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DEPARTMENT OF
MINERALS AND ENERGY



BUREAU OF MINERAL RESOURCES,
GEOLOGY AND GEOPHYSICS

Record 1973/189



MINERAL RESOURCES BRANCH
ANNUAL SUMMARY OF ACTIVITIES
1973

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CONTENTS

	<u>Page</u>
<u>HEADQUARTERS</u>	
<u>MINING ENGINEERING SECTION</u>	
Staff	3
Gold Mining	3
Assessment of Tin Resources	3
Assessment of Iron Resources	3
Estimation of Uranium Reserves	3
Future of Broken Hill	3
Wire Rope Research	4
Legislation	4
Code of Radiological Protection in Radioactive Mining and Milling	4
Conference of Chief Inspectors of Mines	4
Standards Association of Australia	4
Interdepartmental Committee on Foreign Takeovers	4
Other Work	4
<u>MINERAL ECONOMICS SECTION</u>	5
Staff	5
Function of the Section	5
Commodity Studies	6
Australia	
World	
Basic Investigations	
General	9
Lectures and Courses	11
Visitors	11
<u>PETROLEUM TECHNOLOGY SECTION</u>	12
Staff	12
Technical and Scientific Visits, Conferences Etc.,	13
Petroleum Legislation	14
Information and Statistics	15
Petroleum Economics	15
Petroleum and Reservoir Engineering	16
Inventory of Petroleum Reserves	
Reserves Estimation by the Reservoir Engineering Sub-section	
Laboratory Investigations	17
Routine Core Analysis	
Special Core Analysis	
Formation Fluid Analysis	
Hydrocarbon Analysis	
Petroleum Geochemistry	
1. Northwest Shelf	
2. Geochemical Characterisation of Australian Oils	
3. Geochemistry of Phosphorites	
Late stage Diagenesis of Organic Matter in Sediments	
Co-operation with Baas-Becking Geo-biological Laboratory	
Drilling	20
Drilling equipment, vehicles, stores etc.	
Drilling operations	
Visitors	20
<u>BMR RECORDS, PUBLICATIONS, PAPERS ETC.</u>	21

HEADQUARTERS

The staffing position in the Mineral Resources Branch generally improved in 1973; the Mineral Economics Section remained at full strength, two statistical clerks previously provided by the Bureau of Census and Statistics were replaced by EMR positions which were satisfactorily filled and current examination of submissions for additional staff in the Section is encouraging. One vacancy in the Mining Engineering Section which occurred late in the year is certain to be filled in early 1974. Three additional positions were provided for reservoir engineering within the Petroleum Engineering Section, two of which were filled. Toward the end of the year four positions remained unfilled in the Branch, one Mining Engineer, one Petroleum Technologist, a Technical Officer and a Technical Assistant, of which the Mining Engineer and the two Technical positions should be filled in the near future.

The year provided many challenges as demands from new Government policies emerged to provide in general, additional commitments rather than changes to existing programmes. New emphasis on detailed assessment of petroleum resources led to a welcome extension of the reservoir engineering group within the Petroleum Technology Section but preliminary assessment of prospects for the proposed National Petroleum and Minerals Authority, advisory roles on the setting up of this Authority and on the export control of all minerals, field assessments associated with quotas for tin exports and new emphasis on the conservation of mineral resources were additional workloads which unfortunately caused some slowing down in the Branch's programme of assessment of Australian mineral resources. Publications of the Branch were completed although delays occurred for a number of reasons which should be rectified in 1974.

Some reorganisation of commitments within the Petroleum Technology Section during the year transferred the administration of the Petroleum (Submerged Lands) Act from that Section to the Petroleum Exploration Branch which now administers both the Petroleum (Submerged Lands) Act and the Petroleum Search Subsidy Act; the Petroleum Technology Section lost the Technical Officer assisting in the administration of the Petroleum (Submerged Lands) Act but was able to allocate some additional time to the analysis of exploration effort and equity within the Australian petroleum industry. The reservoir engineering group made continuing assessments of natural gas resources on the Northwest Shelf and completed a detailed assessment of petroleum resources of the non-producing fields of Bass Strait. The Petroleum Technology Laboratory continued significant studies on problems of petroleum recovery from reservoirs on the Northwest Shelf and in the Pacoota Formation in Central Australia; continued studies in petroleum chemistry divided Australian crude oils into three groups based on composition and geological environment, indicated two separate types of crudes in the land and offshore portions of the Carnarvon Basin and detailed some regular changes of insoluble organic matter in Cambrian and Precambrian sediments with increasing diagenesis. The drilling programme was satisfactorily completed with five drilling parties, and a new Mayhew drill was ordered as the first step in the reorganisation of the drilling group to operate five Mayhews and discard the three Fox Mobile rigs.

The Mineral Economics Section had a fruitful year although the work completed consisted of essential commodity studies and of ad hoc requests with little of the in-depth analysis the Section has in mind. Special articles for the Quarterly Review dealt with clays in Australia, prospects for the production of zircon in Australia and an assessment of Australian tin resources, contributed by the Mining Engineering Section. The Annual Review for 1971 showed some improvement in presentation and the 1972 edition will include a revised presentation of projected export income and the first of a new series of figures dealing with equity within the Australian mineral industry.

The Mining Engineering Section also had a busy year with effort concentrated on the assessment of mineral resources in Australia although other regular and ad hoc commitments such as progressive estimation of uranium resources, compilation of solid fuel resources of Australia, discussion of the future of Borken Hill, advisory comments on documents forwarded by the Interdepartmental Committee on Foreign Takeovers, and investigation of quotas for tin exports contributed about half of the workload of the Section.

The assessment of Australian mineral resources continues as one of the most important contributions of the Branch, both in fields of petroleum and other minerals; assessments of resources of minerals other than petroleum are carried out, where practicable, by teams drawn from both the Mining Engineering and Mineral Economics Sections. However, in 1973 the assessment of tin and of iron ore resources became the major responsibility of the Mining Engineering Section because of the workload of the Mineral Economics Section. The assessment of tin resources was completed and released and showed that total known reserves were more than three times those previously published; the assessment of iron ore reserves should be completed early in 1974. Assessment of copper resources by a team from the two Sections was planned to begin in 1973 but little work was possible because of urgent requests for preliminary investigations of mining projects for the proposed National Petroleum and Minerals Authority and for examination of quotas for tin exports; the assessment of copper resources should get under way in 1974 as should assessments of resources of lead, zinc and silver.

