DEPARTMENT OF NATIONAL RESOURCES

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Record 1977/47

1977

Summary of Activities

Mineral Resources Branch

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INTRODUCTION

During 1977 the work of the Branch continued to be directed towards two main objectives, viz. monitoring, researching, and dissemination of information on the mineral industry, and the assessment of mineral resources at a national level.

The Branch has been subjected to an increasing work load in achieving the first objective. During 1977 officers of the Branch continued to provide expert information and specialist advice to the Department and other Government departments and agencies mainly as a background to policy formulation. Branch officers acted as technical advisers to inter-departmental committees and provided background briefing for international commodity organisations involved in tin, lead-zinc, copper, iron ore, bauxite, and tungsten. The Branch continued to provide the private sector with information and technical advice on particular aspects of the mineral industry or on specific mineral commodities. Timeliness of Branch publications was improved and subject matter extended, and both formal and informal expressions of appreciation were received from many users.

While much of the information required from the Branch was of an ad hoc nature and many requests for information could be handled without a great deal of time-consuming research, some demands were in fact projects in their own right and as such involved a major input of specialist manpower, an input that was difficult to provide in view of the many deadlines which Branch officers are constantly required to meet. In particular during the period May to November the Branch expended 84 man-days in the preparation of material for the National Energy Advisory Committee (NEAC). If such time-consuming projects are to be given their required share of attention, under the current organisation certain sections of the continuing work of the Branch must suffer. This highlights the need for a small, qualified, competent group within the Branch, sheltered to some extent from continuing 'routine' duties, which has the time to concentrate on major projects, and the experience, ability, and expertise to liaise at an intra and inter-branch level with other officers of BMR and to finalise and produce a report in keeping with the high standards expected of a geoscientific organisation.

During 1977 the Mineral Resources Branch continued to provide a lecturer for the Industrial Mobilisation Course conducted by the Department of Defence in the various capital cities. Branch officers presented two papers at the 48th ANZAAS Congress held in Melbourne in late September, and two papers at the Sixth BMR Symposium held in Canberra in May.

As a contribution to foreign aid, the Branch was directly involved in the planning of and participation in the Canberra section of the International Training Course in Minerals Exploration in September conducted by The Australian Development Assistance Bureau (ADAB), Department of Foreign Affairs. Mining engineers of the Branch advised ADAB on projects in Bangladesh, Thailand, and Burma.

The Chief Mineral Economist was associated with the Scientific Committee on Antarctic Research (SCAR) and the

Australian National Committee for Antarctic Research (ANCAR). In February 1977 he attended a meeting in Dallas, USA of the SCAR Group of Specialists on the effect of mineral exploration and exploitation on Antarctic environment, and in late August he attended a Symposium of Antarctic Geology and Geophysics, and a SCAR Geology Working Group meeting at Madison, USA.

Considerable progress was made during 1977 in the continuing assessment of Australia's mineral resources. As part of their mineral commodity studies, mineral economists of the Branch continued to gather data on, and to assess identified mineral resources; national totals are brought up-to-date, revised, and published annually in the March Quarterly of the Australian Mineral Industry Review. Addition of a geostatistician to the Branch in April 1977 has substantially improved the Branch's ability to assess inferred resources and has laid the groundwork for the development of geostatistical models for estimating potential resources. The findings and recommendations of an inter-Branch committee established to review the methodology of mineral resource assessment and to recommend how BMR should proceed towards achieving the assessment of mineral resources on a national scale, released in the latter part of 1976 (Record 1976/74), have done much to formulate BMR's approach to this difficult exercise.

During the latter half of the year officers of the Branch made both written and oral submissions to the BMR Review Team. The exercise did much to clarify thinking on attitudes towards the role of the Mineral Resources Branch and its contribution to the development of the domestic mining industry, and its relation to other Branches of BMR and Departmental Divisions. The report of the Review Team is expected by the end of the year and should identify the functions of BMR and pave the way for reorganisation of the BMR in general and of the Mineral Resources Branch in particular.

While staff restraints were maintained in line with Government policy throughout the year, there now appears to be some light at the end of the tunnel. The position of Science 3 (Mineral Economist) vacant since mid-1976 has been advertised, and the position of Engineer Class 3 should be advertised before the end of the year. The filling of these two positions will do much to restore the Branch to operating strength.

