CANADA

DEPARTMENT OF ENERGY,
MINES AND RESOURCES

GEOLOGICAL SURVEY OF CANADA

ANNUAL REPORT

APRIL 1, 1974 TO MARCH 31, 1975

FOR DEPARTMENTAL USE ONLY

OTTAWA
1975

CANADA

DEPARTMENT OF ENERGY, MINES AND RESOURCES

GEOLOGICAL SURVEY OF CANADA

ANNUAL REPORT
APRIL 1, 1974 to MARCH 31, 1975

The data comprising this report are reproduced directly from material submitted by the reporting units and have not been edited or retyped. This report is intended for Departmental use and record.

OTTAWA

1975

CONTENTS

Page

ANNUAL REPORT APRIL 1, 1974 to MARCH 31, 1975

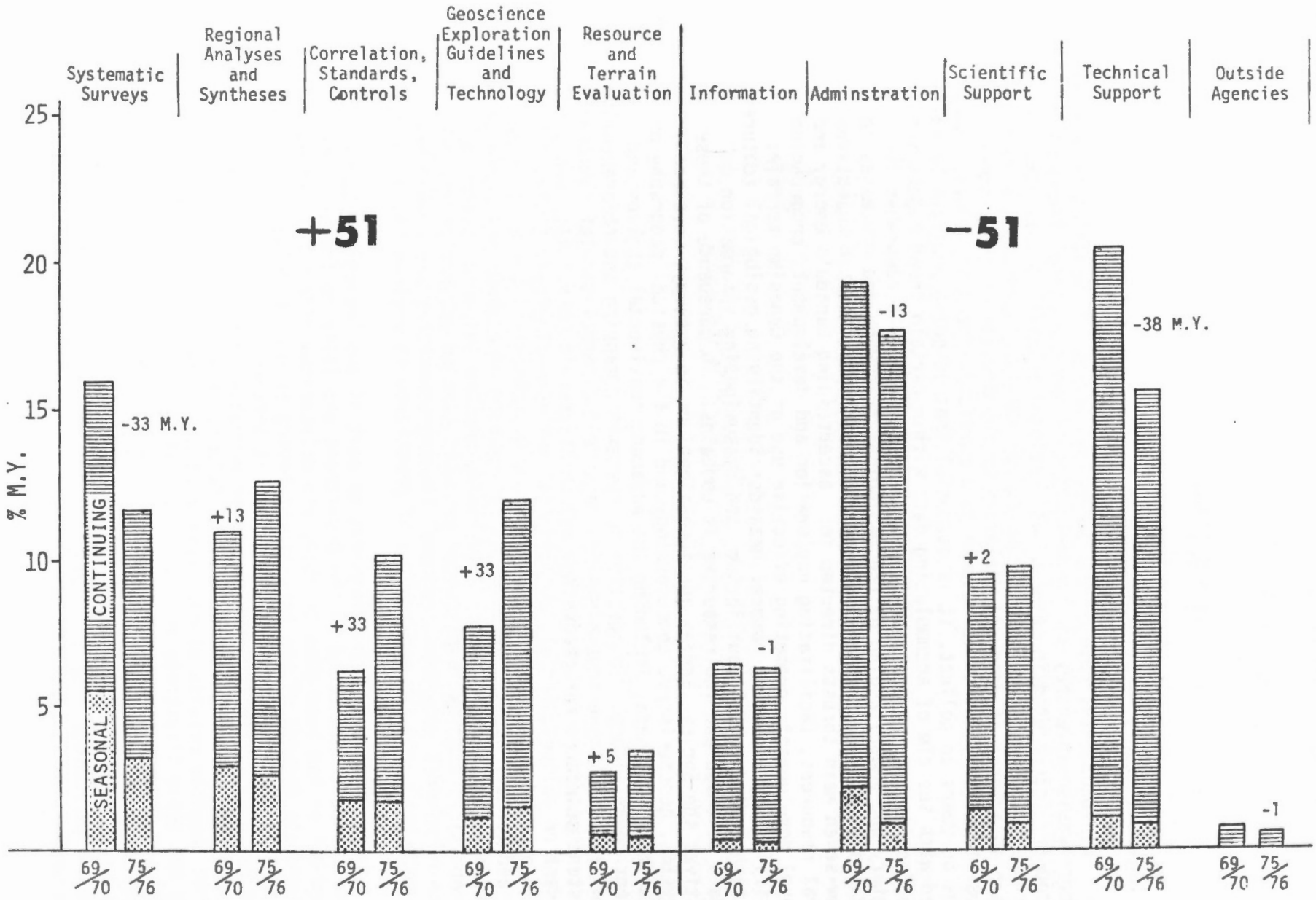
GEOLOGICAL SURVEY OF CANADA

INTRODUCTION

D.J. McLaren, Director General
J.O. Wheeler, Deputy Director General

The fundamental role of the Geological Survey of Canada is to provide a comprehensive inventory and understanding of the geological framework of the country interpreted in terms of all national activities that make use of or are affected by geology. A geological survey should be in a position to warn in advance of resource depletion or degradation of the landmass. Because the data required to respond to a particular need may require many months or years to collect, it is essential that on-going programs be maintained with the aim of accumulating data within certain broad objectives. The objectives of the Geological Survey are to provide a comprehensive inventory and understanding of the geological framework and processes in Canada as a basis for national policy and planning. The main objectives follow seven main thrusts directed to: ascertaining Canada's energy and mineral resources; facilitating exploration and development; encouraging regional development; promoting effective use of the Canadian terrain; identifying and assessing natural hazards; identifying geological features affecting environmental equilibrium, and disseminating information on Canada's landmass and the resources it contains. In pursuance of these objectives the Survey carries out investigations in geology, resource geophysics, geochemistry, geomorphology and in the physical geography of the landmass of Canada, including the adjacent continental shelves and adjacent ocean floors. In addition to systematic mapping and comprehensive topical studies, these investigations require the formulation of nationally consistent standards for chronology and stratigraphic correlation and are dependent on paleontological, petrological and mineralogical studies. In certain other fields such as geophysics and geochemistry, there is a continuing need for the design, development and testing of methods and equipment appropriate for Canadian needs. New fields embrace shipborne geological and geophysical studies, application of statistics to estimation and prediction of mineral potential, regional limno-geochemistry and researches into geotechnics and the application of geoscience to engineering planning.

Early in 1975 Branch management as part of the Geological Survey's Program Forecast submission to the Department and later to Treasury Board, pointed out as had been done in 1974, the deleterious effect our response to the immediate demands of new thrusts was having on our on-going activities. Our position that a strengthening of support services was essential was received favourably although in view of the probable restriction on any expansion of government programs in the near future, it is difficult to predict what the tangible results of our presentation will be. The accompanying figure and table illustrate the manpower reallocations that were made between 1969/70 and 1975/76 to meet the needs of new thrusts. The first period marked the end of major reconnaissance programs and the start of programs that needed more laboratory and other forms of technical support yet in the interval there has been a percentage drop from 30.0 to 25.4 of the authorized strength directed to support activities. We would need 36 man-years to bring scientific and



Note: negative my figures are the numbers of actual man-years needed to bring 75/76 activity to the equivalent 69/70 level.

Fig. 1

Table 1 Increasing demands to meet new issues and concerns have denuded the on-going program of the Geological Survey.

1969-70 (man-years)	%	1975-76 (man-years)	%	Activities
97	(16.0)	95	(11.8)	Systematic Surveys
66	(10.9)	100	(12.5)	Regional Analyses and National Compilations
37	(6.1)	82	(10.2)	Standards, properties and control studies
48	(7.9)	96	(12.0)	Resource identification (Technology)
17	(2.8)	27	(3.4)	Resource endowment
28	(6.3)	50	(6.2)	Resource Data Management Systems
304	(50.1)	352	(44.3)	Support services (administration, scientific, technical, other)
605		802		

technical support activities back to the relative level of 1969/70. Experience has shown that a ratio of one scientist to two support staff (scientific, technical and clerical) permits optimum use of a scientist's time but in order to undertake approved programs for which insufficient manpower was authorized the Geological Survey has been forced to alter the ratio to 1:1. We do not feel that the answer to our manpower constraints lies in terminating existing activities. The activities carried out commonly feed several programs and although the effects of their elimination may not be immediately apparent, sooner or later it is found that essential data are not available when needed.

During 1974-75 Canada was faced with several major issues in the field of natural resources, issues that will continue to dominate in the coming years. The availability of energy and mineral commodities, a greater ability to use the resources of our offshore areas and an increased appreciation of environmental concerns gained in part through an understanding of Canada's terrain are concern to the solution of which the Geological Survey can make significant contributions. It is to be hoped that the Branch will be granted financial and manpower resources adequate to the tasks that face it.

During the report period the Canadian Centre for Geoscience Data was transferred to the office of the Assistant Deputy Minister, Science and Technology.

To bring the department more in line with other departments senior management positions were redesignated in May 1975. The head of the Branch became Director General, division chiefs became directors and other appropriate changes were made. As these changes post-dated the period covered by this report, they are not used in the main part of the report, although used in some departmental reports covering the same period.

In 1973-74 our authorized strength was 779 man-years (including summer assistants and term employees) and the budget was 21 million dollars.

This report is for departmental use only and is not intended for public distribution. The objectives of each division are presented and highlights of their achievements in 1974-75 are recorded. More detailed narratives for each sub-division and section and data on meetings attended, lectures presented and membership on committees follow a standard format. Two published reports - the Annual Index and the Volume of Abstracts - list reports published by the staff in-house and in outside journals and provide a measure of the volume and scope of the Survey's activities. A few of the highlights of the achievements of 1974-75 follow.

Highlights 1974-75

As in previous years the largest component of the Geological Survey's program was devoted to regional mapping and studies on land and offshore areas. Since the early sixties a major thrust of government agencies responsible for offshore programs has been the collection of a data base. Canada is well in advance of most countries in offshore multidisciplinary hydrographic-geophysical surveys and by the end of 1974 72 bathymetric, 33 magnetic and 34 gravity (free air anomaly) charts had been issued. If this program is continued at the same rate, Canada will by the end of the century have the best mapped continental shelf in the world. Data derived from commercial exploration is providing a major contribution to our knowledge of offshore geology. Samples from offshore wells are curated by the federal government. During 1974 data for 19 wells or 60 000 metres of stratigraphic information on east coast geology was released from government files for public use.

The nature and degree of detail of regional studies vary with our degree of understanding of the major elements of the geological framework of Canada. Moreover, the measure of accomplishment in any year may not be impressive but over a sufficient period is significant. For example, 25 years ago our knowledge of the Cordillera consisted of local islands of well understood geology within a larger matrix of relatively unknown geology. In the meantime systematic surveys at 1:250 000 scale have provided nearly complete, reasonably uniform regional coverage that has permitted regional syntheses resulting in the recognition of the nature and distribution of the main tectonic elements. This information has provided the principal focus for the current work - regional, multidisciplinary studies of broad tectono-stratigraphic units, bearing in mind factors that relate to current concepts of mineral and fuel exporation. Similar stages of development have been attained in the Arctic Islands and in the Appalachian regions. Examples of recent findings in these areas include the recognition of Late Devonian granitic plutons within the Shuswap Metamorphic Complex in the Cordillera, of subaqueous accumulation of upper Paleozoic saline deposits in the Arctic Islands in contrast to a sabkha evaporite origin, and of the building of Lower Paleozoic volcanic arc edifices upon a granitic crust in Newfoundland.

The status of knowledge of the geology of the Canadian Shield is in many ways similar to that of the Cordillera about 15 years ago — many local well known areas within a much larger region in which the nature and distribution of complex major rock units are known from the 1:500 000 scale reconnaissance. This information has guided the current more perceptive multidisciplinary approaches that

will achieve a clearer understanding of the evolution of the Shield and form a surer basis for modifying and applying mineral exploration concepts there. Examples of recent advances include the recognition of several localities of granitic basement about 3 billion years old, part of which is overlain by strata containing significant showings of base metals, and that Archean localism was roughly synchronous 2650 billion years ago in widely separated parts of the Shield.

The mapping program for the surficial geology of Canada is not nearly as advanced as is the bedrock program and only 15 per cent of the country is mapped at the scale of 1:250 000 and less than 5 per cent at 1:50 000. Systematic surficial mapping is only being done in areas of immediate importance - 1:250 000 in northern regions and 1:50 000 in the southern populous regions.

Resource evaluation is an important part of the Geological Survey's work and during the year a Uranium Program designed to gather and interpret data on uranium and thorium deposits and to determine their nature and genesis was started. In September a reserve appraisal team composed of staff from CANMET and the Geological Survey began an on-the-site evaluation of the reserves and inferred resources of uranium and thorium in Canada and by March 1975 they were able to submit reports to the Departmental Uranium Resource Appraisal Group.

Terrain evaluation is essential in understanding and assessing terrain hazards and in maintaining and restoring the physical environment. In relatively fragile environments such as that occupied by the Mackenzie Valley Transportation Corridor understanding the nature of surficial deposits is especially necessary, and in 1974 the Geological Survey completed mapping of 43 map-sheets at a scale of 1:125 000. Similar work is currently underway in the Arctic Islands where information is needed to evaluate potential gas pipeline routes.

Interisland pipelines and pipelines in shallow seas in the Arctic will be subject to damage at the land-water/ice interface. During the year considerable advances were made in understanding the origin of bottom scours, a prime indication of past and present ice movement. Markings in depths exceeding 30 metres have been observed.

Parts of the Ottawa-St. Lawrence Lowlands, a highly populated part of Canada, are underlain by sensitive clays. Using existing distribution maps and by studying the behaviour of the clays under dynamic loading and the influence of regional hydrology on slope stability, a better understanding has been gained of the occurrence and mechanism of landslides in this area.

As Canada's population becomes more urbanized more efficient uses must be made of the land within the confines of our cities. During the year a prototype geoscience atlas of the National Capital Region neared completion and a similar set of maps is being prepared for the Hamilton area. Plans were also made to make the large amount of data available on 28 major urban centres available to users in microform.

The distance flown in aeromagnetic surveys was higher in 1974/75 than in 1973/74 both in Canada and for CIDA Projects overseas. A gradiometer for measuring

small differences in the vertical gradient of the Earth's magnetic field has been constructed and installed on one of Geological Survey's two experimental survey aircraft. Initial flights of this unique system have been extremely encouraging. This technique will permit the calibration of existing maps and will allow for the preparation of a 1:5 000 000 magnetic anomaly compilation map for Canada.

Good progress has been made in the development and testing of methods for detecting and mapping the distribution of permafrost, both on land and below the sea-bed. A significant new development has been made, in co-operation with the Communications Research Centre, with the construction of a practicable radar device for soil moisture measurement. High sensitivity airborne gamma-ray spectrometer test surveys were undertaken in 5 provinces (Saskatchewan, Ontario, Quebec, Prince Edward Island and Newfoundland) and compiled during the year. A major (20 000 sq. mile) lake sediment geochemical survey was undertaken in Saskatchewan at the request of the provincial government and DREE, and this contracted operation is the precursor of larger operations under Uranium Reconnaissance Program. A useful start has been made in the co-operative development project with industry relating to borehole exploration methods.

During the year advances were made in developing statistical theory to predict hydrocarbon resources. These techniques developed will be applicable to other resource appraisal programs. In addition adequate documentation is being compiled on the setting in which hydrocarbons occur. One file will contain a comprehensive compilation of all the geological, geochemical and production data of all the major hydrocarbon-producing areas of the world. A second file will contain data on the oil and gas pools of North America. The results of some of these activities in the study of hydrocarbons will be of great value in preparing a second assessment of Canada's hydrocarbon potential scheduled for late 1975-76.

D.J. McLAREN

Attendance at Meetings, Conferences and Courses

Board Meeting, International Geological Correlation Program, Vienna, Austria, April 1974.

International Aid Workshop, St. John's, Newfoundland, May 1974.

Geological Association of Canada, St. John's, Newfoundland, May 1974.

USGS Symposium and Dedication of John Wesley Powell Federal Building, Reston, Virginia, July 1974.

Commonwealth Mining Conference, Ottawa, September 1974.

Institut de la Vie, World Conference on Toward a Plan of Action for Mankind: Needs and Resources, Paris, September 1974.

Ordovician Symposium and Field Excursions, Birmingham, September 1974.

Forum on GSC Program in Y.T., Whitehorse, December 1974.

Special Talks or Lectures

"The Geological Survey To-day and To-morrow", Logan Club (and ISPG and AGC), February and March 1975.

"The Geological Survey in the North", Arctic Circle, March 1975.

Membership on Committees

Chairman, Commission on Stratigraphy of IUGS

Chairman, Silurian-Devonian Boundary Committee of the Commission on Stratigraphy of IUGS

Auditor, Board of International Geological Correlation Program, UNESCO, IUGS

Auditor, Canadian Geoscience Council

Member, Canadian Geological Foundation

J.O. WHEELER

Attendance at Meetings

Canadian Institute of Mining and Metallurgy, Annual Meeting, Montreal, April 23, 1974

Geological Association of Canada, Annual Meeting, St. John's, Newfoundland, May 19-22, 1974

Geological Society of America, Annual Meeting, Miami, Florida, November 17-21, 1974

Northern Geoscience Forum for Mineral Exploration, Whitehorse, Yukon, December 10-11, 1974 and Yellowknife, N.W.T., December 12-13, 1974

Geological Association of Canada, Cordilleran Section Meeting, Vancouver, B.C., February 7-8, 1975

Prospectors and Developers Association Annual Meeting, Toronto, Ontario, March 11, 1975

Talks

"From Dawson to Dawson and Beyond" (Brief history of Geological Survey work in Yukon Territory), Northern Geoscience Forum dinner speaker, Whitehorse, Y.T., December 11, 1975

Membership on Committees

Councillor, Geological Society of America (term expired November 1974)

President and Director, Canadian Geological Foundation

Director, Centre for Precambrian Studies, University of Manitoba

Data Systems Group

In April 1974, W.W. Hutchison was transferred from the Vancouver office to the Director's Office to set up the Data Systems Group. The main objective is to plan, design, test and implement scientific data systems according to current and anticipated needs of government scientists and managers and the geological community in Canada. A preliminary objective, therefore is the analysis of data flow within our organization: this study has commenced under T.M. Gordon who has been seconded part-time to the Data Systems Group.

Systems development has been concentrated in two key areas; computer-assisted cartography and mineral deposit and occurrence files. The computer-assisted cartography project is aimed primarily at assisting the cartographer to produce the final colour geological maps and to aid in subsequent up-dating, especially of the new Geologic Atlas of Canada at a scale of 1:1 000 000. A subsiduary objective, at this time, is to examine these maps as a basis for management of geological data. The problem of mineral deposit and occurrence files has been to profit from the many files set up within, and outside of, the Survey in order to identify the critical data items required to satisfy a number of specific objectives.

In December 1974, D.D. Picklyk joined the Data Systems Group to direct development of the appropriate mineral deposit systems and in late January 1975, G. Martin also joined the Group as Branch Systems Development Officer. In April 1974, operation of the EAI flat-bed plotter (operated by T. Scaga) was transferred to the Data Systems Group.

W.W.HUTCHISON

Attendance at Meetings, Conferences and Courses

Chaired COGEODATA biennial meeting, Paris, April,1974

Trondhjemite Conference, Denver, U.S.A., May, 1974

Geological Association of Canada, St. John's, Newfoundland, May, 1974

Data Base Management of Geologic Information, Geological Surveys of Europe, Hannover, October 1974

International Association of Mathematical Geologists, Syracuse, N.Y., October, 1974

Scientific Committee Meeting, International Geological Correlation Program, Paris, January, 1975.

Cordilleran Section, Geological Association of Canada, Vancouver, February, 1975.

Special Talks or Lectures

"Current practices in use of computer technology to compile and display geological maps", to La Commission de la Carte Geologique du Monde, Paris, France, April 4, 1974

"Nature and origin of trondhjemite in the Coast Plutonic Complex" to Trondhjemite Conference, U.S.G.S., Federal Centre, Denver, U.S.A., May 16, 1974

"Towards an integrated system for data base management in the Geological Survey of Canada" to Meeting of Geological Surveys of Europe, Hannover, Europe, October 1, 1974

"The Geoscience Data Base required for Mineral Resource potential" to Meeting of the International Association of Mathematical Geologists, Syracuse, New York, October 26, 1974

"Origin and Evolution of the Coast Mountains Plutonic Complex, B.C.", University of Bern, Switzerland, January, 1975

Membership on Committees

Past-President, Geological Association of Canada

Chairman, COGEODATA (I.U.G.S. Committee on Storage and Retrieval of Geological Data)

Member, Executive Committee, CODATA

Director, Canadian Geological Foundation

Member (until December 31, 1975), Canadian Geoscience Council

Conferee, Geological Society of America, Publications Committee

Chairman, Scientific Committee IV, International Geological Correlation Program

Completed Manuscripts

1974: "Towards computer based 'systems' for recording, storage, retrieval analysis and presentation of geological field data in the Geological Survey of Canada" in Gordon, T.M. and Hutchison, W.W. (eds.) Geol. Surv. of Canada Paper 74-60, pp. 1 - 6.

1974: "Le Defi Canadian" Presidential address, Geological Association of Canada. Geoscience Canada, Vol. 1, no. w, pp.3 - 6.

1974: "Committee on Storage, Automatic Processing and Retrievel of Geological Data (COGEODATA)". Geological Newsletter: Quarterly Journal of the International Union of Geological Sciences, vol. 1974, no. 1, pp. 40 - 44. Annual activities of COGEODATA.

1974: "Computer-based systems for geological field data". Geol. Surv. Canada paper 74-63, Chairman, W.W. Hutchison.

Publication of symposium convened by Hutchison on behalf of COGEODATA in Paris in November, 1973 and sponsored by I.U.G.S. and UNESCO

1974: "Sub-area retrieval system used on the Coast Mountains Project of the Geological Survey of Canada" with J.A. Roddick, in Gordon, T.M and Hutchison, W.W. (EDS.), Geol. Surv. Canada, Paper 74-60, pp. 29 - 34

PROGRAM OFFICE

The Program office has continued to advise the senior management of the Geological Survey, to reply to numerous parliamentary questions and an increasing number of lengthy questionnaires (MOSST, STATCAN etc.). Detailed information was provided for the paper on EMR Science Program in Arctic Archipelago. The estimated man-year and cost figures by division and activity, were provided for the Program Review. A similar breakdown was prepared for the 1969-70 fiscal year and a comparison made with the current year for the program forecast. Dr. D.G. Benson acted as Program Officer for the year.

SPECIAL PROJECTS

T.E. BOLTON

Dr. T.E. Bolton continued as Secretary of the National Advisory Committee on Research in the Geological Sciences, and until September, 1974, Secretary of the Departmental Grants Review Committee. Scientific activities included investigations of the Ordovician faunas of Melville Peninsula and Akpatok Island, District of Franklin, and through both field and laboratory programmes the Ordovician and Silurian geology of Anticosti Island, Quebec.

Attendance at Meetings and Conferences

Symposium on the Ordovician System, with related field excursions, Birmingham, England, September, 1974.

Eastern Canada Biostratigraphy Seminar, McGill University, Montreal, Quebec, December, 1974.

Northeastern Section, Geological Society of America, Syracuse, New York, U.S.A., March, 1975.

R.J.W. DOUGLAS

Attendance at Meetings

Pan American Institute of Geography and History Guatamala City, Guatamala, March 1975.

Canadian Society of Petroleum Geology, Calgary, September, 1974.

Membership on Committees

Adviser to Pan American Institute of Geography and History Working Group for the Geological Map of South America.

ATLANTIC GEOSCIENCE CENTRE

B. D. Loncarevic

Introduction

As we enter the last quarter of the twentieth century, the world seems to have paused. For a brief moment, open warfare has been suspended and the big guns are silent around the world. The hysteria over the energy crisis seems to have subsided, though we have not solved the underlying problem of resources conservation and allocation. We seem to have accepted a rampant inflation as inevitable, though logically it must lead to the collapse of the present economic order. To our list of unresolved problems we have added the Conference on the Law of the Sea, in spite of the warnings that increasing conflicts in this area might lead to serious international confrontations.

We are delaying the day of reckoning, not because we hope that the problems will go away, but because we need a greater understanding of the nature of complex world systems before we can control them. Progress is being made in this direction with important roles to be played by geoscientists. It is thus appropriate that the most important event of the past year was the GSC Futures Conference convened in Ottawa October 16-18, 1974, in order to try to understand the nature of forces which will shape our work over the next ten to twenty-five years.

In preparation for this conference, AGC held a number of informal evening discussions throughout the summer of 1974. A number of insights were developed suggesting that: (a) The isolation of scientists will end; individuals will become more involved in group or cooperative projects while groups will become more visible in the public arena; (b) As society becomes more complex, more interdependent, and technologically more sophisticated, the public policy will have to be based on greater and greater input of scientific data and advice; (c) Measurements based on digital data processing will lead to an increasingly quantitative approach to geology. This, in turn, will lead to an increasing emphasis on the development of conceptual models based on non-linear mathematics and statistical simulation experiments; (d) As we undertake more and more sophisticated resource inventory, our procedures will approach and eventually become indistinguishable from mineral exploration.

With specific reference to offshore regions, it was also recognized that our concern in the marine areas will be more worldwide, (e) because: (i) Marine science and technology will be perceived as an important tool of foreign policy. In all bilateral science and technology discussions with other countries, "oceanography" has received particular attention; (ii) It is now likely that an International Seabed Authority will be established. Canada will want to have an active, perhaps even leading, role in this Authority; (iii) Canada will see increasing number of requests from LDC's for technical training and assistance as many countries around the world recognize their new responsibilities resulting from the Law of the Sea.

And environmental protection (terrain sciences) of the sea will be an increasing concern, (f) because of: (i) Increasing and persistent pollution of beaches; (ii) Offshore mineral activities; and (iii) Increasing dumping activities and the need to control them (in particular, the nuclear wastes).

Activities

With the developing understanding of the forces which influence our future, the work of AGC continued along three main thrusts as described in the following sections. In addition, some major new initiatives were taken during the year.

Several years ago, it was recognized that subsurface geological samples must be obtained to verify and extend the knowledge of offshore geology. Offshore drilling by the oil industry provided invaluable samples of a special kind and a major part of the effort of the last four years was towards the buildup of the petroleum geology group. During the same period an electric drill was developed for sampling rock outcrops within ten metres of the sea bottom. In order to cover the gap between these two sets of samples, a project is underway to charter a special drillship to sample in the 100 to 300m range below the sea floor. It was hoped that the project CANDRILL 75 could be started in 1975 and for that purpose financial support from the oil industry up to $14 million was secured. The unavailability of a suitable vessel forced a postponement for a year and the start is now planned for 1976. When fully operational, project CANDRILL will sample 30-40 sites per year and will extend over a period of five to ten years at a total cost of $10-20 million.

The second most important new initiative is the negotiation of an unsolicited proposal by HUNTEC (70) Ltd. to undertake a research and development project on the remote sensing of geotechnical properties of marine sediments. The first year's contract is $360,00 and the project should take five years. The result should greatly enhance our capability to deal with the growing demand for engineering data and advice, and for the evaluation of the environmental impact of large-scale offshore developments. A secondary benefit from this project should be the strengthening of a Canadian company with unique expertise in an internationally competitive field.

The HUNTEC contract is the first substantial result of the implementation of the Make-or-Buy Policy. The major exposure to this policy was the requirement to analyze our total program and assess the capabilities of Canadian Industry to undertake portions of that program. This analysis was completed by October 1974 and was used as a part of the submission to the Treasury Board requesting expansion of the Bedford Institute of Oceanography facilities. The submission was approved and an $18.6 million building program is underway with a projected completion date in 1979. A new library, computing centre, auditorium and exhibits area, and cafeteria will be constructed, in addition to almost doubling the existing laboratory space. All the AGC and RMCB personnel will be grouped around the new cores curation facilities in one of the new laboratory wings.

The year has seen the publication of the "Offshore Geology of Eastern Canada" Volume I, and submission to press of Volume II. This is a statement of the status of our present knowledge and represents a culmination of a two-year effort. The material presented in these volumes could form an important contribution to the future edition of the "Geology and Economic Minerals of Canada".

Participation of AGC in International Technical Assistance programs has been at a low level in the past. During the past year Dr. Loncarevic was appointed as the Canadian representative on the Technical Advisory Board of the Coordinating Committee for Offshore Prospecting (CCOP) in South East Asia. Through this connection, the AGC involvement is expected to increase rapidly. Several discussions were held with CIDA and requests from COOP are under consideration. As the first step, facilities and staff are being provided for technical training in offshore geology to two trainees from Indonesia.

In addition to formal lectures presented by AGC staff and recorded elsewhere in this report, the informal series, the Friday morning "Science Hour", was continued throughout the year. 28 AGC and 15 visitors participated in 35 sessions. The topics discussed covered research results (19), trip, conference and cruise reports (8), research proposals (4), and general interest topics (4), which ranged from the Discussion of the Law of the Sea (Arvid Pardo) to the Review of the Research Program of the Marine Ecology Laboratory (B. Muir).

During the year, there were 280 man/day visitors. Since many of them talked to several members of AGC staff and since some visits resulted in considerable workload to answer their queries, it is estimated that over ten percent of professional man/years of AGC were engaged by our visitors.

Personnel Notes

Administration

A small unit has been built up as the Centre becomes less dependent on the Department of the Environment for administrative support. Finance and Personnel functions are independent while cooperative efforts are maintained in materiel management, procurement and registry operations.

During the report year, Corinne Beauvais left for England and was replaced by Carol Racine as personnel clerk. T. Henderson was appointed as accounts clerk. F. MacAusland left in December following an excellent job on Volume I of the book "Offshore Geology of Eastern Canada". Ferne McCoombs joined the Centre as secretary to the scientific program coordinator and administrative officer. Elaine McMullin took up duties as a manuscript typist. A Memorial University co-op student was hired during the winter months to study the financial implications of the Make-or-Buy Policy.

Attendance at Meetings, Conferences and Courses

B. D. Loncarevic

Canadian Committee on Oceanography, Halifax, N. S., May 28-29, 1974

1st Annual Meeting of Canadian Geophysical Union, St. John's, Newfoundland, June 10-13, 1974

NATO Advanced Study Institute on "Geodynamics of Iceland and the North Atlantic Area", Reykjavik, July 1-7, 1974

Institute of Electrical and Electronic Engineers (IEEE) Conference, Halifax, N. S., August 21-23, 1974

Symposium on "Canada's Continental Margin and Offshore Petroleum Exploration", Canadian Society of Petroleum Geologists, Calgary, Alberta, September 29-October 3, 1974

B. R. Pelletier

1st Symposium on the Geological Action of Drift Ice, Quebec, April 20-23, 1974

Canadian Advisory Committee on Remote Sensing, Calgary, Alta., October 28, 1974

Geological Society of America Annual Meeting, Miami, November 17-21, 1974

Beaufort Sea Atlas Workshop, Calgary, January 20-24, 1975

Meeting on Offshore Drilling in Arctic Areas, Ottawa, March 5-6, 1975

Special Talks or Lectures

B. D. Loncarevic

"Multiparameter Hydrographic Surveys" at Canadian Geophysical Union 1st Annual Meeting, St. John's, June 1974

"Canada's Continental Margin and the Offshore Petroleum Exploration", Symposium of Canadian Society of Petroleum Geologists, Calgary, September, 1974

"Historical Origin of Cooperation between Hydrography and Oceanography", to 14th Annual Hydrographic Conference, Halifax, March 1975

"Plate Tectonics", to geology students at Dalhousie University, (24 lectures), 1974/75

B. R. Pelletier

"Ice Scour Marks on the Sea Bottom off Northern and Eastern Canada", 1st Symposium on the Geological Action of Drift Ice, Quebec, April 1974

"Sediment Dispersal Pattern in the Beaufort Sea - Interim Report, Project F4", Beaufort Sea Workshop in Calgary, January 22, 1975

"Sediment Dispersal in the Bay of Fundy", University of New Brunswick and Mount Allison University, February 5 & 6, 1975

"Arctic Marine Geology with Special Reference to the Beaufort Sea", University of New Brunswick and Mount Allison University, February 5 & 6, 1975

"Geological Oceanography of the Bay of Fundy", Blomidon Naturalists Society, Wolfville, N. S., March 17, 1975

"Implications of a Tidal Power Dam in Minas Basin, Institute of Environmental Studies, Dalhousie University, March 31, 1975

Membership on Committees

B. D. Loncarevic

Bedford Institute of Oceanography Directors Coordination Committee

Atlantic Subcommittee on Oceanography - Canadian Committee on Oceanography

National Research Council Advisory Committee on Geodesy and Geophysics

Editorial Board - "Marine Geophysical Researches"

Editorial Board - "Science Forum"

IOC ad hoc Group on Marine Geoscience Data Exchange

Special Technical Adviser to the Coordinating Committee on Offshore Prospecting (CCOP) of the Economic Commission for South East Asia (ECAFE)

Working Group on "Status of Marine Geosience" for Geological Association of Canada/Canadian Geophysical Union - Canadian Geological Society

Nova Scotian Institute of Science, Council

B. R. Pelletier

Atlantic Subcommittee on Oceanography of CCO - Secretary

Subcommittee on Geology - Atlantic Provinces Inter-University Committee on the Sciences - Past Chairman

Working Group on Geoscience - Canadian Advisory Committee on Remote Sensing

Intergovernmental Committee on Submersibles

National Advisory Committee for Research in the Geological Sciences

Management Committee of the Atlantic Geoscience Centre

American Commission on Stratigraphic Nomenclature - Commissioner

Member of Faculty Committee on Graduate Studies, Dalhousie University

Editorial Committees: Canadian Journal of Earth Sciences (Associate Editor)
Maritime Sediments (Editor)

Ph.D. Committees: R. J. Knight, McMaster University
E. H. Owens, University of South Carolina

Manuscripts Approved for Publication

B. D. Loncarevic completed three manuscripts for publication, and B. R. Pelletier completed four manuscripts during the report year.

ENVIRONMENTAL MARINE GEOLOGY SUBDIVISION

D.E. Buckley

Introduction

The Environmental Marine Geology Subdivision is engaged in research to evaluate contemporary and ancient events that are recorded in the marine geologic record and to understand the effects of natural processes that may alter these records. Geological interpretation of the marine environment is achieved by understanding sediment facies, diagenesis and biostratigraphy. Environmental geology processes and properties are identified by studying hydrodynamics, elemental pathways and ecology while environmental quality concerns are evaluated by collecting information relating to geodynamic stability, geochemical anomalies and paleoecological biotopes.

Activities

The Environmental Marine Geology program included 16 projects carried out by 10 scientists, 8 support staff and 4 casual and seasonal assistants. The programs include laboratory experimentation, routine analyses, field observation and sample collection in order to obtain a basic understanding of environmental geology in the marine environment.

The Coastal Geodynamics section completed a detailed time-series study of beach and nearshore processes in the Magdalen Islands during August and November. Comparisons of wave level energy show that the west-facing barriers have approximately twice as much energy in the nearshore zone as the more sheltered east-facing barriers. In addition, levels of wave energy were in the order of five times greater in November than in August. Computed rates of longshore sediment transport give a net volume of approximately 250,000 m^3/year to the north at the west barrier and 100,000 m^3/year to the south at the east barrier.

A detailed study of sedimentation and bedforms was started in the Avon River estuary in the Minas Basin area. Mud flats have developed since the construction of a causeway across the river. Sediments are deposited since the area was no longer swept by the tidal prism. The results of this reconnaissance show that marked changes have occurred in the bottom morphology of the Avon River in the last four years.

As part of departmental involvement with the Ministry of Transport to develop a terrain management policy for Sable Island, a proposal for the stabilization of the zones of active aeolian sediment transport on the island has been prepared. Activities are concerned with the development of a five year program to be carried out under contract.

The Inorganic Geochemistry section was involved in determining the mechanisms of metal interaction between the solid and liquid phases of the marine environment. This work allows assessments to be made of the hazards of man's activities in the marine environment as well as providing insight into the processes that result in potentially economic metal accumulation in oceanic sediments. The geochemical equilibrium of metals in natural waters was studied by using analytical experimentation. The actual species of metal available in nature controls both the metal reactions and the effectiveness of the analytical methods that are used to determine the concentration of these metals. In other work, relationships between metals, dissolved organics and light attenuance have been recognized in areas of fresh water and industrial effluent influxes.

Improvements in the methods for total mercury and total silicate analyses have been realized by doing sample preparation studies, by improving analytical equipment and by conducting inter-laboratory studies. Weak acid and peroxide leach analyses have been applied to recent sediments in order to differentiate between absorbed, organically bound and mineralogically bound metal. Some metals appear to be accumulated by estuarine precipitation processes. Their distribution is related to particle size and organic matter content. In the case of mercury, the strongest relationship occurs with particle size, suggesting that organic binding is not significant. Statistical analyses of analytical data has been improved by the addition of a multiple linear regression program developed by R. Garrett (Resource Geophysics and Geochemistry Division).

Hydrocarbon geochemistry of the east coast offshore wells constituted the major proportion of the Organic Geochemistry program for 1974-75. During the report period approximately 2500 samples from 16 wells were analyzed for their hydrocarbon gas and organic carbon content. Heavy hydrocarbons were extracted and fractionated from 300 samples from 8 wells. Six of these wells were examined in detail in order to estimate the maturity of the organic facies and to evaluate the hydrocarbon potentials. Four comprehensive reports covering these six wells were written for departmental use.

Sediment cores collected from a depression and an adjacent open area in the Gulf of St. Lawrence were compared in terms of organic geochemistry, sediment texture and foraminifera. The sediments from the depression contained usually high concentrations of methane, higher organic carbon, more plant pigments and more diverse foraminiferal assemblages suggesting a relatively fast rate of sedimentation and strong anaerobic fermentation of organic matter.

The project on geotechnical properties of sediments was concluded with additional studies that confirm the previous findings that organic compounds influence the engineering properties of marine sediments.

The Paleoecology section has expanded its research program in foraminiferal ecology of placing greater emphasis on recognizing indicator

assemblages and species ratios that can be used for interpreting the fossil record in Quaternary marine sediments. Research in progress is also aimed at identifying early diagenetic processes that influence the final composition of fossil populations.

Temporal studies of total foraminifera populations in the Restigouche estuary indicate that the distribution of poorly represented forms is highly dependent on environmental stability. Under new studies, the dynamics of living foraminifera, as well as the redeposition of empty tests, is being monitored by establishing sterile substrates at several key nearshore environments. Studies of the effects of test ingestion by larger marine invertebrates suggest that natural conditions leading to the destruction of tests may be solely inorganic (i.e. dissolution) or may include a combination of physical and biological processes. Varying degrees of etching, including total dissolution of $CaCO_3$ tests, has been observed. The degree and type of alteration of the surface of ingested tests appears to vary according to the larger invertebrate and foraminiferal species involved.

Benthonic foraminifera and molluscs are being used in a number of applied nearshore studies on the east coast and in the Arctic. The increase in the ratio of calcareous to arenaceous species in older sediments (probably Holocene in age) suggests that in the past, some of the channels in the Arctic Archipelago had longer open water seasons than occur today. Examination of fossil foraminifera and mollusc assemblages in Pleistocene sediments at various coastal localities in Nova Scotia has shown the existence of two distinct depositional cycles at approximately 38,000 and <13,000, years BP respectively. Molluscs and foraminifera observed in the older deposits suggest that temperatures at that time were similar to those prevailing at present, or possibly slightly warmer.

An assessment of the environmental impact of the Canso causeway construction and of industrial and municipal waste discharges on the environment in the Canso Strait was completed. A characteristic foraminifer in the Gulf of St. Lawrence is *Ammonia beccarii*. A comparison of the distribution of this foram in recent and older sediments shows that the causeway construction extended the influence of Gulf waters up to the present location of the causeway which is at least 4 km to the south of its former limits. In the polluted zone south of the causeway, stressed environments were characterized by relatively large numbers of *E. advena*, *Elphidium incertum/clavatum Gp.*, the mollusc species *Modiolus modiolus* and several tolerant species of ostracods, including *Baffinicythere emarginata* and *Muellerina canadensis*.

Personnel Notes

D.J. Gregor left the Coastal Geodynamics section as a sediment technician in August, 1974 to enroll in the M.A. program at Queen's University. D. Frobel filled this position in October, transferring from

Terrain Sciences. Dr. C.L. Amos began in the section as a post-doctoral fellow in February, 1975. R. Milne left the Organic Geochemistry section to attend medical school at Dalhousie University. B. Baker left the Paleoecology section as a paleontological technician. B. Deonarine filled this vacancy in October, 1974. R.E. Cranston completed the M.Sc. degree in Oceanography at Dalhousie University with the submission of his dissertation entitled "Interactions between Major Cations, pH and Suspended Matter in Coastal Environments".

Attendance at Meetings, Conferences and Courses

D.E. Buckley

Science Council Study on Technology Assessment Seminar, Dalhousie University, Halifax, N.S., April 4, 1974.

Geochemical Course on "Sedimentary Cycling and Chemistry History of Sea Water", Miami, Florida, March 24-28, 1975.

R.E. Cranston

International Conference on Transport of Persistent Chemicals in Aquatic Ecosystems, Ottawa, Ont., April 29 - May 3, 1974.

Geological Society of America Annual Meeting, Miami, Florida, November 17-21, 1974.

D.H. Frobel

Glacial Till Conference, Ottawa, Ont., February 16-18, 1975.

E.H. Owens

1st Symposium on Geological Action of Drift Ice, Quebec, April 20-23, 1974.

14th International Coastal Engineering Conference, Copenhagen, Denmark, June 19 - July 3, 1974.

M.A. Rashid

Annual Meeting of the American Association of Petroleum Geologists, San Antonio, Texas, March 31 - April 4, 1974.

K.R. Robertson

Managerial Grid Seminar, Cornwall, Ont., October 20-25, 1974.

C.T. Schafer

IEEE International Conference, Halifax, N.S., August 21-23, 1974.

G. Vilks

Symposium on "Marine Plankton and Sediments" and the "Third Planktonic Conference", Kiel, West Germany, September 6-13, 1974.

D.A. Walker

7th Annual Scanning Electron Microscope Symposium, Chicago, April 7, 1974.

Geological Society of America Annual Meeting, Miami, Florida, November 17-22, 1974.

G.V. Winters

26th Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Cleveland, Pa., March 2-8, 1975.

Special Talks or Lectures

D.E. Buckley

"A Multidisciplinary Study of Man on the Marine Environment, Canso Strait-Chedabucto Bay"; Canso Regional Vocational School, Port Hawkesbury, Nova Scotia.

R.E. Cranston

"Geochemical Interaction in the Recently Industrialized Strait of Canso"; International Conference on Transport of Persistent Chemicals in Aquatic Ecosystems, April 29 - May 3, 1974.

E.H. Owens

"Effect of Ice in the Littoral Zone of the Southern Gulf of St. Lawrence, 1st Symposium on the Geological Action of Drift Ice, Quebec, April 20-23, 1974.

"Barrier Island Systems in the Gulf of Lawrence", 14th International Coastal Engineering Conference, Copenhagen, Denmark, June 19 - July 3, 1974.

"Barrier Beaches and Sediment Transport in the Southern Gulf of St. Lawrence", Institute of Oceanography, Dalhousie University, Halifax, N.S., October 24, 1974.

G. Vilks

"Comparative Analysis of *Globorotalia pachyderma* (Ehrenberg) in the Watercolumn and Sediments of the Canadian Arctic; Symposium

on "Marine Plankton and Sediments" and the "Third Planktonic Conference", Kiel, West Germany, September 6-13, 1974.

D.A. Walker

"Sudan Black B: A Superior Stain to Rose Bengal for Distinguishing Living from Non-Living Foraminifera", Geological Society of America Annual Meeting, Miami, Florida, November 17-21, 1974.

G.V. Winters

"Dependence of Chelatable Iron Concentrations on Hydrolysis Equilibrium - An Analytical Implications", 26th Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Cleveland, Pa., March 2-8, 1975.

Membership on Committees

D.E. Buckley

Department of the Environment - Environmental Impact Committee

Department of the Environment - Dredging Impact Committee

Theses Committees for R. Dayal (Ph.D.)
J. Willey (Ph.D.)
R. Cranston (M.Sc.)
C. Agosta (M.Sc.)

R.E. Cranston

Bedford Institute of Oceanography Library Committee

Department of the Environment - Environmental Impact Committee

Department of the Environment - Dredging Impact Committee

E.H. Owens

Sable Island Environmental Advisory Committee

Chairman, Terrain Management and Dune Restoration Sub-committee of the Sable Island Environmental Advisory Committee

Thesis Committee - B. Neeley (M.Sc.)

K.R. Robertson

Bedford Institute of Oceanography Building Committee

C.T. Schafer

IEEE Technical Program Committee for "Ocean 74"

Benthonics '75 Technical Program Committee and Co-ordinating Committee

Atlantic Oceanographic Laboratory Deep Sea Drilling Committee

G. Vilks

Benthonics '75 Co-ordinating Committee

F.J.E. Wagner

Associate Committee on Quaternary Research, N.R.C.

Benthonics '75 Co-ordinating Committee

D.A. Walker

Benthonics '75 Co-ordinating Committee

Manuscripts Approved for Publication

During the fiscal year April 1, 1974 to March 31, 1975, nineteen manuscripts were accepted and approved for publication.

EASTERN PETROLEUM GEOLOGY SUBDIVISION

L. P. Purcell

Introduction

Eastern Petroleum Geology Subdivision directs its efforts towards the investigation of the sedimentary basins of Eastern Canada in the onshore and offshore areas. This analysis of the various basins facilitates the assessment of resources, particularly with regard to oil and gas potential. To meet these objectives individual and cooperative scientific programs are carried out in the following areas: (1) the Mesozoic and Cenozoic basins that lie along the continental margins of Eastern Canada from Georges Bank to Baffin Bay, (2) the Upper Paleozoic (Late Devonian to Permian) basins of the Atlantic Provinces, Gulf of St. Lawrence, Grand Banks, and Northeast Newfoundland Shelf, and (3) the Lower Paleozoic basins, including the St. Lawrence Platform, the Hudson Platform and the adjacent southeast Baffin Shelf.

Biostratigraphical studies in the offshore Mesozoic basins have established a comprehensive Middle Triassic to Quaternary biozonation for the Grand Banks and Scotian Shelf. This work combined with lithostratigraphy, sedimentology and seismic data has established that the Scotian Basin and the East Newfoundland Basin were active centres of deposition which, since Lower Triassic, have accumulated in excess of 10-12 kilometers of sedimentary fill. Basin development has been related to the opening of the central north Atlantic in early Middle Jurassic.

In the Labrador Sea - Baffin Bay area, where interest in petroleum potential is currently focused, we must rely mainly on the analysis of geophysical data. Seismic indicates the presence of thick sedimentary sequences of probable Mesozoic and Cenozoic age. Pending more complete stratigraphic control, it appears that the structural style of the continental margin is best explained by differential vertical movements of continental crust.

Of significance this past year was the preparation of a series of maps at a scale of 1:2,000,000 as a cooperative effort of the Subdivision. The maps depict the surface physiography, geology, and basement configuration of the various onshore - offshore sedimentary basins. Deep reflection seismic data were integrated with the field data collected by other groups of the Atlantic Geoscience Centre. Geological contacts offshore were mapped from high-resolution seismic records. These maps are the first of their kind to be constructed.

Our basin analysis program facilitated our work in identifying potential hydrocarbon "plays" and contributed towards the first detailed evaluation of hydrocarbon potential.

Activities

P. Ascoli completed a detailed biostratigraphic study of two wells and selected parts of three other wells from the Scotian Shelf. A project on calpionellid biostratigraphy of the Mohican I-100 well was commenced. During the year a multiple foraminiferal and ostracod biozonation was compiled from information available from wells on the Scotian Shelf and western Grand Banks. This zonation comprises 16 planktonic, 21 deep water benthonic, 14 shallow water benthonic Foraminifera and 13 Ostracod zones.

M. S. Barss has continued palynological studies in the Upper Paleozoic of the Atlantic Provinces, offshore regions of the Gulf of St. Lawrence, Sydney Basin, Grand Banks and in Arctic Canada. Biostratigraphic zonation of four wells in Eastern Canada and four type sections from Ellesmere and Devon Islands were completed. Two reports on age determinations for field geologists were also completed. Studies of two reference sections were commenced. Contributed to compilation for publication of basement and geological maps on 1:2,000,000 scale of Eastern Canada, and completed work on two manuscripts with R. D. Howie.

F. M. Gradstein continued micropaleontological biostratigraphy on wells from the Labrador Shelf and Grand Banks of Newfoundland. Sixteen reports have been completed on fifteen wells on the biostratigraphy and paleoecological interpretations, in an attempt to reconstruct the local and regional depositional history of the area. A project to illustrate, with scanning electron micrographs, the important species and assemblages of forams used for biostratigraphic zonation was commenced. Co-authored two manuscripts for publication.

A. C. Grant pursued analyses of geophysical data from the Labrador and East Newfoundland continental margin in support of the Departmental Hydrocarbon Inventory program. Prepared a brief on "An Arctic program within the northern programs of Energy, Mines and Resources in science and technology", and proposals for Candrill borehole sites for east Grand Banks, Flemish Cap, Northeast Newfoundland Shelf, Labrador Shelf and southern Baffin Shelf. Acted as critical reviewer for 13 manuscripts submitted for publication. Completed compilations for GSC Maps 1400A and 1401A, and submitted six manuscripts for publication.