The Branch continued to provide lecturers for Industrial Mobilization Courses and for seminars in the Australian National University. Contributions to foreign aid policy continued with participation in a training course on mineral exploration and assistance to the Department of Foreign Affairs in planning a second course on mineral sands to be carried out in 1974; assistance was given to many visiting trainees and fellows under the various Australian aid schemes. The Assistant Director continued as Special Adviser on detrital heavy minerals to CCOP/EA, attended a meeting of that ECAFE Committee in Bangkok and completed a short field assignment as Colombo Plan aid to Sri Lanka and attended a meeting of CCOP/SOPAC in Tonga. He also served on Committees dealing with the Law of the Sea and contributed a number of papers on mineral resources offshore.

MINING ENGINEERING SECTION

STAFF

Occupied positions (as at 1 November 1973)

1 Mining Engineer Class 5

Unoccupied Positions (as at 1 November 1973)

1 Mining Engineer Class 3.

STAFF CHANGES

Mr W.G.B. Phillips, Mining Engineer, Class 3 resigned as from 13 September, 1973. Applications to fill the vacancy are currently being assessed.

GOLD MINING

G.F. Mead visited the major gold mining operations and wrote several minutes and comments, particularly on the effects of the repeal of paragraph (O) of Section 23 of the Income Tax Assessment Act.

ASSESSMENT OF TIN RESOURCES

W.G.B. Phillips completed work on the assessment of Australian tin resources and wrote a paper on this subject for the A.M.I. Quarterly Review. The imposition of export quotas later necessitated making a fresh inspection of all tin operations in Australia for the purpose of allotment of quotas.

Mr Phillips also made a separate report on the operations of Base Minerals Ltd; this company had asked for financial assistance.

ASSESSMENT OF IRON ORE RESOURCES

G.F. Mead visited several State capitals as well as Frances Creek, N.T., Savage River, Tasmania and the Pilbara area, Western Australia, to obtain information for the assessment of iron ore resources. The project should be completed by the end of 1973.

ESTIMATION OF URANIUM RESERVES

W.G.B. Phillips prepared an estimate of the uranium ore reserves at Jabiluk and G.F. Mead an estimate of the uranium ore reserves of Koongarra.

FUTURE OF BROKEN HILL

An intergovernmental and industry committee was formed to consider the future of Broken Hill: G.F. Mead participated in the first meeting of the ore reserves sub-committee of this committee.

WIRE ROPE RESEARCH

The Wire Rope Reserach Committee was wound up at the end of June 1973 without achieving its principal aim, i.e. the production of an instrument which would replace the destructive testing of wire ropes. An attempt is being made to continue the test work of Dr Symes at the university of New South Wales on a fee basis.

LEGISLATION

Mr Mead and Mr Phillips both participated at different times in discussions on the scope of the proposed National Petroleum and Minerals Authority Bill. Mr Mead also prepared proposals for instructions under the Seas and Submerged Lands Bill.

CODE OF RADIOLOGICAL PROTECTION IN RADIOACTIVE MINING AND MILLING

The code of radiological protection in radioactive mining and milling was completed and submitted to a new interdepartmental committee which made a number of proposals for alterations. After consideration and incorporation of amendments, the code will be circulated to government departments, including the States, industry and trade unions for further comment.

CONFERENCE OF CHIEF INSPECTORS OF MINES

The conference of Chief Inspectors of Mines was held in Darwin from 13 to 17 August. G.F. Mead participated in the conference in his capacity of secretary. It is proposed to hold the next conference in Canberra in 1974.

STANDARDS ASSOCIATION OF AUSTRALIA

The Iron Ore Committee approved the draft I.S.O. standards for:-

1. Preparation of samples
2. Determination of moisture content
3. Experimental methods for checking the bias of sampling.

INTERDEPARTMENTAL COMMITTEE ON FOREIGN TAKEOVERS

Mr Mead and Mr Phillips both examined and reported on a number of documents on mining which were forwarded for comment by the Interdepartmental Committee on Foreign Takeovers.

OTHER WORK

G.F. Mead prepared a table of solid fuel resources of Australia for the World Energy Conference and a revised version of a paper on mineral exploration tenures. He also examined and commented on the final technical report of the Hail Creek Coal Associates and resulting therefrom prepared a note on the pricing of coking coal.

W.G.B. Phillips contributed to a paper on the effects of currency revaluation on Australian mineral resources and prepared a paper on statistical estimation of mineral resources and a computer programme to reduce price-time series to real terms and produce a graph which was applied to base metal price data.

MINERAL ECONOMICS SECTION

STAFF

Occupied Positions (as at 1 November 1973)

Mineral Economist Class 5	1
Mineral Economist Class 4	1
Mineral Economist Class 3	2
Mineral Economist Class 2	3
Clerk Class 4	1
Clerk Class 2/3	1
Clerical Assistant Grade 2	1

Staff Changes

Mr R.Z. de Ferranti, Mineral Economist Class 3, left the Section in March, to take up duties as Assistant Trade Commissioner (Minerals), London, in the Department of Overseas Trade.

Mr B.G. Elliott was promoted from within the Section to the position of Mineral Economist Class 3, effective from 18 April.

Mr P.J. Roberts commenced duty on 5 July as Mineral Economist Class 2 (vice Mr Elliott).

Mr H.R. Ryan, Clerk Class 4, commenced duty in the Section on 5 July.

Mr S. Westerhuis was promoted to the position of Clerk Class 2/3, as from 12 July.

FUNCTION OF THE SECTION

The broad function of the Mineral Economics Section is to maintain basic information on, and to maintain a continuing review of all aspects of Australian mineral resources and the mineral industry. Information on these subjects is provided in the Australian Mineral Industry Review, published annually and quarterly by the Section. Another important function of these studies is the preparation of advice for the Government on the utilization of Australia's mineral resources, and the provision of assistance in the formulation of Government policy relating to the development of such resources in the national interest. In this regard, the Section's functions have increased over the past year with the formation of new Export Control Divisions and the proposed National Petroleum and Minerals Authority within the Department.

An increasing number of requests for in-depth studies of various facets of the minerals industry is being received from Departments and Statutory bodies such as Australian Industries Development Corporation (AIDC), Department of Environment and Conservation, Prices Justification Tribunal, and the Interdepartmental Committee on Foreign Takeovers.

As the study of mineral commodities and the various sectors of the mineral industry requires a consideration of international as well as domestic factors, such aspects as mining, processing, transportation, utilization, and marketing must be treated in the context of world requirements.

COMMODITY STUDIES

Australia

The Section continued to maintain close contact with the Australian mineral industry. Officers attended industry conventions and visited the offices of various companies and mining and treatment operations of particular interest. Information obtained on these occasions provides the basis of the Australian Mineral Industry Annual and Quarterly Reviews.