MINERAL ECONOMICS SECTION

INTRODUCTION

The Section's two broad and inter-related functions are to obtain information on and maintain a continuing review of all aspects of the mineral industry and to assess Australia's mineral reserves and resources. This enables the Section to provide information about the industry, on request, to government, the industry itself, and the public, as well as publish information at regular intervals.

The work concentrates on the Australian industry and on Australia's mineral resources, but in the world context because of the industry's international character, Australia's dependence on overseas markets for its mineral products, and its importance in the world as a supplier of several mineral commodities. The Section's work follows two main lines, commodity studies and special studies.

Commodity studies are ongoing reviews of all aspects of mineral commodities, from exploration to consumption and including production, processing, trade, and marketing. Such studies are essential to the Section's functions because they provide the information base on which the Section draws to carry out its work and to satisfy the many and varied enquiries put to it.

Special investigations focus on details of particular aspects of the industry, such as mineral exploration, or the closer examination of some particular aspect of a mineral commodity, such as its processing technology. Special studies are also directed along two lines: work which is programmed by the Section, and unprogrammed work to enable it to respond to specific requests for information and advice, particularly from its own Department of National Resources, but also agencies such as the Industries Assistance Commission, the Australian Industries Development Corporation and, more recently, the National Energy Advisory Committee (NEAC).

Of the work that is programmed, studies of the methodology of assessing mineral resources is becoming increasingly important.

The Section prepares the Australian Mineral Industry Annual Review and the Australian Mineral Industry Quarterly Review; details of publications and papers published in Quarterly Reviews and elsewhere are listed separately.

Much of the Section's work depends on statistical data on production and trade and it therefore maintains a close working relationship with the Australian Bureau of Statistics (ABS), through the Statistical Officer (Mining), an ABS Officer outposted to the Section. By arrangement with ABS, the Section also carries out some small statistical collections. These are issued by BMR as bulletins on mineral sands, copper, lead and zinc, tin, and sulphur, sulphuric acid and superphosphate.

STAFF

A new position, Science 1 (Geologist), was allocated to the Section to enhance its specialist capacity for resource assessment-type work. The position was filled on 4 April by J. Cottle, a graduate in applied geology with undergraduate background and postgraduate research experience in applied mathematics, statistics, and computing.

Staffing at 1 November 1977 was:

Science 5 (mineral economist)	1	(I. McLeod)
Science 4 (mineral economist)	2	(B. Elliott, L. Ranford)
Science 3 (mineral economist)	1	(A. Gourlay)
Science 2 (mineral economist)	4	(A. Driessen, G. Hillier, K. Patterson, R. Pratt)
Science 1 (geologist)	2	(J. Cottle, R. Hughes)
Clerk Class 4	2	(G. Mortimer, S. Westerhuis)
Clerk Class 2/3	1	(S. Styles)
Clerical Assistant Grade 4	1	(P. Black)

The Science 3 (mineral economist) position vacated by P. Roberts in August 1976, was temporarily occupied by A. Driessen; R.J. Hughes carried out some of the duties of the resulting vacant Class 2 position.

A Clerk Class 8 continues to be outposted to the Section from ABS, as Statistical Officer (Mining). Mr L. Wright replaced Mr I. Haine in the position from May 1977.

Mr Collin, formerly Senior Project Officer in the Division of Northern Development of the Department of National Resources, is temporarily attached to the Section as a supernumerary following the abolition of the Division.

BASIC COMMODITY STUDIES

The objective of basic commodity studies is to maintain an up-to-date information base on all sections of the mineral industry from exploration to final consumption and covering all intermediate activities such as mining, processing, transportation, trade, and marketing. The wide coverage allows realistic assessments to be made of the effect of any change in one sector of the industry on the performance of the other sectors; the effects of fluctuating prices and changing market opportunities, for example, on mineral exploration or investment in new and existing projects can be very marked. Although the emphasis is on monitoring the domestic industry, the work is necessarily expanded to cover world-wide developments because of the industry's international character and Australia's prominence as a supplier or potential supplier of many minerals - particularly bauxite, mineral sands, coal, iron ore, lead, uranium, and zinc - to world markets.

