GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

RECORD 1987/1

SUMMARY OF PROGRESS OF THE GEOLOGICAL SURVEY OF WESTERN AUSTRALIA DURING 1986 AND PLANS FOR 1987 - 1991

DEPARTMENT OF MINES
WESTERN AUSTRALIA

Geological Survey Record 1987/1

SUMMARY OF PROGRESS OF THE GEOLOGICAL SURVEY OF WESTERN AUSTRALIA DURING 1986 AND PLANS FOR 1987-1991

by

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Western Australia

Department of Mines

Geological Survey of Western Australia

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INTRODUCTION

Dr Alec Trendall voluntarily stepped down from the position of Director of the Geological Survey on 31 August 1986 to become Senior Principal Geologist in the Precambrian Geology Section, and was succeeded by Dr Phillip Playford, who had been Assistant Director General of Mines, and before that, Deputy Director of the Survey.

In his 6 1/2 years as Director, Dr Trendall reoriented the Survey's directions of endeavour following some twenty years in which systematic regional mapping at 1:250 000 scale had been the principal function. Dr Trendall recognized the gaps in our knowledge of the geological history of many parts of Western Australia that had been highlighted by mapping over the previous two decades. Many of these geological problems relate to areas of economic importance, and projects designed solve them could have significant effects on the State's mineral industry.

Despite his major administrative load in a period of changing style of Government management, Dr Trendall managed to keep his own scientific endeavours at a high level during his time as Director.

As leader of International Geological Correlation Programme Project 132 - "Basins of Iron-formation Deposition" - which was established in 1975, Dr Trendall succeeded in obtaining original contributions from twenty internationally recognized scientists, on topics relating to the formation and occurence of Precambrian iron-formations. These papers were published by Elsevier in 1983 as "Iron-formation Facts and Problems" (book 6 in the series "Developments in Precambrian Geology") under the joint editorship of A F Trendall and R C Morris (CSIRO Perth).

Again in 1980, as an invitee, Dr Trendall attended the 23rd Dahlem Workshop organized by Dahlem Konferenzen in Berlin to consider the topic "Biospheric Evolution and Precambrian

Metallogeny". To this, with co-author Dr H L James, he contributed the background paper "Banded Iron-formation: Distribution in Time and Palaeoenvironmental Significance". Physical, chemical and Earth Sciences Research Report (PC)3 "Mineral Deposits and the Evolution of the Biosphere", Editors H D Holland and M Schidlowski (Springer - Verlag 1982) contains the reports from that workshop.

Stimulated by the internationally renowned format of the Dahlem Konferenzen, Dr Trendall proposed for a later workshop the topic "Earth History: How Smooth, How Spasmodic". This was accepted by the Program Advisory Committee as the theme for a workshop held in May 1983, results from which appear in Physical, Chemical and Earth Sciences Report 5 "Patterns of Change in Earth Evolution", editors H D Holland and A F Trendall (Springer-Verlag 1984).

The fourth International Kimberlite Conference held in Perth on 11-15 August, 1986 was convened by Dr Trendall and Professor P Harris (UWA). Dr Trendall was Chairman of the Organizing Committee and Mr John D Lewis (GSWA, Petrology section and co-author of Geological Survey Bulletin 132, "The Kimberlites and Lamproites of Western Australia") was conference secretary. Approximately 70 papers relating to diamonds and their host rocks were delivered and some 80 poster papers displayed. Nearly 300 local, interstate, and overseas geoscientists registered for the conference to learn more about the peculiar group of volcanic rocks that embraces kimberlites and lamproites, and about the comparatively new Western Australian diamond deposits at Argyle and elsewhere.

These examples illustrate Dr Trendall's significant contributions to science during his Directorship of the Survey. His personal example of individual scientific achievement over this period was remarkable.

MINERAL EXPLORATION AND MINING ACTIVITY, 1986

MINERALS

The year was particularly significant for the State's mining industry as the value of mineral production passed the $5 billion mark for the first time. The 1985/86 figure of $5 235 million is a 12.3% increase over the previous period and results mainly from a strong growth in the production value of gold, diamond, and mineral sands, combined with the effects of the devaluation of the Australian dollar.

The total mineral exploration expenditure for 1985/86 in Western Australia ($205M) exceeded the figure for 1984/85 by $16M. This monetary increase of 8.4%, when discounted for cost-inflation, indicates a maintained steady expenditure rate when compared with the total for the previous year.

Expenditure in Western Australia was 46% of the Australian total ($442M) so that this State maintained its position as the most active in Australia in mineral exploration.

Exploration for gold in Western Australia accounted for over 60% of the total State mineral exploration expenditure.

The continued strengthening of the gold price in Australian dollar terms (Mines Department statistics show that an average price of $A477, per ounce, was achieved for 1985-86 production) has meant that this commodity has remained the most attractive exploration target.

Once again, during 1986, the results of gold exploration have been notably successful. During the year 20 new gold mines were brought into production and it is anticipated that a further 28 will be developed during 1987. Particularly significant new mines which started production during 1986 were the Forsayth/Reynolds Mt Gibson Mine (north of Wubin) which will produce 2 000 kg/yr, the

Western Mining Corporation Emu mine (near Agnew) which will produce 1 800 kg gold per annum, and the Brunswick Resources Galtee Moore Mine (north of Mount Magnet) which will produce 1 350 kg per annum. A number of the mines due to commence production during 1987 will be very large producers; these include Boddington (over 5 000 kg per annum), Mt Pleasant (about 2 000 kg per annum) and Sir Samuel (2 000 kg per annum).

Open-cut gold mining operations in the vicinity of old gold shows have continued to dominate the industry; however, an encouraging feature for 1986-87 is the development of a number of significant new underground mines (Golden Crown, Edwards Find and Sir Samuel), and a number of innovative exploration programmes, such as the W.M.C. Gwalia Deeps programme, aimed at finding deep extensions of former major producers. There have also been a number of significant new 'greenfield' discoveries which have resulted from the application of newly developed exploration concepts. Worthy of mention in this context are the Bottle Creek deposit of E.Z./North Broken Hill (east of Menzies) and the significant increase in the reserves of the W.M.C. Kambalda gold operations.

In addition to the new mines mentioned above, there are at least 44 other prospects where significant resources have been indicated and which, with further exploration, may eventually be developed into mines.

Gold production during 1985-86 was over 46 tonnes, valued at just over $707 million, making it third in value after iron ore and alumina. This is the highest production achieved since 1910 but, at an average grade of 4.02 g/tonne, it involved mining almost four times as much ore as was required in 1910, when the average grade was 15.1 g/tonne. It is estimated that production for calendar year 1986 will be about 56 tonnes, not far below the State's historical maximum of 61 tonnes in 1903. If all currently planned mines eventuate, new gold production records are likely to be set in 1987 (estimated 75 tonnes) and 1988 (estimated 85 tonnes).

The year has seen considerable interest in the metamorphic-replacement model for gold mineralization and in exploration based on structures adjacent to major shear zones. Considerably more emphasis is now placed on the application of structural geology to gold exploration.

Although no new iron-ore mines were brought into production in 1986, development plans or feasibility studies were announced for Deepdale, McCamey's Monster, Yandicoogina, and Southdown. Robe River Iron Associates announced that Deepdale K and J deposits were purchased from BHP and will be brought into production when the existing Deepdale workings are depleted. Hancock Mining Ltd hopes to develop the McCamey's Monster deposit to supply to Romania under a barter arrangement. BHP announced that its Yandicoogina deposit will be developed within 2 years to supply its domestic steel mills, and CSR-CRA hope to export their Yandicoogina ore through Hamersley Iron's railway and port facilities.

Exploration and feasibility studies are continuing at the Southdown magnetite deposit 80 km east of Albany; the size and future economic significance of this deposit are still uncertain, but it is clear that the ore would require beneficiation if it is ever to be developed.

Exploration for new base-metal deposits continued during the year, albeit at a reduced level in view of the greatly depressed commodity prices. Most of the activity has been centred on exploration of Devonian reefal carbonates on the Lennard Shelf of the Canning Basin, and on several major exploration projects in the Paterson Province. The most promising base-metal project is that being undertaken by BHP and Shell on Devonian carbonates in the West Kimberley. During the year the partners released reserve estimates for the Blendevale deposit near Fitzroy Crossing. These amount to 20.0 million tonnes at an average grade of 8.3% Zn and 2.5% Pb with minor amounts of Cd and Ag. The proposed sinking of a decline to further evaluate the deposit was postponed because of

the uncertain investment climate. However, late in the year the joint venturers announced the discovery of an orebody at Cadjebut, 80 km southeast of Fitzroy Crossing containing 3.3 million tonnes of 14% Zn and 5% Pb. This was said to meet the BHP requirement of high-grade, low-cost ore, and it appears likely to be developed in the near future.

Western Mining Corporation has continued with its major exploration programme in the vicinity of the Nifty deposit in the Throssell Range area of the Paterson Province. It appears that this province, in which there are a number of other major exploration projects, including those being conducted by Esso and CRA, and which includes the Telfer gold project, will develop as a major mineral province.

The Teutonic Bore copper-zinc mine was closed in early 1986 after the sale of mine and other equipment. With this closure, no base-metal mine is currently operating in Western Australia. However, significant reserves of copper and zinc with minor silver and gold have been delineated for the Scuddles copper-zinc deposit at Golden Grove. Following the sinking of a shaft and diamond drilling, a reserve of 10.6 Mt was announced, comprising 1.3 Mt at 5.1% Cu, 1.7% Zn, 44.4 g/t Ag and 1.3 g/t Au, plus 9.3 Mt at 15.8% Zn, 108.1 g/t Ag, 1.3 g/t Au and 0.5% Cu, in two massive sulphide bodies. A further 4.0 Mt of stringer ore containing 2.9% Cu and 10.1 g/t Ag have also been defined. Metallurgical testing of samples is continuing.

Other minerals to receive attention in exploration during 1986 were uranium, diamond, mineral sands and phosphate.

Two of these, diamond and mineral sands, were the subject of major scientific conferences held in Perth during the year, which attracted considerable national and international interest.

The promising Kintyre uranium prospect in the Paterson Province is being explored by CRA, while the Limestone Creek - Bow

River alluvial diamond deposits in the Kimberleys, the Cooljarloo mineral sands deposit 250 km north of Perth, and the Mount Weld phosphate deposit near Laverton, are all at the advanced feasibility planning stage.

A pilot solution-mining test was carried out during the year by Total at its Manyingee roll-front uranium deposit in the Cretaceous of the Carnarvon Basin near Onslow.

An indicator of the level of exploraton activity in Western Australia is provided by the fact that 39 new mining companies were floated during 1986. Most of these are seeking gold, but there is also interest in platinum, diamond, mineral sands, and industrial minerals.

COAL

Coal exploration and drilling has been confined largely to defining the steaming coals of the Vasse and Hill River areas.

The format for reporting coal and lignite resources has been standardised by the introduction of the Australian Code for Reporting of Identified Coal Resources and Reserves. The clear, practical and improved standards set by the Code will greatly facilitate coal resource reporting.

PETROLEUM

Seventeen exploration wells were drilled in 1986, compared with 65 in 1985, and one well was drilling ahead at the end of the year. Total penetration was 36 272 m, which was a 69% decrease when compared with 116 121 m drilled in 1985, reflecting the international downturn in exploration as a result of the oil-price collapse in early 1986. The most active areas for petroleum exploration were the Carnarvon and the Bonaparte Basins.

There were no new petroleum discoveries made during the year. However, in the Barrow Sub-basin of the Carnarvon Basin substantial flows of gas and oil respectively were recorded from the extension wells Campbell 2 and Saladin 2, respectively. Campbell 2, in a drillstem test over the interval 2 212 - 2 214 m on a 15.88 mm choke, produced gas at a rate of 0.27×10^6 m^3 per day together with 22.4 kL of condensate. Saladin 2, on a drillstem test over the interval 1 110.5 - 1 117m on a 31.75 mm choke, produced 48.1† API oil at 1 740 kL per day together with 0.099×10^6 m^3 of gas. The Saladin field seems likely to prove sufficiently large for commercial development.

Seismic acquisition decreased significantly in 1986, with a recorded coverage of 24 630 km (19 495 km offshore and 5 135 onshore) compared to 41 204 km in 1985, a decrease of 40 percent. Other surveys included 315 km of land gravity and 1 400 km of land magnetic. This reduction in seismic exploration is also in line with the world-wide trend resulting from the falling price of oil early in 1986.

ORGANIZATION, STAFFING, RECRUITMENT AND ACCOMODATION

There was no change to the structure of the Division and the staff structure chart published in GSWA Record 1985/1 (p 10) is still valid. The Geological Survey was fortunate in that, when a service-wide freeze on staff replacements was imposed on 31 May 1986, the few existing staff vacancies had already been advertised and these were allowed to proceed. By September, the professional staff was only one below authorised strength and there were three General classification vacancies. With the staff freeze persisting through the year, no further progress was made with the expansion of the Geological Survey that had been approved, subject to finance, in 1983. Moreover, in October, 1986 the Survey was required to eliminate three positions (one hydrogeologist, one technical assistant, and one field assistant) to comply with the Government's directive to cut 3% from Public Service Staff numbers. These cuts were achieved from positions vacant at the time.

Early in 1986 a new salary structure known as "broadbanding" was introduced throughout the State Public Service. For some positions the salary range for a broadband did not coincide exactly with the range allocated under the old system and, although there were no actual salary reductions, some items will be effectively downgraded when vacated by existing occupants.

For the professional staff the correlation between the old levels and the new broadband levels is as follows:

	OLD	BROADBAND
Level 1	Geologist	2/4 (Cl 7)
2	Geologist	5
3	Project Geologist	6
4	Senior Geologist	7
5	Principal Geologist	7
6	Supervising Geologist, Senior Principal Geologist	8

A-1-8	Assistant Director	8
A-1-9	Deputy Director	9
A-1-12	Director	Class 1

Problems arising from the grouping of Assistant Directors, Supervising Geologists, and the Senior Principal Geologist into a single new broadband level (broadband level 8) had not been resolved at the end of the year.

PROFESSIONAL STAFF

Appointments

Heath, A, BSc	Geologist Level 6 (Temp)	7 January 1986
Strong, C, B App Sci	Geologist Level 2/4 (permanent)	24 April 1986
Fetherston, M, B App Sc, M App Sc	Geologist Level 2/4	1 July 1986
Le Blanc-Smith, G, BSc(Hons), PhD	Senior Geologist Level 7	8 September 1986

Transfer In

Playford, P E	from Assistant Director General of Mines to Director, Geological Survey Division	1 September 1986

Promotions

Knyn, B J	Library Assistant to Librarian Level 5	20 February 1986
Davidson, A	Project Geologist to Senior Geologist Level 7	24 July 1986
Trendall, A F	Director to Senior Principal Geologist Level 8, Precambrian Geology Section	31 August 1986

Resignations

Wilson, A	Senior Geologist	10 January 1986
Brown, I M	Geologist	31 January 1986
Beere, G	Geologist	8 August 1986

CLERICAL AND GENERAL STAFF

Transfer in

Cross, R	from Explosives Division to Officer level 1, library	30 May 1986
Wright, V	from Mining Engineering Division to Officer level 1, Publication sales	15 September 1986

Transfer out

Miller, S	Clerical Assistant Library to Officer level 1, Mining Engineering Division	15 September 1986

Resignation

Crossley, L	Laboratory Assistant	21 April 1986
Collier, J	Geophysical Assistant	16 May 1986

At the end of the year vacancies amounted to an Assistant Librarian level 2/4, and three Officer level 1 positions.

Mr W Preston of the Mineral Economics Sub-section continued in his secondment to the Royalties and Statistics Branch in 1986. After his work as Secretary to the Mineral Revenues Enquiry was completed, he was appointed acting Manager Royalties and Statistics Branch. Meanwhile a temporary appointee, W.A. Heath,

is carrying out the duties of Mr Preston's position in the Geological Survey.

Of particular importance during the year was the arrangement negotiated by Dr Trendall with the Director General of Mines and the Public Service Board that enabled him to return to research geology after 6 1/2 years as Director of the Geological Survey of Western Australia. This is the first time that such an arrangement has been approved in the State Public Service. Dr Trendall is now attached to the Precambrian Geology Section where he will concentrate on a project relating to rocks of the Fortescue Group.

Dr P E Playford transferred from Assistant Director General of Mines to Director, Geological Survey Division on 1 September 1986, returning to the Geological Survey Division after an absence of two years. He had previously been successively Supervising Geologist, Assistant Director, and Deputy Director. This is his third period of appointment to the Geological Survey, his previous employment having been in 1962-1970, and 1971-1984.

Construction of the extensions to Mineral House (formerly referred to as Mineral House II, now known as Mineral House Stage 2) began on 9 September 1985 and work was well under way at the beginning of 1986, with completion scheduled for mid 1987. During 1986 it was established that the Geological Survey Division will occupy floors 4 and 5 of Stages 1 and 2 with the exception of about 225 m^2 on floor 4, stage 2, which space will accommodate the Royalties and Statistics Branch. Considerable time has been spent liaising with the design consultants in planning the detailed layout of the allocated floors in Mineral House.

For environmental and cost reasons, it is necessary to remove all Geological Survey laboratories from the Mineral House Complex before occupation of Stage 2. A laboratory building was designed by the Building Management Authority for erection on land adjoining the Mining Engineering Division Drilling Branch in Cohn Street, Carlisle. Construction will commence early in 1987.

OPERATIONS 1986
BASINS, FUEL AND GROUNDWATER BRANCH

HYDROGEOLOGY SECTION

A D Allen (Supervising Geologist), A T Laws (Senior Geologist), D P Commander (Senior Geologist), W A Davidson (Senior Geologist from 24/7/86) K J-B Hirschberg (Project Geologist), J S Moncrieff, A C Deeney, M W Martin, R J McGowan, R A Smith, P M Thorpe, A M Kern, S J Appleyard (Geologists).

In 1986 the aggregate depth drilled for groundwater resources assessment was 7 265 m. This was 4 064 m more than that drilled in 1985, as a result of drilling an increased number of deep bores.

The drilling for groundwater resources assessment was all undertaken in the Perth Basin. It comprised 4 sites on the Gillingarra Line on which the deepest bore was 1 007 m; one bore to 1 450 m on the Cowaramup Line; and 41 bores (24 sites) for the Cataby Shallow drilling project in which bores ranged in depth to 111 m and had an aggregate depth of 1 762 m.

There has been only slow progress in hydrogeological mapping. A State hydrogeological map at 1:2.5 m scale is in preparation, and contributions to explanatory notes to accompany a National map at 1:5 million scale (Australian Water Resources Council) have been completed. Work on 1:250 000 hydrogeological maps was suspended pending the acceptance and adoption of a standard Australian legend.

Close co-operation has been maintained with the Western Australian Water Authority. The equivalent of 6 geologists were dedicated in 1986 to co-operative work between the two organizations. Some of the more important works undertaken were: the evaluation and assessment of groundwater resources in the Metropolitan Area; contribution to the Perth Urban Water Balance

Study and Gnangara Mound Environmental Review and Management Program; review of monitoring at Lake Coogee; preparation of an exploration program for Derby town water supply; proposal and supervision of a drilling program for Hopetoun Water Supply; and advice on Menzies, Halls Creek and Kununurra water supplies. Other work for the Water Authority was also carried out on other projects, as described later.

Co-operative work has also been undertaken with the Department of Agriculture in the North Stirlings area where 12 sites have been drilled and are being monitored to obtain an understanding of the mechanism of land salination in that area. Work has continued on hydrogeological investigations for proposed liquid and solid landfill sites, for effluent disposal licences and for sites to dispose of low-level radioactive waste. Computer modelling of a groundwater-pollution occurrence in the Kwinana Industrial area was successfully carried out.

Studies into the hydrogeological effects of bauxite mining were continued. Pumping tests were carried out at Del Park and Yarragil North catchment. Slug testing was conducted at Meringee Farms; monitoring bores were established in the Del Park and Yarragil North catchment; and tritium analyses were made to determine recharge within various catchments.

An important study was made of monitoring results designed to establish the effects of logging for the woodchipping industry.

The section has provided advice and done work for other Government Departments, in particular the Department of Conservation and Environment, Main Roads Department, and Commonwealth Department of Aboriginal Affairs. Miscellaneous groundwater information has been provided to consultants, mining companies, the rural community and the general public. Ten (previous year 25) inspections and reports on groundwater prospects were prepared for landowners; 354 (443) counter enquiries were dealt with; and 1124 (1098) telephone enquiries,

seeking advice about drilling and bores, were handled. A number of lectures were given at Department of Agriculture rural seminars and to public interest groups, professional societies and conferences.

The isotope facility at WAIT processed 66 tritium samples and 7 carbon-14 samples, and is providing very valuable data to assist location of intake areas and for determining rates of groundwater recharge.

The introduction of computer technology is continuing. The State Water Resources Information System, being developed in co-operation with the Water Authority, made little progress as a result of other computing priorities at the Water Authority. However, use of Water Authority computing facilities did allow computer modelling of some dewatering, recharge, and solute-transport studies.

In August it was announced that no further Commonwealth funds would be available for exploratory drilling under the National Water Resources Assessment Program. Financial limitations have already restricted exploration in the Perth Basin to an unsatisfactorily slow pace. In more remote areas such as the Canning Basin where substantial fresh groundwater resources are believed to occur, the failure to evaluate and make known these resources may lose opportunities for agricultural development.

Considerable effort and progress has been made to improve staff efficiency and to clear a backlog of work. This has been improved by the adoption of a corporate plan but nevertheless considerable work is still outstanding.

FOSSIL FUELS AND PHANEROZOIC GEOLOGY SECTION

A E Cockbain (Supervising Geologist), R M L Elliott (Principal Geologist), G Le Blanc Smith (Senior Geologist), M F Middleton (Senior Geophysicist), R M Hocking (Project Geologist), G Beere (until 8 August 1986), A J Mory, R P Iasky (Geologists).

The **Petroleum and Coal Resource Sub-sections** continued work on the assessment, processing, storage, and retrieval of data from companies exploring for fossil fuels. During the year full-time production of microfiche commenced. In future all open-file petroleum and coal data will be released on microfiche and no new microfilm rolls will be produced.

In 1986 the numbers of reports copied onto microfiche were: petroleum data - well reports, 64; geophysical survey reports, 73; general reports, 20. One report on coal data was copied to fiche.

During the year an agreement was entered into with Petroleum Information Energy Services Pty Ltd (PI) under which PI will sell to the public full-scale copies of electric logs, seismic cross sections and shot-point base maps. These items are open-file data released under the Petroleum Acts which were sold previously mainly on 35 mm microfilms by the Geological Survey.

In conjunction with the Computer Services Branch and the Petroleum Division, work continued on planning a computer data base (WAPEX) to handle petroleum exploration data. The feasibility study on WAPEX was completed using FOCUS software. The design of the specific program for WAPEX and the related data capture has been suspended due to monetary and staffing restrictions.

To assist with the assessment of undiscovered petroleum resources in the sedimentary basins of Australia by the Bureau of Mineral Resources, onshore well and seismic data were supplied to

Dr D Forman. Dr Forman visited Perth for two weeks in May, 1986 to collect pre-drill data on well objectives and seismic contour maps for each new-field well drilled. The results of his statistical studies are being prepared now for publication.

In September 1986 Dr G Le Blanc Smith was appointed Senior Geologist in the Coal Reserves Sub-section. In the remainder of the year he has worked on familiarizing himself with the coal-related geology of the State, legal matters concerning Collie, and defining technical-computing requirements for coal-reserve evaluation. Work was suspended on the geophysical appraisal of the southern Perth Basin, but will be resumed in 1987.

Work is in progress on updating the coal resource information of the State, together with a bulletin on the Collie Coalfield.

In the **Basin Studies Sub-section**, two bulletins - on the Carnarvon Basin, and the Bonaparte and Ord Basins - have been submitted to the Publication and Information Section, where they are in preparation for publication. Work continued on the seismic stratigraphy of the northern Canning Basin. The regional study of the offshore part of the Bonaparte Basin continued.

Dr M F Middleton was seconded to the Petroleum Division for 3 1/2 months to assist with petroleum reserve assessment. Mr G M Beere resigned from the sub-section during the year.

Field work by two State University of New York post-graduate students continued on research on the diagenesis and dolomitization of Devonian reef complexes in the northern Canning Basin.

During the year work continued on a review of the Phanerozoic sedimentary basins for the planned Memoir 3 on the geology and mineral resources of the State.

PALAEONTOLOGY SECTION

S K Skwarko (Senior Palaeontologist), J Backhouse, K Grey (Project Geologists).

A bulletin "The palaeontology of the Permian of Western Australia" was completed. This work summarizes all that is known of the Permian fossils in this State, and of the Permian System here, including its palaeogeography, climate, sediments, and the correlation of the Western Australian Permian strata with those of other parts of Australia and overseas.

In preparation for the study of the economically important Cretaceous rocks of the southern part of the Northwest Shelf, a card index of data was prepared relevant to Foraminifera, Ostracoda, Radiolaria and calcareous nannoplankton found in the Early Cretaceous of Western Australia.

Preparations were set in motion to build up more representative reference and type macrofossil collections for this State.

Palynological studies continued on the Permian strata of the Collie Basin. It was demonstrated - and is being reported on - that the three sub-basins at Collie can be correlated by means of selected palynomorph species. A total of 31 palynological reports were written on artesian monitoring, the Gillingarra Line, and the Cataby hydrogeological boreholes, and a number of smaller projects.

Scrutiny of stromatolites from the Glengarry and Earaheedy Sub-basins assisted in a better understanding of stratigraphy, correlation, and palaeoenvironments. Preliminary examination of stromatolites from the Waltha Woora Formation and Yeneena Group, and of problematic bedding-plane structures from the Manganese Group provided evidence for stratigraphic correlations. Three papers were published, three others are in preparation, and two reports were written - all on various aspects of Precambrian

stratigraphy - in addition to a lecture and a poster session presented at the 12th International Sedimentological Congress in Canberra, and a lecture and poster session at the 8th Australian Geological Convention in Adelaide.

Biostratigraphic assessment of selected miospore assemblages was continued, to assist with the dating of the Devonian reef complexes in the Lennard Shelf of the Canning Basin. One report was written and a publication is in preparation.

GEOPHYSICS SECTION

L Kevi (Senior Geophysicist), G Street (Geophysicist), J H Watt (Senior Technician), D Reid (Technician).

During 1986 the Geophysics Section continued in its traditional role of acting as a consultant service to the Hydrogeology and Engineering sections, WAWA, and the Departments of Agriculture and CALM.

Geophysical logging was done on a contract basis for private individuals for the first time, due to the absence of any local contractors for logging of water bores. A number of local companies have been encouraged to take up this service. In 1986, 102 bores were logged, including 22 private bores. The major project in logging was the completion of the Gillingarra Line, a series of deep holes north of Perth, which were logged using the SIE system. A full suite of parameters was measured including natural gamma, point resistance, self potential, long and short normals, sonic, neutron, gamma/gamma and temperature. The SIE system is now fully operational and completed logging the first of the Cowaramup Line bores (1 400 metres) in December.

In 1987 it is planned to improve the presentation and processing of logging data. Methods of computer-assisted interpretation will be examined.

Considerable progress has been made for the Department of Agriculture in evaluating the use of geophysical techniques for assistance in defining the causes of dryland salinity. Magnetic, seismic refraction, resistivity, SP, and electromagnetic surveys were carried out in these studies.

Further work will be done in the next two years in evaluating the results and trying other methods such as radiometric surveys and time-domain EM.

The regional gravity project has continued on the Collie Sheet. A number of small-scale structures have been defined. These will be examined in more detail in 1987 as well as further establishing regional stations to the east.

Detailed gravity surveys were carried out at Greenbushes, and in 1987 detailed traverses will be made across some of the magnetic lineaments in the south-west.

A catalogue of aeromagnetic surveys contained in company reports has been prepared on magnetic tape on the Tektronix 4054 computer. The catalogue was transferred to IBM-PC disk and a program written for retrieval based on latitude and longitude. It is hoped to make this available as a record during 1987.

The catalogue of logging records, also on the Tektronix, contains over 2 200 records. During 1987 a check will be made of all logs stored in the section to ensure the catalogue is fully up to date.

In 1986 detailed company aeromagnetic surveys from the Southern Cross greenstone belt were merged with BMR data for assistance in mapping of the region. It is planned to do similar composite maps in 1987 in the Paterson Province, on the Kurnalpi Sheet, and in the Ravensthorpe area.

BMR aeromagnetic data from the Northern Murchison were image processed using the IIS system at the Department of Lands and Surveys, to produce a series of enhanced images for use in geological interpretation.

In addition to its traditional role the Geophysics Section will be more involved in future in regional mapping projects, particularly in areas where good geophysical data are available to assist in understanding the geology.

Particular areas planned for 1987 and 1988 are the Paterson Province, Eastern Goldfields, and the Ravensthorpe area. The main emphasis of this work will be the collation and interpretation of available aeromagnetic and gravity data. Field surveys and, in particular, measurement of magnetic susceptibility, will be carried out to assist in this interpretation.

The project to study the magnetic properties of the weathered layer continued, with detailed surveys being repeated over the laterite areas after they had been mined for bauxite. Results to date suggest that surface "noise" from maghemite in the pisolitic gravels is too severe to "see" basement features. Filtering in one dimension does not remove this "noise".

BASEMENT, MINERALS, AND GEOTECHNICS BRANCH

PRECAMBRIAN GEOLOGY SECTION

J S Myers (Supervising Geologist), A F Trendall (Senior Principal Geologist), I R Williams (Senior Geologist), T J Griffin, W M Hunter, I M Tyler, K P Watkins, A M Thorne, I R Fletcher, C P Swager (Geologists).

Compilation of the first 1:100 000 scale map sheets of the Kalgoorlie region (Cowan, Lake Lefroy, Kalgoorlie and Yilmia) was completed. Explanatory note draft manuscripts were prepared for the previously compiled Widgiemooltha and Boorabbin 1:250 000 map

sheets. A detailed study of the structure of the Golden Mile and surroundings was completed and a manuscript prepared.