Mr J. Ward visited Sydney in March to deliver an Industrial Mobilization Course lecture on mineral resources of Australia, held at Victoria Barracks. At that time, he discussed a joint project of BMR and AAEC with officers of the AAEC at Lucas Heights. Mr Ward was in Brisbane in April, June and July, when he had discussions with the Mines Department and companies concerning developments in the mineral sands industry. In June-July, he also visited mineral sands operations in south-eastern Queensland and northern New South Wales. He was in Western Australia from 16 to 26 July, where he inspected tin mining operations in the Greenbushes area in connection with the allotment of export quotas. He also had discussions with the Geological Survey of Western Australia, and inspected mineral sands operations in the Geographe Bay and Eneabba areas.

Dr Z. Kalix visited Sydney and Melbourne in February/March for discussions on kaolin and fertilizer materials with Government Departments, the Mineral Chemistry Division of C.S.I.R.O. and representatives of mining companies. He had further discussions in Sydney and Melbourne in June with these organisations and with the British Phosphate Commissioners, concerning developments in the sulphuric acid and fertilizer materials industries. He was in Adelaide from 28 June to 8 July for similar discussions with the Mines Department and companies, and was in Perth and Brisbane later in the month. Discussions were held with representatives of Mines Departments, Departments of Agriculture, C.S.I.R.O., the Universities of Adelaide and Western Australia, and companies.

Mr A.J. Gourlay was in Sydney on 8 and 9 March for discussions with the Aluminium Development Council of Australia Ltd (ADCA) and aluminium producers concerning proposed statistical coverage of the secondary aluminium industry. Mr M. Lawrie, Statistical Officer (Mining), CBCS also attended the meeting with the ADCA. Mr Gourlay had further discussions on this subject in May with companies in Melbourne. While in Melbourne, he also discussed with companies general developments in the aluminium industry and in industrial minerals. He visited Perth and Adelaide during the period 23 July to 1 August, for discussions with companies and Mines Departments on developments in bauxite/alumina projects, barite, fluorspar and other industrial minerals, and the South Australian opal industry. He inspected bauxite mining and prospecting operations in the Darling Range area, and the alumina refinery recently completed at Pinjarra.

Mr B.G. Elliott visited major copper producers in Sydney in February, operations at Mount Lyell, Tasmania during July and had discussions with the Mines Department, Hobart. He also visited the Copper and Brass Information Centre on 20 July. During his visit to Tasmania, he inspected lead-zinc mining and treatment operations at Rosebery. From 22 to 26 October, Mr Elliott attended a workshop course arranged by the Australian Mineral Foundation in Adelaide, on statistical methods and their application to mining and ore treatment. He later inspected copper mining and treatment operations at Burra and Kanmantoo, and had discussions with officers of the Department of Mines on copper mining in South Australia. Visits to Copper Producers and Mines Departments combined the requirements of mineral intelligence with preliminary work on the amount of copper reserves in Australia.

Mr R. Pratt visited the Whyalla Steelworks, the Middleback Range iron ore deposits, and the Leigh Creek coalfield, during the period 19-23 March. Dr A.R. Jensen of the Sedimentary Group, Geological Branch, accompanied Mr Pratt on this tour of inspection. In July, Mr Pratt visited the Port Kembla steelworks and colliery operations of Australian Iron and Steel at Wollongong, N.S.W. He attended a meeting of the Tin Advisory Committee, held in Port Kembla on 29 August.

Mr G. Hillier visited Western Australia from 9 May to 6 June. As BMR delegate, he attended the Annual Conference of the Australasian Institute of Mining and Metallurgy, held in Perth from 14 to 18 May. He also discussed developments in the nickel and gold industries with the Mines Department and companies in Perth and visited mining and treatment operations in the Kalgoorlie and Kambalda areas. From 20 to 25 August, he inspected lateritic nickel deposits at Greenvale and Marlborough, Queensland, and copper mining and treatment operations at Mount Morgan. In February, Mr Hillier visited nickel producers in Melbourne for discussions on nickel pricing, and on the world and domestic situation in the industry.

Mr P.J. Roberts visited the lead refinery and zinc fuming plant of Borken Hill Associated Smelters at Port Pirie. He also had discussions with officers of the Mines Department in Adelaide.

World

During the year, members of the Section continued to be occupied with international commodity considerations. In this regard, work done by officers was confined mainly to attendance at interdepartmental meetings dealing with international agreements and study groups on specific mineral commodities, and the preparation of briefs relating to these.

Mr Ward represented the BMR on interdepartmental committees on tin, tungsten and mineral sands. In January, he attended an interdepartmental meeting concerning the introduction of export controls on tin and throughout the year he attended meetings of the Tin Advisory Committee. The introduction of export controls on tin in mid-January by the International Tin Council resulted in a considerable part of Mr Ward's time being occupied with the study of the effects of export quotas on the world industry, and work related to the allotment of export quotas to individual companies.

In July, with Mr Noakes, Mr Ward attended a meeting chaired by the Department of Foreign Affairs, to discuss the syllabus for an international training course on mineral sands to be held in mid-1974.

Mr Ward was overseas from 10 April to 31 May on a study tour of the United States, Canada, United Kingdom, France and Japan. Initially, he was concerned with the structure and function of governmental mineral resources and mineral economics organizations in the United States and Canada. Similar institutions were visited in London, Paris, and Tokyo and various aspects and developments in the mineral industry were discussed with government and private organizations and companies.

Mr Gourlay prepared notes during August in reply to a questionnaire by the Organization for Economic Cooperation and Development (OECD), relative to developments in the Australian aluminium industry since January 1973. He also supplied data on world trade in bauxite, as background for a reply by the Director to a question by the Minister.

In the early part of the year, Mr Elliott prepared comments on losses likely to be suffered by Australian copper producers from export contracts signed prior to the \$US devaluation. Notes on the effects of currency realignments on the mining industry were brought up to date after this devaluation. In May, Mr Elliott prepared briefing notes on the current position in the domestic lead and zinc industry for the Standing Committee meeting of the International Lead and Zinc Study Group. The "Thorium" and "Uranium" sections of a review for the International Energy Survey were prepared, in collaboration with Dr R.G. Dodson, Geological Branch.

In September, Mr Roberts prepared selected portions of the brief for the Australian delegation to the meeting of the International Lead and Zinc Study Group, held in Geneva in early November.

Members of the Section prepared background papers on the major mineral commodities, for use by Australian Government representatives at the meeting of the committee on GATT (General Agreement on Tariffs and Trade) in Geneva.

Basic Investigations

Studies of long-term trends in production and consumption of mineral commodities continued throughout the year. During the course of commodity study tours outlined above and in discussions with company representatives, members of the Section kept abreast of new technology of mineral extraction and processing, and new applications for minerals in industry.

Some continuing study of costs involved in mining, treatment, smelting and refining, and freight is maintained by the individual commodity specialists, to assist in policy advice to the Government on minerals development and in assessment of the industry's contribution to gross national product; more comprehensive studies of costs within the industry are planned when additional staff is available in the Mineral Economics and Mining Engineering Sections.

