	9
Miscellaneous ....	105 450	43	407.8	518	4 912	9
<b>All mines ....</b>	<b>7 347 375</b>	<b>1 049</b>	<b>142.8</b>	<b>33 957</b>	<b>4 622</b>	<b>11</b>
APPM ..	46 853	7	149.4	73	1 558	10
Comalco ....	2 250 595	139	61.7	3 236	1 438	23
EZ, Risdon ....	3 400 897	390	114.7	7 839	2 305	14
Goliath Cement ..	563 785	3	5.3	274	486	91
Mole Creek ....	32 640	5	153.2	115	3 523	23
NW Acid ....	266 608	20	75.0	188	705	9
Port Latta ..	520 141	23	44.2	433	832	13
Tas. Carbide Prod.	242 294	36	148.6	414	1 709	8
Temco ..	492 674	6	12.2	125	254	21
Tioxide Aust. ....	877 439	9	10.3	147	168	12
Ceramic ....	306 422	38	124.0	210	685	6
<b>All works ..</b>	<b>9 000 348</b>	<b>676</b>	<b>75.1</b>	<b>13 054</b>	<b>1 450</b>	<b>15</b>
Collieries ....	120 855	21	173.76	284	2 350	14
Quarries ....	240 808	26	107.9	955	3 966	26
<b>Totals ....</b>	<b>16 709 386</b>	<b>1 772</b>	<b>106.0</b>	<b>48 250</b>	<b>2 886</b>	<b>19</b>

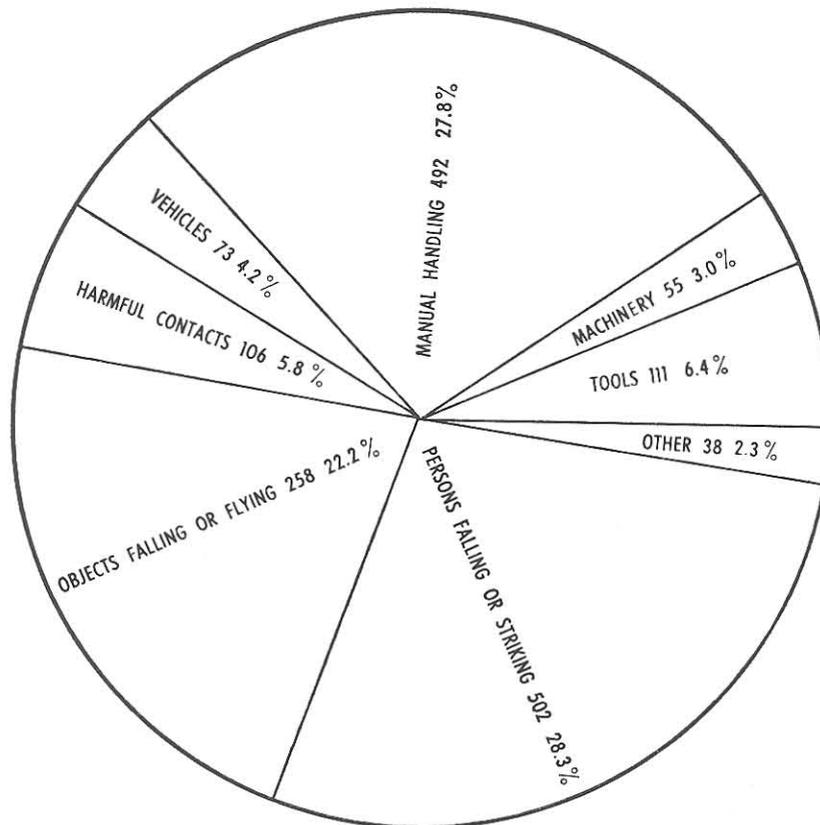
### DESCRIPTION OF FATAL AND SERIOUS ACCIDENTS

#### *Fatal*

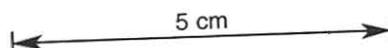
D. Baldock, EZ Co., Rosebery: Struck by fall of rock from the hanging wall.