I. A. Hardy continued research into the various types of computer programs available for application to the subsurface data system at the Atlantic Geoscience Centre. This research has resulted in an interest in a provincial system now in usuage, and tentative arrangements have been made to investigate the utilization of this system. Detailed lithostratigraphic analyses were completed on three wells from the Scotian Shelf and two from the Labrador Shelf. Two internal reports were completed. Contributed to the field trip program proposed for Benthonic '75 conference, by outlining significant areas for collections of Recent Foraminifera.

I. M. Harris continued work on a regional synthesis of the Late Precambrian and Paleozoic stratigraphy and tectonic development of Eastern Canada. Principal objectives are to provide an integrated account of the stratigraphic and tectonic evolution of Atlantic Canada mainly during

Paleozoic times, in order to facilitate the economic evaluation of the Paleozoic rocks of the onshore - offshore region of Eastern Canada. In addition it provides a basis for interpreting the effect of Precambrian and Paleozoic structural elements on the distribution and resources of the offshore Mesozoic - Cenozoic sediments.

R. D. Howie has continued surface and subsurface studies in the Upper Paleozoic of Eastern Canada. Lithostratigraphic analyses of wells contributed to these studies. Paleogeographic facies and isopach maps have been completed for the Horton, Windsor, Canso - Riversdale and Cumberland - Pictou Groups for two publications with M. S. Barss. Interpretation of available geological data and seismic records is being carried out to enhance our ability to assess the hydrocarbon potential of the Upper Paleozoic and to demonstrate the distribution of salt beds being considered for storage purposes. Updating of geological files related to this project in Eastern Canada is in progress.

L. F. Jansa continued lithological and sedimentological studies on wells from the Atlantic continental margin. Detailed petrographic studies of several Grand Banks wells indicate the complexity of the geological development of the Grand Banks area. He has been involved in a cooperative effort collating data from several geological disciplines which has provided an important synthesis of the offshore geology of the Scotian Shelf and Grand Banks. This has resulted in a major publication. He is currently taking part in the JOIDES Cruise, Leg 41 as a sedimentologist.

W. A. M. Jenkins played a major role in the compilation of several lithostratigraphic and biostratigraphic reports on wells drilled on the continental shelf. Palynological analyses of several offshore wells were completed and he consulted on biostratigraphical determinations of Lower Paleozoic rocks.

B. V. Sanford continued regional studies of the Paleozoic rocks of Eastern Canada based on field investigations and subsurface data from exploratory wells. He completed compilation (with other scientific staff) of suites of maps on a 1:2,000,000 scale, of bedrock geology, basement contours and physiographic elements of the onshore - offshore sedimentary basins of Eastern Canada (GSC Maps 1399A, 1400A, and 1401A). Mr. Sanford transferred to Ottawa in August 1974.

L. P. Purcell replaced Mr. Sanford in September 1974 as Head, Eastern Petroleum Geology Subdivision. Most of his activities outside managing the Subdivision were with the sub-committee on geological potential which is responsible for the assessment of the hydrocarbon potential of Canada.

J. A. Wade completed work on the geology and basement configuration maps for publication at 1:2,000,000 scale (GSC Maps 1400A and 1401A). A major (co-authored) report on the regional geological framework and stratigraphy of the Atlantic margin of Canada was completed. A precontinental drift reconstruction of northeastern North America, western Europe

and northwest Africa, based on geological data, was developed. These data present, for the first time, a regional synthesis of the offshore geology of Eastern Canada based on some 50 deep exploratory wells and 11,000 miles of processed marine reflection seismic profiles. The petroleum geological interpretation of the above data was particularly useful in the hydrocarbon assessment for Eastern Canada. This thrust also included more detailed delineation of structures, assessment and incorporation of new well data and a compilation of geothermal data for all available wells. Although all sedimentary basins were reviewed for the 1974/75 assessment, the major emphasis was on those areas considered to have the greatest potential for development of short and medium term resources, which could alleviate anticipated shortfall in Canadian supply of oil and gas.

G. L. Williams has undertaken detailed palynological analyses of samples from six Grand Banks wells and three Labrador Shelf wells; a report was completed for each of these wells. It is now possible to recognize all the Jurassic stages, palynologically. Dinoflagellates now permit delineation of tropical and temperate environments in the Tertiary. Completed work on nine manuscripts for publication.

Personnel Notes

Mr. B. V. Sanford was transferred to GSC, Ottawa in August and in September Mr. L. P. Purcell transferred from ISPG, Calgary to assume the duties of Head of the Subdivision. During the report year Mr. Bhan Deonarine, palynology technician, took up new duties in Environmental Marine Geology Subdivision and was replaced by Mr. B. Crilley, a graduate of Saint John Technical School. Mr. A. Jackson, technician, joined the staff as assistant to Dr. A. C. Grant. At the end of March, Dr. W. A. M. Jenkins, research scientist, transferred to ISPG, Calgary. Eastern Petroleum Geology Subdivision presently consists of 25 positions: the Subdivision Head, one clerk-typist, eleven scientific staff, two draftsmen, five technicians and five microfossil pickers (term employees).

Laboratory Activities

The micropaleontology picking laboratory has picked 2275 samples from 36 offshore wells, and 192 samples from field sections, deep sea drilling and piston cores.

The palynology laboratory has completed processing of 25 wells, 2 shallow coreholes, 87 outcrop localities for age determinations and 34 reference or type sections. These reference sections come from Nova Scotia, Yukon Territory, Acrtic Islands, Portugal, Tunesia and Morocco. Sixteen of the wells processed are confidential. A total of 2515 samples and 8120 slides were prepared. To date, a total of 78 wells, 48 shallow coreholes, 91 reference sections and 170 outcrop localities have been completed.

The sedimentology laboratory picked representative lithologies from 700 well cuttings samples and prepared 700 thin sections. Additionally, 200 thin sections were made for reference samples. Washed and prepared 2900 vials of well cuttings samples for study. Photographs were taken of 360 conventional core samples. Two technicians from the palynology and sedimentology laboratory received instructions in running of the Scanning Electron Microscope and took 120 micrographs.

The marine sediment laboratory provided sediment size analyses of 492 samples and clay mineral preparations on 244 samples collected on ship cruises and environmental geology projects.

Special Talks

F. M. Gradstein

"Geological History and Paleobiogeography of the Jurassic, Cretaceous, and Tertiary of Offshore Eastern Canada"; by F. M. Gradstein, G. L. Williams, P. Ascoli and W. A. M. Jenkins, presented to Symposium on Paleogeography and Paleobiogeography, Organisms and Continents in Space and Time, Woods Hole, Mass., June 3-7, 1974.

"Mesozoic - Cenozoic Stratigraphy of the Continental Margin, Eastern Canada"; by F. M. Gradstein, W. A. Jenkins, G. L. Williams and P. Ascoli, presented at Canadian Society of Petroleum Geologists, International Symposium, Canada's Continental Margins and Offshore Petroleum Exploration, Calgary, Alberta, September 29-October 3, 1974.

A. C. Grant

"Structural Modes of the Western Margin of the Labrador Sea"; presented to Geological Association of Canada Annual Meeting, St. John's, Newfoundland, May 19-22, 1974.

"Geophysical Results from the Continental Margin off Southern Baffin Island"; and

"Labrador Shelf"; both presented to Canadian Society of Petroleum Geologists, International Symposium, Canada's Continental Margins and Offshore Petroleum Exploration, Calgary, Alberta, September 29-October 2, 1974.

I. M. Harris

"Stratigraphy and Sedimentology of the Lower Paleozoic Meguma Group, Nova Scotia"; presented to the Geological Association of Canada - Mineralogical Association of Canada Annual Meeting, St. John's, Newfoundland, May 19-22, 1974.

R. D. Howie

"Paleogeography and Sedimentation in the Upper Paleozoic, Eastern Canada"; by R. D. Howie and M. S. Barss, presented to Canadian Society of Petroleum Geologists, International Symposium, Canada's Continental Margins and Offshore Petroleum Exploration, Calgary, Alberta, September 29-October 2, 1974.

"Upper Paleozoic Rocks of Eastern Canada"; presented to Geology Department of University of New Brunswick, Fredericton, New Brunswick, February 13, 1975.

"A Resumé of the Paleogeography and Facies of the Upper Paleozoic Rocks of Southeastern Canada"; presented to Geology Club of St. Francis Xavier, Antigonish, Nova Scotia, February 24, 1975.

L. F. Jansa

"Jurassic Sedimentation of the Continental Shelf off Nova Scotia and Newfoundland"; American Association of Petroleum Geologists Annual Meeting, San Antonio, Texas, April 3, 1974.

"Geology of the Atlantic Continental Margin of Canada and the Evidence for Continental Drift"; Illinois State Geological Survey, Urbana, Illinois, April 8, 1974.

"Geology of the Continental Margin of Southeastern Canada"; by L. F. Jansa and J. A. Wade, presented to Geological Association of Canada - Mineralogical Association of Canada Annual Meeting, St. John's, Newfoundland, May 19-22, 1974.

J. A. Wade

"Paleogeography and Sedimentation in the Mesozoic and Cenozoic, southeastern Canada"; presented to the Canadian Society of Petroleum Geologists, International Symposium, Canada's Continental Margins and Offshore Petroleum Exploration, Calgary, Alberta, September 29-October 2, 1974.

"Geological History of the Continental Margin of Southeastern Canada", presented to Newfoundland Section, Geological Association of Canada Annual Meeting, St. John's, Newfoundland, March 20-21, 1975.

G. L. Williams

"North Atlantic Plate Tectonics and Microfossils"; by P. Ascoli, F. M. Gradstein, W. A. M. Jenkins and G. L. Williams, presented to Geological Association of Canada - Mineralogical Association of Canada Annual Meeting, St. John's, Newfoundland, May 19-22, 1974.

"Comparison of Late Jurassic - Early Cretaceous Scotian Shelf Palynomorphs with Coeval European Assemblages"; and

"The Top Twenty Cretaceous Dinoflagellates"; presented to the American Association of Stratigraphic Palynologists Annual Meeting, Calgary, Alberta, October 17-18, 1974.

Attendance at Meetings

P. Ascoli

Symposium on Paleogeography and Paleobiogeography;Organisms and Continents in Space and Time, Woods Hole Oceanographic Institute, Woods Hole, Mass., June 3-7, 1974.

M. S. Barss

Annual Meeting of Geological Survey of Canada Palynologists, Calgary, Alberta, October 16, 1974.

American Association of Stratigraphic Palynologists, Calgary, Alberta, October 17-18, 1974.

F. M. Gradstein

VIth African Micropaleontological Colloquium, Tunesia, March 21-April 4, 1974.

Symposium on Paleogeography and Paleobiogeography; Organisms and Continents in Space and Time, Woods Hole Oceanographic Institute, Woods Hole, Mass., June 3-7, 1974.

A. C. Grant

Geological Association of Canada - Mineralogical Association of Canada Annual Meeting, St. John's, Newfoundland, May 19-22, 1974.

Ocean '74, Institute of Electrical and Electronic Engineers, Halifax, Nova Scotia, August 21-23, 1974.

Canadian Society of Petroleum Geologists, International Symposium, Canada's Continental Margins and Offshore Petroleum Exploration, Calgary, Alberta, September 29-October 2, 1974.

I. A. Hardy

Applied Petroleum Geology School, Calgary, Alberta, October 21-November 1, 1974.

I. M. Harris

Geological Association of Canada - Mineralogical Association of Canada Annual Meeting, St. John's, Newfoundland, May 19-22, 1974.

Nova Scotia Mining Society and Atlantic Geoscience Society Field Trip - Lower Carboniferous of Nova Scotia, October 2-4, 1974.

New England Intercollegiate Geological Conference, 65th Annual Meeting, Orono, Maine, October 12-13, 1974.

R. D. Howie

Canadian Society of Petroleum Geologists, International Symposium, Canada's Continental Margins and Offshore Petroleum Exploration, Calgary, Alberta, September 29-October 2, 1974.

L. F. Jansa

American Association of Petroleum Geologists Annual Meeting, San Antonio, Texas, April 1-3, 1974.

Geological Association of Canada - Mineralogical Association of Canada Annual Meeting, St. John's, Newfoundland, May 19-22, 1974.

W. A. M. Jenkins

Northwest European Continental Shelf Symposium, Bristol, England, April 19-21, 1974.

L. P. Purcell

Interdepartmental Subcommittee on Geological Potential, Calgary, Alberta, October 3, 1974.

Interdepartmental Subcommittee on Geological Potential, Dartmouth, Nova Scotia, November 4-5, 1974.

Petroleum and the Continental Shelf of Northwestern Europe, London, England, November 25-29, 1974.

Interdepartmental Subcommittee on Geological Potential, Calgary, Alberta, December 2-6, 1974.

Interdepartmental Subcommittee on Geological Potential, Ottawa, Ontario, January 27-29, 1975.

Interdepartmental Subcommittee on Geological Potential, Calgary, Alberta, March 5-7, 1975.

J. A. Wade

Canadian Society of Petroleum Geologists, International Symposium,

Canada's Continental Margins and Offshore Petroleum Exploration, Calgary, Alberta, September 29-October 2, 1974.

Interdepartmental Subcommittee on Geological Potential, Calgary, Alberta, October 3, 1974.

Interdepartmental Subcommittee on Geological Potential, Dartmouth, Nova Scotia, November 4-5, 1974.

Interdepartmental Subcommittee on Geological Potential, Calgary, Alberta, December 2-6, 1974.

Interdepartmental Subcommittee on Geological Potential, Ottawa, Ontario, January 27-29, 1975.

Interdepartmental Subcommittee on Geological Potential, Calgary, Alberta, March 5-7, 1975.

Geological Association of Canada, Newfoundland Section Annual Meeting, St. John's, Newfoundland, March 20-21, 1975.

G. L. Williams

Geological Association of Canada - Mineralogical Association of Canada Annual Meeting, St. John's, Newfoundland, May 19-22, 1974.

Annual Meeting of Geological Survey of Canada Palynologists, Calgary, Alberta, October 16, 1974.

American Association of Stratigraphic Palynologists, Calgary, Alberta, October 17-18, 1974.

Membership on Committees

P. Ascoli

Member, Coordinating Committee for International Symposium "Benthonics '75".

M. S. Barss

Member, several working groups of the Commission Internationale de Microflore du Paléozoique.

Co-chairman, organizing committee for 1976 Annual Meeting of American Association of Stratigraphic Palynologists.

Member, committee to appraise laboratories for Atlantic Geoscience Centre's new quarters.

Member, Atlantic Geoscience Centre Curation Committee.

F. M. Gradstein

Member, Coordinating Committee for International Symposium "Benthonics '75".

A. C. Grant

Member, Library Committee, Bedford Institute of Oceanography.

Associate Editor, Bulletin of Canadian Petroleum Geology.

I. A. Hardy

Member, Library Committee, Bedford Institute of Oceanography.

Correspondent, Geological Survey of Canada Geogram.

I. M. Harris

Member, Northern Appalachian - Caldeonian Geodynamic Committee.

Coordinator, Society of Economic Paleontologists and Mineralogists (Eastern Section) Field Trip (1975).

R. D. Howie

Member, Library Committee, Bedford Institute of Oceanography.

L. F. Jansa

Participated on JOIDES Atlantic Advisory Panel.

Active Member, Dalhousie University Thesis Committee.

Representative, Canadian Society of Petroleum Geologists.

L. P. Purcell

Member, Interdepartmental Subcommittee on Geological Potential.

J. A. Wade

Member, Interdepartmental Subcommittee on Geological Potential.

Co-editor of Volume II - Offshore Geology of Eastern Canada.

G. L. Williams

Co-chairman, organizing committee for 1976 Annual Meeting of American Association of Stratigraphic Palynologists.

Secretary-Treasurer of Atlantic Geoscience Society.

Manuscripts Approved for Publication

During the year, thirty-four manuscripts were accepted and approved for publication.

PROGRAM SUPPORT SUBDIVISION

K. S. Manchester

Introduction

The support required for the division's marine and field projects covers a broad range. In the early stages of project planning this involves equipment and technical personnel assignment and equipment acquisition, design and modification. In later stages of the project, equipment and supplies must be assembled and loaded on the ship or transported to the field site. Instrument installations and modifications are carried out, liaison with other agencies established, and final equipment installation and calibrations are completed. During the operation, launches, vehicles, instruments and other equipment have to be maintained and operated, special services such as seismic shooting, scuba diving, etc. provided, watchkeepers allotted and data processed. Following the operation, equipment has to be disassembled, refurbished and repaired for stowage maintenance and overhaul, contracts raised, damaged equipment repaired or new equipment ordered and data and samples properly curated, classified and sent for analysis required. This subdivision is responsible for a whole range of field support services as illustrated above.

The subdivision also has the continuing responsibility to maintain a central geoscience data file so that all raw and processed data collected by the Division is easily available, to curate all geological samples collected, maintain and publish data indexes and sample inventories, and operate the regional GSC open file. The subdivision is actively engaged in planning all field projects and in carrying out instrument and methods developmental projects on request by division scientists. The subdivision also co-ordinates and arranges all AGC building construction and laboratory and office space allocation and facilities in co-operation with other Bedford Institute Laboratories.

Activities

There were major cruises on HUDSON and M.V. MINNA and a large field project on the Magdalen Islands supported by the subdivision along with three other smaller cruises and numerous other small field projects in the Maritimes also supported at various levels. The subdivision also assisted the Terrain Sciences Division by supplying equipment and manning a landing barge used by them in the nearshore survey on Somerset Island. We also provided some support to Dr. R. Hesse of McGill University, who took part in the HUDSON cruise in the Labrador Sea.

A decision to provide proper curation for marine geological samples collected over the past eight years was made. A building to properly curate these samples was completed early in 1974 with a dry heated floor area of 2400 sq. ft. and a refrigerated humidity controlled area of 600 sq. ft. to store the collected samples in.

A. Sherin was hired as the first AGC Curator during the summer with a responsibility to develop and operate a proper curation facility at AGC for all past and future geological samples. He has been working with representatives of all subdivisions in AGC and with the Resource Management and Conservation Branch people here at the Bedford Institute of Oceanography in establishing a curation information system, a curation policy and a field geological data acquisition system to use when samples are collected and/or analyses on them performed. The project is now well underway but will take a number of years to completely develop and overcome the backlog of uncurated samples.

The Magdalen Island beach study project carried out by the Environmental Marine Geology Subdivision was provided with a large amount of equipment development, technical and logistics support during both the summer and autumn portions of the project, enabling us to develop our shore based field capability to a greater extent.

The HUDSON cruise to the Arctic required a large effort to equip the ship prior to sailing in July and also to technically support it during all its phases. This was generally satisfactorily completed both during the cruise and in handling the data on the cruise's return.

The major unplanned effort was provided by the grounding and eventual sinking of the M.V. MINNA, our multidiscipline survey ship, on Resolution Island. Fortunately, the sinking, while possible at any time, took about a month to happen, which allowed removal of all instruments and data that could be carried by hand. However, we did lose all the large equipment and portable laboratories and much of the smaller removed equipment was damaged in the haste to remove it before the ship sank. This resulted in a large unplanned requirement for expensive maintenance on all the instruments and to replace the lost instruments and equipment by arranginging new purchases of them.

The data systems section has completed the proper documentation and testing of the Hewlett-Packard 2100 DOSM Shipboard Geoscience Data Processing system. They have also been involved in microfilming and then turning over to National Archives a large portion of our older field data for permanent storage in their Dartmouth, Nova Scotia facility. The section has also been involved in Branch discussions on developing a GSC well data system. This has involved meetings with ISPG in Calgary, and development of a trial AGC subsurface data system here.

It has become very apparent, the last year, that AGC is becoming less season oriented in its field projects, as there were major field projects and cruises in all except a few months of the past year. This round the year field operation has required that much more detailed planning and coordination of the Subdivision's work be carried out than was previously required when most projects were in the summer period only. The reduction of AOL support in some areas, the increasing AGC field program and the increasing scope of the Subdivision's responsibilities resulted in a general reduction of the quality of support that has been provided in some areas. It is hoped by the addition of new staff and the knowledge and funds to use more local outside contractors, that this situation can be reversed.

Personnel Notes

Mr. A.G. Sherin joined the Subdivision on 29 July as the Geological Data and Sample Curator for the Atlantic Geoscience Centre. Mr. L. Brown left the Subdivision in November and was replaced by Mr. F.D. Ewing. Mr. B. Vardy also left the Subdivision in August 1974 and has yet to be replaced. The Subdivision also three casual employees and two summer students for varying periods during the year.

Attendance at Meetings

K.S. Manchester

"IEEE International Conference", Halifax, N.S., August 21-23, 1974.

"Oceanology International Conference", Brighton, England, March 15-22, 1975.

Attendance at Courses

K.G. Shih

Data Management Course, Ottawa, 7-9 October, 1974.

An Introduction to the H.P. 2100 DOSM System, Dartmouth, N.S., January 14-18, 1975.

A.G. Sherin

Data Management Course, Montreal, October 21-25, 1974.

R. Sparkes

An Introduction to Micrographics, Halifax, N.S. February 17-18, 1975.

An Introduction to the H.P. 2100 DOSM System, Dartmouth, N.S. January 14-18, 1975.

B.L. Johnston

An Introduction to the H.P. 2100 DOSM System, Dartmouth, N.S. January 14-18, 1975.

B. Inkpen

Maintenance & Operation of Closed Circuit T.V. Systems, Halifax, N.S., September 23-27, 1975.

A. Boyce

Maintenance & Operation of Closed Circuit T.V. Systems, Halifax, N.S., September 23-27, 1975.

REGIONAL RECONNAISSANCE SUBDIVISION

D.I. Ross

INTRODUCTION

As part of its overall objective of studying the geological framework of the eastern continental shelf and margin of Canada, the Regional Reconnaissance Subdivision efforts during 1974 concentrated on developing four new thrusts. These were

(1) A multidiscipline approach to geological and geophysical studies in the eastern Arctic offshore.

(2) The development of new technology to improve the quality and quantity of data that could be acquired as part of the surficial studies of the eastern shelves.

(3) The broadening of the multiparameter surveys carried out in conjunction with the Canadian Hydrographic Service to include a regional survey of the entire Labrador Sea.

(4) Participation in the Candrill Project through the assignment of project leader.

The last of these is discussed in some detail in the introduction to the Atlantic Geoscience Centre report. The other three main thrusts are discussed in more detail below.

Activities

(1) Eastern Arctic Offshore Studies

During the summer of 1974, CSS HUDSON carried out a multidisciplinary survey in the Eastern Arctic Offshore. The cruise was oriented towards answering some of the major geological and geophysical questions in Davis Strait, Baffin Bay and the adjacent continental shelves and Arctic Sounds. The cruise included significant participation by personnel in other G.S.C. Divisions, particularly the Terrain Sciences Division and ISPG, as well as organizations outside the Geological Survey. Aeromagnetic measurements carried out by Regional Geophysics and Geochemistry Division in Northern Baffin Bay and Smith Sound prior to the beginning of the cruise provided a framework within which to carry out the geophysical surveys in that area, enabling reasonable geophysical coverage to be obtained to delineate the major sedimentary basins in the area. Attempts to sample the bedrock directly with the Bedford Institute drill in Lancaster and Smith Sounds and Davis Strait were hampered by the limited resolution of available seismic data and difficulties experienced in drilling in the Arctic environment. Despite difficulties encountered, core samples were obtained in Lancaster Sound and off southeastern Baffin Island. These represented the first bedrock cores that had been obtained in either of these areas.

Seismic refraction studies in Lancaster Sound and along the Baffin Island shelf provided additional data on the continental transition zone of western Baffin Bay. The results indicated a thick sequence of high velocity sediments in the mouth of Lancaster Sound and further south, off central Baffin Island, a sharp transition from continental to oceanic crustal structure. Additional seismic refraction data in southern Davis Strait and the northern Labrador margin indicated that earlier interpretations of a transition to oceanic crustal structure beneath the northern Labrador Banks was unlikely, and suggested that a thinned continental crust extended considerably further east of the Labrador Shelf out into the region of quiet magnetics in the northwestern Labrador Basin.

The magnetic anomaly pattern in central Baffin Bay had always posed problems in interpretation because of the low amplitudes observed. CSS HUDSON carried out a detailed magnetic survey of a 100 by 200 kilometre region of the Central Basin in an attempt to determine whether or not the anomaly pattern was lineated in a manner similar to other ocean basins. Corrections of the large diurnal variations were made by installing a fixed station magnetometer in a moored buoy in the center of the survey area. The results do show, in fact, a lineated pattern which may provide information on the approximate time of formation of the ocean crust if the anomaly patterns can be tied into an accepted magnetic time scale.

Shallow seismic data complemented with bottom samples, cores and bottom photographs in the Barrow Strait region have been used in conjunction with the detailed bathymetric charts prepared by the Canadian Hydrographic Service to identify earlier drainage patterns in the area and to evaluate Fortier and Morley's early model of a Tertiary drainage pattern in the Arctic Sounds. The information gained from this work, and that carried out by the Canadian Hydrographic Service in Lancaster Sound during the past two years, will prove important in the assessment of possible pipeline crossings in the Barrow Strait region.

(2) New Technology for Marine Surficial Studies

With the increasing demands for more and better information on the geotechnical properties of the unconsolidated sediments covering the continental shelf, Regional Reconnaissance Subdivision has been involved, along with engineers from the Atlantic Oceanographic Laboratory at Bedford Institute, in the evaluation of new techniques for the quantitative mapping of the seafloor sediments. The emphasis has been on an integrated survey approach to the problem using high resolution acoustic systems and the correlation of reflected signal characteristics with sediment type, and sidescan sonar. Backing up the survey program there is a requirement for in situ measuring devices to determine such things as shear strength of the sediments and a systematic sampling program to provide ground truth for the interpretation of the seismic data. As a result of the evaluation of a deep-towed seismic profiling system developed by Huntec ('70) Ltd., AGC has accepted a proposal from Huntec ('70) Ltd., to undertake a research and development project on the remote sensing of geotechnical properties of marine sediments from a regular survey ship. Field work associated with this project will provide the major thrust in our studies of surficial geology during 1975.

(3) Regional Geophysical Survey of Labrador Sea

The joint DOE/EMR multiparameter surveys of eastern offshore Canada were broadened during 1974 to include a regional survey of the entire Labrador Sea. Lines were placed at 20 mile intervals running from the Labrador continental shelf across to the west Greenland margin, seismic data being collected on every second line across the sea plus all lines over the Labrador Shelf. The program was terminated prematurely by the grounding of MV MINNA in Brewster Bay, Resolution Island. The uncompleted portions of the survey will be carried out in 1975. The data acquired has provided excellent control for the regional interpretation of Labrador Sea and complemented by refraction data and additional geophysical information from other sources, has led to a wealth of new ideas on the formation of the Labrador Sea and margin.

Personnel Notes

Dr. Robin Falconer joined Regional Reconnaissance Subdivision as a Post Doctoral Fellow in April 1974. In October 1974 he was awarded the Royal Society of New Zealand "New Geophysics Price for 1974, jointly with Prof. D.A. Christoffel of the Victoria University of Wellington. Mr. Robert Miller replaced Mrs. Jane Latremouille as a technician to work with the Surficial and Bedrock Geology Group in July. Mr. Art Jackson left Regional Reconnaissance the first of July to take up a position with the Eastern Petroleum Geology Subdivision, and was replaced by Mr. Curtis Stevens in July 1974. Mr. Ron Macnab transferred to Computing Services, Atlantic Oceanographic Laboratory, to assume the role of mini-computer specialist in January, 1975.

Attendance at Meetings

D.L. Barrett

I.E.E.E. International Conference, Halifax, N.S., August 21 - 23, 1974. Presented paper by D.E. Heffler.

G.B. Fader

Canadian Society of Petroleum Geologists meeting, Calgary, Alberta, September 30 to October 4, 1974.

R.H. Fillon

Geological Society of America Annual Meeting, Miami, Florida, November 18 - 20, 1974.

Geochemical Course on "Sedimentary Cycling and Chemical History of Sea Water", Miami, Florida, March 24 - 28, 1975.

R.A. Folinsbee

American Geophysical Union Meeting, Washington, D.C., April 8 - 12, 1974.

Penrose Conference on the Interpretation of Magnetic Anomalies, Reston, Virginia, April 15 - 19, 1974.

14th Annual Hydrographic Conference, Halifax, N.S., March 18 - 20, 1975.

R.T. Haworth

7th International Gravity Commission meeting, Paris, France, September 2 - 7, 1974.

Canadian Society of Petroleum Geologists Symposium, Calgary, Alberta, September 30 to October 4, 1974.

GSC Long-Range Futures Conference, Ottawa, Ontario, October 16 - 18, 1974.

Joint DOE/EMR Advisory Board on Multidisciplinary Surveys meeting, Ottawa, Ontario, February 25 - 26, 1975.

C.E. Keen

GAC/MAC Annual Meeting, St. John's, Newfoundland, May 19 - 22, 1974.

I.E.E.E. International Conference, Halifax, N.S., August 21 - 23, 1974.

L.H. King

Newfoundland Power Commission Review Board meeting, Montreal, P.Q., May 13 - 15, 1974.

Inauguration of Submarine Cable CANTAT II and Official Opening of the Beaver Harbour Station, June 21, 1974.

I.E.E.E. International Conference, Halifax, N.S., August 21 - 23, 1974.

Canadian Society of Petroleum Geologists meeting, Calgary, Alberta, September 30 to October 4, 1974.

Industry, Trade and Commerce Oceanographic Data Systems and Services Mission, Halifax, N.S. August 16, 1974.

J.B. MacIntyre

MARS Course, Atlantic Geoscience Centre, Bedford Institute of Oceanography, Dartmouth, N.S., December 10-13, 1974.

D.I. Ross

Canadian Committee on Oceanography, Presentation of JOIDES Proposal, May 27, 1974.

14th Annual Hydrographic Conference, Halifax, N.S., March 18 - 20, 1975.

S.P. Srivastava

Canadian Geophysical Union 1st Annual Meeting, St. John's, Newfoundland, June 10 - 13, 1974.

Special Talks

D.L. Barrett

"A real time seismic signal processing system", by D.E. Heffler. Presented at the I.E.E.E. Ocean 74 Conference, Halifax, N.S., August 21-23, 1974.

R.H. Fillon

"Labrador Shelf: Wisconsin Moraines and the age of the marginal channel". Geological Society of America, Miami, Florida, November 18 to 20, 1974.

R.A. Folinsbee

"Multiparameter surveys of Eastern Canadian Continental Shelf and Margin". Presented at the Penrose Conference on the Interpretation of Magnetic Anomalies, Reston, Virginia, April 15-19, 1974.

C.E. Keen

"Some new results on the continental margin of Eastern Canada". GAC/MAC Offshore Symposium, St. John's, Newfoundland, May 20, 1974.

"Baffin Bay - a frigid ocean basin". Invited lecture course at Scripps Institute of Oceanography, La Jolla, California, April, 1974.

D.I. Ross

"Hydrography in the Arctic - A geoscience opportunity for expanding sub-sea knowledge". Presented at the 14th Annual Canadian Hydrographic Conference, Halifax, N.S., March 18 - 20, 1975.

S.P. Srivastava

"Magnetic Diurnal correction to marine magnetic data". Presented at Canadian Geophysical Union 1st Annual Meeting, St. John's, Newfoundland, June 1974.

Memberships on Committees

R.H. Fillon

Benthonics 75 Coordinating Committee

R.T. Haworth

EMR/DOE Committee on Mulitparameter Surveys

C.E. Keen

Working Group 8 of the International Geodynamics Committee.

Editorial Board, Geoscience Canada.

Editorial Board, Canadian Journal of Earth Sciences.

L.H. King

Editorial Board, Geoscience Canada

D.I. Ross

Canadian Geodynamics Committee

S.P. Srivastava

Working Group I-4, "Magnetic anomalies". Division I of International Association of Geomagnetism and Aeronomy.

W.J.M. van der Linden

Atlantic Geoscience Society, Executive, Newsletter Editor.

Completed Manuscripts

During the fiscal year April 1, 1974 to March 31, 1975, eight manuscripts were accepted and approved by the Division for publication in outside journals; ten for Geological Survey of Canada papers; one Memoir and one for Bulletin d'Information of International Gravity Commission.

CENTRAL LABORATORIES AND ADMINISTRATIVE SERVICES DIVISION

J. A. Maxwell, Chief

Introduction

The success with which the Geological Survey of Canada meets its major scientific objectives is dependent to a large extent on the strength of its internal support units. It is the role of the Central Laboratories and Administrative Services Division to provide chemical and mineralogical scientific support; mechanical and electronic technical support; and to coordinate the operations of administration, financial and personnel services. In addition, the Division encourages a greater interest in Canada's rock and mineral resources by Canadians through the preparation and sale of sets of rocks, minerals and ores; free mineralogical examination of specimens submitted by the public; and through preparation and publication of guidebooks to those Canadian mineral areas of most interest to amateur mineral collectors.

A suite of modern laboratories provides facilities for chemical analysis and mineralogical study of the wide variety of rocks and minerals collected by field geologists in pursuance of Branch objectives. Analytical techniques range from classical wet chemical analysis of rock samples to the *in situ* electron microprobe analysis of micron-sized areas of minerals. X-ray fluorescence, X-ray diffraction, atomic absorption and emission spectrography are used to a considerable extent. Sample preparation and mineral-separating laboratories provide essential preparatory services for the above-mentioned techniques and for specialized laboratories in other Divisions. In order to meet the analytical requirements of the Branch as efficiently as possible and within an acceptable time frame, our scientists pursue an on-going program of instrument and technique development, adaptation and modification commensurate with the state-of-the-art. For example, adaptation of the energy-dispersive technique to electron microprobe analysis has given our laboratory a new and powerful investigative tool that provides Branch scientists annually with several thousands of complete microanalyses of minerals.

Earth science reference standards, prerequisite to the recognition, identification and analysis of minerals, are of vital importance to the scientific activities of the Branch. The Division is concerned with maintaining and extending the Systematic Reference Series of the National Mineral Collection; a national collection of meteorites; a reference and study collection of suites of ore minerals from Canadian and other representative mineral deposits; X-ray powder pattern standards for the identification of minerals; and various analytical standards for the analysis of minerals and rocks. The chemical laboratories play an important role in the international study and certification of rock and mineral standard samples.

Technical support to the Division and Branch is provided by a small but highly-skilled staff and shop facilities for mechanical and electronic design, modification and servicing of scientific instruments. Noteworthy

accomplishments have been made in the fabrication of new and improved geophysical field equipment, and in the adaptation of mini-computers to the collection and processing of analytical data in the chemistry laboratories. Parallelling the scientific and technical support units, a staff of 33 persons performs the unsung but vital tasks of Branch administration and financial support, including such services as secretarial, accommodation, inventory, vehicles, registry, messenger, purchasing, stores, supplies and accounts.

Personnel Notes

Mrs. J.E. Clemmer joined the Division as Secretary in January after a period of six months spent on French Language Training. Mrs. Clemmer comes to the Survey from Environment Canada.

Maryann Petre, who has been acting Division Secretary since December 1973, has been appointed Technical and Administrative Assistant to the Division Chief.

Attendance at Meetings, Conference and Courses

J. A. Maxwell — Seventh Materials Research Symposium, Gaithersburg, Maryland, October 1974.

"Staff Relations for Line Managers", Bureau of Staff Development and Training, Ottawa, December 9-31, 1974.

Special Talks or Lectures

J. A. Maxwell — Plenary lecture entitled "Sampling and sample preparation at the Geological Survey of Canada - the what, why and how", at the Seventh Materials Research Symposium, Gaithersburg, Maryland, October 1974.

Lecture on "Problems in sampling and sample preparation" to British Columbia Analytical Chemistry Group, Vancouver, November 7, 1974.

Membership on Committees

J. A. Maxwell — Branch Management Committee

Chairman, Branch Administrative Officers' Committee

Associate Committee on Meteorites, National Research Council

Departmental Coordinating Committee, Official Languages Requirements

Branch Classification Evaluation Committee, Technical Category

Departmental Group on Postdoctorate Fellowships

J. H. Lapp — Branch Administrative Officers' Committee

Branch Christmas Party Committee

Visitors

Mr. Irving May - Chief, Branch of Analytical Laboratories, United States Geological Survey, accompanied by Dr. H. Rose, Mr. R. Havens and Mr. C. Huffman, July 23-26, 1974.

Dr. J. Ziomek and Mr. J.G. Banert, University of Lodz, Poland, visited the laboratories and were taken on a field trip by H.R. Steacy and H.G. Ansell, July 19, 1974.

Mr. P.J. Moore, Institute of Geological Sciences, London, England, June 3, 1974.

Dr. W.M. Johnson, Deputy Chief, Analytical and Assay Branch, British Columbia Department of Mines and Petroleum Resources, February 8, 1975.

Dr. R. Scholz, Bundesanstalt für Bodenforschung, Hannover, West Germany, October 28, 1974.

M. Curien, Délégué Général de Recherches Science et Technologie in the Ministère de l'Industrie in France, January 21, 1975.

Analytical Chemistry Section

Sydney Abbey

During the year, the Section continued to provide Branch scientific projects with compositional data on rocks and minerals, to develop new techniques and to provide analytical advice to Branch geologists, to other organizations in Canada, and to groups in other countries. The most significant development was the installation and effective operation of a new Philips 1450 Automatic X-ray Fluorescence Spectrometer.

Inaction by Public Works has been a serious impediment to laboratory work. Nine months after the removal of old x-ray equipment, no action has been taken to install chemical laboratory equipment in one room (for which equipment is on hand). The amount of work involved should take hardly more than one day.

International Reference Samples

A limited quantity of analytical data was provided for reference samples on hand from several different sources. The major effort in this area concerned the correlation and evaluation of data on three proposed Canadian reference rocks. Results were provided by one or more laboratories in each of 50 institutions in 19 different countries. A first report on the collaborative study has been completed and the manuscript is undergoing review.

Consultations, Visits, etc.

Students from Laurentian and Queen's Universities spent some days in our laboratories, learning methods for specific purposes. Groups of students from Concordia and McGill Universities and l'Université du Québec also toured our facilities.

Other visitors came, to exchange information or to view our laboratories, from the Institute of Sedimentary and Petroleum Geology, the Ontario Ministry of Natural Resources, the Nova Scotia Technical College, two Canadian commercial laboratories, Pennsylvania State University, the University of Guelph, the Geological Surveys of Ireland and Egypt, the Institute of Geological Sciences (U.K.), Ecole Polytechnique de Montréal, the Commonwealth Scientific and Industrial Research Organization (Australia), the University of Newcastle (Australia) and other institutions in Brazil, the Netherlands and the U.S.S.R. In addition, the laboratories were visited by delegates to the Commonwealth Mining Congress and the Canadian Spectroscopy Symposium.

In the course of personal travels, Sydney Abbey visited the Institute of Geological Sciences and the Laboratory of the Government Chemist, in London, and the Atomic Energy Research Establishment, Harwell.

Requests for advice and assistance regarding equipment, methods and reference samples were received from the Department of Agriculture, from Carleton and Brandon Universities, the University of Western Ontario, and a western Canadian chemical industry.

Chemical and X-Ray Fluorescence Laboratories

Production Analysis

Once again, the number of samples analysed exceeded those received, giving a further reduction in backlog. The use of the new x-ray fluorescence spectrometer resulted in a major re-orientation of analytical work on the great majority of samples received, the problem now being one of maintaining chemical work at an adequate pace to keep up with the output of the x-ray system.

There was a notable increase in demand for the analysis of iron ores.

Method Development and Special Analyses

The new Philips 1450 Automatic X-Ray Fluorescence Spectrometer was installed in July. Operating on a sequential wavelength-scanning scheme, it is much more flexible and versatile than the instrument formerly used. It can be programmed for a variety of tasks. It is providing not only improved analysis for the eight elements formerly determined by x-ray fluorescence, but also for sodium, phosphorus, sulphur, chromium and a variable list of six "trace elements". Originally used with samples in the form of plastic-bonded discs, the system now utilizes cast glass discs prepared by fusion of the sample with a mixture of lithium borates.

A method was developed for the determination of many of the rare-earth elements in a variety of samples. It involves preliminary chemical enrichment, followed by determination by atomic absorption or emission in a nitrous oxide-acetylene flame. Extension to additional elements and/or improvement in sensitivity may be possible by means of x-ray fluorescence or emission spectroscopy.

Analytical work was expedited by the introduction of increased applications of mini-computers. These techniques were applied mainly for x-ray fluorescence, but also proved useful in atomic absorption, colorimetry and with ion-selective electrodes.

Considerable experience was acquired in the monitoring of analytical work done under contract by outside laboratories.

Spectrographic Laboratories

Production Analysis

Output continued at a satisfactory rate, resulting in a substantial reduction in sample backlog. However, production was down appreciably from the preceding year, mainly because the direct-reading instrument was out of action for more than half of the year (details below).

Method Development and Special Analyses

A great deal of time was spent on the installation of additional channels in the direct-reading spectrometer. This work was severely handicapped by missing parts and components, the most serious involving several months' delay in the delivery of electronic equipment required for interfacing the spectrometer with the on-line mini-computer.

Computer storage was applied to emulsion calibration curves and many of the analytical working curves in the photographic analytical systems, resulting in a very great acceleration of the conversion of densitometer readings to concentration values.

Many new synthetic standard mixtures were prepared and some of them used to update old working curves. Preliminary experiments were undertaken on the possible future use of tetra-ethyl orthosilicate in the large-scale preparation of synthetic standards.

A new procedure was developed for preparing much larger quantities than usual of homogeneous synthetic mixtures containing typical concentrations of a large number of trace elements. Mixtures were prepared to represent four different matrices (acidic rock, iron-rich, carbonate, etc.) and their homogenity confirmed by analysis. They are intended for use as daily control standards for production work on the direct-reading spectrometer.

Inter-laboratory analyses were undertaken, in collaboration with le Ministère des Richesses Naturelles du Québec, on a group of rock samples prepared as secondary reference materials.

A major portion of a manuscript was completed, intended eventually to provide a comprehensive description of current spectrographic methods.

Personnel Notes

Gisèle Bélanger resigned her position, which was eventually filled by René Guillas.

Claire Meeds was transferred back from the chemical laboratories to the spectrographic laboratories, eventually filling the position vacated by René Guillas, after working as a casual employee for several years.

G. R. Lachance and R. J. Gravel were seconded from the Mineralogy Section to the Analytical Chemistry Section in connection with the installation and operation of the new x-ray fluorescence spectrometer.

David Hardy, Robert Hélie, Yves Parent and Thomas Wiles worked in the chemical and spectrographic laboratories for varying periods, as summer students.

Nicole Lafontaine and Raymond Laniel worked briefly in the spectrographic laboratories as casual employees.

Diane Ryan joined the chemical laboratory staff as a casual employee early in the year.

Attendance at Meetings, Conferences and Courses

K. A. Church	Course in applied spectroscopy, University of Arizona, August.
Serge Courville	Course in effective writing and oral communication, Cornwall, Ontario, February.
W. H. Champ, K.A. Church, J.G. Sen Gupta and Sydney Abbey	Canadian Spectroscopy Symposium, Ottawa, October.
Sydney Abbey	Centennary Celebrations, Society for Analytical Chemistry, London, July.

Membership on Committees

Serge Courville	Divisional Safety Officer
J.G. Sen Gupta	Vice-Chairman, Ottawa Section, Spectroscopy Society of Canada
	Organizing Committee, Canadian Spectroscopy Symposium, Ottawa, 1974
Sydney Abbey	Standards Committee, the Geochemical Society
	Executive Committee and Co-ordinator of Task Force on Rock Samples, Canadian Certified Reference Materials Project
	Branch Classification Evaluation Committee for Technicians

Production Statistics

1. Samples Processed

	Chemical and XRF	Spectro-graphic
Carried from 1973-74	1,477	686
Received, 1974-75	2,698	1,526
	4,175	2,212
Completed, 1974-75	3,210	1,859
Carried forward	965	353

Divisional Breakdown of Backlog

Central Labs & Admin Services	6	20
Regional & Economic Geology	263	215
Resource Geophys. & Geochem.	691	116
Others	5	2
	965	353

2. Comparison with Preceding Year

	1973-74	1974-75
Samples Received		
Chemical and XRF	2,021	2,698
Spectrographic	2,199	1,526
Samples Completed		
Chemical and XRF	3,338	3,210
Spectrographic	2,468	1,859
Individual Spectrographic Analyses		
Qualitative	43	9
Semi-quantitative	61	121
Quantitative	3,095	2,734
Determinations		
Chemical	18,646	16,465
X-ray Fluorescence	26,400	48,540
Spectrographic (semi-quantitative)	1,660	3,134
(quantitative)	58,596	30,283
Spectrographic Exposures		
Photographic	3,067	3,810
Direct Reader	2,861	522

Completed Manuscripts

The following manuscripts submitted by the staff of the Analytical Chemistry Section were accepted and approved by the Division: 2 GSC papers, 2 outside papers.

Mineralogy Section

R.J. Traill

The scientists and support staff of the Mineralogy Section provide the Branch with facilities and expertise to undertake mineralogical studies, including the specialized fields of crystallography, X-ray diffraction, X-ray fluorescence and electron beam analysis. During 1974-75 the total output of service work, which included sample preparation, mineral separation, mineral identification, mineral analysis and study of samples for age determination, showed an increase of 15 percent over the previous year. This increase was made possible by development of new and improved techniques. The electron microprobe laboratory has gained recognition as one of the most advanced in the world in the use of energy dispersive analysis and on-line computer correction of matrix and other effects. In the X-ray laboratory, techniques were developed for mini-computer recognition of X-ray powder patterns of minerals. This involved creating a magnetic tape reference file of standard X-ray powder patterns, and writing a search program to compare the data for an unknown pattern with those in the standards file. A six-year study of lunar rocks from the Apollo series of missions in co-operation with NASA was terminated in February, and a detailed study of rocks drilled from the ocean floor at the mid-Atlantic ridge was started. Studies of ore samples from the massive sulphide Kidd Creek deposit revealed the presence of a previously unsuspected suite of minerals; a finding which has a bearing on the process of ore treatment. Examination of a very old specimen in the National Mineral Collection from Ontario's first gold producer, the Richardson Mine in Madoc Township, led to the discovery of the radioactive mineral brannerite associated with gold. Radioactive dating established an upper limit for the age of the gold deposits and suggested a genetic relationship with the Deloro stock that is worthy of further exploration. Services to the public included preparation and shipment of 8,000 sets of minerals and rocks, and examination and identification of 208 samples. Additions to the National Mineral Collection amounted to 352 specimens including 25 minerals new to the collection. The Reference Series now contains about 1,700 different, or 75 percent of all known species.

Electron Probe Microanalysis (A.G. Plant, G. Pringle)

Many Branch projects now require sophisticated mineralogical and petrographic studies and during the past year this has led to an important change in the approach to microprobe studies in mineralogy. Project officers are submitting requests which involve considerable petrographic study as well as the provision of a vastly increased number of mineral analyses. This change can be attributed to the success of the now well-established energy dispersive spectrometer, particularly for silicate analyses, and to the benefits that may be derived from detailed studies, such as were completed on the lunar samples. Many requests are now taxing our analytical resolution, both in terms of detection limit and size, and it is clear that our present instrumentation will not be able to fulfil all of our needs within the next year or two.

Statistically, the analytical services, as expressed in terms of service charges, are as follows, with 1973-74 listed for comparison:

	1974-75 $	1974-75 %	1973-74 $	1973-74 %
Regional & Economic Geology	37,500	94.1	22,600	67.1
Resource Geophysics & Geochemistry	100	0.2	1,100	3.3
Terrain Sciences	-	-	400	1.2
Central Laboratories & Administrative Services	2,100	5.3	3,400	10.1
Other (EPB)	150	0.4	6,150	18.3
Total	39,850	100.0	33,650	100.0
Number of Requisitions	34		26	
Number of projects	18 GSC	1 EPB	18 GSC	2 EPB

The increases for 1974-75 over 1973-74 are 18.4% in cost recovery charges and 31% in the number of requsitions.

This demand for analytical services has been and continues to be difficult to fulfill within an acceptable time-frame, and in fact without the additional time spent outside the normal work-week, it is impossible to do so. The reasons are tnreefold: (1) more extensive requests for analytical services, particularly during the last six months; (2) the transfer of G.R. Lachance to the XRF project on a full time basis; and (3) some vexing instrumental problems during the report period. Gordon Pringle was appointed to the project April 1, 1974, but the transfer of G.R. Lachance to Analytical Chemistry has returned the manpower status of the project to that of three years ago. This means that after analytical requests have been fulfilled, there is little, if any, available time to devote to development and research, with the consequent long-term effects on the status of the laboratory and our ability to respond to future requests.