SPECIAL INVESTIGATIONS

In recent years, Australia has become a major world producer of several of the more important minerals, and it seems likely that Australian supplies will become even more important in the future. Accordingly, a stock-take is being undertaken as part of a BMR program of assessment of Australian mineral resources.

Mr Ward co-operated during the year with Mr W.G.B. Phillips of the Mining Engineering Section in the assessment of Australian tin resources. The results of this work were incorporated in an article "The assessment of Australian Tin Resources," published in the AMI Quarterly Review, Vol. 25, No. 4 for June 1973.

Dr Kalix was engaged early in the year in collection of data on Australian clay resources and in writing of an article "Kaolin in Australia", published in AMI Quarterly Review, Vol. 25, No. 3, for March 1973.

Mr Gourlay began a survey of the secondary aluminium industry in Australia. This work involved visits to Sydney and Melbourne, for discussions with ADCA and companies, as already mentioned.

Mr Elliott continued the survey of the domestic situation relative to the recovery and consumption of secondary copper, which he began in 1972. Assessment of Australian resources of copper was initiated and investigations of uranium reserves continued. These surveys entailed visits to mining operations and head offices of companies, as outlined earlier in this summary.

Mr Roberts was engaged in preliminary work in the latter part of the year on a survey of the lead and zinc resources of Australia.

The Section prepared estimates of production, consumption and the contribution of the mineral industry to export income by fiscal years for the period 1972-73 to 1982-83. These data are revised annually for use by the Minister and Government in the consideration of longer-term fiscal policy measures.

GENERAL

The preparation of advices, briefs, papers, etc., on specific subjects to the Secretariat and other Departments and attendance at meetings continued throughout the year. The more notable subjects in this regard included:-

- preparation of briefing material and attendance at interdepartmental discussions concerning International Tin Council, United Nations Tungsten Committee and International Lead-Zinc Study Group meetings;
- preparation of advice and attendance at interdepartmental meetings concerning administration of export controls of minerals under Customs (Prohibited Exports) Regulation 9;

- classification and definition of minerals, un-processed, semi-processed and fully processed, in formulation of departmental policy on the control of mineral exports;
- preparation of advice, briefs, etc., and attendance at meetings of the Interdepartmental Committee on Foreign Takeovers;
- advice to Tin Advisory Committee meeting;
- attendance at interdepartmental meetings concerning the effect of the introduction of export quotas for tin by the International Tin Council;
- meeting with CBCS concerning availability of mining equity statistics and values added in mineral processing;
- meeting with CBCS concerning possible amendments and additions to statistics on mineral exploration expenditure;
- meeting with Minerals Policy Division and officers of South Australian Dept. of the Premier and of Development, for discussions on measures to increase local processing of opals, and export controls on gemstones;
- comments on company request for freight subsidy on barite shipped from South Australia to North West Shelf area;
- supplying background papers on aluminium industry, a proposed meeting of company representatives with Departmental Heads;
- briefing of Central Office on domestic pricing basis for major metals;
- advice to Central Office on future world supply/demand in aluminium;
- calculation of Foreign/Australian equity in the mineral industry, based on value of output;
- advice to Secretariat concerning world reserves of major minerals and Australia's ranking;
- Supplying background material to Secretariat relative to meetings of Copper Supplies Co-ordinating Committee;
- comment on the viability of certain copper projects in New South Wales, for the National Petroleum and Minerals Authority (NPMA);
- preparation for Central Office of information on companies involved in uranium exploration and areas held;
- advice to Central Office concerning iron ore pricing;
- Advice to National Petroleum and Minerals Authority concerning requests by various mining companies for financial assistance;
- advice to Secretariat concerning approaches to Minister by Western Australian gold producers.

Ad hoc enquiries from industry, the public and overseas continued to occupy a large part of the time of members of the Section during the year. The volume of enquiries reflected a continuing strong interest in Australian mineral developments, particularly in regard to mineral sands, iron ore, aluminium, copper, tin, tungsten, gemstones, and industrial minerals.

LECTURES AND COURSES

The section participated in the BMR morning lecture series, and the following addresses were delivered on 19 March:

"Beneficiation of Ilmenites"	- J. Ward
"Developments in the Gemstone Industry"	- A. Gourlay
"Developments in the Copper Industry"	- B. Elliott
"Developments in Coal and Iron Ore"	- R. Pratt
"Developments in Nickel and Gold"	- G. Hillier

Dr Kalix delivered a lecture on "Phosphatic and Potassic Minerals in Australia" on 9 May as part of this series.

Mr Ward and Mr Roberts attended a conference on Mineral Processing in Australia, held at University House, ANU, from 29 to 31 August. Mr Ward also delivered the Industrial Mobilization Course lecture referred to above.

Mr Elliott attended the International Training Course on Mineral Exploration and Administration, held in May at the Australian National University. He presented lectures on "Uranium in Australia" and on the role of the mineral economist in BMR. In November, he attended a course at the Australian Mineral Foundation, Adelaide, on "Statistical Methods and their Application to Mining and Ore Treatment".

Mr Ward, with Mr Noakes, attended a meeting in July chaired by Department of Foreign Affairs, to discuss the syllabus for an international training course on mineral sands, to be held in mid-1974.

Mr Pratt attended as BMR representative the presentation of papers on fluidized iron ore reduction (FIOR), sponsored by Arthur G. McKee and Comapny, USA, and held in September at the Park Royal Motel, Canberra.

VISITORS

Visitors to the Section during 1973 numbered about 200 and included representatives of local and overseas companies, government authorities, research organizations, universities, etc. In particular, visitors from overseas included representatives of -

Bundesanstalt für Bodenforschung, Hannover, FDR;
Aluminium Resources Development corp. (ARDECO), Tokyo;
New Zealand Geological Survey;
Faculty of Economics, University of Oregon;
Marubeni Corporation, Japan;
Geological Survey, Sri Lanka;
E.I. Du Pont de Nemours & Co., Delaware, USA;
Shinagawa Firebrick Co., Japan;
Commissioner of Mines, Kingston, Jamaica,
British Oxygen Co., London;
Ministry of International Trade & Industry (MITI), Tokyo;
Government of India.