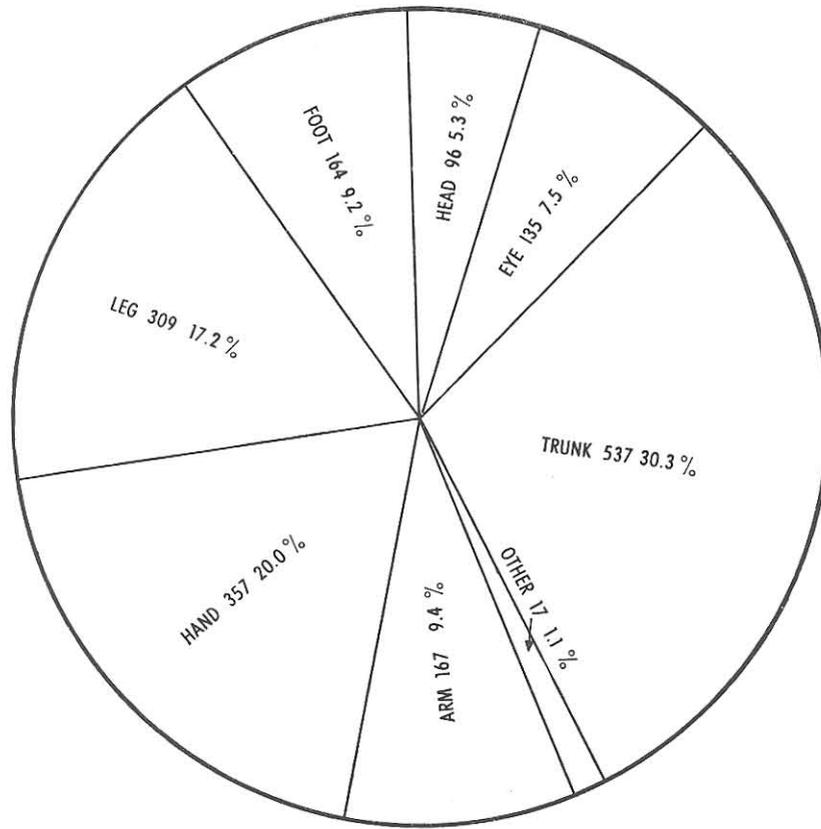
*Serious*

- G. Gillie, Savage River: Struck by falling drill steel; fractured ankle.
- C. Young, EZ Co., Rosebery: Hand caught in bogger chain; amputated finger.
- D. Bell, EZ Co., Rosebery: Hand caught in pulley; two fingers amputated.
- R. MacFarlan, EZ Co., Rosebery: Pinned by derailed Granby; amputated leg.
- P. Janout, EZ Co., Rosebery: Front-end loader bucket crushed foot; amputated toe.
- K. Buller, EZ Co., Hercules: Struck by fall of rock; fractured pelvis.
- L. Slatter, Cleveland Tin: Struck by fall of rock; amputated leg.
- S. L. Maney, Cleveland Tin: Drilled into explosives; eyes damaged.
- B. J. Hays, NW Acid: Stepped into hot calcine; severe burns to foot.
- P. M. Kelly, Que River: Struck by fall of rock; permanent disability to arm.
- D. Martin, Mount Lyell: Caught in loco buffer; amputated foot.
- W. A. McMahon, Mount Lyell: Tyre burst; fractured jaw.
- T. J. Briers, Mount Lyell: Timber struck foot; fractured foot.
- C. R. Hodgson, Mount Lyell: Fell on rake; fractured coccyx.
- P. Cutting, Mount Lyell: Truck rolled on foot, fractured ankle.
- P. C. Hall, Mount Lyell: Struck by fall of rock; fractured leg.
- B. F. Cox, Mount Lyell: Jammed legs; fractured leg.
- O. C. Hauge, Mount Lyell: Fell from rise; fractured ankle.
- J. J. Wayland, Mount Lyell; Jammed between loco and car; crushed leg.
- D. Vincent, Cornwall Coal: Tripped carrying timber; fractured ankle.
- H. Biermann, Comalco: Hammering welding lug; blinded in one eye.
- C. Allford, Goliath: Fell from semi-trailer; fractured thigh.
- R. Aylett, Readymix, Launceston: Struck by fall of rock; fractured leg.
- G. Scott, Mole Creek Lime: Truck reversed over face; fractured leg.
- D. Dylestra, Mole Creek Lime: Jumped off loader; fractured leg.
- A. H. Olsen, Temco: Metal spill; burns to leg and back.