Despite these constraints, and with the exception of the extensive requests from Baragar (740103) and Thorpe (680060), virtually all requisitions have been completed within four weeks. The energy dispersive spectrometer has permitted a large increase in the number of analyses reported, and although it has been used predominantly in the silicate mineral studies, it has also been invaluable in the qualitative evaluation of suites of sulphides and other non-silicate mineral assemblages, e.g. Thorpe (680060) and Jambor (750034). The more extensive requisitions have included the following:

Baragar (680096)	- 165 analyses of silicate minerals in Seal Lake Volcanics
Ermanovics (690010)	- 269 feldspar analyses in sections across a diabase dyke to aid in interpretation of paleomagnetic data
Jambor (750034)	- 70 analyses of secondary minerals from the Dumont low grade Ni deposit
Jambor (700041)	- 305 analyses of biotite and feldspar to aid study of porphyry Cu deposits

Emslie (670003)	- 550 silicate analyses in study of anorthositic rocks
Baragar (740103)	- 600 mineral analyses in samples collected during Leg 37 of the Deep Sea Drilling Project - still in progress
Thorpe (680060)	- preliminary data in approximately 50 polished sections from the mineralogically complex bornite ore zone of the Texasgulf Kidd Creek deposit. This assemblage consists of approximately 60 minerals, including selenides and selenian sulphides, and the data have already assisted in the evaluation of the metallurgical characteristics of the ores.

These latter two requisitions are still in progress and upwards of an additional four months will be required to complete their initial requests. Furthermore, these studies can be expected to generate further requests, for example, the study of samples from pillow lavas in the Mid-Atlantic Ridge by Baragar is intended to assist future studies of Precambrian pillow lavas.

The increase in output of analytical mineral data is posing its own problems of data handling and assimilation. But unlike large numbers of rock analyses, which lend themselves easily to data processing, an increase in mineral data requires a commensurate increase in the traditional discipline of petrography.

Consultations

Requests for advice and information on equipment, analytical methods and standard samples were received from the following: Canadian Universities (Dalhousie, Guelph, Manitoba, Memorial, Montreal, New Brunswick, Ottawa, Quebec), Ontario Department of the Environment, Ontario Department of Mines, Falconbridge Laboratories, USGS Menlo Park, Smithsonian Institute, Washington, SUNY Stonybrook, Los Alamos Laboratories, Universities of Chicago, Indiana, New Mexico, Rhode Island, and Cal Tech. Staff from many of these and other institutions visited our laboratory during the year, particularly during the Microbeam Analysis Society Meeting in Ottawa in July.

A.G. Plant spent time fulfilling requests for consultation by I.N.R.S. - Pétrole, Université de Québec, for their new materials analysis laboratory - involving visits to the demonstration laboratories of three scanning electron microscope manufacturers; and by the Department of Earth Sciences, University of Manitoba.

X-ray Diffraction and General Mineralogy (R.J. Traill, M. Bonardi, R.N. Delabio and A.C. Roberts)

The following XRD services were provided in support of Branch projects:

2,761	powder camera identifications
75	Gandolfi camera patterns
18	Guinier camera patterns
10	cell determinations
4	diffractometer identifications of assemblages
8	boulangerite d-spacing measurements
1	pyrrhotite composition

Standard powder patterns of 33 new minerals were prepared and added to the reference file. Single crystal studies of alstonite using Weissenberg and Precession cameras were completed, and study of a hydrated rare-earth carbonate began. Mineralogical studies were completed on 108 mineral concentrates which were then forwarded to the Geochronology Section. Diffractometer studies were completed on 176 clay mineral samples submitted by Regional Geology and Terrain Sciences Divisions, and the Vancouver and Dartmouth offices. Laser probe studies were suspended for most of the year coincident with a leave of absence of Mr. Bonardi.

X-ray Fluorescence Analysis (G.R. Lachance)

A new Philips PW 1450 automatic X-ray fluorescence spectrometer was installed in room 707 and the old Philips 1540 unit was transferred from room 771 to 707. A fusion technique was developed using the Claisse Fluxer and the analytical section staff were given instructions on the production of reproducible clear glass discs for the comprehensive analysis of rocks using the PW 1450 instrument. A hardware and software program was developed to measure characteristic X-ray intensities and convert these data to weight percent for 18 elements (Na, Mg, Al, Si, P, S, K, Ca, Ti, Cr, Mn, Fe plus 6 "trace elements" selected by the submitter). During the period July 1974 to February 1975 this scheme of analysis provided 22,000 determinations on 1700 rock samples. Mr. Getachew Miriam from Ethiopia was given a period of instruction on XRF theory and the operation of X-ray spectrometers.

Extraterrestrial Materials (R.J. Traill, A.G. Plant, H.R. Steacy)

Polished thin sections of lunar rocks from the Apollo 16 and 17 missions were studied, with emphasis on features attributable to impact melting. Resemblances to anorthosite-rich melt rocks and breccias from the Lake Mistassin and Manicouagan craters were noted. The research agreement with NASA (R.J. Traill, Principal Investigator) for the study of lunar rocks was terminated February 1 after six years of co-operative studies. A small fragment (24 grams) of a previously unreported Canadian meteorite, Riverton, Manitoba, was obtained for the National Meteorite Collection. A polished thin section of Riverton was prepared and a detailed mineralogical study was initiated. Three new portable meteorite displays were assembled with some financial assistance from the National Research Council. Two of our older displays were allocated to the Museum of Science and Technology on semi-permanent loan for display at the astronomical observatory.

Mineralogy for Rock Hounds (Ann P. Stenson)

A guidebook in the series "Rocks and Minerals for the Collector" was written and submitted for publication. The areas covered the Magdalen Islands and the Island of Newfoundland. Field work was completed along the route between Sudbury and Winnipeg and results are being incorporated in a new guidebook covering that area. The text was written and illustrations were selected for a colourful popular-series poster on gemstones that is now available to the public.

Mineral and Ore Collections (H.R. Steacy, H.G. Ansell)

Accessions to the mineral collection - which is the reference portion of Canada's National Mineral Collection - totalled 352, strengthening the collection's capability of assisting Branch projects. Important Canadian accessions included a broad suite of minerals from the Jeffrey Mine, Quebec; and representative specimens of rare phosphates recently discovered in the Yukon Territory. During the summer, 2,500 pounds of selected specimens were collected from 25 localities in Newfoundland, Quebec and Ontario for study and exchange. This material included eudialyte and rare zirconium and rare earth minerals from Kipawa, Quebec. An important accession to the ore collection was the gift of Dr. J.J. Brummer of a large suite of kimberlites and associated rocks and minerals from South Africa and other localities.

Canadian research was assisted by compliance with 65 individual requests for mineral samples, requiring careful selection and provision of 275 samples. A suite of specimens was provided to the National Museum of Natural Sciences for display in their Hall of Geology. The general public was assisted by Mr. Ansell's examination of 208 samples with the results being incorporated in 88 mailed reports and 54 verbal reports.

Mr. Steacy acted as host to groups visiting Logan Hall and assisted with the visit to the Survey building by delegates to the Commonwealth Mining and Metallurgical Congress. Information and guidance were provided to the Prime Minister's office in the use of natural mineral specimens for gifts abroad. The text and illustrations were prepared for a popular series poster on Minerals.

Mineral Sets Preparation Unit (J.M. Larose)

J.M. Larose, J. Turpin, T. Racine and J. Angrignon prepared and shipped 7,594 Prospector's Sets of Rock and Mineral Chips. The distribution of these throughout Canada was as follows:

Alberta	1,463
British Columbia	1,378
Manitoba	70
New Brunswick	235
Newfoundland	53
Nova Scotia	272
Northwest Territories	324
Ontario	1,410
Prince Edward Island	9
Quebec	768
Saskatchewan	549
Yukon	340
Ottawa Office	614
Minister's Office	8
Others	101

Sales of the 120-specimens collection of minerals, rocks, ores and fuels representing the raw materials of the Canadian mineral industry amounted to 367. At the request of the National Film Board, 125 special collections were supplied to accompany Earth Sciences film-strip kits. The total revenue from the sale of sets and collections amounted to $29,600.00.

From May 15 to October 1, more than 28 tons of minerals, rocks, ores and fossils used in the various collections produced by the Geological Survey were collected from 72 localities in the Northwest Territories, British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec and New Brunswick. Over 21,000 miles were covered. During the field season, Mr. Larose was ably assisted by Mr. B. Machin from the Mineral Separation Laboratories.

Mineral Separating Unit (J.C. Paris)

The staff included J.C. Paris, B. Machin and M. Huot for the full year, and C. Blake, R. Christie, A.G. Brown and R. Charbonneau for part of the year. 10,194 samples were processed, representing an increase of 110%, reflecting an overall increase of 55% in our production and 75% in the preparation of mineral concentrates. These services were mostly for Branch projects. Only one of the larger projects was for the preparation of samples to be analysed in the private sector.

The following number of operations were performed:

Crushing, Grinding, Sizing	10,189
Heavy liquid separations	2,977
Frantz Isodynamic "	1,639
Carpco magnetic "	695
Wilfley table "	148
Superpanner "	461
Concentrate extraction	715

Personnel Notes

A.G. Brown and R. Charbonneau left the Mineral Separating Unit; the former retiring on medical grounds, and the latter as the successful candidate for a position in the Mines Branch (now CANMET). They were replaced by C. Blake and R.W. Christie.

M. Bonardi was on leave of absence from October to the end of the fiscal year at the University of Cosenza in Italy, where he is assisting the staff to establish a new suite of earth science laboratories.

G.J. Pringle transferred from the X-ray Diffraction Laboratory to the Electron Microprobe Laboratory as replacement for Elvira Gasparrini.

A.C. Roberts joined the staff of the X-ray Laboratory as a mineralogist replacing G.J. Pringle.

G.R. Lachance and R.J. Gravel were seconded to the Analytical Chemistry Section to work on the new Philips X-ray Spectrometer.

Attendance at Meetings, Conferences and Courses

H.G. Ansell	GAC-MAC Annual Meeting, Newfoundland, May 1974
G.R. Lachance A.G. Plant G.J. Pringle	9th Annual Meeting of the Microbeam Analysis Society, Ottawa, July 1974
J.M. Larose	Prospectors and Developers Association Annual Meeting, Toronto, March 1975
H.R. Steacy	EMR Managerial Grid Course, Cornwall, April 1974.
	Tucson Gem and Mineral Show, Arizona, February 1975
Ann P. Stenson	GAC-MAC Annual Meeting, Newfoundland, May 1974
	Annual Meeting of Joint Committee on Powder Diffraction Standards, Swarthmore, Pennsylvania, March 1975
R.J. Traill	Canadian Spectroscopy Symposium, Ottawa, October 1974
	National Research Council Associate Committee on Meteorites, Regina, October 1974
	Mineralogical Society of America, Annual Meeting, Miami, November 1974

Special Talks or Lectures

A.G. Plant	Invited lecture on "The electron microprobe and mineralogy" to the Ottawa Valley Mineral Association,
	Lecture at University of Manitoba on "Some aspects of electron microprobe analysis".
A.G. Plant H.R. Steacy	Joint invited lecture on "Meteorites" to the Ottawa Valley Mineral Association.
R.J. Traill	Invited paper on "History of the Electron Probe Micro-analyzer" at the Canadian Spectroscopy Symposium, Ottawa, October 1974.

Membership on Committees

R.N. Delabio	Branch Organizer, United Way Campaign
G.R. Lachance	Member, Branch Computer Facilities Committee
	Treasurer, Ninth National Conference of the Microbeam Analysis Society

A.G. Plant	Mineralogical Association of Canada representative on the International Mineralogical Association Commission for Cosmic Mineralogy
	Vice-chairman, Ninth National Conference of the Microbeam Analysis Society
H.R. Steacy	Vice-President, Mineral Museums Advisory Council
	Mineralogical Association of Canada representative on the International Mineralogical Association Commission on Museums
	Geological Association of Canada representative on Youth Science Foundation
	Member, EMR Tower Exhibits Committee
Ann P. Stenson	Treasurer, Mineralogical Association of Canada
	Mineralogical Association of Canada representative on the Joint Committee on Powder Diffraction Standards
R.J. Traill	Chairman, Research Subcommittee, National Research Council Associate Committee on Meteorites
	Member, Branch and Departmental Classification Evaluation Committees

Production Statistics

Summary and Comparison of Annual Mineralogy Services Charges

	1971-72		1972-73		1973-74		1974-75	
	$	%	$	%	$	%	$	%
			SAMPLE PREPARATION					
REG	18,394	61.6	20,653	76.5	33,440	85.0	40,937	70.7
RGG	680	2.3	1,400	5.2	60	0.2	952	1.6
TS	0	0	40	0.2	32	0.1	16	0
CLAS	10,175	34.1	4,789	17.7	5,752	14.6	16,015	27.7
OTHER	600	2.0	112	0.4	50	0.1	0	0
TOTAL	29,849	100.0	26,994	100.0	39,334	100.0	57,920	100.0

MINERALOGY AND XRD

REG	16,143	50.7	13,745	44.9	13,160	44.2	15,315	47.5
RGG	1,949	6.1	2,740	9.0	640	2.1	490	1.5
TS	1,715	5.4	1,620	5.3	1,975	6.6	2,195	6.8
CLAS	11,565	36.3	12,260	40.1	13,716	46.1	14,280	44.2
OTHER	460	1.5	215	0.7	290	1.0	0	0
TOTAL	31,832	100.0	30,580	100.0	29,781	100.0	32,280	100.0

ELECTRON MICROPROBE

REG	30,400	95.1	22,150	86.0	22,400	67.0	37,160	94.1
RGG	475	1.5	1,150	4.5	1,100	3.3	100	0.2
TS	0	0	250	1.0	400	1.2	0	0
CLAS	1,100	3.4	900	3.5	3,400	10.2	2,100	5.3
OTHER	0	0	1,300	5.0	6,150	18.4	150	0.4
TOTAL	31,975	100.0	25,750	100.0	33,450	100.00	39,510	100.0

TOTAL CHARGES

REG	73,032	68.7	62,476	64.5	78,567	68.2	95,907	72.3
RGG	7,160	6.8	5,650	5.8	4,238	3.7	1,542	1.2
TS	1,715	1.6	1,910	2.0	2,407	2.1	2,211	1.6
CLAS	23,306	21.9	18,156	18.8	23,498	20.4	32,721	24.7
OTHER	1,060	1.0	8,629	8.9	6,490	5.6	330	0.2
TOTAL	106,273	100.0	96,821	100.0	115,200	100.0	132,711	100.0

Completed Manuscripts

The following manuscripts, submitted by the staff of the Mineralogy Section were accepted and approved by the Division: 6 GSC papers, 9 outside papers and 2 posters (Minerals and Gemstones).

Mechanical Services and Instrument Development Shop

G. A. Meilleur

During 1974-75, the staff of the Mechanical Services and Instrument Development shops provided technical support for Branch projects in the form of mechanical engineering, design, drafting, fabrication, inspection and maintenance of laboratory and field instruments and equipment. In addition to in-house work, the unit was responsible for recommending, ordering and supervising the considerable amount of mechanical services work that is contracted out by the Branch to commercial shops. A new milling machine was purchased to provide greater capacity and versatility in machining. Two major projects in the past year were: fabrication of re-entrant cavity Q meters for the Electrical Methods Section; and re-design and

fabrication of new indexing instrumentation for an Astatic Magnetometer, at the request of the Paleomagnetism Section. Other projects, such as development of a sun compass and motorization of a parabolic antenna for satellite tracking,are pending due to a lack of personnel and appropriate facilities which likely will be made available during the coming year (1975-76).

The demand for the construction and development of laboratory equipment, along with the design and fabrication of field equipment, has maintained a growth percentage which is comparable to that of previous years, thus maintaining a persistent backlog of work which is not being processed and completed in time to provide the full efficiency and achievement expected.

Number of work orders processed - - - - - - - 147

Distribution -	REG	57	39%
	RGG	38	26%
	CLAS	27	18%
	TS	14	9%
	Others	11	8%

In process - 8 Backlog - 17

A total of 89 requisitions were originated for material purchasing and for contracting work to commercial enterprises, including jobs sent to Mines Branch and the National Research Council. Excluded from the total are jobs and material requisitions sent directly from divisions to commercial enterprises. A new milling machine was purchased and is expected to be in operation early in 1975-76. This machine will considerably relieve the pressure on our Aciera milling machine, in operation since 1960, and will provide greater capacity and versatility in machining a greater range of hard materials which are commonly used in the fabrication of scientific equipment.

Attendance at Meetings, Conferences and Expositions

G.A. Meilleur — Attended 3 monthly meetings of the Society of Manufacturing Engineers

International Machine Tool Exposition, Philadelphia

Visited Rutherford Research, Rutherford, N.J.

Membership on Committees

G.A. Meilleur — Branch Parking Committee

Electronic Services and Equipment Development

F. W. Jones

The functions of the unit are to maintain and service scientific equipment and to assist scientists with modification and up-dating of laboratory instrumentation. Mini-computers have come so much to the fore in the field of collecting and processing data from automated systems that it can be considered as a ninety percent take over of all electronic work tied to development and maintenance of laboratory equipment. There are ten mini-computers in the Geological Survey alone and this unit has been involved directly or indirectly with all of these during the year; in most instances relating to advice or interchange of ideas rather than any actual work because in all cases the manufacturers are able to provide repair services. It is usually necessary however to locate fault areas so that sections for repair can be sent out rather than have servicemen in at very high field rates of labour cost.

Service costs for the four computers in this division have been mimimal and all are performing a very useful function. The new Nova 1220 in the Spectrographic Laboratory is loaded with 'Extended Basic Language' and has been in full use by persons learning 'Basic' and by those with 'Basic' programs to run. A short course of six four hour sessions was held in Room 661 to start people off on programming.

The general servicing of laboratory equipment has been taken over by O.L. Coté, and he is now conversant with the servicing of the Philips & Picker-Nuclear X-ray analysis unit, also the Spectrographs and Densitometers and the Atomic Absorption instrument in the chemistry laboratories. He has also taken a short course on miniature computers (Algonquin College) and is receiving instruction here on Nova computer interfacing and programming.

It is hoped during the course of the new fiscal year to fulfill the request from Dr. Hutchison to study the DEC PDP 11 computer used by the Cartography Division, with a view to offering technical advice service.

Attendance at Meetings, Conferences and Courses

F.W. Jones — Institute of Electrical and Electronic Engineers, New York City, March 1975.

Financial Services

W. E. Cooke

Very few, if any of the personnel who form part of the Geological Survey, have not at one time or another, required the services of the Financial Section located on the second floor of the building. Under the direction of the Branch Comptroller, financial management and services are responsible for all aspects of financial activities as it applies to divisions located in Ottawa, Halifax, Calgary and Vancouver.

The Branch Comptroller's Office is responsible for submitting the yearly Program Forecast, preparing and submitting the Main Estimates, monthly expenditures and man-year forecasts and also provides functional guidance to other administrators within the Branch, on matters relating to budgeting. financial procedures and management reporting.

The Accounts Section, under the supervision of Mrs. M.I. (Mary) Going is responsible for travel claims, removal claims, keeping records of field accounts and payment of invoices. The staff includes Mrs. Marion Hodowanec, whose duties are the auditing and submission for payment of travel claims and field accounts for Regional and Economic Geology, Terrain Sciences and Atlantic Geoscience Centre. All travel arrangements, reservations, bookings, etc. are handled by Mrs. I.M. Deslauriers, whose duties also include the audit and payment of all travel claims and field accounts settlements for the remaining divisions of the Branch. Mrs. Linda Edwards, who has since left the Survey to devote her time with her family, was responsible for the finalization of all invoices submitted by Central Laboratories and Administrative Services. On her departure, Mrs. A.E. (Betty) Lisle, formerly with Regional and Economic Geology, took over her duties.

Personnel Notes

Mr. J.R. Hickson, Branch Comptroller for several years with GSC, left in September to take over the position as Head, Financial Services, National Energy Board. Mr. John Azar, from Consumers & Corporate Affairs, will take up the position as Comptroller on completion of French Language Training. Mr. L. Diansfield left the Survey in March to advance his career as an admin. trainee. He was replaced by Mr. W.E. (Ed) Cooke from U.I.C. Head Office.

During the summer months, we were fortunate to obtain the services of two Carleton University students, Miss Dianne Hall and Mr. Alfred Tsang.

Activities

The Program Forecast submitted in January showed the following dollars and man-years:

M.E.R.P.	$18,991,000	665 M.Y's
E.S.P.	2,320,000	89 "

Main Estimates submitted in October were as follows:

	Man-years	Pers	O & M	Capital	Grants
M.E.R.P.	693	11,242,000	8,555,000	1,092,000	560,000
E.S.P.	96	1,583,000	1,070,000	73,000	91,000

Statistics obtained from the Accounts Section appear as follows:

Field accounts accounted for	137
Travel claims processed	197
Removal claims processed	20
Invoices paid	2,000
Air reservations	784

Personnel Unit

K. J. Fracke

The major role of Personnel in Geological Survey during 1974-75 was in the field of recruitment of employees, however, Personnel also played a significant part in the processing and expediting of classification actions and in the interpretation of collective agreements and grievance procedures.

For your information, the following is a breakdown of classification and staffing actions processed by Personnel during 1974-75.

Position Analysis Schedules Received from the Branch	Position Analysis Schedules Classified/Reviewed
202	176

Staffing Actions

Cosep - 121 (SA +GA)
Term (incl. students other than Cosep)

Scientific and Professional	34
Technical	36
Admin Support	29
Operational	17
Total	116

Continuing

Scientific and Professional	32
Technical	10
Admin Support	21
Total	63

Administrative Services

L. A. Jackson

On 8 July 1974 Mr. Keith Pollitt left his position as Chief Administrative Officer for a position in EMR Headquarters. This move triggered a re-organization of Branch Administration which then became Branch Administrative Services and Financial Comptroller, sections under the Chief, Central Laboratories and Administrative Services Division. Mr. Lawrence Lajoie became Head, Branch Administrative Services and Mr. John Hickson, the Financial Comptroller. In August Mr. Lajoie became ill and has not yet returned to work. Mr. L.A. Jackson, the Divisional Administrative Officer, Terrain Sciences Division, became Acting Head, Branch Administrative Services.

Mrs. Juanita Metz, supervisor of the Branch Secretarial Services, attended Management Development for Support Staff course at Algonquin College. Mrs. Angelica Koops, the assistant supervisor, transferred to the Geological Information Processing Division. Mr. W. Anderson set a precedent in becoming the first male in the formerly all female section, starting as a typist, graduating to an office equipment operator and finally becoming the assistant supervisor. Other staff changes were - departures: S. Amos, L. Carson, M. White, R. Del Rio and newcomers J.A. Booth, D. Busby, C.J. Barnard and Mrs. C.H. Wiskemann.

Staff changes in Branch Registry and Messenger Service Unit were - departures: M. Decker. E. Moerman, D. Petticrew and M. Collin; newcomers were D.I. McCuaig and Pat Scriven.

Ted Ricketts, supervisor Accommodation, Building Maintenance, Inventory and Vehicles, won a promotion and left the Department. Mr. Irv. Salter has filled the position in an acting capacity for the balance of the year. Mr. Ray Rozon completed a Defensive Driver's Instructors Course and became the instructor for the Department's Safety Program.

Membership on Committees

L.A. Jackson	Departmental Administrative Advisory Committee
	Departmental Safety Committee
	Departmental Parking Committee
	Departmental Suggestion Award Committee
	Departmental ad-hoc Committee on Pool Parking
	Branch Administrative Officers Committee
	Administrative Support Classification and Assessment Committees

GEOLOGICAL INFORMATION PROCESSING DIVISION

Peter Harker

Introduction

The principal objectives of the Division are the communication of the results of the scientific program of the Geological Survey to users and potential users; the maintenance of a scientific library and associated data systems as an earth science information base and the provision of geoscientific information services to the public. In support of these objectives, the Division maintains capabilities and facilities in scientific editing and information, cartography, library services, technical photography and publication distribution.

As publisher for the Survey the Division manages a comprehensive publication program and issues Memoirs, Bulletins, Economic Geology Reports, Miscellaneous Reports and Papers together with various categories of maps. All have a long publication record and an established reputation in the world community of earth scientists. 75 printed reports were issued during the year ranging from a few pages to several hundred pages in length and extensively illustrated. The number is somewhat reduced from the previous year and this undoubtedly reflects the growing popularity and usefulness of the Survey's Report of Activities. Issued in two volumes last year and comprising almost a thousand pages of text in the new large format, these reports are certainly providing an important outlet for short summary reports of current Survey research and three volumes are proposed for next year. 31 geological maps were published, many of them in colour. 341 aeromagnetic maps were issued.

Continued increase in the cost of printing has required maximum economy in order to maintain a reasonable volume of output. Such economies have been achieved by means of the larger page size and increased use of offset printing from typescript produced in the Geological Survey on magnetic card typewriters which simplify the editorial process and give an aesthetically acceptable product that compares well with the much more expensive conventional letterpress.

Many reports and maps were placed on Open File at the principal offices of the Survey as the fastest way of releasing information, local arrangements are made for users to obtain copies at their own expense. Open Files provide a means of advanced publication and they may also provide an outlet for large and bulky data compilations that cannot easily be handled as formal publications. 65 Open Files were released during the year bringing the total number of items on open file to 260.

A significant part of the total research output of the Geological Survey finds an outlet for publication in scientific journals and 120 papers were published in this way. Outside publication complements the in-house program by providing external standards of acceptability and a degree of visibility not always available to government publications.

Maps and illustrations for reports are prepared by the Geological Cartography Section which provides a comprehensive service to the Branch. In addition to the preparation of edited manuscript material for printing as multicoloured final maps, uncoloured preliminary maps and figure illustrations, the Section, with its well equipped Photomechanical Unit, provides base maps on which field officers plot and compile their data and prepared manuscript geological maps. The Section also performs a great variety of drafting, display and reproduction services. Considerable progress has been made in computer-assisted cartography and most of the programming problems have been worked out. The second experimental map was completed and printed essentially as a final test before embarking on the principal objective of the automated project, namely the production of a series of 1:1 000 000 geological maps of Canada. The commitment of staff and equipment to this objective has been a great stimulus and several maps are well in hand. Computer assistance promises long term savings in time and labour, but equally important is the multi-use geological data base that will be developed as the geological data for each map is digitized and put into retrievable and machine processable form.

All maps and reports are released through the Publications Distribution Section and a monthly information circular announcing all publications and open files is mailed to several thousand addresses in Canada, the United States and overseas. More than 250 000 items were distributed through this office and 18 000 requests for publication or information were handled. Sales facilities for geological reports and maps are also maintained in Calgary and Vancouver, both offices report high volume of business and serve a large clientele of over the counter enquirers.

The Library of the Geological Survey is the principal earth science data base for the branch and it contains a large and nationally important collection of books and periodicals on geology and related sciences, occupying more than two miles of shelving. It comprises over 125 000 volumes as well as a large number of microfilms and microfiche. As a result of long standing exchanges with foreign scientific institutes, many unique sets of serials are held. An extensive map library is part of the main library and there are branch libraries at Dartmouth, Calgary and Vancouver. In addition to providing a bibliographic service for the research program of the Survey, its resources are used by the scientific community at large and nearly 6000 interlibrary loans were made; on the other hand interlibrary borrowings have increased considerably, an indication of the changing pattern of Survey research and the need for information outside the mainstream of geological thought. The Library is responsible for release of information on open file, for the operation of several data files, for data storage and retrieval and for keypunching into the Departmental computer system as a service to branch scientists. A computerized information dissemination service provides bibliographic references on a monthly basis according to the user's scientific interest profile. This service - CAN/SDI - is offered in collaboration with the National Research Council's Canada Institute for Scientific and Technical Information. There are 100 users who pay an annual subscription for this service. The feasibility of offering retrospective bibliographic services using a mix of commercial and institutional earth science data bases is being explored and it is hoped to offer such a service at cost in the coming year.

The Division provides geoscience information on a wide variety of topics through a technical enquiries telephone listing and by correspondence, and on many occasions the Division staff forms the first contact between the Department and the enquiring public.

Personnel Notes

Mrs. W. Robertson left the Geological Survey of Canada at the end of December and Mrs. L. Nadon is our new divisional secretary.

Meetings and Conferences

P. Harker participated in the International Workshop on Earth Science Aid to Developing Countries held at Memorial University, St. John's, Newfoundland and acted as Publication Advisor.

P. Harker represented the Geological Survey at the dedication of a bronze plaque in honour of Sir William Logan at Percé, Quebec on September 10th and gave a short address on the life and works of Logan and the significance of the Gaspé region in Logan's contribution to Canadian geology.

Membership on Committees

P. Harker - GSC History Committee

- Chairman, Departmental Committee on Scientific and Technical Information

- GSC Exhibits Committee

STATUS OF GEOLOGICAL MANUSCRIPTS ON MARCH 31, 1974
WITH COMPARABLE FIGURES FOR 1971-72 and 1972-73

Type of Report	In Process[1]				Published During Year			
	74-75	73-74	72-73	71-72	74-75	73-74	72-73	71-72
Memoirs	7	6	13	11	5	7	2	6
Bulletins	18	25	20	11	13	10	8	22
Economic Geology Reports	0	2	2	2	2	1	1	1
Miscellaneous Reports	1	3	0	0	4	0	4	0
Multicolour Maps *	-	32	11	30	22	26	32	31
P. S. Maps *	-	4	9	10	9	20	16	19
Papers	47	33	42	30	51	57	44	59
Open File Reports	0	0	0	0	69	59	56	31

[1]Includes I.S.P.G. and T.S. editorial units

*For maps see report of Cartographic Unit

SCIENTIFIC EDITING

R.G. Blackadar

The accompanying table gives the volume of work handled during the report period. No backlog of unedited manuscripts exists in the hands of any of the scientific editors. The delays that do occur are in areas beyond the functional control of the Geological Survey - especially the printing of maps and reports.

The use of a larger format, 8½-by 11-inch page size has met with general approval from both staff and users. The Report of Activities series in this format is especially flexible and early in 1975 it was decided to add an issue to the series. In 1975 the report will be released in January, June and a November issue which will include highlights of the field season.

Mr. P.J. Griffin was the successful candidate for a newly created scientific editor's position. Mr. Grffin graduated from the University of Ottawa in 1973 and worked for a short time at the Bedford Institute of Oceanography in Dartmouth, Nova Scotia before joining our staff.

Mrs. J. Copeland resigned from her position as editorial assistant to accept another position elsewhere in the department. She was replaced by Mrs. A.F.V. Koops who transferred from her position of assistant supervisor, Secretarial Services.

Membership on Committees

R.B. Blackadar - GSC History Committee

- EMR Scientific and Technical Information Committee

GEOLOGICAL CARTOGRAPHY SECTION

E.P. Nunn

During the year encouraging progress was made in the development of the computer assisted cartography work of the Section. "Preliminary Map 4-1972, Nueltin Lake" was produced as a multicoloured map by the computer assisted method and the production of a colour proof of Map 1339A, Athabasca of the 1/1 000 000 geological atlas series was accomplished.

The advancement made by our Section in handling and processing geological data for cartographic purposes has been enthusiastically recognized by certain cartographic authorities in the U.S.A. and in Europe.

In March 1975 Unit A was established as the Computer Assisted Cartography Unit and some re-arrangement of personnel was made. Pierre Debain was placed in charge of the Unit as an acting DD 7.

Units B and C under the supervision of L.W. Babcock and E.A. Dumbrell respectively were given responsibility for all maps and illustrations produced by conventional methods.

The fact that Unit C is located at City Centre continued to hinder the production effectiveness of the Cartographic Section.

PERSONNEL

The Section suffered a sad loss by the sudden death of H.S. Nichol on November 27, 1974.

J.G. Crepin resigned in May to accept a position outside the government service and R.G. Lewis resigned in October to take a position with the Department of Indian and Northern Affairs at Fort Smith, N.W.T.

R. Allard was promoted to the level of DD 2 and Y. St. Pierre and J.A.Y. Pratt were promoted to the DD 4 level.

E.P. Nunn continued as the Acting Superintendent of Cartography.

MEMBERSHIP ON COMMITTEES

R.E. Leader	- Board of Directors, Ontario Institute of Chartered Cartographers
J.G.E. Gagnon	- Member, Cartography Suggestions Award Sub Committee
B. Mainville	- Member, Cartography Suggestions Award Sub Committee

PRODUCTION DATA

Maps and illustrations completed by the Cartography Section at end of fiscal year:

	1973-74	1974-75
Multicoloured geological maps	26	22
Preliminary geological maps	28	4
Figure illustrations (pocket)	51	47
Figure illustrations (page)	299	258
Open File maps	-	71
Open File profiles	-	373
Multicoloured maps reprinted	14	7
Preliminary maps reprinted	14	1
Aeromagnetic maps reprinted	127	61
Indexes to Publications revised	10	10

Miscellaneous drafting totalled 60 aeromagnetic maps, 170 illustrations and 105 slides. Miscellaneous jobs such as plotting projections, assembling base maps, preparing open file items, preparing displays etc. along with the miscellaneous drafting accounted for approximately 25% of our total man year.

Maps and illustrations in progress at the end of fiscal year:

	1973-74	1974-75
Multicoloured geological maps	32	41
Multicoloured geological maps (computer assisted)	-	7
Preliminary geological maps	4	4
Figure illustrations	254	80
Federal Government Province-Saskatchewan Geochemistry Maps	-	5
Base-maps for marine geology	-	3

Maps and illustrations received, 1974-75:

	1973-74	1974-75
Multicoloured geological maps	32	21
Preliminary geological maps	23	5
Figure illustrations	398	149

PHOTOMECHANICAL UNIT

N.E. Buck

Work completed in Photomechanical Unit at the end of fiscal year:

Mapping Camera	1973-74	1974-75
Film negatives and positives	8 183	6 503
Contact Processes		
Film negatives	17 598	17 550
Colour Keys on Film	1 085	1 060
Peelcoats	273	259
Scribetches	47	67
Colour Proofs	72	119
Whiteprints	5 810	7 848
Xerox prints	222 438	184 103

LIBRARY SERVICES

Mrs. D.M. Sutherland

Owing to the absence of the head librarian for five months, two periods of six weeks' absence of the cataloguer and the CTF/OF clerk at French classes, as well as extended sick leave and leave without pay of other clerks, the morale of the library staff has been low for almost the whole year. This is reflected in the quantity and quality of the work done and in the annual statistics, which show only what was actually accomplished. It was a struggle just to provide services and prevent the build-up of large backlogs.

In order to reinforce the need for a greater number of man-years in the library, the extra assistance given to the library in former years has been itemized below. These statistics reveal that from 1968/69 to 1972/73 there has been at least one-half of a man-year providing professional assistance. With the extra staff in the winter of 1971/72 the library was able to carry out work not since attempted: for example binding of periodicals, revision and care of the stacks, and sustained program of updating the exchanges and building the collection.

One of the biggest problems is the condition of the stacks. Overcrowding is the worst aspect and this leads to deteriorating and loss of material. The time wasted in searching for mislaid publications and the frustration of the users when they cannot find material is increasing.

Statistics

I Acquisitions (received by purchase, exchange or gift)

Periodicals and serials	20 051
Books	770
Maps	709
CTF Reports	524
Open Files	65

II Circulation

(a) Loans

Books, periodicals etc. to GSC staff	23 992
To individuals other than GSC staff	3 086
To other libraries	1 130
Maps	974
CTF Reports	343

(b) Articles xeroxed in lieu of loan	4 654
(c) Books borrowed or photocopies obtained from other libraries for use of GSC staff	511

(d)	Open Files examined		268
(e)	New registrations		
	Government Officials		133
	Industrial representatives		37
	University professors and students		
	Carleton		62
	Ottawa		33
	Others		15
	General Public		22

III Cataloguing

Books, periodicals, serials	954
Analytics	1 134
Maps	799

IV Clerical

Letters, etc.	425
Catalogue cards printed	15 000 (approx.)
Pages xeroxed	90 261
Requisitions and purchase orders	
- Library	955
- Division	77
Total Subscriptions	
- Library	814
- Division	17

V Reference and Interlibrary Loans

Library enquiries (estimate)		9 000
CTF enquiries		135
Interlibrary loan requests received:		
by form	3 812	
by telex or letter	1 120	
by telephone	1 057	5 989
Publications requested for GSC staff from other libraries		569

VI Translations

Prepared by Secretary of State Dept.	88
Photocopies sold	108

VII Data Processing Unit

Cards punched by DPU staff	300 000 (approx.)
Cards punched by GSC users	191 350
Retrievals from GEODAT file	68
Analyses entered into GEODAT file	3 889
Data sets processed	172

VIII CAN/SDI Unit

Requests for Information	62
Total GEO.REF Profiles	158
Total Profiles by the GSC Search Centre	189

The GSC library participated in the CAN/OLE Pilot project sponsored by CISTI. CAN/OLE is an on-line interactive retrieval system developed jointly by the NRC Computation Centre staff and CISTI for the purpose of searching bibliographic information retrospectively.

Casual and Summer Students in the Library

1968/69	4 summer students 2 casuals (full time) Part time librarian for cataloguing
1969/70	4 summer students Part time librarian for cataloguing One casual (the second was lost owing to the freeze)
1970/71	2 summer students Part time librarian in reference One casual (eventually became permanent)
1971/72	Winter works assistance - 2 librarians 4 clerks 3 summer students
1972/73	Part time librarian in reference 1 casual for three months (to cover absence of permanent staff) 1 student
1973/74	2 students One casual for three months (to cover absence of permanent staff)

PUBLICATIONS DISTRIBUTION OFFICE

J.L.L. Touchette

The following publications were received and made available for distribution during the year:

Economic Geology Series	2
EG-1 Part C (Fr. Map Folio)	1
Memoirs	5
Bulletins	13
Preliminary Papers	51
Preliminary Papers (reprinted)	8
Miscellaneous Geology	22
Miscellaneous Report Series	4
Miscellaneous Report Series (reprinted)	2
Departmental Annual Reports (2 E, 2 F)	4
Open Files	2
Open Files (reprinted)	2
Index to Pubs. (reprinted)	1
Maps "A" Series	22
Maps "A" Series (reprinted)	5
Preliminary Maps	9
Preliminary Maps (reprinted)	3
Aeromagnetic Maps	341
Aeromagnetic Maps (reprinted)	76
Indices to GSC Maps (revised)	1
Indices to Aeromagnetic Maps	2
Indices to Aeromagnetic Maps (revised)	21

Distribution Data

Maps	98 482
Reports	87 619
Indices, listings, etc.	67 653
Total distribution (free and paid)	253 754

Other Data

Requests for publications, information, rock and mineral sets	18 120
Visitors (Cash sales 1662) Others 2735)	4 397
Notification lists	24
Total publications advertised	467

Revenue

Cash received from sales of reports, maps, rock and mineral sets, photographs, etc.		$101 575.21
Sales charged to deposit account	$13 848.78	
Rock sets and publications supplied to Sales Office:		
Calgary	47 142.30	
Vancouver	26 308.40	
Quebec	3 126.50	
Yellowknife	6 086.25	
Whitehorse	6 968.25	$103 480.48
TOTAL SALES VALUE		$205 055.69

PHOTOGRAPHIC SERVICES

J.W. Kempt

We have had a very busy, perhaps hectic year with the work load continually increasing.

By persistent on-the-job training we have finally arrived at a situation where there is a considerable amount of interchangeability among staff members. This puts us into a position where we are not crippled when someone takes a holiday or falls ill.

However, the latest addition to our staff, Mr. Carl Hodge, has been offered a position by the Department of National Defence and will shortly be leaving us.

This puts us again into a situation where we are vulnerable until such a time as we acquire a replacement and train him or her in our methods and procedures.

In particular the work load in the colour laboratory has become extremely difficult, especially due to the last minute rush jobs by the perennial latecomers. A request for additional staff remains unanswered!

A look to the future

(1) We shall be moving the photographic section down to the first floor sometime in the new year. The space alloted to us is smaller than we have at present, but with a bit of judicious juggling we have managed to arrive at a reasonable compromise.

(2) Due to the increase in work load and without any sign of additional help we must turn to automation to solve our problems. In particular this means the purchase of an automated colour processor for our colour section.

We have covered the most important problems and changes that confront us at present. What follows is the yearly report of work done.

G.S.C. Photographic Section
Production Report
FOR THE YEAR 1974 - 1975

Photographs Produced	B/W Negs	Colour Negs	Colour Transp.	Totals Exposed
Equip't-labs-Portraits-Passport	150		184	334
Con. tone-maps-charts	1570	12	2672	4254
Line copies	1268		259	1527
Rock&mineral Specimens	270		1310	1580
Fossil&Macro fossil Specimens	1459	12	6	1477
Macro-Micro-Thin&Polished Spec.	577		198	775
Auto-Radiographs	131			131
Req. Processing B&W Rolls / Col. Rolls	890		710	
Field Photos. B&W Rolls / Col. Rolls	5545		270	
Colour Duplicates			142	142
Total Processed	11860	24	5751	10220
By Government Photo Centre				
By Commercial Photo Services			300	

Prints&Enlargements	Exposed	Processed	Dried	
Black&White	23522	23522	23522	
Colour				Totals
	23522	23522	23522	70566

Prints&Enlargements Numbered&Stamped	12503	
Prints&Enlargements to outside Agencies	418	
Colour Slides	4268	
B&W Slides	916	
Slides mounted	4710	
Negatives Opaqued	1270	
Negatives retouched	247	
Prints spotted	208	
	24540	52395
		300
Grand total		123261

(J. W. Kempt)
Supervisor
June 9th, 1975

INSTITUTE OF SEDIMENTARY AND PETROLEUM GEOLOGY

D. F. Stott, Director

INTRODUCTION

The role of the Institute of Sedimentary and Petroleum Geology is to provide a comprehensive inventory and understanding of the geological framework of the sedimentary basins of western and arctic Canada. These activities are concerned with: ascertaining and evaluating Canada's energy minerals (specifically petroleum, gas, coal and other minerals); facilitating exploration and development by providing geological information related to the occurrences of hydrocarbons, coal, and other minerals; establishing standard chronology and biostratigraphic correlations by paleontological methods; disseminating information on Canada's landmass and resources.

All of the mainland area for which the Institute has responsibility has been mapped at a scale of 1: 250, 000 although final compilations of some areas will not be published for several years. Much of the southern and central Foothills and Rocky Mountains have been mapped at 1: 50, 000 and future mapping, particularly that relating to coal evaluation and structural style, will be at more refined scales. On the Arctic Islands, recent mapping has been concentrated in the Queen Elizabeth, Axel Heiberg, and Ellesmere Islands. New projects are being initiated in the western part of the Sverdrup Basin, northern Ellesmere Island, and in the Somerset-Boothia region; the latter area being of considerable interest as a potential route for a gas line from the Arctic Islands to eastern Canada.

Major advances have been made in the development of methodology for the determination of potential hydrocarbon resources. The techniques being developed will have application to other resource appraisal programs. Potential resource data on petroleum and gas have been prepared for the second Department report on "An Energy Policy for Canada" and the assessment of potential hydrocarbon regions is an ongoing activity.

Advances have been made in integrating palynological, organic geochemical, and inorganic geochemical (clay mineralogical and clay chemical) studies directed toward the determination of the presence or absence of petroleum source rock, degree of thermal alteration, depth of burial, and other parameters related to the development and accumulation of hydrocarbon and migration of fluids within sedimentary rocks. The areas of the Mackenzie Delta, Beaufort Sea, and Sverdrup Basin continue to be of major concern because of the hydrocarbon potential and current discoveries of oil and gas. New field projects have been initiated that are directed toward the understanding of zinc-lead mineralization in the carbonate-shale sequences, as well as other minerals which occur within sedimentary rocks.

Recently, clay studies in the carbonate-shale facies suggest some direct applications in the field of lead-zinc mineralization. Emphasis is being given also to investigation of minerals other than hydrocarbons. Investigations of evaporitic rocks are being continued to determine the occurrence of additional sources of industrial minerals such as potash and barite, and as potential sites for the storage and/or disposal of radioactive waste.

The quantitative and qualitative assessment of the coal resources of Canada is developing into a major program within the Division. Many of the activities parallel those of the hydrocarbon assessment. The development of adequate methodology to assess the total coal resources of Canada is a major challenge at the present time. Data are being accumulated on coal resources of Nova Scotia, New Brunswick, Prince Edward Island, Ontario, Saskatchewan, Alberta, and British Columbia. The first report on the Joint Federal-Provincial Program for the evaluation of the lignite coal resources of southern Saskatchewan was prepared in late 1974. The final report is scheduled for the fall of 1975.

Studies in the various fields of paleontology are establishing and refining models of biostratigraphic and paleoecological zonations. Such models contribute not only to the geoscientific core-program but are directly applicable to the investigations required for resource evaluation. Many of the paleontological studies are concentrated in the regions of Mackenzie Delta and Sverdrup Basin but others are being utilized in conjunction with investigations of the carbonate-shale mineralization and in the coal program.

All maps and illustrations required by Institute staff for publications by the Geological Survey, or in scientific journals, are prepared within the Division; the work includes all drafting for black and white and multicolour illustrations as well as photomechanical and reproduction work. Scientific activities are supported also by a photographic laboratory, and library services.

The building which ISPG occupies is owned by the Department of Energy, Mines and Resources and, as a result, the Division has responsibilities related to building and engineering services. The building houses, in addition to the Division's staff, members of the Terrain Sciences Division, the Mining Research Centre of the Canada Centre for Mineral and Energy Technology, and an office of the National Energy Board.

The building also serves as a major repository for drilling cores, samples, and other data from both onshore and offshore exploration activities in Yukon and Northwest Territories, and for samples from all provinces and from the continental shelves. A distribution office is maintained for the sale of departmental publications, including topographical maps and aerial photographs.

Personnel Notes

Mrs. M. Cascadden, the Director's secretary, resigned in September, 1974, to join her husband who had been transferred to Vancouver. Mrs. Cascadden had been with ISPG since 1969.

Mrs. A. Fenwick, formerly with the National Energy Board, was appointed as secretary in late September.

Attendance at Meetings, Conferences and Courses

D.F. Stott

Edmonton Geological Society Annual Meeting, Edmonton, April 10, 1974.

Branch Management Meeting, Dartmouth, Nova Scotia, May 15-17, 1974.

Geological Association of Canada, Annual Meeting, St. John's, Newfoundland, May 18-22, 1974.

Seminar on delegation of Staffing, Public Service Commission, Edmonton, June 27, 1974.

Princeton Conference, "Central and Northern Rocky Mountains", Red Lodge, Montana, August 26, 27, 1974.

Canadian Society of Petroleum Geologists, Annual Meeting, October 1-3, 1974.

Futures Conference, Geological Survey of Canada, Ottawa, October 15-18, 1974.

Program Review, Department of Mines, Winnipeg, November 5, 1974.

Program Review, Saskatchewan Department of Mineral Resources, Regina, Saskatchewan, November 6, 1974.

Program Review, United States Geological Survey, Denver, Colorado, December 10, 11, 1974.

Special Talks or Lectures

D.F. Stott

"The role of ISPG in Western and Arctic Canada" - to Annual Meeting of the Edmonton Geological Society, Edmonton, Alberta, April 10, 1974.

Membership on Committees

D.F. Stott

Science Policy Committee, Canadian Society of Petroleum Geologists, Member.

Institute Committees

Library Committee:	E.W. Bamber (Chairman)
	M. Jones (Secretary)
	R.W. Klassen
	R.I. Thompson
	R. Thorsteinsson
	T.T. Uyeno
	J.N. Van Elsberg
Exhibits Committee:	D.W. Gibson (Chairman)
	A.R. Cameron
	E.J.W. Irish (ex officio)
	W.S. MacKenzie
	W.P. Vermette
Nomenclature Committee:	R.W. Macqueen (Chairman)
	E.J.W. Irish (ex officio)
	D. Morrow
	J.H. Wall
Committee on Clay Mineralogy and Geochemistry:	R.M. Procter (Chairman)
	A.E. Foscolos
	Geochemistry Section Head
	R.W. Macqueen
	H.P. Trettin
Committee on Curation of Rocks and Fossils:	J.D. Aitken (Chairman)
	A.G. Heinrich
	W.S. Hopkins
	A.D. Miall
	A.W. Norris
	L.L. Price

Committee on Photography:	G.R. Davies (Chairman)
	N.C. Ollerenshaw
	A.E.H. Pedder
Safety Committee:	H.R. Balkwill (Chairman)
	M. Northcott
	G.M. Peterkin
	S. Pickering
Tour Committee:	G.K. Williams (Chairman)
	U. Mayr
	R.G. Walker
	D.G. Wilson
McConnell Club:	R.I. Thompson (President)
	P.R. Gunther (Secretary)
Computer Committee:	K.J. Roy (Chairman)
	W.W. Brideaux
	A.D. Miall

GEOLOGICAL INFORMATION SUBDIVISION

E.J.W. Irish

The Subdivision provides scientific editing as well as cartography, photography, and library services for the Institute. It is responsible, also, for the distribution of publications of the Geological Survey and of other major branches of the Department of Energy, Mines and Resources. A major activity is the processing for publication of all scientific manuscripts in order to promote and maintain high quality standards for reports and maps presenting the results of the research of the Institute. After preparation, manuscripts are forwarded either to Ottawa for printing and publication in the appropriate report series of the Geological Survey or to the editorial staff of one of the scientific journals.

All maps and illustrations required by the Institute staff for publication by the Geological Survey, or in scientific journals and guidebooks, are prepared in the Cartographic Section; the work includes all drafting for black and white and multicolour illustrations as well as photomechanical and reproduction work. The unit also handles a large amount of miscellaneous drafting for slides, displays and open files.

A photographic laboratory provides general and specialized photographic services for the Institute staff.

All publications of the Geological Survey, publications west of the Canadian Shield of the Surveys and Mapping Branch, and various miscellaneous departmental publications are sold and distributed from the publications office. The unit includes, also, an order office of the National Air Photo Library. Aerial photographs may be viewed and ordered through this office.