PETROLEUM TECHNOLOGY SECTION

Staff

Occupied Positions (as at 1 November 1973)

- 1 Petroleum Technologist, Class 5
- 1 Petroleum Technologist, Class 4
- 3 Petroleum Technologist, Class 3
- 1 Petroleum Technologist, Class 2
- 2 Chemist, Class 2

- * 1 Rotary Drilling Supervisor, Grade 1
- * 2 Driller, Grade 2
- 5 Driller, Grade 1
- 4 Assistant Driller
- 1 Senior Technical Officer (Science), Grade 1
- 1 Technical Officer (Science), Grade 1
- + 1 Clerk, Grade 5
- + 1 Clerical Assistant, Grade 2

* Recommendation has been made to the Executive Council for the creation of a new position (810) of Rotary Drilling Supervisor, Grade 2 to which the occupant of Grade 1 position may be promoted. The vacant Grade 1 position will be filled by the promotion of Driller Grade 2.

+ These positions are seconded from the Operations Branch.

Unoccupied Positions (as at 1 November 1973)

- 1 Technical Officer (Science) Grade 1 - Vacated by V. Laban
- 1 Technical Assistant Grade 2 - Vacated by Z. Horvarth
- 1 Petroleum Technologist, Class 4, Position No. 695

Staff Changes

Mr V. Laban was promoted to the position of Technical Officer (Science) Grade 2 and transferred to the Petroleum Exploration Branch in July 1973.

Mr Z. Horvarth was promoted to the position of Technical Officer (Science) Grade 1 in March 1973.

Mr L. Kurylowicz joined the Section as Petroleum Technologist, Class 2 in April 1973.

Mr A.W. Waldron joined the Section as Senior Technical Officer (Science) Grade 1 in March 1973.

Other Staff

1 Trainee Technical Officer (Science) has been employed in the Petroleum Technology Laboratory from 6 February 1973.

1 vacation student was employed in the laboratory from 6 December 1972 to 5 January 1973.

TECHNICAL AND SCIENTIFIC VISITS, CONFERENCES ETC.

Mr H.S. Taylor-Rogers attended eight meetings of the Oil Advisory Committee and prepared correspondence relating thereto. He made a one-day visit in December 1972 to the offices of B.O.C. of Australia Ltd. and the Mines Department in Perth to arrange for the supply of the outstanding technical and scientific information required for the estimation of hydrocarbon reserves on the Northwest Shelf. In March 1973 he attended two sessions of the 1973 APEA Conference in Canberra.

Mr Konecki attended the Conference of the Institute of Fuel (Australian Membership) held in Canberra in November 1972 and presented a paper. In February 1973 he participated in a seminar on crude oil pricing organised by Dr Susan Bambrick of the ANU School of Economics, and in June attended a meeting of the Sedimentary Supervisors Group of BMR.

Mr J.M. Henry attended in March 1973 the APEA Conference in Canberra and presented a joint (with K. Blair) paper. On June 14, 1973 he attended the Sedimentary Supervisors' meeting of BMR.

Mr K. Blair attended in March 1973 the APEA Conference in Canberra as co-author of a joint paper presented by J.M. Henry.

Mr B.A. McKay with K. Blair gave in March 1973 a talk at the BMR Wednesday lecture series on "Thermodynamic studies of hydrocarbons and their role in assessing reservoir potential." In September 1973 he attended a five day workshop course in Adelaide on "General Petroleum Reservoir Engineering Part 1" given by Prof. H.K. Van Poolen.

Dr T.G. Powell attended in March the 1973 APEA Conference in Canberra and presented a joint (with D. McKirdy) paper. In October 1973 he visited the Wollongong University College and gave two lectures on the origin of petroleum and Australian oils to staff and students. He then visited CSIRO in North Ryde to discuss overlapping geochemical work on the Northwest Shelf.

Mr D. McKirdy attended the APEA Conference in Canberra as co-author of a joint paper with T.G. Powell. In August 1973 he attended the ANZAAS Congress in Perth, W.A. and presented a paper on the Tindelpina Shale. He has been granted leave of absence from 5 March 1973 for two years to study for a PhD. degree at the ANU in Canberra.

Mr L. Kurylowicz attended in May 1973 a two-day seminar on sedimentation given at BMR by Dr A.R. Jensen. In June 1973 he attended a 5-day course on formation evaluation techniques given at the Australian Mineral Foundation in Adelaide, and in September 1973 he attended a workshop course of 10 working days on "General Petroleum Reservoir Engineering - Parts 1 and 2" given by Prof. H.K. Van Poolen at the AMF in Adelaide, S.A.

PETROLEUM LEGISLATION

Until May 1973, the Petroleum Technology Section was responsible for the receipt, registration and storage of all information required to be submitted by titleholders under the provisions of the Petroleum (Submerged Lands) Act and the Directions which had been issued by the States and Territories. From this date, the Petroleum Exploration Branch assumed this responsibility.

During the year, briefs were prepared for reference purposes for Head Office and for meetings of the Australian Minerals Council.

The Attorney General's Department advised that due to the heavy load imposed upon the Parliamentary Counsel because of the large number of new Bills which were being brought forward, the Parliamentary Counsel would be unable to undertake the drafting of the Regulations under the Petroleum (Submerged Lands) Act. The Victorian Parliamentary Counsel had indicated that he was in a position to assist and he had accordingly been given the responsibility for the preparation of the first draft.

In October 1973, Mr Taylor-Rogers attended in Adelaide a meeting of the Regulations Committee at which representatives of all States and the Commonwealth were present. The drafts of five parts of the Draft Instructions which had been prepared by Victoria were examined; certain minor technical amendments were made and the redraft will be submitted to all States and the Commonwealth for approval.

INFORMATION AND STATISTICS

The Section prepared for publication and distribution the following:-

- (i) Petroleum Exploration and Development Titles Map and Key (half-yearly as at 30 June and 31 December).
- (ii) Petroleum Newsletter - quarterly. (Nos. 51, 52, 53 and 54 issued).
- (iii) Big Activity - monthly
- (iv) Wells and Footage Drilled - quarterly
- (v) Breakdown of Petroleum Exploration, Development and Production Activity and Expenditure - annually
- (vi) Statistics and information on petroleum exploration, development, production, resources etc. in Australia for various publications, e.g. World Oil, Oil and Gas Journal, the petroleum chapter in Australian Mineral Industry Review, Australia in Facts and Figures, various yearbooks and pamphlets.

PETROLEUM ECONOMICS

A paper entitled "Australian Contribution in Expenditure and Development of Its Indigenous Petroleum Resources" was prepared and presented at the 1973 A.P.E.A. Conference. This paper examined expenditure, source of funds, ownership and equity in petroleum titles, future developments and targets.

Since the beginning of 1973 as a result of the change in Government, a considerable amount of time and effort has been expended on the analysis of the Australian and overseas equity interests in various petroleum titles and fields. Special studies were made of the Woodside-Burmah Oil N.L. title areas and of the titles and farmouts in the Cooper Basin.

Work has started on a paper entitled "An Economic and Statistical Appraisal of Petroleum Exploration and Development in Australia" for presentation at the 1974 A.P.E.A. Conference in Perth.