Field mapping on the Newman and Robertson sheets was completed, and mapping was carried out in the northern sector of the Western Gneiss Terrain. Field mapping commenced in the King Leopold Orogen.

Preparation of bulletins and accompanying maps for the Ashburton Fold Belt and Murchison projects was almost completed.

Sm-Nd isotope analyses were carried out at WAIT (Curtin University) on rocks from the Murchison Province, Sylvania Inlier, Balfour Downs sheet and the Fraser Range.

Prof. Liu Ruqi from the Tianjin Geological Academy of the Chinese Ministry of Metallurgical Industry visited the Murchison and Pilbara regions as part of an exchange between the Survey and the Tianjin Geological Academy.

Other work of the section included preparation of material for a new edition of the Geology and Mineral Resources of Western Australia (Memoir 3).

MINERAL RESOURCES SECTION

J G Blockley (Supervising Geologist), P H Harrison, W A Preston, A H Hickman (Senior Geologists), S L Lipple, W Keats, I M Brown (until 31 January 1986), W Witt, B Davies, M J Fetherston (after 1 July 1986), A G Heath (temporary) (Geologists).

For much of 1986 the Section was understaffed due to resignations, secondments, and the absence of officers on long service leave. The administrative load of the Section has been particularly heavy. Over 45 person weeks were spent dealing with ministerial matters and enquiries from other Divisions and Government Departments. In addition numerous enquiries from mining companies and members of the public were dealt with.

The Senior Geologist of the **Mineral Economics Sub-section** was seconded as Acting Manager, Royalties and Statistics Branch for all of 1986, and a temporary replacement continued to compile and update the mineral occurrence computer data base (MININFORM). Input of gold data up to the present has been completed but minor corrections and additions to other commodities are still being undertaken. Other duties have included the preparation of an iron ore reserves map of the Pilbara, compilation of exploration and development statistics for W.A., and selected project and commodity reviews.

In the **Evaluation Sub-section** all field work, and much of the laboratory work, has been completed on a study of the potential for platinum group elements within Western Australia. One paper, on the mineral potential of layered intrusions within the Western Gneiss Terrain, was published during the year. Writing up and publication of a series of papers to present the remainder of the results awaits re-analysis of samples, for the full range of platinum-group elements, by an analytical method which has been newly developed by the Government Chemical Laboratories. Unforeseen problems with this method, which have delayed the study, have now been overcome.

Meanwhile, a confidential assessment of reserves, resources and potential for heavy mineral sands in Western Australia was carried out at the request of the "Work Party on Conservation and Rehabilitation in the Mining Industry". An evaluation of the reserves and resources of nickel and gold mineralization within the Kambalda Agreement area was also carried out and the results incorporated in the (confidential) MININFORM database.

The Senior Geologist of the **Economic Geology Sub-section**, Dr A Hickman, attended the international earth science conference "Geocongress '86" held in Johannesburg, and presented a paper, on Precambrian conglomerate-hosted gold deposits in Western Australia. The paper drew attention to remarkable similarities between gold mineralization and stratigraphy in the Pilbara and

South Africa. These similarities, and a conclusion that further exploration could reveal significant Witwatersrand-type gold mineralization within mineable depths in the Pilbara, stimulated considerable interest.

Work on the Murchison Province included the compilation of maps showing the size, style and lithological associations of all known mineral deposits. In mid-1987 this information will be published on a 1:500 000 map of the Province, also showing regional stratigraphy and structure, and will later be included in the forthcoming bulletin on the Murchison Province.

A study of gold mineralization in the Bullfinch-Forrestania and Westonia greenstone belts of the Southern Cross Province was commenced. Field mapping of selected areas of interest was undertaken at 1:50 000 scale, and maps are being compiled at 1:100 000 and 1:500 000. The major aims of the study are to address both structural and stratigraphical controls on gold mineralization, and to document and classify the various types of gold deposit in the area.

The investigation of the nature and geological setting of skarn-hosted tungsten mineralization in the north-eastern Gascoyne Province is near completion. A detailed petrological and analytical program, including electron microprobe analysis of skarn phases, has been concluded. All maps, sections and plots of geochemical data have been completed. Preliminary synthesis of the data indicates that the Gascoyne skarns are of the type that is equivalent to a group which contains most of the important tungsten skarn deposits in the word.

Field mapping of the Bardoc 1:100 000 sheet was largely completed. Work began on a geochemical and petrological study of various layered sills, with sampling of the Mount Pleasant body. This work is being carried out as part of a regional study of gold mineralization within the Eastern Goldfields.

A paper on silica sand and gypsum was later published in 'Industrial Minerals' and has generated considerable interest in these commodities.

A study of the State's gypsum resources was commenced, and a paper on the future of the mining industry in the Shark Bay area was prepared and presented to the Shark Bay Strategy Committee.

The **Exploration Data Sub-section,** received 2 530 mineral exploration volumes during the year (cf 2 059 in 1985). This brings the total held in the M Series collection to 19 280 volumes on 5 047 projects. First reports on around 450 projects were submitted during the year.

A Community Exployment Project to index reports for the WAMEX database and microfilm these for open file release, was concluded in April. Following a submission by the incoming Director of the Survey, Cabinet agreed to a new task-force initiative, with employment of contract staff (4), redeployment of GSWA staff (1 geologist and 4 assistants) and $30 000 funding of contract microfilming. Two geologists and one technical assistant are being employed on contract for twelve months, and a part-time geologist for a total of six months. It is intended that the total WAMEX/M Series task force of 4 geologists and 8 assistants will eliminate the indexing/microfilming backlog by October 1987. In view of the convenience, cost, greater efficiency, and scope for improved productivity, a decision was made to change from roll film to microfiche.

During the year, an additional 884 volumes on 302 projects were released to Open File, bringing the total to 5 992 volumes on 2 141 projects. Industry requests for information from reports not yet microfilmed numbered 119, resulting in the release of an additional 518 volumes on 126 projects.

ENGINEERING AND ENVIRONMENTAL GEOLOGY SECTION

R P Mather (Supervising Geologist), A J Smurthwaite (Senior Geologist), G W Marcos, J R Gozzard (Project Geologists), S M Belford and S J Brice (Geologists).

In the **Engineering Geology Sub-section**, the projects in 1986 were again almost exclusively conducted for other Government Departments or instrumentalities.

For the Water Authority of Western Australia the following projects were undertaken. Geological mapping and/or core logging and report preparation for Harris River dam site 5; North Dandalup dam site; Big Brook Dam; Canning Dam emergency spillway area; Churchman Brook, Bickley and Stirling Dams safety review; Buckland Hill Reservoir; Bungendore Park and Mount Hill (2 sites including a pumping station); tank sites; Carradine Road school site; and Woodman Point sewage treatment works.

For Marine and Harbours Department, geological work was undertaken for projects at Hillary's Boat Harbour (pile foundations) and Dawesville cutting outlet to the sea (quarries for breakwater armour stone and core material).

For Main Roads Department, assessments of cutting stability or quarry site investigations were made for sites in the Derby - Gibb River Road, Halls Creek - Duncan Highway, Noble Falls, and Eyre Highway areas.

Other minor investigations were undertaken for Local Government authorities and the general public, and bi-annual reports prepared for data gathering in the South West Seismic Zone.

The **Environmental Geology Sub-section** had published by the end of this period the Perth, Fremantle, Armadale and Serpentine environmental geology maps; cartography was well in hand on

Collie, Muja, Lake Clifton - Hamel, Capel, Busselton and Mundaring; fieldwork was completed and maps compiled for the Broome - Roebuck Plains and Yallingup; and fieldwork was in progress on the Karragullen, Gleneagle and Jumperkine sheets.

The Mandurah, Pinjarra, Harvey - Lake Preston and Bunbury - Burekup Urban Geology maps were used as bases for the compilation of a series of environmental geology maps covering these areas.

The Sub-section took over from the Mineral Resources section the project to review the bauxite deposits in the southwest of the State and compile a bulletin.

A draft report on the limesand and limestone resources between Lancelin and Bunbury and a practical guide for interpreting the environmental geology map series were compiled.

A computerised industrial minerals database was designed and all relevant information typed in, utilizing FOCUS software.

Reports were prepared for other Government departments following requests for geological advice principally by the Department of Conservation and Land Management, Department of Conservation and Environment and the State Planning Commission. A number of Town Planning Schemes, Coastal Management Plans and Environmental Review and Management Programs were also reviewed. Advice on mineral resources and related matters was also prepared for a number of committees including the Work Party on Conservation and Rehabilitation in the Mining Industry, Consultative Committee for the State Conservation Strategy, Extractive Industry Committee and Mine Management Planning Liaison Group. Input to two draft reports of the Collie Landuse Working Group was also provided.

GEOCHEMISTRY SECTION

R Davy (Senior Geochemist)

Reports issued in 1986 marking the completion of projects included a Record on the composition and mineralogy of a core which intersected the Marra Mamba Iron Formation and the underlying Roy Hill Shale Member of the Jeerinah Formation, a report on the Mount Edgar Batholith (co-authored with J D Lewis) and a paper in the Journal of Geochemical Exploration on the Boddington gold deposit (co-authored with M El-Ansary of Reynolds Australia Ltd).

Other papers issued in connection with ongoing projects, and which involved co-authorship with other workers, included two BMR Records on volcanic rocks of the Pilbara and a GSWA Record on the economic significance of granitoids from Poona in the Murchison. A paper on rare-earth compositions of mafic/ultramafic rocks in the Pilbara was presented at the International Volcanological Congress in New Zealand in early 1986.

Ongoing investigations include study of the (meta)volcanic rocks of the Pilbara (with A Y Glickson of the BMR), characterization of Collie Coals (with A C Wilson) and of the Mount Clement precious metal project (with R Clarke, GCL and D Seymour, Tasmanian Geological Survey), and completion of the geochemical contribution to the Murchison Bulletin. A study of the laterite profiles at the Mount Gibson gold deposit has begun jointly with Reynolds Australia Ltd and the Government Chemical Laboratories.

PETROLOGY SECTION

W G Libby (Senior Petrologist), J D Lewis (Project Geologist), A L Ahmat (Geologist).

Petrological studies conducted as a service for other section during the year resulted in the completion of 49 reports covering 1 163 thin sections.

Transfer of the rock and mineral data system from Government Computing to the Department's IBM mainframe computer was completed

and tested satisfactorily. The system is now operational in batch update mode and can be interrogated either indirectly through the microfiche catalogue or directly using a newly acquired terminal comprising keyboard, VDU and printer.

Bulletin 132, "The Kimberlites and lamproites of Western Australia", was distributed at the Fourth International Kimberlite Conference which began in Perth on 11 August, 1986. Other projects were brought to completion with publication of Report 20, Geochronology of the Gascoyne Province and Metamorphic Patterns in the Greenstone Belts of the Southern Cross Province, Western Australia. Petrological studies in the Murchison Province are nearing completion.

The isotope geochonology sub-program continued to produce substantial results in conjunction with the Precambrian and Mineral Resources Sections and Curtin University.

Dating by the rubidium-strontium whole-rock technique continued to accompany mapping in the northwestern part of the Western Gneiss Terrain, Sylvania Dome, the Murchison Province, and the southeastern part of the Pilbara Block. A special study of dates at Muttabarty Hills is in progress. Late tectonic activity is being dated by the biotite rubidium-strontium technique along the western margin of the Yilgarn Block, especially in the Murchison Province, the northwestern part of the Western Gneiss Terrain, and along a line between Harvey and Kondinin. Sampling in the southwest corner of the state is progressing.

Dating by samarium-neodymium techniques is disclosing the early history of the Murchison Province, southeast Pilbara plutons, basement in the Fortescue River Valley, the Jimberlana Dyke, and of the Manfred and Julimar basic complexes in the Western Gneiss Terrain.

Lead-isotope dating was conducted on samples from the Hamersley Basin, Rudall Metamorphics, Gascoyne Province and Bangemall Basin.

SUPPORT SERVICES BRANCH

PUBLICATION AND INFORMATION SECTION

W B Hill (Project Geologist), B M Nash, I Ruddock, C A Strong (Geologists).

The following table summarizes the production of publications during 1986 at the **Publication Sub-section.**

	Carried over from 1985	Received 1986	Released 1986	In progress 31 Dec. 1986
Information pamphlets	2	2	3	1
Records	7	12	16	3
Reports	6	4	7	3
Bulletin	2	4	2	4
Explanatory notes	2	3	1	4

In addition to the above, four environmental geology maps were released.

Details of publications released and in progress are given later, in the section headed publications.

In the **Information Sub-section** public inquiries and drafting requests remained constant at about 1 500 and 1 000 respectively.

The sub-section contributed to the WAMEX and WAPEX steering committees. A retrieval system for mineral deposits information

(MININFORM) was designed and a similar system for industrial mineral deposits (INDUSTRIAL MININFORM) has been started. Retrieval systems for coloured slides and metals prices have also been established. Considerable data have been collated and input to each system.

LIBRARY

B Knyn (Assistant Librarian until 20 February, then Librarian), R Cross, J Nossiter.

In 1986 members of the public visiting the library totalled 3 380 of whom 921 made use of the microfilm reading and printing facilities. Staff loans totalled 702, and 596 inter-library Loans were arranged.

Heavy usage of the WAMEX open-file exploration database continued throughout 1986, and in addition 39 computer searches of WAMEX were conducted for the public.

The library obtained the facilities of a Telecom Computerphone and printer enabling direct on-line access to the Australian Bibliographic Network (ABN) and to the AUSINET and DIALOG networks.

MUSEUM

A Thomas, Technical Officer

In 1986, 18 school and college groups were conducted through the museum. A new entry panel was prepared and replacements found for some purloined reference specimens.

As part of general celebrations of Western Australia Week a display illustrating the discovery and proclamation of the Kimberley Goldfield was prepared for exhibition in the Alexander Library and shown again later in the year at a shopping centre.

Displays illustrating the Department's functional relationship to the mining and exploration industries were prepared for the Royal Agricultural Society's Show and the "Paci-Expo" at Fremantle Port Authority's Terminal Building. A display to promote map sales was prepared to coincide with map week. These three displays were prepared in conjunction with the Surveys and Mapping Division.

A collection of gold specimens held for safe keeping at the Perth Mint, was recatalogued before being viewed by a panel of Geoscientists gathered to consider future possible uses to be made of this valuable specimen collection.

Numerous small displays were prepared to promote publication sales, and several rock and mineral specimen sets prepared for gift or loan to schools.

LABORATORY SECTION

G Williams (Laboratory Manager), J Williams, M Winsor, M Brzusek, P Glover, L Crossley (until 21 April 86) (Laboratory Technicians), and P Boner (wages) for part of the year.

The following statistics show the level of activity in the laboratory for 1986.

Thin sections prepared (293 of which were polished)	1 962
Palynology samples prepared	712
A A S element determinations (plus 800 computer graphs plotted)	416
Samples crushed and pulverized	176
Mineral separations (mainly biotite)	35
Rock specimens cut and polished	133
Polished mounts	27
Specific gravity determination	1
Serial slabbing	5
Staining (CO_3/dolomite & ankerite/siderite)	32

Latex molds	189
Fossils cleaned and/or extracted from rocks	1 118
Clay/silt particle size dist.	85
Photographic prints	1 318
35mm B & W films developed	35
12 x 9 cm films developed	131
Radiographs processed	4

In 1987 a new laboratory will be built at Carlisle. With the exception of photography, all GSWA laboratory facilities will be transferred to the new complex which is to be sited next to the Mines Department Drill Store. The building is to be equipped with the latest laboratory safety systems.

REGIONAL OFFICES

At the Kalgoorlie Regional Office Drs W Witt (in charge) and C Swager maintained geological advice and access to microfilmed open-file reports throughout the year, in addition to conducting field projects described elsewhere.

Although the office accommodation at the W A School of Mines has functioned well since the establishment of the Kalgoorlie Regional Office, there are other advantages that might be realized by providing office space at the Brookman Street Offices of the other Mines Department Divisions in Kalgoorlie. Accordingly, consideration is being given to a proposal to extend those offices to provide accommodation for the Geological Survey officers.

Karratha office, having been vacated in November 1985 when Mr Commander was transferred to Perth, remained unmanned until Dr Alan Thorne transferred there in April 1986. Dr Thorne has been engaged on mapping in the Ashburton Fold Belt, a project due for completion in 1987.

CO-OPERATING ORGANIZATIONS

CURTIN UNIVERSITY OF TECHNOLOGY (FORMERLY WEST AUSTRALIAN INSTITUTE OF TECHNOLOGY)

The University continues to co-operate in a number of projects in which radio-isotope determinations are an essential part.

Samarium/neodymium, rubidium/strontium and lead/lead age determinations continued during the year with Curtin University providing the mass-spectrometer, chemical-laboratory and computing facilities, and the Geological Survey supplying the operator (Dr I Fletcher).

Geologist Dr P Thorpe, using Geological Survey consumables, continued with carbon-14 and tritium determinations with Curtin equipment and laboratory facilities.

Curtin University personnel will also co-operate during 1987 in a study of Cretaceous units of the southern North West Shelf, to determine characteristics favourable to petroleum occurences.

BUREAU OF MINERAL RESOURCES

Dr A Y Glikson of BMR is collaborating with Drs Davy and Hickman of the Geological Survey to complete phase 2 of the Pilbara Geochemistry project in which volcanic rocks from that region will be examined, their petrogenesis deduced, and their potential for mineralization assessed.

Data for statistical assessment of the prospects for undiscovered petroleum resources in selected Western Australian sedimentary basins were supplied to Dr Forman (BMR) and his report is awaited.

A BMR representative held discussions in Perth with Geological Survey staff and in Kalgoorlie with exploration company personnel

on the manner of presentation of regolith maps covering the Kalgoorlie 1:1 000 000 map sheet area.

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION (CSIRO)

In 1986 the CSIRO made available its microprobe analyser for use by GSWA personnel requiring this equipment for testing rocks from several areas.

A co-operative study of the Marra Mamba Iron Formation (R C Morris CSIRO and J G Blockley GSWA) has been completed but requires presentation.

UNIVERSITIES OUTSIDE WESTERN AUSTRALIA

Field work on the diagenesis and dolomitization of Devonian reefal and associated rocks in the Kimberley region by Ph.D. candidates B Ward and V Pedone of the State University of New York (SUNY) was completed in 1986. M Wallace (University of Tasmania), is proceeding with laboratory work on Devonian material from his Ph.D. project area around Geikie Gorge. N Hurley (University of Michigan) successfully completed his Ph.D. on the Oscar Range reef complex.

Investigation of layered mafic complexes in the Western Gneiss Terrain by M Cornelius of the University of Leoben (Austria) which was suspended in 1986, will resume in 1987.

B Simonsen (Oberlin College Ohio USA) will continue his study of sedimentology of the Wittenoom Dolomite and C Brown (University of London), will continue mapping and structural interpretation of the Stirling/Barren Ranges area.

G Buntebarth (University of Clausthal, Germany) will examine core samples from the southern North West Shelf to determine heat-flow characteristics. Results will contribute to the development

of a regional framework for the structural and thermal evolution of this area.

EXPLORATION COMPANIES

In 1986, a major treatise - The Kimberlites and Lamproites of Western Australia - was published as GSWA Bulletin 132. The contribution of co-author C B Smith (CRA) to this work and in conducting the Fourth International Kimberlite Conference (held in Perth August 1986) is gratefully acknowledged. Numerous other CRA personnel also contributed to the success of that conference.

A study of lateritic profiles at the Mt Gibson gold deposit is being conducted jointly by Dr R Davy (GSWA) and staff of Reynolds Australia Ltd, owners of the mine.

STATE GOVERNMENT DEPARTMENTS

Close co-operation with the W A Water Authority continued on numerous projects relating to groundwater occurrence and development.

The Department of Lands and Surveys made their image-processing equipment available to produce-colour enhanced magnetic contour maps.

The photogrammetric section of Lands Dept will also supply systematic colour photography at 1:25 000 scale of parts of the Eastern Goldfields to assist in the Geological Survey's 1:100 000 mapping program.

FUTURE DIRECTION OF THE GEOLOGICAL SURVEY

In September 1986, the incoming Director, Dr Phillip Playford, released a discussion document entitled "Future direction of the Geological Survey", outlining his ideas on the future strategy for development of the Survey. This was studied by and discussed with staff of the Survey, the Director General of Mines, Minister for Minerals and Energy, and representatives of the mining industry. After some minor modifications were made the strategy was adopted as Survey policy, and implementation began in October 1986.

The principal features of the new policy can be summarized as follows:

* **Geological Survey Liaison Committee:** A liaison committee has been set up comprising representatives of the Geological Survey, Chamber of Mines, Association of Mining and Exploration Companies, BMR, CSIRO, University of WA, Curtin University, and WA School of Mines, and chaired by the Director of the Survey. The objectives of the committee are firstly to examine and advise on the Survey's operations, and secondly to co-ordinate geoscientific research by Government and academia in Western Australia. The Geological Survey needs to ensure that it is carrying out work that is relevant to the needs of industry, and the liaison committee will be an appropriate forum through which to gauge industry views and seek broad support for the Survey's program. Two meetings of the committee were held, in October and December 1986.

* **Five-year Planning:** Five-year planning, linked to the Corporate Plan, has now been introduced in place of the previous annual planning. Project proposals are now mission oriented and are assessed on the basis of their economic and geoscientific importance to the State. Deadlines are specified, and are expected to be met, for the completion of each project.

* **Scientific Priorities:** Emphasis is to be placed on field-based, economically oriented, applied research, with the production of geological maps being given the highest priority. There has been a steady decline in field work by Survey staff in recent years; in 1976 each staff member spent an average of 67 days per day in the field, but in 1986 this had fallen to only 17 days (Fig. 1). In 1987 the target will be to achieve a 30% increase in field work, and during the next three years a total 100% increase will be sought.

* **Exploration Data Release:** The large backlog of company reports, that are due for release but can not be made available because they have not been microfilmed, has been of major concern to both exploration companies and the Survey directorate. A program to clear this backlog in 12 months has been instituted, involving employment of contract geologists and support staff and the use of private microfilm services.

* **Performance Appraisal:** A comprehensive performance-appraisal system for all staff is being introduced for the Survey, after examining the systems in use by various exploration companies in WA and fully consulting staff members.

* **Personal Computing:** A high priority has been given to the acquisition of PCs, to be used by geoscientists for both word processing and scientific computing. It is intended that over the next several years every staff member having a continuing need for such computing will be provided with a PC or other work station.

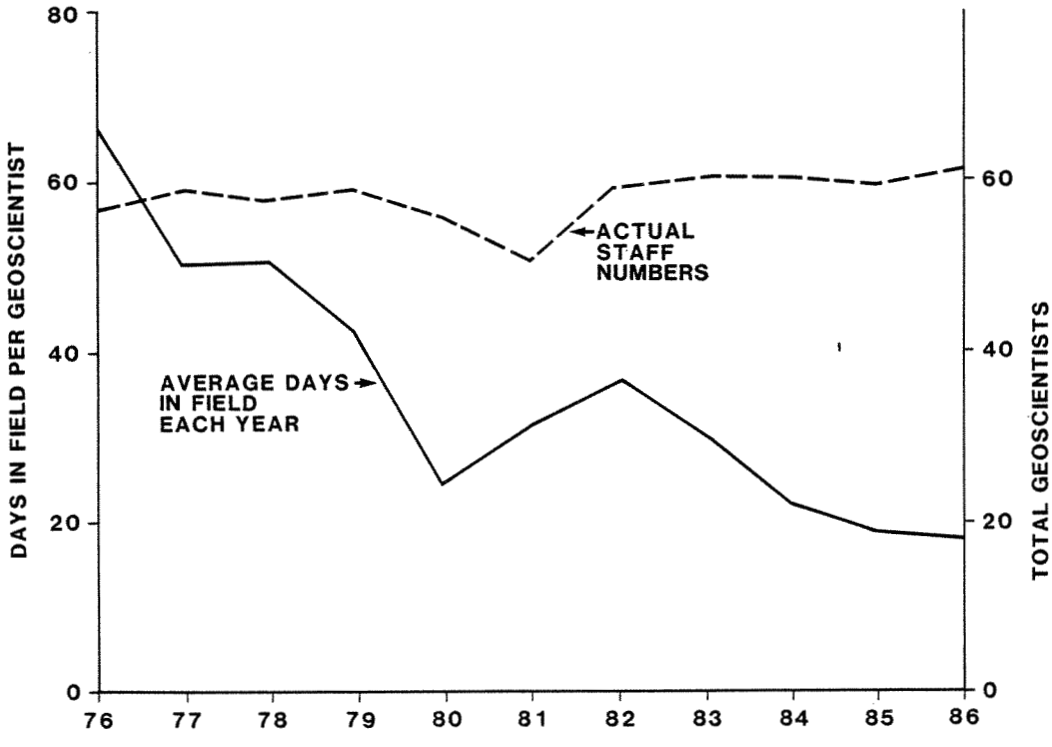

Figure 1: Graph of the average number of days spent in the field per year by each geoscientist, 1976-1986.

PROGRAM FOR 1987-1991

A five-year program, for the years 1987-1991, has been scheduled for the Geological Survey. This is the first time that such a long-term program has been proposed; previous work plans have been on a one-year basis only. The intention is that each year's program will now be seen to form an integral part of a long-term planning strategy.

The plan for 1987-1991, and those for subsequent years, are to be considered as "rolling" five-year plans, in that only the program for the first year is to be regarded as committed. The programs for the following four years will be subject to revision, as required by circumstances, when successive five-year plans are formulated each year.

The total number of projects being undertaken is excessive, given the available staff, but this will change during 1987, when a backlog of partly completed projects is to be cleared. As a result, the number of concurrent projects undertaken by individual staff will be reduced, and their work will become increasingly oriented towards high-priority tasks.

The intention of the five-year program is to concentrate on those aspects of geoscience that the Geological Survey does best, are of most value to industry and the general community, and are not being undertaken by others. It is intended to increase the level of field-based research, on the basis that geological mapping is the primary geoscientific role of the Survey.

The program is summarized in the tables at pages 43-48, and is covered in more detail in the subsequent text. Figures 2.4 (following page 48) show the location of field-oriented sub-programs and projects.

Some features of major new or expanded projects are outlined below in the following sections.

Geological mapping

Following completion of the first-edition 1:250 000 regional mapping of the State, priority is now being given to more detailed mapping, at 1:100 000 scale, of areas having high economic potential. The five-year program includes the mapping of twenty five 1:100 000 sheets, most of which cover prospective greenstone belts in the Eastern Goldfields. In addition, second-edition 1:250 000 mapping will proceed over important sheet areas where revision of the geology is desirable, and nine such sheets are to be mapped during the period.

Eastern Goldfields study

The mapping program in the Eastern Goldfields is to form part of an integrated study of the gold-bearing greenstone belts between Norseman and Menzies, relating gold and other mineralization to structure and stratigraphy, and studying the geology of individual deposits. This research will include a detailed structural study of the Golden Mile area.

North West Shelf study

A geological and geophysical study of the Mesozoic sequence on the North West Shelf, beginning with the Cretaceous, will be undertaken in conjunction with the Curtin University of Technology. This work will aim to integrate the results of the many seismic surveys and exploratory wells in this area.

Geology and mineral resources of National Parks

A program of geological mapping and mineral-resources assessment of the State's national parks is to begin, and will in due course be extended to cover other major nature reserves. The first three parks to be studied, commencing in 1987, will be the Rudall River, D'Entrecasteaux, and Hamersley Range National Parks.

Paterson Orogen

A major research project on the geology of the Paterson Orogen will begin in 1987, to include known mineralized belts in the Rudall, Throssell Range, and Telfer areas. This region is believed to be one of the most prospective "frontier" exploration areas in the State. The work on the Rudall River National Park will form part of this research.

Goldfields palaeodrainage groundwater study

A program of drilling, geophysical logging, sampling, and test pumping will be undertaken in a palaeodrainage system in the Eastern Goldfields in order to obtain information relevant to the development and management of saline water supplies for the mining industry. This will be the first such program undertaken by the Survey directed towards non-potable water supplies.

Hydrogeological mapping

A program of hydrogeological mapping, at 1:250 000 scale, will be extended over key areas of the State, with associated 1:100 000 maps where appropriate. A hydrogeological map of the State at 1:2 500 000 scale will also be produced in 1987.

The geology of Western Australia, Memoir 3

A new memoir on the geology of Western Australia, replacing Memoir 2, is to be produced in 1987, together with a new edition of the State geological map (1:2 500 000).

Computerization

The use of EDP systems in the Survey will be expanded as rapidly as possible. PC equipment will be acquired progressively over the next 5 years, with the objective of providing access to a workstation for each geoscientist having ongoing needs for scientific-computing, data-processing, or word-processing facilities.