During this report-period, at the request of the ISPG, members of the Departmental Management Consulting Services spent considerable time in re-organizing stock shelving and office space and in modernizing office methods and procedures of the Publications and Distribution Section.

The library contains an important collection of scientific books, journals and documents relating to the mission of the Institute. It serves the scientists in their research and also offers services to oil and mining company personnel, staff members of the University of Calgary, and the general public. The library also provides an outlet for the Geological Survey Open File system, a valuable means of releasing data and information to the user public with the least possible delay.

Personnel Notes

During the report-period, Mrs. M. D. Wallace resigned her position with the Cartographic Section. In November, this position was filled by Mrs. Susan E. Gill.

Mrs. Margaret McKenzie transferred from the ISPG library to the Curation and Technical Services Section in October. In November, Mrs. Edith A. Dykes joined the staff of the library.

In November, Mrs. Andrena Woolf transferred from the Energy Subdivision to fill the position in the Publications and Distribution Section vacated by F. Maiden who resigned in October.

Attendance at Meetings, Conferences and Courses

J. C. Graff

Association of Calgary Special Libraries. Inaugural meeting, December, 1974.

Workshop on computerized reference services, University of Calgary, March, 1975.

L. MacLachlan

General Meeting of the Ontario Institute of Chartered Cartographers, Ottawa, Ontario, May, 1974.

Manuscripts Processing Section

E.J.W. Irish

Activities

Since April 1, 1974, the number of manuscripts submitted for processing for publication has increased dramatically, and the several factors involved indicate a continued increase.

In part, this is due to the continuing addition of new scientific and technical members to the staff. Also, the work-load has been increased because (a) more and more GSC Bulletins are being printed by the Offset process and (b) an increasing number of manuscripts are being placed on Open File prior to publication.

Procedures (a) and (b) are both done in an effort to make information available as soon as possible.

Production Data

	1974 - 1975
Manuscripts processed and forwarded to printer	
GSC Memoirs	1
GSC Bulletins	5
GSC Papers	39
Maps (A-series)	3
Outside Papers	20
Manuscripts being processed for publication	
GSC Memoirs	0
GSC Bulletins	7
GSC Papers	6
Maps (A-series)	2
Outside Papers	2
Publications printed	
GSC Memoirs	1
GSC Bulletins	5
GSC Papers	27
Maps (A-series)	0
Outside Papers	5
Open File items initiated	13

Geological Cartography Section

L. MacLachlan

Activities

This Section, comprising two units -- drafting and reproduction -- is responsible for all cartographic work required by the Institute. This includes maps and illustrations for reports authored by the scientific staff and either published by the Geological Survey or in scientific journals and guidebooks throughout the world.

A large part of the output is classified as miscellaneous drafting and is not destined for publication in any form. Such work consists of drafting for slides, forms, special bases, preparation for Open File, exhibits, signs, and charts.

The photomechanical and reproduction unit is extremely busy and has required the assistance of casual help on a full-time basis for the past two years. It is hoped that the installation of an automatic film processor in the coming year will alleviate the problem to some extent.

Production Data

Maps and figure illustrations prepared by the Cartographic Section and sent to Ottawa for printing between April 1, 1974 and March 31, 1975:

	1973-1974	1974-1975
Multicoloured geological maps	5	10
Figure illustrations (page)	327	340
Figure illustrations (pocket)	46	35

Miscellaneous drafting, which required 35.5 per cent of the total drafting time over the past year, amounted to 798 separate items, of which 227 were slides and 160 were figures for outside publications.

Manuscripts received	1973-1974	1974-1975
Multicoloured geological maps	2	9
Figure illustrations (page)	174	396
Figure illustrations (pocket)	24	40

Maps and illustrations in progress at March 21, 1975		
Multicoloured geological maps	2	0
Figure illustrations (page)	71	18
Figure illustrations (pocket)	21	15

Backlog of maps and illustrations in the Section	1973-1974	1974-1975
Multicoloured geological maps	0	3
Figure illustrations (page)	65	234
Figure illustrations (pocket)	3	9
Reproduction services		
Diazo prints	5859	6073
Photostat prints	786	670
Photomechanical services		
Film (sheets, negative and positive)	1723	3242
Drafting keys on scribe	62	65
Blueline on Cronaflex	257	205
Colour proofs	13	20
Peel coats	78	132
C-1 prints	706	714
KC-5 prints	776	973

Photographic Section

D. G. Lawrence

Activities

The Section is responsible for providing all general and specialized photographic services for the Institute staff.

Production Data

	1973-1974	1974-1975
Total number 4"x5" black and white negatives		1,643
Total number black and white prints	9,103	11,175
Total number contact proofs	742	760
Total number of line negatives		682
Total number of colour negatives and prints		67
Total number rolls, 35 mm colour slide film (average 25 photos/roll)	110	120
Total number rolls, 35 mm black and white film (average 20 photos/roll)	109	74
Total number rolls of film supplied by staff for processing		56
Total number of slides mounted	450	703
Total number of requisitions processed	398	532
Total operations for the fiscal year	14,546	15,812

I. S. P. G. Library

M. Jones

Activities

The number of scientists at the Institute increased substantially during the year. This, together with the continued change of emphasis of the research programs, resulted in large demands on the library budget and an increased number of requests for information searches and bibliographic compilations.

Statistics

Acquisitions

Books, etc. acquired by purchase (including periodicals)	1,499
Books, etc. acquired by gift or exchange	1,832

Circulation

Books and periodicals (to staff only)	14,058
Interlibrary loans	
Borrowed from GSC, Ottawa	158
Borrowed from other libraries	200
Loans and Xerox copies provided	411

Reference

Inquiries (less than five minutes)	4,994
Inquiries (information searches over five minutes)	1,512

Publications and Air Photo Section

M. H. Brooks

Activities

This Section was re-designed completely following suggestions made by B. McKee and J. DelVillano of the Departmental Management Consulting Services, Ottawa. The office is now on a self-serve basis for the selection of topographical maps. The service was made completely operational in January with the addition of a specialized N. C. R. cash register. This has eliminated the time required to write invoices for each transaction.

The microfilm and microfiche viewers for aerial photographs have been in partial operation since early March. The Section now has complete microfilm coverage for the Province of Alberta and hopes to have complete coverage of Canada in the near future. The system has met with approval from the general public and saves considerable time.

A greater number of people made use of the reading room in the report-year, with several thousand photographs being viewed. As the microfilm viewer becomes more fully operational, we believe that the orders will increase and the viewing time become shorter.

Distribution Data

Office statistics

There was a reduction in written correspondence with this office, but a greater number of customers made inquiries by telephone or in person.

Distribution

Year	Items Received	Items Sold	Value of Items Sold
1973 - 1974	101,125	43,441	$43,216.95
1974 - 1975	81,886	37,856	47,251.01

Breakdown of deposits

	1973 - 1974	1974 - 1975
Surveys and Mapping	$16,067.83	$19,214.58
Mineral development	415.71	213.36
Geological Survey	25,113.55	24,730.61
Gravity Maps	415.71	198.35
Total Receipts:	$42,012.80	$44,346.90

Breakdown of accounts

	1973 - 1974	1974 - 1975
Credit sales	$22,852.60	$23,892.45
Cash sales	19,821.85	21,637.80
Received on account	22,750.80	21,824.10

Orders forwarded to NAPL

Total orders forwarded . . . . . 273 consisting of:

23,286 black and white contact prints
3 colour contact prints
187 flight line index maps
116 diapositives
5 mosaics
147 enlargements
59 ERTS photographs

PALEONTOLOGY SUBDIVISION

B.S. Norford

The Subdivision is responsible for scientific studies in paleontology and biostratigraphy in support of exploration for, and assessment of, the non-renewable resources of western and northern Canada. The program is closely co-ordinated with those of the other Subdivisions of the Institute, with similar programs of the Atlantic Geoscience Centre, the Regional and Economic Geology Division and with those of a number of universities in Canada, the United States, France and the United Kingdom. A substantial and increasing portion of the program of the Subdivision is conducted by consulting companies and by university scientists.

Detailed field investigations throughout western and northern Canada, together with associated laboratory and office studies, establish and refine models of biostratigraphic zonation and paleoenvironments for application throughout most of Canada. A large component of the program involves dating, correlation and determination of depositional environments of rocks in the subsurface of northern Canada by means of detailed studies of palynomorphs, foraminifers, conodonts and other microfossils and macrofossils recovered from the cuttings and cores derived from wells drilled in the Yukon and Northwest Territories in search of petroleum and natural gas.

The Subdivision produced 7 GSC Bulletins, 4 GSC Papers and contributions to 2 others, 7 manuscripts published in scientific journals and 186 reports for restricted circulation.

Personnel Notes

The Subdivision presently consists of a permanent staff of sixteen scientists, six technicians, a secretary, and a number of temporary assistants. It comprises diverse paleontological laboratories and extensive reference collections of fossils.

Four scientists are stationed in Ottawa where Dr. Frebold (retired) continues his distinguished career with the Survey. In addition, a postdoctoral fellow (R.A. McLean), three doctoral students (P. Johnston, R.V. Ludvigsen, R.E. Smith) and four E.M.R. Research Agreements were supported by the Subdivision.

J.H. Wall joined the Subdivision in August from the Research Council of Alberta. T.P. Poulton joined the Subdivision in February after completing his Ph.D. at Queen's University. Late in March, W.A.M. Jenkins transferred to the Subdivision from the Atlantic Geoscience Centre. S. Carbone resigned from the Survey in October, 1974 and M.A. Tomica joined the Subdivision (Macropaleontology Laboratories) at the close of the year. R.A. McLean began tenure of his postdoctoral fellowship in September.

Attentance at Meetings, Conventions and Courses

B.S. Norford

Economics Society of Alberta, Seminar, "Alberta's Future Economic Development", Calgary, March 14, 1975.

Membership on Committees

B.S. Norford

International Union of Geological Sciences, Working Group on Cambrian-Ordovician Boundary, Member.

Palaeontological Association, Overseas Representative (Canada).

Canadian Society of Petroleum Geologists, Palaeontology Division, Chairman.

Micropaleontology Laboratories

R.D. Michie
M.A. Tomica

Production Statistics

The macropaleontology laboratories provide services that prepare fossils for study. One of the main functions of the laboratories is to produce precisely oriented thin sections showing the internal structures of fossils. Over 2,100 sections of corals, fusulinids and small foraminifers were prepared in the past year. Other services include chemical and mechanical extractions of fossils, casting and moulding, grinding, sawing, and polishing of rocks and fossils. The functions of the curating office were transferred to the Regional Geology Subdivision during the year.

Micropaleontology Laboratories

D. F. Haden
H. M. Johnson
S. A. Pickering
L. L. Heisler

Foraminiferal Laboratory

During the year laboratory personnel processed and curated the following samples:

Surface (outcrop)	492
Subsurface (well cuttings, core)	725
Total	1,217

1,681 samples were picked for microfossils by outside contract. Services performed as direct scientific support included photomicrography, drafting, log plotting, microfossil lists and distribution chart compilation. Other duties included supervision of three technicians and casual employees in the micropaleontological laboratories, equipment purchasing and maintenance, monitoring of safety procedures, and investigation and development of new laboratory procedures and techniques.

D. F. Haden completed courses in operation and use of scanning electron microscopes and in first aid. One student (Lois Palmer) was instructed in foraminiferal preparation and supervised for approximately four months during the year.

Palynology Laboratory

The laboratory processed a total of 936 samples for palynomorph study this year; 836 samples for miospore study and 200 samples for megaspore study and reference checks. Of these, 626 samples were prepared for projects led by Drs. Brideaux, Hopkins, and Sweet; and 310 for other GSC projects. These preparations were made from both clastic rock and coal samples obtained from the Arctic Islands, Yukon Territory, District of Mackenzie, eastern and western Canada.

The general duties of the technicians included processing and mounting of samples, development of new laboratory techniques and procedures, photomicrographic services, and general maintenance of the palynology and photography (Rm. 219) laboratories; also detailed scientific support (microscope studies) and training of a technician from another division in basic palynology laboratory procedures. Special duties performed by the technicians included:

1) Preparation, organization and presentation of instructional and scientific material for a seminar-workshop on palynological laboratory techniques. The workshop was attended by twenty-five palynologists, laboratory managers and technicians from industry and universities.

2) Compilation of information required for the establishing of a Palynology Laboratory in Turkey (Dr. McGregor's UNESCO assignment). This information included pictures, sketches, blueprints, equipment and chemical lists, manufactureres lists, cost estimates and general procedural and technical recommendations.

Conodont Laboratory

During the year, 266 samples were processed, picked and recorded as follows:

87 - Research projects - Dr. Uyeno
165 - Research projects led by other scientists of GSC, of other government departments and of Oil Companies
14 - residues only (as above)

Assistance in preparation and picking was given by a student (Claude Aussante) during summer months. L.L. Heisler spent 2 months of the year on scientific compilation.

Subdivision Manuscripts

Manuscripts for 7 GSC Bulletins, 9 GSC Papers or parts, and 7 Papers for outside journals were accepted and approved by the Division during 1974-1975. A number of reports of limited circulation also were prepared.

Reports

The Subdivision produced a total of 181 reports in 1974-1975 for direct quotation in publications, identifying and dating 3,927 lots of fossils as follows:

Bamber	3 reports on	31 lots
Brideaux	16 reports on	87 lots
Frebold (retired)	14 reports on	141 lots
Hopkins	24 reports on	163 lots
Jeletzky	10 reports on	543 lots
Nassichuk	1 report on	4 lots
Norford	16 reports on	134 lots
Norris	6 reports on	36 lots
Pedder	7 reports on	65 lots
Poulton	2 reports on	4 lots

Sweet	6 reports on	26 lots
Tozer	24 reports on	140 lots
Uyeno	20 reports on	151 lots
Wall	10 reports on	222 lots
Scientists in universities	10 reports on	98 lots
Scientists in industry	13 reports on	2,082 lots

Micropaleontology Section

T.T. Uyeno

Activities

The Section is responsible for research in the paleontology of microfossils, the establishment and further refinement of biochronology, and the interpretation of depositional environment and geography, both marine and continental, with the use of microfossils. The responsibility extends country-wide for some disciplines, and more particularly to the Yukon, the Northwest Territories, and western Canada for others. Proper understanding of depositional history and precise dating and correlation of strata are mandatory for correct evaluation of potential hydrocarbon deposits, including coal. In many lithologies, microfossils are the only fossils present, and are particularly useful in subsurface studies owing to their durability and minute size. Studies are conducted in close co-operation with other geologists of the Geological Survey of Canada, and of industry and universities.

Scientists of the Section conducted field studies on Tertiary rocks of Axel Heiberg and Ellesmere Islands, and collected comparative material from mondial standard sections of the Devonian System in Belgium and of the Cretaceous System in southern England. Subsurface collections include samples from wells drilled on the Mackenzie Delta and the Arctic Islands, offshore British Columbia, and coal seams from southern Saskatchewan. Some specific studies of the Section include palynology (spores, megaspores, pollens, and dinoflagellates) of the Jurassic through Tertiary rocks of the Mackenzie Delta area and the Arctic Islands; Paleocene megaspores from coal seams of southern Saskatchewan; Mesozoic Foraminifera of the Mackenzie Delta area and the Arctic Islands; and Siluro-Devonian conodonts of the Arctic Islands, western District of Mackenzie, and southern Manitoba.

Attendance of Meetings, Conferences and Courses

W.W. Brideaux, W.S. Hopkins, Jr., and A.R. Sweet

American Association of Stratigraphic Palynologists, Annual Meetings, Calgary, October 17-19, 1974.

GSC Palynology Workshop, Calgary, October 16, 1974.

W. S. Hopkins, Jr.

Louisiana State University, Short Course in Cenozoic and Quaternary Palynology, Baton Rouge, Louisiana, January 14-19, 1975.

T. T. Uyeno

International Symposium on Belgian Micropaleontological Limits, Namur, Belgium, September 1-11, 1974.

J. H. Wall

Canadian Society of Petroleum Geologists, Symposium on Canada's Continental Margins and Offshore Petroleum Exploration, Calgary, September 29 - October 2, 1974.

Visits, Consultation and Study of Comparative Material

T. P. Chamney

University of London, England, Winter 1974-1975.

T. T. Uyeno

Institut Royal des Sciences Naturelles de Belgique, Brussels, Belgium; September 15-22, 1974.

Natur-Museum Senckenberg, Frankfurt/Main, West Germany; September 23, 1974.

Phillipps Universität, Marburg/Lahn, West Germany, September 24-26, 1974.

Memberships on Committees

W. W. Brideaux

American Association of Stratigraphic Palynologists, Vice-President, 1973-74; Co-chairman, Annual Meeting Committee, October 15-19, 1974.

T. T. Uyeno

North American Devonian Study Group, Member.

J. H. Wall

Journal of Foraminiferal Research, Associate Editor.

Special Talks and Lectures

W.S. Hopkins, Jr.

"Comments on Lower Cretaceous geology and contained terrestrial microflora of the Sverdrup Basin, N.W.T."; American Association of Stratigraphic Palynologists, Annual Meeting, Calgary, October 17-19, 1974.

A.R. Sweet

"Reconnaissance survey of Mesozoic and Tertiary megaspores in southern Canada"; American Association of Stratigraphic Palynologists, Annual Meeting, Calgary, October 17-19, 1974.

J.H. Wall

"The micropaleontology of the Upper Cretaceous Bearpaw Formation of southern Alberta"; Canadian Society of Petroleum Geologists, Palaeontology Division, Calgary, February 17, 1974.

Macropaleontology Section

A.W. Norris

Activities

The Section is responsible for research in the paleontology of invertebrate macrofossils, and in biostratigraphy and interpretation of depositional environments and paleobiogeography by the use of fossils. The area of responsibility includes the western provinces, Yukon Territory, and Districts of Mackenzie and Franklin. The establishment and continued refinement of biochronological zonation of Phanerozoic sediments is a vital part of searching for and assessing the economic resources of the rocks of this vast region. Activities of the Section are closely integrated with other Sections of the Institute, and the Division of Regional and Economic Geology, particularly in stratigraphical, paleoecological, sedimentation and economic studies.

Current stratigraphic and biostratigraphic studies include the Devonian rocks and fossils of southern Manitoba, Yukon Territory, District of Mackenzie, and Ellesmere Island; Mississippian corals of western North America; Carboniferous biostratigraphy in northeastern British Columbia; Carboniferous ammonoids and evaporite deposits of the Canadian Archipelago; Upper Permian ammonoids of northeastern British Columbia; and Lower Cretaceous mound-like carbonate rocks of Ellef Ringnes Island. Several members of the Section were involved in international committees and commissions on problems of faunal correlations and stage and series boundaries of two of the Phanerozoic Systems.

Attendance at Meetings, Conventions and Courses

A.W. Norris

Field conferences and meetings of the Subcommission on Devonian Stratigraphy held in West Germany, France and Belgium, August 23 - September 5, and in Morocco, March 1-15, 1974.

Membership on Committees

W.W. Nassichuk

International Union of Geological Sciences, Commission on Stratigraphy, Secretary-General.

International Union of Geological Sciences, Subcommission on Permian Stratigraphy, Vice-Chairman.

International Union of Geological Sciences North American Study Group on the Permian System, Member.

A.W. Norris

International Union of Geological Sciences, Subcommission on Devonian Stratigraphy, Member.

North American Devonian Study Group, Organizing Member.

A.E.H. Pedder

Second International Symposium on Corals, Paris, 1974, Member, Organizing Committee.

International Union of Geological Sciences, Subcommission on Devonian Stratigraphy, Corresponding Member.

International Palaeontological Association, International Research Group, Canadian Secretary.

Ottawa Paleontology Section

E.T. Tozer

The unit consists of scientists specialized in studies of the macropaleontology and biostratigraphy of the Mesozoic rocks of northern and western Canada.

Attendance at Meetings, Conferences and Courses

J.A. Jeletzky

International Symposium on Molluskan Phylogeny, London, England, April 10-17, 1974.

Canadian Society of Petroleum Geologists, Symposium on Canada's Continental Margins and Offshore Petroleum Exploration, Calgary, September 29 - October 2, 1974.

International Union of Geological Sciences, Working Groups on Jurassic-Cretaceous Boundary and on Mid-Cretaceous Events, Paris, France, November 5-7, 1974.

Geological Society of America and associated societies, Annual Meetings, Miami, U.S.A., November 18-20, 1974.

Membership on Committees

J.A. Jeletzky

International Union of Geological Sciences, Subcommission on Cretaceous Stratigraphy, Member.

International Geological Correlation Program, Mid-Cretaceous Events Project, Canadian Representative.

E.T. Tozer

International Union of Geological Sciences, Vice-Chairman, Subcommission on Triassic Stratigraphy.

International Union of Geological Sciences/United Nations Educational Scientific and Cultural Organization, International Correlation Programme, Secretary, Canadian National Committee.

Special Talks and Lectures

J.A. Jeletzky

"Mid-Cretaceous biochronological events in western and arctic Canada"; International Union of Geological Sciences, Working Group on Mid-Cretaceous Events, Paris, France, November 5-8, 1974.

J.A. Jeletzky

"Cretaceous transgressions and regressions in western and arctic Canada"; Geological Society of America, Annual Meetings, Miami, U.S.A., November 18-20, 1974.

Visits

J.A. Jeletzky

Federal Geological Survey, Hanover, West Germany, November 10-16, 1974.

Institute of Marine Sciences, University of Miami, U.S.A., November 21-30, 1974.

REGIONAL GEOLOGY SUBDIVISION

G.C. Taylor

The Subdivision's major role is the development of the geoscience data base for the sedimentary basins of western and northern Canada that lie east of the Rocky Mountain Trench and west and north of the Canadian Shield. Data are obtained through surface mapping; stratigraphic studies; subsurface studies of well samples, cores, and mechanical logs; and, under the marine environment, from geophysical records. These studies are augmented by laboratory investigations and collated with the output of other units, particularly the Paleontology Subdivision, to document the geology and conceptual models as interpreted or developed by the Subdivision's Research Scientists. This, in effect, constitutes the Basin Analysis Program, rather than the narrower aspect of just the subsurface component as it has been construed in the past. The results of these investigations are made available to the public through publication or by oral presentation.

The Subdivision acts also in a secondary role as an internal advisor to the Energy Subdivision, assisting them in their evaluation of the hydrocarbon potential of the sedimentary basins. Within the context of Canada's Energy supplies it requires little foresight to recognize the re-emergence of coal as a major resource. Anticipating the need for a much stronger data-base, some of our man-power has been redirected to investigate the geology of coal.

The Subdivision's mandate is carried out with a staff of 19 Research Scientists complemented by five Physical Scientists. In addition, there are two vacancies (one staffed). Productivity in our major role is documented by the publication of 4 GSC Bulletins, 20 GSC Papers, 2 A-series maps, 4 preliminary maps, and 13 outside papers during fiscal year 1974-75.

Personnel Notes

For his fine paper published in the G.S.A. Bulletin, G.R. Davies (co-authored by Ludham) received honorable mention by the Medal of Merit Award Committee of the Canadian Society of Petroleum Geologists. This esteem is undoubtedly reflected in his election to the office of Vice-President of that Society.

Several new appointments were made to the Subdivision. R.I. Thompson joined the staff in June, coming to us from the British Columbia Department of Mines. He is conducting structural studies in the Rocky Mountains of British Columbia.

D.W. Morrow joined the staff in July coming from Mobil Oil. He will be studying carbonate rocks in the Mackenzie mountains.

U. Mayr also joined the Subdivision in July coming from J.C. Sproule and Associates. Dr. Mayr is studying the Paleozoic carbonates of the eastern Arctic Islands.

G.E. Reinson joined the staff in November as a clastic sedimentologist, coming from Amoco Canada Petroleum Company. Dr. Reinson, also, will be working initially in the eastern Arctic.

During the year, the curation function for the Institute was assigned also to the Subdivision. M.A. McKenzie transferred from the Library staff in October to become Curation Clerk and R.J. Broadfield joined the staff in February as storesman.

A. Carbone joined the staff as a technician in May replacing J.L. Rees who resigned the position.

Helen Belyea retired in December after a long and distinguished career with the Survey. We are most fortunate that Dr. Belyea continues to work in our midst, finishing outstanding projects and remaining available for consultation.

W.S. MacKenzie resigned his position at the end of the fiscal year to accept a foreign posting with Industry.

K.J. Roy transferred from the Subdivision to accept the position of Head of the Petroleum Geology Section of the Energy Subdivision.

R.L. Christie has spent most of the report-year on exchange with the Greenland Geological Survey working both in the field and at the home office in Copenhagen.

J.C. Trenchant, a student from France, completed his assignment in lieu of military service, having worked on Middle Devonian lithostratigraphy of the Zama Rainbow areas, Elk Point Basin, northern Alberta.

Attendance at Meetings, Conferences and Courses

G.C. Taylor

Management Development for Research Managers, Hawkesbury, Ontario, January, 1975.

Geological Society of America, Rocky Mountain Section, Flagstaff, Arizona, May, 1974.

Northern Mainland Section

D.G. Cook

Activities

Research interests of scientists concerned with studies in the Northern Mainland pertain to stratigraphic and structural studies in the Interior Plains, the Mackenzie Delta, and the thrust and fold belt of the Cordillera, in general between 64 degrees north latitude and the Arctic Ocean. Research during 1974-75 included both surface and subsurface studies, aimed at energy and mineral resource evaluation in conjunction with the establishment of a sound geoscience data base. Surface studies included a field study of Proterozoic stratigraphy, preparation of stratigraphic reports on Mesozoic stratigraphy, and preparation of geological maps and reports of northern Yukon Territory, northern Mackenzie Mountains, and northern Franklin Mountains. Subsurface studies dealt primarily with Mesozoic and Cenozoic strata in the Mackenzie Delta, and Paleozoic and Mesozoic strata in the northern Interior Plains including Porcupine Plateau.

Attendance at Meetings, Conferences and Courses

D.G. Cook

Geological Association of Canada - Mineralogical Association of Canada, Annual Meeting, St. John's, Newfoundland, May 19-22, 1974.

Second Canadian Symposium on Remote Sensing, Guelph, Ontario, April 29-May 1, 1974.

Meeting of the Geoscience Working Group of the Canadian Advisory Committee on Remote Sensing, Calgary, Alberta, October 29, 1974.

Management Grid Seminar, Cornwall, Ontario, March 16-22, 1974.

J.D. Aitken

Participated in the organization and presentation of the non-credit course "Zinc and Lead Deposits in Canadian Sedimentary Environments" Division of continuing education, University of Calgary, March 17-18, 1975.

D.W. Myhr

Canadian Society of Petroleum Geologists, 1974 Symposium, "Canada's Continental Margins and offshore Petroleum Exploration", Calgary, October 2, 1974.

Canadian Society of Petroleum Geologists Sedimentology Workshop. Use of sedimentary structures for recognition of clastic environments; Calgary, October 17-18, 1974.

American Association of Petroleum Geologists, Society of Economic Paleontologists and Mineralogists; Joint Annual Meeting, San Antonio, Texas, April 1-3, 1974.

D.K. Norris

International Society for Rock Mechanics, Denver, Colorado, September 2-8, 1974.

Canadian Society of Petroleum Geologists, 1974 Symposium, "Canada's Continental Margins and Offshore Petroleum Exploration", Calgary, September 29 - October 2, 1974.

F.G. Young

American Association of Petroleum Geologists - Society of Economic Paleontologists and Mineralogists; Joint Annual Meeting, San Antonio, Texas, April 1-3, 1974.

Canadian Society of Petroleum Geologists, 1974 Symposium, "Canada's Continental Margins and Offshore Petroleum Exploration", September 29 - October 2, 1974.

Canadian Society of Petroleum Geologists, Clastics Core Conference, Calgary, October 17, 18, 1974, Organizing Committee Member.

Special Talks and Lectures

D.G. Cook

"Tectonic Thickening in the Western Main Ranges"; presented to the Canadian Society of Petroleum Geologists, Structural Geology Group, March 24, 1975.

J.D. Aitken

"Foreigners on the Lena"; an invited address to the Cordilleran Section, Geological Association of Canada, Vancouver, October 10, 1974.

D.W. Myhr

"Geology of the Beaufort-Mackenzie Basin"; co-authored with C.J. Yorath and F.J. Young; Canadian Society of Petroleum Geologists Luncheon, January, 1975.

D.K. Norris

Tenth Commonwealth Mining and Metallurgical Congress, "The Great Coal Route", September 16-20, 1974, Leader.

Department of Geology, University of Calgary, "The Kaltag Fault and its place in Cordilleran Tectonics", Calgary, November 4, 1974.

Conference on Canada's Northern Resources, "The Geology and Mineral Potential of northern Yukon Territory", Whitehorse, December 10, 1974 and Yellowknife, December 12, 1974.

The Geological Association of Canada, "The Geology and Mineral Potential of northern Yukon Territory, Vancouver, January 9, 1975.

Coal Miner Foreman's Course, Southern Alberta Institute of Technology, "The Geology of western Canadian Coal Deposits", Blairmore, Alberta, February 8, 1975; Calgary, Alberta, February 10, 1975; Seba Beach, Alberta, Febrary 15, 1975; Canmore, Alberta, February 16, 1975; Grande Cache, Alberta, March 9, 1975; Hinton, Alberta, March 10 and 11, 1975.

F.G. Young

Canadian Society of Petroleum Geologists, Noon Luncheon Meeting, October 16, 1974, "Bioturbation structures in clastic rocks".

Canadian Society of Petroleum Geologists, Paleo Group Meeting, December 16, 1974, "Trace fossils and substrate relationships".

Canadian Society of Petroleum Geologists, Noon Luncheon Meeting, January 6, 1975, "Geology of the Beaufort-Mackenzie Basin"; co-authored with C.J. Yorath and D.W. Myhr.

Southern Mainland Section

R. W. Macqueen

Activities

Stratigraphic, sedimentological and structural studies in the eastern Cordilleran Orogen and southern Interior Platform of Alberta and British Columbia continue to improve our knowledge of the nature, origin, deformational history, and economic potential of the sedimentary suites involved. During 1974-75, regional work in the Cordillera of northeastern British Columbia was continued, involving synthesis and interpretation of data for both reconnaissance and detailed scales of mapping. Progress was made in the northeastern British Columbia Cordillera on defining the relationship between Paleozoic carbonate-shale transitions and the zinc-lead occurrences in the area. Detailed geological studies of the Foothills of southwestern Alberta, an area in which there is considerable interest in coal and hydrocarbon occurrence, were continued: several detailed geological maps and cross-sections of this area were completed. A surface study of coal-bearing Mesozoic rocks in the Central Alberta Plains nears completion. New projects begun during the year include a study of coal-bearing Mesozoic rocks in the southern Foothills of British Columbia, and a regional compilation and synthesis of salt deposits in western Canada, initiated at the request of Atomic Energy of Canada Ltd. and primarily involving published data.

Attendance at Meetings, Conferences and Courses

R.W. Macqueen

Geological Association of Canada, Annual Meeting, St. John's, Newfoundland, May, 1974.

Geological Society of American, Annual Meeting, Miami, Florida, November, 1974.

Geological Association of Canada, Cordilleran Section, Annual Meeting: "Intrusive rocks and mineral deposits in the Cordillera", Vancouver, February 7, 8, 1975.

Geological Association of Canada Council meeting, Toronto, Ontario, October 18, 1974.

American Commission on Stratigraphic Nomenclature. Meeting in Denver, Colorado, September 18, 1974.

Edmonton Geological Society - Edmonton Section, Geological Association of Canada, Annual Meeting, April 16, 1974.

N.C. Meijer-Drees

Canada's Continental Margins and Offshore Petroleum Exploration; Canadian Society of Petroleum Geologists, Calgary, September 29 - October 2, 1974.

N.C. Ollerenshaw

"The Geology of Reefs" by Dr. T.P. Scoffin, sponsored by University of Calgary and C.S.P.G., February 26-28, and April 9-11, 1975.

G.K. Williams

Canadian Society of Petroleum Geologists, 1974 Symposium, "Canada's Continental Margins and Offshore Petroleum Exploration", Calgary, September 29 - October 2, 1974.

Special Talks and Lectures

R.W. Macqueen

"Facies changes, dolomitization, and zinc-lead mineralization in Devonian rocks of Peace River area, Rocky Mountains, northeastern British Columbia"; co-authored by G.C. Taylor. Geological Association of Canada, Annual Meeting, St. John's, Newfoundland, May 21, 1974.

"Carbonate facies and metallic mineral exploration"; talk to Canadian Institute of Mining and Metallurgy, Calgary Branch, January 22, 1975.

"Base metal deposits in Sedimentary Rocks"; Graduate Seminar, University of British Columbia, March 12, 1975.

"Devonian rocks and zinc-lead mineralization, northeastern British Columbia": co-authored by R.I. Thompson; talk given to Geological Association of Canada. Cordilleran Section, Vancouver, March 13, 1975.

Contributor to workshop: "Zinc and lead deposits in Canadian Sedimentary Environments"; University of Calgary, March 17 and 18, 1975, organized by Prof. A.A. Levinson [Contributors: A.A. Levinson, R.B. Farquharson (University of Calgary); B. Hitchon (Research Council of Alberta); and D.F. Sangster, J.D. Aitken, and R.W. Macqueen (Geological Survey of Canada)].

N.C. Ollerenshaw

Leader of field trip for the Structural Geology Group of the Canadian Society of Petroleum Geologists to Sheep River in May, 1975.

Gave lecture on the geology of the Foothills to the Department of Geology, University of Calgary, March 25, 1975.

R.I. Thompson

"Lead and zinc in Middle Devonian carbonate rocks of northeastern British Columbia"; talk to Geological Association of Canada, Cordilleran Section, Vancouver, March 13, 1975.

Marine Geology

Activities

In August, 1974, in co-operation with the Atlantic Geoscience Centre, a cruise was undertaken in northern Baffin Bay and Lancaster Sound. The purpose of the project was to obtain samples of the sea-floor bedrock with the use of an electric core-drill designed by the Metrology Division of the Atlantic Oceanographic Laboratory. A number of short, bedrock cores were successfully recovered, and these, in conjunction with high-resolution seismic records will be used to add to the growing understanding of the geology of this region.

In the Beaufort Sea-Mackenzie Delta region, donated industrial deep reflection seismic data were used in support of structural and tectonic studies in order to define the major structural sub-provinces of the area.

Attendance at Meetings, Conferences and Courses

C.J. Yorath

Geological Association of Canada-Mineralogical Association of Canada, Annual Meeting, St. John's, Newfoundland, May, 1974.

Canadian Society of Petroleum Geologists, 1974 Symposium, "Canada's Continental Margins and Offshore Petroleum Exploration", Calgary, September 29 - October 2, 1974.

Seismic Interpretation for Geologists - a course on seismic interpretation given in Calgary, October, 1974.

Special Talks and Lectures

C.J. Yorath

"The Tectonic development of the southern Beaufort Sea" - C.J. Yorath, D.K. Norris - presented at the symposium "Canada's Continental Margins and Offshore Petroleum Exploration", Calgary, October, 1974.

"The geology of the Beaufort-Mackenzie Basin" - C.J. Yorath, D.W. Myhr and F.G. Young, presented to the Canadian Society of Petroleum Geologists, January, 1975.

Arctic Islands Section

R. Thorsteinsson

Activities

Work in the Arctic Islands is directed mainly toward the interpretation of the stratigraphic and structural history of Phanerozoic sedimentary rocks of the Arctic Archipelago, and the evaluation of the economic potential of these strata. A secondary objective is research on the relationship of tectonic features of the Arctic Islands to continental and ocean structures and history. The field phases of two major projects were completed: one on Banks Island; the other on King Christian Island, and the Ringnes Islands. Advance preparations were made to initiate two other major field programs: one on northern Ellesmere Island; the second on Somerset Island and the Boothia Peninsula.

Attendance at Meetings, Conferences and Courses

H.R. Balkwill

American Association of Petroleum Geologists-Society of Economic Paleontologists and Mineralogists, Annual Meeting, San Antonio, Texas, April 1-3, 1974.

National Conference on Earth Sciences, Banff, Alberta, May 5-9, 1974.

G.R. Davies

American Association of Petroleum Geologists-Society of Economic Paleontologists and Mineralogists, Annual Meeting, San Antonio, Texas, April 1-3, 1974.

Course in "Geology of reefs", joint Canadian Society of Petroleum Geologists-University of Calgary, February, 1975.

Three-day visit to Lamont-Doherty Geological Observatory of Columbia University, New York, December, 1974.

J.W. Kerr

Canadian Society of Petroleum Geologists, 1974 Symposium, "Canada's Continental Margins and Offshore Petroleum Exploration", Calgary, May, 1974.

A.D. Miall

Canadian Society of Petroleum Geologists, 1974 Symposium, "Canada's Continental Margins and Offshore Petroleum Exploration", Calgary, May, 1974.

Seminar "Seismic Methods in Geology", Canadian Society of Petroleum Geologists, April, 1974.

Seminar "The Geology of Reefs", Canadian Society of Petroleum Geologists, February and April, 1975.

D.G. Wilson

Canadian Society of Petroleum Geologists, 1974 Symposium, "Canada's Continental Margins and Offshore Petroleum Exploration", May, 1974.

Special Talks and Lectures

H.R. Balkwill

"Tectonic and depositional framework of Arctic Islands: Sverdrup Basin"; American Association of Stratigraphic Palynologists, Annual Meeting, Calgary, Alberta, October 16, 1974 (co-authored, H.P. Trettin).

"Tectonic and depositional framework of Arctic Islands: Sverdrup Basin"; Geological Association of Canada, Cordilleran Section, Vancouver, December 11, 1974 (co-authored, H.P. Trettin).

"Mesozoic and Cenozoic tectonics and sedimentation, Sverdrup Basin, Arctic Archipelago"; Canadian Society of Petroleum Geologists, Technical Meeting, Calgary, March 26, 1975.

G.R. Davies

Fifteen oral presentations were given to various groups during the year. Most of these were presented during a two-week tour in late November - early December that developed from an invitation to repeat the talk given at the 1974 AAPG-SEPM Annual Meeting to students at McGill University. Talks summarizing the results of field and laboratory work on upper Paleozoic carbonates and evaporites in the Sverdrup Basin of the Arctic Islands were presented to the following groups:

American Association of Petroleum Geologists, Annual Meeting, San Antonio, Texas
McMaster University, Ontario
University of Toronto, Ontario
Queen's University, Ontario
McGill University, Quebec
University of North Carolina, N.C.
McConnell Club, I.S.P.G., Calgary

Talks covering Ph.D. studies of modern carbonate sedimentation in Shark Bay, Western Australia, were given during 1974 at the following places:

McMaster University, Ontario
University of Toronto, Ontario
Queen's University, Ontario
Carleton University, Ontario
McGill University, Quebec
State University of New York at Queens, New York
University of North Carolina, N.C.
Syracuse University, New York

J.W. Kerr

"Tectonic Setting of Lead-Zinc Deposits, Arctic Islands, Canada"; to Second Annual Geoscience Forum, Yellowknife, December, 1974.

A.D. Miall

"Post-Paleozoic Geology of Banks, Prince Patrick and Eglinton Islands, Arctic Canada"; Canadian Society of Petroleum Geologists, October, 1974.

H.P. Trettin

"Tectonic and depositional framework of Arctic Islands"; (invited paper, Annual Meeting, American Association of Stratigraphic Palynologists, Calgary, October 16, 1975 (co-authored, H.R. Balkwill).

"Tectonics and deposition in the Arctic Islands", Structural Geology Division, Canadian Society of Petroleum Geologists, Calgary, November, 1975 (co-authored, H.R. Balkwill).

"Tectonics and deposition in the Arctic Islands", Cordilleran Division, Geological Association of Canada, Vancouver, November, 1975 (co-authored, H.R. Balkwill).

Membership on Committees

H.R. Balkwill

Advisory Committee on National Conference on Earth Sciences (University of Alberta, Canadian Society of Petroleum Geologists), Member.

Canadian Society of Petroleum Geologists, Director.

Bulletin of Canadian Petroleum Geology, Associate Editor.

D.G. Cook

Field Trip Committee, Canadian Society of Petroleum Geologists, Canadian Society of Exploration Geophysicists, Chairman.

Link Award Committee of Canadian Society of Petroleum Geologists, Member.

Geoscience Working Group, Canadian Advisory Committee on Remote Sensing, Member.

G.R. Davies

Technical Program Committee, Canadian Society of Petroleum Geologists, 1974, Chairman.

National Research Council, Negotiated Grant Committee (McGill University Proposal).

M.Sc. Program, Department of Geology, University of Calgary, External Examiner.

D.W. Gibson

Subcommission on Triassic Stratigraphy, International Commission on Stratigraphy, IUGS, Member.

R.W. Macqueen

Geological Association of Canada, 1973-75, Councillor.

Programme Committee, Geological Association of Canada, Chairman.

American Commission on Stratigraphic Nomenclature, 1974-75 (representing ISPG), Chairman-designate.

Geoscience Canada (Publication of Geological Association of Canada), Associate Editor.

A.D. Miall

Stratigraphic Nomenclature Committee, Canadian Society of Petroleum Geologists, Member.

Exhibits Committee, Canadian Society of Petroleum Geologists Offshore Symposium, September, 1974, Chairman.

D.W. Myhr

Geological Highway Map and Signs Committee, Canadian Society of Petroleum Geologists, Member.

Field Trip Committee, Canadian Society of Petroleum Geologists, Canadian Society of Exploration Geophysicists, Member.

N.C. Ollerenshaw

Circulation Committee, Canadian Society of Petroleum Geologists, Chairman.

Field Trip Committee, Canadian Society of Petroleum Geologists, Canadian Society of Exploration Geophysicists, Member.

D.K. Norris

Medal of Merit Committee, Canadian Society of Petroleum Geologists, Member.

Committee for the preparation of C.S.P.G. Stratigraphic Guide Book, Canadian Society of Petroleum Geologists, Chairman.

H.P. Trettin

Canadian Geodynamics Subcommittee, National Advisory Committee on Research in the Geological Sciences, Corresponding member.

C.J. Yorath

Education and Applications of Geology Committee, Canadian Society of Petroleum Geologists, Chairman.

Proceedings of International Symposium on Canada's Continental Margins and Offshore Petroleum Exploration, October, 1974, Editor.

Geology and Solid Earth Geophysics Panel for the Committee on Polar Research under the National Academy of Science for the United States, Member.

F.G. Young

Geological Research Committee, Canadian Society of Petroleum Geologists, Member.

Core Committee, Canadian Society of Petroleum Geologists, Member.

Sedimentary Laboratories, Core Repository and Curation Section

Lapidary and Sedimentology Laboratory

The lapidary produced 2,800 thin sections, of which 1,000 required special procedures and 750 were stained for mineral identification. The laboratory also conducted a small number of size analyses and heavy mineral separations.

Cores, Samples, Electric Logs

Electric Logs received from Riley's Datashare

Territories	B.C.	Alta.	Sask.	Man.	Total
443	370	8,552	789	39	10,193

Samples received - all sources

Territories	B.C.	Alta.	Sask.
47,451	39,097	267,996	18,178

Core received from Territories - 534 boxes

Total visitors - 2,100

Samples were examined from a total of 780 wells and there were 14,340 boxes of core requested.

Curation

The curation system became fully operative during February, 1975. In addition to day-to-day retrievals and shipping, it received 9,500 specimens of rocks and fossils for permanent storage, of which more than half were backlog material collected before April 1, 1974. At the accelerated present rate of progress, it is estimated that the remaining backlog of 60,000 specimens will be cleared in about two and one-half years.

The card-index system in present use, designed for a computer file, is being prepared for electronic filing under both GRASP and MARS systems on a trial basis.

ENERGY SUBDIVISION

R. G. McCrossan

The Subdivision is responsible for the basic work necessary for the evaluation of the energy commodities of coal and petroleum occurring in the sedimentary basins of western Canada. The geological studies are done either within the Subdivision or co-ordinated through the Regional Geology Subdivision of the Institute and contribute to national inventories of the resources of petroleum and coal. Two groups operating within this subdivision also have a national responsibility through departmental headquarters for the preparation of quantitative estimates of the national resources.

The Subdivision comprises four sections. Two of these are responsible for the two main energy commodities: one for information and data pertaining to petroleum and one for all matters related to coal. A third section is responsible for geochemical investigations. Organic geochemistry data support directly the petroleum evaluation programs, whereas the results of inorganic geochemical studies are integrated, in large part, with the work of the Regional Geology Subdivision. The fourth section, a small unit, is responsible for selecting that material used for detailed studies in support of the petroleum evaluation program from the large amount of basic geophysical data available. The evaluation of petroleum and coal resources is based on the integration of the four sections.

A greatly improved assessment of the petroleum resources of Canada was completed this year through a departmental committee whose work is co-ordinated and centralized in the Energy Subdivision. The committee comprises members from four different agencies of the Federal Government including the Resources Branch of the Department of Indian and Northern Affairs, the Resource Conservation and Management Branch of our own department, as well as the Atlantic Geoscience Centre, Dartmouth, and the Energy Subdivision of the Institute of Sedimentary and Petroleum Geology in Calgary, both of which are units of the Geological Survey of Canada. Considerable improvement has been made in the methods used in this work and much improvement in the data base has occurred over the last year. Nevertheless, much remains to be done that could further improve the estimates. It is anticipated that the 1974 estimate will be published by the time this report appears. The Coal Section has continued its work on the evaluation of the Saskatchewan lignite and, in co-operation with the Saskatchewan Government, a series of reports will be prepared soon on this large program. Other major projects in coal evaluation have been anticipated but their initiation must wait for the resolution of several problems in Federal-Provincial relationships which, hopefully, will be achieved in the coming year.

A large monograph on the organic geochemistry of the Western Canada Sedimentary Basin is now in press. This publication comprises the results of a three-year co-operative project with the Institut Français du Pétrole, and such a large region anywhere in the world. It will provide an important bench mark, both in international co-operation and the rapidly developing field of organic geochemistry. Besides this volume, the Subdivision submitted four manuscripts for publication in the Geological Survey Paper series and six in other scientific journals.

Personnel Notes

P.L. Purcell, originally Senior Petroleum Geologist, transferred to the Atlantic Geoscience Centre in Dartmouth, Nova Scotia to accept the position of Head, Eastern Petroleum Geology Section. The vacated position of Senior Petroleum Geologist has not yet been filled.

R.M. Procter was promoted from the position as head of the Petroleum Geology Section to that of Assistant Head, Energy Subdivision. He was replaced as head of the Petroleum Geology Section by K.J. Roy.

R.G. Walker was appointed head of the Geophysics Section.

B.A. Latour, previously acting as head of the Coal Geology Section, has now been officially confirmed in that position.

Attendance at Meetings, Conferences and Courses

R.G. McCrossan

United States Geological Survey, Petroleum Geology, Program review, Denver, December 11, 12, 1974.

Research Symposium on Petroleum Occurrence and Estimation, Stanford University, Palo Alta, California, August 20-23, 1974.

Opening of USGS National Centre with program on Government's Role in Resources and Environment, Reston, Virginia, July 10-12, 1974.

National Conference on Earth Science - Geological principles of World Oil Occurrence, Banff, May 6-10, 1974.

R.M. Procter

North Sea Conference - London, November 20-29, 1974.

United States Geological Survey, Petroleum Geology, Program review, Denver, December 11, 12, 1974.

American Association of Petroleum Geologists, Annual Meeting, San Antonio, Texas, April 1-3, 1974.

Special Talks and Lectures

R.G. McCrossan

"Canadian Basin Classification" to National Conference on Earth Sciences, Banff, May 8, 1974.

Basin Consanguinity in Resource Evaluation - American Association of Petroleum Geologists, Research Symposium, Stanford University, August 20, 1974.

Membership on Committees

R.G. McCrossan

EMR, Subcommittee on Geological Potential, Petroleum Resources Committee, Chairman.

R.M. Procter

EMR, Subcommittee on Geological Potential, Petroleum Resources Committee, Secretary.

Research Committee American Association of Petroleum Geologists, Member.

Oil and Gas Pool Data Bank, American Association of Petroleum Geologists, Canadian Chairman.

Subdivision Manuscripts

Manuscripts approved for publication during the year include 4 in the GSC Papers series, 6 in outside journals, and 2 internal (Departmental) reports.

Geology of Petroleum

K.J. Roy

Activities

The Geology of Petroleum Section is primarily responsible for co-ordinating the assessment of Canada's potential petroleum resources, and conducting research on the habitat of oil and on methods of resources evaluation. A secondary responsibility is the development and maintenance of computer data files related to well data, oil and gas pool data and others.

During 1974-75, the computer programs used in resource assessment were modified and translated into FORTRAN to increase the flexibility of analysis and to increase precision of the system. The new system was used in the assessments of Canada's hydrocarbon potential completed in March 1975.

Members of the section, in conjunction with members of the Regional Geology Subdivision, documented the various hydrocarbon plays in the mainland Northwest Territories and Yukon Territory south of the Mackenzie Delta. Members of the section presented information regarding hydrocarbon potential of the Northwest Territories and Yukon Territory to the assessment committee and ran the computer system for the Canadian assessment.

Documentation of hydrocarbon plays in the Mackenzie Delta and Arctic Islands areas is now underway.

The computer file of data from wells north of 60° is now up to date and is being used, as is the file of information on oil and gas pools in western Canada. Data from nine petroleum zones in western Canada have been put into a data file that will contain information on all major hydrocarbon zones in the world. The file and retrieval systems are being developed in conjunction with the Institut Français du Pétrole and will be used to obtain worldwide data to be used in the Canadian assessment.