A great portion of the industrial information with which the Section deals comes to it from both industry and government in Australia and overseas, and by way of many trade and technical

journals, newsletters, and newspapers. The Section maintains a specialised library, outposted from BMR's main library, and indexes and references its own material. Some references, particularly those pertaining to the Australian mineral industry, are also forwarded as input to Australian Earth Sciences Information Systems (AESIS).

As another part of basic studies, commodity specialists also maintain close personal contact with the numerous companies and organisations comprising the industry, and the Section gratefully acknowledges the assistance, information, and good-will proffered by the industry through informal discussion and visits by commodity specialists to mines and plants. Helpful information is often also exchanged with visitors to the Section, of which there were about 150 in the 12 months to 1 November 1977. Commodity specialists also attend industry symposia and conferences each year, as well as technical courses, to keep abreast of progress and latest developments in the industry. On occasions commodity specialists deliver papers at such symposia; details of attendances are listed separately.

The Section's information base meets various needs, each by way of providing information, but by different channels. As an on-going function the Section provides information through its regular publications, the Australian Mineral Industry Annual Review and Australian Mineral Industry Quarterly Review. The Section also compiles and distributes quarterly bulletins on mineral sands, copper, lead and zinc, tin, an annual bulletin on sulphur, sulphuric acid and superphosphate statistics and, for the first time in 1977, a series of Preliminary Annual Summaries providing timely but preliminary statistics and commentary on developments concerning the more important commodities.

The information base also satisfies the many casual enquiries received by the Section from governments, the industry, and the general public. Many queries are quickly answered, but others require more preparation.

Much of the Section's accumulated experience is also directed to the preparation of papers, briefing notes, and other material which are needed for various commissions of enquiry, Australian and international commodity groups, and other organisations such as United Nations agencies; these include the International Tin Council, International Lead and Zinc Study Group, International Bauxite Association, UNCTAD Export Group on Copper, and UNCTAD Committee on Tungsten. Contributions were also made during the year to UNCTAD papers on iron ore and manganese and to an Intergovernmental Council of Copper Exporting Countries (CIPEC) 10th Anniversary Quarterly Review. A particularly large contribution was made to the National Energy Advisory Committee (NEAC), details of which are reported in the following section. In the 12 months to 1 November 1977, commodity specialists spent about 400 man-days (18 percent of the total man-days of staffed positions - excluding leave) on responding to the various requests for information from government, the industry and the public; of this about 85 man-days were taken up with NEAC work, all of it in the period May to November.

SPECIAL STUDIES

The Section's capactity to carry out programmed special investigations is limited by its commitment to respond to the numerous enquiries it receives from government and industry which, by their nature, take priority over longer-term projects. In the year under review information on energy resources was particularly sought, and the Section made a substantial contribution to NEAC's discussion paper on energy, as well as participating in NEAC Standing Group, No. 2 on resources, trade, and forecasting.

Over recent years programmed studies have been mainly in the field of resource assessment, both in assessing Australia's identified mineral resources and in studying the various methodologies which might be used for this work. To date, work has concentrated on known (identified) resources and the results of this continuing work are published annually in the first (March) quarter edition of the Australian Mineral Industry Quarterly Review. The field of estimating undiscovered resources is comparatively new and at present beyond the Section's capacity. However the Section has reviewed some methodologies in this still-developing field and is continuing to monitor developments. The Section's current work in the theory of resource assessment is in developing a mathematically sound method for calculating and expressing national estimates of inferred mineral resources, that is resources for which quantitative estimates are based largely on knowledge of the geological character of the deposit and for which there may be only a few, if indeed any, samples or measurements. This work will eventually lead to the development of geomathematical models for assessing hypothetical and speculative resources (undiscovered resources).

Detailed studies of Australia's identified tungsten and asbestos resources are in progress; a study of Australia's identified antimony resources was completed last year and published in the Australian Mineral Industry Quarterly Review 28 (2), but an assessment of domestic identified copper resources begun last year has been suspended because of difficulties encountered in obtaining all the information required.

The Section's contribution to NEAC, made jointly with other Branches in BMR, was also largely concerned with reserves and resources, but of non-renewable energy-source materials (petroleum, coal, uranium, thorium, and oil shale).