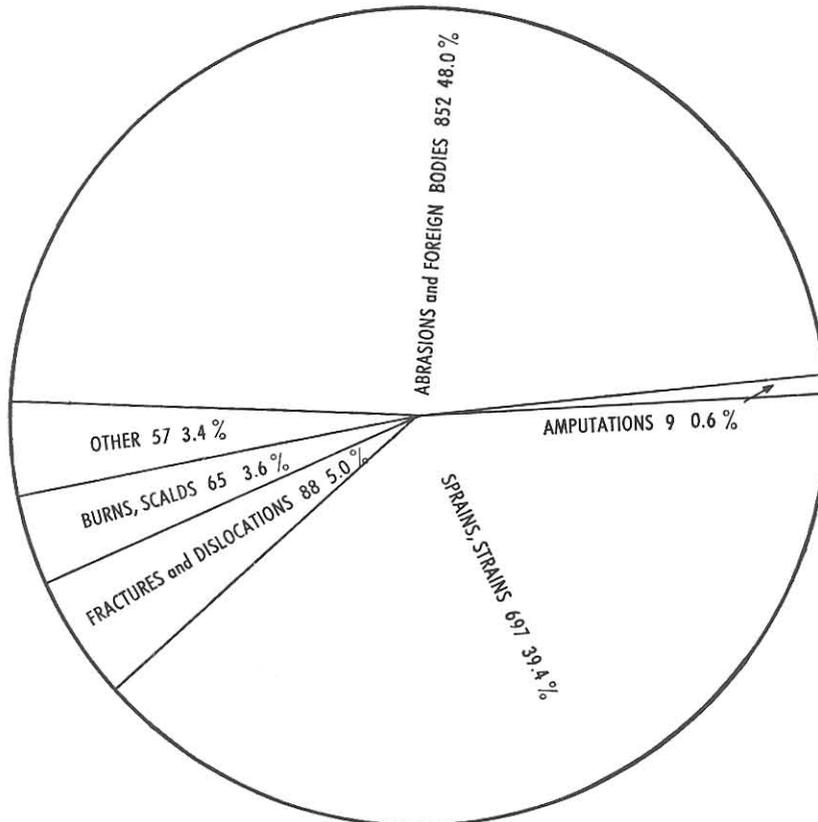


*Accident Factor*





*Accidents: Location of injury*



*Accidents: Nature of injury*

5 cm

## DANGEROUS GOODS

*The Dangerous Goods Act 1976*

## IMPORTS OF EXPLOSIVES

	<i>Hobart</i>	<i>Launceston</i>	<i>King Island</i>	<i>Burnie</i>	<i>Straban</i>	<i>Total</i>
Nitro-compounds (kg) ....	159 750	50 250	103 000	284 700	408 750	1 006 450
Detonators .. ....	269 000	199 000	140 000	375 610	413 500	1 397 110
Explosives shipments (No.)	4	4	4	4	4	20
Ammonium nitrate imported for use as an explosive (tonnes) .. ....	196	....	....	1 767	....	1 963

The number of licences and permits issued were: Magazine Licences, 117; Other Licences, 395; Shot Firer's Permits, 61.

## IMPORTS OF INFLAMMABLE LIQUIDS

	<i>Bell Bay</i>	<i>Burnie</i>	<i>Devonport</i>	<i>Hobart</i>	<i>Total</i>
Inflammable liquids imported in bulk (tonnes)—					
Aviation gasoline .. ....	3 061	....	....	1 500	4 561
Kerosene—					
Aviation .. ....	7 285	....	....	14 121	21 406
Lighting .. ....	....	508	3 505	3 840	7 853
Power .. ....	....	....	....	600	600
Motor spirit—					
Premium .. ....	62 811	27 955	45 400	104 205	240 371
Regular .. ....	10 629	4 760	8 294	23 441	47 124
LP gas .. ....	1 929	....	....	2 080	4 009
Total .. ....	85 715	33 223	57 199	149 787	325 924
Tankships (No.) .. ....	29	12	12	29	82

Licences to keep, 2 400; Plans approved, 350; Exemptions granted, 27; Permits to import, 17.

## ACCIDENTS

The local agent for an oil company received severe burns when pumping motor spirit with a petrol-engined power pack, which back-fired and ignited.

A workshop-garage complex containing three vehicles was destroyed when a leaking LP gas cylinder exploded causing a fire.

A fire occurred at an oil depot whilst dewatering a motor spirit tank using an unearthed draining bucket. The fire was quickly controlled using dry powder extinguishers and foam.

A country post office and store was destroyed by fire. The fire was first noticed in a store room containing flammable liquids; the cause of ignition is not known.

The tankership M.V. 'Bethioua' ran aground near George Town on the evening of 18 December 1976. The ship was leaking fuel from its cargo of 27 000 tonnes of premium motor spirit. Petrol vapour threatened the town and the State Emergency Services were called out. Parts of George Town were evacuated during the night. The tanker was pulled clear of the reef the following morning and taken to the Bell Bay oil wharf where repairs were effected. Spillage amounted to approximately 1 237 tonnes.

A truck used for delivering home heating oil ran away whilst parked in a steep area in Burnie. It overturned and crashed into a house. The house was damaged but no one was injured.

An oil spill took place in the Emu River at Burnie when a leak developed in the tube bundle of an oil-fired boiler. at APPM Ltd. The leak took place in the early hours of the morning and 95% of the spill was removed in clean-up operations during the day.

### SPECIAL INVESTIGATIONS

**P. Allan, B.Sc., A.H.-W.C., M.I.E. (Aust.), M.I.M.M., M.Aust.I.M.M., Hobart**

#### DIESEL ENGINES UNDERGROUND

One temporary and sixteen permanent approvals for the operation of diesel engines underground were issued during the year. This represents a 25% decrease from the previous year and when considered quarterly illustrates a zero demand in the final quarter reflecting the then current economic situation.