Personnel Notes

K.J. Roy was promoted to head of the Section in February, 1975.

J. Van Elsberg and N.E. Haimila joined the staff as assessment geologists in November, 1974.

S.L. Ott joined the staff as data manager in August, 1974.

Attendance at Meetings, Conferences and Courses

N.L. Ball

American Association of Petroleum Geologists, Annual Meeting, San Antonio, Texas, April 1-3, 1974.

Canadian Stratigraphic Services logging course, Calgary, Alberta, October 28 - November 5, 1974.

F. Der

Canadian Institute of Mining and Metallurgy, 25th Annual Meeting, Calgary, Alberta, May 7-10, 1974.

Canadian Society of Petroleum Geologists, 1974 Symposium, "Canada's Continental Margins and Offshore Petroleum Exploration", Calgary, Alberta, September 29 - October 2, 1974.

N.E. Haimila

Remote sensing conference, University of Kansas, February 18-20, 1975.

Carbonate sedimentology course, University of Calgary, February 4-9, 1975.

K.J. Roy

American Association of Petroleum Geologists, Annual Meeting, San Antonio, Texas, April 1-3, 1974.

Canadian Society of Petroleum Geologists, 1974 Symposium, "Canada's Continental Margins and Offshore Petroleum Exploration", Calgary, September 29 - October 2, 1974.

Special Talks or Lectures

K.J. Roy

"Application of probabilistic methods of resource evaluation", given at a 2-day workshop in Ottawa in January, 1975. Meeting was to co-ordinate activities of resource assessors and economists.

Membership on Committees

N.L. Ball

American Association of Petroleum Geologists, North American oil and gas field map and data bank committee, Member.

F. Der

Association of professional engineers, geologists, geophysicists meetings committee, Member.

K.J. Roy

EMR, Subcommittee on Geological Potential, Petroleum Resources Committee, Member.

Ad hoc metric log committee, Member.

Geology of Coal

B. A. Latour

Activities

This section is responsible for planning and conducting national coal inventory programs and for co-ordinating and assessing scientific studies concerned with the depositional and structural history and with environments of the sedimentary complexes of Canada's coal deposits.

Coal Evaluation

Preliminary evaluation of the coal resources of southern Saskatchewan was completed in late October, 1974. Data for this evaluation were generated by a two-summer joint Federal-Provincial drilling program. Included in the resource calculation were: all coal seams at least 5 feet thick within 150 feet of surface; and seams 3 to 5 feet thick, provided the overburden to coal ratio was less than, or equal to, 15 linear feet of overburden to 1 linear foot of coal. The total estimate for Saskatchewan lignite coal resources is 5.7 billion short tons of coal with a specific gravity of 1.29. Evaluation studies are continuing and a final publication of geology, evaluations and conclusions is expected in the spring of 1976.

Considerable effort was expended in planning a proposed exploration program to be conducted on the Dominion Government Coal Blocks in southeastern British Columbia. This 5-year program is designed to include surface mapping, diamond core drilling, reverse circulation drilling, downhole geophysical logging, adit construction and sample analysis.

Coal Petrology

Petrographic analyses of Saskatchewan lignites confirmed an earlier observation of a concentration of certain components in the seams toward the bottom of the coal-bearing section. The coals from the Wood Mountain area have somewhat different petrographic composition than those from the Estevan and Willowbunch areas.

Petrographic examinations were made of potential coking coals from certain areas of the Foothills Belt of British Columbia with a view to determining detailed information pertaining to coking quality and ash content.

In the application of rank data to the search for oil and gas, information from coals and coaly material from Alberta was related to existing occurrences of hydrocarbons in the province. Studies on similar materials from the Mackenzie Delta, using both reflectance data and spore and pollen transmittance data, were used to interpret maximum temperatures to which the rocks in the section had been exposed. Temperature is a critical factor in the generation and preservation of hydrocarbons.

Personnel Notes

P.A. Hacquebard transferred to the Atlantic Geoscience Centre to carry on coal research for the eastern Canadian coal basins.

Attendance at Meetings, Conferences and Courses

T.F. Birmingham

26th Canadian Conference on Coal, Calgary, September 10-13, 1974.

Symposium on Coal Evaluation, Calgary, Alberta, October 31 - November 1, 1974.

A.R. Cameron

Visit to Coal Research Laboratory of Geologisches - Landesamt, Nordrheim - Westfalen, Krefeld, West Germany, September 9-16, 1974.

Symposium on Coal Evaluation, Calgary, October 31 - November 1, 1974.

P.R. Gunther

26th Canadian Conference on Coal, Calgary, Alberta, September 10-13, 1974.

Symposium on Coal Evaluation, Calgary, Alberta, October 31 - November 1, 1974.

American Association of Stratigraphic Palynologists, Calgary, Alberta, October 16-19, 1974.

P.A. Hacquebard

26th Canadian Conference on Coal, Calgary, Alberta, September 10-13, 1974.

Symposium on Coal Evaluation, Calgary, Alberta, October 31 - November 1. 1974.

J.A. Irvine

Field trip to Texas Gulf Coast for comparative studies of ancient and modern sedimentary environments, April 1-10, 1974.

26th Canadian Conference on Coal, Calgary, Alberta, September 10-13, 1974.

Symposium on Coal Evaluation, Calgary, Alberta, October 31 - November 1, 1974.

Saskatchewan Geological Society Symposium on Fuels: A Geological Appraisal, Regina, November 7, 8, 1974.

B.A. Latour

Circum-Pacific Energy and Mineral Resources Conference, Honolulu, August 26-30, 1974.

26th Canadian Conference on Coal, Calgary, Alberta, September 10-13, 1974.

Symposium on Coal Evaluation, Calgary, Alberta, October 31 - November 1, 1974.

Special Talks or Lectures

A.R. Cameron

"Principles of Coal Petrography", Symposium on Coal Evaluation, Calgary, Alberta, October 31 - November 1, 1974.

P.R. Gunther

"Transmittance and reflectance data from three Mackenzie Delta boreholes"; McConnell Club Meeting, Calgary, Alberta, September 27, 1974 and also at American Association of Stratigraphic Palynologists, Calgary, Alberta, October 17, 1974.

P.A. Hacquebard

"Origin of Coal", presented at course on Coal Geology Fundamentals, University of Oklahoma, Norman, Oklahoma, October 14-16, 1974.

"Correlation between Coal Rank, Paleotemperature and Petroleum Occurrences in Alberta", McConnell Club, Calgary, Alberta, September 27, 1974.

"Origin of Coal", University of Calgary, Calgary, Alberta, February 19, 1975.

J.A. Irvine

"Evaluation of Borehole Sampling Methods Applicable to Lignite Resource Exploration", Saskatchewan Geological Society Symposium on Fuels, Regina, November 7, 8, 1974.

B.A. Latour

"Coal Resources of the Canadian Cordillera", Circum-Pacific Energy and Mineral Resources Conference, Honolulu, August 26-30, 1974.

Membership on Committees

A.R. Cameron

Industrial Applications Subcommittee of International Commission for Coal Petrology, Member.

Brown Coal Working Group, International Commissions for Coal Petrology, Member.

Canadian Coal Petrographers Group, Chairman.

Canadian Advisory Committee on Coal Research, Member.

P.A. Hacquebard

Nomenclature Subcommittee of International Commission for Coal Petrology, Member.

Subcommittee for Petrography of Organic Matter in Sediments and Application to Geology, International Commission for Coal Petrology, Member.

Pennsylvanian Stratigraphy Committee of Coal Geology Division, Geological Society of America, Member.

Canadian Advisory Committee on Coal Research, Member.

J.A. Irvine

EMR Coal Committee, Member

B.A. Latour

EMR Coal Committee, Member.

Geochemistry

T.G. Powell

Activities

The inorganic geochemistry, mineralogy and clay mineralogy group provides scientific services to the Division; develops, adapts and publishes analytical techniques in X-ray diffractometry, X-ray fluorescence and analytical chemistry and carries out research in the field of diagenesis related to the oil-generating potential of source rocks. The mineralogy and clay mineralogy laboratories determine, qualitatively and semi-qualitatively, minerals in sedimentary rocks, as well as performing

X-ray fluorescence analyses. In conjunction with the inorganic chemistry laboratory, they investigate clay syntheses, diagenesis, methodology in clay mineralogy and mineralogical transformation of clays. The inorganic geochemistry laboratory determines the elemental composition of sedimentary rocks and makes quantitative studies of minerals and clay minerals in sedimentary rocks by differential dissolution, differential fusion, wet chemical analyses and a combination of instrumental analytical methods such as thermal, thermogravimetric, differential thermogravimetric.

The use of clay minerals in determining the degree of diagenesis and oil-generating potential of sediments continues to be investigated. The application of clay minerals to the study of paleosols has been investigated.

The main activity of the organic geochemistry group is concerned with potential petroleum source rocks and levels of thermal diagenesis in the Arctic Islands and District of Mackenzie, and the characterization and correlation of crude oil types in these areas. In addition, a geochemical study has been carried out on oils and source rocks in Alberta in conjunction with the Institut Français du Pétrole. Crude oils in the central part of the Alberta Basin have been classified into three types and have been related to specific source rocks. The heavy oils in eastern Alberta have been shown to have been derived from the central part of the basin, but have been altered extensively by water washing and biodegradation. Biodegradation has been observed also in oils from the Mackenzie Delta and appears to be a common process.

Personnel Notes

L.R. Snowdon was granted education leave and, from August 1974, is spending 2 years at Rice University, Houston.

Attendance at Meetings, Conferences and Courses

L.R. Snowdon

American Association of Petroleum Geologists, San Antonio, Texas, April 1-3, 1974.

A.G. Heinrich

Integrated course on X-ray spectrometry, University of Albany, New York, June 3-14, 1974.

T.G. Powell

Garden Conference on Organic Geochemistry, Plymouth, New Hampshire, August, 1974.

A.E. Foscolos

Clays and Clay Mineral Conference, Cleveland, Ohio, October, 1974.

Special Talks or Lectures

T.G. Powell

"Geological controls on crude oil composition in Australia and Papua New Guinea", Canadian Society of Petroleum Geologists Luncheon Meeting, November 1974.

"Effect of source material, environment of deposition and diagenesis on the organic content of sedimentary rocks", ISPG McConnell Club, February, 1975.

Mineralogy and Clay Mineralogy Laboratories

A.G. Heinrich

The mineralogy and clay mineralogy laboratory determines qualitatively and semi-quantitatively the clay minerals in sedimentary rocks; evaluates the degree of sediment diagenesis and deciphers the paleoclimate of ancient soils by thorough study of clay minerals; carries out basic research in the field of clay mineralogy and performs X-ray fluorescence analyses.

During the report-year, 756 rock samples were processed for the Institute staff and other government agencies, yielding 3,730 mineral determinations and 565 elemental analyses. In addition, 550 size fractionations, 3,955 mineral determinations and 100 elemental analyses were made for the research projects. Two technicians were employed on this work.

Inorganic Geochemistry Laboratories

R.R. Barefoot

The inorganic geochemistry laboratory determines the elemental composition of sedimentary rocks and clay minerals, and the quantities of minerals by differential dissolution, differential fusion, wet chemical analyses and thermal techniques.

The output for ISPG staff is as follows:

1.	Wet-chemical analyses by atomic absorption spectroscopy	630
2.	Carbon determinations	228
3.	Sulphur determination	718
4.	Thermal analyses	132
5.	Mineral analyses	830
6.	Miscellaneous determinations (conductivities, pH, phosphate, etc.)	180
	Total	2,718

In addition to the service work, 2,650 elemental analyses were carried out for various research projects. One technician was assisted by one summer student.

During 1974-75, E. Okoy, student at the University of Calgary, was trained to carry out his M.Sc. thesis in organic geochemistry. R. Taylor, Research Technologist, Dept. of Geology, University of Calgary, was trained in methods of inorganic geochemistry.

Organic Geochemistry Laboratory

M. Northcott

Saturated hydrocarbon gas analyses, and organic and total carbon analyses were run on samples of drill cuttings from 21 wells in the Northwest Territories and Arctic Islands. Approximately 4,200 gas analyses and 4,800 carbon analyses were made. Gas logs of all wells were plotted and levels of thermal diagenesis were estimated. About 110 extractions of cuttings and cores were completed and 56 oils were distilled. Approximately 165 column chromatographies were done to separate extracts into saturates, aromatics, and resins, and 16 CHNO analyses were done on kerogen and bitumen samples.

In addition, revised extraction and liquid chromatographic procedures were introduced and a crude oil analysis scheme was developed.

Techniques for the quantitative analysis of n-alkanes and isoprenoids were improved.

In addition to three technicians, one summer student and one casual were employed during the year.

Geophysics

R.G. Walker

Activities

This unit is responsible for the compilation, analysis and interpretation of geophysical data and other information. Information derived from non-confidential records is made available to other scientists in the programs to assist in describing the structural configurations within and between the sedimentary basins of northern Canada in support of petroleum resource evaluation and basin analysis. Priorities have been given to the evaluation of the Sverdrup Basin, offshore and onshore Mackenzie Delta and the Beaufort Sea.

During 1974-75, the following progress was made:

N.W.T. and the Yukon - A total of 233 reports (covering 150,000 sq. miles), which have been submitted to government agencies, have been reviewed and the anomalous conditions that exist on the Middle Devonian carbonates and basement have been mapped from the gravity, magnetic and reflection seismic submissions.

Beaufort Sea-Mackenzie Delta - The locations of approximately 11,000 shot points have been mapped at a scale of 1" = 250,000". A total of 6,000 line miles of reflection seismic data have been interpreted and correlated and are now ready for digitizing and mapping.

Personnel Notes

Mrs. C.R. Bosgra joined the Geophysics Section in August as a Geophysical Technician.

Attendance at Meetings, Conferences and Courses

R.G. Walker

CSPG-CSEG Information Update 1974, Calgary, Alberta, April 17-19, 1974.

S.E.G. International Convention, Dallas, November 10-14, 1974.

REGIONAL AND ECONOMIC GEOLOGY DIVISION

J.E. Reesor, Chief

This division is responsible for all aspects of the geological framework of Canada, excluding the Western Canada and Arctic Sedimentary Basins, but including the Pacific Continental Shelf. In addition, units of the division are charged with responsibility for integration of the regional framework with mineral deposit data and metallogenic concepts and using the results in projecting the mineral resource potential of the country.

The objectives of the division are: to provide a systematic study of the geological framework across the country to standards consistent with the needs for mineral resource discovery and evaluation of future resource potential; to provide standards, controls and reference material to ensure consistent correlation and uniform presentation of the geology of Canada; to establish the geological settings favourable to the occurrence of mineral deposits and fuels; and to establish the potential abundance and probable distribution of mineral resources in Canada.

Objectives of the division are expressed not in square miles covered nor in pages of data accumulated, but in terms of a sophisticated data-base consistent with leading current concepts and ideas. A measure of accomplishment in any year may not be impressive.

Twenty-five years ago, Cordilleran geology consisted primarily of gaps with local 'islands' of well understood geology. After years of systematic accumulation of geological information, regional syntheses were possible, embodying stratigraphy, intrusive rocks, structure and metamorphism all interrelated through paleontologic and geochronologic studies. Now, tectono-stratigraphic units can be studied on a broad regional basis, problems are well-defined and current work is designed to contribute a broad range of criteria for exploration and resource evaluation of contained mineral deposits. In the process there is a constant improvement of the data-base as portrayed on 1:250,000 scale geological maps.

At present, geology of the Canadian Shield consists in large part of gaps dotted with well-studied localities. The objective of the next twenty-five years is to provide sufficiently detailed coverage over most of the more important regions of the shield, particularly in the least well known areas of the Northwest Territories. Steps toward this goal are measured in the increasing number of geological maps, better understanding of the chronology of igneous or metamorphic successions in a few areas, a beginning attempt at regional correlation of some major rock groups and progressive accumulation of necessary data bearing not only on the prime objective of mineral resource discovery and evaluation of mineral resource potential but having a myriad of

uses requiring a broad, sophisticated geological data-base. This is not accomplished in a year, but can be measured in terms of projects completed in three to four year cycles.

Resource discovery and resource potential forecasts build upon the accumulating data-base by adding ever increasingly sophisticated knowledge of Canadian deposits and those known elsewhere in the world for which favourable geologic settings may be known in Canada. As with the data-base, such knowledge builds slowly and often depends upon the growing expertise of one or several individuals in broad fields of mineral deposit geology combined with an understanding of regional geology and metallogenic concepts. Measurements of accomplishments are visible in the rapidity with which new ideas, new mapping information and new discoveries of mineral deposits can be integrated into an overall appreciation of mineral potential in Canada.

Studies within the division contributing to the geological data-base emphasize geological mapping, with publication at 1:250,000 scale, and accompanying reports. Regional syntheses are compiled and published at a scale of 1:1,000,000.

Current activity in the Canadian Shield is concentrated mostly in the Northwest Territories with a view towards providing a geological data-base consistent with modern standards in a region less well-known than that farther south. Work in the Bear-Slave Province on the stratigraphy of the Yellowknife Supergroup showed some of the details of the relationship of the basal units to the granitic basement of the supracrustal rocks; laboratory work showed the basement rocks to be 3 billion years old. A narrow zone of massive sulphides was found to be associated with volcanic rocks near the basal unit of the supracrustal rocks. Work in the Fox fold belt on Melville Peninsula proved the presence of ultramafic flows and a number of acid volcanic centres within the Prince Albert Group. As a result, the potential for eventual discovery of mineral deposits within this belt is much enhanced. A new project across central Baffin Island was directed mainly toward study of the stratigraphy, structure and metamorphism of the Piling Group of Aphebian age. These complex sequences were selected for further investigation on the basis of previous regional 8-mile reconnaissance studies.

Similarly, regional mapping studies in the Cordillera were concentrated in St. Elias Mountains previously unmapped and in Selwyn Basin, as a basis for guiding current extensive mineral exploration in Lower Paleozoic strata. In the latter area preliminary attempts are being made to integrate regional geology, paleontological and biostratigraphic studies and the occurrence of all mineral deposits into a metallogenic synthesis as a sophisticated guide to further mineral exploration and evaluation of the extent of future mineral resources.

The economic geology group within the division carries a continuing mandate to study and keep informed of developments in major mineral commodities across the nation. This serves as

a basis for evaluation of resource potential in Canada and utilizes the accumulated expertise of this group in assessing many types of potential resource discoveries in Canada. To accumulate and use such information, much effort has been expended in the past year to develop suitable systems for computer storage, treatment and retrieval of mineral deposit data. New Federal-Provincial agreements for mineral development in areas of provincial jurisdiction and for non-renewable resource evaluation projects make ever increasing demands on the wide-ranging expertise of commodity geologists of the division.

Underlying all mapping and mineral deposit studies of the division is the common concept of geological time. This concept is essential in establishing the succession of geologic processes in the formation and evolution of the crust and its contained mineral deposits. For Precambrian rocks most paleontological methods so well established in Phanerozoic rocks are not applicable, so great emphasis is put on isotopic geochronology and, to some extent, paleomagnetism. Isotope geochronology using Pb-U, Rb-Sr, and K-Ar methods seeks first to establish the geological succession in individual areas then over broad tectonic units and finally to provide basic data for broad regional correlation. For example, current results show Archean volcanism to have taken place at essentially the same time in widely scattered regions of the Canadian Shield from the Slave Province in Northwest Territories to northeastern Ontario. Current paleomagnetic studies indicate that extensive crustal plate movements did not occur in Aphebian or later times, thus the Archean volcanism took place in widely separated areas and was not dispersed from a single centre through crustal plate movements.

Experts within our staff continue involvement in Canadian International Development Agency projects such as the Omo River project of Ethiopia with the responsibility for mapping a large territory and training Ethiopian geologists in the whole process from reconnaissance mapping to final publication of the results.

Personnel Notes

The division at present has a continuing staff of 146, including 107 professional scientists and 39 support staff.

During the year, members of the Division submitted for publication 73 internal and 51 external manuscripts. They also presented a total of 125 talks to various meetings and institutions involving, in all, 145 audiences.

W.N. Houston continued in his role as Data Manager, responsible for expediting the computer processing of field related data. Assistance for the geologist is provided by the data manager in many ways - as a consultant for the design of field data forms, as a systems analyst for the creation of data bases, and as a general computer specialist providing advice

on information on available facilities. As part of the latter function, a growing program library is maintained consisting of about 5 generalized packages and several special-purpose programs and subroutines.

One of the ongoing activities of the data manager is to maintain contacts not only within the Department of Energy, Mines and Resources but externally as well. During the past year this involved membership on 4 committees and discussions with several external agencies from Canada, the United States and West Germany. In addition, consultations were held with more than 50 geologists and computer scientists within the Department.

At present there are about 6 field data files and approximately 8 mineral deposit files in use in the division, and interest and activity continue to grow.

Membership on Committees

J.E. Reesor
- Chairman, Metamorphic Map of North America.
- Member, Ad Hoc Branch Committee on Research Scientist Appraisal.

W.H. Houston
- Member, Data-Base Sub-Group, Data Processing Institute of the Federal Institute of Management.
- Member, Geological Survey of Canada Plotter Sub-Committee.
- Member, Geological Survey of Canada User's Guide Committee.
- Member, Mineral Deposits Working Group of Geological Survey of Canada.

ECONOMIC GEOLOGY SUBDIVISION

G.B. Leech

The Economic Geology Subdivision identifies and interprets through field and laboratory investigations the geological characteristics of mineral deposits and their relationships to their geological environments. It develops and applies metallogenic and geomathematical methods to evaluate the non-hydrocarbon mineral resources of Canada. It provides information to government agencies and industry in support of the management and development of these resources.

The objectives of the Economic Geology Subdivision are:

1. to relate the gensis of economic concentrations of commodities to the evolution of the geological framework of Canada and thereby to

2. determine regional and local geological features that are favourable to the occurrence of mineral deposits and are guides to their discovery and to use this understanding to

3. evaluate the distribution, character and amount of Canada's mineral resources.

The Subdivision integrates four main types of activities toward these objectives:

1. Commodity metallogeny, which is the comprehensive study of all aspects of the geology of specific mineral commodities to determine the ways in which they are concentrated in the Earth's crust and the consequences in terms of quality, distribution and identification of such concentrations. Selected commodities among the major components of the Canadian mineral economy receive ongoing study whereas other commodities, selected on the basis of economic and strategic priorities and the availability of manpower, are studied on a term basis.

2. Regional metallogeny, which relates the nature and distribution of the mineral deposits in a specific large segment of a geological province to its geological features. These studies that embrace numerous mineral commodities and extensive regions, integrate commodity metallogeny with regional geology in its broadest sense.

3. Geomathematical research and development in quantification, statistical analysis and interpretation of geoscience data, with emphasis on the evaluation of specific mineral resources on a regional basis.

4. Development and operation of data banks of documentary and computerized information required for and generated by the other activities.

This year marked the initiation of regional metallogeny in its own right, with the appointment of a scientist to study the metallogeny of the northern part of the Canadian Cordillera on a full-time basis.

The inexorable increase in advisory and liaison work arising from federal-provincial agreements, the development of mineral policy and the Non-Renewable Resources Evaluation Program was partly met by the new appointment of a co-ordinator and the strengthening of two programs in the metallogeny of major commodities.

The Uranium Program now centres upon a continuing series of quantitative evaluations of resources of uranium additional to measured reserves and on assistance in evaluating the latter. The increased responsibilities and deadline pressures were partly offset by the new appointment of an experienced uranium specialist. The evaluations now demanded will increasingly require specifically uranium-oriented regional geological studies in addition to studies of identified uranium deposits.

The pioneering nature of the geomathematics program is reflected in the progress of Project Appalachia, an intradivisional project that seeks to combine regional geology, metallogeny and geomathematics in the development and application of computer-based methods of regional resource appraisal. At this stage, progress depends heavily upon the development of mathematical models whose assumptions and restrictions are geologically acceptable but which can nevertheless accommodate the unavoidably imprecise nature of many geological data.

The systematic evaluation of national mineral resources requires the strong support of computer-based files of mineral deposit data. This year saw good progress in the development of specifications for broadly based files at index and deeper geological levels and on certain specialized files. Realization of these computerized files requires additional support.

Personnel Notes

D.C. Findlay, a mineral exploration consultant and a former member of the Geological Survey of Canada in charge of the Whitehorse, Yukon Territory office, rejoined the staff in May, 1974. He conducts mineral resource liaison duties, does studies in support of mineral policy formulation and is Co-ordinator of the Non-Renewable Resource Evaluation Program (NREP).

Attendance at meetings, conferences and courses

G.B. Leech - Symposium on base-metal resources in stratabound deposits, U.S. Geological Survey, Denver, Colorado, U.S.A., May, 1974.

- Workshop on mineral resource evaluation methodology, Ottawa, Ontario, May, 1974.
- Geological Association of Canada, Annual Meeting, St. John's, Newfoundland, May, 1974.
- Internatinal Association on the Genesis of Ore Deposits; Varna, Bulgaria, Sept., 1974.
- Geological Society of America - Society of Economic Geologists, Miami, Florida, U.S.A., Nov., 1974.
- American Institute of Mining, Metallurgical and Petroleum Engineers - Society of Economic Geologists, New York, New York, U.S.A., Feb., 1975.

F.D. Anderson
- Conference on the Middle North, University of Quebec at Chicoutimi, Quebec, Oct., 1974.
- Classification standards course, Department of Energy, Mines and Resources, Ottawa, Ontario, Feb., 1975.

D.C. Findlay
- 26th Canadian Conference on Coal, Calgary, Alberta, Sept.,1974.
- Prospectors and Developers Association, Annual Convention, Toronto, Ontario, March, 1975.

P. Moyd
- Canadian Institute of Mining and Metallurgy, Montreal, Quebec, April, 1974.
- Prospectors and Developers Association,Annual Convention, Toronto, Ontrario, March, 1975.

Special talks or lectures

G.B. Leech
-"Approaches to quantitative regional evaluation of mineral resources"; Workshop on mineral resource evaluation methodology, Ottawa, Ontario, May, 1974.
-"Metallogeny of Canada - the geologic setting"; Joint meeting of Society of Economic Geologists and American Institute of Mining, Metallurgical and Petroleum Engineers, New York, New York, U.S.A., Feb., 1975.
-"Mineral Resource Evaluation"; Queen's University, Kington, Ontario, March, 1975.

Membership on Committees

G.B. Leech
- Publication Committee, Society of Economic Geologists.
- Councillor, Geology Division, Canadian Institute of Mining and Metallurgy.
- Barlow Memorial Medal Committee, Canadian Institute of Mining and Metallurgy.
- Advisory Council on Engineering, Queen's University, Kingston, Ontario.

- Nominations Committee, Earth Sciences Division, Royal Society of Canada.
- Working Group on Global Tectonics, Commission for the Tectonics of Ore Deposits, International Association on the Genesis of Ore Deposits.
- Committee for the Metallogenic Map of North America.
- Committee on the History of the Geological Survey.
- Uranium Resource Appraisal Group, Department of Energy, Mines and Resources.

P. Moyd

- Special Volumes Committee, Canadian Institute of Mining and Metallurgy.
- Interbranch Liaison Committee on Indusrial Minerals, Department of Energy, Mines and Resources.

Special Projects

Special Projects comprises the Uranium Program and the Iron and Manganese Program.

The objectives of the Uranium Program are to gather and interpret data on uranium and thorium deposits and to determine their nature and genesis, in order to assess Canada's resources of uranium and thorium and to assist and encourage exploration.

Following the first meeting of the Departmental Uranium Resource Appraisal Group (URAG), in early June, the Uranium Program personnel made a preliminary calculation of the reserves and resources of the Elliot Lake area, Ontario. In September, a reserve appraisal team, comprising two members of each of CANMET and the Geological Survey began an on-the-site evaluation of the reserves and inferred resources of uranium and thorium in the major uranium deposits of Canada. In October, V. Ruzicka joined the group and spearheaded the operation. A report on reserves in the major deposits was submitted jointly by the Reserves and the Additional Resources Sub-committees to URAG in March, and a preliminary report on additional uranium and thorium resources in and near the major uranium deposits was submitted by the Additional Resources Sub-committee. Research on improved methodologies for resource appraisal of various environments throughout Canada for each type of uranium deposit was begun in March.

The objectives of the iron and manganese program are, firstly, to study and evaluate Canadian resources of these commodities and, secondly, to investigate the wider metallogenic significance of certain iron deposits and their use as guidelines in exploration for base metals and gold deposits in the Canadian Shield.

Collection and compilation of data on iron and manganese deposits and the geochemistry of iron formations and maintenance of reference files on subsea resources of manganese and other minerals continued throughout the year. The program leader resumed an active role in it in October, on completion of a two year assignment as Commonwealth Geological Liaison Officer in London, England.

Personnel Notes

H.W. Little was appointed chairman of the Additional Resources Sub-committee of the newly-formed Departmental Uranium Resource Appraisal Group (URAG). V. Ruzicka joined the Uranium Program in October, and, at the request of Dr. C.H. Smith, undertook the major responsibility for calculation of reserves and estimation of additional resources.

In February, 80 per cent of the duties of M. Turay, Correlation and Standards Subdivision, were assigned to the Uranium Program.

G.A. Gross, in October, 1974, completed a two year assignment in London, England for the Geological Survey of Canada at the Commonwealth Geological Liaison Office, where he served as Executive Secretary and Geological Liaison Officer for the Commonwealth Committee on Mineral Resources and Geology. In the course of the assignment he visited ten countries in Africa for review and consultation on policy, programme development and evaluation, staffing and scientific exchange. The CGLO represented a number of Commonwealth countries at international scientific meetings at UNESCO in Paris and in the United Kingdom and maintained active liaison with the professional communities in the earth sciences in most of the Commonwealth countries. A monthly Newsletter produced in the Liaison Office was distributed to about 500 geological organizations in government, industry and universities in more than 40 countries.

Attendance at Meetings

A. Boyer
- Prospectors and Developers Association, Annual Convention, Toronto, Ontario, March, 1975.

G.A. Gross
- 8th Meeting of the Commonwealth Scientific Committee, Lusaka, Zambia, July 2-18, 1974.
- International Conference on the Results of the International Hydrological Decade, and on Future Programmes in Hydrology, Paris, France, Sept. 2-14, 1974.
- Commission for the Geological Map of the World, Association of African Geological Surveys, UNESCO, Paris, France, April, 1974.
- Association of Geoscientists for International Development, Seminar on Earth Science Aid to Developing Countries, St. John's, Newfoundland, May, 1975.

- Geological Association of Canada, Annual Meeting, St. John's, Newfoundland, May, 1975.
- Prospectors and Developers Association, Annual Convention, Toronto, Ontario, March, 1975.

H.W. Little
- International Atomic Energy Symposium on the Formation of Uranium Ore Deposits, Athens, Greece, May,1974.
- Prospectors and Developers Association, Annual Convention, Toronto, Ontario, March, 1975.

C.R. McLeod
- Institute of Lake Superior Geology, Sault St. Marie, Ontario, May, 1974.
- Fifth Underwater Mining Institute, Milwaukee, Wisconsin, U.S.A., May, 1974.

V. Ruzicka
- Prospectors and Developers Association, Annual Convention, Toronto, Ontario, March, 1975.

Special Talks

V. Ruzicka
-"Types of uranium deposits not known in Canada", Prospectors and Developers Association, Annual Convention, Toronto, Ontario, March, 1975.

Membership on committees

G.A. Gross
- Member, Editorial Board, Precambrian Research.
- Executive Secretary and Geological Liaison Officer for the Commonwealth Committee on Mineral Resources and Geology, from Sept., 1972 to Oct. 1974.

H.W. Little
- International Atomic Energy Agency (Working Group No. 2).
- Uranium Resources Appraisal Group, Department of Energy, Mines and Resources Uranium Additional Resources Sub-committee (chairman).

C.R. McLeod
- Department of Energy, Mines and Resources discussion group on Deep Ocean Mining.

V. Ruzicka
- Uranium Resources Appraisal Group, Department of Energy, Mines and Resources.
- Uranium Additional Resources Sub-committee.

Geomathematics Section

F.P. Agterberg

The section carries out a program in order to develop mathematical methods for the quantification, statistical analysis and integration of geoscience data. Patterns of occurrence of various types of mineral deposits are correlated with parameters systematically quantified for the geological framework.

Emphasis during the year was on evaluation and analysis of coded information contained in two comprehensive computer-based data files for (2) regional geology and (b) mineral deposits of the Canadian Appalachian region. This activity is part of Project Appalachia which is an intradivisional cooperative effort to combine regional geological, metallogenic and geomathematical concepts in the development and application of computer-based methods of regional mineral resource appraisal. A series of meetings was held during the year with members of the Mineral Deposit Geology and Appalachian Sections to evaluate patterns consisting of numbers calculated using the multiple regression method for correlations between data from the two files.

These reviews were useful for the further planning of the geomathematics program on regional resource appraisal which now consists mainly of the following four types of activity: (1) Development of new methods for the estimation of probabilities of occurrence for various types of mineral deposits and provision of a mathematical background to the concept of mineral potential expressed in numbers of tons of metal per unit of area; (2) Evaluation of other statistical methods used for resource evaluation including those applied in other countries; (3) Application of a wider group of methods of multivariate statistical analysis, specifically cluster analysis, classification analysis and canonical correlation in order to attempt to statistically classify mineral deposits and the environments that contain them; and (4) Updating and improvement of the plotting, computing and contouring program packages acquired for processing Project Appalachia data.

Requests for assistance in support of activities of other groups also impose demands on the section. This has included a trial application of the GDMS/GEODAM storage and retrieval system to a mineral deposit file as well as pairwise conversions between this system, CDC/MARS and IBM/SAFRAS. Members of the section are deeply involved in geostatistical aspects of the Uranium Program. Outside the subdivision, statistical advice was provided to an increasing number of staff members including personnel of the Institute of Sedimentary and Petroleum Geology and the Bedford Institute of Oceanography.

Attendance at meetings, conferences and courses

F.P. Agterberg - Canadian Insitute of Mining and Metallurgy, Annual Meeting, Montreal, Quebec, April, 1974.

- Symposium on Statistics and Related Topics, Carleton University, Ottawa, Ontario, Oct.,1974.
- Third Chautaugua on "Computers and Mineral Resources", University of Syracuse, New York, Oct., 1974.

C.F. Chung
- Carleton University Course No. 70.450: Parametric Estimation, Sept.-Dec., 1974.
- Symposium on Statistics and Related Topics, Carleton University, Ottawa, Ontario, Oct., 1974.
- Third Chautaugua on "Computer and Mineral Resources",University of Syracuse, New York, Oct., 1974.
- Carleton University Course No. 70.458: Stochastic Modules, Jan.-March, 1975.

A.G. Fabbri
- Canadian Institute of Mining and Metallurgy, Annual Meeting, Montreal, Quebec, April, 1974.
- Fourth Meeting of International Association on the Genesis of Ore Deposits, Varna, Bulgaria, Sept., 1974.
- "Data Base Concepts and File Organization", Course by Control Data Institute for Advanced Technology, Ottawa, Ontario, Oct., 1974.
- Third Chautaugua on "Computers and Mineral Resources" University of Syracuse, New York, Oct., 1974.
- American Association of Petroleum Geologists Short Course on "Computer Applications in Earth Sciences", Syracuse, New York, March, 1975.

R.M. Laramée
- "Data Base Concepts and File Organization", Course by Control Data Institute for Advanced Technology, Ottawa, Ontario, Oct., 1974.
- "MARS System", Course by Computer Science Centre, Ottawa, Ontario, Oct., 1974.
- "Record Manager" Course by Computer Science Centre, Ottawa, Ontario, Feb., 1975.
- American Association of Petroleum Geologists Short Course on "Computer Applications in Earth Sciences", Syracuse, New York, March, 1975.

A.S. Wong
- System 2000, PART A: Basic Natural Language, and Part B: Procedural Language, Computer Science Centre, Ottawa, Ontario, Dec.,1974.

Special talks and lectures

F.P. Agterberg
-"Geomathematical studies in Greenstone Belts", Seminar, Ecole Polytechnique, Montreal, Quebec, April, 1974.

-"Estimation of the Average Size of Mineral Grains from Thin-section Data", Symposium on Statistics and Related Topics, Carleton University, Ottawa, Ontario, Oct., 1974.
-"Statistics in Geology", Course GEO 3100, University of Ottawa, 2 hours weekly, Jan.-April, 1975.

A.G. Fabbri -"Design and Structure of Geological Data Banks for Regional Mineral Potential Evaluation", Canadian Institute of Mining and Metallurgy, Annual Meeting, Montreal, Quebec, April, 1974.

Membership on committees

F.P. Agterberg
- Associate Editor, Canadian Journal of Earth Sciences.
- Computer Applications and Process Control Committee of Canadian Institute of Mining and Metallurgy (Representative of Geology Division).
- Member, International Editorial Board of Computers & Geoscience.

A.G. Fabbri
- Secretary-Treasurer, Commission on the Tectonics of Ore Deposits, International Association on the Genesis of Ore Deposits.

R.M. Laramée
- Working Group on computerization of mineral deposit files, Geological Survey of Canada.

Mineral Deposits Geology Section

D.F. Sangster

Charged with the responsibility of attaining a broad knowledge of all major types of Canadian mineral deposits, this section comprises 16 geologists and one precision worker. Studies are currently underway on the geology of 17 elements (metallic and non-metallic) and the rare earths; in addition, two projects have been concerned with detailed mineralogical aspects of certain types of mineral deposits, chiefly nickel and porphyry copper.

The section program comprises the following activities: (1) comprehensive geological studies of all aspects of selected mineral commodities and the manner in which these are concentrated in the Earth's crust; (2) metallogenic studies of large geological segments of Canada to relate the distribution and nature of mineral deposits within the geological framework of these segments; (3) a geologically oriented merging of the foregoing activities as the basis for estimations of the mineral potential of selected regions or the nation as a whole; and (4) provision of advice and geological

information on Canada's mineral deposits for mineral policy, socio-economic assessments, land-use studies, and related matters.

Significant accomplishments during 1974-75 included: participation in three conferences on the methodology of Quantitative Resource Evaluation and the exchange of data on mineral Deposits pertinent to this objective (two of the conferences were initiated by the United States Geological Survey; the other by the Department of Energy, Mines and Resources and attended by provincial representatives); establishment of a computer-based file to handle data on reserves of certain Canadian mineral commodities; establishment of the key parameters to be used in a computer-based index of Canadian mineral deposits; continuing development of the geological specifications for a computer-based file of the geology of Canadian mineral deposits; participation with other Branches of the Department and the Manitoba Department of Mines, Resources,and Environmental Management in planning projects to be carried out in the coming fiscal-year under the Non-renewable Resource Evaluation Program.

Members of the Mineral Deposits Geology Section also published numerous scientific papers and reports in Geological Survey and outside journals. Included in these were major reports on the geology of Canadian tin and niobium-tantalum deposits.

In a typically active field season, section members examined mineral deposits in virtually every geological province of Canada. They examined also the geological features and settings of selected types of deposits outside the country that are not well known in Canada but which, in view of Canadian geology, may eventually be identified here.

Personnel Notes

Dr. O.R. Eckstrand was again selected by the Canadian Institute of Mining and Metallurgy to be Visiting Lecturer and, in this capacity, addressed university student groups at Ecole Polytechnique, Laval, and University of Quebec (Chicoutimi).

Three new members joined the section this year:

A.E. Soregaroli, a native of Iowa, U.S.A., completed his undergraduate studies at Iowa State University and his M.Sc. at the University of Idaho. Moving to Vancouver in 1962, he continued graduate studies at the University of British Columbia, obtaining his Ph.D. in 1968. From 1965 to 1972 he was employed by Noranda Exploration Co. Ltd., and when he left the company in 1972 he was Chief Geologist, Western Division. From 1972-1974 he was an Assistant Professor with the Department of Geological Sciences at the University of British Columbia. In 1974 he joined Mineral Deposits Geology Section as geologist responsible for molybdenum and porphyry copper deposits.

K.M. Dawson, a native of British Columbia completed his undergraduate studies at the University of British Columbia, and obtained his Ph.D. from the same institution in 1972. From 1971-1973, he was Senior Exploration Geologist with Placer Mexicana, engaged in exploration for porphyry copper and gold deposits. He joined the Economic Geology Subdivision early in 1974. His main studies are on the metallogeny of the northern Cordillera.

F.M. Vokes was born in Scarborough, Yorkshire, and completed his undergraduate studies at the University of Leeds, England. From 1950-1953 he carried out studies of the Zambian copper belt, following which he joined the Geological Survey of Norway. He obtained his Ph.D. from the University of Oslo in 1957, and immediately came to Canada for a year and a half to study molybdenum deposits. Returning to Norway, he taught at the University of Oslo until 1966 with the exception of a stint in Cyprus with the U.N. Development Project. In 1966 he was appointed to the Chair of Ore Geology at the University of Trondheim where he remained until December, 1974 at which time he came to Canada and joined the Mineral Deposits Geology Section of the Survey. He is carrying out specialized studies related to lead-zinc mineralization.

Attendance at meetings, conference and courses

K.M. Dawson	- American Association of Petroleum Geologists, short course on "Computer Applications in Earth Sciences", Syracuse, New York, U.S.A., March, 1975. - Geological Association of Canada, Cordilleran Section, Vancouver, British Columbia, Feb., 1975.
O.R. Eckstrand	- Canadian Institute of Mining and Metallurgy, Annual Meeting, Montreal, Quebec, May, 1974.
J.L. Jambor	- Mineralogical Association of Canada, Annual Meeting, St. John's, Newfoundland, May, 1974.
R.V. Kirkham	- Geological Association of Canada, Annual Meeting, St. John's, Newfoundland, May, 1974. - Symposium on Stratiform Copper Deposits, Belgium, Sept., 1974. - Society of Economic Geologists,New York, Feb., 1975. - Symposium on appraisal of copper resources in porphyry deposits, Menlo Park, California, U.S.A., Dec., 1974. - Symposium on base-metal resources in strata-bound deposits, Denver, Colorado, U.S.A., May, 1974.

- Workshop on mineral resource evaluation methodology, Ottawa, Ontario, May, 1974.

R. Mulligan
- 4th Symposium, International Association on the Genesis of Ore Deposits, Bulgaria, Sept., 1974.
- Symposium on Metallization Associated with Acid Magmatism, Czechoslovakia, Sept.,1974.

N. Prasad
- Attended several short course in Ottawa on various computer techniques:
  (i) Fortran debugging
  (ii) Uses of Cal-Comp plotter
  (iii) Magnetic Tapes and their uses
  (iv) SCOPE
  (v) Data management
  (vi) MARS (advanced).

J.Y.H. Rimsaite
- Mineralogical Association of Canada, Annual Meeting, St. John's, Newfoundland, May, 1974.

D.F. Sangster
- Geological Association of Canada, Annual Meeting, St. John's, Newfoundland, May, 1974.
- 4th Symposium, International Association on the Genesis of Ore Deposits, Bulgaria, Sept., 1974.
- Prospectors and Developers Association, Annual Convention, Toronto, Ontario, Mar., 1975.
- Symposium on base-metal resources in stratabound deposits, Denver, Colorado, U.S.A., May, 1974.
- Workshop in mineral resource evaluation methodology, Ottawa, Ontario, May, 1974.

A.E. Soregaroli
- Geological Association of Canada, Cordilleran Section, Vancouver, British Columbia, Feb., 1975.
- Symposium on appraisal of copper resources in porphyry deposits, Menlo Park, California, U.S.A., Dec., 1974.

R.I. Thorpe
- Geological Association of Canada, Annual Meeting, St. John's Newfoundland, May, 1974.
- Workshop on mineral resource evaluation methodology, Ottawa, Ontario, May, 1974.

Special talks

K.M. Dawson

-"Geology and characteristics of lead-zinc deposits in the Mackenzie Mountains", Geological Discussion Group, Toronto, Ontario; and Geoscience Forum, Yellowknife, Northwest Territories, and Whitehorse, Yukon Territory.

O.R. Eckstrand

-"Archean ultramafic rocks and associated nickel deposits", Dalhousie University, Laurentian University, Ecole Polytechnique, Laval University, Université de Québec (Chicoutimi).
-"Nickeliferous opaque mineral assemblages and serpentinization", Dalhousie University Halifax, Nova Scotia.

R.V. Kirkham

-"Environments of formation of concordant and peneconcordant copper deposits in sedimentary sequences", Symposium on appraisal of copper resources in porphyry deposits, Menlo Park,California, U.S.A. and Symposium on Stratiform U and Cu Deposits, Montreal,Quebec.
-"A synopsis of Canadian stratiform copper deposits in sedimentary sequences", Stratiform Copper Symposium, Belgium.
-"Importance of porphyry deposits in copper resource appraisal of U.S. and Canada", Symposium on appraisal of copper resources in porphyry deposits, Menlo Park, California, U.S.A.
-"Porphyry deposits in the Canadian Shield and Appalachians", Symposium on appraisal of copper resources in porphyry deposits, Menlo Park, California, U.S.A.
-"Copper deposits of Canada and resource evaluation", Geological Society of Zambia, Zambia.
-"Alkalic porphyry deposits in the Canadian Cordillera", Symposium on appraisal of copper resources in prophyry deposits, Menlo Park, California, U.S.A.
-"Rock geochemical studies, Babine Lake area, B.C.", Symposium on appraisal of copper resources in porphyry deposits, Menlo Park, California, U.S.A.
-"Canadian sedimentary copper deposits", Dalhousie University, Halifax, Nova Scotia.
-"Copper deposits of Canada/Eastern Canada; their geology and classification", Society of Economic Geologists, New York, U.S.A.

R. Mulligan
-"Tin in stratabound massive sulphide deposits", International Association on the Genesis of Ore Deposits, Bulgaria, and Symposium on Metallization Associated with Acid Magmatism, Czechoslovakia.

J.Y.H. Rimsaite
-"Mineral assemblages and low grade metamorphic-metasomatic alterations in an Archean greenstone belt, Malarctic,Quebec", Mineralogical Association of Canada, St. John's, Newfoundland.

D.F. Sangster
-"Possible origins of lead in volcanogenic massive sulphide deposits of calc-alkaline affiliation", Geological Association of Canada, Annual Meeting, St. John's, Newfoundland.
-"Canadian stratabound lead-zinc deposits in sedimentary environments", Society of Economic Geologists, New York, U.S.A.
-"Canadian sediment-hosted lead-zinc deposits", University of Western Ontario, London, Ontario.
-"Stratabound lead-zinc deposits: their characteristics and depositional environment", Outcrop Club, University of Western Ontario, London, Ontario.
-"Classification, geological criteria, and origin of sediment-hosted zinc-lead deposits", University of Calgary Workshop, Zinc and lead deposits in sedimentary environments.
-"Specifics of some Canadian deposits", University of Calgary Workshop, Zinc and lead deposits in sedimentary environments.

A.E. Soregaroli
-"Geology of the Brenda deposit", Symposium on appraisal of copper resources in porphyry deposits, Menlo Park, California, U.S.A.
-"Relative ages of Cu and Mo in porphyry deposits", Symposium on appraisal of copper resources in porphyry deposits, Menlo Park, California, U.S.A.
-"Nature and distribution of porphyry deposits in the Canadian Cordillera", Geological Association of Canada, Cordilleran Section, Vancouver, British Columbia.
-"Characteristics of Cordilleran porphyry deposits", University of Western Ontario, London, Ontario.

Membership on Committees

O.R. Eckstrand	- Associate Editor, Geoscience Canada. - Working Group on Computerization of mineral deposits files, Geological Survey of Canada.
J.L. Jambor	- Co-editor, Canadian Mineralogist.
D.F. Sangster	- Age Dating Committee, Geological Survey of Canada. - Chief Treasurer, International Association on the Genesis of Ore Deposits. - Editorial Board, Economic Geology. - Member-at-large, International Geological Correlation Program.
A.E. Soregaroli	- Vice-President, Cordilleran Section, Geological Association of Canada. - Member, Editorial Committee, Canadian Institute of Mining and Metallurgy, Vol. 15, "Geology of prophyry copper deposits of the Canadian Cordillera".

Production Statistics

Mineral Deposits Laboratory

C.R. McLeod and R.D. Burke

Preparation of Polished sections:

Regional and Economic Geology Division

Economic Geology Subdivision	275
Correlation and Standards Subdivision	5
Precambrian Subdivision	69
Special Projects	14
Resource Geophysics and Geochemistry	19
Central Laboratories and Technical Services	6
Total	388
Specimens cored	50
Large specimens slabbed	397
Large specimens polished	352

Mineral Data Bank

D.R.E. Whitmore

The Mineral Data Bank is the repository for, and secondary source of geological data on mineral deposits in the Geological Survey of Canada. For the principal mineral commodities it cooperates with the Mineral Deposits Section in the collection

and circulation of published data and in the standardization and computerization of files. For the rest it maintains files and watching briefs, ready to supply data on request.

The review of currently active mineral deposits, UPDATE, was discontinued at the beginning of the year. It proved too time consuming for the benefits derived. Material (location and geological background) formerly circulated in UPDATE is now accumulated in an UPDATE file which can be consulted by those interested.

Computerization of geological and other data on mineral deposits remains a prime concern of the unit. A TEST FILE (OPSEP) of 100 deposits, selected from the 700 considered in the mineral potential study Operation September, was created at the beginning of the year using the data management system GEODAM (GDMS). GEODAM, although conceptually very promising for the management of mineral deposit data, is only partially developed. The TEST FILE was, therefore, converted into a form manageable by MARS VI and tested, with promising results.