NEAC was established in March 1977 to advise the Federal Government on energy matters and to assist in formulating and developing a national energy policy. The Committee of eighteen, appointed for their capacity to make personal contributions to the work of the Committee as distinct from playing a representative role, is expected to act as a link between the Federal Government and all other bodies working in the energy field - State Government Departments and authorities, private companies, university research workers, and learned societies. The Mineral Economics Section compiled and provided detailed information on Australia's resources of uranium and thorium, black coal and brown coal, and assessed the adequacy of available data and discussed the potential of further discovery.

The Section's commitment also extended to providing BMR's liaison to three NEAC Standing Groups; this was undertaken by L. Ranford, B. Elliott, and R. Pratt as liaison officers to NEAC's Standing Groups 2, 3, and 1, respectively.

OTHER WORK

The growing amount of information handled by the Section and the obvious need for quick and effective access to it is beginning to create a need for better methods of handling and presenting this information. During the year a computer program was implemented to prepare graphs of metal prices. Next year's work program proposes to study the feasibility of adopting a unified approach, compatible with possible computer processing, for classifying, recording, and retrieving the diverse information about the various commodities, presently managed by the individual specialists. Microfilming of company reports was also begun during the year and this work is continuing.

Late in 1976 the Scientific Committee on Antarctic Research, an international scientific body, set up a Group of Specialists on the Environmental Impact Assessment of Mineral Exploration/Exploitation in Antarctic (EAMREA) so that it could respond to a request for advice on this subject from the Antarctic Treaty Nations. Mr I. McLeod was appointed a member of EAMREA by SCAR. He attended a meeting of the Group in Dallas, USA, in February and assisted in preparing the Group's report, which was submitted to governments in August.

Several papers discussing the work of the Section were prepared during the year for the BMR Review Committee.

SYMPOSIA, CONFERENCES, COURSES AND LECTURES

Symposia, conferences and courses attended by members of the Section during the year included:

A.I.M.M. Annual Conference and A.M.I.R.A. Technical Meeting, Hobart (I. McLeod).

N.S.W. Mines Department, Annual Symposium, Sydney (K. Patterson).

A.M.F. Course on 'Application of statistics and geostatistics in ore evaluation in South Africa', Adelaide (J. Cottle).

A.M.F. Course on 'Mineral commodity studies', Adelaide (B. Elliott).

Institute of Engineers Energy Conference, Canberra (K. Patterson).

Symposium on Antarctic Geology and Geophysics and SCAR Working Group Meeting, Madison, USA (I. McLeod).

Prof. Pretorius' lecture series 'A Strategy for mineral exploration in South Africa', Sydney (B. Elliott).

ANZAAS Conference, Melbourne (L. Ranford).

University of New England course on coal and coal geology, Armidale (R. Pratt).

Australian National University, steel industry symposium, Canberra (R. Pratt).

NUEXCO Uranium Seminar, Sydney (L. Ranford).

Prof. Stermole's course on 'Economic evaluation and investment decision methods', Sydney (A. Driessen).

Lectures and papers delivered, and addresses given by members of the Section include:

'Mineral resource assessment', at BMR Symposium, Canberra (L. Ranford)

'Australian mineral resources in a world perspective', at ANU Canberra (L. Ranford).

'Aspects of geomathematics applied to mineral resource assessment', A.I.M. Canberra Branch (J. Cottle).

'The Australian mineral sands mining industry', ANZAAS, Melbourne (J. Ward).

'Australia's mineral resources', ANZAAS, Melbourne (L. Ranford).

Various members of the Section also delivered lectures to the International Training Course in mineral exploration, for developing countries. L. Ranford addressed the Parliamentary Back Bencher's Committee on uranium resources.

PUBLICATIONS

Released in 1976

Australian Mineral Industry 1975 Review.

Australian Mineral Industry Quarterly Review, Volume 29, Nos 1, 2, and 3 and 4.

Record 77/3, Mineral Resources of Australia, 1976.

Papers published were:

PRATT, R., 1977 - Iron ore in Australia 1965 to 1975 - a decade of growth. Bureau of Mineral Resources, Australia, Australian Mineral Industry Quarterly Review, 29(1), 10-27.