The most notable development has been the interest shown in increasing haulage capacity in order to prolong the viable life of decline systems and to control haulage costs.

Difficulties experienced by King Island Scheelite in obtaining economically acceptable vehicles suited to their new underground operations led to consideration being given to the modification of Caterpillar 769B surface haulage vehicles left over from the open-cut operations into suitable underground vehicles. The success of the conversion has proved the adaptability of the equipment and encouraged another mining company, Renison Limited, to convert two like vehicles in a similar manner.

#### VIBRATION MONITORING AND BLASTING ASSISTANCE

The newly developed and more mobile vibration equipment has now been fully field tested and proved, with a steadily increasing demand for the service as it becomes more widely known.

The principal use during the year was a prolonged study of the Readymix Group's Bridgewater quarry to establish the compatibility of the operations with a proposed Housing Department subdivision. The basic investigation to establish the existing vibration parameters expanded eventually into an operational study of the quarry which has not only proved beneficial to the operators but reduced the vibration levels and allowed housing construction to approach much closer than was originally envisaged.

Minor vibration investigations were also carried out at quarries belonging to C. R. Johnson, Morningside, BHP, Beaconsfield, A. R. Stone, Devonport and Circular Head Dolomite, Smithton.

On behalf of the Department of Public Works, special studies were conducted into pile driving operations on the site of the Leven River bridge, blasting operations on the Midland Highway and traffic vibrations in the vicinity of Somerset Cliffs.

On behalf of the Hobart City Council Engineer's Department a number of studies were carried out into the effects which could be expected from the use of normal and high-frequency vibrating rollers while on behalf of the Marine Board of Hobart tests were carried out and advice given on the methods of blasting used to deepen the water at the Macquarie No. 4 wharf.

In addition a number of examinations and studies were carried out for private individuals and insurers regarding possible damage to properties as a result of various sources of vibration.

#### DUST INVESTIGATIONS

These continue to be mainly concerned with asbestos fibre at the Goliath Portland Cement Company, Railton, the Tasmanian Electro-Metallurgical Company and the Comalco refinery at Bell Bay.

## NOISE INVESTIGATIONS

These were carried out concurrently with applicable vibration studies. The only serious problem, a sheet trimming machine at Goliath Portland Cement Company, was adequately dealt with when the company completely surrounded the machine with a soundproof enclosure.

## MECHANICAL INSPECTION

**W. C. Hodgson, M.I.E.Aust.**

Plant and machinery inspections were carried out through the year to monitor compliance with Parts V, VII and IX of the Mines Inspection Act.

*Hoists*

ROSEBERY No. 2 SHAFT: The auxiliary cage fell 400 m to the shaft bottom when the hoist rope broke after snagging on part of the shaft steelwork. Fortunately the cage was empty and no one was hurt. The equipment was undergoing adjustment at the time by the manufacturers who had just completed modifications to the braking system.

It is disquieting to note that this could have occurred at any time during the working life of the hoist, and that neither the manufacturers, the company, nor the Department foresaw the possibility, or indeed would have been likely to.

This is the second such mishap on this hoist. The first resulted from a brake failure at the winding engine which has since been modified by the manufacturers GEC. On that occasion also, the cage was empty.

The lesson seems clear. At no time should men's lives hang by a single component, the integrity of which is essential to safety.

ROSEBERY No. 1 SHAFT: Modifications to conveyances to bring them into line with the material requirements of regulation 46 were completed.

HERCULES HAULAGE: New skips and re-designed attachments have now been installed.

PRINCE LYELL SHAFT: Difficulties in maintaining brake performance on the skip hoist necessitated bringing the manufacturers on site to carry out tests and make further adjustments to the pneumatic system. This work was in hand at the end of the year.

*Vehicles*

The steady decline in accidents resulting from vehicular malfunction is gratifying and reflects the steady improvement in maintenance.

*General*

Examination of new plant and equipment for approval included:—

- Completion of Temco No. 5 FeSi unit.
- Commencement of Temco No. 3 FeMn unit.
- Commencement of Comalco No. 4 potline.
- Completion of Goliath coal firing plant.

*Certificates of Competency*

Forty-nine candidates were examined for certificates as crane drivers, winding engine drivers and IC engine drivers.

## ELECTRICAL INSPECTION

**E. J. Bartkus, M.I.E.Aust., Hobart**

Inspection of electrical installations and equipment was carried out at all mines and works.

With a few exceptions, upgrading and improving old installations throughout the mines and works are progressing satisfactorily.

### *Accidents*

Four electrical accidents were investigated during 1976. Two were due to negligence of electrical personnel when testing live circuits, one to current leakage from incorrectly connected electrical equipment and one to insulation breakdown. Three of these circuits did not have earth leakage protection and thus could have resulted in fatalities.

New installations approved during 1976:—

Temco No. 5 FeSi unit and sinter plant.

Temco No. 3 FeMn unit.