Specifications for an index file, CANMINDEX, were agreed upon at the year end by the geologists concerned and through cooperation with the Mineral Development Sector it may be merged with the MEPI file to produce a single shallow index file applicable to essentially all the mineral deposits in the country, estimated at from 50,000 to 100,000. The balance of the content of the TEST FILE will be incorporated in a deeper geological file (M-2), specifications for which are still being developed at the year end.

Personnel Notes

Dr. Whitmore was an expert witness on behalf of the Crown at a trial in Chicoutimi, Quebec, Feb. 11-14 arising out of the expropriation of mineral claims in the Senneterre area for a DND radar site in 1951.

CORRELATION AND STANDARDS SUBDIVISION

W.H. Poole

The subdivision provides support to regional and economic geological programs of the Geological Survey of Canada through several scientific approaches: petrological, biostratigraphical, geochronological and geological. The criteria and geological models developed lead to improved understanding of igneous and metamorphic processes of rock genesis and transformation, of correlation and paleoecology of strata, of the age and sequence of volcanic plutonic and metamorphic events, and of the mineral and hydrocarbon potential of selected sequences.

Petrological studies are underway on selected rock types. Alkaline rocks of Canada have been examined and the associated base metal sulphide occurrences documented. Anorthositic rocks are derived from a deep crustal level on the mantle; those near Harp Lake, Labrador, contain copper-nickel sulphide deposits being actively explored. Granite is a very common rock type, and in the Canadian Appalachian Region is often associated with economic minerals. Some ultrabasic plutons in the Cordillera Region appear to be genetically related to Triassic volcanism. Studies of them in cooperation with regional geologists of the Cordilleran and Pacific Margin Subdivision will aid in the understanding of the physical volcanic paleogeography and thence to the evaluation of the sulphide potential of the volcanics. Regional metamorphism is a complex process that has affected vast tracts of the Canadian Shield and bordering Phanerozoic foldbelts. The mineral assemblages are keys to the environment of formation mainly in terms of pressure and temperature. Computer data banks and programs are being developed to yield these parameters for particular assemblages, and a metamorphic map of the Canadian Shield in part of Manitoba is being compiled. Support is also provided to the Branch Data System Group undertaking the task of co-ordinating the use of electronic data processing and designing major data managment systems.

Four scientists pursue biostratigraphic and paleontologic studies of particular fossil groups: Early Paleozoic trilobites and ostracodes and later Paleozoic spores. Their work is complementary to that of paleontologists of the Institute of Sedimentary and Petroleum Geology in Calgary, Alberta and Atlantic Geoscience Centre in Dartmouth, Nova Scotia. Successions of Ordovician trilobite faunas have led to improved dating of strata in Newfoundland and refinement in the understanding of faunal realms as related to once-separated continental and oceanic plates. Careful biostratigraphic studies viewed in relation to various rock facies are contributing to the evaluation of lead and zinc sulphide potential of Cambrian strata in Yukon Territory and Northwest Territories. Microscopic spores have permitted dating and correlation of some otherwise unfossiliferous, undated strata in the Hudson Bay region. Ostracodes in the Paleozoic strata of Anticosti Island, Quebec and Northwest Territories have been zoned and may prove useful for correlation in wells drilled for oil and gas exploration.

Age determination by isotopic analysis has proven itself manifold as a necessary tool in the Canadian Shield as well as in the bordering Phanerozoic belts. The three systems - K-Ar, Rb-Sr and U-Pb - are studied and used in our laboratory. Each system is applied optimally under different geological conditions and each complements the other. The U-Pb system uses mainly zircons, a very minor constituent of many rocks, and under most geological conditions seems to yield the most useful information, particularly in Precambrian rocks and those commonly with the most complex history of development. The zircon system this year yielded the oldest reliable age, about 3,000 m.y., from the the Slave Province in Northwest Territories, another step in unravelling the geological evolution of the Canadian Shield.

In the Appalachian Region, current study of a selected area of volcanic rocks in Newfoundland is expected to result in a reconstruction of a former island arc and an interpretation of the original place and environment of deposition of small base-metal sulphide deposits. This is a difficult and demanding task and if even only partly successful will be valuable to sulphide deposit prediction there and elsewhere in similar island arc deposits.

Personnel Notes

On June 1, 1974, W.H. Poole became Head, Correlation and Standards Subdivision, to fill the position vacated by J.E. Reesor. About that time,D.G. Benson, staff geologist attached to the subdivision office, was seconded to the Branch Planning Office under the Deputy Director.

On September 9, 1974, the Lapidary and Paleontology Preparation Laboratories were transferred to the subdivision office and combined as the Lapidary-Paleontology Service Unit under the supervision of B.J. Botte.

Attendance at Meetings

W.H. Poole

- Penrose Conference on "Geologic Interpretation of Magnetic Data", Reston, Virginia, U.S.A., April, 1974.
- Geological Association of Canada, Annual Meeting, St. John's, Newfoundland, May, 1974.
- Field conference, Swedish Geodynamic Project, Caledonides of Sweden and Norway, Aug.-Sept., 1974.
- Meeting and field conference, Ordovician System Symposium, the Palaeontological Association, Birmingham, England, Sept., 1974.
- Meeting and field conference, La Chaîne Varisque d'Europe Moyenne et Occidentale, Rennes, France, Sept., 1974.

- Meeting, Working Committee, International Geological Correlation Program, Caledonian Orogen Project, Halifax, Nova Scotia, Feb., 1974.

Special Talks

W.H. Poole

-"Geology and Geophysics of Gaspé - Maritime Provinces", Reston, Virginia, U.S.A., April, 1974.
-"Geology and mineral deposits of Canadian Appalachians", Geological Survey of Canada Workshop , Ottawa, Ontario, May, 1974.
-"Plate tectonic evolution of Canadian Appalachians", Trondheim, Norway, Aug., 1974; Rennes, France, Sept.,1974.

Membership on Committees

W.H. Poole

- Member, Geological Survey of Canada, Exhibits Committee.
- Member, Working Committee, International Geological Correlation Program, Caledonian Orogen Project.

Lapidary - Paleontology Service Unit

B.J. Botte

A. Paleontology Preparation Laboratory (B.J. Botte)

Name	Saw Cuts	Thin Sections	Polished Surfaces	Rubber Molds	Plaster Casts	Rubber Peels Casts		Mech. Prep.
Bolton, T.E.	179	211		5	10			
Copeland, M.J.	97	97						
Dean, W.T.	252			6	8			
Frebold, H.	47			108	162	75		81
Fritz, W.H.								
Jeletzky, J.A.	2	2		64	132	2		
Tozer, E.T.			2	53	208			
Poulton, T.	20			105	412	168		5
Division and Branch Services	679	19	5	299	356	70	10	73
TOTAL	1276	319	7	640	1288	316	10	150

Parcels received 383
Parcels shipped 266
Fossil localities recorded
Invertebrates (GSC #89779 to 91990) 2211
Plants (GSC #9110 to 9335) 225
96 lots of fossils received from ISPG with ISPG catalogue numbers were processed.

B.J. Botte as Department First Aid Coordinator, arranged 11 Standard First Aid Training Courses within the Department and examined some 218 candidates for First Aid Certificates. He also examined 5 classes of some 86 candidates from other Government Departments for First Aid certificates. He visited petrographic laboratories in Victoria and Vancouver, British Columbia.

Five groups of geology students and one group of mining engineers visited the laboratory.

B.J. Botte attended an Industrial Accident Prevention Conference in Toronto, and several meetings in Occupational Health and Safety in Ottawa sponsored by the Department.

3. Lapidary Laboratory (A.E. Whitehead)

The laboratory has a three-man staff consisting of A.E. Whitehead, Y. Demers and M. Beaulne.

Work Report for 1974-75:

(1)	Standard thin sections with small, large and no cover slips	4532
(2)	Standard oriented thin sections with small, large and no cover slips	60
(3)	Large oriented thin sections, with or without cover slips	390
(4)	Polished thin sections	469
(5)	Stained thin sections with large cover slips	389
(6)	Grain thin sections with small, large and no cover slips	196
	Subtotal	6036
(7)	Standard thin sections with large cover slips purchased from Coats Petrographic Services, Vancouver (1062) and from Ecole Polytechnique, Montreal (50)	1112
	Total	7148

Man-Hour Jobs 1974-75:

(1)	Large and small polished surfaces	163 - 91 3/4 hrs.
(2)	Trim Saw Cuts	3600 -140 1/4 hrs.
(3)	Other duties	327 - 56 3/4 hrs.
	Total	4090 -288 3/4 hrs.
(4)	Slab saw cuts	544 -245 1/4 hrs.

Special Jobs:

(1) Several ceramic discs were resurfaced for Mr. Lavergne. These discs could then be re-used, resulting in considerable saving.
(2) Sixty ceramic crucibles were ground and levelled for J. Paris.
(3) Samples of jade were prepared for Economic Geology, Embassy and National Film Board Collections.

(4) Several pieces were squared off to 5 mm thick, squared rods 1.5 cm were made from rough samples, and a 5-mm thick slice was prepared for Dr. Katsube for electrical rock property studies.
(5) Mounted grains were polished for Dr. Emslie.
(6) Several samples were prepared for auto-radiographs.
(7) Numerous samples were stripped of weathered surfaces prior to chemical analysis and staining.
(8) Twelve rock samples were polished for A. Stenson to be used for her publication on Newfoundland.
(9) Sixty-eight light grain sections were ground for J. Claque.
(10) Twenty samples were polished for Dr. Ermanovics on behalf of Mr. Parks for structural study.
(11) Numerous trim and slab, saw serial cuts were done for Dr. Campbell on 12 samples to study structure.
(12) Twelve standard and 12 polished thin sections of samples from Europe were made for Dr. Emslie. These samples required the use of a new fine grade of grinding powder (280).
(13) A slab of quartz and granite were cut for J. Bouvier (Central Laboratories and Technical Services Division) to be used as a hot plate and a cooling plate; also, a glass vessel was ground.
(14) For H. Steacy a sample was slabbed and a section made to determine if it were a meteorite.
(15) Several sections were made for Dr. Prest to determine which would be the best to be photographed and enlarged as a display for the Montreal Olympics, 1976.
(16) For Dr. Baragar, 25 thin sections from polished mounts from R. McLeod's Laboratory were made from his Mid Atlantic Ridge samples. These were mounted on a standard glass slide polished face down, ground down to standard thickness and later transferred to another standard slide with epoxy and polished surface up.
(17) Sections were made, mounted in aerodite and polished for H.G. Ansel from samples of feldspar. This was an arduous job but proved satisfactory.
(18) Difficult sections were made from artifacts on request from the Department of Indian Affairs.

Plaques and Mementos:

(1) Book Ends

Book ends of granite were made for E. Raymond (International Boundary Commission), and Mr. Southerland on Retirement; a similar set, of lepidolite, were made for K. Pollitt on leaving the Geological Survey.

(2) Paper Weights were presented to J.R. Hickson, S. McKinley and Mrs. L. Blouin on their departures.

(3) Other Activities

(a) Consultations

Discussions were held and some polished thin sections were made at Carleton University on their Micro-Mini machine to become familiar with their procedure.

(b) Experiments

Beaulne successfully established the use of aerodite for polished thin sections.

C. Micropaleontology Laboratory (D.K. Kerr)

Sixty-two samples were submitted for microfaunal examination by M.J. Copeland, T.E. Bolton, W.T. Dean and W.H. Poole. These rock samples were crushed, weighed, etched, washed and dried. The resulting fractions were stirred into heavy liquid and the heavy fractions examined for conodonts. Slides of conodonts were returned to the collectors. Samples came from the following localities:

Newfoundland	NWT	District of Mackenzie	No information
4	47	1	10

The remainder of the work period involved assisting Dr. W.H. Fritz. Duties involved drafting for publication and internal reports, and the cleaning of trilobite collections. Trilobite samples were sorted, numbered, saw cuts made, and rock fragments crushed and examined under the microscope. Trilobites were cleaned and smoked with magnesium oxide. All field collections from 1973 and 1974 were completed.

Petrology Section

Edgar Froese

The Petrology Section studies the processes and conditions of formation of igneous and metamorphic rocks by integrating results obtained by field observation, experiment, and theory.

Investigation of anorthosite massifs has contributed to an understanging of their origin, emplacement, and subsequent history. The discovery of high-pressure pyroxenes in some anorthosites suggests a derivation of the magma from mantle material.

Various alkaline complexes were studied. It was demonstrated that omphacitic pyroxene is stable in alkaline rocks subjected to medium-grade metamorphism.

Laboratory studies on the mineralogy of the Axelgold ultrabasic pluton in the Cordillera Region are underway. The pluton and others like it appear to be genetically related to Triassic volcanism. These studies will aid in the evaluation of the potential of volcanogenic sulphide deposits by helping to reconstruct the physical volcanism of the volcanic rocks.

Work was begun on a metamorphic map of part of Manitoba as a contribution to a proposed metamorphic map of the Canadian Shield.

There has been continued study directed towards applying computing techniques to phase equilibria in the study of metamorphic rocks in order to use mineral assemblages as indicators of metamorphic conditions.

Support is being provided to the Branch Data System Group which is concerned with electronic processing of geological data.

Personnel Notes

Edgar Froese was appointed Head of Petrology Section for the fiscal year 1974-75. In February, 1975, M. Turay was assigned eighty per cent of her duties with the Uranium Resources Evaluation Program of the Economic Geology Subdivision.

Attendance at Meetings

K.L. Currie
- Geological Association of Canada-Mineralogical Association of Canada, Annual Meeting, St. John's, Newfoundland, May, 1974.
- Geological Association of Canada, Cordilleran Section, Vancouver, British Columbia, Feb., 1975.
- Friends of the Gardar Conference, Copenhagen, Denmark, 1974.

R.F. Emslie
- Geological Association of Canada-Mineralogical Association of Canada, Annual Meeting, St. John's, Newfoundland, May, 1974.
- Centenary of the Geological Society of Belgium, Liège, Belgium, Aug., 1974.

E. Froese
- NATO Advanced Study Institute on "Volatiles in Metamorphism", Nancy, France, Aug., 1974.
- Geological Society of America, Annual Meeting, Miami Beach, Florida, U.S.A., Nov., 1974.

T.M. Gordon
- Geological Association of Canada-Mineralogical Association of Canada, Annual Meeting, St. John's, Newfoundland, May, 1974.
- NATO Advanced Study Institute on "Volatiles in Metamorphism", Nancy, France, Aug., 1974.
- Geological Society of America, Annual Meeting, Miami Beach, Florida, U.S.A., Nov. 1974.

Special Talks

K.L. Currie
- "Petrology of the Manicouagan structure, Quebec" and "Role of Liquid Immiscibility in the Ice River Complex, B.C.", McGill University, Montreal, Quebec, Oct., 1974.

-"Pressures and temperatures indicated by the assemblage jadeite-nepheline-albite in alkaline rocks", Frinds of the Gardar Conference, Copenhagen, Denmark, June, 1974.
-"The nature and significance of alkaline intrusive rocks in the Canadian Cordillera", Geological Association of Canada, Cordilleran Section, Feb., 1975.

R.F. Emslie
-"The Harp Lake Complex, Labrador", Geological Association of Canada-Mineralogical Association of Canada, Annual Meeting, St. John's, Newfoundland, May, 1974.
-"The Harp Lake Complex, Labrador, and the Morin Complex, Quebec", Geological Society of Belgium, Liège, Belgium, Aug., 1974.

T.M. Gordon
-"A mathematical technique for the analysis of assemblage data", Geological Association of Canada-Mineralogical Association of Canada, Annual Meeting, St. John's, Newfoundland, May, 1974.
-"Algebraic methods in the study of natural assemblages", Geological Society of America, Annual Meeting, Miami Beach, Florida, U.S.A., Nov., 1974.

Membership on Committees

K.L. Currie
- Lamprophyre Nomenclature Subcommittee of International Union of Geodesy and Geophysics, Committee on Systematic Petrography.

T.M. Gordon
- Department of Energy, Mines and Resources Computer Working Committee.
- Geological Survey of Canada, Computer Users Committee.
- Geological Survey of Canada, Age Determination Committee.

Petrology Laboratory

M. Turay

The petrology laboratory provides equipment and help for petrographic investigations and certain mineral separations. Petrographic services carried out on request include specific gravity determinations, mineral composition determinations, mineral staining, special petrographic studies, determination of optical properties of minerals and development of new petrographic techniques.

The laboratory also provides occasional help for the classification of samples in the representative rock collections (Curator, W.U. ter Haar Romeny). A chemical laboratory is used

for wet chemical work (mineral staining, etc.) and for mineral separation. The X-ray powder diffractometer is used, under supervision, by various members of the Regional and Economic Geology Division for mineral identification.

Work performed during the report year:

Mineral staining.....	337
X-ray powder diffraction.....	18
Petrographic determination.....	61

The petrographic determinations included 25 artifacts for the National Museum of Canada and one sample of a statue for the National Gallery of Canada. Twenty samples of basic dykes were studied for Drs. Fahrig and Bridgwater. Two papers on fission track dating were reviewed. A poster on rocks for the general public was designed.

M. Turay joined Dr. P. Hoffman's field party in the Bear Province during the month of July, and since February, 1975 has been seconded to the Uranium Resources Evaluation Section of the Economic Geology Subdivision.

Eastern Paleontology Section

W.T. Dean

The work of the Section's four research scientists is to refine biostratigraphic methods of correlating and determining the age of Paleozoic rocks of the Appalachian Region and other parts of Canada by studying, describing and evaluating the faunas and palynofloras they contain.

During the year, the staff completed 51 scientific reports on 324 lots of fossils for the Geological Survey of Canada and other organizations in North America and Europe. Zonal standards were developed for correlation of Silurian rocks of Anticosti Island, Quebec and Ordovician rocks of the Hudson-Foxe Basin and southwestern District of Mackenzie based on ostracodes. Descriptions were prepared of trilobites from Newfoundland, Quebec and British columbia that will provide a basis for their use in correlation of Ordovician rocks of these regions. A concept was proposed that three grand cycles (shale-carbonate pairs) in Lower Cambrian rocks extend from Mexico to Yukon Territory, and that they will be useful for correlation and for predicting the occurrence of stratiform mineral deposits.

Ultimately, the refinement of biostratigraphy capability for Canadian rocks depends upon establishment of world-wide biostratigraphic standards to which zones in Canada can be correlated. During the year the staff of the Eastern Paleontology Section contributed toward this goal by membership on the International Subcommissions of Cambrian, Ordovician, and Devonian Stratigraphy of the International Union of Geological Sciences, and by collaboration with scientists from other countries in study of biostratigraphically critical fossils from western Europe, Turkey, and North Africa.

Personnel Notes

D.C. McGregor spent 3 weeks in January, 1975 as palynological consultant to the Turkish Petroleum Corporation, Ankara, Turkey, through the United Nations Office of Technical Cooperation.

On September 9, 1974, the Paleontology Service Unit was transferred from Eastern Paleontology Section to Correlation and Standards Subdivision Office.

Attendance at Meetings

M.J. Copeland
- Palaeocope Ostracoda Symposium, Baltic-Scanian Silurian Project, Visby, Sweden, Aug., 1974.
- Eastern Canada Biostratigraphy Seminar, McGill University, Montreal, Quebec, Dec., 1974.
- Northeastern Section, Geological Society of America, Syracuse, New York, U.S.A., March, 1975.

W.T. Dean
- Symposium on the Ordovician System, with related field excursions; also meeting of Subcommission for Ordovician Stratigraphy and associated Working Groups, Birmingham, England, Sept., 1974.

D.C. McGregor
- Field conference in Germany, France and Belgium, Subcommission on Devonian Stratigraphy, International Union of Geological Sciences, Aug.-Sept., 1974.
- Symposium on Belgian Micropaleontological Limits, and Executive committee meeting, Commission International de Microflore du Paléozoique, Namur, Belgium, Sept., 1974.
- Working Groups, International Commission for Palynology, Queens' College, Cambridge, England, Sept., 1974.
- Symposium on "Evolutionary Significance of the Exine", Linnean Society, London, England, Sept., 1974.
- Annual meeting, American Association of Stratigraphic Palynologists, Calgary, Alberta, Oct., 1974.
- Working Group 13-B, Commission Internationale de Microflore du Paléozoique, King's College, London, England, Jan., 1975.
- Field Conference, Subcommission on Devonian Stratigraphy, Morocco, Feb.-March, 1975.

Special Talks

M.J. Copeland -"Late Ordovician to Middle Silurian palaecope faunas, Anticosti Island, Quebec, Canada", Visby, Sweden, Aug., 1974.

W.T. Dean -"Some aspects of Ordovician correlation and trilobite distribution in the Canadian Appalachians", Birmingham, England, Sept., 1974.

D.C. McGregor -"Early and Middle Devonian spores of the Moose River Basin, Ontario", London, England, Jan., 1975.

Membership on Committees

M.J. Copeland
- Chairman, Geological Survey of Canada, Earth Science Publication Committee.
- Member, Geological Survey of Canada, Internal Newsletter Committee.
- Member, ad hoc Committee on Paleozoic Ostracoda, International Ostracode Congress.

W.T. Dean
- Titular Member, Subcommision on Ordovician Stratigraphy; Vice-Chairman, Working Group, Cambro-Ordovician Boundary; Corresponding Member, Subcommission on Cambrian Stratigraphy; Corresponding Member, Working Group, Middle/Upper Cambrian Boundary, all of International Union of Geological Sciences.

W.H. Fritz
- Corresponding Member, Working Group, Precambrian/Cambrian Boundary, International Union of Geological Sciences.

D.C. McGregor
- Titular Member, Subcommission on Devonian Stratigraphy, International Union of Geological Sciences.
- Chairman,International Affairs Committee, American Association of Stratigraphic Palynologists.
- Member, North American Devonian Study Group.
- Member, Executive Committee; and North American Secretary, of Commission Internationale de Microflore du Paléozoique.

Production Statistics

Paleopalynology Laboratory - 325 samples were processed by technician P. Webb to recover miospores, megaspores, acritarchs, chitinozoa and miscellaneous palynomorphs. From the resulting residues, 1834 slides were prepared and megaspores were picked from 212 samples.

Type Fossil Collection

Thomas E. Bolton continued as Curator of the National Type Collection of Invertebrate and Plant Fossils. A total of 1,472 type specimens described in both Geological Survey of Canada and outside publications were added to the collection in 1974. Publications in which these types were reported are as follows:

GSC Bull. 231 - Trilobitoidea, Cambrian, B.C..... 11
232 - Conodonts, Devonian, Alberta..... 76
240 - Trilobites, Ordovician, Newfoundland..... 59
241 - Ostracodes, Silurian, Quebec.....528
244 - Ostracodes, Ordovician, District of Mackenzie.....142
GSC Paper 73-12 - Palynomorphs, Cretaceous, Arctic..... 69

Total.....885

Types in Outside Publications:

Andrew, H.N., Gensel, P.G. and Forbes, W.H. (Univs. Connecticut and Maine), Palaeontology, 17:2..... 12
Barnes, C.R. (Univ. Waterloo), Symp. Geol. Can. Arctic..... 27
Boucot, A.J. (Oregon State Univ.) and Chiang, K.K. (Univ. Calgary), J. Pal., 48:1..... 17
Carter, J.L. (Carnegie Mus.), J. Pal., 48:4..... 3
Dixon, O.A. (Univ. Ottawa), J. Pal., 48:3..... 14
Hofmann, H.J. (Univ. Montreal), Can. J. Earth Sci., 11:8.... 4
Jeletzky, J.A. (G.S.C.), Geol. J., Sp. Issue 5..... 10
Jones, B. (Univ. Ottawa), J. Pal., 48:5..... 19
Kuc, M. (G.S.C.), Can. J. Eath Sci., 11:3..... 14
Lenz, A.C. (Univ. Western Ontario), Can. J. Earth Sci.,11:8. 39
Lespérance, P.J. (Univ. of Montreal), Am. J. Sci., 274 4
Ludvigsen, R. (Univ. of Western Ontario), N. Jb. Geol. Paleont. Mh., 3..... 6
Mamet, B.L. (Univ. Montreal), Revue de Micropal., 15:2.....103
McGregor, D.C. (G.S.C.), Can. J. Earth Sci., 11:1..... 52
Perry, D.G. (Univ. Western Ontario), Klapper, G. (Univ. Iowa) and Lenz, A.C. (Univ. Western Ontario), Can. J. Earth Sci., 11:8.....117
Riding, R. (Univ. Newcastle), Geol. Mag., 111:2 and Palaeontology, 17:3..... 4
Riding, R. (Univ. Newcastle) and Jansa, L.J. (G.S.C.), Can. J. Earth Sci., 11:10..... 3
Rigby, J.K. (Univ. Brigham Young), Can. J. Earth Sci.,11:10. 1
Riva, J. (Univ. Laval), Palaeontology, 17:1..... 38
Russell, L.S. (Royal Ont. Mus.), Life Sci. Contr. 102..... 10
Sliter, W.V. (G.S.C.), J. Foram. Res., 3:4..... 47
Strimple, H.L. (Univ. Iowa) and Nassichuk, W.W. (G.S.C.), J. Pal., 48:6..... 8
Wiedmann, J. (Univ. Tubingen), Ecologae Geol. Helv., 66:3... 17
Yochelson, E.L.(U.S.G.S.) and Copeland, M.J. (G.S.C.), Can. J. Earth Sci., 11:1..... 18

Total.....587

Geochronology Section

R.K. Wanless

The Geochronology Section is responsible for the coordination of the radiometric age determination program of the Geological Survey of Canada and undertakes isotopic analyses of rocks and/or minerals required to support detailed geochronological studies. Age determinations are based on the K-Ar, Rb-Sr and U-Pb isotopic systems. Stable isotope analyses of sulphur, carbon and lead are also provided.

During the past year increased emphasis has been placed on the application of U-Pb dating techniques to zircons selected from key rock units. Laboratory facilities have been expanded with the objective of processing 100 zircon samples per year. The development of the capability to process very small quantities of zircon facilitates comparison of the response of the K-Ar, Rb-Sr and U-Pb isotopic systems within the single rock unit to the tectonic and metamorphic events that have affected the rocks. By undertaking such research it is often possible to distinguish between the original age of intrusion or deposition and the time of subsequent metamorphic events.

Zircon is a minor constituent of rocks and consequently large samples are required in order to obtain sufficient for precise age measurement. A field testing kit has been used to identify favourable rocks before samples are selected. Fourteen field sampling kits were provided for field officers in 1974 and in addition, members of the Geochronology Section visited 11 field parties to assist with the collection of specific key samples. During the 1974 field operation, 138 zircon-bearing samples were shipped to Ottawa for age study; concentrates have now been prepared from many and preliminary age results reported.

This year completed zircon age measurements have spanned the range from 60 m.y. to over 3,000 m.y. The oldest age was obtained for rocks representing the Archean basement in the Slave Structural Province and is the first rock of this antiquity to be dated in our laboratory. In addition, recent results obtained for acid volcanic units in the Slave Province proved to be identical to ages previously obtained for similar rocks in the Ennadai-Rankin Inlet area and the Noranda area. The geochronological results thus indicate that acid volcanism occurred simultaneously about 2,650 m.y. ago in widely separated regions of the Canadian Shield.

The hardware required to interface the laboratory mini-computer to all mass spectrometers was designed and assembled. Five of the six mass spectrometers are now equippped with an operator panel that permits the analyst to initiate transfer of itosopic data to the computer and to control the flow of data during the analysis. A software package for mass spectrometer sample data acquisition operating under the real-time disc operating system has been developed (by personnel of Computer

Science Centre) and successfully tested. This system permits the simultaneous transfer of information from all mass spectrometers and the calculation of all isotopic parameters and age results. Use of this facility greatly accelerates the flow of data in the laboratory and makes it possible for the analyst to critically assess the analytical output before terminating the instrumental analysis.

Personnel Notes

Maurice Côté joined the staff as an isotopic analyst on December 28, 1973 and resigned on September 13, 1974. He was assigned to the analysis of the stable isotopes of carbon and sulphur.

Charles Reithmeier joined the laboratory staff as an isotopic analyst on November 6, 1974. He is employed in the stable isotope program.

Sharon Lindsay, employed as a chemical technician in the Rb-Sr sample preparation laboratory, resigned in April, 1975.

Attendance at Meetings

R.K. Wanless - International Conference on the Geology and Geochemistry of the oldest Precambrian Rocks; Redwood Falls, Minnesota, U.S.A., Sept.-Oct., 1974.

Membership on Committees

R.K. Wanless
- Secretary, Subdivision of Geochronology and Isotopic Studies, Canadian Geophysical Union.
- Member, Geological Survey of Canada, Age Determination Committee.

Production statistics

Argon extractions	178
Argon isotopic analyses	194
Potassium isotope dilution determinations	104
K-Ar ages completed	133
Rubidium isotopic analyses	170
Strontium isotopic analyses	199
Rb-Sr isochron projects completed	19
Lead isotopic analyses	179
Uranium isotopic analyses	64
Zircon analyses completed	51
Common lead isotope standards	2
Sulphur samples converted to SO_2	102
Sulphur isotopic analyses	204
Carbon isotopic analyses	95

Appalachian Section

W.H. Poole

The objectives of the Appalachian Section are to define the composition, stratigraphy and structure of the rocks of the Appalachian geosyncline and eastern Canadian platformal regions; thus to determine their mode of origin and evolution and to provide information for the evaluation of the potential for mineral and hydrocarbon resources. This information is made available to the public in the form of published maps, reports and scientific papers.

Investigations during the year were mainly of stratigraphical and structural nature. A study of the regional geology of Southern Avalon Peninsula in eastern Newfoundland marked the final phase of reconnaissance mapping in the Canadian Appalachian Province. This project, to be completed in 1975, is being carried out under a contract let to Memorial University of Newfoundland. The results of recently completed studies of the geology of the northern extremity of Great Northern Peninsula is in the process of preparation for publication. The report, when completed, will be of considerable value to current engineering feasibility studies relating to a proposed tunnel to be constructed beneath Strait of Belle Isle to carry electric power to insular Newfoundland from the Gull Island hydroelectric power dam under construction in Labrador. The report will also assist exploration companies in locating the more favourable areas for zinc deposits such as those near Daniel's Harbour in western Newfoundland, where mining will begin in 1975. In northeastern Newfoundland, a detailed study of volcanic rocks was initiated. The objective of this program is to reconstruct the environments of volcanism and the formation of associated (sub-economic) sulphide deposits.

The L'Anse aux Meadows National Historic Park, the viking site occupied about 1000 A.D. at the northern end of Great Northern Peninsula, was briefly studied for Parks Canada, and information supplied that will aid in the development of the park for tourists.

Compilation maps at 1:2 million scale initiated and largely compiled at Atlantic Geoscience Centre were completed of the geology, physiography and basin structure of the onshore-offshore regions of Eastern Canada. The three maps focus on the sedimentary basins of eastern Canada that are believed to have hydrocarbon potential. A regional study of the evaporite basins of Canada was begun with one objective being to investigate the feasibility of utilizing salt deposits for the storage of radioactive wastes.

Advice and project evaluation were provided to mineral development programs in the Atlantic Provinces, funded mostly by Department of Regional Economic Expansion.

Personnel Notes

On June 1, 1974, W.H. Poole assumed duties as Head, Correlation and Standards Subdivision, and continued as head of the Appalachian Section. The section became part of the Subdivision. On September 1, 1974, B.V. Sanford was transferred to the Appalachian Section from Atlantic Geoscience Centre where he had been in charge of the Eastern Petroleum Geology Subdivision. His new responsibilities will consist of geological studies in eastern Canadian platformal strata and the co-ordination of an inventory of the geology of evaporitic basins of Canada.

Attendance at meetings, conferences and courses

H.H. Bostock
- Friends of the Grenville field trip to Morin anorthosite, Ste.Adele, Québec, Sept., 1974.

L.M. Cumming
- Inventory Planning meetings for L'Anse aux Meadows National Historic Park, Ottawa, July and December, 1974.
- Strait of Belle Isle Tunnel Crossing meeting, St. John's, Newfoundland, Nov., 1974.

B.V. Sanford
- International Offshore Symposium, Canadian Society of Petroleum Geologists, Oct., 1974.

Special talks and lectures

L.M. Cumming
- "Geology of tunnel location", and "Geology and physical properties of the rocks in the Strait of Belle Isle Region", Strait of Belle Isle Tunnel Crossing Meeting, St. John's, Newfoundland, Nov., 1974.
- "Zinc Occurrences in Western Newfoundland", Memorial University, St. John's, Newfoundland, Nov., 1974.
- "Resource Developments, Western Newfoundland", Ottawa Kiwanis Club, Ottawa, Ontario, Feb., 1975.

B.V. Sanford
- "Paleogeography and sedimentation of the Lower Paleozoic - Eastern Canada" International Offshore Symposium - Canadian Society of Petroleum Geologists, Calgary, Alberta, Oct., 1974.

Membership on Committees

H.H. Bostock
- Member, Departmental of Energy, Mines and Resources Safety Committee.

L.M. Cumming
- Member, Geological Survey of Canada, Earth Science Education Committee.

- Member, Executive Committee, Canadian Institute of Mining and Metallurgy, Ottawa Branch.
- Chairman, Nominating Committee, Logan Club, Geological Survey of Canada.

B.V. Sanford

- Member, Subcommittee on Undersea Features, Canadian Geographical Board.

PRECAMBRIAN SUBDIVISION

W.F. Fahrig

This unit comprises 25 officers and two physical scientist support staff engaged in Precambrian studies, three officers and two support staff engaged in paleomagnetic studies and a draftsman. Since completion of the reconnaissance mapping of the Canadian Shield in 1973, the subdivision has engaged in more detailed geology and special studies in areas of most economic potential, mainly north of 60 degrees north latitude. Field work in Northwest Territories was confined largely to the Bear-Slave Structural Province where six parties operated and the Foxe Fold Belt where three parties were engaged. Four parties mapped elsewhere in Canada: in northern Saskatchewan, on the Manitoba-Ontario boundary, in the Kirkland Lake area, Ontario and on the north coast of Labrador, Newfoundland.

Within the Bear-Slave Province, P.F. Hoffman and J.C. McGlynn continued the work in two adjacent map-areas (Sloan River and Calder River) with emphasis on regional volcanic stratigraphy and its relationship to mineral deposits, R.A. Frith studied gneiss domes within Indin Lake map-area, W.R.A. Baragar investigated volcanic belts at Yellowknife, Wolverine Lake and James River, and J.B. Henderson made sedimentological studies of the Yellowknife Supergroup in the upper Back River area and in High Lake, Point Lake, Beechy Lake and Hearne Lake map-areas. F.H.A. Campbell commenced a stratigraphic and sedimentological study of the Goulburn Group of early Proterozoic (Aphebian) age in the Kilohigok Basin, Bathurst Inlet.

Within the Foxe Fold Belt, W.C. Morgan commenced a four year project to study the Piling Group and its relationship to basement in central Baffin Island and T. Frisch and M. Schau completed studies of gneissic and volcanogenic rocks of the Prince Albert Group, Melville Peninsula.

Elsewhere,F.W. Chandler studied the Daly Lake Group of the Wollaston Lake Fold Belt in northeastern Saskatchewan. This group comprises migmatized sandstone and limestone and is of economic significance because it is host to base metal and uranium deposits. I. Ermanovics (with G. Park, Keele University, England) began study of the Island Lake map-area on the Manitoba-Ontario boundary. Three greenstone belts were mapped in detail and studies were carried out on their contained sulphide concentrations. R.H. Ridler commenced a regional metallogenic and volcanic stratigraphic investigation of the Superior Province in the area west of Kirkland Lake and extended known stratigraphy of the Kirkland Lake area westward 35 miles to Matachewan, Ontario. D. Bridgwater, an exchange geologist with the Geological Survey of Greenland, studied the early Precambrian rocks in the Saglek area, coast of Labrador, Newfoundland.

The Precambrian Subdivision has been divided into four sections, three of which deal with the regional geology of the Canadian Shield, and a fourth section that carries out investigations largely to apply paleomagnetic techniques to the solution of Precambrian geological problems. The Bear-Slave Section under J.C. McGlynn will investigate the geology of the Bear and Slave Provinces, the Northern Churchill Section under K.E. Eade will deal with the geology of the Churchill Province excluding those parts that lie in northern Saskatchewan and Manitoba, and the Superior-Grenville Section under R.H. Ridler will study the geology of the Superior and Grenville Provinces and parts of the Churchill Province that lie in northern Manitoba and Saskatchewan. The Paleomagnetic Section will be the responsibility of E.J. Schwarz. The three Precambrian Sections were organized late in 1974; separate reports on their activities have not been prepared for the present publication.

Three members of the Subdivision, M.J. Frarey, W.R.A. Baragar and F.C. Taylor have been assigned special projects outside the sectional organization.

Under the title "Nice Canada" the subdivision held a series of eleven seminars between December 20, 1974 and March 14, 1975. These well attended Friday afternoon sessions, coordinated by M. Schau, discussed and debated the composition, morphology, methodology of mapping and distribution of gneissic rocks of Canada.

Personnel Notes

L.P. Tremblay was on assignment with the Canadian Industrial Development Agency for two weeks in April, 1974.

A.N. Lecheminant and J. Bourne joined the staff of the subdivision in April and June respectively, D. Bridgwater was on exchange from the Geological Survey of Greenland, and R. Herd was attached as a post-doctoral fellow in October. A. Davidson returned from leave of absence but remains on secondment to the Canadian Industrial Development Agency. P.F. Hoffman has been on leave of absence during the winter of 1974-75 as Fairchild Distinguished Scholar at California Institute of Technology. Technical support on a continuing basis is being supplied by the addition of Physical Scientist I. Maley in May. W. Karvinen resigned from the subdivision in June, 1974 to accept a post with the Ontario Division of Mines.

Attendance at meetings, conferences and courses

W.R.A. Baragar - Geological Association of Canada, Annual Meeting, St. John's, Newfoundland, May 20-22, 1974.

	- Post-Cruise meeting, Deep Sea Drilling Project (JOIDES) Leg 37, Halifax, Nova Scotia, Aug. 26-27, 1974.
	- Workshop on Archean Textures, Kingston, Ontario, Oct. 4-5, 1974.
	- Central Canada Universities Conference, University of Ottawa, Ottawa, Ontario, Oct. 18, 1974.
	- Penrose Conference on pre-Mesozoic Plate Tectonics, Vail, Colorado, U.S.A., Jan. 5-10, 1975.
J. Bourne	- Friends of the Grenville, Field Trip to Morin Anorthosite, Ste. Agathe, Quebec, Sept. 12-13, 1974.
	- Metamorphism in the Grenville Province, Queen's University, Kingston, Ontario, April 3, 4, 1974.
	- Prospectors & Developers Association, Annual Convention, Toronto, Ontario, March 9-11, 1975.
F.H.A. Campbell	- Geological Association of Canada - Mineralogical Association of Canada, Annual Meeting, St. John's, Newfoundland, May 20-22, 1974.
F.W. Chandler	- Institute of Lake Superior Geology, Annual Meeting, Sault Ste. Marie, Ontario, May 1-5, 1974.
	- Geological Survey of Canada - Ontario Division of Mines Huronian Field Trip (with K.D. Card, M.J. Frarey), Sudbury - Sault Ste. Marie, Ontario, April 29-May 1, 1974.
I.F. Ermanovics	- International Conference - Geology and Geochemistry of the Oldest Precambrian Rocks, Redwood Falls, Minnesota, U.S.A., Sept. 29-Oct. 4, 1974.
	- Superior Geotraverse Workshop, University of Toronto, Toronto, Ontario, Feb. 24, 25, 1975.
W.F. Fahrig	- Institute of Lake Superior Geology, Annual Meeting, Sault Ste. Marie, Ontario, May 1-5, 1974.

	- Friends of the Grenville, Field trip to Morin Anorthosite, Ste. Agathe, Quebec, Sept. 12-13, 1974.
	- International Conference - Geology and Geochemistry of the Oldest Precambrian Rocks, Redwood Falls, Minnesota, U.S.A., Sept. 29-Oct. 4, 1974.
M.J. Frarey	- Institute of Lake Superior Geology, Annual Meeting, Sault Ste. Marie, Ontario, May 1-5, 1974; Co-leader of field trip, Igneous rocks of the north shore of Lake Huron.
J.A. Fraser	- Workshop on Structural Geology (conducted in Kaladar, Ontario region by Prof. W.M. Schwerdtner, University of Toronto), Oct. 15-17, 1974.
T. Frisch	- Geological Society of America, Annual Meeting, Miami Beach, Florida, U.S.A., November 1974.
R.A. Frith	- American Geophysical Union, Annual Meeting, Washington, U.S.A., Apr. 8-12, 1974.
	- International Conference - Geology and Geochemistry of the Oldest Precambrian rocks, Redwood Falls, Minnesota, U.S.A., Sept. 29-Oct. 4, 1974.
J.B. Henderson	- International Conference - Geology and Geochemistry of the Oldest Precambrian Rocks, Redwood Falls, Minnesota, U.S.A., Sept. 29-Oct. 4, 1974.
	- Geological Society of America, Annual Meeting, Miami Beach, Florida, U.S.A., Nov. 1974.
	- Yellowknife Geoscience Forum, Yellowknife, Northwest Territories, Dec. 12, 13, 1974.
W.W. Heywood	- Geological Association of Canada - Mineralogical Association of Canada, Annual Meeting, St. John's, Newfoundland, May 20-22, 1974.
P.F. Hoffman	- Yellowknife Geoscience Forum, Yellowknife, Northwest Territories, Dec. 12, 13, 1974.

	- Penrose Conference on pre-Mesozoic Plate Tectonics, Vail, Colorado, U.S.A., Jan. 5-10, 1975.
	- Cordilleran Section, Geological Society of America, Annual Meeting, Los Angeles, California, U.S.A., March 25-27, 1975.
G.D. Jackson	- Friends of the Grenville, Field Trip to Morin Anorthosite, Ste. Agathe, Quebec, Sept. 12-13, 1974.
	- International Conference - Geology and Geochemistry of the Oldest Precambrian Rocks, Redwood Falls, Minnesota, U.S.A., Sept. 29-Oct. 4, 1974.
M.B. Lambert	- Canadian Institute of Mining - Metallurgy, Rouyn-Noranda Branch Meeting, Noranda, Quebec, May, 1974.
	- Deep River Science Association Meeting, Deep River, Ontario, October, 1974.
	- The Royal Canadian Institute Meeting, Toronto, Ontario, November, 1974.
A.N. LeCheminant	- Geological Association of Canada - Mineralogical Association of Canada, Annual Meeting, St. John's, Newfoundland, May 20-22, 1974.
	- Prospectors and Developers Association, Annual Convention, Toronto, March 9-11, 1975.
J.C. McGlynn	- International Conference - Geology and Geochemistry of the Oldest Precambrian Rocks, Redwood Falls, Minnesota, U.S.A., Sept. 29-Oct. 4, 1974.
	- Penrose Conference on pre-Mesozoic Plate Tectonics, Vail, Colorado, U.S.A., Jan. 5-10, 1975.
W.C. Morgan	- Institute of Lake Superior Geology - Annual Meeting, Sault Ste. Marie, Ontario, May 1-5, 1974.
	- International Conference - Geology and Geochemistry of the Oldest Precambrian Rocks, Redwood Falls, Minnesota, U.S.A., Sept. 29-Oct. 4, 1974.

	- Geological Society of America, Annual Meeting, Miami Beach, Florida, U.S.A., Nov. 1974
R.H. Ridler	- Geological Association of Canada - Mineralogical Association of Canada, Annual Meeting, St. John's, Newfoundland, May 20-22, 1974.
	- NATO Symposium, Metallogeny and Plate Tectonics, St. John's, Newfoundland, May 23-31, 1974.
	- Workshop on Archean Textures, Kingston, Ontario, Oct. 4-5, 1974.
	- Society of Economic Geologists, Meeting, New York, U.S.A., Feb. 16-18, 1975.
	- Superior Geotraverse Workshop, University of Toronto, Feb. 24-25, 1975.
M. Schau	- Geological Association of Canada - Mineralogical Association of Canada, Annual Meeting, St. John's, Newfoundland, May 19-22, 1974.
	- Yellowknife Geoscience Forum, Yellowknife, Northwest Territories, Dec. 12-13, 1974.
R. Skinner	- Geological Survey of Canada - Ontario Division of Mines, Huronian field trip Sudbury to Sault Ste. Marie, Ontario, April 29-May 1, 1974.
	- Institute of Lake Superior Geology Annual Meeting and field trip, Sault Ste. Marie - Wawa, Ontario, May 1-5, 1974.
	- Superior Geotraverse Workshop, University of Toronto, Feb. 24-25, 1975.
F.C. Taylor	- Prospectors and Developers Association, Annual Convention, Toronto, Ontario, March 9-11, 1975.
L.P. Tremblay	- Canadian Institute of Mining and Metallurgy, Annual Meeting, Montreal, April 21-25, 1974.

Special talks or lectures

W.R.A. Baragar
- "Plateau basalts of Canadian Shield", Ecole Polytechnique, Montreal, Quebec, April 5, 1974.
- "Seal Lake and Croteau volcanic rocks of Labrador", Geological Association of Canada - Mineral Assoc. Canada, Annual Meeting, St. John's, Newfoundland, May 22, 1974.
- "Recognition of aquagene textures in Archean basalts", Workshop on Archean textures, Queen's University, Kingston, Ontario, Oct. 5, 1974.
- "The eruption on Heimaey", Central Canada Universities Conference, University of Ottawa, Ottawa, Ontario, Oct. 18, 1974.
- "Evidence of Pre-Grenville rifting", Penrose Conference on pre-Mesozoic Plate Tectonics, Vail, Colorado, U.S.A., Jan. 8, 1975.

F.H.A. Campbell
- "Geology of the Kilohigok Basin", Brock University, St. Catharines, Ontario; University of Western Ontario, London, Ontario; Windsor University, Windsor, Ontario; Laurentian University, Sudbury, Ontario; University of Manitoba, Winnipeg, Manitoba; Concordia University, Montreal, Quebec.
- "The Lynn Lake - Flin Flon area, and correlation problems", Carleton University, Ottawa, Ontario.

I.F. Ermanovics
- "A discussion of age determinations of Archean rocks in Manitoba south of Latitude 54°"- Superior Geotraverse Workshop, University of Toronto, Toronto, Ontario, Feb. 1975.
- "Problems of the Archean Crust in the Western Superior Province", Department of Geology, Concordia University, Montreal, Quebec.

T. Frisch
- "Whole-rock Rb/Sr ages of metamorphic rocks from northern Ellesmere Island, Canadian Arctic Archipelago" (with A.K. Sinha), Geological Society of America, Annual Meeting, Miami Beach, Florida, U.S.A., Nov. 1974.

- "New data on the inclusion assemblage of the Bokkos phonolitic-basanitic plug, Nigeria" (with J.B. Wright), Geological Society of America, Annual Meeting, Miami Beach, Florida, U.S.A. Nov. 1974.

R.A. Frith

- "Pre-Kenoran tonalites in the Western Slave Province of the Canadian Shield", American Geophysical Union, Washington, D.C., U.S.A., April 12, 1974.

- "Ancient tonalites and their possible mode of emplacement - a geochronological and structural study", International Conference - Geology and Geochemistry of the Oldest Rocks, Redwood Falls, Minnesota, U.S.A., Oct. 2, 1974.

J.B. Henderson

- "Reconnaissance of Yellowknife Supergroup 1974", Yellowknife Geoscience Forum, Yellowknife, Northwest Territories, Dec. 1974.

P.F. Hoffman

- "Volcanism and plutonism in the Great Bear Batholith", University of Southern California, University of California, Santa Cruz, California, and University of British Columbia, Vancouver, British Columbia.

- "Aulacogens", University of California, Santa Cruz, California, U.S.A.

M.B. Lambert

- "The Heimaey volcanic eruption, Iceland, 1973", The Toronto Geological Discussion Group, Toronto, Ontario; The Deep River Science Association, Deep River, Ontario; Canadian Institute of Mining and Metallurgy, Rouyn-Noranda Branch, Noranda, Quebec; The Royal Canadian Institute, Toronto, Ontario; Phillemon Wright High School, Hull, Quebec.

J.C. McGlynn

- "Tectonics of Churchill Province", Penrose Conference on pre-Mesozoic Plate Tectonics, Vail, Colorado, U.S.A., Jan. 1975.

- "Archean Supracrustal Rocks of Slave Province", Symposium on Archean Volcanology, University of Montreal, Montreal, Quebec, March 1974.

W.C. Morgan

- "The Nain-Churchill Boundary in the Torngat Mountains, North Labrador: an Archean-Proterozoic Structural Province Contact in the Canadian Precambrian Shield", Geological Society of America, Annual Meeting, Miami Beach, Florida, U.S.A., Nov. 1974.

R.H. Ridler

- Invited lecturer and Guide, University of Arizona, Abitibi Field Trip, Kirkland Lake area, May 17-18, 1974.

- "Volcanic stratigraphy and metallogeny of the Rankin Inlet-Ennadai Belt, District of Keewatin, N.W.T.", NATO Symposium on Metallogeny and Plate Tectonics, at Geological Association of Canada Meeting, St. John's, Newfoundland, May 20-22, 1974.

- "Ultramafic cumulates, Kakaki Lake", Workshop on Archean textures, Queen's University, Kingston, Ontario, Oct. 4, 5, 1974.