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA, 1987-1991 PROGRAM SUMMARY

OBJECTIVE 1: INVESTIGATE, INTERPRET, AND RECORD THE GEOLOGY OF WESTERN AUSTRALIA

Programs	1.1 Prepare and maintain geological maps of the whole State at standard scales accompanied by explanatory notes & reports	1.2 Define the main tectonic units and achieve a comprehensive understanding of their evolution	1.3 Establish an understanding of the relationships between the main tectonic units	1.4 Date geological events and episodes within an appropriate time framework
Projects or Sub-programs	*1.1.2 Albany 1:1 000 000* *1.1.3 Balfour Downs 1:250 000* *1.1.4 Boorabbin 1:250 000* *1.1.5 Robertson 1:250 000* *1.1.6 Widgiemooltha 1:250 000* *1.1.8 Neuman 1:250 000* *1.1.9 Kalgoorlie 1:100 000* *1.1.10 Yilmia 1:100 000* *1.1.11 Coxon 1:100 000* *1.1.12 Lake Lefroy 1:100 000* *1.1.13 Bardoc 1:100 000* *1.1.14 Turee Creek 1:250 000* 1.1.15 Kalgoorlie 1:250 000 1.1.16 Rudall 1:250 000 1.1.17 Lennard River 1:250 000 *1.1.18 Geological map of WA* *1.1.19 Davyhurst 1:100 000(89)* 1.1.20 Riverina 1:100 000 1.1.21 Ballard 1:100 000 *1.1.22 Dumsville 1:100 000(88)* *1.1.23 Menzies 1:100 000* 1.1.24 Edjudina 1:100 000 1.1.25 Yabboo 1:100 000 *1.1.26 Kanowna 1:100 000(89)* 1.1.27 Gindalbi 1:100 000 1.1.28 Kurnalpi 1:100 000 1.1.29 Norseman 1:100 000 1.1.30 Laverton 1:100 000 *1.1.31 Neuman 1:100 000* 1.1.32 Ravensthorpe 1:100 000 *1.1.33 Paterson 1:100 000(90)* *1.1.34 Broadhurst 1:100 000(90)* 1.1.35 Rudall 1:100 000 1.1.36 Connaughton 1:100 000 1.1.37 Pearana 1:100 000	*1.2.1 Alkali granites of Eastern Goldfields* *1.2.2 Binneringie and other dolerite dykes* *1.2.3 Ashburton Fold belt* *1.2.4 Bresnahan Group* *1.2.5 Fortescue Group(90)* *1.2.7 King Leopold Orogen(89)* 1.2.8 Regional gravity mapping *A Bridgetown 1:100 000* B Dinninup 1:100 000 C SW Seismic Zone *1.2.9 SW Yilgarn linear zones* *1.2.10 Western Gneiss Terrain (North)(88)* *1.2.11 Bonaparte and Ord Basins* *1.2.14 Stromatolites, Glengarry Basin* *1.2.16 Wittenoom Dolomite study* *1.2.17 Mt Barren Group (88)* *1.2.18 Stratigraphy, Swan Coastal Plain* *1.2.19 Precambrian correlation - WA and Southern Africa* *1.2.20 Woongarra Volcanics Study* 1.2.21 Capricorn Orogen - high-grade metamorphics *1.2.22 Fortescue Group atmosphere(88)* 1.2.23 Halls Creek Orogen	*1.3.1 Southeastern Pilbara* *1.3.4 Proterozoic correlation(89)* *1.3.5 Precambrian biostratigraphy(S-P)* A Stromatolite distributions B Bangemall Group C Savory Group D Fortescue Group E Capricorn Orogen F Paterson Orogen G Officer Basin H Kimberley I Moora Group J Conical stromatolites K Miscellaneous L Synthesis	*1.4.1 Isotope geochronology(S-P)* *1.4.2 Radio-isotope geochronology and hydrology(S-P)* *A Perth artesian groundwater* B Carbon 14 age of lake sediments *1.4.3 Apply palaeontologic techniques(S-P)* *1.4.4 Post Archaean tectonic history western Yilgarn Block* 1.5 Achieve a good understanding of the surficial deposits and weathered layer associated with the geomorphological evolution of Western Australia *1.5.1 Magnetic properties of the regolith*

Italics - work to be conducted in 1987.
Roman - work to commence after 1987.

Italics(88) - work continues through 1987 to completion in 1988.
Italics(S-P) - work involves a continuing sub-program.

OBJECTIVE 2: RELATE MINERAL, PETROLEUM AND GROUNDWATER OCCURRENCES AND POTENTIAL TO THE GEOLOGY OF THE WESTERN AUSTRALIA

Program 2.1 Carry out detailed geoscientific investigations of specific structural and stratigraphic units at scales appropriate for understanding their mineral, fossil fuel and groundwater potentials

2.1.1 Eastern Goldfields Study *A Coxon/Lake Lefroy 1:100 000 maps* *B Yilmia/Kalgoorlie 1:100 000 maps* *C Kalgoorlie regional gold study* *D Golden Mile structure* *E Davyhurst-Mt Ida belt* *F Kanowna/Gindalbi/Kurnalpi 1:100 000(91)* *G Dunnsville/Menzies/Edjudina/Yabboo 1:100 000(91)* H Coolgardie-Norseman gold study I Geochemistry; Broad Arrow-Lake Ballard area ***2.1.3 Murchison metallogenic*** ***2.1.4 Pilbara geochemistry Phase 2*** ***2.1.9 Collie Basin(88)***	***2.1.10 Offshore Bonaparte Basin*** ***2.1.12 Northern Canning Basin*** ***2.1.13 Geophysics, S Perth Basin(88)*** ***2.1.14 NW Shelf studies*** *A Cretaceous(89)* B Jurassic C Triassic ***2.1.15 Mafic complexes, Western Gneiss Terrain(88)*** ***2.1.16 Permian palaeostratigraphy*** ***2.1.17 Devonian reef complexes*** ***2.1.18 Structure, thermal history, NW Shelf*** ***2.1.19 Petroleum source rocks*** ***2.1.20 Perth Basin coal(89)***	2.1.21 N margin Perth Basin 2.1.22 Ordovician, Canning Basin ***2.1.23 Paterson Orogen(91)*** ***2.1.24 Geology and mineral resources of national parks*** *A Rudall River(91)* *B D'Entrecasteaux(89)* *C Hamersley Range(89)* D Fitzgerald River E Unspecified 2.1.25 Ravensthorpe - West River greenstone belt 2.1.26 Ninghan greenstone belt 2.1.27 Mineral potential SW Western Gneiss Terrain

Program 2.2 Drill selected sites in structural units to help understand their mineral, fossil fuel and groundwater potential

2.2.1 Perth Basin shallow aquifers *A Busselton* *B Cataby* *C Scott Coastal Plain(89)* D Leeman E Greenough	2.2.2 SW Yilgarn minor basins ***2.2.3 Fortescue Coastal Plain*** 2.2.4 Collie Basin Groundwater Resources ***2.2.7 Goldfields palaeodrainage groundwater(88)***	***2.2.12 Perth Basin deep aquifers(S-P)*** *A Gillingarra Line* *B Cowaramup Line* C Karriedale Line D Dongara Line E Wicherina Line F Ajana Line

OBJECTIVE 2: RELATE MINERAL, PETROLEUM AND GROUNDWATER OCCURRENCES AND POTENTIAL TO THE GEOLOGY OF WESTERN AUSTRALIA (cont.)

Program	2.3 Characteristics of known mineral deposits		2.4 Develop conceptual models for mineral and fossil fuel deposits
	2.3.1 Bauxite deposits of SW(88) *2.3.2 Gold mineralization of WA* *A Bullfinch-Forrestania* *B Kalgoorlie regional gold* C Northern Southern Cross Province D Southern Southern Cross Province E Leonora Belt	F Laverton Belt G Coolgardie-Norseman *2.3.4 Nanutarra-Uaroo tungsten* *2.3.6 Mt Clement* *2.3.7 Mine inspections(S-P)*	*2.4.1 Mount Gibson(88)* *2.4.3 Potential for platinum group elements* *2.4.5 Collie Basin structure(88)* *2.4.6 Pegmatites in WA(91)* 2.4.7 Trace metals in groundwaters

OBJECTIVE 3: EVALUATE THE MINERAL, FOSSIL FUEL, AND GROUNDWATER RESOURCES OF WESTERN AUSTRALIA

Programs	3.1 Establish and maintain up-to-date comprehensive information on mineral, fossil-fuel and groundwater resources and on exploration for them	3.2 Assess undiscovered resources of economically important earth-sourced commodities	3.3 Evaluate the Reserves/Resources of specific mineral commodities
	3.1.1 Mineral exploration data(S-P) *3.1.2 Reserves/Resources inventory(S-P)* *3.1.3 Geoscientific evaluation of coal exploration(S-P)* *3.1.4 Geoscientific evaluation of petroleum exploration(S-P)* 3.1.5 Geophysical exploration data 3.1.6 Evaluation of stream-sediment geochemistry in the Kimberley	No projects planned	*3.3.2 Gypsum resources of WA(88)* *3.3.3 Industrial minerals assessment planning(S-P)* *3.3.4 Petroleum reserves assessment(S-P)* *A Saladin and Tubridgi Fields* 3.3.5 Silica sand deposits 3.3.6 Talc and magnesite in WA 3.3.7 Clay minerals *3.3.8 Limestone and limesand resources between Kalbarri and Black Point(91)* *A Lancelin to Bunbury* B Bunbury to Black Point C Kalbarri to Lancelin 3.3.9 Industrial minerals, Greenough area

OBJECTIVE

4: PROVIDE GEOTECHNICAL ADVICE AND SERVICES ON LAND USE, GROUNDWATER, ENVIRONMENTAL MANAGEMENT, URBAN DEVELOPMENT AND ENGINEERING PROJECTS

Program	**4.1** Provide geotechnical advice and assistance to other Government departments and instrumentalities	**4.2** Prepare and maintain hydrogeological maps at appropriate scales	**4.3** Prepare and maintain environmental geological maps in areas subject to competing land-use pressures	**4.4** Identify and study geological hazards and their effects	**4.5** Carry out geotechnical and geoscientific studies for land-use, environmental-management and hydrogeology projects
	4.1.1 Engineering geol. miscellaneous(S-P) *4.1.2 Engineering geol. dams and damsites(S-P)* *4.1.3 Land capability assessment(S-P)* *4.1.5 Harris Dam(90)* *4.1.6 Groundwater; advice to Govt Depts(S-P)* *4.1.11 Eval. groundwater in Metro area(S-P)* *A Lexia* *4.1.13 Groundwater contaminants* *A Licensed disposal(S-P)* *B Pollution inventory* *4.1.14 Irrigation areas(S-P)* *4.1.18 Hydrogeological consultants reports(S-P)* *4.1.19 Town Water Supplies(S-P)* *A Derby groundwater* *4.1.20 Wetlands(S-P)* *A Thompsons Lake(88)* *4.1.21 Geophysical Inv. for Govt Depts(S-P)*	*4.2.1 1:250 000 Maps(S-P)* *A Broome* *B Collie* *C Marble Bar* *D Perenjori* *E Derby* *F Kalgoorlie(88)* G La Grange H Munro I Bencubbin J Kellerberrin K Menzies L Leonora M Corrigin N Dumbleyung O Newdegate P Southern Cross Q Mandora R Sir Samuel S Sandstone T Noonkanbah U Hyden V Moora **4.2.2 1:100 000 Maps(S-P)** A Busselton B Ord C Bunbury D Pinjarra E Gingin	*4.3.1 1:50 000 maps(S-P)* *A Busselton* *C Capel* *C Yallingup* *D Burekup* *E Gleneagle* *F Karragullen* *G Jumperkine(88)* *H Albany(88)* I Geraldton J Carnarvon K Esperance L Kalgoorlie 4.3.2 1:100 000 Darling Range *4.3.3 1:25 000 Rottnest Island* *4.3.4 Hydrogeological advice for environmental maps(S-P)*	*4.4.1 SW Seismic zone(S-P)* 4.4.2 Engineering aspects of basic rocks	*4.5.1 Geophysical well logging(S-P)* *4.5.2 Land and stream salinization research* *A Bauxite mining(S-P)* *B North Stirlings land reclamation(89)* 4.5.3 Hydrochemical study of Harvey area

OBJECTIVE 5: MAKE GEOSCIENTIFIC AND GEOTECHNICAL INFORMATION AVAILABLE BY APPROPRIATE METHODS

Programs	5.1 Compile and issue publications, and make geotechnical and geoscientific information publicly available by appropriate methods	5.2 Establish and maintain EDP facilities including databases for government, public and industry	5.3 Establish and maintain a fossil collection
	5.1.1 Public presentation of results(S-P) *5.1.3 Memoir 3* *5.1.4 Mineral Deposits map* *5.1.5 Geological background to development of Perth* *5.1.7 State 1:2 500 000 Hydrogeological map* *5.1.8 Hydrogeology of the Perth Metro area(88)* *5.1.12 Hydrological advice to public(S-P)* *5.1.13 Respond to public enquiries(S-P)* *5.1.14 Maintain information in pamphlets(S-P)* *A Hydro notes(S-P)* *B Guide to Environmental maps* C Revise Gemstone pamphlet D Platinum pamphlet *E Overview of Mining(S-P)* 5.1.15 Geomorphological history of Swan Coastal Plain 5.1.16 Building Stones of WA *5.1.17 M-Series backlog*	*5.2.1 Review hardware and software requirements(S-P)* *5.2.2 MININFORM(S-P)* *5.2.3 WAMEX - M Series(S-P)* *5.2.4 State Water Resources Information System(S-P)* *5.2.5 WAMEX - Coal(S-P)* *5.2.6 Geophysical Data (S-P)* *5.2.8 WAPEX(S-P)* *5.2.9 Rock and Mineral Data(S-P)* *5.2.10 Develop and maintain minor EDP systems(S-P)* *5.2.11 Computerization of petrological studies(88)*	*5.3.1 Reference fossil collection(S-P)* A. Systematic description of Devonian Bivalvia of Lennard Shelf, Canning Basin

OBJECTIVES	6: MAINTAIN AND DEVELOP TECHNICAL AND SUPPORT FACILITIES TO MEET ALL OTHER OBJECTIVES		7: PROVIDE GEOSCIENTIFIC ADVICE IN SUPPORT OF MINES DEPARTMENT
Programs	6.1 Development of new techniques	6.2 Support Services for Geological Survey activities	*7.0.1 Petroleum Act(S-P)* *7.0.2 Mineral exploration and development (S-P)* *7.0.3 Mining Act(S-P)*
	6.1.1 Well Logging Systems(S-P) *A Modify SIE hardware* *B Install calibration facility* *6.1.3 Hydrogeological technology(S-P)* *A Slug test evaluation* B Geophysical tracing of pollution plumes 6.1.4 Geophysics in Soil Salinity(S-P) A Transient EM in N Stirling area	*6.2.1 Maintain appropriate support services* *6.2.2 Petrological services(S-P)* *6.2.3 Process publications(S-P)* *6.2.4 Publications and information support to staff(S-P)* *6.2.5 Geochemical services(S-P)* *6.2.6 Aeromagnetic data interpretation(S-P)*	*7.0.4 Review external engineering and environmental reports(S-P)* *7.0.5 Bauxite extraction planning(S-P)* *7.0.7 Petroleum tenement planning(S-P)*

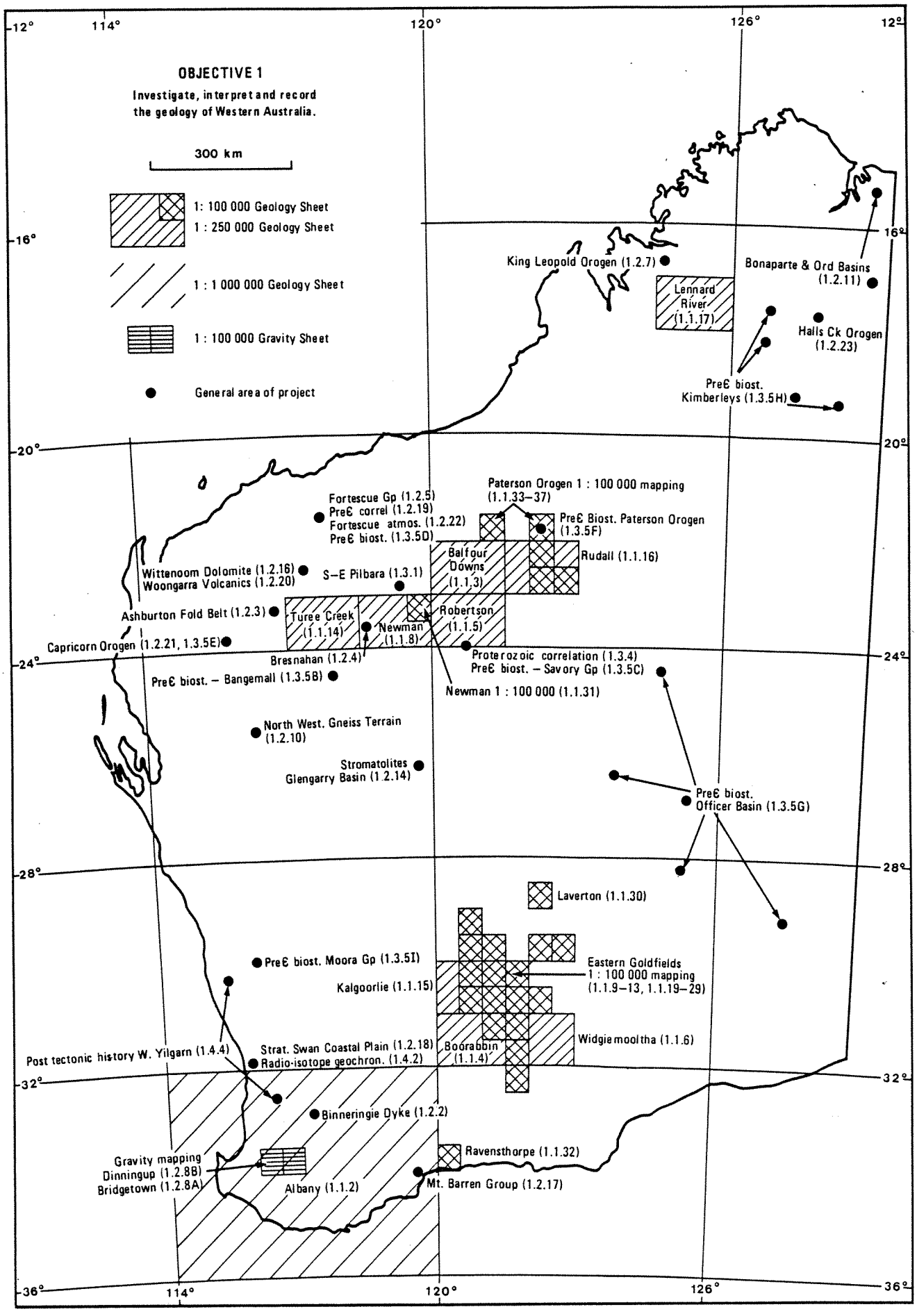
OBJECTIVE 1
Investigate, interpret and record the geology of Western Australia.
300 km
1: 100 000 Geology Sheet
1 : 250 000 Geology Sheet
1 : 1 000 000 Geology Sheet
1 : 100 000 Gravity Sheet
General area of project
12°
114°
120°
126°
16°
20°
24°
28°
32°
36°
King Leopold Orogen (1.2.7)
Bonaparte & Ord Basins (1.2.11)
Lennard River (1.1.17)
Halls Ck Orogen (1.2.23)
PreЄ biost. Kimberleys (1.3.5H)
Paterson Orogen 1 : 100 000 mapping (1.1.33–37)
Fortescue Gp (1.2.5)
PreЄ correl (1.2.19)
Fortescue atmos. (1.2.22)
PreЄ biost. (1.3.5D)
PreЄ Biost. Paterson Orogen (1.3.5F)
Balfour Downs (1.1.3)
Rudall (1.1.16)
Wittenoom Dolomite (1.2.16)
Woongarra Volcanics (1.2.20)
S–E Pilbara (1.3.1)
Ashburton Fold Belt (1.2.3)
Turee Creek (1.1.14)
Newman (1.1.8)
Robertson (1.1.5)
Capricorn Orogen (1.2.21, 1.3.5E)
Bresnahan (1.2.4)
Proterozoic correlation (1.3.4)
PreЄ biost. – Savory Gp (1.3.5C)
PreЄ biost. – Bangemall (1.3.5B)
Newman 1 : 100 000 (1.1.31)
North West. Gneiss Terrain (1.2.10)
Stromatolites Glengarry Basin (1.2.14)
PreЄ biost. Officer Basin (1.3.5G)
Laverton (1.1.30)
PreЄ biost. Moora Gp (1.3.5I)
Eastern Goldfields 1 : 100 000 mapping (1.1.9–13, 1.1.19–29)
Kalgoorlie (1.1.15)
Widgiemooltha (1.1.6)
Boorabbin (1.1.4)
Post tectonic history W. Yilgarn (1.4.4)
Strat. Swan Coastal Plain (1.2.18)
Radio-isotope geochron. (1.4.2)
Binneringie Dyke (1.2.2)
Ravensthorpe (1.1.32)
Gravity mapping
Dinningup (1.2.8B)
Bridgetown (1.2.8A)
Albany (1.1.2)
Mt. Barren Group (1.2.17)

Figure 2

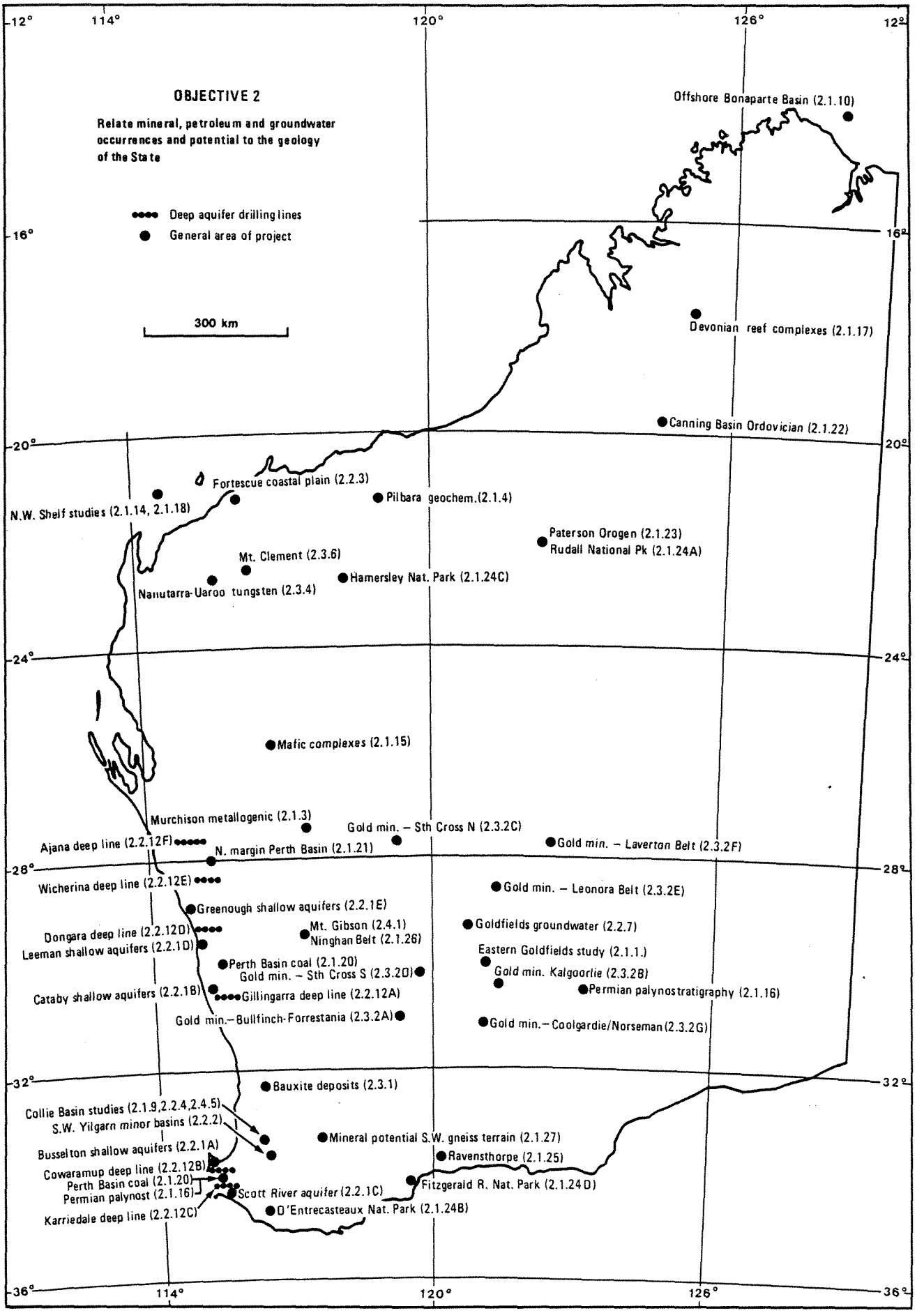
OBJECTIVE 2
Relate mineral, petroleum and groundwater occurrences and potential to the geology of the State
Deep aquifer drilling lines
General area of project
300 km
12°
114°
120°
126°
16°
20°
24°
28°
32°
36°
Offshore Bonaparte Basin (2.1.10)
Devonian reef complexes (2.1.17)
Canning Basin Ordovician (2.1.22)
Fortescue coastal plain (2.2.3)
N.W. Shelf studies (2.1.14, 2.1.18)
Pilbara geochem.(2.1.4)
Paterson Orogen (2.1.23)
Rudall National Pk (2.1.24A)
Mt. Clement (2.3.6)
Hamersley Nat. Park (2.1.24C)
Nanutarra-Uaroo tungsten (2.3.4)
Mafic complexes (2.1.15)
Murchison metallogenic (2.1.3)
Gold min. – Sth Cross N (2.3.2C)
Ajana deep line (2.2.12F)
N. margin Perth Basin (2.1.21)
Gold min. – Laverton Belt (2.3.2F)
Wicherina deep line (2.2.12E)
Gold min. – Leonora Belt (2.3.2E)
Greenough shallow aquifers (2.2.1E)
Mt. Gibson (2.4.1)
Ninghan Belt (2.1.26)
Dongara deep line (2.2.12D)
Goldfields groundwater (2.2.7)
Leeman shallow aquifers (2.2.1D)
Eastern Goldfields study (2.1.1.)
Perth Basin coal (2.1.20)
Gold min. – Sth Cross S (2.3.2D)
Gold min. Kalgoorlie (2.3.2B)
Permian palynostratigraphy (2.1.16)
Cataby shallow aquifers (2.2.1B)
Gillingarra deep line (2.2.12A)
Gold min.–Bullfinch-Forrestania (2.3.2A)
Gold min.–Coolgardie/Norseman (2.3.2G)
Bauxite deposits (2.3.1)
Collie Basin studies (2.1.9,2.2.4,2.4.5)
S.W. Yilgarn minor basins (2.2.2)
Mineral potential S.W. gneiss terrain (2.1.27)
Busselton shallow aquifers (2.2.1A)
Ravensthorpe (2.1.25)
Cowaramup deep line (2.2.12B)
Perth Basin coal (2.1.20)
Fitzgerald R. Nat. Park (2.1.24D)
Permian palynost (2.1.16)
Scott River aquifer (2.2.1C)
Karriedale deep line (2.2.12C)
D'Entrecasteaux Nat. Park (2.1.24B)

Figure 3

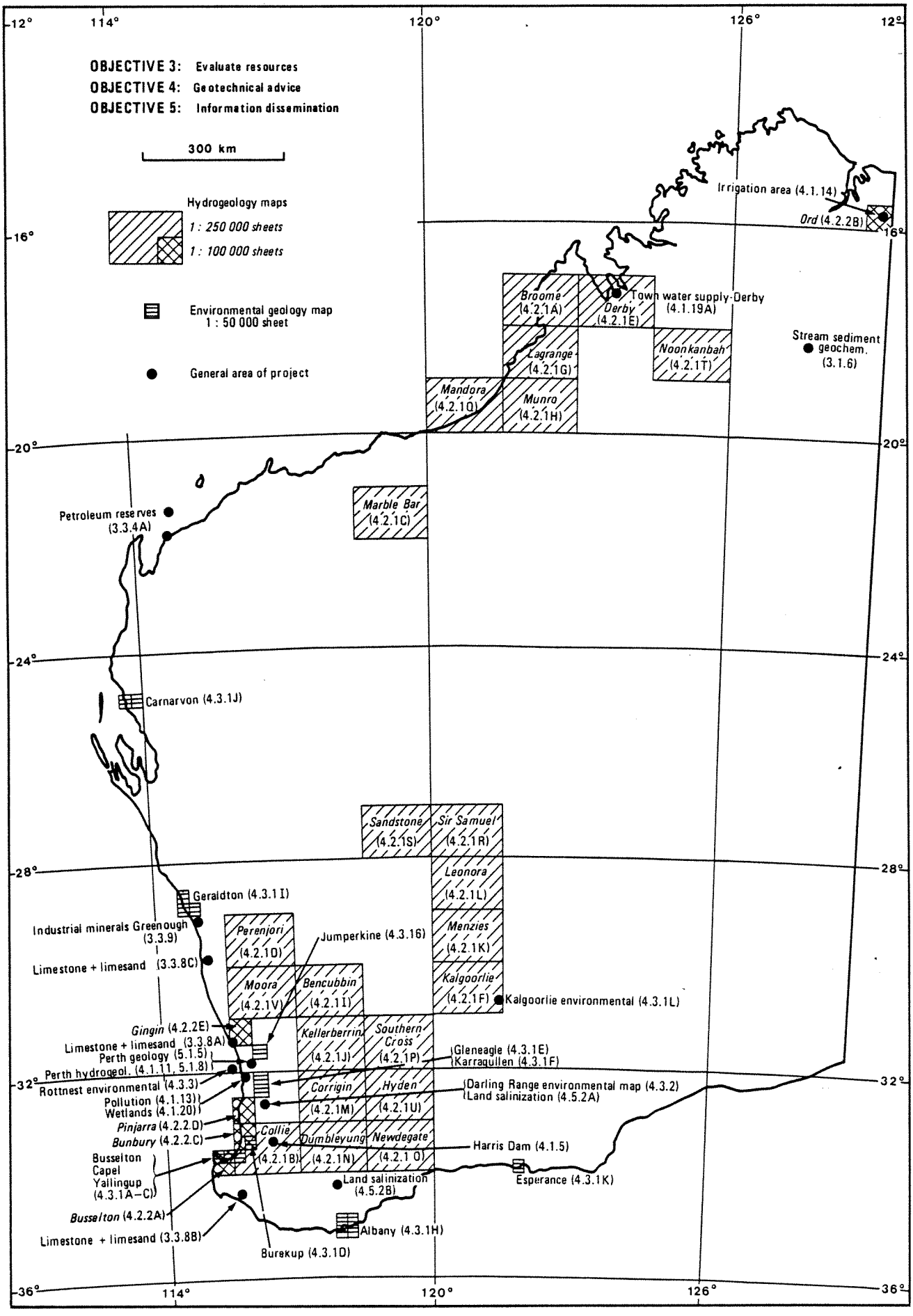
OBJECTIVE 3: Evaluate resources
OBJECTIVE 4: Geotechnical advice
OBJECTIVE 5: Information dissemination
300 km
Hydrogeology maps
1 : 250 000 sheets
1 : 100 000 sheets
Environmental geology map 1 : 50 000 sheet
General area of project
12°
114°
120°
126°
16°
20°
24°
28°
32°
36°
Irrigation area (4.1.14)
Ord (4.2.2B)
Broome (4.2.1A)
Derby (4.2.1E)
Town water supply-Derby (4.1.19A)
Lagrange (4.2.1G)
Noonkanbah (4.2.1T)
Stream sediment geochem. (3.1.6)
Mandora (4.2.1Q)
Munro (4.2.1H)
Marble Bar (4.2.1C)
Petroleum reserves (3.3.4A)
Carnarvon (4.3.1J)
Sandstone (4.2.1S)
Sir Samuel (4.2.1R)
Leonora (4.2.1L)
Menzies (4.2.1K)
Kalgoorlie (4.2.1F)
Kalgoorlie environmental (4.3.1L)
Geraldton (4.3.1I)
Industrial minerals Greenough (3.3.9)
Limestone + limesand (3.3.8C)
Perenjori (4.2.1D)
Jumperkine (4.3.16)
Moora (4.2.1V)
Bencubbin (4.2.1I)
Gingin (4.2.2E)
Limestone + limesand (3.3.8A)
Perth geology (5.1.5)
Perth hydrogeol. (4.1.11, 5.1.8)
Rottnest environmental (4.3.3)
Pollution (4.1.13)
Wetlands (4.1.20)
Pinjarra (4.2.2D)
Bunbury (4.2.2C)
Busselton Capel Yallingup (4.3.1A–C)
Busselton (4.2.2A)
Limestone + limesand (3.3.8B)
Kellerberrin (4.2.1J)
Southern Cross (4.2.1P)
Gleneagle (4.3.1E)
Karraqullen (4.3.1F)
Corrigin (4.2.1M)
Hyden (4.2.1U)
Darling Range environmental map (4.3.2)
Land salinization (4.5.2A)
Collie (4.2.1B)
Dumbleyung (4.2.1N)
Newdegate (4.2.1O)
Harris Dam (4.1.5)
Land salinization (4.5.2B)
Esperance (4.3.1K)
Albany (4.3.1H)
Burekup (4.3.1D)