Analysis of the success ratios for new field wildcats for the period 1966 to 1972 indicates a crude oil discovery ratio of 1 in 35 and a natural gas discovery ratio of 1 in 12.7.

With regard to the exploration, development and production expenditure and activity the analysis indicates that the expenditure by private enterprise on exploration has continued to rise to the end of 1972 and exploration in 1972 - mainly geophysical activity - exceeded that in 1971.

PETROLEUM AND RESERVOIR ENGINEERING

Assessment of Petroleum Reserves

Australia's petroleum reserves on land and offshore recorded over the year were published quarterly in the Petroleum Newsletter Nos 51, 52, 53, and 54. The estimates of petroleum reserves (natural gas, natural gas liquids and crude oil) were based on company estimates, verified wherever practicable, by the Reservoir Engineering Sub-section and/or on its own assessment and reservoir studies. Included in the statements of reserves are those of the proved and probable categories considered to be recoverable by current methods and techniques. Australia's petroleum reserves at 30 September 1973 were estimated to be as follows:

TABLE 1

	Crude Oil (x 10 ⁶ bbl)	Natural Gas Liquids* (x 10 ⁶ bbl)	Natural (Sales) Gas** (x 10 ¹² ft ³)
Initial Reserves	2106.0	1823.0	32.86
Cumulative Production to 30.9.73	443.6	5.5	0.42
Current Reserves at 30.9.73	1662.4	1817.5	32.44

- * Include condensate and LPG
- ** Includes methane and ethane

Not included in these estimates are reserves of oil at Eaglehawk, Egret, Goodwyn and Dockerell, and of gas and liquids at Dockerell and Scott Reef - all on the Northwest Shelf, but included are reserves of oil, gas and liquids at Bream, Mackerel, Flounder, Snapper and Tuna in the offshore Gippsland Basin in addition to those at Barracouta, Marlin, Halibut and Kingfish in that basin.

The depletion of reserves due to production to the end of September 1973 has amounted to 21 percent in respect of crude oil, 0.3 percent in respect of natural gas liquids and about 1.3 percent in respect of natural (sales) gas. Mr M.C. Konecki prepared tables of liquid and gaseous fuel resources in Australia and Papua New Guinea for the World Energy Conference.

Reserves Estimation by the Reservoir Engineering Sub-section

During the year the Sub-section has carried out its own preliminary assessment of petroleum reserves in respect of the Rankin, North Rankin, Goodwyn and Angel gas-condensate fields and very tentative estimates in respect of oil discoveries in Goodwyn No. 3, Eaglehawk No. 1, Egret No. 1 and Dockerel No. 1 wells in the Dampier Sub-basin. A recent re-assessment of the Angel field after Angel No. 3 was completed resulted in a severe reduction of an estimate made earlier in the year.

In the offshore Gippsland Basin, five fields not yet in production have been assessed in terms of proved and probable recoverable petroleum reserves; they include Bream, Tuna, Snapper, Mackerel and Flounder. The four producing fields - Barracouta, Marlin, Halibut and Kingfish - are being assessed, and it is planned that the project will be completed by the end of the year.

Following completion of Palm Valley No. 3 in the Amadeus Basin yet another estimate of gas reserves in the Palm Valley structure was made by the Sub-section. The drilling of the three wells so far has extended the length of the gas accumulation for a distance of 10 miles along the crest of the 30-mile long Palm Valley structure, but the greatly varying rates of flow obtained during tests and the considerable improvement of the flow rates following fracing operations in Palm Valley Nos 1 and 3 indicate that the permeability of the (main) Pacoota reservoir depends to a high degree on the natural fracture system, which is probably best developed in the vicinity of No. 2 well. In these circumstances the assessment of reserves presents a much more difficult problem than in the case of reservoirs with intergranular porosity and permeability.

In the last quarter of 1973 the Sub-section undertook to estimate the reserves of LPG (liquified petroleum gas) in the oil and gas accumulations in Australia.

Results of these assessments are given in Tables 2 and 3.

LABORATORY INVESTIGATIONS

Routine Core Analysis

During the year, 1456 samples of cores were examined from 102 cores in 42 wells. The tests carried out involved effective porosity, gas permeability, fluid saturation, bulk and grain density. Data from these tests were used in the estimation of petroleum reserves, in gravity and other geophysical investigations, and as a check on the accuracy of other laboratories operating in particular areas of the country. Porosity, permeability and density measurements in the Canning and offshore Carnarvon Basins were summarized and supplied to the Basin Study Group of the Petroleum Exploration Branch.

Special Core Analysis

Petrophysical investigations were carried out on 99 samples from 12 wells in the Cooper and Amadeus Basins and in the Dampier Sub-basin.

The greater part of this work involved measuring the gas recovery characteristics of hydrocarbon reservoirs on the Northwest Shelf by displacement with water. These tests are relevant to the problem of recoverable reserves from reservoirs producing under active water drive from large aquifers. Other tests of significance included capillary pressure measurements on core samples from the Palm Valley No. 3 well in the Amadeus Basin to evaluate the pore characteristics of the tight gas bearing sandstones of the Pacoota Formation, capillary pressure and relative permeability measurements on the oil bearing sandstones of the Tirrawarra Formation in five Tirrawarra wells, Cooper Basin, and the determination of the effects of overburden pressure on the porosity and vertical and horizontal permeability of the hydrocarbon reservoirs of the Northwest Shelf.

Formation Fluid Analysis

A total of 56 samples of formation waters from 27 wells was examined during the year. This analysis included determination of chlorides, total salinity, pH, electrical resistivity and total solids content.

Hydrocarbon Analysis

Nineteen samples of natural gas and twenty-two samples of crude oil and condensate were analysed during the year. All of these samples were derived from wells drilled under the Petroleum (Submerged Lands) Act or the Petroleum Search Subsidy Act. Fifteen bitumen samples, all from beach localities, have been analysed.

Petroleum Geochemistry

1. Northwest Shelf

Following the discovery of oil at Eaglehawk, further studies on the origin of petroleum on the Northwest Shelf have been carried out. There now appear to be two separate types of crude oil with different sources in the Carnarvon Basin. The first type is naphthenic in composition and is represented by the oil occurring in the Windalia Sand in the Barrow Island oilfield and in a Triassic Sandstone reservoir of the Eaglehawk structure. The oil is thought to be derived from Cretaceous sediments. The second type is paraffinic-naphthenic in composition and constitutes the condensates and oil occurring in sandstone reservoirs in the Rankin, Goodwyn, N. Rankin, Angel and Legendre structures. It is thought to have derived from Jurassic sediments. The oil at Egret is considered to be a mixture of the two types.