- Invited lecturer and Guide, Noranda Explorations Inc., Abitibi Field Trip, Kirkland Lake area, Ontario, Oct. 21-23, 1974.

- "Syngenesis, epigenesis and synthesis, the Archean metallogeny of Kirkland Lake", McMaster University, Hamilton, Ontario, Nov. 12, 1974.

- "Volcanism of the Universal (Wernerian) Archean Ocean", Laurentian University, Sudbury, Ontario, Dec. 3, 1974.

- "The Gold metallogeny of Archean exhalites", Symposium on Canadian Economic Geology, Society of Economic Geologists Meeting, New York, U.S.A., Feb. 16-18, 1975.

- "Paleomagnetic stratigraphy of the Skead Group, Kirkland Lake, Ont.", Superior Geotraverse Workshop, Toronto, Ontario, Feb. 24-25, 1975.

- "The relationship of Archean volcanism and metallogeny", University of Minnesota, Duluth, Minnesota, U.S.A., March 5-7, 1975.

- "The gold metallogeny of Archean exhalites" (in French), Symposium on Archean Sedimentary Ore Deposits, University of Montreal, Montreal, Quebec, March 20, 1975.

M. Schau

- "Facies distribution and development in the Prince Albert Group, Districts of Franklin and Keewatin" (with F.H.A. Campbell), Geological Association of Canada, Meeting, St. John's, Newfoundland, May 20, 1974.
- "Low grade metamorphism and metasomatism of the Nicola Group, B.C."
- "Heterogeneous glass from Heimaey Iceland" (with E. Gasparrini), Geological Association of Canada, Annual Meeting, St. John's, Newfoundland, May 1974.
- "Ultramafic sills and dykes in the Prince Albert Group, Districts of Franklin and Keewatin" (with F.H.A. Campbell), Geological Association of Canada, Annual Meeting, St. John's, Newfoundland, May 1974.
- "The Prince Albert Belt", Yellowknife Geoscience Forum, Yellowknife, Northwest Territories, Dec. 1974.
- "Gneiss Clusters I have known" and "Magnetic Studies in Gneiss Terrains", Geological Survey of Canada, Gneiss Seminars, Ottawa, Ontario.

L.P. Tremblay

- "How I mapped gneisses in the Beaverlodge Area", Geological Survey of Canada, Gneiss Seminar, Dec. 20, 1974.
- "Geology of Canada", Geological Survey of Canada, to delegates of the 10th Commonwealth Mining & Metallurgy Congress, Ottawa, Ontario, Sept. 5, 1974.

<u>Membership on Committees</u>

W.R.A. Baragar

- Canadian National Committee for International Union of Geodesy and Geophysics.

	- Geological Association of Canada, Editorial Committee.
	- Logan Club, Geological Survey of Canada (Chairman).
	- Volcanology Division, Geological Association of Canada (member).
M.J. Frarey	- Committee on Radioactive Waste Disposal, Department of Energy, Mines and Resources.
	- Committee on Precambrian nomenclature and stratigraphy, Geological Survey of Canada.
J.B. Henderson	- Geological Survey of Canada representative on American Commission on Stratigraphic Nomenclature.
W.W. Heywood	- Executive Committee, Canadian Institute of Mining and Metallurgy, Ottawa Branch.
	- Sub-committee on Class 4 Air Charter, Department of Energy, Mines and Resources, Equipment Committee.
P.F. Hoffman	- Geoscience Canada, Geological Association of Canada, (associate editor).
	- Subcommission on Precambrian Stratigraphy, International Union of Geological Sciences, (correspondent).
M.B. Lambert	- Geological Survey of Canada representative, Department of Energy, Mines and Resources, Equipment Committee.
J.C. McGlynn	- Northwest Territories - Federal Interdepartmental Coordinating Committee.
R.H. Ridler	- Age Determination Committee, Geological Survey of Canada.
	- Geogram, Geological Survey of Canada.
F.C. Taylor	- Age Committee, Geological Survey of Canada (Chairman).

- Department of Energy, Mines and Resources, Field Equipment Committee (Chairman).

L.P. Tremblay

- Precambrian Nomenclature Committee, Geological Survey of Canada.

- Uranium Committee, Geological Survey of Canada.

Paleomagnetism Section

E.J. Schwarz

The program of the section is aimed at obtaining information of geological significance by using magnetic properties of rocks and single minerals. Most of the work is done in cooperation with other staff members of the Geological Survey of Canada.

Progress was made in the following programs:

1. More precise determination of the polar wandering curve based on new results from the Grenville Province in Quebec (Mealy Mountains, Lac St. Jean, Sept-Îles anorthosites and associated rocks). Study of the Circum-Ungava geosyncline initiated last year with sampling of the Smith Island basalts was expanded into the Richmond Gulf area. Good results were also obtained for the Kaminak (Northwest Territories) and Hopedale (Labrador, Newfoundland) dykes. The study of early Archean rocks from Greenland is continuing.

2. Magnetic stratigraphy of Paleozoic and Precambrian sedimentary rocks in the St. Lawerence valley and the Abitibi greenstone belt is being investigated. Work on the Trenton limestone (Ordovician) has been partially successful as well as work on relatively weakly metamorphosed Archean volcanics.

3. Study of the intrinsic magnetic properties of pyrrhotite has been completed. The results may be used for the identification of pyrrhotite phases in natural pyrrhotite associated with ore bodies. A preliminary theoretical study of the effect of cation vacancy ordering has also been completed. A pilot study on ore deposits in well-defined mining areas suggests good possibilities for applied work in providing means of selecting magnetic anomalies in prospecting for sulphide base metal deposits.

4. The tectonic evolution of the Cordillera Region is being evaluated by paleomagnetic techniques. Studies on the Mt. Barr, Hope, East Sooke and Copper Mountain intrusions have been completed.

5. Upper Proterozoic sedimentary strata and basic intrusive rocks on both sides of the Boothia Arch, Northwest Territories have been sampled. Paleomagnetic measurements on this material are nearly complete. The Mistastin mangerite pluton east of Schefferville, Quebec was sampled for paleomagnetic study.

Attendance at meetings, conferences and courses

E.J. Schwarz
- Penrose Conference on Geological Interpretation of Magnetic Maps, Washington, D.C., U.S.A., April 17-21, 1974.

J.H. Foster
- American Geophysical Union, Washington, D.C., U.S.A., April 8-12, 1974.
- Prospectors and Developers Association, Annual Convention, Toronto, Ontario, March 9-11, 1975.

Special talks or lectures

E.J. Schwarz
- "Magnetic properties of pyrrhotites and magnetic anomalies associated with sulphide deposits", Penrose Conference on Geological Interpretation of Magnetic Maps, Washington, D.C., U.S.A., April 1974.
- "Magnetic properties of pyrrhotites and magnetic anomalies associated with sulphide deposits", Brock University, St. Catharines, Ontario.
- "Rock and Paleomagnetism", Brock University, St. Catharines, Ontario.

J.H. Foster
- "Paleomagnetic Stratigraphy", Bedford Institute of Oceanography, Dartmouth, Nova Scotia; Queen's University, Kingston, Ontario; Ottawa University, Ottawa, Ontario; Windsor University, Windsor, Ontario.

Membership on committees

E.J. Schwarz
- Archeomagnetism, Commission III, International Association on Aeromagnetism and Aeronomy.

CORDILLERAN AND PACIFIC MARGIN SUBDIVISION

H. Gabrielse

The Cordilleran and Pacific Margin Subdivision is based in the Sun Tower Building, Vancouver, British Columbia. It includes a Geological Research Unit comprising 16 officers and 7 support personnel and an Information Services Unit comprising 4 staff members. During the year the Information Services Unit was completely reorganized with the intent of increasing self service facilities for customers and more closely integrating library and sales functions.

Geological Research Unit

This unit conducts geological research in the Cordilleran Orogen. It prepares maps, reports and scientific papers that describe the general composition, structure, origin and geological development of the Cordillera Region and relates these to mineral deposits to help in assessing the mineral potential, to guide mineral exploration and to provide aid for planning of the orderly development of land utilization in the region. The Marine Geology Group is conducting a long range program of geological and geophysical studies of the Pacific Continental Shelf and Slope to provide information on hydrocarbon and other resource potential. Ultimately, the objectives of the subdivision are concerned with providing a comprehensive geological data-base which will lead to a better understanding of the geology of the Cordilleran Orogen and of the geological processes involved in its tectonic evolution. The investigations are supplemented by, or supplement, related cooperative activities by other subdivisions and divisions of the Geological Survey of Canada and the Geological Branch of the British Columbia Department of Mines and Petroleum Resources. In addition, the subdivision supports research carried on by graduate students from various universities. Current activities of the subdivision are directed towards two interrelated objectives: the completion of the reconnaissance phase of regional investigations to provide a broad geological and tectonic framework for the Cordillera Region, and detailed studies of specific problems to further the understanding of the nature and sequence of geological processes, with particular reference to the formation and localization of mineral deposits. Reconnaissance studies were carried out in southwestern Yukon Territory, north-central British Columbia, southern Coast Mountains and southern Vancouver Island. Detailed investigations were concerned with the relationships of mineral deposits to stratigraphy and structure in southeastern Yukon Territory, Tertiary volcanic rocks and Upper Paleozoic and Mesozoic sedimentary and volcanic rocks in southwestern Yukon Territory, Mesozoic strata in north-central British Columbia, low to high grade metamorphic rocks bordering and lying within the Shuswap Metamorphic Complex, and studies of hot springs and recent volcanic rocks to determine geothermal energy potential. The Marine Geology Group carried out a restricted program of geophysical surveys off the west coast of Vancouver Island.

Three projects of the subdivision are directly concerned with energy resources of the Cordillera Region. Studies of the Pacific Continental Shelf and Slope and of successor basins are designed to provide information for assessment of hydrocarbon and uranium energy potential. The geothermal program, in conjunction with a project carried out by the Earth Physics Branch provides data relating to possible geothermal energy sources. Projects in north-central British Columbia and particularly in southeastern Yukon Territory are in areas of intense mineral exploration. In these areas, stratigraphic data gathered by the Geological Survey of Canada is critical for exploration for strata-bound mineral deposits.

The entire technical staff of 17 officers was involved in field projects during the 1974 field season. R.B. Campbell led a large operation in St. Elias Mountains of southwestern Yukon Territory, largely within Kluane National Park. On this project regional investigations were carried out by R.B. Campbell and C.J. Dodds, Upper Paleozoic strata were examined by J.W.H. Monger, Upper Jurassic, Lower Cretaceous and Tertiary rocks were studied by G.H. Eisbacher and Tertiary volcanic rocks were studied by J.G. Souther. In addition, the subdivision supported a contract to P.B. Read for study of Upper Triassic volcanic rocks in St. Elias Mountains. D.J. Tempelman-Kluit continued study of stratigraphy, structure, and metallogeny in Pelly Mountains and adjacent Yukon Plateau while supporting two Ph.D. and one Master's thesis programs. S.L. Blusson continued study of selected stratigraphic and structural problems important to the understanding of metallogeny in Selwyn Basin of south-eastern Yukon Territory. T.A. Richards began the reconnaissance mapping of Hazelton W½ (93 H W½) map-area in west-central British Columbia with emphasis on the relationship of Mesozoic stratigraphy, particularly volcanic centres, to mineral deposits. H.W. Tipper studied selected Mesozoic localities in the Inter-montane Belt to obtain data leading to a better understanding of Mesozoic paleogeography. With T.A. Richards he examined lower Jurassic strata on Queen Charlotte Islands for comparison with rocks of similar age exposed on the mainland. H. Gabrielse examined strata and structures bordering Rocky Mountain Trench and Sifton Pass. A.V. Okulitch under term employment continued study of the terrain bordering and lying within the western part of the Shuswap Metamorphic Complex. B.E.B. Cameron completed field work on Tertiary strata of the Nootka Sound area on the west coast of Vancouver Island. J.E. Muller continued the reconnaissance study of Victoria map-area, a project that will complete the present program of regional mapping on Vancouver Island, J.A. Roddick and G.J. Woodsworth, a term employee, completed the reconnaissance mapping of Pemberton W½ map-area. P.B. Read, under contract, carried out detailed studies of selected parts of Lardeau W½ map-area. D.L. Tiffin and R. Currie were engaged in seismic and magnetic studies off Hesquiat Peninsula on the west coast of Vancouver Island. S.F. Leaming studied jade localities in selected areas of the Cordillera Region for purposes of a comprehensive publication.

Three members of the subdivision took part in a field trip in the southern Appalachian Mountains during late November, 1974. The trip formed the basis for comparison of geology and concepts between the Appalachian and Cordilleran orogens. The subdivision again played a major role in organizing and participating in the annual meeting of the Cordilleran Section of the Geological Association of Canada held in Vancouver during February, 1975. Three members took part in a Government-Industry Geoscience Forum in Whitehorse, Yukon Territory in December, 1974.

Consultations with exploration geologists from industry remained at a high level during the year.

Personnel changes

During the year Mr. R.L. Jones joined the staff as Administrative Officer for the subdivision. Miss M.K. Akehurst was appointed Librarian and placed in charge of the Information Services Unit. Miss L.L. Harvie resigned as clerk in the Information Services Unit and Dr. W.W. Hutchison was transferred to headquarters in Ottawa.

Attendance at meetings

S.L. Blusson
- American Institute of Mining Engineers, Annual Meeting, New York, 1975.
- Prospectors and Developers Association, Annual Convention, Toronto, Ontario, March 9-11, 1975.
- Cordilleran Section Symposium, Geological Association of Canada, Vancouver, British Columbia, Feb., 1975.

B.E.B. Cameron
- Canadian Society of Petroleum Geologists 1974 Symposium; Canada's Continental Margins and Offshore Petroleum Exploration, Calgary, Alberta, Sept. 29-Oct. 2, 1974.

R.B. Campbell
- Northern Geoscience Forum, Whitehorse, Yukon Territory, Dec., 1974.
- Cordilleran Section Symposium, Geological Association of Canada, Vancouver, British Columbia, Feb., 1975.
  Scientific Field Trip Southern Appalachian Mountains, Nov., 1974.

R.G. Currie
- Penrose Conference on the Geological Interpretation of Magnetic Data, Reston, Virginia, U.S.A., April, 1974.

G.H. Eisbacher
- Scientific Field Trip, Southern Appalachian Mountains, Nov., 1974.
- Cordilleran Section Symposium, Geological Association of Canada, Vancouver, British Columbia, Feb., 1975.

H. Gabrielse	- Circum Pacific Energy and Mineral Resources Conference, Honolulu, Hawaii, U.S.A., Aug., 1974. - Geological Society of America, Annual Meeting, Miami Beach, Florida, U.S.A., Nov.,1974. - Scientific Field Trip, Southern Appalachian Mountains, Nov., 1974. - Northern Geoscience Forum, Whitehorse, Yukon Territory, Dec., 1974.
S. Leaming	- British Columbia Gem Craft Show, sponsored by Lapidary Rock and Mineral Society of British Columbia, Oct., 1974. - Cordilleran Section Symposium, Geological Association of Canada, Vancouver, British Columbia, Feb., 1975.
J.W.H. Monger	- Cordilleran Section Symposium, Geological Association of Canada, Vancouver, British Columbia, Feb., 1975.
J.E. Muller	- Northwest Scientific Association, Vancouver, British Columbia, May, 1974. - Cordilleran Section Symposium, Geological Association of Canada, Vancouver, British Columbia, Feb., 1975.
T.A. Richards	- Cordilleran Section Symposium, Geological Association of Canada, Vancouver, British Columbia, Feb., 1975.
J.A. Roddick	- Northwest Scientific Association, Vancouver, British Columbia, May, 1974. - Trondhjemite Workshop, United States Geological Survey, Denver, Colorado, U.S.A. May, 1974. - Circum Pacific Plutonism Project, Phase 3, San Diego, California, U.S.A. and Northwest Mexico, Sept., 1974. - Cordilleran Section Symposium, Geological Association of Canada, Vancouver, British Columbia, Feb., 1975.
J.G. Souther	- Cordilleran Section Symposium, Geological Association of Canada, Vancouver, British Columbia, Feb., 1975. - Tertiary and Quaternary Volcanism in the Western Cordillera, University of British Columbia, Vancouver, British Columbia, March, 1975. - Tectonic Implications of Volcanicity in Western Canada, University of Alberta, Edmonton, Alberta, March, 1975.

D.J. Tempelman-Kluit - Northern Geoscience Forum, Whitehorse, Yukon Territory, Dec., 1974.
- Cordilleran Section Symposium, Geological Association of Canada, Vancouver, British Columbia, Feb., 1975.

D.L. Tiffin - Circum Pacific Energy and Resources Conference, Honolulu, Hawaii, U.S.A., Aug., 1974.
- Canada's Continental Margins and Offshore Petroleum Exploration Conference, Calgary, Alberta, Sept., 1974.

Special Talks

S.L. Blusson -"The Redstone bedded copper deposit, District of Mackenzie, Northwest Territories", Society of Economic Geologists sessions at American Institute of Mining Engineers Annual Meeting, New York, U.S.A. Feb., 1975.

B.E.B. Cameron -"Tertiary regional geology of the Canadian Pacific Margin and adjacent offshore areas", Northwest Scientific Association, 47th Annual Meeting, Vancouver, British Columbia, May, 1974.
-"Fossils through the microscope", 1974 Pacific Earth Science Methods Workshop, Vancouver, British Columbia, May, 1974.
-"Offshore drilling in British Columbia", Canadian Broadcasting Corporation interview, Oct., 1974.
-"The ocean's Petroleum resources", Annual Meeting, Association of Professional Engineers of British Columbia, Victoria, British Columbia, Oct., 1974.

R.B. Campbell -"Operation Saint Elias", Northern Geoscience Forum, Whitehorse, Yukon Territory, Dec., 1974.
-"Shuswap Metamorphic Complex and Columbia Mountains", University of British Columbia, Vancouver, British Columbia, March, 1974.

R.G. Currie -"Interpretation of magnetic and gravity data, Strait of Juan de Fuca", Penrose Conference, Reston, Virginia, U.S.A., April, 1974.
-"A Review of offshore geophysical activity and methods, British Columbia and the Western Arctic", British Columbia Geophysical Society, Vancouver, British Columbia, Jan., 1975.

G.H. Eisbacher

-"Geology of Kluane National Park", Vancouver Natural History Society, Vancouver, British Columbia, July, 1974.
-"Tectonics and Sedimentation-Columbia Orogen", Princeton University, New Jersey, U.S.A., Nov., 1974.
-"Successor Basins - Canadian Cordillera", Queen's University, Kingston, Ontario, Nov., 1974.
-"Marine and non-marine clastics in late orogenic basins of the Cordillera", McMaster University, Hamilton, Ontario, Nov., 1975.
-"Rocky Mountain structure and foreland sedimentation", Carleton University, Ottawa, Ontario, Nov., 1974.
-"Plutonic debris in Cordilleran sedimentary basins", Cordilleran Section Symposium, Geological Association of Canada, Vancouver, British Columbia, Feb.,1975.
-"Landslide hazards in Western Canada", Simon Fraser University, Vancouver, British Columbia, Feb., 1975.

H. Gabrielse

-"Environments of Cordilleran depositional basins", Circum Pacific Energy and Mineral Resources Conference, Honolulu, Hawaii, U.S.A., Aug., 1974.
-"Plans for future work of G.S.C.in Yukon Territory", Northern Geoscience Forum, Whitehorse, Yukon Territory, Dec., 1974.
-"Tectonic setting of intrusive rocks in the Canadian Cordillera", Cordilleran Section Symposium, Geological Association of Canada, Vancouver, British Columbia, Feb., 1975.

S.L. Leaming

-"Jade Deposits", Richmond Rock Club, Richmond, British Columbia, March, 1975.

J.W.H. Monger

-"Eugeosynclinal rocks in the Canadian Cordillera", University of British Columbia, Vancouver, British Columbia, March, 1975.
-"Eugeosynclinal rocks of the North American Cordillera", Institute of Sedimentary and Petroleum Geology, Calgary, Alberta, March, 1975.

J.E. Muller

-"Geological evolution of Canada's Pacific Margin on Vancouver Island", Northwest Scientific Association, 47th Annual Meeting, Vancouver, British Columbia, May, 1974.

-"Plutonic rocks and related mineral deposits of Vancouver Island" (with D.J.T. Carson and K.E. Northcote), Cordilleran Section Symposium, Geological Association of Canada, Vancouver, British Columbia, Feb., 1975.

J.A. Roddick

-"Geology of the southern Coast Mountains", Northwest Scientific Association, 47th Annual Meeting, Vancouver, British Columbia, May, 1974.
-"Field setting of the Coast Plutonic Complex", Trondhjemite Workshop, United States Geological Survey, Denver, Colorado, U.S.A., May, 1974.
-"Summary of the Coast Plutonic Complex of British Columbia and mechanism of its emplacement", Circum-Pacific Plutonism Project of the International Union of Geological Sciences, San Diego, California, U.S.A., Sept., 1974.

J.G. Souther

-"Tertiary and Quaternary volcanism in the Western Cordillera", University of British Columbia, Vancouver, British Columbia, March, 1975.
-"Tectonic Implications of volcanicity in Western Canada", University of Alberta, Edmonton, Alberta, March, 1975.

D.J. Tempelman-Kluit

-"Aeromagnetic expression of various types of plutonic bodies in Yukon", Penrose Conference on aeromagnetic interpretation, Reston, Virginia, U.S.A., April, 1974.
-"Regional exploration targets for base metals in Yukon Crystalline Terrane", Mining Exploration Group Meeting, Vancouver, British Columbia, March, 1974.
-"Stratigraphy of the Pelly Mountains and its implications concerning the age of metamorphic rocks in the Yukon Crystalline Terrane", Northern Geoscience Forum, Whitehorse, Yukon Territory, Dec., 1974.
-"Setting of plutonic rocks in Yukon Crystalline Terrane", Cordilleran Section Symposium, Geological Association of Canada, Vancouver, British Columbia, Feb., 1975.

Membership on committees

B.E.B. Cameron

- Sessional Chairman, Northwest Scientific Chairman, Northwest Scientific Association Annual Meeting, May, 1974.

R.B. Campbell	- Chairman, British Columbia Section, Canadian Institute of Mining and Metallurgy. - Member of Council, Canadian Institute of Mining and Metallurgy.
G.H. Eisbacher	- Associate Editor, Geoscience Canada. - Publications Committee, Geological Association of Canada.
H. Gabrielse	- Chairman, Committee on Penrose Conferences, Geological Society of America. - Co-Editor, Pacific Geology. - Associate Editor, Bulletin, Canadian Petroleum Geology. - Member, W.G. 2. Inter-Union Commission on Geodynamics. - Member, Federal Interdepartmental Coordinating Committee for Yukon Territory.
S. Leaming	- British Columbia Museum of Mining, Britannia Beach, British Columbia.
J.W.H. Monger	- Secretary-Treasurer, Cordilleran Section, Geological Association of Canada. - Geological Association of Canada, representative on Program Committee for joint Geological Association of Canada-Society of Economic Geologists-Mineralogical Association of Canada-Canadian Geophysical Union meeting to be held in Vancouver, 1977. - Geological Society of America, Committee on Committees. - National Research Council, Geodynamics Sub-Committee.
J.A. Roddick	- Editor, Circum-Pacific Plutonism Project.
J.G. Souther	- Vice-Chairman, Volcanology Division, Geological Association of Canada.
D.L. Tiffin	- Pacific Sub-Committee on Oceanography. - Requirements Board - Department of the Environment, Strait of Georgia Project, Ship Design Committee. - Geodynamics Working Group 2, Study Group 2. - Department of the Environment, Guiding Committee on Offshore Surveys.

Information Services Unit

M.K. Akehurst

Renovation of the 6th floor, Sun Towers Building has been completed in conjunction with the integration of library and sales functions. The reorganization of space permits display of topographic maps and various geological publications. The library provides service to the Geological Research Unit, Terrain Sciences Division, Explosives Division, and, on a limited scale, consulting geologists.

The statistics show that the number of visitors was slightly lower than during the previous years. The total value of sales increased from $54,130.84 to $57,548.02.

MONTH	VISITORS	TOPOGRAPHIC MAPS NO.	TOPOGRAPHIC MAPS $	G.S.C. PUBLICATIONS NO.	G.S.C. PUBLICATIONS $	ROCK & MINERAL SETS @$2	MINERAL SETS @$25	PHOTOCOPIES NO.	PHOTOCOPIES $	MINES BRANCH NO.	MINES BRANCH $	B.C. DEPT. OF MINES $ PUBS.	B.C. DEPT. OF MINES $ TAX	I.G.C. $	TOTAL $
Apr.	809	4,683	2,946.27	1,183	1,896.37	190.00	225.00	114	17.10	6	7.85	289.50	218.57	122.00	5,912.66
May	943	7,544	4,639.70	1,417	2,163.90	142.00	50.00	94	14.15	18	13.00	154.50	305.18	231.00	7,713.43
June	833	5,301	3,283.35	505	769.00	156.00	25.00	150	20.95	3	9.25	39.50	152.71	14.00	4,469.76
July	820	5,948	3,454.05	606	964.83	216.00	100.00	128	9.40	4	2.60	58.50	151.30	10.00	4,966.68
Aug.	788	6,087	2,993.42	495	887.23	54.00	75.00	454	22.70	7	30.50	206.00	117.13	208.00	4,593.98
Sept.	749	3,550	2,187.25	516	757.00	266.00	300.00	506	25.30	8	9.00	53.75	124.90	7.00	3,730.20
Oct.	812	3,541	2,287.50	854	1,408.93	332.00	800.00	521	32.80	9	8.25	46.80	147.36	58.00	5,121.64
*Nov.	550	5,540	2,657.00	588	1,131.23	188.00	50.00	353	30.90	16	16.00	231.00	91.70	10.00	4,405.83
Dec.	400	1,994	1,402.90	1,338	1,992.10	210.00	50.00	134	8.95	3	3.25	77.50	114.83	52.00	3,911.53
Jan.	631	2,688	1,744.94	991	2,247.85	204.00	150.00	451	22.75	4	13.25	76.00	110.17	22.00	4,590.96
Feb.	660	1,918	1,675.40	822	1,441.35	210.00	200.00	296	17.75	6	7.75	115.00	122.74	57.00	3,846.99
March	583	2,106	2,452.00	829	1,295.60	84.00	150.00	-	-	-	-	111.00	157.76	34.00	4,284.36
	8,578	50,900	31,723.78	10,144	16,955.39	2,252.00	2,175.00	3,201	222.75	84	120.70	1,459.05	1,814.35	825.00	57,548.02

* November, 1974 Price Increase, Rock and Mineral Sets @ $4.00 and $50.00

RESOURCE GEOPHYSICS AND GEOCHEMISTRY DIVISION

A. G. Darnley, Chief

The responsibilities of the Division are to act as a national centre for research and development into geophysical and geochemical methods for application to mineral resource evaluation and exploration, terrain investigations, and the better definition of bedrock geology; also, to advise upon and provide systematic geophysical and geochemical surveys as required for various purposes.

The objectives of the division are to obtain in progressive steps systematic geophysical and geochemical data for all areas of the country, to serve as a quantitative base for mineral resource discovery and evaluation at both the regional and local level; to establish the most appropriate methods and standards for these quantitative surveys; to use suitable geophysical methods in support of terrain studies; to use the best available methods of interpreting, presenting and integrating geophysical and geochemical data in conjunction with geological information.

The activities of the Division have been traditionally organized around scientific specializations. This has led to strength in method development, and in the execution of particular methods, but less satisfactory performance in providing solutions to problems which are broader than individual methods can satisfy. Steps have been taken towards remedying this situation with the Division by identifying three main program areas and assigning coordinator roles to individuals.

The longest established group of activities in the Division fall within the Magnetic Survey Program, for which Dr. P. J. Hood is coordinator. This Program combines the output of the Magnetic Methods, Contract Surveys, Digital Compilation and part of the Experimental Airborne Surveys Sections.

Mr. L. S. Collett is coordinator of the Engineering and Environmental Geophysics Program, which is currently the chief concern of the Electrical Methods and Seismic Methods Sections.

The Uranium Reconnaissance Program, coordinated by the Division Chief, absorbs the bulk of the effort of the Geochemistry, Radiation Methods and part of the Experimental Airborne Operations Sections. This program is the newest, but is already the most extensively funded, and sets new standards of technical and administrative complexity.

Goals have been met in every major aspect of the work. The distance flown in aeromagnetic surveys was higher in 1974/75 than in 1973/74, both in Canada and for CIDA Projects overseas. A gradiometer for measuring small differences in the vertical gradient of the Earth's magnetic field has been constructed and installed on one of GSC's two experimental survey aircraft. Initial flights of this unique system have been extremely encouraging. Good progress has been made in the development and testing of methods for detecting and mapping the distribution of permafrost,

both on land and below the sea-bed. A significant new development has been made, in cooperation with the Communications Research Centre, with the construction of a practicable radar device for soil moisture measurement. High sensitivity airborne gamma-ray spectrometer test surveys were undertaken in five provinces (Saskatchewan, Ontario, Quebec, Prince Edward Island and Newfoundland) and compiled during the year. Extensive arrangements were made for the start of the Uranium Reconnaissance Program in 1975. A major (20,000 sq. mile) lake sediment geochemical survey was undertaken in Saskatchewan at the request of the provincial government and DREE, and this contracted operation is the precursor of larger operations under URP. A useful start has been made in the cooperative development project with industry relating to borehole exploration methods.

Further advances have been made in the use of minicomputers for process control, and for on-line analysis. The automated atomic absorption unit, reported last year as complete and operational, is now linked via cassette tape recorder and a telephone coupler with the main EMR computer, allowing immediate manipulation of the data by any program available there. The Division's high sensitivity airborne gamma-ray spectrometer, besides having had extensive circuit renovations, is now equipped to provide full spectral recording.

The ensuing pages deal in alphabetical order with the three principal missions with which the Division is concerned, and section reports are appended to the most relevant missions. Special projects not included elsewhere are dealt with at the end of the report.

During the year, members of the Division submitted 74 manuscripts for publication, internal and external.

As in previous years, a large number of visitors came to the Division. A sample listing is given under the Electrical Methods Section report.

Personnel Notes

Dr. A. Larochelle - commencing May 20, 1974, was on full-time secondment to CIDA headquarters in Ottawa where he served as geophysical advisor to the Engineering Division.

Q. Bristow - at the request of the Director, devoted a considerable proportion of his time during the last four months of the year to act as Accommodation Officer, ascertaining and planning future Branch space requirements in the Ottawa area.

Mrs. M. L. Wilson - who joined the Division office in January 1974, continued throughout the year to provide general office support services.

Attendance at Meetings

A. G. Darnley
- Society of Exploration Geochemists, Vancouver, B. C. April 1-3, 1974.
- IAEA Symposium on Formation of Uranium Ore Deposits, Athens, Greece, May 6-10, 1974 (Session Chairman).
- International Workshop on Earth Science Aid to Developing Countries, St. John's, Newfoundland, May 17-22, 1974.
- IUGS Geoscience and Man Committee, Limits to Growth Meeting, Bad Homburg, Germany, July 22-24, 1974.
- Provincial Mines Ministers Meeting, Moncton, N. B. October 6-9, 1974.
- ERDA Uranium Industry Seminar, Grand Junction, Colorado, October 21-24, 1974.
- IAEA Consultants Meeting on Calibration in Uranium Exploration, Vienna, Austria, December 9-12, 1974. (Chairman).
- Prospectors and Developers Annual Convention, Toronto, March 10-12, 1975, Session Coordinator "Uranium Exploration '75".

Papers Presented and/or Published

A. G. Darnley: The geophysical approach to uranium exploration: published in Northern Miner, March 7, 1974.

A. G. Darnley: Uranium in Canada: distribution, discovery and measurement: presented IUGS Geoscience and May, July 1974.

A. G. Darnley and R. G. Garrett: Regional Geochemistry, its philosophy and use: published in Northern Miner, November 28, 1974.

A. G. Darnley: Standardization and calibration of natural radioactivity surveys carried out for geological and exploration purposes: presented IAEA Consultants meeting, December, 1974.

A. G. Darnley: Geophysics in uranium exploration: presented Prospectors and Developers Convention, March 1975.

A. G. Darnley, E. M. Cameron and K. A. Richardson: The Federal Provincial Uranium Reconnaissance Program: presented at Prospectors and Developers Convention, March 1975.

Membership on Committees

A. G. Darnley - Chairman, IAEA Consultants Working Group on Reporting Methods and Calibration in Uranium Exploration.

- Chairman, Canadian Geoscience Council Organizing Committee for "Exploration '77" Symposium.

- Chairman, Ottawa Branch CIM.

- Member, IUGS Committee Geoscience and Man.

ENGINEERING AND ENVIRONMENTAL GEOPHYSICS PROGRAM

The Electrical and Seismic Sections are responsible for programs directed towards research in both land and marine geophysical methods for engineering and geological mapping problems. The methods used are DC resistivity, VLF Radiohm, electromagnetic induction, radar, conventional and shallow seismic techniques. The aim of the program is to investigate the use of these techniques for determining the lateral distribution and thickness of permafrost on land and off-shore and gain a knowledge of the physical properties of frozen materials. These sections take a leading role in assessing and developing new techniques and publish progress reports on their research.

The main thrust of the program has continued during 1974/75 in the permafrost environment. DC resistivity, VLF Radiohm and shallow seismic surveys were conducted over the Heart Lake (near Norman Wells) and Involuted Hill test sites in the Mackenzie Valley. Further radar experiments were conducted in spring of 1974 in the Tuktoyaktuk area. A number of companies and universities have used these test sites for experimentation and it is expected that more will do so as the sites become better known. Resistivity and seismic surveys in cooperation with Terrain Sciences Division have been conducted on Banks, Melville and Ellesmere Islands and Boothia Peninsula. DC resistivity surveys were also done at Malcolm River to establish the thickness of gravel deposits in the area.

On the off-shore work in the Arctic, a map is being compiled for the southern part of the Beaufort Sea of the top of the sub-seabottom permafrost layer. Approximately 8000 line miles of company seismic records are being utilized in this compilation. A marine seismic survey at Kay Pt., Yukon Territories, was completed to map the top of the permafrost in the Babbage River Delta as part of the study of Arctic coastal processes. DC resistivity and seismic surveys were conducted over the ice in Kugmallit Bay and the interpretations were confirmed by drilling. Similar soundings were initiated through the ice at Consett Head, Melville Island, over the inter-island pipeline route. Seismic and resistivity specifications were prepared for a contract survey along the Mackenzie Highway route at Martin River and Willowlake River crossing north of Fort Simpson.

Electrical Methods

L. S. Collett

This section investigates and develops passive and active electrical techniques and instrumentation and adapts them to the needs of the Canadian government. Airborne electromagnetic systems are assessed for mapping thickness and conductivity of overburden. The Scintrex Tridem System is a 3-frequency EM system and is presently being evaluated. Flying has been completed over test sites at Hawkesbury and Timmins, Ontario. Theoretical feasibility studies involve dipole-dipole soundings in permafrost, induction methods for sea-ice thickness and plane wave behaviour of VLF (very low frequency) and higher frequencies with altitude. Soil moisture measurements of ground are being measured using time domain reflectometer (TDR) techniques at radar frequencies. These measurements are being correlated with absorption phenomena of gamma rays. An electrical rock property laboratory is continuing the study of electrical parameters of rocks and their modification due to the inclusion of conducting minerals, such as sulphides, and the variation of temperature as in the case of frozen ground and ice inclusions. Knowledge of these electrical parameters is necessary for theoretical studies and data interpretation.

Personnel Notes

Annan, A. P. - joined staff on October 1, 1974 (RS 1)

Collett, L. S. - Principal Investigator, NASA, for one year period commencing February 1, 1974.

- Coordinator of Industry-GSC cooperative program on borehole exploration geophysics.

- Coordinator on Engineering and Environmental Geophysics Program.

- Outside reader, M.Sc. Thesis, McGill University.

Katsube, T. J. - Co-Investigator, NASA, for one year period commencing February 1, 1974.

Morra, R. R. - married on September 28, 1974 (née Dufour)

Sloka, R. J. - joined staff on June 5, 1974 (TIRL-EL)

Attendance at Meetings, Conferences and Courses

Annan, A. P. - Meeting on Geophysical Survey Systems Inc., Burlington, Mass., Feb. 3, 1975.

- Courses on RM Organization, FTN Extended and RM Form, Computer Science Centre, February 25-27, 1975.

Butterfield, D. C. - Course on Borehole Logging, Widco (Canada) Sales and Service Ltd., Calgary, August 6-23, 1974.

Collett, L. S. - Meetings on Geothermal Energy, several during the year with Earth Physics Branch (Jessop) and National Research Council (Tupper), EMR Science Management.

- Meeting with Industry (Cominco, Inco, Noranda and Canex Placer) to organize borehole exploration program with GSC, April 11, 1974.

- Meeting with Department of Industry, Trade and Commerce on PAIT Project - Crone Geophysics, July 30, 1974.

- Meeting on soil moisture with Department of Agriculture, September 24, 1974.

- Classification Board Meeting, ESS/EG, Sept. 26, 1974.

- Meeting of Associate Committee on Geodesy and Geophysics, NRC, September 27, 1974.

- Meeting of Federal/Provincial Program re EM systems on aircraft, September 30, 1974.

- Meeting Dept. Industry, Trade and Commerce, PAIT-Scintrex Ltd., Concord, Ontario, October 24, 1974.

- Meeting Classification Board, GLT, November 7, 1974.

- Society of Exploration Geophysicists, Dallas, Texas, November 11-14, 1974 (session chairman).

- Meeting DREE-Quebec and SOQUEM, Quebec, Nov. 21-22, 1974.

- Intradepartment Liaison Meeting on Industrial Minerals (Airborne EM Systems for gravel detection) November 26, 1974.

- Meeting on University Grants, NRC (2 proposals), January 8, 1975.

- Meeting on National Research Council IRAP-SOQUEM, January 10, 1975.

- Meeting of Microwave Sensing Committee, Communication Research Centre, January 28, 1975.

- Advise Canadian Patents and Developments Limited on patent application, February 13, 1975.

- Meeting of National Research Council IRAP-Geonics Limited, February 14, 1975.

- Meeting on Permafrost Geophysics Program for Geological Association of Canada, February 27, 1975.

Davis, J. L.

- Meeting at Geophysical Survey Systems Inc., Burlington, Mass., July 8, 1974 and Feb. 3, 1975.

- Meeting on Soil Moisture, Canada Centre for Remote Sensing, Aug. 27, 1974 and with Department of Agriculture, September 24, 1974.

- Perch Lake Symposium Workshop for waste disposal, Chalk River, Ontario, December 9-11, 1974.

Dyck, A. V.

- Society of Exploration Geophysicists, Dallas, Texas, November 11-14, 1974. Held meeting on summer work with Cominco, Inco, Noranda and Canex Exploration.

- Meeting with Inco and Noranda, Toronto, Nov. 18, 1974.

Frechette, J.

- Course on PDP 8 Minicomputer, Algonquin College, Fall Term, 1974.

Gauvreau, C.

- Board Meeting, Public Service Commission, EL-4, September 9, 1974.

- Course, Computer Science Centre, Tape Format and Usage, November 26, 1974.

- Course, Computer Science Centre, Bit Manipulation and Character Handling, January 14, 1975.

- Course, Algonquin College, Linear Circuits II, Spring Term, 1974.

- Course, Algonquin College, Electronic Circuits, Fall Term, 1974.

Katsube, T. J.

- Attended NATO Advanced Study Group on Physical Properties of Rocks, Newcastle upon Tyne, U.K. April 22-26, 1974 (presented paper).

- Course, Calcomp Plotter, Computer Science Centre, August 15-16, 1974.

- Attended EM Induction Conference, Carleton University Ottawa, August 22-28, 1974 (presented paper).

- Meeting at University of Toronto with Dr. D. W. Strangway and G. Olhoeft, September 13, 1974.

- Annual Meeting of Society of Exploration Geophysicists, Dallas, Texas, November 10-14, 1974.

- Meeting at USGS, Denver, Colorado, Nov. 18-19, 1974.

- Visited Zonge Engineering and Research Organization, Tucson, Arizona, November 20, 1974.

- Visited Anaconda American Brass Ltd., Tucson, Arizona, November 21, 1974.

- Visited Cominco Limited, Toronto, Ontario, November 22, 1974.

- Attended many meetings as member of Microwave Subcommittee to prepare report on "Establishment of an Interdepartmental Program for All-Weather Monitoring and Surveillance of the Near Surface Environment of the Land and Sea by Remote Sensing".

Morra, R. R. - Course, Calcomp Plotter, Computer Science Centre, August 15-16, 1974.

Scott, W. J. - Attended GSC Futures Conference, October 17-18, 1974.

- Annual Meeting of Society of Exploration Geophysicists, Dallas, Texas, November 11-14, 1974.

Sinha, A. K. - GRID course, Cornwall, Ontario, April 1-5, 1974.

- Attended EM Induction Workshop, Carleton University, August 22-28, 1974 (presented paper).

- Annual Meeting of Society of Exploration Geophysicists, Dallas, Texas, Nov. 11-14, 1974 (presented paper).

Special Talks or Lectures

Katsube, T. J. - Talk, Soil Moisture Meeting, Canada Centre for Remote Sensing August 27, 1974.

- Lecture, USGS, Denver, Colo., November 18, 1974.

Scott, W. J. - Addressed Sydenham Club (Medical Doctors), Toronto, October 31, 1974 on "Permafrost".

- Series of 3 lectures as part of a course at Ecole Polytechnique, Montreal, November 25, 1974, December 2 and 9, 1974.

- Seminar, Ecole Polytechnique - McGill, Montreal, February 28, 1975 on "Involuted Hill".

Membership on Committees

Collett, L. S.
- Member, Canadian National Committee for the International Union on Geodesy and Geophysics, National Research Council.
- Member, Departmental Classification Committee, Electronics Category.
- Liaison Officer, PAIT (Program for the Advancement of Industrial Technology), Department of Industry, Trade and Commerce, 2 projects (Scintrex and Crone).
- Liaison Officer, IRAP (Industrial Research Assistance Program), National Research Council, 2 projects (SOQUEM and Geonics).

Katsube, T. J.
- Member, Microwave Subcommittee of Working Group on Sensors, Canada Centre for Remote Sensing.
- Secretary, Spectroscopy Society of Canada, Ottawa Valley Section.
- Member of Committee of American Society for Testing Materials, Section D-9: Electrical Insulating Materials.

Scott, W. J.
- Member of Working Group on Computer-based Storage, Retrieval and Compilation of Geologic Field Data (Project No. 710098).
- Secretary, Exploration Geophysics Subdivision, Canadian Geophysical Union, GAC-CAP.

Papers Published During 1974-75

GSC	21
Open File	1
Outside Papers	8

CIM Bull	- 1
NRC Technical Memorandum	- 5
Geoscience Canada	- 1
Can. J. Earth Sciences	- 1

Visitors to the Section

1. Foreign visitors

Australia (4), Brazil (1), India (2), Indonesia (1), Italy (1), Japan (1), Nigeria (1), Poland (3), South Africa (1), Spain (1), Sweden (1), U.S.A. (2), USSR (1), West Germany (1) and Yugoslavia (2). A total of 23 foreign visitors visited the section during 1974-75. Most of the enquiries were related to mineral prospecting techniques.

2. Canadian visitors

Minimum number of tabulated visitors to the section, from Industry (27), Universities (11), and other Government Departments (16): Total 54.

The enquiries from industry are mainly concerned with problems in mineral exploration. The visitors from universities are usually on a fact-finding mission to support their proposals for EMR and NRC grants. Other government departments, mainly Industry, Trade and Commerce, National Research Council and Department of Supply and Services seek advice on PAIT, IRAP and unsolicited proposal submissions, respectively, chiefly in electromagnetic and induced polarization techniques.

Seismic Methods Section

Acting Head: J. M. Hunter

This section is responsible for seismic programs directed toward research and uses conventional refraction and reflection methods applied to geological problems throughout Canada.

In the Sverdrup Basin refraction work, a north-south line was run on the ice during 1974, from the edge of the permanent polar pack south between Ellef Ringnes and Amund Ringnes Islands to the southeast. This is a continuation of the east-west refraction line that was started in 1972 as a cooperative industry-government project in which six companies participated.

For urban geological purposes, a shallow seismic survey was conducted in the Hamilton Metropolitan area for a depth-to-bedrock map. Shallow reflection seismic surveys were conducted over a salt dome occurrence in the Magdalen Islands in cooperation with SOQUEM. Good reflections were observed in some locations but were not recorded in others.

A good start has been made on determining the physical properties and hence the identification of bottom sediments along the Arctic coast. Not only does this seismic technique look promising but it can be done through the ice. Theoretical model studies for reflections from the lower permafrost boundary were continued in cooperation with the University of Western Ontario. The amplitudes of various frequency wavelets was completed for velocity gradient boundaries typical of the Mackenzie Delta.

Section Head duties were shared by J. A. Hunter and A. Overton until L. S. Collett was appointed coordinator for Engineering and Environmental Geophysics in December 1974.

Personnel Notes

Good, R. L. - joined the section on April 1, 1974 (ESS 4).

Attendance at Meetings, Conferences, Courses

Hunter, J. A.
- Meeting with Dr. R. F. Mereu, University of Western Ontario, London, Ontario, on computer model studies of seismic waves in permafrost for thickness determinations, April 17, 1974.
- Meeting with Newmont Exploration Ltd., Danbury, Conn., on recent developments in borehole acoustic exploration techniques, April 22-23, 1974.
- Attended Offshore Technology Conference, Houston, Texas, May 6-8, 1974.
- Visited petroleum companies in Calgary and Edmonton, to discuss permafrost in Beaufort Sea and arrange to obtain company data for permafrost subbottom map of Beaufort Sea, November 18-22, 1974.
- Attended a meeting of the Beaufort Sea Permafrost Committee under auspices of the National Academy of Sciences, Menlo Park, California, December 15-16, 1974, involving a research plan for offshore permafrost of the Alaskan Coast (presented report).
- Attended Beaufort Sea Investigators' Conference, Calgary, Alberta, January 21-23, 1975, where for the first time all the Beaufort Sea Investigators and Industry Coordinators assembled to review the progress of the project.
- Meeting with Dr. Yu, Ecole Polytechnique, Montreal, January 30, 1975, to discuss the use of Rayleigh Wave technique to the measurement of permafrost thickness.
- Meeting with M.O.T. Marine Services Branch in company with R. L. Good and C. F. M. Lewis to inspect "CCGS Nahidik", Hay River, N.W.T. March 18, 1975, to discuss plans for the summer field season.

MacAulay, H.A.
- Visited petroleum companies in Calgary and Edmonton to discuss permafrost in Beaufort Sea and arrange to obtain company data for permafrost subbottom map of Beaufort Sea, November 18-22, 1974 and January 7-10, 1975.

Overton, A. - Attended several Departmental Interbranch meetings regarding cooperation with Earth Physics Branch for planning seismic profile in Beaufort Sea.

- Attended Annual Meeting of Society of Exploration Geophysicists, Dallas, Texas, November 11-14, 1975.

- Attended Ad Hoc Committee on Positioning Systems for Scientific Activities in the Arctic, November 6, 1974, for GSC positioning requirements.

Special Talks or Lectures

Hunter, J.A. - Lecture to Amoco Ltd., Calgary, November 24, 1974, "A seismic method to map offshore permafrost in the Beaufort Sea".

- with A. S. Judge (Earth Physics Branch) presented interim report to Beaufort Sea Investigators Meeting on project F-1 "Frozen Seabed Materials" January 22, 1975.

Membership on Committees

Hunter, J.A. - Mining, Engineering and Groundwater Committee, Society of Exploration Geophysicists.

- Working Committee on Subsea Bottom Permafrost, Arctic Offshore Program, National Academy of Science (U.S.A.).

Overton, A. - Member of Ad Hoc Committee Investigating Inter-Departmental Requirements for Navigation Systems in the Arctic.

Papers published during 1974-75

Geol. Surv. Can.:	9
Outside Papers:	8

MAGNETIC SURVEY PROGRAM

P. J. Hood

This program entails developing new magnetic survey instrumentation and techniques, conducting experimental aeromagnetic surveys over land and sea, devising new techniques for the digital treatment, presentation and interpretation of resultant data, preparing specifications for surveys carried out under contract, monitoring their execution, and supervising the publication of results. Geological interpretations of the results are provided to the fullest extent possible with the staff available.

During 1974, P. J. Hood and M. E. Bower continued the co-operative ocean aeromagnetic project with the National Aeronautical Establishment. The North Star aircraft of the National Aeronautical Establishment which is equipped with an inboard digital-recording cesium magnetometer system was used as the survey platform, and during the report year travelled from coast to coast and into the High Arctic in collecting magnetic survey data. Survey operations were carried out during the period April 17 to May 2 in northern Baffin Bay. The flight elevation was maintained at 300 metres (1,000 feet) above sea level along the survey profiles flown.