Figure 4

GEOLOGICAL SURVEY DIVISION
FIVE-YEAR CORPORATE PLAN 1987-1991

PROJECT (P) OR SUB-PROGRAM (SP)		1987 J F M A M J J A S O N D	1988 J F M A M J J A S O N D	1989 J F M A M J J A S O N D	1990 J F M A M J J A S O N D	1991 J F M A M J J A S O N D
GEOLOGICAL MAPPING						
1.1.2 ALBANY 1:1 000 000	P	JSM(1]				
1.1.3 BALFOUR DOWNS 1:250 000	P	IRW(1)				
1.1.4 BOORABIN 1:250 000	P	WMH(8)				
1.1.5 ROBERTSON 1:250 000	P	IRW(8) IMT(4)				
1.1.6 WIDGIEMOOLTHA 1:250 000	P	TJG(<1)				
1.1.8 NEWMAN 1:250 000	P	IMT(8) WMH* IRW(W)				
1.1.9 KALGOORLIE 1:100 000	P	--WMH*---]				
1.1.10 YILMIA 1:100 000	P	--WMH*---]				
1.1.11 COWAN 1:100 000	P	--TJG*-]				
1.1.12 LAKE LEFROY 1:100 000	P	--TJG*-]				
1.1.13 BARDOC 1:100 000	P	WW*--]				
1.1.14 TUREE CREEK 1:250 000	P	AMT(5) IMT(8) WMH*]				
1.1.15 KALGOORLIE 1:250 000	P				[-------WMH* CPS* WW*----------]	
1.1.16 RUDALL 1:250 000	P				[---KPW* BMD* IRW*------]	
1.1.17 LENNARD RIVER 1:250 000	P		[----------TJG* IMT* PEP*----------]			
1.1.18 GEOLOGICAL MAP OF WESTERN AUSTRALIA	P	[JSM(4) RMH(4)				
1.1.19 DAVYHURST 1:100 000	P	[----------WMH* WW*----------]				
1.1.20 RIVERINA 1:100 000	P			[---------WMH*----------]		
1.1.21 BALLARD 1:100 000	P				[---------WMH*----------]	
1.1.22 DUNNSVILLE 1:100 000	P	[--------CPS*----------]				
1.1.23 MENZIES 1:100 000	P	[------------WW* CPS*------------]				
1.1.24 EDJUDINA 1:100 000	P			[------------CPS*----------]		
1.1.25 YABBOO 1:100 000	P				[---------CPS*----------]	
1.1.26 KANOWNA 1:100 000	P	[----------ALA* & BMR STAFF----------]				
1.1.27 GINDALBI 1:100 000	P			[----------ALA*----------]		
1.1.28 KURNALPI 1:100 000	P			[---------ALA* & BMR STAFF ----------]		
1.1.29 NORSEMAN 1:100 000	P			[----------WW*----------]		

NOTE: Initials represent the geoscientists involved (see key at back),
with the number of person-weeks shown in brackets
* = Time allocated to another project, see main report on the program.

PROJECT (P) OR SUB-PROGRAM (SP)		1987 J F M A M J J A S O N D	1988 J F M A M J J A S O N D	1989 J F M A M J J A S O N D	1990 J F M A M J J A S O N D	1991 J F M A M J J A S O N D
GEOLOGICAL MAPPING (continued)						
1.1.30 LAVERTON 1:100 000	P				[----------BMD*----------]	
1.1.31 NEWMAN 1:100 000	P	--IMT* --]				
1.1.32 RAVENSTHORPE 1:100 000	P		[----------SLL*----------]			
1.1.33 PATERSON 1:100 000	P	[----------BMD*----------]				
1.1.34 BROADHURST 1:100 000	P	[----------BMD* KPW* SMB*----------]				
1.1.35 RUDALL 1:100 000	P		[----------KPW* SMB* IRW*----------]			
1.1.36 CONNAUGHTON 1:100 000	P			[----------KPW* IRW* SMB*----------]		
1.1.37 PEARANA 1:100 000	P	[----------IRW* AFT*----------]				
STUDIES OF TECTONIC UNITS						
1.2.1 ALKALI GRANITES OF EASTERN GOLDFIELDS	P	WGL				
1.2.2 BINNERINGIE DYKE & OTHER DOLERITE DYKES	P	GS(3) JHW(1) DR(3)				
1.2.3 ASHBURTON FOLD BELT	P	AMT(18)--]				
1.2.4 BRESNAHAN GROUP	P	----WMH(8)-------]				
1.2.5 FORTESCUE GROUP	P	----------AMT(132) AFT(116)----------]			----------AMT(30) AFT(45)---------->	
1.2.7 KING LEOPOLD OROGEN	P	----------TJG(114) IMT(99) JDL(40) 2 BMR STAFF----------]				
1.2.8 REGIONAL GRAVITY MAPPING	SP	---------- ---------- ---------->				
A. BRIDGETOWN 1:100 000		LK(10)-]				
B. DINNINUP 1:100 000			[----------LK(38) JHW(17) DR(18)----------]			
C. SW SEISMIC ZONE					[LK(18) JHW(5) DR(6)	
1.2.9 SOUTHWEST YILGARN LINEAR ZONES	P	PRD(5) GS(4) JSM(1) LK(3) JHW(4) DR(3)				
1.2.10 WESTERN GNEISS TERRAIN, NORTHERN SECTOR	P	------JSM(22) WGL(4) IF(10)-------]----------JSM(50)---------->				
1.2.11 BONAPARTE & ORD BASINS	P	--AJM(2)---]				
1.2.14 STROMATOLITES FROM GLENGARRY SUB-BASIN	P	--------KG(24)---------]				
1.2.16 WITTENOOM DOLOMITE STUDY	P	--------SIMONSON-------]				
1.2.17 MOUNT BARREN GROUP STRUCTURE	P	----------BROWN----------]				
1.2.18 STRATIGRAPHY OF SWAN COASTAL PLAIN	P	[---ADA(7)--]				
1.2.19 PRECAMBRIAN CORRELATION OF WA & SOUTHERN AFRICA	P	[----------RDG(15)----------]				
1.2.20 WOONGARRA VOLCANIC STUDY	P	[---AFT(9)-----]				
1.2.21 CAPRICORN OROGEN	P					[KPW(25) WMH(25) RD(5) JGB(13) AHH(12)------>
1.2.22 ATMOSPHERIC CONDITIONS IN FORTESCUE GROUP TIME	P	----------PACKER----------]				
1.2.23 HALLS CREEK OROGEN	P				[----------TJG(86) IMT(86)---------->	

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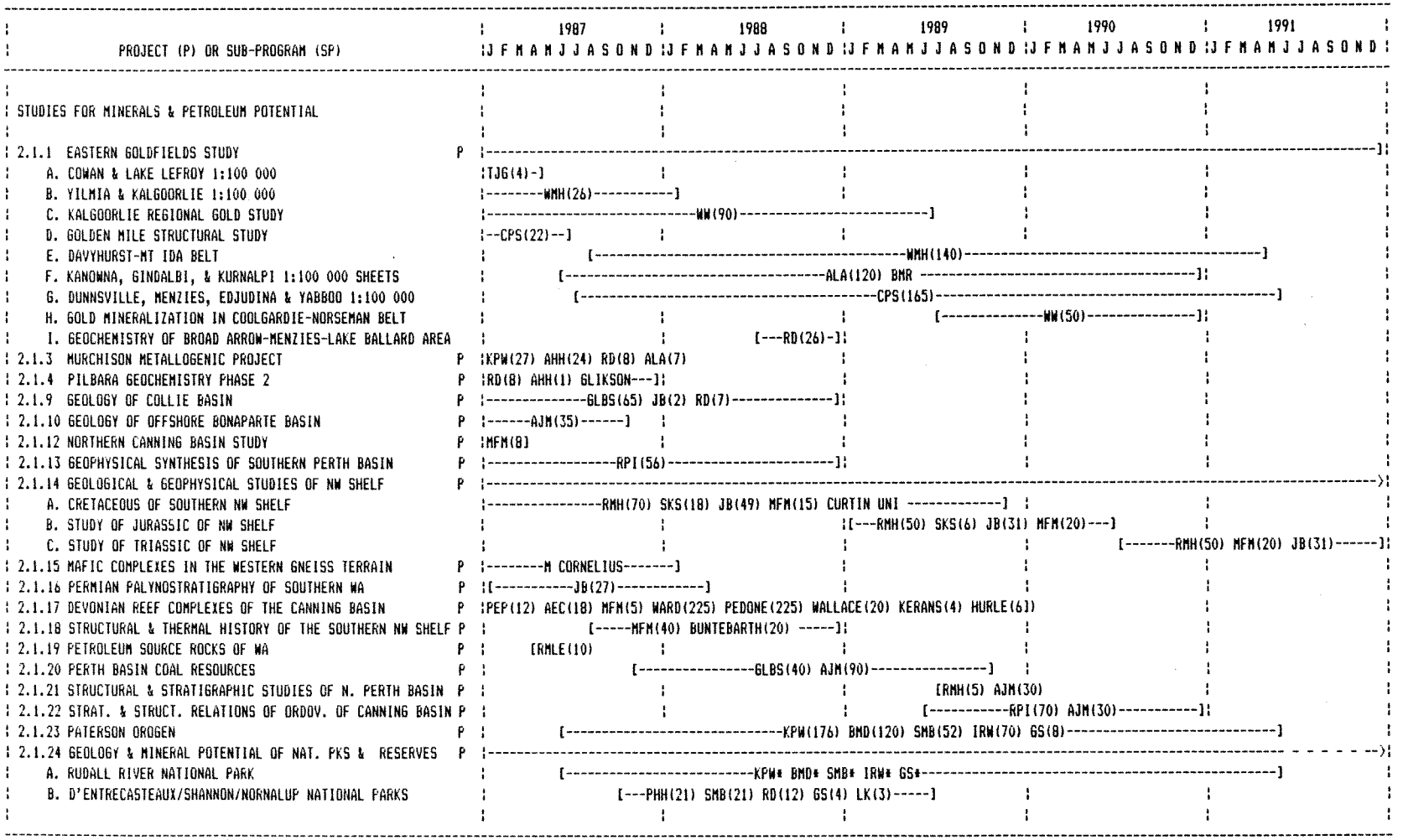
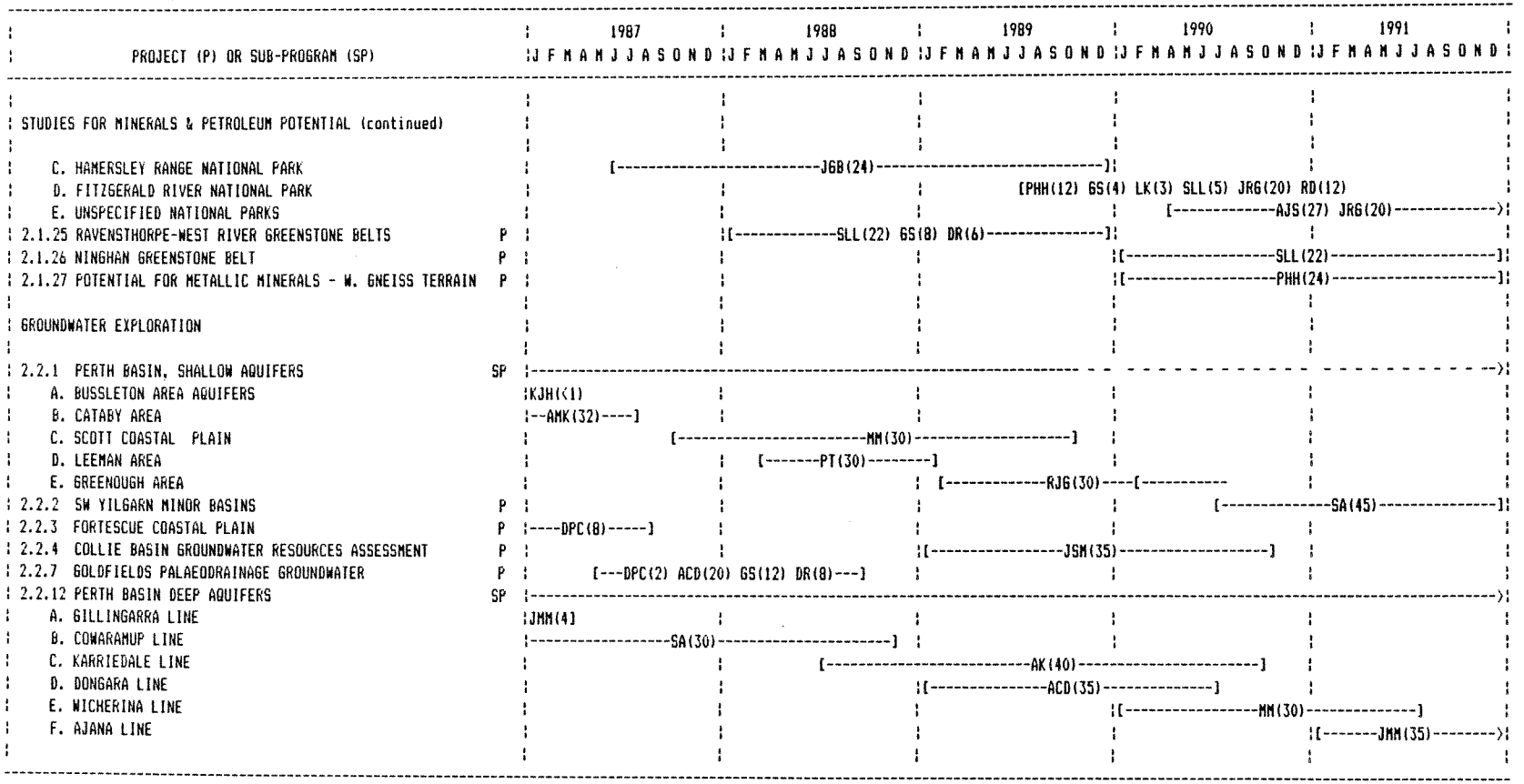
RELATIONSHIPS BETWEEN TECTONIC UNITS						
1.3.1 GEOLOGICAL EVOLUTION OF SE PILBARA	P	IMT(21)				
1.3.4 PROTEROZOIC CORRELATION	P	------------------IRW(85)	KG(20)------------------	---------]		
1.3.5 PRECAMBRIAN BIOSTRATIGRAPHY	SP		[------------------	------------------	------------------	------------------>
A. STROMATOLITE DISTRIBUTIONS			[KG(2)			
B. BANGEMALL BIOSTRATIGRAPHY			[-----KG(10)-------]			
C. SAVORY GROUP BIOSTRATIGRAPHY				KG(8]		
D. FORTESCUE GROUP BIOSTRATIGRAPHY				KG(8]		
E. CAPRICORN OROGEN BIOSTRATIGRAPHY				KG(8]		
F. PATERSON OROGEN BIOSTRATIGRAPHY				[---KG(8)--]		
G. OFFICER BASIN BIOSTRATIGRAPHY					[-KG(12]	
H. KIMBERLEY BIOSTRATIGRAPHY					KG(10]	
I. MOORA GROUP BIOSTRATIGRAPHY					[KG(8]	
J. CONICAL STROMATOLITES					KG(8]	
K. MISCELLANEOUS PROTEROZOIC BIOSTRATIGRAPHY						KG(12]
L. SYNTHESIS OF PRECAMBRIAN BIOSTRATIGRAPHY						[-----KG(20)-----]
GEOCHRONOLOGY						
1.4.1 ISOTOPE GEOCHRONOLOGY	SP	------------------	------------------	AFT(18) IF(215) WGL(20) JGB(10)	------------------	------------------>
1.4.2 RADIO-ISOTOPE GEOCHRONOLOGY & HYDROLOGY	SP	- - - - - - - - -	- - - - - - - - -	- - - - - - - - -	- - - - - - - - -	- - - - - - - - ->
A. PERTH ARTESIAN GROUNDWATER		PT(15)]				
B. CARBON-14 AGE OF LAKE SEDIMENTS OF SWAN COASTAL PLAIN				[-------PT(24)--------]		
1.4.3 APPLY PALAEONTOLOGICAL TECHNIQUES	SP	------------------	------------------	SKS(10) JB(60) KG(20)	------------------	------------------>
1.4.4 POST-ARCHAEAN TECTONIC HISTORY OF W. YILGARN BLOCK	P	------------------	------------------	WGL(75)	------------------	------------------]
REGOLITH STUDIES						
1.5.1 MAGNETIC PROPERTIES OF THE REGOLITH	P	------------------GS(12)	JHW(12) DR(12)------------	---------]		

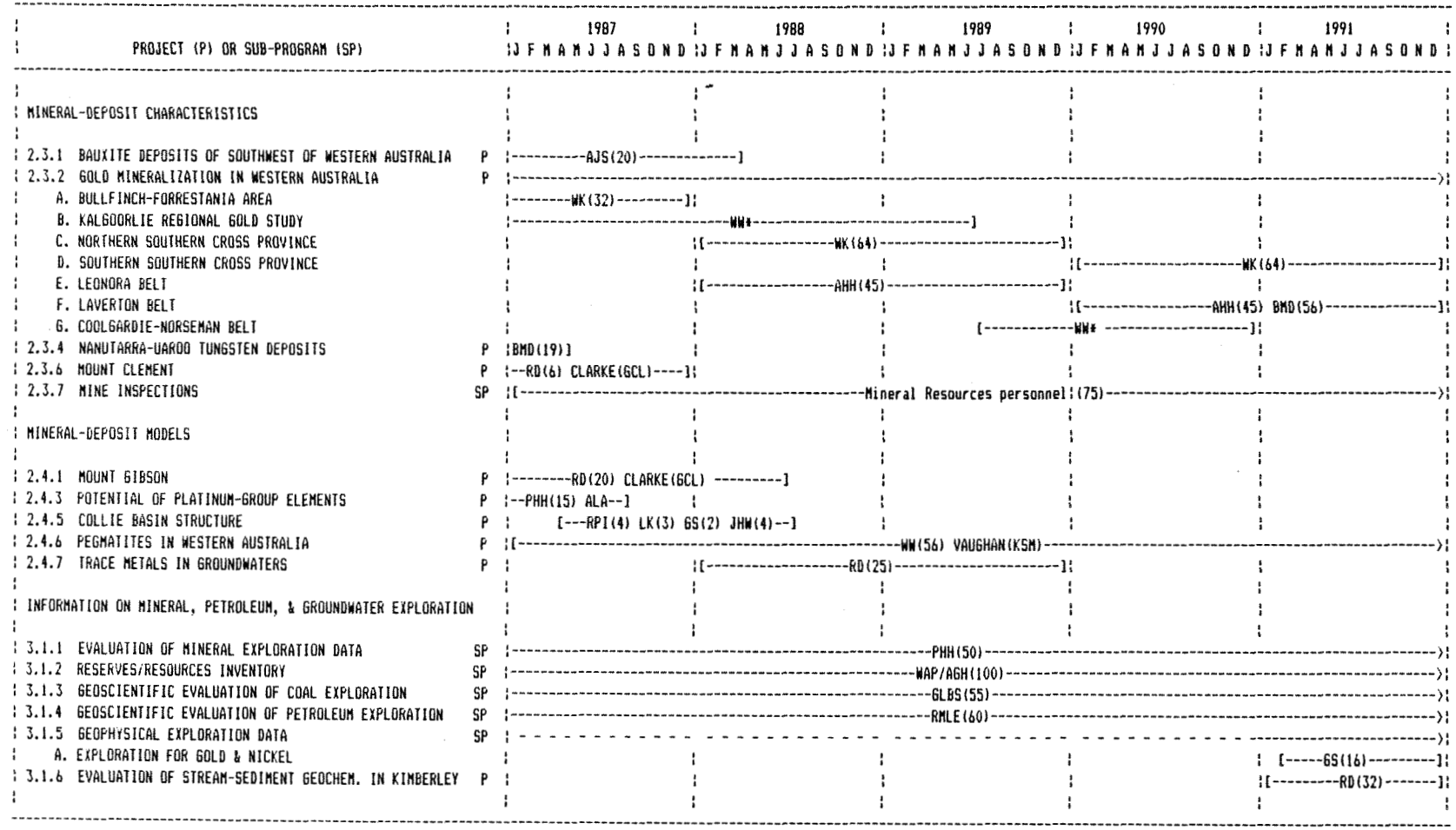
GEOLOGICAL SURVEY DIVISION
FIVE-YEAR CORPORATE PLAN 1987-1991



GEOLOGICAL SURVEY DIVISION
FIVE-YEAR CORPORATE PLAN 1987-1991



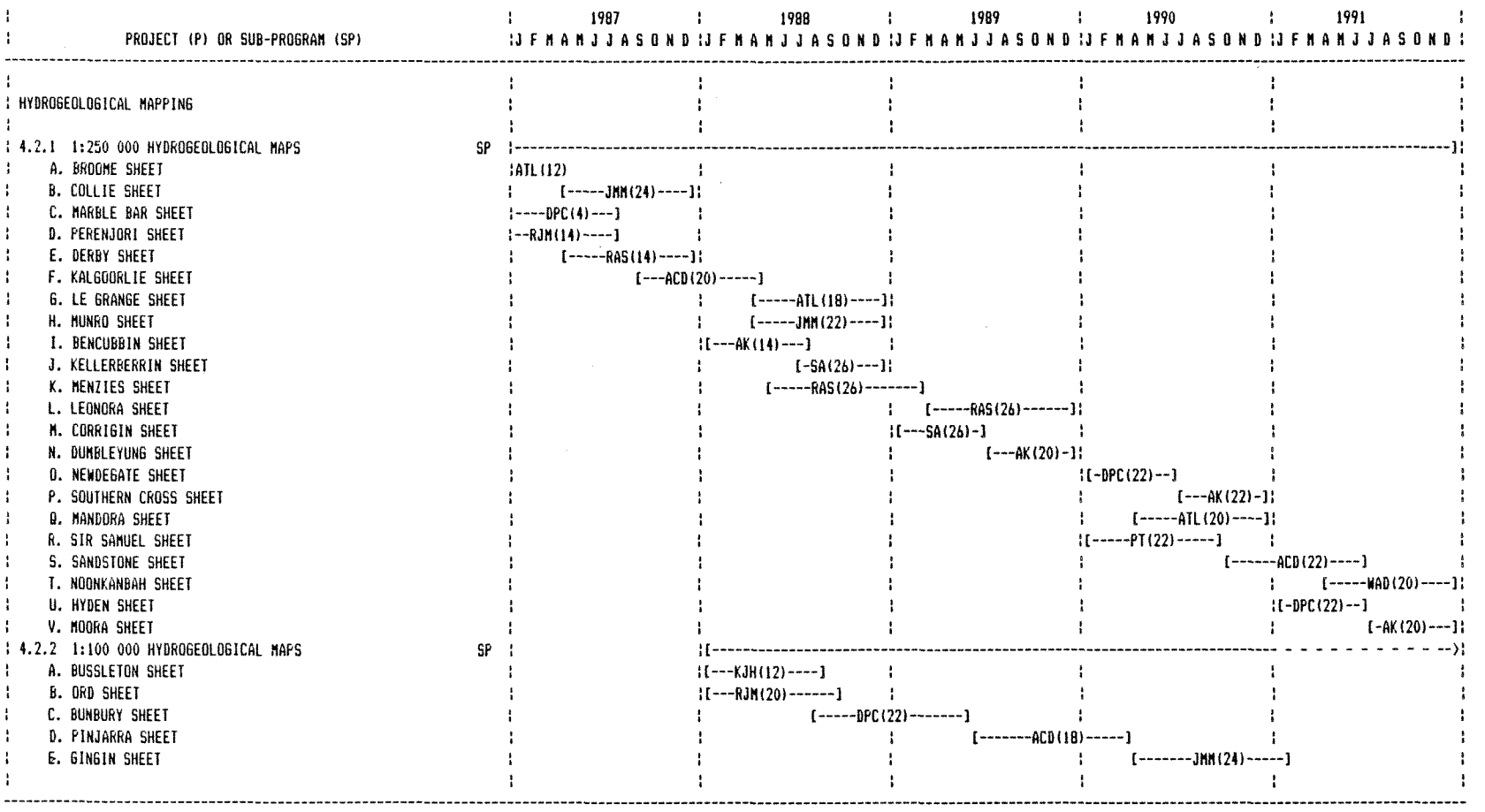
GEOLOGICAL SURVEY DIVISION
FIVE-YEAR CORPORATE PLAN 1987-1991



GEOLOGICAL SURVEY DIVISION
FIVE-YEAR CORPORATE PLAN 1987-1991

PROJECT (P) OR SUB-PROGRAM (SP)		1987 J F M A M J J A S O N D	1988 J F M A M J J A S O N D	1989 J F M A M J J A S O N D	1990 J F M A M J J A S O N D	1991 J F M A M J J A S O N D
EVALUATION OF MINERALS & PETROLEUM RESOURCES						
3.3.2 GYPSUM RESOURCES OF WESTERN AUSTRALIA	P	[-----JMF(20)----------]				
3.3.3 INDUSTRIAL MINERAL ASSESSMENT PLANNING	SP			JRG(20)		
3.3.4 PETROLEUM RESERVES ASSESSMENT	SP			MFM(48)		
A. STUDY SALADIN & TUBRIDGI FIELDS		MFM(12]				
3.3.5 SILICA SAND DEPOSITS OF WESTERN AUSTRALIA	P		[-------JMF(20)---------]			
3.3.6 TALC & MAGNESITE IN WESTERN AUSTRALIA	P			[-------JMF(20)---------]		
3.3.7 CLAY MINERALS	P				[---------JMF(40)	
3.3.8 LIMESTONE & LIMESAND RESOURCES - KALBARRI & BLACK PT	P					
A. BETWEEN LANCELIN & BUNBURY		JRG(2)				
B. BETWEEN BUNBURY & BLACK POINT			[JRG(6)]			
C. BETWEEN KALBARRI & LANCELIN						[JRG(6)]
3.3.9 INDUSTRIAL MINERAL RESOURCES OF THE GREENOUGH AREA	P			[---------JRG(13)----------]		
GEOTECHNICAL & HYDROGEOLOGICAL ADVICE						
4.1.1 ENGINEERING GEOLOGICAL ADVICE: MISC. CONSTRUCTIONS	SP			RPM(20) GWM(70) JRG(10) SJB(25)		
4.1.2 ENGINEERING GEOLOGICAL ADVICE: DAMS & DAMSITES	SP			RPM(50) GWM(120) SJB(40)		
4.1.3 LAND CAPABILITY ASSESSMENT	SP			AJS(5) JRG(5)		
4.1.5 HARRIS DAM	P			SJB(145)		
4.1.6 ADVICE ON GROUNDWATER TO OTHER GOVERMENT DEPARTMENTS	SP		ATL(20) ADA(10) DPC(10) WAD(10) KJH(5) ACD(5) JMM(5) RJM(10)			
4.1.11 EVALUATION & ASSESSMENT OF G/WATER IN PERTH METRO	SP				WAD(20)	
A. HYDROGEOLOGY OF LEXIA AREA		WAD(4)				
4.1.13 GROUNDWATER CONTAMINANTS & POLLUTANTS	SP					
A. LICENSED EFFLUENT & WASTE SITES				KJH(70)		
B. POLLUTION SITE INVENTORY & REVIEW		KJH(12)				
4.1.14 IRRIGATION AREA EVALUATION	SP			KJH(30) RJM(60)		
4.1.18 REVIEW CONSULTANTS REPORTS FOR OTHER DEPARTMENTS	SP		ADA(5) ATL(10) DPC(10) WAD(10) KJH(10)			
4.1.19 TOWN WATER SUPPLIES	SP		WAD(15) KJH(20) AK(30) RAS(60) RJM(50)			
A. DERBY REGIONAL GROUNDWATER ASSESSMENT		[--------RAS(12)--------]				
4.1.20 WETLAND STUDIES	SP					
A. HYDROGEOLOGY OF THOMPSONS LAKE		[-----------PT(9)----------]				
4.1.21 GEOPHYSICAL INVEST. & ADVICE FOR OTHER GOV'T DEPTS	SP		LK(50) GS(45) RPM(5) GWM(5) SJB(5) JHW(45) DR(45)			