2. Geochemical Characterization of Australian Oils

Geochemical examination of Australian crude oils has continued during the year. The following conclusions have been reached so far:

- a) Australian oils in general have gravities higher than 35° API and low sulphur and asphalt contents. They range from paraffinic to paraffinic-naphthenic in composition.
- b) Major factors contributing to the composition of Australian crude oils include the depositional environment of the source rock and the relative contribution of the cuticles of pollen spores and leaves derived from higher plants to the source material.
- c) Australian oils have been divided into three groups based on their composition and geological environment. These are:-
 - A. Paraffinic oils associated with non-marine sediments
 - B. Paraffinic-naphthenic oils associated with marginal deltaic sediments
 - C. Naphthenic oils associated with marine shales and carbonates
- d) Maturation of paraffinic oils of non-marine origin results in a change in the relative proportions of different distillation fractions but there is little change in overall composition.
- e) Alteration processes such as water washing and biodegradation are not common in Australia.

3. Geochemistry of Phosphorites

Twenty phosphorites ranging in age from Recent to Precambrian have been analysed for their organic content. Organic carbon values range from 0.5% to 10%. Those which have suffered little diagenesis have unusually high asphalt content. Phosphorites yield significant quantities of naphthenic and aromatic hydrocarbons and may form the source material for heavier petroleum. However, no likely phosphorite source rocks are known in Australia.

Late Stage Diagenesis of Organic Matter in Sediments

The organic content of a number of Cambrian and Precambrian sediments has been examined in order to understand the late stages of organic diagenesis. With late stage diagenesis or early metamorphism there is a progressive graphitisation of the insoluble organic matter in sediments. This has been particularly well shown in a study of the kerogen from the Tindelpina Shale in the Adelaide Geosyncline. There is a progressive graphitisation of kerogen with increasing metamorphism from east to west across the geosyncline. This is accompanied by an increase in the crystallinity of illite and a change in the magnetic anomaly pattern. Studies on the soluble organic matter in Cambrian and Precambrian sediments have revealed regular changes in the yield of soluble organic matter and in the proportion of saturated and aromatic hydrocarbons with increasing diagenesis.

Co-operation with Baas-Becking Geobiological Laboratory

The role of micro-organisms in the alteration and generation of petroleum precursor material is being investigated by artificial decay experiments of pure algal cultures.

DRILLING

Drilling Equipment, Vehicles, Stores Etc.

Recommendations were submitted and approved for the replacement of tanker and drilling rig prime movers, also the purchase of one (1) new Mayhew 1000 drilling rig.

Over the next 12 months, 3 Fox-Mobile B4OL drilling units will be disposed of by the Stores and Transport Branch.

During the next 3 years, 5 existing prime-movers presently carrying the drilling rigs and 5 prime-movers presently carrying the 1000 gallon tanks will be replaced.

Seven (7) drilling units were completely overhauled, rust-proofed and painted. Repairs to core barrels and all drilling equipment have been carried out by the drilling personnel, and the machining of various items of equipment by the Department of Works in Canberra.

A complete reconciliation of drilling stores was completed prior to the departure of the drill parties into the field.

All major vehicle repairs were carried out by The Truck and Car Sales (Canb.) Pty Ltd., Fyshwick A.C.T., while all minor vehicle and major overhaul of welding units, water pumps and motors was carried out by our own Drilling Sub-section mechanics.

Drilling Operations

Five drill parties were formed to carry out drilling in support of hydrological investigations in the A.C.T., diamond drilling and coring in the Northern Territory (Alcoota, Granites-Tanami, Rum Jungle, Alligator River, Murgarella) areas, and stratigraphic drilling in Western Australia (Pitzroy Crossing and Balgo Mission areas,) and the Cape York Peninsula and the Boulia/Windorah areas of Queensland. The drilling was completed in accordance with the approved 1973 program.

In some instances the work was completed ahead of schedule; this made it possible to undertake additional drilling at Rum Jungle, Alice Springs, Alcoota and Granites-Tanami.

Table 4 summarises the results of drilling and coring for the period 1.11.72 to 31.10.73, and a sketch map shows the movements of drill parties during the field operations in 1973.

Visitors

During the period under review 120 visitors were received in the Section.

EMR RECORDS, PUBLICATIONS, AND PAPERS

- POWELL, T.G., and McKIRDY, D.M., 1973 - Crude oil correlations in the Perth and Carnarvon Basins. APEA J., 13 (1), 81-85. Record No. 72/142.
- POWELL, T.G., and McKIRDY, D.M., 1973 - Relationship between ratio of pristane to phytane, crude oil composition and geological environment in Australia. Nature (Phys. Sci.), 243, 37-39. Record No. 73/5.
- POWELL, T.G., and McKIRDY, D.M., 1973 - The geochemical characterisation of crude oils from Australia and Papua New Guinea. Economic Geology of Australia and Papua New Guinea. (In press). Record No. 73/43.
- POWELL, T.G., and McKIRDY, D.M., 1973 - The effect of source material, rock type and diagenesis on the n-alkane content of sediments. Geochim. Cosmochim. Acta. 623-633.
- McKIRDY, D.M., 1973 - Organic geochemistry in Precambrian research. Record No. 73/99.
- McKAY, B.A., 1973 - Thermodynamic (PVT) studies of hydrocarbons and their role in assessing reservoir potential. Record No. 73/169.
- HENRY, J.M., and BLAIR, K., 1973 - Australian contribution in expenditure and development of its indigenous petroleum resources. APEA J., 13 (2), 29-34. Record No. 73/36.
- Petroleum Technology Section, 1973 - Wells and footage drilled for petroleum exploration and development in Australia and Papua New Guinea in 1971. Record No. 73/17.
- PETRUSHEVSKI, E., 1973 - Wells and footage drilled for petroleum exploration and development in Australia and Papua New Guinea in 1972. Record No. 73/138.
- BLAIR, K., KURYLOWICZ, L.W., and WALDRON, T.W., 1973 - Mackerel Oil and gas estimated reserves. Record No. 73/140 (Confidential).
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- Petroleum Technology Section, 1973 - Petroleum exploration contractors, service companies, consultants in Australia, June 1973. (A directory).
- KALIX, Z., 1973 - Kaolin in Australia. Aust. Miner. Ind. Quart. Rev. 25(3)

PHILLIPS, W.G.B., 1973 - The assessment of Australian Tin Resources. Aust. Miner. Ind. Quart. Rev. 25 (4).

ALFREDSON, P.G.*; ROYSTON, D.*; WARD, J., WRIGHT, W.J.*, 1973 - Survey of Future Production of Zircon and Zirconium in Australia. Aust. Miner. Ind. Quart. Rev. 26 (1)

* Australian Atomic Energy Commission

NOAKES, L.C., and JONES, H.A., - Mineral Resources Offshore. Contribution to "Economic Geology of Australia and Papua New Guinea".