Comalco wharf flameproof installations.

Devonport Marine Board No. 4 berth flameproof installations.

Mt Lyell 1 200 h.p. ventilation shaft fans.

Tioxide new acid plant.

New equipment approved for use in mines:—

ICI 'Detameter' firing circuit tester.

Asahi photo-electric firing circuit tester.

Exxon Inc., USA, 'Maxi' and 'Mini' exploders.

ICI 'Cabelec' anti-static hose.

## DRILLING

### DIAMOND DRILLING

**H. Murchie, B.Sc., D.R.T.C., M.Aust.I.M.M.**

Five crews operated diamond drills throughout the year. Mud flushing techniques were introduced and once operators gained experience, better drilling performances were obtained.

### *River Investigation*

An accelerated program of site investigation drilling was carried out in conjunction with the Materials and Research Division of the Public Works Department and consultants, Maunsell and Partners Pty Ltd, for the second Derwent River crossing. Progress and results were improved on previous work by using the Mayhew 1000 as both a rotary and a diamond drilling machine. Many problems associated with drilling on water through deep silts have now been solved.

### CHURN DRILLING

The Keystone drill continued tin exploration work in north-eastern Tasmania and also carried out some site investigation and water investigation work.

## VEHICLES

Five new vehicles were purchased during the year. They were:—

One 5-ton Bedford 4 x 4 MJR diesel truck for use with the Mayhew 1000.

One 1-ton Holden 4 x 2 truck for general use.

One 3-ton International D-1410, 4 x 4 for material delivery and plant moves.

One 1-ton Nissan 4 x 4 truck with long wheel base and free-wheeling hubs.

One 2-ton Toyota Dyna dual-cab, 4 x 2 for servicing two crews on coal exploration.

The last two vehicles will be used as replacements to the Willys J3800 trucks which are expensive to run and maintain. If they prove successful it is hoped to increase the use of similar vehicles.

The Drilling Branch operates a fleet of twenty-three vehicles, the oldest being first registered in 1966. Priority will be given this coming year to modernising and upgrading our transport facilities.

## STAFF

Mr Derek Murray commenced duties as Drilling Superintendent in July after many years contract drilling throughout Australia. His extensive experience will be of great value to the branch.

## DRILLING DETAILS 1976

<i>Location</i>	<i>Purpose</i>	<i>Drill</i>	<i>No. of holes</i>	<i>Total depth (m)</i>
<i>Diamond—</i>				
Margate ....	Stratigraphic investigation	Joy 12B	1	79.25
Oliver Hill ..	Mineral investigation ....	F20C	1	116.00
Claude Road ....	Mineral investigation ....	F20C	3	122.32
Macquarie Point ....	Site investigation ....	F20C and Triefus 16	14	109.97
Old Beach ..	Seismic investigation ....	Triefus 16	5	30.50
Mornington ..	Seismic investigation ....	Triefus 16	6	36.60
Ulverstone ..	Road investigation ..	Triefus 16	6	90.35
Stanley ..	Landslip investigation ....	Triefus 16	2	17.00
Rosebery ....	Mineral investigation ....	Joy 12B	1	290.16
Zeehan ..	Mineral investigation ....	Joy 12B	1	112.71
Fingal ....	Coal investigation ..	Joy 30 HD	1	480.44
Fingal ....	Coal investigation ..	EDECO 36	2	623.93
Dowsings Point ....	Bridge foundation ..	F20C and Triefus 16	7	106.19
Elizabeth Matriculation College ....	Site investigation ....	F20C	7	65.95
Scamander ....	Mineral investigation ....	F20C	1	172.90
		Total:	59	2 464.14
<i>Diamond/Auger—</i>				
St Leonards ..	Road investigation ..	Gemco 210A	5	43.08
Macquarie St, Hobart	Site investigation ....	Gemco 210A	10	175.01
Beauty Point ....	Landslip investigation ....	Gemco 210A	28	643.88
Launceston City Council ....	Site investigation ....	Gemco 210A	1	18.20
Greens Beach ....	Stratigraphic investigation	Gemco 210A	3	88.39
Launceston ..	Site investigation ....	Gemco 210A	2	21.00
		Total:	49	989.56
<i>Rotary/Diamond—</i>				
River Derwent ..	Bridge foundation ..	Mayhew 1000	18	816.01
River Jordan ....	Bridge foundation ..	Mayhew 1000	1	24.36
		Total:	19	840.37