GEOLOGICAL SURVEY DIVISION
FIVE-YEAR CORPORATE PLAN 1987-1991



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ENVIRONMENTAL MAPPING						
4.3.1 1:50 000 ENVIRONMENTAL MAPPING	SP	[----------	----------	----------	----------	---------->
A. BUSSELTON SHEET		SMB(1)				
B. CAPEL SHEET		SMB(1)				
C. YALLINGUP SHEET		SMB(2)				
D. BUREKUP SHEET		GWM(13)-]				
E. GLENEAGLE SHEET		[-----AJS(4)----]				
F. KARRAGULLEN SHEET		--------AJS(4)-----]				
G. JUMPERKINE SHEET		----------AJS(10)----------]				
H. ALBANY AREA		[----------JRG(26)----------]				
I. GERALDTON AREA				[----------JRG(20)----------]		
J. CARNARVON AREA					[-----AJS(24)------]	
K. ESPERANCE SHEET					[-----SMB(20)------]	
L. KALGOORLIE AREA				SMB(5)		
4.3.2 CENTRAL DARLING RANGE 1:100 000 MAP	P		[-----AJS(20)----]			
4.3.3 ROTTNEST ISLAND	P	JRG(4)				
4.3.4 HYDROGEOLOGICAL ADVICE FOR ENVIRON. GEOLOGY MAPS	SP	[----------	----------	ADA(5-10) ATL(5-10) ----------	----------	---------->
GEOLOGICAL HAZARDS						
4.4.1 SOUTHWEST SEISMIC ZONE DATABASE	SP	[----------	----------	RPM(10) ----------	----------	---------->
4.4.2 ENGINEERING ASPECTS OF PETROLOGY OF BASIC ROCKS	P			[----------JDL(13)----------]		
HYDROGEOLOGICAL ENVIRONMENTAL PROJECTS						
4.5.1 GEOPHYSICAL WELL LOGGING	SP	[----------	----------	LK(15) GS(10) JHW(65) DR(45) ----------	----------	---------->
4.5.2 LAND & STREAM SALINIZATION RESEARCH	SP					
A. RESEARCH RELATING TO BAUXITE MINING		[----------	----------	PT(60) MM(120) GS(1) ----------	----------	---------->
B. NORTH STIRLINGS LAND RECLAMATION		[----------	SA(12) ATL(15) ----------	----------	----------	----------
4.5.3 HYDROCHEMICAL STUDY OF HARVEY AREA	P		[---------ACD(20)---------]			

GEOLOGICAL SURVEY DIVISION
FIVE-YEAR CORPORATE PLAN 1987-1991

PROJECT (P) OR SUB-PROGRAM (SP)		1987 J F M A M J J A S O N D	1988 J F M A M J J A S O N D	1989 J F M A M J J A S O N D	1990 J F M A M J J A S O N D	1991 J F M A M J J A S O N D
PUBLICATION OF GEOSCIENTIFIC INFORMATION						
5.1.1 PUBLIC PRESENTATION OF RESULTS	SP			Various staff		
5.1.3 MEMOIR 3	P	--ALL STAFF(55) RDG(15)]				
5.1.4 MINERAL DEPOSITS MAP	P	PHH(2) WK(2)				
5.1.5 GEOLOGICAL BACKGROUND TO DEVELOPMENT OF PERTH	P	--EEG staff(8) PRD(8)--]				
5.1.7 STATE 1:2 500 000 HYDROMAP	P	DPC(4)				
5.1.8 HYDROGEOLOGY OF PERTH METRO AREA	P	[----------WAD(12) ADA(6)----------]				
5.1.12 HYDROGEOLOGICAL ADVICE TO THE PUBLIC	SP			Hydro(240)		
5.1.13 RESPOND TO PUBLIC ENQUIRIES	SP			WBH(45) IR(45) BMN(45) CAS(45)		
5.1.14 MAINTAIN INFORMATION PAMPHLETS	SP			WBH(5) IR(5) CAS(5)		
A. HYDRONOTES		[		ATL(20) RAS(20)		
B. GUIDE TO USE OF ENVIRONMENTAL GEOLOGY NOTES		JRG(2)				
C. REVISE GEMSTONE INFORMATION PAMPHLET		P&I-->				
D. PRODUCE PLATINUM INFORMATION PAMPHLET		P&I-->				
E. OVERVIEW OF MINING				BMN(25)		
5.1.15 GEOMORPHOLOGICAL HISTORY OF SWAN COASTAL PLAIN	SP		[----------JRG(10) WYRWOLL(UWA) COLLINS(CUT)			]
5.1.16 BUILDING STONES OF WESTERN AUSTRALIA	SP					[-------JRG(19)----]
5.1.17 M-SERIES BACKLOG	P	SLL(17) JMF(20) 2CONTRACT(93)				
EDP FACILITIES						
5.2.1 REVIEW COMPUTER HARDWARE & SOFTWARE	SP	[		BMN(30) Various staff		
5.2.2 MININFORM	SP			AGH/WAP(60) BMN(30) JRG(5) AJS(2) SM		
5.2.3 WAMEX - M SERIES	SP			SLL(100)		
5.2.4 STATE WATER RESOURCES INFORMATION SYSTEM	SP			ACD(15)		
5.2.5 WAMEX (COAL DATA)	SP			GLBS(20)		
5.2.6 EST. & MAINT. OF EDP SYSTEM ....- GEOPHYSICAL DATA	SP			LK(20) GS(20) JHW(25) DR(15)		
5.2.8 WAPEX (S SERIES)	SP			RPI(50)		
5.2.9 ROCK & MINERAL DATA SYSTEM	SP			Petrology(35)		
5.2.10 DEVELOP & MAINTAIN EDP SYSTEMS	SP			BMN(75) CAS(20) Various staf		
5.2.11 COMPUTERIZATION OF PETROLOGICAL STUDIES	P	[----------WGL(3)----------]				

GEOLOGICAL SURVEY DIVISION
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PROJECT (P) OR SUB-PROGRAM (SP)		1987 J F M A M J J A S O N D	1988 J F M A M J J A S O N D	1989 J F M A M J J A S O N D	1990 J F M A M J J A S O N D	1991 J F M A M J J A S O N D
FOSSIL COLLECTION						
5.3.1 REFERENCE COLLECTION OF FOSSILS	SP		SKS(72)			SKS(2)
A. DEVONIAN BIVALVIA	P				SKS(50)	
NEW TECHNOLOGY DEVELOPMENT						
6.1.1 MAINTAIN DEVELOP WELL-LOGGING SYSTEMS	SP					
A. MODIFY SIE HARDWARE.....		JMM(5) JHW(3) DR(2)				
B. GEOPHYSICAL LOGGING CALIBRATION FACILITY				JMM(10) LK(<5) McPHERSON(SME)		
6.1.3 DEVELOPMENT OF HYDROGEOLOGICAL TECHNOLOGY	SP					
A. PNEUMATIC SLUG TEST EVALUATION & DEVELOPMENT		ACD(4) RJM(2) SA(2) MM(1)				
B. PLOTTING POLLUTION PLUMES USING GEOPHYSICS			(KJH(5) GS(10)			
6.1.4 GEOPHYSICS IN SOIL SALINITY	SP					
A. EM SOUNDINGS - LAND SALINIZATION IN NORTH STIRLINGS			[-GS(6) JHW(5)-]			
SUPPORT SERVICES						
6.2.1 MAINTAIN SUPPORT SERVICES FOR GEOLOGICAL SURVEY	SP			Various staff		
6.2.2 MAIN. OF PETROLOGICAL SERVICES TO GEOLOGICAL SURVEY	SP			WGL(50) JDL(120) ALA(50)		
6.2.3 PROCESS PUBLICATIONS	SP			WBH(140) IR(155) CAS(140)		
6.2.4 PUBLICATIONS & INFORMATION SUPPORT	SP			WBH(20) IR(20) BMN(20) CAS(10)		
6.2.5 GEOCHEMISTRY SERVICES	SP			RD(25)		
6.2.6 AEROMAGNETIC DATA ADVICE	SP					GS(20)
A. PROVIDE ADVICE & REVIEW DATA ON EASTERN GOLDFIELDS			GS(21)			
GEOSCIENTIFIC ADVICE TO DEPARTMENT OF MINES						
7.0.1 ADVICE ON PETROLEUM ACT MATTERS	SP			RMLE(40)		
7.0.2 ADVICE ON MIN. EXPLORATION, DEVELOPMENT & ECONOMICS	SP			Min. Resources & FFRPG staff (275)		
7.0.3 ADVICE ON MINING ACT MATTERS	SP			Min. Resources, FFRPG & EEG staff (255)		
7.0.4 REVIEW REPORTS FOR MINES & OTHER DEPARTMENTS	SP			EEG staff(50)		
7.0.5 BAUXITE EXTRACTION PLANNING	SP			AJS(25)		
7.0.7 PETROLEUM TENEMENT PLANNING	SP			RMLE(65) MFM(8)		

NOTE: Initials represent the geoscientists involved (see key at back),
with the number of person-weeks shown in brackets
* = Time allocated to another project, see main report.

KEY TO GSWA STAFF INITIALS

ACD	A C Deeney	Hydrogeology
ADA	A D Allen	Hydrogeology
AEC	A E Cockbain	FFRPG (Fossil Fuels)
AFT	A F Trendall	Precambrian Geology
AGH	A G Heath	Mineral Resources
AHH	A H Hickman	Mineral Resources
AJM	A J Mory	FFRPG (Fossil Fuels)
AJS	A J Smurthwaite	EEG (Engineering & Environ. Geology)
AK	A Kern	Hydrogeology
ALA	A L Ahmat	Petrology
AMT	A M Thorne	Precambrian Geology
ATL	A T Laws	Hydrogeology
BMD	B M Davies	Mineral Resources
BMN	B M Nash	P&I (Publications & Information)
CPS	C P Swager	Precambrian Geology
CAS	C A Strong	P&I (Publications & Information)
DPC	D P Commander	Hydrogeology
DR	D Reid	Geophysics
GLBS	G Le Blanc Smith	FFRPG (Fossil Fuels)
GS	G Street	Geophysics
GWM	G W Marcos	EEG (Engineering & Environ. Geology)
IF	I Fletcher	Precambrian Geology
IMT	I M Tyler	Precambrian Geology
IR	I Ruddock	P&I (Publications & Information)
IRW	I R Williams	Precambrian Geology
JB	J Backhouse	Palaeontology
JDL	J D Lewis	Petrology
JGB	J G Blockley	Mineral Resources
JHW	J H Watt	Geophysics
JMF	J M Fetherston	Mineral Resources
JMM	J M Moncrieff	Hydrogeology
JRG	J R Gozzard	EEG (Engineering & Environ. Geology)
JSM	J S Myers	*Precambrian Geology*
KG	K Grey	Palaeontology
KJH	K-J Hirschberg	Hydrogeology
KPW	K P Watkins	Precambrian Geology
LK	L Kevi	Geophysics
MFM	M F Middleton	FFRPG (Fossil Fuels)
MM	M Martin	Hydrogeology
PEP	P E Playford	Directorate
PHH	P H Harrison	Mineral Resources
PRD	P R Dunn	Directorate
PT	P Thorpe	Hydrogeology
RAS	R A Smith	Hydrogeology
RD	R Davy	Geochemistry
RDG	R D Gee	*Directorate*
RJM	R J McGowan	Hydrogeology
RMH	R M Hocking	FFRPG (Fossil Fuels)
RMLE	R M L Elliott	FFRPG (Fossil Fuels)
RPI	R P Iasky	FFRPG (Fossil Fuels)
RPM	R P Mather	EEG (Engineering & Environ. Geology)
SA	S Appleyard	Hydrogeology
SJB	S J Brice	EEG (Engineering & Environ. Geology)
SKS	S K Skwarko	Palaeontology
SLL	S L Lipple	Mineral Resources
SMB	S M Belford	EEG (Engineering & Environ. Geology)
TJG	T J Griffin	Precambrian Geology
TTB	T T Bestow	Directorate
WAD	W A Davidson	Hydrogeology
WAP	W A Preston	Mineral Resources
WBH	W B Hill	P&I (Publications & Information)
WGL	W G Libby	Petrology
WK	W Keats	Mineral Resources
WMH	W M Hunter	Precambrian Geology
WW	W Witt	Mineral Resources

INITIALS OF OTHER STATE BODIES & INSTITUTIONS INVOLVED

BMR	Bureau of Mineral Resources
CUT	Curtin University of Technology
GCL	Goverment Chemical Laboratory
KSM	Kalgoorlie School of Mines
UWA	University of Western Australia

OBJECTIVE 1: INVESTIGATE, INTERPRET, AND RECORD THE GEOLOGY OF WESTERN AUSTRALIA.

PROGRAM 1.1: PREPARE AND MAINTAIN GEOLOGICAL MAPS OF THE WHOLE OF WESTERN AUSTRALIA AT STANDARD SCALES ACCOMPANIED BY EXPLANATORY NOTES AND REPORTS.

Project 1.1.2: Albany 1:1 000 000

Mission: Compilation of Albany 1:1 000 000 geological map from existing 1:250 000 geological maps and other information (Precambrian Geology).

Commenced : August 1986

Completion : 31 March 1987

Geoscientist: J S Myers (2 weeks)

Project 1.1.3: Balfour Downs 1:250 000

Mission: Remap and prepare a second edition of the Balfour Downs 1:250 000 geological sheet and explanatory notes (Precambrian Geology).

Commenced : 1983

Completion : 31 January 1987

Geoscientist: I R Williams (1 week)

Supervisor : J S Myers

Project 1.1.4: Boorabbin 1:250 000

Mission: Remap and prepare a second edition of the Boorabbin 1:250 000 geological sheet and explanatory notes (Precambrian Geology).

Commenced : October 1981

Completion : 28 February 1987

Geoscientist: W M Hunter (8 weeks)

Supervisor : J S Myers

Project 1.1.5: Robertson 1:250 000

Mission: Remap and prepare a second edition of Robertson 1:250 000 geological sheet and explanatory notes. (Precambrian Geology)

Commenced : 1983

Completion : 30 April 1987

Geoscientists: I R Williams (8 weeks)
I M Tyler (4 weeks)

Supervisor : J S Myers

Project 1.1.6: Widgiemooltha 1:250 000

Mission: Remap and prepare a second edition of Widgiemooltha 1:250 000 geological sheet and explanatory notes. (Precambrian Geology)

Commenced : 1980

Completion : 31 January 1987

Geoscientist : T J Griffin (less than 1 week)

Supervisor : J S Myers

Project 1.1.8: Newman 1:250 000

Mission: Remap and prepare a second edition of Newman 1:250 000 geological sheet and explanatory notes. (Precambrian Geology)

Commenced : 1985

Completion : 30 September 1987

Geoscientists: I M Tyler (8 weeks)
W M Hunter*
I R Williams (5 weeks)

Supervisor : J S Myers

* Time allocation included in project referred to in "mission"

Project 1.1.9: Kalgoorlie 1:100 000

Mission: Produce a geological map of the Kalgoorlie 1:100 000 Sheet (3136) from work carried out in project 2.1.1B. (Precambrian Geology)

Commenced : 1981

Completion : 31 May 1987

Geoscientist: W M Hunter*

Supervisor : J S Myers*

Project 1.1.10: Yilmia 1:100 000

Mission: Produce a geological map of the Yilmia 1:100 000 Sheet (3135) from work carried out in project 2.1.1B. (Precambrian Geology)

Commenced : 1981

Completion : 31 May 1987

Geoscientist: W M Hunter*

Supervisor : J S Myers*

Project 1.1.11: Cowan 1:100 000

Mission: Produce a geological map of the Cowan 1:100 000 Sheet (3234) from work carried out in project 2.1.1A. (Precambrian Geology)

Commenced : 1981

Completion : 30 April 1987

Geoscientist: T J Griffin*

Supervisor : J S Myers*

Project 1.1.12: Lake Lefroy 1:100 000

Mission: Produce a geological map of the Lake Lefroy 1:100 000 Sheet (3235) from work carried out in project 2.1.1A. (Precambrian Geology)

Commenced : 1981

Completion : 30 April 1987

Geoscientist: T J Griffin*

Supervisor : J S Myers*

* Time allocation included in project referred to in "mission"

Project 1.1.13: Bardoc 1:100 000

Mission: Produce a geological map of the Bardoc 1:100 000 Sheet (3137) from work carried out in project 2.1.1C (Mineral Resources).

Commenced : September 1985

Completion : 31 March 1987

Geoscientist: W Witt*

Supervisor : A H Hickman/J G Blockley*

Project 1.1.14: Turee Creek 1:250 000

Mission: Remap and prepare a second edition of Turee Creek 1:250 000 geological sheet and explanatory notes. (Precambrian Geology)

Commenced : 1983

Completion : 31 October 1987

Geoscientists: A M Thorne (5 weeks)
I M Tyler (8 weeks)
W M Hunter*

Supervisors : J S Myers (1 week)

Project 1.1.15: Kalgoorlie 1:250 000

Mission: Prepare a second edition of Kalgoorlie 1:250 000 geological sheet and explanatory notes; in conjunction with projects 2.1.1B, C, E, G. (Precambrian Geology, Mineral Resources)

Commencement : 1 January 1990

Completion : 30 April 1991

Geoscientists: W M Hunter*
C P Swager*
W Witt*

Supervisors : J S Myers, J G Blockley*

* Time allocation included in project referred to in "mission"

Project 1.1.16: Rudall 1:250 000

Mission: Prepare a second edition of Rudall 1:250 000 geological sheet and explanatory notes in conjunction with projects 2.1.23, 2.1.24A. (Precambrian Geology, Mineral Resources)

Commencement : 1 June 1990

Completion : 31 May 1991

Geoscientists: K P Watkins*
B M Davies*
I R Williams*

Supervisor : J S Myers*

Project 1.1.17: Lennard River 1:250 000

Mission: Prepare a third edition of Lennard River 1:250 000 geological sheet and explanatory notes in conjunction with projects 1.2.7 and 2.1.17. (Precambrian Geology, FFRPG)

Commenced : 1 June 1988

Completion : 31 December 1989

Geoscientists: T J Griffin*
I M Tyler*
P E Playford*

Supervisors : J S Myers*
A E Cockbain*

Project 1.1.18: Geological map of Western Australia

Mission: Produce a new edition of the State geological map. (Precambrian Geology, FFRPG)

Commencement : 1 February 1987

Completion : 31 June 1987

Geoscientist : J S Myers (4 weeks)
R M Hocking (4 weeks)

Supervisors : J S Myers
A E Cockbain

* Time allocation included in project referred to in "mission"

Project 1.1.19: Davyhurst 1:100 000

Mission: Produce a geological map of the Davyhurst 1:100 000 Sheet (3037) from work carried out in projects 2.1.1C and 2.1.1E. (Precambrian Geology, Mineral Resources)

Commencement : 1 January 1987

Completion : 30 April 1989

Geoscientists: W M Hunter*
W Witt*

Supervisors : J S Myers/J G Blockley*

Project 1.1.20: Riverina 1:100 000

Mission: Produce a geological map of the Riverina 1:100 000 Sheet (3038) from work carried out in project 2.1.1E. (Precambrian Geology)

Commencement : 1 May 1989

Completion : 30 April 1990

Geoscientist : W M Hunter*

Supervisor : J S Myers*

Project 1.1.21: Ballard 1:100 000

Mission: Produce a geological map of the Ballard 1:100 000 Sheet (3039) from work carried out in project 2.1.1E. (Precambrian Geology)

Commencement : 1 May 1990

Completion : 30 April 1991

Geoscientist : W M Hunter*

Supervisor : J S Myers*

* Time allocation included in project referred to in "mission"

Project 1.1.22: Dunnsville 1:100 000

Mission: Produce a geological map of the Dunnsville 1:100 000 Sheet (3036) from work carried out on project 2.1.1G. (Precambrian Geology)

Commencement : 1 July 1987

Geoscientist : 30 June 1988

Geoscientist : C P Swager*

Supervisor : J S Myers*

Project 1.1.23: Menzies 1:100 000

Mission: Produce a geological map of the Menzies 1:100 000 Sheet (3138) from work carried out on project 2.1.1C and 2.1.16. (Mineral Resources, Precambrian Geology)

Commencement : 1 July 1987

Completion : 31 December 1988

Geoscientists: W Witt*
C P Swager*

Supervisor : J G Blockley/J S Myers*

Project 1.1.24: Edjudina 1:100 000

Mission: Produce a geological map of the Edjudina 1:100 000 Sheet (3338) from work carried out on project 2.1.1G. (Precambrian Geology)

Commencement : 1 January 1989

Completion : 31 May 1990

Geoscientist : C P Swager*

Supervisor : J S Myers*

* Time allocation included in project referred to in "mission"

Project 1.1.25: Yabboo 1:100 000

Mission: Produce a geological map of the Yabboo 1:100 000 Sheet (3438) from work carried out on project 2.1.1G. (Precambrian Geology)

Commencement : 1 June 1990

Completion : 31 May 1991

Geoscientist : C P Swager*

Supervisor : J S Myers*

Project 1.1.26: Kanowna 1:100 000

Mission: Produce a geological map of the Kanowna 1:100 000 Sheet (3236) from work carried out on project 2.1.1F. (Petrology, Precambrian Geology)

Commencement : 1 June 1987

Completion : 31 May 1989

Geoscientists: A L Ahmat*
BMR Geoscientist

Supervisors : J S Myers/W G Libby*

Project 1.1.27: Gindalbi 1:100 000

Mission: Produce a geological map of the Gindalbi 1:100 000 Sheet (3237) from work carried out on project 2.1.1F. (Petrology, Precambrian Geology)

Commencement : 1 June 1989

Completion : 31 December 1990

Geoscientist : A L Ahmat*

Supervisor : J S Myers/W G Libby*

* Time allocation included in project referred to in "mission"

Project 1.1.28: Kurnalpi 1:100 000

Mission: Produce a geological map of the Kurnalpi 1:100 000 Sheet (3336) from work carried out on project 2.1.1F. (Petrology, Precambrian Geology)

Commencement : 1 June 1989

Completion : 31 December 1990

Geoscientists: BMR Geologist
A L Ahmat*

Supervisors : J S Myers/W G Libby*

Project 1.1.29: Norseman 1:100 000

Mission: Produce a geological map of the Norseman 1:100 000 Sheet (3233) from work carried out in project 2.1.1H. (Mineral Resources)

Commencement : 1 July 1989

Completion : 31 December 1990

Geoscientist : W Witt*

Supervisors : A H Hickman/J G Blockley*

Project 1.1.30: Laverton 1:100 000

Mission: Produce a geological map of the Laverton 1:100 000 Sheet (3340) from work carried out in project 2.3.2F. (Mineral Resources)

Commencement : 1 June 1990

Completion : 31 December 1991

Geoscientist : B M Davies*

Supervisors : A H Hickman/J G Blockley*

* Time allocation included in project referred to in "mission"

Project 1.1.31: Newman 1:100 000

Mission: Produce a geological map of the Newman 1:100 000 Sheet (2851) from work carried out in project 1.3.1. (Precambrian Geology)

Commenced : 1985

Completion : 31 May 1987

Geoscientist : I M Tyler*

Supervisor : J S Myers*

Project 1.1.32: Ravensthorpe 1:100 000

Mission: Produce a geological map of the Ravensthorpe 1:100 000 Sheet (2930) from work carried out in project 2.1.25. (Mineral Resources)

Commencement : 1 January 1988

Completion : 31 December 1989

Geoscientist : S L Lipple*

Supervisor : J G Blockley*

Project 1.1.33: Paterson 1:100 000

Mission: Produce a geological map of the Paterson 1:100 000 Sheet (3354) from work carried out in Project 2.1.23. (Mineral Resources, Precambrian Geology)

Commencement : 1 June 1987

Completion : 30 May 1990

Geoscientist : B M Davies*

Supervisor : J S Myers*

* Time allocation included in project referred to in "mission"

Project 1.1.34: Broadhurst 1:100 000

Mission: Produce a geological map of the Broadhurst 1:100 000 Sheet (3353) from work carried out in project 2.1.23 (Mineral Resources, Precambrian Geology, Engineering and Environmental Geology).

Commencement : 1 June 1987

Completion : 1 December 1990

Geoscientists: B M Davies* K P Watkins*
S M Belford*

Supervisor : J S Myers*

Project 1.1.35: Rudall 1:100 000

Mission: Produce a geological map of the Rudall 1:100 000 Sheet (3352) from work carried out in project 2.1.23. (Precambrian Geology, Engineering and Environmental Geology)

Commencement : 1 May 1988

Completion : 1 December 1990

Geoscientists: K P Watkins* S M Belford*
I R Williams*

Supervisor : J S Myers*

Project 1.1.36: Connaughton 1:100 000

Mission: Produce a geological map of the Connaughton 1:100 000 Sheet (3452) from work carried out in project 2.1.23. (Precambrian Geology, Engineering and Environmental Geology)

Commencement : 1 May 1989

Completion : 1 December 1990

Geoscientists: K P Watkins*
I R Williams*
S M Belford*

Supervisor : J S Myers*

* Time allocation included in project referred to in "mission"

Project 1.1.37: Pearana 1:100 000

Mission: Produce a geological map of the Pearana 1:100 000 Sheet (3154) from work carried out on projects 2.1.23 and 1.2.5. (Precambrian Geology)

Commencement : 1 May 1987

Completion : 1 December 1990

Geoscientists: I R Williams*
A F Trendall*

Supervisor : J S Myers*

PROGRAM 1.2: DEFINE THE MAIN TECTONIC UNITS AND ACHIEVE A COMPREHENSIVE UNDERSTANDING OF THEIR EVOLUTION.

Project 1.2.1 Alkali granites of the Eastern Goldfields

Mission: Define the chemical composition of alkaline granitic and volcanic rocks of the Eastern Goldfields and derive their geological history (Petrology).

Commenced : 1982

Completion : 14 January 1987

Geoscientist : W G Libby

Project 1.2.2: Binneringie and other dolerite dykes

Mission: Study the extent and composition of selected dolerite dykes and their relationship to major structural changes in the Yilgarn. Also determine why some dykes are contaminated and whether this contamination has any economic significance (Geophysics).

Commenced : 1 March 1986

Completion : 23 January 1987

Geoscientist : G Street (3 weeks)

Technicians : J H Watt (1 week)
D Reid (3 weeks)

Supervisor : L Kevi

* Time allocation included in project referred to in "mission"

Project 1.2.3: Ashburton Fold Belt

Mission: Stratigraphic, sedimentological and structural analysis of the Ashburton Fold Belt to determine evolution of the southwest margin of the Pilbara Block and its relationship to mineralization (Precambrian Geology).

Commenced : September 1981

Completion : 31 May 1987

Geoscientist : A M Thorne (18 weeks)

Supervisor : J S Myers (1 week)

Project 1.2.4: Bresnahan Group

Mission: Sedimentological and stratigraphic analysis of the Bresnahan Group to evaluate final stages of the Capricorn Orogen evolution (Precambrian Geology).

Commenced : February 1986

Completion : 30 September 1987

Geoscientist : W M Hunter (8 weeks)

Supervisor : J S Myers (1 week)

(The time quoted above includes time allocated to Newman and Turee Creek 1:250 000 maps; see Projects 1.1.8 and 1.1.14.)

Project 1.2.5: Fortescue Group

Mission: Sedimentological, stratigraphic, volcanological, and structural analysis of rocks of the Fortescue Group with special reference to their relationship to the Ventersdorp and Witwatersrand Supergroups of South Africa and the associated mineralization (Precambrian Geology).

Commenced : November 1986

Completion : 31 May 1990

Geoscientists: A M Thorne (132 weeks)
A F Trendall (116 weeks)

(Follow-up work of 30 weeks and 45 weeks respectively.)

Supervisor : J S Myers (4 weeks)

Project 1.2.7: King Leopold Orogen

Mission: Undertake reconnaissance and detailed geological mapping with petrology, whole-rock geochemistry, and geochronology to elucidate the evolution of the orogen and its potential for economic mineralization (Precambrian Geology, Petrology). See also mapping project 1.1.17.

Commenced : April 1986

Completion : 31 December 1989

Geoscientists: T J Griffin (114 weeks)
I M Tyler (99 weeks)
J D Lewis (40 weeks)
BMR geochemist
BMR geochronologist

Supervisor : J S Myers (3 weeks)

Sub-program 1.2.8: Regional gravity mapping

Mission: Undertake regional gravity surveys of areas containing identified geological problems or having potential economic significance (Geophysics).

A. Bridgetown 1:100 000 Bouguer anomaly map (covering area containing small sedimentary basins of economic importance for coal).

Commenced : 1 July 1985

Completion : 30 April 1987

Geoscientist: L Kevi (10 weeks)

Technicians : J H Watt (4 weeks)
D Reid (5 weeks)

B. Dinninup 1:100 000 Bouguer anomaly map.

Commencement: 1 February 1988

Completion : 31 December 1989

Geoscientist: L Kevi (38 weeks)

Technicians : J H Watt (17 weeks)
D Reid (18 weeks)

C. Preliminary gravity traverse across the Southwest Seismic Zone.

Commencement: 1 June 1990

Completion : 30 December 1990

Geoscientist: L Kevi (18 weeks)

Technicians : J H Watt (5 weeks)
D Reid (6 weeks)

Project 1.2.9: Southwest Yilgarn Linear Zones

Mission: Carry out geological and geophysical investigations of aeromagnetic linear zones in the southwest Yilgarn Block (Directorate, Geophysics).

Commenced : 1 May 1986

Completion : 31 July 1987

Geoscientists: P R Dunn (5 weeks)
G Street (4 weeks)
J S Myers (1 week)
L Kevi (3 weeks)

Technicians : J H Watt (4 weeks)
D Reid(3 weeks)

Project 1.2.10: Western Gneiss Terrain, Northern Sector

Mission: Define the extent and nature of the northern part of the Western Gneiss Terrain and elucidate its boundary relationships with the Yilgarn granite-greenstones and the Gascoyne Province; also assess the economic potential of mantled gneiss domes associated with the boundary with the Gascoyne Province (Precambrian, Petrology).