NOAKES, L.C., 1973 - Mineral Resources of Australia. Bur. Min. Geol. and Geophys. Record 1973/1 (open file)

NOAKES, L.C., and MACDONALD, E.H., - Activities in the field of detrital heavy minerals in CCOP. Bur. Min. Res. Geol. & Geophys. Record 1973/23 (open file)

MACDONALD, E.H., and NOAKES, L.C., 1973 - Investigation of detrital heavy mineral deposits in Indonesia. Colombo Plan Report published by Australian Department of Foreign Affairs.

WARD, J., 1973 - Documentation and analysis of the mineral industry in North America, the United Kingdom, France, and Japan. Record 1973/128 (restricted) Australian Dept of Foreign Affairs.

TABLE 2.
NON-PRODUCING FIELDS

Negl. - Negligible
N.D. - Not determined

Basin	Field	Estimated Proved plus Probable Reserves					
		In Place			Recoverable		
		Raw Natural Gas (x 10 ¹² ft ³)	Condensate (x 10 ⁶ bbl)	Crude Oil (x 10 ⁶ bbl)	Raw Natural Gas (x 10 ¹² ft ³)	Condensate (x 10 ⁶ bbl)	Crude Oil (x 10 ⁶ bbl)
Offshore Gippsland	Bream	0.6612	27.7704	63.0441	0.4960	20.8320	33.0982
	Flounder	0.3620	21.9038	110.1106	0.2170	15.6456	55.0553
	Mackerel	0.0877	Negl.	455.9852	0.0527	Negl.	227.9927
	Snapper	3.6819	64.4363	64.4363	2.9428	51.5490	9.1720
	Tuna	1.0937	25.0790	522.7165	0.7377	20.0632	85.2607
	Sub-Total	5.8865	139.1895	1276.2927	4.4412	100.0918	410.5789
Dampier (Sub-basin)	Angel	2.1569	90.1584	-	1.3370	54.0604	-
	Goodwyn	8.7045	308.1393	-	5.8320	206.4528	-
	North Rankin	10.8031	232.8902	-	7.0740	151.3836	-
	Rankin	0.4000	14.0000	-	0.2400	8.4000	-
	Sub-Total	22.1445	631.1960	-	14.4830	420.2968	-
Amadeus	Palm Valley	12.9032	N.D.	-	6.4516	N.D.	-

TABLE 3

Estimated Reserves of LPG in Some Non-producing Fields

Basin	Field	Proved plus Probable Reserves	
		In Place (x 10 ⁶ bbl)	Recoverable (x 10 ⁶ bbl)
Offshore	Bream	29.2	21.9
	Flounder	N.E.	N.E.
Gippsland	Mackerel	58.4	35.0
	Snapper	130.3	104.2
	Tuna (m-1)	20.5	15.4
Sub-total		238.4	176.5
Dampier (Sub-basin)	Angel	81.9	50.8
	Goodwyn	294.0	197.0
	North Rankin	297.2	193.2
	Rankin	8.0	4.8
Sub-total		681.1	445.8
Amadeus	Palm Valley	151.6	75.8

N.E. Not estimated.

TABLE 4.

BMR DRILLING OPERATIONS 1.11.72 - 31.10.73

OPERATIONS	AREA LOCATION	PERIOD		WAITING ON WATER (hours)	TOTAL FOOTAGE DRILLED & CORED	RIG REPAIRS (hours)	NO. OF HOLES	DRILLED (feet)	CORED (feet)	NO. OF CORES	AVERAGE CORE RECOVERY %	TIME USED FOR		AVERAGE PENETRATION		DEPTH AVERAGE (feet)
		From	To									Drilling (hours)	Coring (hours)	Drilling (feet/hr)	Coring (feet/hr)	
GEOLOGICAL- METALLIFEROUS	N.T. AILERON	1.11.72	22.11.72	6.75	1643.0	-	11	1590.0	53	13	87.31	32.00	18.00	49.69	2.94	149.36
	BATCHELOR	30.4.73	28. 6.73													
		16.10.73	23.10.73	16.00	1726.5	6	16	1645.5	81	22	89.86	198.25	49.75	8.30	3.98	107.91
	ALLIGATOR RIVER	6. 7.73	24. 7.73													
		18. 9.73	10.10.73	15.00	2573.0	1	14	2510.0	63	17	99.41	64.00	31.00	39.22	2.03	183.79
GEOLOGICAL- SEDIMENTARY	N.T. MURGENELLA	3. 7.73	7. 9.73	2.50	2980.0	3.5	5	2904.0	76	13	88.46	78.00	17.5	37.23	4.34	596.00
	W.A. CANNING	7. 6.73	22.10.73	43.25	6724.0	2.5	12	5611.0	1113	115	82.57	217.75	77.25	25.77	30.08	560.33
	BASIN															
	OFFICER	1.11.72	24.11.72	35.00	650.0	-	1	546.0	104	14	75.36	50.00	18.50	10.92	5.62	650.00
	BASIN															
	QLD EROMANGA	11.5. 73	14. 7.73													
	BASIN															
	CARPENTARIA	22.8. 73	26.10.73	22.00	4924.5	13.0	13	4322.5	602	63	89.33	306.00	108.00	14.13	5.57	378.81
	BASIN															
	CARPENTARIA	5. 7.73	29.10.73	1.50	4721.0	37.0	5	4480.0	241	28	84.14	293.50	26.75	15.26	9.01	944.20
	BASIN															
ENGINEERING GEOLOGY AND HYDROLOGY	ACT WESTON															
	CREEK	28.11.72	28. 5.73	-	2323.0	4.0	23	2216.0	107	31	86.77	263.00	26.00	6.12	4.12	101.00
	KAMBAH															
	Mt. STROMLO															
	PINE RIDGE															
	ORRORAL VALLEY															
	LAKE GINNINDERRA															
	N.S.W. TANTANGARA															
GEOPHYSICAL- SEISMIC	GOOCONG DAM															
	W.A. OFFICER															
	BASIN	1.11.72	24.11.72	9.00	19143.0		466	19143.0				144.00		132.94		41.08
TOTALS				151	47408.0	67.0	566	44968.0	2440	316	87.02	1745.50	372.75	25.76	6.55	83.76

SUMMARY

Total footage drilled	= 44 968 feet
Total footage cored	= 2 440 "
Total footage drilled & cored	= 47 408 "
Total number of holes drilled	= 566 "
Average all surveys - core recovery	= 87.02%
Deepest hole drilled	= 1 100 " (335.28 metres)

MINERAL RESOURCES BRANCH
 PETROLEUM TECHNOLOGY SECTION
 BMR DRILL PARTIES
 DRILLING LOCATIONS
 AND MOVEMENTS 1973