<i>Location</i>	<i>Purpose</i>	<i>Drill</i>	<i>No. of holes</i>	<i>Total depth (m)</i>
<i>Rotary/Percussion—</i>				
Lewisham .. .. .	Water investigation .. .	Mayhew 1000	4	216·00
Glenorchy .. .. .	Site investigation .. .	Mayhew 1000	2	24·57
Bridport region .. .	Water investigation .. .	Failing WW1	24	1 103·45
Ulverstone .. .. .	Site investigation .. .	Failing WW1	1	33·52
			<b>Total:</b>	<b>31</b>
				<b>1 377·54</b>
<i>Churn—</i>				
Surrey .. .. .	Tin investigation .. .	Keystone 55	17	369·00
Branxholm .. .. .	Tin investigation .. .	Keystone 55	15	595·00
Tomahawk .. .. .	Water investigation .. .	Keystone 55	7	89·34
Ulverstone .. .. .	Site investigation .. .	Keystone 55	5	161·00
			<b>Total:</b>	<b>44</b>
				<b>1 214·34</b>

## SUMMARY OF DRILLING

<i>Drill type</i>	<i>No. of drills operating</i>	<i>Depth drilled (m)</i>
Diamond .. .. .	5	2 464·14
Diamond/Auger .. .	1	989·56
Rotary/Diamond .. .	1	840·37
Rotary/Percussion .. .	2	1 377·54
Churn .. .. .	1	1 214·34
	<b>10</b>	<b>6 885·95</b>

## NORTH-WESTERN DISTRICT

W. R. Tindal, A.W.A.S.M., M.Aust.I.M.M.

E. C. Leyland, A.W.A.S.M., A.M.Aust.I.M.M.

R. C. Thomas, A.C.S.M., M.Aust.I.M.M., Burnie

## EXPLORATION

*The Mount Lyell Mining and Railway Co. Ltd*

Consolidated Mining Lease. Thirty diamond drill holes were completed during the year for a drilling advance of 3 213 m. Of this drilling, twenty-five holes (2 643 m) were for exploration and five holes (570 m) for mine service.

E.L. 9/66, Mount Tyndall Area. Detailed geological mapping and soil sampling programs were completed in the Red Hills-Gooseneck and Henty Fault Zone areas, to aid in selection of geophysical anomalous zones for diamond drilling, scheduled for commencement at the beginning of 1977. Reconnaissance mapping was also conducted in the White Spur area prior to the establishment of the geophysical grid comprising approximately 49 000 m of traverse lines. The gradient array induced polarisation survey of this grid was completed in December 1976. A similar geophysical survey was completed over the southern end of the Gooseneck area, following the establishment of a small grid (totalling 2 500 m of traverse lines) in order to define the southern extension of the black shale-pyroclastic horizon, which flanks the massive felsic lava body on Red Hills.

E.L. 10/69, Dora-Huxley Area. Reconnaissance geological mapping and soil sampling programs were completed in the Roaring Meg Creek-Miner's State Ridge and Sedgwick-Beatrice areas. Subsequently a geophysical grid was established on the southern flank of Mount Sedgwick (Beatrice grid, totalling approximately 49 000 m of traverse lines), in preparation for a gradient array induced polarisation survey to commence in January 1977. A short vehicle access track (2 km) was established from existing roads in the Comstock Valley to facilitate access into the grid area.

E.L. 41/71, Henty-Yolande Area. Geochemical soil sampling surveys were completed on the Basin Lake and West Sedgwick (south-west extension) grids, indicating scattered areas of anomalous values for copper, lead and zinc. Gradient array and pole-dipole induced polarisation surveys were conducted on the West Sedgwick grid, involving the coverage of approximately 4 500 m of traverse lines. Subsequently an additional 3 300 m of traverse lines were established preparatory for further geophysical surveys, directed towards outlining the northern extensions of the previously indicated anomalous zones.

S.P.L. 129, Trial Harbour Area. Traverse line cutting (totalling approximately 20 km) was completed in order to extend the Area D grid (in the vicinity of Kelvin and Mayne's workings), and to commence the establishment of the East Heemskirk grid. Soil sampling programs were conducted in these areas and on the South Heemskirk grid and additional detailed ground magnetic coverage was completed in Area D.

E.L. 21/76, Jukes-Darwin Area. Following the granting of E.L. 21/76, work has concentrated on the evaluation of all available data from previously conducted projects in the area, in order to establish future exploration programmes.

The exploration expenditure for the respective areas was:—

	\$
Consolidated Mining Lease ....	155 544
E.L. 9/66 ....	42 443
E.L. 10/69 ..	33 129
E.L. 41/71 ..	18 624
S.P.L. 129 ..	12 206
E.L. 21/76 ..	2 364
	264 310

#### *Electrolytic Zinc Co. of Australasia Ltd*

During 1976 the major exploration activity was north of Rosebery, mainly in the Bulgobac E.L. 12/72, which is now a joint venture with Getty Oil, and to a lesser extent in a regional mapping project from Rosebery to Que River. This latter project is still in progress.

E.L. 1/62, Mt Black. Only limited field work has been undertaken this year, but work is proceeding on plotting all available information onto the new standard plans (10 000, 5 000 and 1 000 scale series). Work on the Cutty Sark and Koonya prospects has been postponed until early 1977.