ROBERTS, P.J. 1977 - Mineral exploration in Australia 1965 to 1973. Bureau of Mineral Resources, Australia, Australian Mineral Industry Quarterly Review, 29(2), 48-59.

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS, 1977 - Australian mineral reserves and resources, 1976. Bureau of Mineral Resources, Australia, Australian Mineral Industry Quarterly Review, 29 (3 and 4), 86-91.

WARD, J. 1977 - The Australian titaniferous minerals industry and its resources. Metallurgical Society of A.I.M.E., 1, 457-79.

WARD, J. 1977 - The Australian mineral sands mining industry. 48th ANZAAS, Abstracts 1977, 1, 74.

RANFORD, L.C., 1977 - Australia's mineral resources. 48th ANZAAS, Abstracts 1977, 1, 80.

In Press

ELLIOTT, B.G. - Copper mining in Australia 1953-75 and the future sufficiency of reserves. Bureau of Mineral Resources, Australia, Australian Mineral Industry Quarterly Review, 30(1).

DRIESSEN, A. - The Australian sulphur industry 1951-76 Bureau of Mineral Resources, Australian Mineral Industry Quarterly Review 30(2).

Australian Mineral Industry Quarterly Review Volume 30 Nos. 1 and 2.

In Preparation

Australian Mineral Industry 1976 Annual Review.

Australian Mineral Industry Quarterly Review, Volume 30(3).

HILLIER, G. - Assessment of Australian tungsten resources.

COLLIN, R. - Progress and potential of Australian mineral processing.

MINING ENGINEERING SECTION

The Mining Engineering Section is a mining research and advisory section within the Mineral Resources Branch. The mining engineers provide information and advice to Government on mining matters, for example on mine feasibility and profitability, methods of mining, recommendations for development programs, and requests for mining assistance submitted to the Government. The section also provides assistance to the mineral resource assessment groups of BMR in their compilation of economic and sub-economic mineral resources by calculating data on capital and operating costs of mining projects. In co-operation with the State Mines Departments the Section participates in the compilation of a standard mine-operating code of practice. A schedule of State mining royalties and Australian Government mining tax provisions is kept up-to-date, together with State mining legislation amendments. In 1977 the Section extended the use of the computer for the calculation of mine feasibility studies, and initiated a mining data bank on a computerised storage and retrieval system.

STAFF

Occupied Positions (as at 1 October 1977)

1 Engineer Class 5
1 Engineer Class 3

ACTIVITIES

Conference of Chief Inspectors of Mines

This conference was not held in 1977; however, changes were made in the basic code of Mine Safety as a result of the 1976 conference.

Visits to Mines

Mr Timoney visited the underground workings of the Mount Lyell, Renison, Rosebery, and Cleveland mines of Tasmania, to observe the different stoping techniques and methods of wall support. Visits such as these keep the section up-to-date with the application of new stoping techniques, and methods of wall support. This enables the mining engineer to assess the ratio of recoverable ore reserves from the mining method, together with the dilution factor. Mr Erskine visited the Utah Blackwater open-pit strip coal mine and B.H.P.'s Cook underground coal mine in the same area. He also visited the new Telfer open-pit gold mine and the Mount Whaleback, Mount Tom Price and Paraburdoo iron ore mines. As with all large projects both successes and failures were evident on these visits. Utah's Blackwater pit was having slope stability problems; Cook underground colliery was undergoing a shortage of skilled staff in this period of rapid expansion of coal mining; Telfer gold mine showed itself to be a well-executed operation, especially considering that it is the most remote mine in Australia - a major feature is its 5000 km computer link with its Melbourne office. The Telfer venture could become highly successful, but the earth and rock-moving contractors to the operation have recently gone into receivership, demonstrating the tight costing and difficult operating conditions at such a remote location. At the two large iron ore mines visited the most

obvious difficulties were those associated with communications between management and workers in such large and intricately co-ordinated operations.

The Googong Dam Project

E. Timoney continued to act as mining advisor to the project executive committee throughout the year.

GENERAL ASSISTANCE TO GOVERNMENT DEPARTMENTS

Department of the Northern Territory

Mr Timoney co-operated with officers of the Department of the Northern Territory and visited Groote Eylandt and Bell Bay, Tasmania to assist in a joint report on the fulfilment of an agreement to grant the Eastern leases on Groote Eylandt. The report was completed and submitted to Assistant Secretary, Mines Branch, Darwin for his assessment.