Commenced : June 1983

Completion : 31 May 1988

Geoscientists: J S Myers (22 weeks)
W G Libby (4 weeks)
I Fletcher (10 weeks)

(Follow-up work of 50 weeks for J S Myers.)

Project 1.2.11: Bonaparte and Ord Basins

Mission: Mapping and reinterpretation of the geological history of the onshore Ord and Bonaparte Basins (FFRPG).

Commenced : 1 April 1980

Completion : 1 June 1987

Geoscientist : A J Mory (2 weeks)

Supervisor : A E Cockbain (less than one week)

Project 1.2.14: Stromatolites from the Glengarry Sub-Basin

Mission: Define mappable horizons in the Glengarry Sub-basin based on stromatolites, and compare the stromatolite sequences with those of the Earaheedy Sub-basin (Palaeontology).

Commenced : 1 January 1986

Completion : 31 December 1987

Geoscientist : K Grey (24 weeks)

Supervisors : R D Gee S K Skwarko(1 week)

Project 1.2.16: Wittenoom Dolomite Study

Mission: Systematic regional stratigraphic and sedimentological study of the Wittenoom Dolomite as a means of establishing the depositional conditions for it and stratigraphically adjacent banded iron formations in the Hamersley Basin (Precambrian Geology).

Commenced : 1985

Completion : 31 December 1987

Geoscientist : B Simonson (Oberlin College, USA)

Supervisor : A F Trendall (less than a week)

Project 1.2.17: Mount Barren Group Structure

Mission: Study Mount Barren Group and Stirling Range Formation to understand structural evolution of part of the Albany-Fraser Province (Precambrian Geology).

Commenced : March 1986

Completion : 30 September 1988

Geoscientist : C Brown (Imperial College Ph.D. student)

Supervisor : J S Myers

Project 1.2.18: Stratigraphy of the Swan Coastal Plain

Mission: Collate and review data collected from the sampling of over 600 boreholes and from surface mapping, to derive a comprehensive description of the late Cainozoic stratigraphy of the Swan Coastal Plain. This will provide a detailed geological framework for the assessment of major groundwater resources and studies of heavy mineral deposits (Hydrogeology).

Commencement : 12 October 1987

Completion : 25 March 1988

Geoscientist : A D Allen (7 weeks)

Project 1.2.19: Precambrian correlation of Western Australia and southern Africa

Mission: Workshops to be established for collaboration between geologists from Western Australia and southern Africa to identify common factors between the Precambrian of both areas (Precambrian Geology).

Commenced : December 1986

Completion : 1 April 1989

Geoscientist : R D Gee (5 weeks per year)

Project 1.2.20: Woongarra Volcanics Study

Mission: Establish and describe the regional extent and boundary relationships of the Woongarra Volcanics, and establish their potential as a source of economic mineralization (Precambrian Geology).

Commencement : 5 May 1987

Completion : 31 December 1987

Geoscientist : A F Trendall (9 weeks)

Supervisor : J S Myers

Project 1.2.21: Capricorn Orogen

Mission: Study and map the geology and metallogeny of the high-grade metamorphic-plutonic complex of the Capricorn Orogen to establish its mineral potential in the light of the economic importance of rocks of similar age elsewhere (e.g. Paterson Orogen).

Commencement : 1 June 1991

Completion : 31 May 1995

Geoscientists: K P Watkins (25 weeks in 1991)
W M Hunter (25 weeks in 1991)
R Davy (5 weeks in 1991)
J G Blockley (13 weeks in 1991)
A H Hickman (12 weeks in 1991)

Supervisors : J S Myers, J G Blockley (1 week each)

Project 1.2.22: Atmospheric conditions in Fortescue Group time

Mission: Study palaeontology, sedimentology and stable-isotope geochemistry of selected formations of the 2.7 Ga old Fortescue Group and deduce atmospheric conditions at the time of deposition.

Commenced : 1986

Completion : 31 December 1988

Geoscientist : Bonnie Packer (Ph.D. student UCLA)

Supervisor : A M Thorne (M Walter, BMR; W Schopf, UCLA)

Project 1.2.23: Halls Creek Orogen

Mission: Undertake geological mapping of the Halls Creek Orogen producing 1:100 000 maps of selected areas. Correlate tectonic and stratigraphic units and study their relationship to mineralization. (Precambrian Geology)

Commencement : 1 January 1990

Completion : 31 December 1994

Geoscientists: T J Griffin (86 weeks to end 1991)
I M Tyler (86 weeks to end 1991)

Supervisor : J S Myers (2 weeks)

PROGRAM 1.3: ESTABLISH AN UNDERSTANDING OF THE RELATIONSHIPS BETWEEN THE MAIN TECTONIC UNITS

Project 1.3.1: Geological Evolution of the Southeastern Pilbara

Mission: Detailed mapping, with petrological, geochemical and geochronological studies, to elucidate the geological evolution of the Sylvania Dome and adjacent Hamersley Basin. Establish a tectonic model for the Capricorn Orogen and the relationships between the Pilbara and Yilgarn cratons. (Precambrian Geology)

Commenced : 1983

Completion : 31 March 1988

Geoscientist : I M Tyler (21 weeks)

Supervisor : J S Myers (1 week)

Project 1.3.4: Proterozoic Correlation

Mission: Map and correlate the younger Proterozoic rocks of the eastern Bangemall Basin (now Savory Basin) and adjacent areas, in the light of a new stratigraphic interpretation of the rock sequence and using stromatolite biostratigraphy; also assess the relationship of these rocks to the mineralized sequences of the Paterson Orogen and Bangemall Basin (Precambrian Geology, Palaeontology).

Commenced : 1986

Completion : 31 May 1989

Geoscientists: I R Williams (85 weeks)
K Grey (20 weeks)

Supervisor : J S Myers (4 weeks)

Sub-program 1.3.5: Precambrian biostratigraphy

Mission: Undertake biostratigraphic studies to establish inter-relationships between major tectonic units.

A. Revise stromatolite distributions (2 weeks)
Completion: 20 February 1988

B. Bangemall Group biostratigraphy (10 weeks)
Completion: 31 December 1988

C. Savory Group biostratigraphy (8 weeks)
Completion: 1 March 1989

D. Fortescue Group biostratigraphy (8 weeks)
Completion: 1 May 1989

E. Capricorn Orogen biostratigraphy (8 weeks)
Completion: 1 July 1989

F. Paterson Orogen biostratigraphy (8 weeks)
Completion: 31 December 1989

G. Officer Basin biostratigraphy (12 weeks)
Completion: 1 May 1990

H. Kimberley biostratigraphy (10 weeks)
Completion: 1 August 1990

I. Moora Group biostratigraphy (8 weeks)
Completion: 1 November 1990

J. Conical stromatolites (8 weeks)
Completion: 31 December 1990

K. Miscellaneous Proterozoic biostratigraphy (12 weeks)
Completion: 1 April 1991

L. Synthesis of Precambrian biostratigraphy (20 weeks)
Completion: 31 December 1991

Geoscientist : K Grey (time as above)

Supervisors : R D Gee / S K Skwarko (5 weeks)

PROGRAM 1.4: DATE GEOLOGICAL EVENTS AND EPISODES WITHIN AN APPROPRIATE TIME FRAMEWORK

Sub-program 1.4.1: Isotope Geochronology

Mission: Undertake geochronology for various projects as required, in association with other institutions.

Geoscientists: I Fletcher (full-time)
W G Libby (4 weeks per year)
J G Blockley (2 weeks per year)

Supervisor : A F Trendall (3 weeks per year)

Sub-program 1.4.2: Radio-isotope geochronology and hydrology

Mission: Determine the age of groundwater and solid samples by employing radiometric analytical techniques for carbon 14 and tritium. This work is in support of groundwater resources assessment and Quaternary geochronology (Hydrogeology).

A. Perth artesian groundwater

Commenced : 6 October 1986

Completion : 30 April 1987

Geoscientist : P Thorpe (15 weeks)

Supervisor : A D Allen (less than 1 week)

B. Carbon-14 age of lake sediments of the Swan Coastal Plain

Commencement : 1 April 1989

Completion : 1 March 1990

Geoscientist : P Thorpe (24 weeks)

Supervisor : A D Allen (less than 1 week)

Sub-program 1.4.3: Apply palaeontological techniques

Mission: Examine fossils to determine the age of sedimentary rocks to assist in geological interpretation on other projects (Palaeontology).

Geoscientists: J Backhouse (12 weeks per year)
K Grey (4 weeks per year)

Supervisor : S K Skwarko (2 weeks per year)

Project 1.4.4: Post-Archaean tectonic history of the western margin of the Yilgarn Block

Mission: Undertake biotite geochronology and petrology along a series of traverses on the western side of the Yilgarn Block to the Darling Fault and across the Leeuwin-Naturaliste and Northampton Blocks in order to trace the post-Archaean tectonic history of the area and develop conceptual models for the occurrence of concealed mineral deposits (Petrology).

Commenced : 1982

Completion : 31 December 1991

Geoscientist : W G Libby (75 weeks)

PROGRAM 1.5: ACHIEVE A GOOD UNDERSTANDING OF THE SURFICIAL DEPOSITS AND WEATHERED LAYER AND THE ASSOCIATED GEOMORPHOLOGICAL EVOLUTION OF WESTERN AUSTRALIA

Project 1.5.1: Magnetic properties of the regolith

Mission: Investigate in detail the magnetic properties of laterites and the masking effect these have on geophysical measurements of underlying rocks (Geophysics).

Commenced : 1 February 1985

Completion : 30 June 1989

Geoscientist : G Street (12 weeks)

Technicians : J H Watt, D Reid (12 weeks each)

Supervisor : L Kevi

OBJECTIVE 2: RELATE MINERAL, PETROLEUM, AND GROUNDWATER OCCURRENCES AND POTENTIAL TO THE GEOLOGY OF WESTERN AUSTRALIA.

PROGRAM 2.1: CARRY OUT DETAILED GEOSCIENTIFIC INVESTIGATIONS OF SPECIFIC STRUCTURAL AND STRATIGRAPHIC UNITS, AT SCALES APPROPRIATE FOR UNDERSTANDING THEIR MINERAL, FOSSIL FUEL AND GROUNDWATER POTENTIALS.

Project 2.1.1: Eastern Goldfields Study

Mission: Undertake geological mapping of the gold-bearing greenstone belts between Norseman and Menzies, including the Davyhurst-Mt Ida belt and the area east of Kalgoorlie, at 1:100 000 scale; study the structure of the Golden Mile and the overall structure and stratigraphy of the goldfields in relation to mineralization; investigate the geological setting of individual gold deposits; study the petrology of layered basic rocks - in particular the Bulong Complex; study the rock geochemistry of the volcanic rocks of the region; and assess the value of multispectral scanning (MSS) as an aid to mapping in the goldfields region (Precambrian Geology, Mineral Resources, Petrology).

Commenced : 1981

Completion : 31 December 1991

Geoscientists: Details by sub-project following:

A. Cowan and Lake Lefroy 1:100 000

Mission: Map Cowan and Lake Lefroy 1:100 000 geological sheets (Projects 1.1.11 and 1.1.12) and produce report on their geology.

Commenced : 1981

Completion : 30 April 1987

Geoscientist : T J Griffin (4 weeks)

Supervisor : J S Myers (1 week)

B. Yilmia and Kalgoorlie 1:100 000 sheets

Mission: Map Yilmia and Kalgoorlie 1:100 000 geological sheets (Projects 1.1.9 and 1.1.10) and produce report. Collaborate with Open University (UK) in assessment of use of MSS data from Kalgoorlie area (Includes 2 months at Open University).

Commenced : 1981

Completion : Maps and report 31 May 1987
MSS assignment 31 January 1988

Geoscientist : W M Hunter (26 weeks)

Supervisor : J S Myers (1 week)

C. Kalgoorlie regional gold study

Mission: Study petrography, ore microscopy, and geochemistry of mineralization and wall-rock to derive regional controls of gold and other mineralization in the belt between Kambalda and Menzies. Includes mapping the Bardoc and parts of Menzies and Davyhurst sheets at 1:100 000 scale (Projects 1.1.13, 1.1.19, and 1.1.23).

Commenced : September 1985

Completion : 30 June 1989

Geoscientist : W Witt (90 weeks)

Supervisor : A H Hickman/J G Blockley (1 week per year)

D. Golden Mile structural study

Mission: Undertake a detailed study of the mineralized and associated rocks in the Golden Mile area to determine the structure and its relationship to gold mineralization.

Commenced : 1 January 1986

Completion : 30 June 1987

Geoscientist : C P Swager (22 weeks)

Supervisors : A H Hickman/J S Myers (1 week per year)

E. Davyhurst-Mt Ida belt

Mission: Undertake geological mapping of the greenstone belt between Davyhurst and Mt Ida and produce 1:100 000 geological maps of Davyhurst, Riverina, and Ballard (Projects 1.1.19, 1.1.20, and 1.1.21). Collaborate with CSIRO regolith study and carry out further assessment of MSS data.

Commencement : 1 August 1987

Completion : 30 April 1991

Geoscientist : W M Hunter (140 weeks)

supervisors : A H Hickman/J S Myers (1 week per year)

F. Kanowna, Gindalbi and Kurnalpi 1:100 000 Sheets

Mission: Undertake geological mapping of the Kanowna, Gindalbi, and Kurnalpi 1:100 000 Sheet areas (Projects 1.1.26, 1.1.27, and 1.1.28) and produce a covering report. Study petrology of layered basic sills, particularly the Bulong Complex.

Commencement : 1 June 1987

Completion : 31 December 1990

Geoscientist : A L Ahmat (120 weeks)
BMR Geoscientist

Supervisors : A H Hickman/W G Libby (1 week per year)

G. Dunnsville, Menzies, Edjudina, and Yabboo 1:100 000 Sheets

Mission: Undertake geological mapping of the Dunnsville, Menzies, Edjudina, and Yabboo 1:100 000 Sheet areas. Study structure on these sheets and elsewhere within the Eastern Goldfields Study area to obtain a regional appreciation of the relationship of mineralization to structure.

Commencement : 1 July 1987

Completion : 31 May 1991

Geoscientist : C P Swager (165 weeks)

Supervisor : J S Myers/A H Hickman (1 week per year)

H. Gold mineralization in the Coolgardie-Norseman Belt

Mission: Map the Norseman 1:100 000 geological sheet (Project 1.1.29) and assess the regional controls and styles of mineralization in the belt from Davyhurst through Coolgardie to Norseman.

Commencement : 1 July 1989

Completion : 31 December 1990

Geoscientist : W Witt (50 weeks)

Supervisors : A H Hickman/J G Blockley (1 week per year)

I. Geochemistry of Broad Arrow-Menzies-Lake Ballard area

Mission: Evaluate company geochemical data in M-series for Broad Arrow-Menzies-Lake Ballard area

Commencement : 1 July 1988

Completion : 31 December 1988

Geoscientist : R Davy (26 weeks)

Supervisor : J G Blockley (1 week per year)

Project 2.1.3: Murchison metallogenic project

Mission: Geological mapping, geochemical, geochronological and geophysical studies of the Murchison Province greenstone belts, granitoids and gneisses to investigate their geological evolution and mineralization.

Commenced : July 1983

Completion : 31 July 1987

Geoscientists: K P Watkins (27 weeks)
A H Hickman (24 weeks)
R Davy (8 weeks)
A L Ahmat (7 weeks)

Supervisors : J S Myers/J G Blockley (1 week)

Project 2.1.4: Pilbara Geochemistry Phase 2

Mission: Analyse samples, both spatially and temporally, to categorize the volcanic rocks, consider their petrogenesis and assess their potential for mineralization.

Commencement : 1974

Completion : 31 December 1987

Geoscientists: R Davy (8 weeks)
A H Hickman (1 week)
A Y Glikson (BMR)

Supervisor : R Davy (1 week)

Project 2.1.9: Geology of the Collie Basin

Mission: By field and core examination, sampling, geochemical and palaeontological studies, and review of company reports, revise the sedimentological, stratigraphic and structural framework of the Collie Coalfield and the evolution of the basin (FFRPG/ Palaeontology/Geochemistry).

Commenced : 1 June 1983

Completion : 31 December 1988

Geoscientists: G Le Blanc Smith (65 weeks)
J Backhouse (2 weeks)
(complete 31 April 1987)
R Davy (7 weeks)

Supervisor : A E Cockbain

Project 2.1.10: Geology of the offshore Bonaparte Basin

Mission: Analyse seismic surveys and well data to obtain an understanding of the basin's regional stratigraphy, structure, palaeoenvironments, evolution and petroleum potential (FFRPG).

Commenced : 1 April 1985

Completion : 30 October 1987

Geoscientist : A J Mory (35 weeks)

Supervisor : A E Cockbain

Project 2.1.12: Northern Canning Basin Study

Mission: Analyse regional geophysical data (especially seismic) in the Lennard Shelf and Fitzroy Trough to understand the stratigraphy, tectonic style, and evolution of the basin in order to assist exploration for petroleum and base metals (FFRPG).

Commenced : 1 February 1986

Completion : 1 March 1987

Geoscientist : M F Middleton (8 weeks)

Supervisor : A E Cockbain

Project 2.1.13: Geophysical synthesis of the Southern Perth Basin

Mission: Synthesize seismic, magnetic, and gravity data with geology from exploration wells in the southern Perth Basin to give an integrated picture of the subsurface structure and evolution of the basin in order to assist exploration for petroleum, coal and water (FFRPG).

Commenced : 3 January 1985

Completed : 31 December 1988

Geoscientist : R P Iasky (56 weeks)

Supervisor : A E Cockbain

Project 2.1.14: Geological and geophysical studies of North West Shelf oil and gasfields

Mission: Undertake geological and geophysical studies of selected onshore and offshore geological units of the NW shelf to determine characteristics favourable to petroleum occurrence (FFRPG/ Palaeontology, Curtin University of Technology).

A. Study of Cretaceous of Southern North West Shelf.

Commenced : 31 December 1986

Completion : 1 November 1989

Geoscientists: R M Hocking (70 weeks)
S K Skwarko (18 weeks)
J Backhouse (49 weeks)
M F Middleton (15 weeks)
Curtin University of Technology personnel

Supervisor : A E Cockbain (2 weeks)

B. Study of Jurassic of North West Shelf.

Commencement : 1 January 1989

Completion : 30 June 1990

Geoscientists: R M Hocking (50 weeks)
S K Skwarko (6 weeks)
J Backhouse (31 weeks)
M F Middleton (20 weeks)

Supervisor : A E Cockbain

C. Study of Triassic of North West Shelf.

Commencement : 1 July 1990

Completion : 31 December 1991

Geoscientists: R M Hocking (50 weeks)
M F Middleton (20 weeks)
J Backhouse (31 weeks)

Supervisor : A E Cockbain

Project 2.1.15: Mafic complexes in the Western Gneiss Terrain

Mission: Detailed study of surface exposures and drill core of remnants of layered mafic complexes in the Western Gneiss Terrain.

Commencement : September 1984

Completion : 1 February 1988

Geoscientist : M Cornelius (Ph.D. student Montan University, Austria)

Supervisor : R D Gee (1 week)

Project 2.1.16: Permian palynostratigraphy of southern WA

Mission: Undertake comprehensive review of available material from the Permian of the southern Perth and Officer Basins (Palaeontology).

Commencement : 15 January 1987

Completion : 31 March 1988

Geoscientist : J Backhouse (27 weeks)

Supervisor : S K Skwarko

Project 2.1.17: Devonian reef complexes of the Canning Basin

Mission: Carry out a comprehensive synthesis of research results and geological mapping (FFRPG, Univ. N.Y., Univ. of Tas., Univ. of Texas, Marathon Oil)

Commenced : 1 June 1985 (as project 2.1.6)

Completion : 30 December 1989

Geoscientists: P E Playford (12 weeks)
A E Cockbain (18 weeks)
M F Middleton (5 weeks)

Outside Geoscientists:
B Ward (State Univ. of N.Y.)(full time)
V Pedone (State Univ. of N.Y.)(full time)
M Wallace (Univ. of Tasmania)(20 weeks)
C Kerans (Univ. Texas)(4 weeks)
N F Hurley (Marathon Oil Co)(4 weeks)

Supervisor : P E Playford

Project 2.1.18: Structural and thermal history of the southern NW Shelf

Mission: Develop a regional framework for the structural and thermal evolution of the southern North West Shelf (FFRPG + University of Clausthal, Germany).

Commencement : 20 July 1987

Completion : 30 December 1988

Geoscientist : M F Middleton (40 weeks)

Outside Research Scientist: G Buntebarth (20 weeks)

Supervisor : A E Cockbain (1 week)

Project 2.1.19: Petroleum source rocks of W.A.

Mission: Compile and review all data relating to source rocks associated with known hydrocarbon accumulations for the purpose of delineating target areas for oil and gas (FFRPG).

Commencement : 30 March 1987

Completion : 5 June 1987

Geoscientist : R M L Elliott (10 weeks)

Supervisor : A E Cockbain

Project 2.1.20: Perth Basin Coal Resources

Mission: Provide a geological background to the known coal resources in the Perth Basin; establish depositional models as a guide to exploration and assess the known coal resources and reserves (FFRPG).

Commencement : 2 November 1987

Completion : 30 October 1989

Geoscientist : G Le Blanc Smith (40 weeks)
A J Mory (90 weeks)

Supervisor : A E Cockbain

Project 2.1.21: Structural and stratigraphic studies of the northern margin of the Perth Basin

Mission: Resolve by field mapping and review of all existing data a number of stratigraphic and structural problems associated with the Palaeozoic deposits of the northern Perth Basin, as an aid to petroleum exploration (FFRPG).

Commencement : 1 July 1989

Completion : 31 December 1989

Geoscientists: R M Hocking (5 weeks)
A J Mory (30 weeks)

Supervisor : A E Cockbain (1 week)

Project 2.1.22: The stratigraphy and structural relations of the Ordovician of the Canning Basin

Mission: Define more comprehensively the stratigraphy, sedimentology and structural environment of the Ordovician sediments of the Canning Basin through comprehensive study of outcrop, well, seismic, gravity and magnetic data, in order to assist oil exploration in the basin.

Commencement : 3 June 1989

Completion : 30 December 1990

Geoscientist : R P Iasky (70 weeks)
A J Mory (30 weeks)

Supervisor : A E Cockbain (2 weeks)

Project 2.1.23: Paterson Orogen

Mission: Map the Rudall Metamorphic Complex and cover rocks, and study the evolution of these rocks and their relationship to mineralization, assisted by the use of available aeromagnetic data. Also study the geomorphology and regolith geology of selected areas (i) to provide background for future land-use assessments and (ii) to assess the effect of recent geological events on Precambrian mineralization (Precambrian Geology, Mineral Resources, Environmental Geology, Geophysics). See also related mapping Projects 1.1.16, 1.1.33 to 1.1.37.

Commencement : 1 June 1987

Completion : 31 May 1991

Geoscientists: K P Watkins (176 weeks)
B M Davies (120 weeks)
S M Belford (52 weeks)
I R Williams (70 weeks from 1989)
G Street (8 weeks)

Supervisor : J S Myers (1 week per year)

NOTE: Part of this project involves the Rudall River National Park and it will form part of the National Parks mapping program (2.1.24A).

Project 2.1.24: Geology and mineral potential of National Parks and nature reserves

Mission: Produce geological maps at appropriate scales and report on the geology and mineral potential of National Parks and appropriate nature reserves, as required.

A. Rudall River National Park - see Paterson Orogen Project (2.1.23)

B. D'Entrecasteaux-Shannon-Nornalup National Parks -study and report on the geology and mineral potential of the above parks and their proposed extensions

Commencement : October 1987

Completion : 30 June 1989

Geoscientists: P H Harrison (21 weeks)
S M Belford (21 weeks)
R Davy (12 weeks)
G Street (4 weeks)
L Kevi (3 weeks)

Supervisors : J G Blockley/R P Mather (1 week)

C. Hamersley Range National Park - study and report on the geology and mineral potential of the Hamersley Range National Park

Commencement : June 1987

Completion : 31 December 1989

Geoscientist : J G Blockley (24 weeks)

D. Fitzgerald River National Park - study and report on the geology and mineral potential of the Fitzgerald River National Park and its proposed extensions

Commencement : 1 July 1989

Completion : 31 December 1990

Geoscientists: P H Harrison (12 weeks)
G Street (4 weeks)
L Kevi (3 weeks)
S L Lipple (5 weeks)
J R Gozzard (20 weeks)
R Davy (12 weeks)

Supervisors : J G Blockley
A J Smurthwaite

E. Unspecified National Parks - study and report on the geology and mineral potential of unspecified National Parks.

Commencement : 1 April 1990

Geoscientists: A J Smurthwaite (27 weeks)
J R Gozzard (20 weeks)

Project 2.1.25: Ravensthorpe-West River greenstone belts

Mission: Undertake mapping of the Ravensthorpe (Project 1.1.32) and part of the Cocanarup sheet areas at 1:100 000 scale to elucidate the geological setting of the mineral deposits in that area (Mineral Resources, Geophysics)

Commencement : 1 January 1988

Completion : 31 December 1989

Geoscientists: S L Lipple (22 weeks)
G Street (8 weeks)

Technician : D Reid (6 weeks)

Supervisor : J G Blockley (1 week)

Project 2.1.26: Ninghan greenstone belt

Mission: Prepare a map at 1:100 000 of the greenstones covering Ninghan and Mount Gibson and study the regional controls of gold mineralization (Mineral Resources).

Commencement : 1 January 1990

Completion : 31 December 1991

Geoscientist : S L Lipple (22 weeks)

Supervisor : J G Blockley (1 week)

Project 2.1.27: Potential for metallic minerals in the southern part of the Western Gneiss Terrain

Mission: Review available reports and investigate mineral occurrences in the southern part of the Western Gneiss Terrain to elucidate their relationship to known geology and assess the potential for economic mineralization.

Commencement : 1 January 1990

Completion : 31 December 1991

Geoscientist : P H Harrison (24 weeks)

Supervisor : J G Blockley (1 week)

PROGRAME 2.2: DRILL AT SELECTED SITES WITHIN STRUCTURAL UNITS TO DETERMINE DATA THAT COULD ASSIST IN UNDERSTANDING THEIR MINERAL, FOSSIL FUEL AND GROUNDWATER POTENTIALS.

Sub-program 2.2.1: Perth Basin, shallow aquifers

Mission: By drilling, geophysical logging, test pumping, monitoring and the review of all relevant geological and hydrogeological data, determine the stratigraphy, structure, hydrogeology and groundwater resources of the unconfined aquifers of the Perth Basin (Hydrogeology).

A. Busselton area aquifers

Commenced : 1983

Completion : 30 January 1987

Geoscientist : K-J Hirschberg (less than 1 week)

Supervisor : A D Allen

B. Cataby area

Commenced : 2 February 1985

Completion : 30 July 1987

Geoscientist : A M Kern (32 weeks)

Supervisor : A D Allen

C. Scott coastal plain

Commencement : 5 October 1987

Completion : 30 October 1989

Geoscientist : M Martin (30 weeks)

Supervisor : A D Allen (1 week)

D. Leeman area

Commencement : 1 March 1988

Completion : 31 January 1989

Geoscientist : P Thorpe (30 weeks)

Supervisor : A D Allen

E. Greenough area

Commencement : 2 February 1989

Completion : 1 July 1990

Geoscientist : R J McGowan (30 weeks)

Supervisor : A D Allen

Project 2.2.2: SW Yilgarn minor basins

Mission: By drilling, geophysical logging, test pumping, monitoring and the review of all relevant geological, geophysical and hydrogeological data, determine the stratigraphy, structure, hydrogeology and groundwater resources of the Wilga, Boyup Brook and other minor cratonic basins of the SW Yilgarn Block (Hydrogeology).

Commencement : 1 July 1990

Completion : 30 December 1991

Geoscientist : S Appleyard (45 weeks)

Supervisor : A D Allen

Project 2.2.3: Fortescue Coastal Plain

Mission: Undertake drilling, geophysical logging, testing, and monitoring at 31 shallow bore sites in the lower valley of the Fortescue River to determine the stratigraphy, structure, and hydrogeology of alluvial aquifers (Hydrogeology).

Commenced : 1 June 1983

Completion : 28 August 1987

Geoscientist : D P Commander (8 weeks)

Supervisor : A D Allen

Project 2.2.4: Collie Basin Groundwater Resources Assessment

Mission: Drill, geophysically log, test and monitor boreholes, and assess all available data to investigate the groundwater flow systems and resources of the Collie Basin. This will assist the management of groundwater and facilitate the modelling of the impact of mine dewatering on resources (Hydrogeology).

Commencement : 1 January 1989

Completion : 1 October 1990

Geoscientist : J S Moncrieff (35 weeks)

Supervisor : A D Allen (1 week)

Project 2.2.7: Goldfields palaeodrainage groundwater

Mission: Gain an understanding of the hydrogeology of a palaeodrainage in the Eastern Goldfields, based on an appropriate program of drilling, geophysical logging, sampling, and test pumping. The results will provide data of direct assistance to development and management of saline groundwater resources of use in the mining industry. A comprehensive program of sampling will support an understanding of the hydrochemical evolution and geochemistry of the brines (Hydrogeology).

Commencement : 1 May 1987

Completion : 25 September 1988

Geoscientists: D P Commander (2 weeks)
A C Deeney (20 weeks)
G Street (12 weeks)

Technician : D Reid (8 weeks)

Supervisor : A D Allen (1 week)

Sub-program 2.2.12: Perth Basin deep aquifers

Mission: By drilling, geophysical logging, test pumping, monitoring and the review of all relevant geological and hydrogeological data, determine the stratigraphy, structure, hydrogeology and groundwater resources of the deep, principally confined, aquifers of the Perth Basin (Hydrogeology).