E.L. 12/72, Bulgobac. A reconnaissance gradient array I.P. survey, soil geochemistry and geological mapping were undertaken in the Boco area. A diamond drill hole was in progress at the end of the year.

Access to the northern area has proved a problem and only reconnaissance mapping has been completed to date. An extensive program is planned for the next year.

S.P.L. 3, Tullah. Only limited field work was undertaken in the Tullah lease. The Murchison mine was investigated for its open-cut potential but the results indicated that this project was not feasible.

E.L. 2/76, Loongana. This licence is held in a joint venture with Geopeko, with Geopeko the manager. Work undertaken this year was geological mapping and stream sediment geochemistry. Three prospects have been selected for follow-up work.

Regional Mapping, Rosebery-Que River. In conjunction with Comstaff Pty Ltd, a regional mapping project of the Mt Reid Volcanics (and their equivalents) north of Rosebery is being undertaken. Work to date has centred on mapping of existing access plus the extensive access being developed by the Hydro-Electric Commission.

#### *Minops Pty Ltd*

1M/75. Geological mapping and channel sampling of the Razorback Shear south of the present open-cut was carried out along the Lewis Ridge. The results of this sampling indicate that the mineralisation is worthy of further detailed investigation.

63M/75. Geological mapping and drainage sampling for tin mineralisation was undertaken but only trace amounts of tin were realised. With the consolidation of 63M/75 with 1M/75 the exploration emphasis for 1977 will be directed towards the testing of the geophysical anomalies within 1M/75.

62M/75. Reconnaissance inspections coupled with some sampling of outcrops were made during the year.

#### EXPLOSIVES

Four 200 x 20 mm plugs of A.N.60 exploded in a draw-point on the 195 m level of the Prince Lyell mine when another large rock for 'popping' was dumped from a front-end loader too close to a blister blast positioned in a cavity between two large rocks. No serious damage to equipment occurred and of the three men in close proximity, only the driver of the unit suffered minor damage to his hearing. Following this incident the whole secondary blasting procedure at Mount Lyell was changed to prevent a similar occurrence.

When a small charge was fired in a hole drilled to 200 mm in a large rock which would not enter the crusher jaws at No. 4 crushing station, Mount Lyell, a large explosion took place. Fortunately the major effect of the blast was horizontal and went out through the side wall of the building. Since the crusher had been left running and the rock pieces had been crushed before the men deemed it safe to return, the cause was not conclusively established. It is considered that an unexploded charge was present in the remnants of one of the originally drilled holes. Inspection for butts in large rocks as they travel along the apron feeder, as previously requested, is now being undertaken.

A miner, S. L. Maney, bored into a butt in a rise at the Cleveland mine on 19 November 1976. The company flew Mr Maney directly to the Royal Eye Hospital, Melbourne and following operations and treatment the damage to both eyes can now be assessed as minor.

#### NORTH-EASTERN DISTRICT

##### **R. A. A. Seymour, B.Sc., M.I.M.M., A.M.Aust.I.M.M., Launceston**

The main developments in the district were the building of two new furnaces at the Tasmanian Electro-Metallurgical Co. Pty Ltd and the start of building a new modern brickworks at Longford by Clifton Brick (Tas.) Pty Ltd.

APPM Ltd's clay mine and treatment plant settled into operation supplying kaolin for the company's paper mills.

One new small tin producer came into steady production during the early part of the year. Interest in tin picked up in the last few months with the rise in the price. The higher price has enabled Aberfoyle Tin N.L. to look at marginal ore reserves and plan ahead for a few more years at Rossarden.

The advent of PVC pipes made the production of clay pipe at Humes Ltd factory uneconomic and the kilns were shut down.

Complaints from local residents were received about blasting in quarries in Launceston and Beaconsfield. These were investigated but no evidence of property damage caused by blasting vibration was found. Seismic recordings of blast vibrations at Beaconsfield were taken by the Special Duties Inspector from Hobart.

Advice was given on procedures, etc., to various applicants for leases and licences to operate.

Water sampling of streams and effluents was carried out periodically in parts of the South Esk River and Ringarooma River catchments affected by mining.

The Inspector of Explosives ensured that necessary safety precautions were taken after the grounding of the tanker 'Bethioua' in the Tamar, and during subsequent operations to empty the tanker and carry out temporary repairs.

The Inspector of Mines visited King Island to inspect mining operations there and also attended a course held at Rosebery on the non-destructive testing of wire ropes conducted by Dr H. E. J. Symes.

## SOUTHERN DISTRICT

**R. Billingham, B.Sc., A.R.S.M., A.M.Aust.I.M.M., Hobart**

### STRATHGORDON

Pearson Bridge Pty Ltd experienced serious problems in driving the tailrace tunnel for the Hydro-Electric Commission at the Gordon River dam site. Bad ground conditions were encountered on several occasions which required temporary reduction in size of the 10 m diameter tunnel and installation of steel sets. By the end of the year, 350 m still remained to be developed.