Australian Development Assistance Bureau

Considerable office work (studying and commenting on consultants' reports) was continued by Mr Erskine for various ADAB projects (Bangladesh beach sands, Thailand lignite, and Burma cassiterite and beach sands). The Bangladesh project has progressed to funding by the Department of Overseas Trade of a feasibility study now almost completed by AMDEL. The Thailand lignite project has produced worthwhile results from engineering geology consultants (pit-slope stability), geophysics consultants (gravity and seismic test runs successfully delineate the lignite-bearing horizon), and mine planning consultants. The planning of Thailand's new open-pit coal mine at Wailek will be done in Australia by a mining engineer from Thailand who will work under the supervision of the Victorian State Electricity Commission engineers.

The Burmese mineral reconnaissance discovered no economic mineralisation on the one brief traverse carried out in the two areas, although each area is highly prospective, one for beach sands, and the other for tin.

GEOSTATISTICS FOR ORE RESERVE ESTIMATION

Following preliminary work during the past year by Mr Erskine in an attempt to adapt modern geostatistical theory for use in our intermittent requirement for ore reserve estimation, the difficulties are now being resolved following the recruitment of Mr J. Cottle to the Mineral Economics Section. Mr Cottle plans to have an experimental program ready for testing by about March 1978. This program will then be used by the Mining Engineering Section to evaluate ore reserves from raw data supplied by the mining companies.

MINING COST ASSESSMENT

Mr Timoney developed a broad computer program of economic open-pit copper prospects of various grades and tonnage. Programs were also run outlining preliminary studies of a copper-silver-lead-zinc project, a copper-uranium project, and a silver-lead-zinc project. The study outlines capital

costs, operating costs, smelting cost, taxation royalty, and discounted rate of return. Because of lack of precise company costs the system is of necessity based on a knowledge of mining techniques associated with minimum published information and the application of some broad figures.

MINING COST ANALYSIS PROJECT (MICAP)

A major computer program (to run on the Customs I.C.L. computer) is being developed by Mr Erskine of the Mining Engineering Section and Mr E. Smith of the A.D.P. Section and is now about half-complete. The punched cards for the first half have been sent to the Customs computer for a test run. The program, in 'Prosper' language, is being written by Mr E. Smith with intermittent assistance from an International Computer Ltd consultant.

SYMPOSIA, CONFERENCES, COURSES, AND LECTURES

Mr Erskine attended the following:

- Annual seminar conducted by the NSW Department of Mines, May in Sydney.
- 'Application of Computers to Mining' (APCOM 77), July in Brisbane
- Seminar on 'Mining Taxation' organised by the Australian National University, in Canberra.
- Seminar on 'Mining Equipment and Systems' organised by Caterpillar of Australia Ltd, October in Sydney.

He presented a paper 'The effect of inflation and cost escalation on ore reserves' at the 1977 BMR Symposium. He lectured on 'Feasibility studies and mining costs' at the International Training Course in Mineral Exploration and gave talks on 'Mine Fill' and 'Gold' within BMR.

VISITORS AND ENQUIRIES

During the year mining engineers received many visitors and handled enquiries from mining companies, individuals, Government Departments, Universities, and other agencies on a wide variety of subjects associated with mining techniques, mineral resources, underground support, and mining equipment.

The diversity of enquiries is illustrated by the selective examples listed below:

- Feasibility of a local invention to lift broken rocks from underground workings.
- The services provided by mining consultants.
- Check on feasibility study for a bauxite mining operation in the Amazon valley.
- Feasibility study of capital and operating costs for a large iron-ore project.

- Development of the underlying theory for analysis of the incremental waste-to-ore ratio of an open-pit development.
- Detailed breakdown of inputs and outputs of plant and machinery in Australian mining operations.
- Equipment and methods of detecting carbon monoxide.
- Advice on State mining legislation regarding conditions of:
  (1) application for prospecting areas
  (2) application for gold and mineral leases
  (3) special mining leases.
- Advice on State environmental control on mining.
- Advice on State customs treatment plants, i.e. State batteries.
- Advice on structure of Northern Territory small-scale mining and conditions of Government assistance.