A. Gillingarra Line

Commenced : 1981

Completion : 14 March 1987

Geoscientist : J S Moncrieff (4 weeks)

Supervisor : D P Commander/A D Allen

B. Cowaramup Line

Commenced : 26 November 1986

Completion : 30 November 1988

Geoscientist : S Appleyard (40 weeks)

Supervisor : D P Commander/A D Allen

C. Karriedale Line

Commencement : 1 July 1988

Completion : 1 October 1990

Geoscientist : A Kern (40 weeks)

Supervisor : D P Commander/A D Allen

D. Dongara Line

Commencement : 3 January 1989

Completion : 1 July 1990

Geoscientist : A C Deeney (35 weeks)

Supervisor : D P Commander/A D Allen

E. Wicherina Line

Commencement : 3 January 1990

Completion : 1 July 1991

Geoscientist : M Martin (30 weeks)

Geoscientist : D P Commander/A D Allen

F. Ajana Line

Commencement : 3 January 1991

Completion : 1 July 1992

Geoscientist : J S Moncrieff (35 weeks)

Supervisor : D P Commander/A D Allen

PROGRAM 2.3: BY GEOSCIENTIFIC INVESTIGATION AT APPROPRIATE SCALES DETERMINE THE ESSENTIAL CHARACTERISTICS OF KNOWN MINERAL DEPOSITS AS AN AID TO FUTURE EXPLORATION.

Project 2.3.1: Bauxite deposits of the southwest of Western Australia

Mission: Examination of company and GSWA data to plot regional distribution of bauxite; detailed studies of selected deposits and profiles to determine the reserves and resources of bauxite and the factors controlling its formation (Mineral Resources, Engineering and Environmental Geology).

Commenced : 5 January 1982

Completion : 31 March 1988

Geoscientist : A J Smurthwaite (20 weeks)

Supervisor : J G Blockley (2 weeks)

Project 2.3.2: Gold mineralization in Western Australia

Mission: Produce a series of mineral resources reports to describe gold mineralization throughout the State. Each report will, for a given area, describe the controls of gold mineralization and present a metallogenic interpretation as well as documenting the geology of the individual mines and prospects (Mineral Resources).

A. Bullfinch-Forrestania area

Mission: Produce a report as described above for the gold deposits in the greenstone belt between Bullfinch and Forrestania.

Commenced : 1 January 1986

Completion : 31 December 1987

Geoscientist : W Keats (32 weeks)

Supervisors : A H Hickman/J G Blockley (1 week)

B. Kalgoorlie regional gold study -see Eastern Goldfields Study, Project 2.1.1

C. Northern Southern Cross Province

Mission: Produce a report on gold mineralization in the Sandstone and Youanmi areas.

Commencement : 1 January 1988

Completion : 31 December 1989

Geoscientist : W Keats (64 weeks)

Supervisors : A H Hickman/J G Blockley (2 weeks)

D. Southern Southern Cross Province.

Mission: Produce a report on gold mineralization in Mount Jackson, Lake Johnston, Manning Range and other minor greenstone belts.

Commencement : 1 January 1990

Completion : 31 December 1991

Geoscientist : W Keats (64 weeks)

Supervisors : A H Hickman/J G Blockley (2 weeks)

E. Leonora Belt

Mission: Report on gold mineralization in the Leonora, Lawlers, Agnew and Wiluna centres.

Commencement : 1 January 1988

Completion : 31 December 1989

Geoscientist : A H Hickman (45 weeks)

Supervisor : J G Blockley (2 weeks)

F. Laverton Belt

Mission: Report on gold mineralization around Laverton as part of the production of the Laverton 1:100 000 geological map (Project 1.1.30).

Commencement : 1 January 1990

Completion : 31 December 1991

Geoscientists: A H Hickman (45 weeks)
B M Davies (56 weeks)

Supervisor : J G Blockley (2 weeks)

G. Coolgardie-Norseman Belt - see Eastern Goldfields Study (2.1.1)

Project 2.3.4: Nanutarra-Uaroo tungsten deposits

Mission: Geological mapping of known tungsten deposits in the Nanutarra-Uaroo area and petrological, geochemical, isotopic, and fluid inclusion studies to establish metallogeny (Mineral Resources).

Commenced : November 1985

Completion : 30 April 1987

Geoscientist : B M Davies (19 weeks)

Supervisor : J G Blockley

Project 2.3.6: Mount Clement

Mission: Identify the origins of the Mount Clement gold deposit using geology, mineralogy and chemistry, and predict if other such deposits are likely in the Ashburton Trough (Geochemistry) (GCL)

Commenced : 1982

Completion : 31 December 1987

Geoscientist : R Davy (6 weeks)
R Clarke (Govt Chem. Labs)

Sub-program 2.3.7: Mine Inspections

Mission: Undertake inspections of operating mines to obtain information on geology and mineralization while workings are open. File reports to be made and used in appropriate studies such as Project 2.3.2 (Mineral Resources).

Geoscientists: Mineral Resources personnel as available (about 15 weeks per year in total)

Supervisor : J G Blockley

PROGRAM 2.4: DEVELOP CONCEPTUAL MODELS FOR THE OCCURRENCE AND DISTRIBUTION OF MINERAL AND FOSSIL FUEL DEPOSITS.

Project 2.4.1: Mount Gibson

Mission: Investigate the geochemical pattern of a gold-mineralized laterite and weakly mineralized underlying rocks, and compare with similar deposits elsewhere (Geochemistry, GCL).

Commenced : 1986

Completion : 30 June 1988

Geoscientist : R Davy (20 weeks)
R Clarke (Govt Chem. Labs)

Project 2.4.3: Potential for platinum-group elements

Mission: Undertake field and laboratory studies on chromitites, gossans, sulphides, and layered mafic/ultramafic intrusions, to identify areas with potential for occurrence of platinum-group elements in Western Australia (Mineral Resources, Petrology).

Commenced : April 1983

Completion : 31 August 1987

Geoscientists: P H Harrison (15 weeks)
A L Ahmat (completed)

Supervisor : J G Blockley (1 week)

Project 2.4.5: Collie Basin structure

Mission: Investigate by the use of seismic reflection and refraction the structure of the Collie Basin, in order to assist coal exploration and mine planning in the basin (FFRPG, Geophysics).

Commence : 1 April 1987

Completion : 1 July 1988

Geoscientists: R P Iasky (4 weeks)
L Kevi (3 weeks in 1988)
G Street (2 weeks in 1988)

Technician : J H Watt (4 weeks)

Supervisor : A E Cockbain

Project 2.4.6: Pegmatites in Western Australia

Mission: Collect a systematic data base on the mineralogy of pegmatites in Western Australia; and try to recognize regional and district zoning patterns which could assist in exploration for Li, Rb, Cs, Nb, Ta, Sn, and rare earth elements (Mineral Resources).

Commencement : January 1987

Completion : 30 March 1992

Geoscientist : W Witt (56 weeks) (sampling to be carried out while undertaking Eastern Goldfields study; completion of this study full-time in 1991)
J Vaughan (Kalgoorlie School of Mines)

Supervisor : J G Blockley

Project 2.4.7: Trace metals in groundwaters

Mission: Carry out trace-element analyses of all waters sampled by the Hydrogeology section, and evaluate the use of groundwaters in defining nearby rock-types and mineralization (Geochemistry).

Commencement : 1 January 1988

Completion : 31 December 1989

Geoscientist : R Davy (25 weeks)

OBJECTIVE 3: EVALUATE THE MINERAL, FOSSIL FUEL, AND GROUNDWATER RESOURCES OF WESTERN AUSTRALIA.

PROGRAM 3.1: ESTABLISH AND MAINTAIN UP-TO-DATE COMPREHENSIVE INFORMATION ON MINERAL, FOSSIL FUEL, AND GROUNDWATER RESOURCES AND ON EXPLORATION FOR THEM.

Sub-program 3.1.1: Evaluation of mineral exploration data

Mission: Collect, from all available sources, current data on mineral exploration and development in order to advise Government on the status and future of mining ventures (Mineral Resources).

Geoscientist : P H Harrison (about 10 weeks per year)

Supervisor : J G Blockley

Sub-program 3.1.2: Reserves/resources inventory

Mission: Collect and collate on EDP base, all mineral reserve and resource information for Western Australia and from this prepare summary information to Government at short notice as required, and produce periodic reserve tabulations (Mineral Resources).

Geoscientists: W A Preston) 20 weeks A G Heath)per year
Supervisor : J G Blockley

Sub-program 3.1.3: Geoscientific evaluation of coal exploration

Mission: Review proposals and reports concerning coal exploration, and continuously assess resources and exploration trends (FFRPG).

Geoscientist : G Le Blanc Smith (11 weeks per year)

Supervisor : A E Cockbain

Sub-program 3.1.4: Geoscientific evaluation of petroleum exploration

Mission: Review proposals and reports concerning petroleum exploration, and continuously assess resources, exploration trends, and prospectivity (FFRPG).

Geoscientist : R M L Elliott (12 weeks per year)

Supervisor : A E Cockbain

Sub-program 3.1.5: Geophysical exploration data

Mission: Evaluation of geophysical data provided in company reports in support of metallogenic and other studies (Geophysics).

A. Evaluation of various geophysical methods used in the exploration for gold and nickel

Commencement : 15 February 1991

Completion : 31 December 1991

Geoscientist : G Street (16 weeks)

Supervisor : L Kevi

Project 3.1.6: Evaluation of stream-sediment geochemistry in the Kimberley

Mission: Evaluate M Series stream-sediment data from the Halls Creek and King Leopold Mobile Zones (Geochemistry).

Commencement : 1 January 1991

Completion : 31 December 1991

Geoscientist : R Davy (32 weeks)

PROGRAM 3.2 ASSESS UNDISCOVERED RESOURCES OF ECONOMICALLY IMPORTANT EARTH-SOURCED COMMODITIES.

No projects planned.

PROGRAM 3.3: EVALUATE THE RESERVES/RESOURCES OF SPECIFIC MINERAL COMMODITIES STATE-WIDE OR IN SELECTED REGIONS.

Project 3.3.2: Gypsum resources of Western Australia

Mission: Report on the geology and resources of gypsum deposits in Western Australia and review the processing, uses, markets, and future direction of the industry (Mineral Resources).

Commencement : 1 July 1987

Completion : 30 June 1988

Geoscientist : J M Fetherston (20 weeks)

Supervisor : J G Blockley

Sub-program 3.3.3: Industrial minerals assessment planning

Mission: Provide information on geology and industrial minerals to the State Planning Commission's Extractive Industry Committee (Engineering and Environmental Geology).

Geoscientist : J R Gozzard (4 weeks per year)

Supervisor : A J Smurthwaite

Sub-program 3.3.4: Petroleum reserves assessment

Mission: Undertake geological and geophysical studies based on company and other data to progressively update the assessment of the State's petroleum reserves (FFRPG, Petroleum Division).

Geoscientist : M F Middleton (12 weeks per year from 1988)

A. Study Saladin and Tubridgi fields

Commencement : 27 April 1987

Completion : 17 July 1987

Geoscientist : M F Middleton (12 weeks)

Supervisor : A E Cockbain

Project 3.3.5: Silica sand deposits of Western Australia

Mission: Report on the geology and resources of silica sand and review the processing, uses, markets, and future directions of the industry (Mineral Resources).

Commencement : 1 July 1988

Completion : 30 June 1989

Geoscientist : J M Fetherston (20 weeks)

Supervisor : J G Blockley

Project 3.3.6: Talc and magnesite in Western Australia

Mission: Review the known talc and magnesite deposits in Western Australia and the prospects for further discoveries or developments (Mineral Resources).

Commencement : 1 July 1989

Completion : 30 June 1990

Geoscientist : J M Fetherston (20 weeks)

Supervisor : J G Blockley

Project 3.3.7: Clay minerals

Mission: Provide a detailed account of the economic and potentially economic deposits of all classes of clay minerals and review their processing, uses and marketing, and the future directions of the industry (Mineral Resources).

Commencement : 1 July 1990

Completion : 30 June 1992

Geoscientist : J M Fetherston (40 weeks)

Supervisor : J G Blockley

Project 3.3.8: Limestone and limesand resources between Kalbarri and Black Point

Mission: Establish the limestone and limesand resources in the coastal area between Kalbarri and Black Point to assist in land-use planning (Engineering and Environmental).

A. Between Lancelin and Bunbury

Commenced : 15 March 1985

Completion : 28 February 1987

Geoscientist : J R Gozzard (2 weeks)

Supervisor : A J Smurthwaite

B. Between Bunbury and Black Point

Commencement : 1 October 1988

Completion : 31 January 1989

Geoscientist : J R Gozzard (6 weeks)

Supervisor : A J Smurthwaite

C. Between Kalbarri and Lancelin

Commencement : 1 February 1991

Completion : 31 May 1991

Geoscientist : J R Gozzard (6 weeks)

Supervisor : A J Smurthwaite

Project 3.3.9: Industrial-mineral resources of the Greenough area

Mission: Review and report on the industrial-mineral resources of the Greenough Sub-division of the Geraldton (Mid-West) Region as recommended in report of the Country Centres Project (Geraldton Mid-West) Working Group. Work to be carried out in association with Sub-program 4.3.1(I)

Commencement : 31 March 1989

Completion : 31 July 1990

Geoscientist : J R Gozzard (13 weeks)

Supervisor : R P Mather

OBJECTIVE 4: PROVIDE GEOTECHNICAL ADVICE AND SERVICES ON LAND USE, GROUNDWATER AND ENVIRONMENTAL MANAGEMENT, URBAN DEVELOPMENT, AND ENGINEERING PROJECTS.

PROGRAM 4.1: RESPOND TO REQUESTS FROM OTHER GOVERNMENT DEPARTMENTS OF INSTRUMENTALITIES FOR ADVICE AND ASSISTANCE ON GEOTECHNICAL MATTERS.

Sub-program 4.1.1: Engineering geological advice, miscellaneous constructions

Mission: Undertake field investigations and provide geological advice on earth conditions or earth-sourced materials for other Government departments (Engineering and Environmental).

Geoscientists: R P Mather (4 weeks per year)
G W Marcos (14 weeks per year)
J R Gozzard (2 weeks per year)
S J Brice (5 weeks per year)

Supervisor : R P Mather

Sub-program 4.1.2: Engineering geological advice, dams and damsites

Mission: Undertake engineering geological investigations of proposed damsites and dams under construction and support surveillance of existing dams and ancillary works (Engineering and Environmental).

Geoscientists: R P Mather (10 weeks per year)
G W Marcos (24 weeks per year)
S J Brice (8 weeks per year)

Supervisor : R P Mather

Sub-program 4.1.3: Land capability assessment

Mission: On referral from other Government departments, examine areas from an environmental geology viewpoint to determine their capability of supporting development (Engineering and Environmental).

Geoscientist : A J Smurthwaite (1 week per year)
J R Gozzard (1 week per year from 1988)

Supervisor : R P Mather

Project 4.1.5: Harris Dam

Mission: Undertake geological investigations in support of the design and construction of the Harris Dam (Engineering and Environmental)

Commenced : 1985

Completion : 31 December 1990

Geoscientist : S J Brice (145 weeks)

Supervisor : R P Mather (30 weeks)

Sub-program 4.1.6: Advice on groundwater to other Government departments

Mission: Conduct field investigations where necessary and advise on the occurrence of groundwater for other Government departments (Hydrogeology).

Geoscientists: D P Commander (2 weeks per year)
W A Davidson (2 weeks per year)
K-J Hirschberg (1 week per year)
A C Deeney (1 week per year)
J M Moncrieff (1 week per year)
R J McGowan (2 weeks per year)

Supervisor : A T Laws (4 weeks per year)
A D Allen (2 weeks per year)

Sub-program 4.1.11: Evaluation and assessment of groundwater in the Perth Metropolitan Area

Mission: Undertake evaluation and review of the confined and unconfined aquifers in the Perth Basin by mapping, drilling, and test-pumping and provide support to the Water Authority in the management of the groundwater resources of the region. (Hydrogeology)

A. Hydrogeology of the Lexia area

Commenced : 22 April 1983

Completion : 30 January 1987

Geoscientist : W A Davidson (4 weeks)

Supervisor : A D Allen

Further commitment: 4 weeks per year

Sub-program 4.1.13: Groundwater contaminants and pollutants

Mission: Catalogue sources of groundwater pollution and monitor groundwater in the vicinity of licensed effluent sites, landfill areas, and sources of industrial wastes to assess possible aquifer contamination. This will support appropriate groundwater management and the provision of advice to the public regarding any existing contamination levels at sites of proposed private boreholes (Hydrogeology, WAWA).

A. Licensed effluent and waste sites

Commenced : 1980 - continuing

Geoscientist : K-J Hirschberg (14 weeks/year)

Supervisor : A T Laws (less than 1 week)

B. Pollution site inventory and review

Commencement : 2 March 1987

Completion : 29 May 1987

Geoscientist : K-J Hirschberg (12 weeks)

Supervisor : A T Laws/A D Allen

Sub-program 4.1.14: Irrigation area evaluation

Mission: Investigate, monitor, model, and evaluate irrigated areas to assist in management and allocation of groundwater supplied for irrigation (Hydrogeology/WAWA/Agriculture Dept)

Geoscientists: K-J Hirschberg (6 weeks per year)
R J McGowan (12 weeks per year)

Supervisor : A T Laws/A D Allen

Sub-program 4.1.18: Review consultants' reports for other Departments

Mission: Examine the hydrogeological implications and validity of consultants' reports on works likely to affect existing groundwater balance or groundwater quality (Hydrogeology).

Geoscientists: A T Laws (2 weeks per year)
D P Commander (2 weeks per year)
W A Davidson (2 week per year)
K-J Hirschberg (2 weeks per year)

Supervisor : A D Allen (1 week per year)

Sub-program 4.1.19: Town water supplies

Mission: Hydrogeological investigations to assess existing groundwater supplies or locate new supplies for town and community reticulation schemes (Hydrogeology/WAWA).

Geoscientists: W A Davidson (3 weeks per year)
K-J Hirschberg (4 weeks per year)
A Kern (6 weeks per year)
R A Smith (12 weeks per year)
R J McGowan (10 weeks per year)

Supervisor : A D Allen

A. Derby Regional Groundwater Assessment

Commenced : 1 August 1986

Completion : 24 December 1987

Geoscientist : R A Smith (12 weeks)

Supervisor : A T Laws/A D Allen (2 weeks)

Sub-program 4.1.20: Wetlands studies

Mission: Conduct hydrogeological investigations including drilling, monitoring, chemical analyses, and water and salt balance determinations to assist in management of natural wetlands (Hydrogeology/WAWA).

A. Hydrogeology of Thompsons Lake

Commenced : 2 March 1984

Completion : 26 February 1988

Geoscientist : P Thorpe (9 weeks)

Supervisor : A T Laws/A D Allen

Sub-program 4.1.21: Geophysical investigations and advice for other Government departments

Mission: Undertake seismic and resistivity surveys to determine depth to basement and other factors relevant to Government works projects (Geophysics).

Geoscientists: L Kevi (10 weeks per year)
G Street (9 weeks per year)
R P Mather (1 week per year)
G W Marcos (1 week per year)
S J Brice (1 week per year)

Technicians : D Reid (6 weeks per year)
J H Watt (9 weeks per year)

Supervisor : L Kevi

PROGRAM 4.2: PREPARE AND MAINTAIN HYDROGEOLOGICAL MAPS OF WESTERN AUSTRALIA, AT SCALES APPROPRIATE FOR LOCAL GROUNDWATER CONDITIONS.

Sub-program 4.2.1: 1:250 000 hydrogeological maps

Mission: Investigate and collate hydrogeological data, and compile hydrogeological maps at a scale of 1:250 000 (Hydrogeology).

A. Broome Sheet

Commenced : 1984

Completion : 31 March 1987

Geoscientist : A T Laws (12 weeks)

Supervisor : A D Allen

B. Collie Sheet

Commencement : 1 April 1987

Completion : 30 December 1987

Geoscientist : J S Moncrieff (24 weeks)

Supervisor : D P Commander (1 week)/A D Allen

C. Marble Bar Sheet

Commenced : 1 October 1982

Completion : 31 July 1987

Geoscientist : D P Commander (4 weeks)

Supervisor : A D Allen

D. Perenjori Sheet

Commenced : 1982

Completion : 17 July 1987

Geoscientist : R J McGowan (14 weeks)

Supervisor : D P Commander/A D Allen

E. Derby Sheet (including reconnaissance drilling)

Commencement : 1 April 1987

Completion : 30 December 1987

Geoscientist : R A Smith (14 weeks)

Supervisor : A D Allen

F. Kalgoorlie Sheet

Commencement : 1 September 1987

Completion : 30 April 1988

Geoscientist : A C Deeney (20 weeks)

Supervisor : D P Commander/A D Allen

G. La Grange Sheet (including reconnaissance drilling)

Commencement : 1 April 1988

Completion : 30 December 1988

Geoscientist : A T Laws (18 weeks)

Supervisor : A D Allen

H. Munro Sheet (including reconnaissance drilling)

Commencement : 1 April 1988

Completion : 30 December 1988

Geoscientist : J S Moncrieff (22 weeks)

Supervisor : A D Allen

I. Bencubbin Sheet

Commencement : 2 January 1988

Completion : 1 July 1988

Geoscientist : A Kern (14 weeks)

Supervisor : A D Allen

J. Kellerberrin Sheet

Commencement : 1 July 1988

Completion : 30 December 1988

Geoscientist : S Appleyard (26 weeks)

Supervisor : A D Allen

K. Menzies Sheet

Commencement : 1 May 1988

Completion : 28 February 1989

Geoscientist : R A Smith (26 weeks)

Supervisor : A D Allen

L. Leonora Sheet

Commencement : 1 March 1989

Completion : 30 December 1989

Geoscientist : R A Smith (26 weeks)

Supervisor : A D Allen

M. Corrigin Sheet

Commencement : 2 January 1989

Completion : 1 July 1989

Geoscientist : S Appleyard (26 weeks)

Supervisor : A D Allen

N. Dumbleyung Sheet

Commencement : 1 July 1989

Completion : 30 December 1989

Geoscientist : A Kern (20 weeks)

Supervisor : A D Allen

O. Newdegate Sheet

Commencement : 2 January 1990

Completion : 1 July 1990

Geoscientist : D P Commander (22 weeks)

Supervisor : A D Allen

P. Southern Cross Sheet

Commencement : 1 July 1990

Completion : 30 December 1990

Geoscientist : A Kern (22 weeks)

Supervisor : A D Allen

Q Commencement : 1 April 1990

Completion : 30 December 1990

Geoscientist : A T Laws (20 weeks)

Supervisor : A D Allen

R. Sir Samuel Sheet

Commencement : 1 January 1990

Completion : 1 October 1990

Geoscientist : P Thorpe (22 weeks)

Supervisor : A D Allen

S. Sandstone Sheet

Commencement : 1 October 1990

Completion : 1 July 1991

Geoscientist : A C Deeney (22 weeks)

Supervisor : A D Allen

T. Noonkanbah Sheet (including reconnaissance drilling)

Commencement : 1 April 1991

Completion : 30 December 1991

Geoscientist : W A Davidson (20 weeks)

Supervisor : A D Allen

U. Hyden Sheet

Commencement : 2 January 1991

Completion : 1 July 1991

Geoscientist : D P Commander (22 weeks)

Supervisor : A D Allen

V. Moora Sheet

Commencement : 1 July 1991

Completion : 30 December 1991

Geoscientist : A Kern (20 weeks)

Supervisor : A D Allen

Sub-program 4.2.2: 1:100 000 Hydrogeological maps

Mission: Investigate and collate hydrogeological data, and compile hydrogeological maps with explanatory notes on a scale of 1:100 000

Commencement : 3 January 1988

A. Busselton Sheet

Commencement : 3 January 1988

Completion : 1 September 1988

Geoscientist : K-J Hirschberg (12 weeks)

Supervisor : A D Allen

B. Ord Sheet

Commencement : 3 January 1988

Completion : 1 October 1988

Geoscientist : R J McGowan (20 weeks)

Supervisor : A D Allen

C. Bunbury Sheet

Commencement : 1 August 1988

Completion : 1 June 1989

Geoscientist : D P Commander (22 weeks)

Supervisor : A D Allen

D. Pinjarra Sheet

Commencement : 1 June 1989

Completion : 1 April 1990

Geoscientist : A C Deeney (18 weeks)

Supervisor : A D Allen

E. Gingin Sheet

Commencement : 1 April 1990

Completion : 1 February 1991

Geoscientist : J S Moncrieff (24 weeks)

Supervisor : A D Allen

PROGRAM 4.3: PREPARE AND MAINTAIN ENVIRONMENTAL GEOLOGICAL MAPS IN AREAS SUBJECT TO COMPETING LAND-USE PRESSURES.

Sub-program 4.3.1: 1:50 000 Environmental Mapping

Mission: Compilation of environmental geological maps at 1:50 000 scale to assist land-use planning, resource development, environmental management, housing development, and engineering construction.

A. Busselton Sheet

Commenced : August 1985

Completion : 31 January 1987

Geoscientist : S M Belford (1 week)

Supervisor : A J Smurthwaite/R P Mather

B. Capel Sheet

Commenced : August 1985

Completion : 31 January 1987

Geoscientist : S M Belford (1 week)

Supervisor : A J Smurthwaite/R P Mather

C. Yallingup Sheet

Commenced : July 1986

Completion : 28 February 1987

Geoscientist : S M Belford (2 weeks)

Supervisor : A J Smurthwaite/R P Mather

D. Burekup Sheet

Commencement : 5 January 1987

Completion : 5 May 1987

Geoscientist : G W Marcos (13 weeks)

Supervisor : A J Smurthwaite/R P Mather

E. Gleneagle Sheet

Commenced : 22 January 1985

Completion : 18 September 1987

Geoscientist : A J Smurthwaite (4 weeks)

Supervisor : R P Mather

F. Karragullen Sheet

Commenced : 3 May 1985

Completion : 23 October 1987

Geoscientist : A J Smurthwaite (4 weeks)

Supervisor : R P Mather

G. Jumperkine Sheet

Commenced : 1 October 1985

Completion : 10 April 1988

Geoscientist : A J Smurthwaite (10 weeks)

Supervisor : R P Mather

H. Albany area: Oyster Harbour, Albany, Two Peoples Bay/Breaksea and Torbay Sheets

Commencement : 15 March 1987

Completion : 30 September 1988

Geoscientist : J R Gozzard (26 weeks)

Supervisor : A J Smurthwaite/R P Mather

I. Geraldton area: Geraldton, Walkaway and Howatharra Sheets

Commencement : 1 March 1989

Completion : 31 July 1990

Geoscientist : J R Gozzard (20 weeks)

Supervisor : A J Smurthwaite/R P Mather

J. Carnarvon area: Carnarvon and Nyrinde Sheets

Commencement : 1 March 1990

Completion : 31 December 1990

Geoscientist : A J Smurthwaite (24 weeks)

Supervisor : R P Mather

K. Esperance Sheet

Commencement : 1 March 1990

Completion : 31 December 1990

Geoscientist : S M Belford (20 weeks)

Supervisor : A J Smurthwaite/R P Mather

L. Kalgoorlie area: compile an environmental geology overlay to fit current 1:50 000 geological map of the Kalgoorlie area

Commencement : 1 September 1989

Completion : 15 October 1989

Geoscientist : S M Belford (5 weeks)

Supervisor : A J Smurthwaite/R P Mather

Project 4.3.2: Central Darling Range 1:100 000 map

Mission: Map and compile the environmental geology of the Dwellingup and northern half of the Nalgerin 1:100 000 Sheet areas, interpreting the bedrock geology below laterite.

Commencement : 20 April 1988

Completion : 15 December 1988

Geoscientist : A J Smurthwaite (20 weeks)

Supervisor : R P Mather

Project 4.3.3: Rottnest Island

Mission: Produce an environmental geology map of Rottnest Island at 1:25 000 scale.

Commencement : 1 October 1987

Completion : 31 October 1987

Geoscientist : J R Gozzard (4 weeks)

Supervisor : A J Smurthwaite/R P Mather

Sub-program 4.3.4: Hydrogeological advice for environmental geology maps

Mission: Provide technical and other support for environmental geological mapping and for activities of other sections by carrying out hydrogeological investigations, providing advice, and contributing to publications.

Geoscientists: A D Allen (1-2 weeks per year)
A T Laws (1-2 weeks per year)

PROGRAM 4.4: IDENTIFY AND STUDY GEOLOGICAL HAZARDS AND THEIR EFFECTS.

Sub-program 4.4.1: Southwest seismic zone

Mission: Provide State coordination of data collection in the southwest seismic zone and liaise with Bureau of Mineral Resources to provide half-yearly report to ATEND (Accredited Technical Experts on National Disasters) on progress of data collection relevant to earthquake activity.

Geoscientist : R P Mather (2 weeks per year)

Project 4.4.2: Engineering aspects of the petrology of basic rocks in southwestern Western Australia.

Mission: Examine a selection of basic dykes in the Southwest and study their petrology in order to provide a framework for advising on the hazards presented by basic dykes on engineering projects.

Commencement : 1 January 1989

Completion : 30 June 1990

Geoscientist : J D Lewis (13 weeks)

Supervisor : W G Libby

PROGRAM 4.5: CARRY OUT GEOTECHNICAL AND GEOSIENTIFIC STUDIES FOR APPLICATION IN LAND-USE, ENVIRONMENTAL-MANAGEMENT, AND HYDROGEOLOGY PROJECTS.

Sub-program 4.5.1: Geophysical well logging

Mission: Conduct a service program of down-hole geophysical logging of boreholes, drilled mainly for water-resources evaluation and development (Geophysics).

Geoscientists: L Kevi (3 weeks per year)
G Street (2 week per year)

Technicians : J H Watt (13 weeks per year)
D Reid (9 weeks per year)

Sub-program 4.5.2: Land and stream salinization research

Mission: Undertake hydrogeological research (including drilling, testing, monitoring and geophysics) into the effects of land-use change (including mining, forestry practice and agriculture) on groundwater and soil salinity (Hydrogeology, Geophysics, CALM, Dept of Agriculture, WAWA).

A. Research relating to bauxite mining

Commenced : 1973

Completion: continuing

Geoscientists: P Thorpe (12 weeks per year)
M Martin (24 weeks per year)
G Street (1 week in 1987)
Supervisor : A T Laws (1 week per year)

B. North Stirlings land reclamation

Commenced : 5 May 1986

Completion : 23 December 1989

Geoscientist : A T Laws (15 weeks)
S Appleyard (12 weeks)

Supervisor : A T Laws
A D Allen

Project 4.5.3: Hydrochemical study of the Harvey area

Mission: Comprehensively review all analytical results from sampling groundwater in the shallow monitoring bores located on the Swan Coastal Plain crossed by the Murray and Serpentine Rivers, to provide an understanding of the evolution of groundwater quality in flow systems and define the pattern of pollution in the area.