### GENERAL

Investigations were made into several minor blasting nuisances following complaints from the public and procedures were modified where necessary. Inspections were made of numerous quarries, gravel pits and small lease areas used for winning construction materials.

### EXPLORATION

#### *Geopeko Limited*

Field exploration activity on King Island was concentrated around the perimeter of the Grassy Granite near the producing Dolphin mine on E.L. 15/66. Work was oriented towards detailed geological studies of the area prior to deep diamond drilling. 1 822 m of auger drilling and 1 030 m of shallow core drilling were completed using the company's Jacro drill. Detailed geophysical surveys were conducted and a detailed photogeological interpretation of the area was undertaken by a company specialising in such work.

Preliminary field exploration was commenced on E.Ls 2/76, 10/74 and 9/74 on mainland Tasmania and 807.5 m of auger drilling were completed.

On the production leases of King Island Scheelite, 2 254 m of core drilling was completed at Bold Head mine and 1 033 m at Dolphin mine. Both Geopeko and contract diamond drillers were used.

## Report of the Mount Cameron Water Race Board for the year ended 31 December 1976

THE MINISTER FOR RESOURCES AND ENERGY

We submit the report of the Mount Cameron Water Race Board for the year ended 31 December 1976.

The loss of \$18 326 was slightly less than the deficit of \$18 767 for 1975. At present there are two operators obtaining water for tin mining purposes which should result in higher revenue for 1977. However, the problem exists as to how to increase the revenue sufficiently to offset the continuing losses. Several alternatives have been investigated but a solution has not been found to date.

The race system generally is in good condition but constant attention to maintenance is necessary in order to meet water supply commitments. Replacement of one slip area was necessary during the year and improved methods of race cleaning have been examined.

The normal staff of three persons has been reduced to two permanent officers and one part-time officer. The cost of workers' compensation insurance is being administered through the Government scheme which has effected a considerable saving on premiums. The Board now meets loss of wages and medical expenses only. It is fortunate that there have been no claims for compensation for many years.

The Board expects some improvement in its finances but this is dependent upon efforts to contain costs and to improve its current revenue.

J. G. SYMONS, Chairman  
H. K. TURNER, Member  
V. WOOD, Member

### MOUNT CAMERON WATER RACE SUSPENSE ACCOUNT

STATEMENT OF RECEIPTS AND PAYMENTS FOR THE YEAR ENDED 31 DECEMBER 1976

<i>Receipts</i>	\$	<i>Payments</i>	\$
Sale of water—		Salaries and wages, including pay-roll tax	23 680·20
Fixed on cash sale .....	6 183·50	Insurance .....	365·86
Royalty scale .....	.....	Car allowance .....	150·00
Domestic use .....	248·00	Maintenance materials .....	475·49
Balance (loss) .....	18 325·75	Miscellaneous .....	85·70
	<u>\$24 757·25</u>		<u>\$24 757·25</u>

### MOUNT CAMERON WATER RACE

STATISTICS FOR YEAR ENDED 31 DECEMBER 1976

<i>Registered Rainfall</i>		<i>Production</i>	<i>Tonnes</i>
Great Musselroe .....	873·79 mm	Tin oxide produced—	
Little Musselroe .....	881·50 mm	Fixed scale .....	19·00
		Royalty scale .....	.....
		<i>Employment</i>	
		Average per week—	
		Fixed scale .....	9
		Royalty scale .....	.....
			—
			9
			—
	<u>1 204</u>		

## Report of the Ringarooma and Cascade Water Board for the year ended 31 December 1976

THE MINISTER FOR RESOURCES AND ENERGY

We submit the report of the Ringarooma and Cascade Water Board for the year ended 31 December 1976.

The Cascade dam is in good order and has been kept full but the Mt Paris dam has been emptied. No developments occurred in proposals to use the water system for irrigation but discussions are in progress which might lead to the re-opening of the Briseis tin mine at Derby which originally depended upon the water system for water supplies for its tin mining operations.

The loss of \$1 418 consists of interest on the capital cost of the system and caretaking charges on the Cascade dam.

J. G. SYMONS, Chairman  
H. K. TURNER, Member  
V. WOOD, Member

### RINGAROOMA AND CASCADE (WATER) SUSPENSE ACCOUNT

STATEMENT OF RECEIPTS AND PAYMENTS FOR THE YEAR ENDED 31 DECEMBER 1976

<i>Receipts</i>	\$	<i>Payments</i>	\$
Balance (loss)    ... .. .	1 417·68	Interest on capital cost    ... .. .	1 267·68
		Caretaking    ... .. .	150·00
	\$1 417·68		\$1 417·68