Commencement : 3 January 1988

Completion : 1 February 1989

Geoscientist : A C Deeney (20 weeks)

Supervisor : A D Allen (1 week)

OBJECTIVE 5: MAKE GEOSCIENTIFIC AND GEOTECHNICAL INFORMATION AVAILABLE BY APPROPRIATE METHODS.

PROGRAM 5.1: COMPILE AND ISSUE PUBLICATIONS RECORDING THE RESULTS OF GEOSCIENTIFIC INVESTIGATIONS, AND MAKE GEOTECHNICAL AND GEOSCIENTIFIC INFORMATION PUBLICLY AVAILABLE BY APPROPRIATE METHODS.

Subprogram 5.1.1 Public presentation of results

Mission: Prepare papers for publication, and deliver talks to a wide range of audiences as a means of disseminating geoscientific results of investitations.

Geoscientists: Various staff as necessary.

Project 5.1.3: Memoir 3

Mission: Compile and publish Memoir 3 "Geology and Mineral Resources of Western Australia" (All Sections).

Commencement : 1985

Completion : 31 December 1987

Geoscientists: All staff (55 weeks)

Supervisor/Editor: R D Gee (15 weeks)

Project 5.1.4: Mineral Deposits Map

Mission: Prepare revision of the existing mineral deposits map (Mineral Resources).

Commenced : June 1986

Completion : 30 April 1987

Geoscientists: P H Harrison (2 weeks)
W Keats (2 weeks)

Supervisor : J G Blockley

Project 5.1.5: Geological background to the development of Perth

Mission: From existing data on the surface and subsurface geology of the Perth Metropolitan area, compile a popular account of the geological history of the region and its relevance to the community (Directorate, Engineering & Environmental, FFRPG, Hydrogeology).

Commenced : 1982

Completion : 31 December 1987

Geoscientists: Mainly Engineering and Environmental Section (8 man weeks)

Supervisor/Editor: P R Dunn (8 weeks)

Project 5.1.7: State 1:2 500 000 hydrogeological map

Mission: Compile hydrogeological data for a State map summarizing knowledge of the groundwater resources of WA (Hydrogeology).

Commenced : 1 September 1986

Completion : 30 January 1987

Geoscientist : D P Commander (4 weeks)

Supervisor : A D Allen

Project 5.1.8: Hydrogeology of the Perth Metropolitan Area

Mission: Compile and synthesize hydrogeological data to provide a comprehensive account of the hydrogeology of the Perth Metropolitan Area (Hydrogeology).

Commenced : 3 January 1981

Completion : 26 August 1988

Geoscientist : W A Davidson (12 weeks)

Supervisor : A D Allen (6 weeks)

Sub-program 5.1.12: Hydrogeological advice to the public

Mission: Provide hydrogeological advice to non-government inquirers on the availability, utilization, control, and quality of groundwater (Hydrogeology).

Geoscientists: Hydrogeological section (48 man weeks per year)

Supervisor : A D Allen (1 week per year)

Sub-program 5.1.13: Respond to public geological enquiries

Mission: Maintain information systems to enable quick responses to public queries on all aspects of Western Australian geology (Publications and Information).

Geoscientists: W B Hill (9 weeks per year) I Ruddock (9 weeks per year) B M Nash (9 weeks per year) C A Strong (9 weeks per year)

Supervisor : W B Hill

Sub-program 5.1.14: Maintain information pamphlets

Mission: Periodically review and revise existing pamphlets and compile new pamphlets where a demand is identified (P & I, Hydrogeology, Engineering & Environmental Geology).

Geoscientists: W B Hill (1 week per year)
I Ruddock (1 week per year)
C A Strong (1 week per year)

A. Hydronotes (on groundwater problems etc, two issues per year)

Commencement : 30 March 1987

Geoscientists: A T Laws (4 weeks per year)
R A Smith (4 weeks per year)

B. Guide to use of environmental geology maps

Commencement : 1 March 1987

Completion : 14 March 1987

Geoscientist : J R Gozzard (2 weeks)

Supervisor : A J Smurthwaite

C. Revise information pamphlet on gemstones

D. Produce information pamphlet on platinum.

C and D to be produced by P & I staff when time available.

E. Update and produce 'Overview of Mining' as required.

Geoscientist : B M Nash (5 weeks per year)

Project 5.1.15: Geomorphological history of the Swan Coastal Plain

Mission: Outline the picture of geomorphological evolution of the Swan Coastal Plain as an aid to exploration and development of mineral and water resources (Engineering and Environmental Geology, University of WA, Curtin University).

Commencement : 1 January 1988

Completion : 31 December 1991

Geoscientists: J R Gozzard (10 weeks)
K H Wyrwoll (UWA)
L Collins (Curtin)

Supervisor : R P Mather

Project 5.1.16: Building Stones of Western Australia

Mission: Compile a database of building-stone producers, products, reserves etc, test the materials, and produce a report reviewing existing and potential building-stone sources (Engineering and Environmental Geology).

Commencement : 1 March 1991

Completion : 31 December 1991

Geoscientist : J R Gozzard (19 weeks)

Supervisor : A J Smurthwaite

Project 5.1.17: M-Series backlog

Mission: Undertake a program to overcome the backlog in the microfilming and release of M Series reports (Mineral Resources).

Commencement : December 1986

Completion : 31 December 1987

Geoscientists: S L Lipple (17 weeks)
2 contract geologists (93 man-weeks)
J M Fetherston (20 weeks)

Supervisor : J G Blockley

PROGRAM 5.2 ESTABLISH AND MAINTAIN EDP FACILITIES, INCLUDING DATABASES FOR GOVERNMENT, PUBLIC AND INDUSTRY

Sub-program 5.2.1: Review computer hardware and software requirements.

Mission: Review and update plans for the progressive development of computer facilities required to support the scientific-computing, data-processing, and word-processing needs of the Geological Survey. A principal objective during 1987-1991 will be to provide direct access to a workstation for each geoscientist having ongoing needs for such facilities.

Geoscientists: Various

Co-ordinator : B M Nash (6 weeks per year)

Sub-program 5.2.2: Mininform

Mission: Maintain an EDP base covering significant mineral exploration/development projects, ore reserves and operations (Mineral Resources, Engineering & Environmental Geology).

Geoscientists: A G Heath) 12 weeks
W A Preston) per year
B M Nash (6 weeks per year)
J R Gozzard (1 week per year)
A J Smurthwaite (2 weeks from 1988)
S M Belford (2 weeks from 1988)

Supervisor : J G Blockley

Sub-program 5.2.3: WAMEX - M Series

Mission: Receive, index, and store statutory reports on mineral exploration; microfilm open-file reports, and extract and enter keywords on an EDP base (Mineral Resources).

Geoscientist : S L Lipple (20 weeks/year)

Supervisor : J G Blockley

Sub-program 5.2.4: State Water Resources Information System

Mission: Set up and maintain an EDP databank for groundwater resources information, in collaboration with the WA Water Authority. This includes the transcription of the existing water-bore record cards to the computer-based system (Hydrogeology, WAWA).

Geoscientist : A C Deeney (3 weeks per year). Note that the system will not be operational until additional staff are provided for data coding and key punching.

Supervisor : A D Allen

Sub-program 5.2.5: WAMEX (coal data)

Mission: Curate and index statutory reports on coal exploration to provide faster release of exploration data by applying the WAMEX EDP system (FFRPG/Computer Services).

Geoscientist : G Le Blanc Smith (4 weeks per year)

Support staff: L de Leuw
Technical assistants

Supervisor : A E Cockbain (1 weeks per year)

Sub-program 5.2.6: Establishment and maintenance of EDP systems for processing, storage and issue of geophysical data

Mission: Establish databases for storing and retrieving various types of geophysical information and develop programs for processing data (Geophysics).

Geoscientists: L Kevi (4 weeks per year)
G Street (4 weeks per year)

Technicians : J H Watt (5 weeks per year)
D Reid (3 weeks per year)

Supervisor : L Kevi

Sub-program 5.2.8: WAPEX (S-series database)

Mission: Receive, index, and store statutory reports on petroleum exploration, and arrange microfilming of those reports that are publicly available.

Geoscientist : R P Iasky (10 weeks per year)

Support staff: L de Leuw

Supervisor : R M L Elliott (2 weeks per year)/
A E Cockbain

Sub-program 5.2.9: Rock and mineral data system

Mission: Maintain and operate the rock and mineral EDP catalogue (Petrology).

Geoscientists: Petrology group staff (7 man weeks/year)

Supervisor : W G Libby

Sub-program 5.2.10: Develop and maintain EDP systems

Mission: Use standard software and personal computing facilities, set up and maintain minor data-bases in support of projects, sub-programs, and the operations of various sections. Advise on development of EDP systems and liaise with Computer Services.

Personnel : C A Strong (4 weeks per year)
Various

Co-ordinator : B M Nash (15 weeks per year)

Project 5.2.11: Computerization of petrological studies

Mission: Develop a system for computer-based analyses of petrological/chemical data to allow rapid graphical comparison of suites of rocks, and calculations and display of petrological indices (Petrology).

Commenced : 1985

Completion : 1 April 1988

Geoscientist : W G Libby (3 weeks)

PROGRAM 5.3. ESTABLISH AND MAINTAIN A FOSSIL COLLECTION

Sub-program 5.3.1: Reference fossil collection

Mission: Establish and maintain a comprehensive collection of fossils relating to the biostratigraphy of Western Australia (Palaeontology).

Completion : Cambrian collection (31 March 1987)
Ordovician collection (31 July 1987)
Devonian collection (30 November 1987)
Carboniferous collection (31 March 1988)
Triassic collection (31 July 1988)
Jurassic collection (30 November 1988)
Cretaceous collection (31 March 1989)
Tertiary collection (31 July 1989)
Quaternary collection (30 November 1989)
Thereafter ongoing maintenance and expan-sion as new material becomes available

Geoscientist : S K Skwarko (72 weeks, then 1 week per year)

A. Systematic description of Devonian Bivalvia from the Lennard Shelf, Canning Basin

Commencement : 1 March 1990

Completion : 31 October 1991

Geoscientist : S K Skwarko (50 weeks)

OBJECTIVE 6: MAINTAIN AND DEVELOP TECHNICAL AND SUPPORT FACILITIES TO MEET ALL OTHER OBJECTIVES.

PROGRAM 6.1: MAINTAIN AWARENESS OF NEW TECHNIQUES AND TECHNOLOGY APPLICABLE TO ALL GEOSCIENTIFIC WORK OF THE SURVEY, AND ACQUIRE AND DEVELOP THEM FOR APPLICATION IN PROGRAMS WHEREVER APPROPRIATE.

Sub-program 6.1.1: Maintain and develop well-logging systems

Mission: Review geophysical logging equipment, data logging facilities and associated software to meet the needs of advancing technology (Hydrogeology, Geophysics, Drilling Branch).

A. Modify SIE hardware to accept existing Gearhart-Owen tools, improve reliability of hard-copy output, and develop additional software programs to provide derivative logs and histograms (Geophysics/Hydrogeology).

Commenced : 1984

Completion : 31 March 1987

Geoscientist : J S Moncrieff (5 weeks)

Technicians : J H Watt (3 weeks)
D Reid (2 weeks)

Supervisor : L Kevi

B. Install and maintain a geophysical logging calibration facility (Geophysics, Hydrogeology, Drilling Branch).

Geoscientists: J S Moncrieff (2 weeks/year)
L Kevi (less than 1 week/year)

Drilling Engineer: D M McPherson (SME)

Sub-program 6.1.3: Development of hydrogeological technology

Mission: Undertake development and research into new techniques in hydrogeology which improve accuracy or efficiency in data collection or application (Hydrogeology).

A. Pneumatic slug test evaluation and development
Commenced : 1985

Completion : 30 May 1987

Geoscientist : A C Deeney (4 weeks)
R J McGowan (2 weeks)
M Martin (1 week)
S Appleyard (2 weeks)

Supervisor : A D Allen (less than 1 week)

B. Plotting pollution plumes using geophysics

Commencement : 3 January 1988

Completion : 31 March 1988

Geoscientists: K-J Hirschberg (5 weeks)
G Street (10 weeks)

Supervisors : A D Allen
L Kevi

Sub-program 6.1.4: Geophysics in soil salinity

Mission: Evaluate possible methods to assist in soil-salinity research, including EM, SP, galvanic resistivity, magnetometric resistivity (MMR) and VLF EM methods (Geophysics).

A. Apply transient electromagnetic soundings for the purpose of investigating the geological environment of land salinization in the North Stirling area.

Commencement : 1 May 1988

Completion : 31 December 1988

Geoscientist : G Street (6 weeks)

Technician : J H Watt (5 weeks)

PROGRAM 6.2: MAINTAIN EFFECTIVE SUPPORT SERVICES FOR GEOLOGICAL SURVEY ACTIVITIES

Sub-program 6.2.1: Maintain appropriate support services

Mission: Provide administrative, program planning, technical and general services to sections of the Geological Survey and to other Divisions of the Mines Department where required (Directorate, Geological Services, Library etc).

Personnel : Various

Sub-program 6.2.2: Maintenance of petrological services

Mission: Provide petrological services to identify rocks and minerals and assist in the interpretation of rock evolution (Petrology).

Geoscientist : W G Libby (10 weeks per year)
J D Lewis (24 weeks per year)
A L Ahmat (10 weeks per year)

Supervisor : W G Libby

Sub-program 6.2.3: Process publications

Mission: Process technical manuscripts for publication as books, maps or microforms; includes copy editing and organization for printing (P & I).

Geoscientists: W B Hill (28 weeks per year)
I Ruddock (31 weeks per year)
C AStrong (28 weeks per year)

Supervisor : W B Hill

Sub-program 6.2.4: Publications and Information support

Mission: Assist and advise staff on sources of data, preparation of papers, maintenance of manual recording systems and storage of photographs, reference maps etc (Publications and Information).

Geoscientist : W B Hill (4 weeks per year)
B M Nash (16 weeks per year)
I Ruddock (4 weeks per year)
C A Strong (2 weeks per year)

Supervisor : W B Hill

Sub-program 6.2.5: Geochemistry services

Mission: Maintain geochemistry services to other sections of the Geological Survey.

Geoscientist : R Davy (5 weeks per year)

Sub-program 6.2.6: Aeromagnetic data interpretation

Mission: Carry out interpretation of aeromagnetic data and provide advice in support of geological mapping (Geophysics).

Geoscientist : G Street (5 weeks per year from 1990)

A. Provide advice to colleagues as required and review geophysical data on Eastern Goldfields

Completion : 31 October 1989

Geoscientist : G Street (21 weeks)

Supervisor : L Kevi

OBJECTIVE 7: PROVIDE GEOSCIENTIFIC ADVICE IN SUPPORT OF THE OPERATIONS AND RESPONSIBILITIES OF THE DEPARTMENT OF MINES

Sub-program 7.0.1: Advice on Petroleum Act matters

Mission: Provide advice where required on matters concerned with petroleum exploration and development in Western Australia (FFRPG).

Geoscientist : R M L Elliott (8 weeks per year)

Supervisor : A E Cockbain (1 week per year)

Sub-program 7.0.2: Advice to Government on mineral exploration, development, and economics

Mission: Prepare briefing notes and position papers for the Minister for Minerals and Energy and Government departments, as required, on aspects of mineral exploration and development in Western Australia (Mineral Resources, FFRPG)

Geoscientists: Mineral Resources and FFRPG staff (total 55 man-weeks per year)

Sub-program 7.0.3: Advice on Mining Act matters

Mission: Advise on geological aspects relating to administration of the Mining Act (Mineral Resources, FFRPG, Engineering & Environmental).

Geoscientists: Mineral Resources FFRPG, and Engineering & Environmental staff (total 57 man-weeks per year)

Sub-program 7.0.4: Review engineering and environmental reports for Mines Department and other departments

Mission: Check the geoscientific content of various engineering and environmental reports prepared by and for other Government departments (Engineering & Environmental).

Geoscientists: Engineering & Environmental staff (10 weeks per year)

Sub-program 7.0.5: Bauxite extraction planning

Mission: Advise Government through established groups and committees on bauxite mining plans and strategies to provide for optimal use of the resource with due regard to environmental constraints (Engineering & Environmental Geology).

Geoscientist : A J Smurthwaite (5 weeks per year)

Sub-program 7.0.7: Petroleum Tenement Planning

Mission: Undertake geological and geophysical studies based on company and other data to delineate areas for gazettal as petroleum tenements (FFRPG, Petroleum Division).

Commencement : 2 January 1987

Geoscientist : R M L Elliott (13 weeks per year)
M F Middleton (2 weeks per year from 1988)

Supervisor : A E Cockbain (1 week per year)

PUBLICATIONS

RELEASED DURING 1986

Information Pamphlets

Bauxite and Aluminium

Vanadium

Iron

Records

1985/2 Review of petroleum exploration, development, and production, in Western Australia to the end of 1984, by R.M.L. Elliott, R.P. Iasky, and K.A. Crank.

1985/3 WAMEX users guide (revised), by J.D. Carter and S.L. Lipple.

1985/5 Revised stratigraphic nomenclature in the Carnarvon Basin, Western Australia, by R.A. Hocking.

1985/6 The mineralogy and composition of a core which intersects the Marra Mamba Iron Formation and the Roy Hill Shale Member, by R. Davy.

1986/1 Summary of progress of the Geological Survey of Western Australia during 1985 and plans for 1986, by A.F. Trendall.

1986/2 Surveys conducted and wells drilled in 1985, and wells drilled to the end of 1985 for petroleum exploration in Western Australia, by R.M.L. Elliott and R.P. Iasky.

1986/3 Two-dimensional gravity modelling with the Tektronix 4054 graphic system, by L. Kevi.

1986/4 Explanatory notes on the Kellerberrin 1:250 000 geological sheet, Western Australia, by R.J. Chin.

1986/5 Revised stratigraphic nomenclature for the onshore Bonaparte and Ord Basins, Western Australia, by G.M. Beere and A.J. Mory.

1986/6 Phanerozoic sedimentary basins of Western Australia and their petroleum potential, by A.E. Cockbain.

1986/7 Explanatory notes on the Corrigin 1:250 000 geological sheet, Western Australia, by R.J. Chin.

1986/8 Hydrogeology of the western Fortescue valley, Pilbara region, Western Australia, by J.C. Barnett and D.P. Commander.

1986/9 Economic significance of geochemical data from the granitoids in the Poona - Dalgaranga area, Murchison Province, by R. Davy, A.H. Hickman, K.P. Watkins and P.C. Muhling.

1986/10 Vertical electrical-sounding interpretation using the Tektronix 4054 graphic system, by L. Kevi.

1986/11 Explanatory notes on the Peak Hill 1:250 000 geological sheet, Western Australia, by R.D. Gee.

1986/12 Explanatory notes on the Cue 1:250 000 geological sheet, Western Australia, by K.P. Watkins, I.M. Tyler, and A.H. Hickman.

Reports

14 Professional papers for 1983, containing

The hydrogeology of Lake Mariginiup, by J. Hall.

Carboniferous of Western Australia - a review, by A.E. Cockbain.

Palaeozoic stratigraphy of the Ord Basin, Western Australia and Northern Territory, by A.J. Mory and G.M. Beere.

Structural and stratigraphic relationships in the Archaean granite - greenstone terrain around Cue, Western Australia, by K.P. Watkins and I.M. Tyler.

The Fraser Complex - a major layered intrusion in Western Australia, by John S. Myers.

A rubidium-strontium date from felsic volcanics within the Mount Roe Basalt of the Wyloo Dome, by J.R. de Laeter, D.B. Seymour, and W.G. Libby.

Rubidium-strontium biotite dates in the Gascoyne Province, Western Australia, by W.G. Libby and J.R. de Laeter.

Upward-shallowing sequences in the Precambrian Duck Creek Dolomite, Western Australia, by A.M. Thorne.

Stromatolites in the Proterozoic Duck Creek Dolomite, Western Australia, by Kathleen Grey.

Stratabound axinite in the Weeli Wolli Formation and its occurrence in related dolerites, by R. Davy and M. Pryce.

Rept 15. Geology of the Gascoyne Province, Western Australia, by S.J. Williams.

Rept 16. Stratigraphy, structure, and economic geology of the Mount Monger area, Eastern Goldfields Province, by A.H. Hickman.

Rept 17 The Mount Edgar Batholith, Pilbara area, Western Australia - Geochemistry and petrography, by R. Davy and J.D. Lewis.

Rept 18 Late Devonian sponges of Western Australia, by J. Keith Rigby.

19 Professional Papers for 1984 containing

Metamorphic patterns in the greenstone belts of the Southern Cross Province, by A.L. Ahmat.

Problematic microstructures in the Proterozoic Discovery Chert, Bangemall Group, Western Australia. Ambient grains or microfossils? by Kathleen Grey.

Stromatolite evidence supporting a correlation of the Proterozoic Uaroo and Bangemall Groups, Western Australia, by Kathleen Grey.

The mineral potential of layered igneous complexes within the Western Gneiss Terrain, by P.H. Harrison.

Liquid-waste disposal in Perth. A Hydrogeological assessment, by K-J.B. Hirschberg.

Occurrence, distribution, and origin of smithsonite in the No.2 lead-zinc deposit at Narlarla, Western Australia, by C.R. Ringrose.

The sedimentology of a tide-influenced fan-delta system in the Early Proterozoic Wyloo Group on the southern margin of the Pilbara Craton, Western Australia, by A.M. Thorne and D.B. Seymour.

Age and stratigraphy of a sequence of metavolcanic and metasedimentary rocks in the Prairie Downs - Deadman Hill area, southwestern margin of the Sylvania Dome, by I.M. Tyler.

20 Geochronology of the Gascoyne Province, by W.G. Libby, J.R. de Laeter, and J.S. Myers.

Bulletins

131 Geology of the eastern part of the Nabberu Basin, Western Australia, by J.A. Bunting.

132 Kimberlites and lamproites of Western Australia, by A.L. Jaques, J.D. Lewis, and C.B. Smith.

Maps

1:250 000 geological series (map and notes) Dumbleyung, by R.J. Chin and A.T. Brakel.

1:250 000 geological series (map only) Corrigin, Cue, Kellerberrin, and Peak Hill.

1:50 000 environmental geology maps
Armadale, by J.E. Jordan
Fremantle, by J.R. Gozzard
Perth, by J.R. Gozzard
Rockingham, by J.R. Gozzard
Serpentine, by J.E. Jordan

IN PREPARATION AT END OF 1986

Information Pamphlet

Gemstones in Western Australia

Records

Explanatory notes on the Wyloo geological sheet (2nd edn), by D.B. Syemour, A.M. Thorne, and D.F. Blight.

Hydrogeology of Lake Toolibin, by M.W. Martin.

Silica sand and gypsum in Western Australia, by I.M. Brown.

Reports

Regional geology of the Kalgoorlie-Boulder gold-mining district, by W. Keats.

Archaean geology of the Mount Narryer region, by I.R. Williams and J.S. Myers.

Professional Papers for 1985, containing

Geochemical patterns in granitoids of the Corunna Downs Batholith, Western Australia, by R. Davy.

Geology and hydrology of the superficial formations and coastal lakes between Harvey and Leschenault Inlets (Lake Clifton Project), by D.P. Commander.

The transition between the Hamersley and Fortescue Groups as evidenced in drill core, by R. Davy and A.H. Hickman.

Geology and exploration history of uraniferous and auriferous pyritic conglomerates in Western Australia, by J.D. Carter and R.D. Gee.

Brachiopods and bivalves of the Kungurian (late Early Permian) age from the top of the Coolkilya Sandstone, Carnarvon Basin, Western Australia, by N.W. Archbold and S.K. Skwarko.

Bulletins

Palynological studies of Late Jurassic and Early Cretaceous sediments, Perth Basin, Western Australia, by John Backhouse.

The geology of the Carnarvon Basin, Western Australia, by R.M. Hocking, H.T. Moors, and W.J.E. van der Graaff.

Palaeontology of the Permian of Western Australia, edited by S.K. Skwarko.

The geology of the onshore Bonaparte and Ord Basins, by G.M. Beere and A.J. Mory.

Explanatory Notes

Kellerberrin, by R.J. Chin.
Corrigin, by R.J. Chin.
Cue (2nd edn), by K.P. Watkins, I.M. Tyler, and A.H. Hickman.
Peak Hill (2nd edn), by R.D. Gee.

Maps

1:250 000 geology
- Wyloo (2nd edn)
- Balfour Downs (2nd edn)

1:100 000 geology
- Cowan
- Lefroy

1:50 000 environmental geology
- Muja
- Lake Clifton
- Collie
- Mundaring

PAPERS PUBLISHED ELSEWHERE BY GEOLOGICAL SURVEY STAFF

Appleyard, S.J. and Bawden, J., 1986, The effects of urbanization on nutrient levels in the unconfined aquifer underlying Perth, Western Australia: AWRC Groundwater Systems under Stress Conference, Brisbane 1986, p. 4981-498.

Buntebarth, G. and *Middleton, M.,* 1986, A comparison of two vitrinite reflectance methods for estimating paleotemperature gradients, in Paleogeothermics: Springer-Verlag, Lecture Notes in Earth Sciences 5, p. 95-104.

Clarke, R.M. and *Williams, I.R.,* 1986, Moolooite, a naturally occurring hydrated copper oxalate from Western Australia: Mineralogical Magazine v.50 p.295-298.

Cockbain, A.E., 1986, Devonian stromatoporoids from the Carnarvon Basin, Western Australia, in Lindsay, J.M. (ed.), Stratigraphy, palaeontology, malacology, papers in honour of Dr Nell Ludbrook: Dept Mines Energy South Australia Spec. Pub. 5, p. 29-33.

Davy, R., and El Ansary, M., 1986, Geochemical patterns in the laterite profile at the Boddington gold deposit, Western Australia: Journal of Geochemical Exploration, v. 26, p. 119-144, Amsterdam, Elsevier Science Publishers B.V.

de Laeter, J.R. *Fletcher, I.R.,* Bickle, M.J., *Myers, J.S., Libby, W.G., and Williams, I.R.,* 1986, RbSr, Sm-Nd, and Pb-Pb geochronology of ancient gneisses from Mount Narryer, Western Australia: Australian Journal of Earth Sciences, v.32, no.4, p. 349-350.

Gee, R.D., Myers, J.S., and Trendall, A.F., 1986, Relation between Archaean high-grade gneiss and granite - greenstone terrain in Western Australia: Precambrian Research 33, p. 87-102.

Grey, K., 1986, Late Precambrian stromatolite biostratigraphy of the Eastern Pilbara, in 8th Australian Geological Convention, Adelaide: Geol. Soc. Australia, Abstracts, p.89.

Grey, K., and Gee, R.D., 1986, Stromatolites in the Precambrian Glengarry Sub-basin, Nabberu Province, Western Australia, in 12th International Sedimentological Congress, Canberra: Abstracts Volume.

Grey, K., and Thorne, A.M., 1986, Stromatolites in upward shallowing sequences, in 8th Australian Geological Convention, Adelaide: Geol. Soc. Australia, Abstracts p. 240.

Grey, K., and Thorne, A.M., 1986, Stromatolites in upward shallowing sequences, in 12th International Sedimentological Congress, Canberra: Abstracts Volume.

Glikson, A.Y., *Davy, R., and Hickman, A.H.,* 1986, Geochemical data files of Archaean volcanic rocks, Pilbara Block, Western Australia: Bur. Min. Resour. Aust. Record 1986/14 (restricted).

Glikson, A.Y., Pride, C., Jahn, B., *Davy, R., and Hickman, A.H.,* 1986, Rare earth elements of Archaean mafic-ultramafic volcanic sequences, Pilbara Block, Western Australia: in International Volcanological Congress Auckland New Zealand 1-9 February 1986 Abstracts p. 159.

Glikson, A.Y., Pride, C., Jahn, B., *Davy, R., and Hickman, A.H.,* 1986, RE and HFS (Ti, Zr, Nb, P, Y) element evolution of Archaean mafic-ultramafic volcanic suites, Pilbara Block, Western Australia: Bur. Min. Resour. Aust., Record 1986/6.

Hickman, A.H., and Harrison, P.H., 1986, A review of the occurrence of, and potential for, Precambrian conglomerate-hosted gold mineralization within Western Australia, in Geocongress 86: Geol. Soc. South Africa, Extended Abstracts, p. 301-306.

Lipple, S.L., 1986, Creation of geoscience resources: a case study on the development and potential evolution of a mineral exploration database (WAMEX) in Shelley, E.P., (editor) Proceedings of the Third International Conference on Geoscience Information, Adelaide, S. Australia, 1-6 June 1986, v. 1, p. 231-244, Australian Mineral Foundation, Adelaide.

Lipple, S.L., and Street, G.J., 1986, Reporting requirements of the 1978-85 Mining Act, Western Australia, in Title management of mining and petroleum, tenements in Western Australia: Australian Institute of Geoscientists, Seminar 4, p. 133-167.

Myers, J.S., 1986, Tectonic evolution of Archaean gneisses in the Fisknaesset region of south-west Greenland (Chinese), in Proceedings of International Symposium on Precambrian Crustal Evolution, Vol. 3: Geol. Soc. China, Spec., Publ., p. 95-115.

Rothery, D.A., *Hunter, W.M.,* Drury, S.A., and Hunt, G.A., 1986, Large scale geological mapping using airborne thematic mapper imagery in Western Australia, in International Symposium on Mapping from Modern Imagery, September 1986, Edinburgh: Remote Sensing Society, Proceedings.

Smith, R.A., and Allen, A.D., 1986, The unconfined aquifer and effects of urbanisation - Perth, Western Australia: AWRC Groundwater Systems under Stress Conference, Brisbane 1986, p. 479-486.

Street, G.J., and Reid, D., 1986, Gamma radiation from steel drill casing: Exploration Geophysics 17, p. 122.