There were several objectives for the field operation. The first was to obtain reasonably detailed coverage of two areas of Smith Sound. The first detailed survey was located immediately west of Cape Parry in northwestern Greenland and the second area was in Smith Sound proper. The Cape Parry survey was undertaken to delineate better an interesting sedimentary feature that was apparent on sea magnetometer and seismic reflection records obtained by the Atlantic Geoscience Centre. It was intended that the survey be carried out and the results be compiled prior to a marine geophysical survey being conducted by the CSS Hudson in northern Baffin Bay in order that the marine survey profiles could be positioned to obtain the most useful information. The aeromagnetic results were compiled by Margaret Bower immediately upon the return of the survey aircraft to Ottawa. The resultant profiles in map form were made available to the Atlantic Geoscience Centre in time for the marine operation in Smith Sound.

The second objective was to obtain additional profiles in between some of the lines previously flown in northern Baffin Bay in order to complete an aeromagnetic reconnaissance at a thirty-mile line spacing in that area. The third objective was to further evaluate a computerized electronic navigation system which utilizes the Global Navigation System 200 VLF receiver and Doppler navigation systems. Comparison was made during the sorties of simultaneous hyperbolic and range-range calculations of position; it appears that the range-range mode gives the most accurate fixes. A new modification this year was a display for the navigator of track, groundspeed and distance and bearing to any one of eight predetermined waypoints, and position update at waypoints. This proved to be useful for flying patterns and parallel tracks for the offshore surveys.

A number of flights were also made south of Halifax and west of Vancouver Island, recording both MAD and total magnetic field data. In order to determine the basic noise levels of the aircraft and equipment, and thus the validity of the high resolution data, the aircraft was taken to the magnetically quiet site on Eleuthera Island in the Bahamas.

All the above trips were also navigation exercises, continuing the experiments with the computerized VLF-Doppler system. It is concluded that the most accurate navigation is obtained by using the VLF over the long term, and using the doppler, drift and heading to smooth out short term anomalies in the VLF. Further experiments in remote aircraft tracking were conducted in conjunction with the Communications Research Centre at Shirley Bay. The onboard computer system was modified to transmit every 10 seconds a 64 bit coded message, via synchronous satellite, to the computer at Shirley Bay; the message contained the aircraft identification and the microsecond distance to two VLF transmitters. The Shirley Bay computer was able to plot the North Star's position in real time at such distant points as Saskatchewan, offshore from Nova Scotia and south of Florida. To further the development of VLF navigation, records are being collected of VLF transmissions in all areas where the North Star operated.

Ocean aeromagnetic data in the Labrador Sea and Baffin Bay has been edited for release to the public. Included are magnetic tapes, tape dumps, plotter charts and logs. The data released so far was acquired between 1964 and 1973 and represents 205 hours of line flying. A paper on the work carried out in the Davis Strait area was presented at the CSPG-GAC Symposium on Canada's Continental Margins and Offshore Petroleum Exploration held in Calgary in the Fall and a paper was subsequently submitted for the proceedings volume.

An annual review of mineral exploration techniques and equipment was again prepared by P. J. Hood and published for the eleventh year in succession in the February 1975 issue of the Canadian Mining Journal. Tabulations of commercially available drill-hole and IP equipment and airborne geophysical services were compiled. These review articles are essentially a service to industry and summarize for them what new equipment, techniques, etc. are available for mineral exploration, and the extent to which the various methods are being utilized throughout the world. Reprints of these articles are much sought after by industry and such agencies as CIDA and the UN to keep their personnel up-to-date. These articles help to maintain Canada's prestige and leadership in the mineral exploration field throughout the world. In addition a compilation of research being carried out in government agencies, the universities and the geophysical companies was written as a separate chapter for the 1974 Canadian Geophysical Bulletin. P. J. Hood also took part in the Canadian Electronics and Scientific Instruments fair held in Shanghai during April 1974 and presented a review of Canadian geophysical capability. An account of his visit to China was subsequently prepared as a GSC Topical Report.

From February 27 to March 9, 1975, P. J. Hood visited Guyana to evaluate a proposal submitted by the Geological Survey of Guyana for assistance in geophysical surveys. To ascertain the feasbility of fly-

ing low-level aeromagnetic surveys in western Guyana, a reconnaissance of the Pakaraima Mountain area was made using a Britten-Norman Islander aircraft.

As part of the development work of the Magnetic Survey Program, an inboard vertical gradiometer system, the first of its kind in the world in airborne geophysical survey instrumentation, was installed on the GSC Queenair experimental survey aircraft. This work has been the prime responsibility of P. Sawatzky assisted by D. Olson, A. Dicaire and H. Knapp. The geological Survey's vertical aeromagnetic gradiometer system is designed to map vertical contacts between large outcropping rock formations having a minimum effective susceptibility of about 500×10^{-6} emu/cc, which is typically the case for many areas of the Canadian Precambrian Shield. In order that the airborne system not be turbulence=limited and that the difference reading (divided by the sensor separation) would correspond closely to the actual gradient reading, an inboard gradiometer was decided upon. With the physical dimensions of the tail section of the present survey aircraft, the largest separation of the two magnetometer heads that is feasible is 2 metres (the separation is actually 2.08 metres). The sensitivity of the airborne gradiometer system is 0.004 gammas per metre and it was flown for the first time as an operating unit on November 5, 1974 in the Ottawa area. Upon completion of the gradiometer installation, the first priority was to compensate the system as well as possible. Two separate active compensator systems manufactured by Canadian Aviation Electronics are being employed for this purpose. Initially the upper and lower magnetometers were compensated separately. The next step was to eliminate any interference between the sensors. It was ascertained, however, with considerable relief that the cross-coupling was practically non-existent. The present figures of merit for the upper system is 0.42 gammas and for the lower system is 0.50 gammas, and for the combined systems is 1.16 gammas, which is 0.56 γ/m.

After the first phase of test flying had been completed and an acceptable figure-of-merit for the aircraft had been obtained, a series of test surveys were commenced in which the aircraft was flown in its normal survey configuration. The first test survey was in the White Lake area (NTS 31 F/7) immediately west of Ottawa and was flown in order to obtain experimental data to be used in deciding the optimum survey specifications (flight elevation, flight-line spacing) for vertical gradiometer surveys. The White Lake area has been flown at two elevations, 500 and 1000 feet, using a 1000-foot flight-line spacing. The results obtained by the airborne gradiometer system to date demonstrate conclusively the superior resolution of the gradiometer compared to the total field results, and it is clear that a first vertical derivative map reflects the underlying geology much better than does the classical total field map.

Three ground stations to monitor the diurnal variation of the Earth's magnetic field have also been completed and these will be used in the flying of the control line network for the Magnetic Anomaly Map of Canada.

M. T. Holroyd has updated the aeromagnetic data automatic mapping system (ADAM) to allow compilation of aeromagnetic gradiometer data, to permit two-dimensional digital filtering, and to permit manually determined re-adjustments in problem survey data. Most effort by S. D. Dods and I. Butt has gone into the compilation of the Kirkland Lake and Dalhousie high resolution aeromagnetic surveys, which will be published during 1975. Much effort was expended in these surveys in flight path recovery and base map problems.

Aeromagnetic survey techniques have been under active development in the Geological Survey of Canada since the first airborne magnetometer was introduced shortly after World War II by modification of submarine detection equipment. This development work and its subsequent utilization in aeromagnetic surveys by Survey staff eventually led to an aeromagnetic survey program for the whole of the Canadian Precambrian Shield, which was contracted out to the airborne geophysical survey industry. Up to the end of 1974 approximately 4.5 million line miles has been flown (164,000 line miles in 1974/75 alone and the program has been completed for Nova Scotia, Prince Edward Island, New Brunswick, Ontario, Manitoba, Saskatchewan and Alberta in cooperation with the relevant provincial agencies. In addition, aeromagnetic survey coverage has been obtained for the island of Newfoundland. Thus the aeromagnetic survey program has resulted in some 6900 one-mile and 400 four-mile aeromagnetic maps being issued and these form a substantial bank of data for mineral resource endeavours in Canada.

During the report year, 337 aeromagnetic maps were published. The aeromagnetic survey contracts are monitored by a group led by E. Ready which is located in the City Centre. The contract aeromagnetic survey group is also responsible for a number of other activities related to the Magnetic Survey Program. These include (1) storage and retrieval of archival survey records; (2) acquisition and recompilation of aeromagnetic maps produced in earlier surveys; (4) inspection of high resolution maps resulting from aeromagnetic surveys carried out by the GSC Queenair aircraft; (5) inspection of overseas aeromagnetic survey contracts funded by CIDA; (6) answering requests for aeromagnetic survey data and providing advice to GSC geologists, mining companies etc.

A summary of the progress achieved on surveys carried out in Canada and monitored by the contract aeromagnetic surveys group is given in Table 1.

TABLE I: Aeromagnetic Surveys in Canada

SURVEY AREA	MILES FLOWN 1974-1975	MAPS PUBLISHED IN 1974-1975 1 mi/inch	2 mi/inch	4 mi/inch
Mackenzie-Keewatin	38,888	78	7	11
Labrador-Quebec	*17,663	4	-	
Labrador (only)		80	-	3
Quebec (only)		1	-	
Melville Peninsula	27,022	-	-	-
New Quebec (1972-78)	88,323	-	-	-
** Quebec (1969-71)	--	72		14
*** British Columbia	--	14		9
	171,896	240	7	37

* Line mileage accumulated in both Labrador and Quebec.

** Publication completed.

*** Aeromagnetic data, flown in 1971, purchased from private company.

In addition, 52 high sensitivity aeromagnetic maps in the Jellicoe area of western Ontario were published at a scale of 1:25,000 plus a composite map of the entire area surveyed at the scale of 1:125,000. The monitoring and quality control of the compilation of 35 high sensitivity maps at the scale of 1:25,000 in the Kirkland Lake area, Ontario, as well as 60 high sensitivity maps in the Dalhousie area, New Brunswick, has also been carried out. In addition, reproduction and printing tenders were prepared for the above 96 maps.

The production and compilation of aeromagnetic and radiometric data for a survey in the Ivory Coast was also monitored. Three field inspections, each of one month's duration, were carried out by W.Knappers in Ivory Coast where the contractor is operating three survey aircraft. Approximately 100 maps at the scale of 1:50,000 were checked for flight path recovery specifications as well as the compilation procedures prior to the publication of twenty of the 1:50,000 maps. The status of the aeromagnetic surveys funded by CIDA is given in Table 2.

TABLE 2: Aeromagnetic Surveys Funded by CIDA

COUNTRY	L/Km FLOWN 1974-1975	AEROMAGNETIC MAPS PUBLISHED 1974-75 1:50,000	1:200,000	RADIOMETRIC MAPS PUBLISHED 1974-75 1:50,000	1:200,000
Ivory Coast	220,000	20	--	--	--
Pakistan	Partial preparation of specifications.				
Upper Volta	Partial preparation of specifications.				
Brazil	Final contract negotiations; survey not yet begun.				

The master control lines flown in eastern Canada in 1974 for the Magnetic Anomaly Map of Canada have been partially compiled. The flight path has been plotted and various loops have been levelled; the levelling error between Ottawa and St. John's, Newfoundland, is 20 gammas. In addition approximately 15 four-mile sheets were processed by E. Haley and D. Reveler to produce residual magnetic contours for the 1:1,000,000 map. Many deep-seated features of geological interest are apparent on the map and were the subject of two papers presented by P. J. Hood during the year at scientific meetings in St. John's and Calgary.

L. J. Kornik and P. H. McGrath completed the evaluation of a test range established near Timmins, Ontario, where aeromagnetic and ground surveys were carried out in 1972. Various filter techniques were applied to the high resolution aeromagnetic data and it was concluded that the first vertical derivative data appears to be the most useful in defining local magnetic anomalies relating to small scale geological features. A manuscript of this study has been accepted for publication in the Report of Activities.

L. J. Kornik started the evaluation of the data produced by the new inboard vertical gradiometer system installed in the GSC Queenair aircraft. Several test areas have been chosen in the Ottawa area to ensure that the equipment is functioning optimally. One test area in the Renfrew area near White Lake has been flown with the new aeromagnetic gradiometer. The data is being utilized to determine what map format and compilation techniques are required to publish the data. L. J. Kornik also carried out a ground magnetic survey over the Geochemical grid in the Agricola Lake Area, District of Mackenzie, at the request of the Geochemical Section.

During the past year, P. H. McGrath has designed several two-dimensional vertical gradient operators to be used to enhance the "fine structure" in high resolution aeromagnetic survey data. After a series of tests a particular operator was selected, and has been incorporated into a package of computer programs which are being employed to produce vertical gradient maps of the Dalhousie high resolution survey. Using these derived maps it is possible to more readily interpret the near-surface geology than was previously possible using total field maps. For example, the wavelength of anomalies appearing on the maps is significantly reduced so that structural features such as faults are much more apparent on vertical gradient maps. The resulting derived maps will be employed by the New Brunswick Department of Natural Resources to support their field mapping projects in the survey area.

P. H. McGrath has also developed a set of guidelines for digitally recorded, high sensitivity total magnetic field and gradiometer surveys based on a theoretical analysis of the upward continuation of white noise. Comparison of theoretically derived highest frequency components are in good agreement with those inferred from the amplitude spectra of real data which was recorded at three different flight elevations. Hence a rational approach for the selection of sampling parameters has been established.

During the 1974 field season P. H. McGrath and G. W. Cameron participated with H. H. Bostock in a study of the Appalachian volcanic rocks of the Notre Dame Bay area, Newfoundland. A vertical field ground magnetic survey was carried out near Roberts Arm. One hundred and sixty-two kilometres of profile were measured using a 25 metre sampling interval. The magnetic data has been transferred onto computer cards in order to produce computer plots of the data. Also filtered traces of the data are being calculated. In comparing the two types of magnetic trace with the local geology derived from a traverse along the Roberts Arm highway, the most striking feature is the correlation between changes in the amplitudes and wavelengths of the small magnetic anomalies and corresponding changes in the underlying geology. Hence it appears that the mapping of the geographical distribution of the various magnetic anomaly patterns may be an effective aid in support of the geological mapping of the Roberts Arm Group. Analysis of the additional ground magnetic data plus completion of the geological mapping in the surrounding terrain will provide an improved basis for assessment of this correlation.

Personnel Notes

G. W. Cameron - was successful in a competition for a permanent position in the Radiation Methods Section and transferred on January 1, 1975.

Attendance at Meetings, Conferences and Courses

P. J. Hood

- Canadian Electronics and Scientific Instruments Exhibition, Shanghai, China, April 16-26, 1974. Presented a paper entitled "Mining geophysics: an introduction to Canadian equipment and techniques".

- Canadian Geophysical Union, CAP/CAS Congress, St. John's Newfoundland, June 10-13, 1974. Presented papers entitled "Status of aeromagnetic surveying in Canada" and "Magnetic anomaly map of Atlantic Canada" with P. H. McGrath and R. T. Haworth as co-authors.

- Symposium on Canada's Continental Margins and Offshore Petroleum Exploration, Calgary, September 29-October 2, 1974. Presented papers entitled "Aeromagnetic reconnaissance of Davis Strait and adjacent areas" with Margaret Bower, "Magnetic anomaly map of the Atlantic Provinces" with P. H. McGrath and R. T. Haworth as co-authors, and "A geophysicist's impressions of China" (at the Science and Suds Session).

- Zmuda Memorial Conference on Geomagnetic Field Models, American Geophysical Union, Colorado Springs, March 24-25, 1975. Presented a paper entitled "Residual magnetic anomaly maps for Eastern Canada and Guyana".

P. H. McGrath - Penrose Conference on Geologic Interpretation of Magnetic Data, Reston, Virginia, April 14-19, 1974. Presented paper entitled "Aeromagnetics of Eastern Canada and adjacent areas".

Special Lectures

P. J . Hood - "A geophysicist's impressions of China" to the Atlantic Geoscience Centre in Dartmouth on June 14, 1974 and to the Logan Club on December 3, 1974.

Membership on Committees

P. J. Hood
- Chairman, Exploration Geophysics Subdivision, Canadian Geophysical Union.
- Chairman, Program Committee and member, Organizing Committee, Exploration '77 Symposium.
- Member, Canadian National Committee for the IUGG (until March 31, 1975).
- Member, Working Group 3 (Geomagnetic Instruments and Standards), Division 5 (Observatories, Instruments, Indices and Data), International Association of Geomagnetism and Aeronomy.
- Member, Committee for Co-operation with Government Agencies, Society of Exploration Geophysicists, Tulsa, Oklahoma.

Publications

Ten articles were published in the GSC (Summary of Activities) Paper series, together with a GSC topical report. Two review articles were published in the Canadian Mining Journal and the Canadian Geophysical Bulletin, a book review in Tectonophysics, and a reply to a discussion of an article previously published in Geophysics.

DIGITAL COMPILATION SECTION

M. T. Holroyd

The Digital Compilation Section is responsible for compiling digitally recorded aeromagnetic total field and gradiometric data and providing Systems Analysis and Programming services to other sections with regard to bulk digital geophysical-geochemical data compilation. It also carried out analysis and programming work in fields less directly related to aerogeophysics.

This year saw the continued application and improvement of the ADAM (Aeromagnetic Data Automatic Mapping) System. Work began to extend the system to allow compilation of aeromagnetic gradiometer data.

The Geochemical Data Compilation System, begun the previous year, was completely redesigned to allow usage via interactive remote terminals and should be completed this year.

Programs were written for the compilation of radiometric flight path data produced by automatic digitization and recommendations made for the further improvement of the Radiometric Compilation Programs.

M. T. Holroyd designed and wrote the digital acquisition and processing section of the specifications for the coming Goias project in Brazil.

To simplify the work necessary for the coming Branch accommodations redistribution, the IBAM (Interactive Building Accommodation Management) system was designed, written and implimented. It provides automatic "housekeeping" of names, addresses and numbers of people per room, etc. while allowing on-paper redistribution of personnel by interactive terminal commands. As it incorporates a feature to select, re-order and print out sub sets of the data at any time, and add, delete or change entries, it is an ideal basis for a digital telephone directory.

Membership on Committees

M. T. Holroyd - Branch Computer Users Committee

- Departmental Computer Working Committee

Attendance at Courses

M. T. Holroyd - one-week course on spectral analysis and digital filtration methods at Purdue University, Lafayette, Indiana.

EXPERIMENTAL AIRBORNE OPERATIONS

P. Sawatzky

This section is responsible for (a) the design, construction and testing of airborne geophysical survey equipment and the evaluation of electronic navigation systems used to position survey lines, (b) experimental airborne geophysical survey operations in any part of Canada in which the two GSC aircraft (Beechcraft B80 Queenair and Short Bros. Skyvan) are used.

A vertical gradiometer aeromagnetic system has been completed for the Queenair aircraft and much effort has been expended in the compensation of the dual-sensor inboard system. The combined figure of merit has been reduced to an acceptable level and experimental surveys have commenced. Three ground stations to monitor the diurnal variation of the earth's magnetic field have also been completed and these will be used in the flying of the control line network for the Magnetic Anomaly Map of Canada. Work is also proceeding in the evaluation of video camera systems for precise track recovery and in the use of VLF navigation systems for the digital recording of latitude and longitude information directly in survey operations together with the other pertinent data. If successful, the system will make redundant the conventional technique of track recovery using 35 mm cameras with the attendant processing of the resultant negative film, which is a troublesome procedure in field operations.

During the past season, the 28 volt DC auxiliary ground power unit used to supply power to the aircraft for starting and for ground testing of the survey system began requiring an undue amount of maintenance. In addition, spare parts were becoming difficult to purchase and were consequently expensive. To replace the present APU, a 7 PH Briggs and Stratton gasoline engine and a 200 ampere DC aircraft generator were purchased. These units together with a voltage regulator and some aircraft relays have been assembled into a much more reliable ground power unit. The present engine should be much easier to repair because parts for it are generally available.

Attendance at Meetings

T. R. Flint - Microcomputer-microprocessor Course, Ottawa,
D. G. Olson - January 28-30, 1975.

URANIUM RECONNAISSANCE PROGRAM

A. G. Darnley

The objective of this program is to provide high-quality systematic reconnaissance data relating to the distribution of uranium in Canada, to serve as a guide and incentive in exploration for new deposits, and to provide a basis for national uranium resource appraisal. GSC will undertake preliminary reconnaissance and feasibility studies as required, but the principal operations will be contracted, and entail airborne radioactivity and ground geochemical surveys. GSC will maintain on-going R and D activities relating to methods of uranium exploration, in parallel with this program.

The main activities during 1974/75 have involved extended discussions with technical representatives of all the provinces as a preliminary to making detailed plans. The program will be cost-shared with the provinces. Specifications have been drawn up and negotiations commenced for the initial phase of contract work in 1975. As part of the need to provide public information on uranium exploration, a successful morning session consisting of five papers was held at the Prospectors and Developers Association Meeting in Toronto in March.

RADIATION METHODS SECTION

K. A. Richardson

This Section is responsible for the development, testing and evaluation of nuclear geophysical methods, and remote sensing methods for geological mapping and exploration. Activities of the Section include investigation of airborne, ground and borehole methods.

The major activity in 1974-1975 was in collection of airborne gamma-ray spectrometry data. Surveys were carried out in Saskatchewan under the Canada-Saskatchewan Agreement on Mineral Exploration and Development in Northern Saskatchewan, in Ontario to investigate uranium distribution in possible source rocks for the Elliot Lake deposits and to examine a Palaeozoic uranium occurrence west of Ottawa, in Quebec to obtain data on the Johan Beetz type of uranium occurrence, and in Prince Edward Island and Newfoundland to test the feasibility of using airborne spectrometry for the Uranium Reconnaissance Program in these Atlantic provinces.

Some ground work was done in the Elliot Lake area to verify that the airborne radioelement distribution pattern reflected the bedrock composition rather than the percentage of outcrop. Ground radiometric investigations were made in conjunction with geochemical work on the Palaeozoic uranium mineralization west of Ottawa.

Upgrading of the GSC high sensitivity airborne gamma-ray spectrometer began in 1974 which will result in some electronics improvements in the system to be flown in 1975, and a computer-based multichannel

spectrometer to be test flown in 1976. Theoretical studies on optimizing detector sizes, increasing the accuracy of airborne measurements by improving the determination of correction coefficients, and developing filtering techniques were carried out.

The gamma-ray spectrometry laboratory provided over 500 sample analyses for thorium, uranium and potassium, the spectrometer calibration was improved, and equipment was installed to enable research into the possibility of measuring disequilibrium in the uranium decay series.

Investigation of nuclear techniques in borehole logging began in 1974 with a literature review of the current state-of-the-art prepared for publication.

In the field of remote sensing, 2200 line miles of colour aerial photography were acquired in the Beechey Lake area, N.W.T. as part of an integrated geophysical and geochemical investigation of a multi-element geochemical anomaly located in 1973. The colour photography showed gossan distribution, gave structural information that directed further work in the area, and was used to produce a detailed topographic map of the area.

An evaluation of side look radar imagery for the Hearne Lake map sheet N.W.T. showed this to be a relatively rapid and inexpensive method for producing a mosaic, but with some limitations on the quality of the mosaic, compared to conventional air photo mosaics.

Finally, the GSC library of satellite imagery, maintained by the Section, continued to expand, and includes over 200 colour LANDSAT images, and all of the SKYLAB photographs of Canada.

1974 SKYVAN SURVEYS

High Sensitivity Gamma-Ray Spectrometry

Saskatchewan	9,000	line miles
Blind River, Ontario	1,848	
South March, Ontario	1,144	
Havre St. Pierre, Quebec	1,748	
Johan Beetz, Quebec	691	
Prince Edward Island	804	
Burin Peninsula, Newfoundland	246	
St. George Basin, Newfoundland	340	
Cross Country, Ottawa-Sudbury	1,120	
Cross Country, Newfoundland	520	line miles
	17,461	miles
	27,938	km

Personnel Notes

R. L. Grasty - seconded to the Department of Environment, Victoria, for 1975.

G. W. Cameron - joined the Section as Geophysicist in January 1975 coming from Magnetic Methods Section.

J. M. Carson - joined the Section as Geophysicist in February 1975 coming from staff of Sir Sanford Fleming College.

P. B. Holman - position reclassified to Physical Scientist, Geophysicist.

J. P. Parker - moved to the Geochemistry Section of the Division and was replaced as section electronics technician by -

Y. B. Blanchard - in March 1975, who came from the Communications Research Centre.

J. D. McNeil and F. E. Wright - joined the Section in 1974 in term positions.

Attendance at Meetings

K. A. Richardson - U.S. Atomic Energy Commission Annual Industry Seminar, Grand Junction, Colorado, October 1974.

- Geological Society of America Annual Meeting, Miami Beach, November 1974.

- Prospectors and Developers Association Annual Meeting, Toronto, March 1975.

P. G. Killeen - Saskatchewan Annual Summary of Geological Investigations, Regina, November 1974.

- Manitoba Annual Summary of Geological Investigations, Winnipeg, November 1974.

- Prospectors and Developers Association Annual Meeting, Toronto, March 1975.

B. W. Charbonneau- Prospectors and Developers Association Annual Meeting, Toronto, March 1975.

V. R. Slaney - International Society of Photogrammetry, Commission VII, Banff, October, 1974.

Oral Presentations

K. A. Richardson - Uranium, thorium and potassium distributions in the Bear, Slave and Churchill structural provinces of the Canadian Shield. Geological Society of America, 1974 Annual Meeting.

V. R. Slaney - Satellite Imagery Applied to Earth Science in Canada. International Society for Photogrammetry, Commission VII, Banff, October 1974.

Publications

Outside	10
GSC Papers	8
Open Files	4

Committees

V. R. Slaney - Geoscience Working Group of Canadian Advisory Committee on Remote Sensing.

GEOCHEMISTRY SECTION

E. M. Cameron

This Section is responsible for research on geochemical processes; for obtaining data to assist in mineral resource appraisal and exploration; and for providing geochemical support to various government programs, including external aid, regional development, and environmental studies.

During this year the major part of the Section's effort was diverted from its previously mainly research role, to the establishment of procedures for large-scale contracted surveys. This National Geochemical Reconnaissance (NGR) program is presently largely in support of the Uranium Reconnaissance Program and Federal-Provincial mineral development agreements. Over the longer term, this program will provide a consistent group of methodologies for all Federal and Federal-Provincial geochemical surveys; for storing and presenting the data, and for disseminating the information in suitable form for such requirements as resource evaluations, mineral exploration, environmental studies, agriculture, etc.

The change to contracted surveys was more difficult and time consuming than anticipated. In particular, establishing control procedures has required a great deal of effort. The first survey carried out under contract involved lake sediments collected over a 20,000 square mile area of Saskatchewan. This was part of the Federal-Saskatchewan mineral development agreement. E. H. W. Hornbrook, R. G. Garrett and

J. J. Lynch were mainly responsible for this work, but many others contributed. For such surveys it was determined that the most appropriate division of effort was for the sampling, sample preparation and analytical components to be carried out under contract, with orientation surveys, contract specification, analytical control, data merging, presentation and interpretation by the GSC. This results in a ratio of approximately two thirds of the expenditures by contractors, to our third by GSC.

The other major effort of the section was to host a multidisciplinary study of methods of resource appraisal in an area of the northern Shield. Our recent work on lake sediment reconnaissance has shown those methods to be promising for rapidly assessing the mineral resource potential of large areas of the Canadian Shield. However, the best results will come when these data are integrated with geological and geophysical information. This field investigation of lake sediment anomalies included geological work, sulphide mineral studies, VLF-resistivity, gravity, magnetometry, aerial colour photography, as well as rock, soil and water geochemical investigations. Cooperating with E. M. Cameron, C. C. Durham, W. Dyck, I. R. Jonasson and an analytical group from this section were: W. J. Scott, L. J. Kornik, and V. R. Slaney (all R.G.G.); J. B. Boyd, R. A. Gibb and M. D. Thomas (Earth Physics Branch); J. D. Williams (DOE) and T. Pearce and D. Lefebvre (Queen's University).

Other important work included studies of sulphide minerals (I. R. Jonasson); the use of helium and other gases in mineral exploration (W. Dyck); and development of a computer-controlled atomic absorption spectrometer (Q. Bristow), R. G. Garrett contributed to the Branch's development of autocartographic methods.

Personnel Notes

R. J. Allan - accepted a position as Chief, Canada Centre for Inland Waters - Western (Winnipeg) in January.

David Hobbs - accepted a position as a mathematician-programmer with the Department of Agriculture in January.

Greig Lund - joined the section as Geochemical Data Manager in January.

Attendance at Meetings, Conferences and Courses

E. M. Cameron - Fifth International Geochemical Exploration Symposium Vancouver, March-April 1974.

- Prospectors and Developers Association, Toronto, March 1975.

C. C. Durham - Second Annual Geoscience Forum, Yellowknife N.W.T. December 12-13, 1974.

W. Dyck - AEC Uranium Industry Seminar, Grand Junction, Colorado, October 22-23, 1974.

- Field study trip of U.S. Uranium deposits in Wyoming, Colorado and New Mexico, Oct. 24 - Nov. 1, 1974.

R. G. Garrett - International Association of Mathematical Geology, 3rd Chautauqua on "Computers and mineral resources" held at Syracuse University, New York, October 1974.

- Prospectors and Developers Association, Toronto, March 1975.

- Fifth International Geochemical Exploration Symposium, Vancouver, April 1974.

E. H. Hornbrook - Fifth International Geochemical Exploration Symposium, Vancouver, April 1974.

- Prospectors and Developers Association, Toronto, March 1975.

I. R. Jonasson - First International Congress on Mercury, Barcelona, Spain, May 1-5, 1974.

- Prospectors and Developers Meeting, Toronto, March 1975.

- Fifth International Geochemical Exploration Symposium, Vancouver, March-April 1975.

Lectures Given

E. M. Cameron - Geochemical methods of exploration for massive sulphide mineralization in the Canadian Shield (Fifth International Geochemical Exploration Symposium).

C. C. Durham - Second Annual Geoscience Forum, Yellowknife, N.W.T. December 12-13, 1974.

W. Dyck - Geochemistry applied to uranium prospecting: 43rd Annual Convention of the Prospectors and Developers Association, Toronto, March 10-12, 1975.

R. G. Garrett - Copper in Proterozoic acid volcanics as a Guide to Exploration in the Bear Province; Fifth International Geochemical Symposium, Vancouver.

E. H. Hornbrook - Regional Lake Sediment Geochemical Survey for Zinc
P. H. Davenport - Mineralization in Wuteus, Newfoundland; Proc. Fifth
and A. J. Butler- Geochemical Exploration Symposium, Vancouver, 1974.

C. F. Gleeson
E. H. Hornbrook - Semi-Regional Geochemical Studies Demonstrating the Effectiveness of Till Sampling at Depth: Proc. Fifth Geochemical Exploration Symposium, Vancouver 1974.

I. R. Jonasson
D. F. Sangster - Fifth International Geochemical Exploration Symposium on Mercury in Sphalerites from base metal deposits of Canada, April 1974.

Membership on Committees

E. M. Cameron - Editor-in-Chief, Journal of Geochemical Exploration.

- Council, Association of Exploration Geochemists.

W. Dyck - GSC Uranium Committee

R. G. Garrett - Chairman, Branch Computer Facilities Committee

- Chairman, Association of Exploration Geochemists Committee on Computer Application.

E. H. Hornbrook - Canada-Saskatchewan Mineral Development Program.

Geochemistry Laboratories

J. J. Lynch, Chief Analyst

Efforts to improve and diversify the services of these laboratories continued during the past year. Precision and sensitivity for the determination of arsenic and antimony were greatly improved by the introduction of a hydride evolution-atomic absorption method for these two elements. During the coming year the application of this method to the determination of selenium, tellurium and tin will be investigated. A wet chemical method for the determination of titanium was put into routine use. Investigations into the determination of barium and strontium by atomic absorption proved somewhat disappointing although the problem was overcome by using a solution technique with a direct reading spectrometer and determining these two elements by emission spectroscopy. Calcium, magnesium and manganese can also be determined concurrently using the same method. Flameless atomic absorption methods were established on a routine basis for the determination of zinc and copper in water samples. During the coming fiscal year anodic stripping will be investigated as a means of determining thallium in silicate material as well as attempting to differentiate the different inorganic and organic species of certain elements in water. The general purpose D.C. arc method used in the Direct Reading Spectrometer laboratory was revised so that silicate and carbonate rocks could also be analyzed.

In the summer of 1974, a field laboratory was designed by R. Horton and J. J. Lynch for use in a remote area at Friday Lake, N.W.T. Over the course of the summer zinc, copper, lead and silver were determined in soils and waters. During the coming summer months field laboratories will be set up at Sackville, New Brunswick, and High Lake, N.W.T.

The past fiscal year marked the beginning of contracting analyses to commercial laboratories. In this connection, seventeen commercial laboratories in Montreal, Ottawa, Toronto and Vancouver were visited in order to assess their capabilities and expertize. Tables 1, 2, 3 and 4 contain appropriate statistics related to sample preparation, trace element, direct reading spectrometer and field laboratories as well as contracted analyses.

TABLE I

Sample Preparation Laboratory

	1973-74	1974-75
Samples carried over	0	0
Samples received	4610	3530
Samples completed	4610	2480
Samples withdrawn	0	1050
Samples carried forward	0	0
Sizing	1505	420
Crushing	3405	2460
Ball Milling	3105	2565
inding	405	2460
Superpanner	360	225
Frantz	200	225
Heavy Liquid	100	45
Hand Picking	25	30

TABLE II

Trace Element Laboratory

	1973-74	1974-75
Samples carried over	4334	3335
Samples received	6141	5630
Samples completed	7140	7027
Determination	88,889	73,848
Samples carried forward	3335	1938

TABLE III

Direct Reading Laboratory

	1973-74	1974-75
Samples carried over	80	0
Samples received	122	2447
Samples completed	202	2411
Determinations	6838	12,086
Samples carried forward	0	36

TABLE IV

Field Laboratory, Friday Lake, N.W.T.

	1974
Soil samples dried and sized	800
Soil and Water samples analysed	1400
Determinations	4400

TABLE V

Contract Analyses 1974-75

Samples sent out	7695
Samples completed	7508
Samples carried over	187
Determinations	60,773

MISCELLANEOUS AND SPECIAL PROJECTS

Borehole Geophysics Program

A. V. Dyck

A cooperative program with four companies (Cominco, Noranda, Inco and Canex Placer) was undertaken by the Geological Survey of Canada to determine the state-of-the-art in borehole surveying for mining purposes and to make a comparison of induced polarization, electromagnetic and magnetic methods. The program consists of three phases, the first of which is a survey of the literature of all geophysical methods. The second phase consists of a field program that was commenced in 1974 and will continue in 1975. The third phase will hopefully result in improvement of borehole survey methods for mining purposes.

Analytical and Nuclear Instrumentation

Q. Bristow

The automated analysis of geochemical samples by a computer controlled atomic absorption spectrophotometer has been refined to the point that it is now possible to transmit the data, recorded on cassette tape, via a telephone coupler directly to the EMR computer at 588 Booth Street for processing. A programme written by M. T. Holroyd of the Digital Compilation Section combines these "wet chemistry" analyses with other data from the same samples for use in the final contoured maps showing element distribution. This represents an illustration of the philosophy that minicomputers should be used for process control and data acquisition only, while sophisticated processing of that data should wherever possible be left to a larger and more powerful machine geared for the purpose.

The development of a trace gas analyser, which was started at the University of Toronto Institute for Aerospace Studies in 1970 under very modest funding, has now been placed on a firm footing by D.S.S. bridge financing. Under the new arrangements, Sciex Ltd., a firm started by members of the Aerospace Institute staff, have a contract to build two units, one of which will be delivered to the GSC by about March 1976. A second part of the arrangement provides the Aerospace Institute itself with substantial funds for the necessary research to develop algorithms for the unambiguous identification of various classes of trace gases. It is intended to conduct experimental airborne surveys using the device in order to see if gases can be detected which emanate from buried ore deposits. If this proves to be the case, then the trace gas analyser could be a revolutionary new tool in resource exploration.

The first phase of a two phase project to update the high sensitivity airborne gamma-ray spectrometry system is now complete. This involved replacing the all important signal conditioning electronics with units designed in terms of the newer and more sophisticated linear integrated circuits which are now available. The result has been a dramatic improvement in the ability of the system to resolve the peaks which occur in the natural radioactivity spectrum, and this in turn should result in a corresponding improvement in field performance.

During the course of this work, a programme was written to allow a minicomputer to be used as a gamma-ray spectrometer, with the capability for recording and displaying complete spectra and for performing in seconds some of the tedious calculations which are necessary in checking the performance of scintillation detectors. This has proved invaluable in checking the new signal conditioning electronics for the airborne system. It has already enabled us to respond quickly to a request by one of the airborne survey companies for a detailed test of a new scintillation detector whwch they had acquired, and it will be used to monitor the performance of commercial airborne gamma-ray spectrometry systems to be used in contract surveys under the Uranium Reconnaissance Program.

Two publications appeared in print during the year.

Membership on Committees

Q. Bristow - Chairman, Advisory Committee on Electronic Technology, Algonquin College, Ottawa.

G.S.C. Activities in International Development

B. E. Manistre

Through the medium of a Memorandum of Understanding reached between the Department of Energy, Mines and Resources and the Canadian International Development Agency (CIDA), the Geological Survey of Canada has continued to supply technical advice and services to CIDA during the past year.

Requests from CIDA have generally fallen into one of four categories. In the first category, individual officers have been asked to visit developing countries to evaluate proposals for earth science projects. Visits were made to Guyana (Dr. P. J. Hood) and Ivory Coast, Mali (Dr. A. Larochelle).

In the second category, officers have been seconded to CIDA for periods of one or more years. This included a continuing project in Ethiopia (Dr. T. Davidson) and a secondment to the CIDA engineering division (Dr. A. Larochelle).

In the third category, GSC has interviewed Canadians for service abroad under CIDA contract (Nigeria) and agreed to accept trainees for practical attachment to GSC projects from Brazil, Pakistan, Uganda, Ethiopia and Yugoslavia and Indonesia under various sponsoring agencies.

The fourth category includes those CIDA projects in which GSC has a continuing responsibility. This normally involves the preparation of technical specifications, advice on the proposals or tenders received from Canadian companies, inspection and monitoring of contracts and acceptance of the work on behalf of CIDA.

In Brazil, the GSC is acting as technical advisers to the Departamento Nacional da Producao Mineral (DNPM) of the Ministry of Mines and Energy for a comprehensive mineral exploration project in the Goias state. This is a joint Canada-Brazil project partly financed by a Canadian loan from CIDA, administered by the Inter American Development Bank in Washington ($4.4 million) and partly by Brazil ($6.5 million). The project will extend over the next 4-5 years.

An initial airborne magnetic-radioactive survey will be flown over the project area (375,000 km^2) by a consortium of Canadian companies under contract to DNPM. Concurrently, Pilot studies will be undertaken in five small areas of known mineral occurrences utilizing a variety of geochemical and geophysical methods in order to determine which techniques are liable to be most effective under Brazilian conditions. This work will be carried out by Canadian companies under four separate contracts.

In 1974, GSC prepared specifications for all contracts and work will begin in 1975. Inspection and technical supervision of the work will be undertaken by GSC officers.

In Pakistan, GSC is preparing specifications for an airborne magnetic survey in two areas of Baluchistan, primarily designed to define and analyse known mineralized belts partly covered by extensive alluvium. Advice on contract award, inspection and acceptance will be undertaken for CIDA.

In the Ivory Coast, specifications for a photo geological mapping project were approved in 1974 and contract supervision will be provided in 1975.

Advice was given on the selection of a consultant for the interpretation of the airborne magnetic maps resulting from an earlier CIDA project in Cameroun. This work will also be monitored for CIDA.

GSC also participated actively in the International Workshop in Earth Science Aid to developing countries held at St. John's, Newfoundland, in May 1974. The proceedings of this workshop were published as GSC paper 74-57.

Attendance at Meetings

B. E. Manistre - International Workshop in Earth Science Aid to Developing Countries, St. John's, Newfoundland, May 1974.

Special Projects

R. W. Boyle

R. W. Boyle continued the compilation on metallogenesis and primary halos. Field work was done in England and France and in the Madoc area, Ontario.

Membership on Committees

R. W. Boyle - served as Vice President of the Association of Exploration Geochemists.

- served on the Associate Committee on Scientific Criteria for Environment Quality, N.R.C.: metals panel.

Attendance at Meetings

R. W. Boyle - symposium and field trips of the International Association of Genesis of Ore Deposits held in Varna, Bulgaria and in the Massif Central in France during September and October 1974.

TERRAIN SCIENCES DIVISION

J.S. Scott, Chief

INTRODUCTION

Responsibilities of the Division are focused upon all aspects of surficial geology and geomorphic processes of the Canadian landmass including the coastal and adjacent offshore regions exclusive of the coastal and offshore regional responsibilities of the Atlantic Geoscience Centre. These responsibilities are met by scientific, technical, and support staff based in Ottawa and small operational units located at Canada Centre for Inland Waters, Burlington, Ontario, Institute of Sedimentary and Petroleum Geology, Calgary, and the Vancouver offices of the Geological Survey.

The objectives of the Division are: to provide a systematic coverage of surficial geology of the Canadian landmass consistent with the information requirements for effective use of the terrain and for the interpretation of Quaternary and Holocene geological events; to identify and assess the occurrence and magnitude of natural terrain hazards; to provide geoscience information to assist in the maintenance and restoration of the physical environment; and to provide standards, controls, and reference materials to ensure consistency of correlation between geological events of the Pleistocene and Holocene Epochs and to develop and maintain standards of mapping of surficial geology appropriate to national needs.

Although major features of the glacial geology of Canada have been portrayed at a scale of 1:5,000,000 (Geological Survey of Canada, Map 1253A, 1968) systematic surficial geology maps exist for only a small part of Canada. At present approximately only 15 per cent of the surficial geology of Canada has been mapped at a scale of 1:250,000 and less than 5 per cent of the country at a scale of 1:50,000. Thus systematic surficial geology mapping at scales of 1:250,000 in northern regions and 1:50,000 in the southern populous regions of Canada constitutes a major activity of the Division.

In view of the extensive unmapped area of the country, priority of work within a program year is assigned on the basis of response to government imperatives such as Environmental-Social Program, Northern Pipelines, provincial requirements in relation to economic development, and on the significance of a specific area to the understanding of the regional surficial geology.

Surficial geology mapping at a field scale of 1:125,000, supported by Environmental-Social Program, Northern Pipelines, was completed for the Mackenzie Valley Transportation Corridor and the major emphasis in northern mapping was redirected to the Arctic Islands in anticipation of terrain information requirements for potential gas pipeline routes from the Arctic Islands to southern Canada. A pilot project of landscape mapping involving geomorphologists, geologists, botanists, and wildlife zoologists was completed for eastern Melville Island and terrain mapping was completed for the Boothia Peninsula between 68° and 72°N. Field work in Boothia Peninsula also was utilized in the evaluation of ERTS-1 satellite data for small scale mapping in the Canadian North. Terrain mapping of Banks Island, in response to information required for the administration of the Territorial Land Use Regulations, was begun as part of a three-year project required to cover the entire island.

Terrain mapping activities were continued in the eastern District of Keewatin, an area in which the Division is also evaluating the potential use of glacial drift as a prospecting medium. Mapping in eastern Keewatin will be extended north to Boothia Peninsula and south to adjoin the recently

completed mapping in the Churchill-Nelson drainage basins. In this developing region of Canada, terrain information thus is directly applicable to both mineral exploration and engineering evaluation of potential gas pipeline routes.

In southern Canada terrain mapping of Cape Breton Island was completed and continued work in Newfoundland has brought the level of surficial geological map coverage to approximately 80 per cent of completion.

Surficial geology mapping at a scale of 1:50,000 was continued in the lower Fraser River valley and in support of urban geology studies in Hamilton, Ottawa-Hull, and Montreal.

Systematic mapping of surficial geology in offshore regions and the study of coastal processes constitute significant activities of the Division. These studies are in progress in Straits of Georgia and Juan de Fuca and in the Beaufort Sea as part of the industry-sponsored Beaufort Sea Project. Although very heavy ice conditions in the Beaufort Sea during the summer of 1974 limited the extent of ship-borne surveys, side-scan sonar data obtained by the Division in Mackenzie Bay and Beaufort Sea contributed to the understanding of the origin of bottom scour in these critical areas of petroleum exploration.

Studies of coastal processes in Barrow Strait and elsewhere in the Arctic Islands region were undertaken to provide information pertinent to proposed pipeline crossings of interisland channels. The use of SCUBA diving techniques beneath the arctic ice was a novel approach employed in some of these studies to complement, by direct observation, information normally acquired by remote sensing or by widely spaced bottom sampling.

Environmental impact assessment of major engineering projects is an increasing activity of the Division as a direct outgrowth of Divisional expertise in terrain mapping and studies of geomorphic processes. Assessment of design packages covering segments of the Mackenzie Highway, evaluation of geotechnical data obtained along the route of the highway, and assessment of granular material resources for construction of the highway were major activities.

Previous work by the Division in mapping the distribution of Champlain Sea clays in the Ottawa-St. Lawrence Lowlands has been utilized as the basis for a study of the occurrence and mechanism of landslides within these sensitive clays. An investigation into the behaviour of the clays under dynamic loading and the influence of regional hydrogeology on slope stability are salient aspects of the study.

Correlation of geological events and evaluation of environmental changes within the Quaternary and Holocene Epochs are dependent upon measurement of time and upon an understanding of the character and distribution of past and present biological assemblages. Accordingly, the Division operates a quality-controlled radiocarbon laboratory and complements its stratigraphic studies through the work of specialists in palynology, paleontology, paleoentomology, and paleobryology.

During the year the Division approved 115 Internal Reports comprising: 23 Papers; 1 Memoir; 1 Bulletin; 18 Open Files; 4 Final Maps; 1 Miscellaneous Report; and 44 contributions to Report of Activities, 75-1 (Pt. A), and 23 contributions to Report of Activities, 75-1 (Pt. B). In addition 40 papers were approved for Outside Publication.

REPORTS ON SUBDIVISION AND SECTIONS

DIVISIONAL HEADQUARTERS

Divisional Headquarters comprises the Chief of Division, to which position Dr. J.S. Scott was appointed in June, Assistant Division Chief, Dr. B.G. Craig and the staff of specialized units who provide the necessary support services required for divisional management and operations.

The Scientific and Technical Services Unit provides photogrammetric, cartographic, editorial and computer programming services to scientists of the Division. During the year Mrs. G. Mizerovsky employed quantitative photogrammetric techniques in the preparation of detailed contour and planimetric maps for scientific projects in Newfoundland, eastern James Bay region, the arctic coast and arctic islands. Mr. D. Egan, as Divisional draftsman, prepared approximately 60 maps and 250 figures, slides and miscellaneous drawings illustrating various aspects of the scientific projects of the Division. Ms. H. Dumych, as Divisional editor, provided editorial review for approximately 15 manuscripts, supervised the hiring of summer students and participated in various special assignments for divisional management. Systems analysis services have been provided in the areas of data management and its scientific applications by K. Shimizu and D. Proudfoot. The Administration and Financial Services Unit under Mr. L.A. Jackson, Division Administrative Officer, who with clerical support provides the Division with essential accounting and personnel services. In August, Mr. Jackson took over the duties as Acting Head, Branch Administrative Services and Mrs. M.R. Cade became Acting Division Administrative Officer. Also, during the year Mr. Jed Cochrane, an Administrative Trainee, was given instructions in Administrative duties mainly of a financial nature. As in previous years considerable time was spent giving administrative and financial advice and producing financial reports for the E.M.R. Co-ordinator, Environmental-Social Program, Northern Pipelines, E.M.R. Co-ordinator, Beaufort Sea Task Force and the senior Branch contact with the Mackenzie Highway Environmental Working Group. The Clerical and Secretarial Unit under Miss L.S. Morency, Clerical Assistant to Division Chief, to whom credit is due for the compilation of much of the subsequent material in this report, and who, with secretarial support from Mrs. D.M. Meheden and stenographic support, provides these services to the Division.

Personnel Notes

A. Pissart: a Professor with the Université de Liège, Belgique, visited Canada, through the auspices of Canada Council, to do field work on Banks Island during the summer of 1974.

D.A. Proudfoot: joined the permanent staff in September 1974 after having worked with the Division as a term-casual.

Attendance at Meetings, Conferences and Courses

B.G. Craig: attended the Glacial Till Conference held in Ottawa in February 1975.

G. Mizerovsky: attended special session: International Symposium on Quaternary Environments of the C.A.G. meetings held in Toronto, May 1974; and the Glacial Till Conference held in Ottawa, February 1975.

D.A. Proudfoot: attended the Prospectors and Developers Convention held in Toronto in March 1975.

J.S. Scott: presented a paper at the 27th Canadian Geotechnical Conference held in Edmonton, November 1974; and at the Glacial Till Conference held in Ottawa, February 1975.

Special Talks or Lectures

J.S. Scott: gave a talk on geological containment of radioactive wastes to the Canadian Nuclear Association, Technical and Safety Committee at A.E.C.L. Sheridan Park, Toronto in February 1975.

Membership on Committees

L.A. Jackson
- Alternate Chairman, Administrative Support Classification and Evaluation Committee
- Member, Administrative Support Appraisal Committee
- Member, Branch Safety Committee
- Member, Branch Parking Committee

J.S. Scott
- Vice-President, North America, International Association of Engineering Geologists
- Member, Mines Branch, Pit Slope Project Selection Committee
- Member, Subcommittee on Foundations, Canadian Advisory Committee on Rock Mechanics
- Chairman, Departmental Committee on Radioactive Waste Disposal
- Member (ex officio), Subcommittee on Urban Engineering Terrain Problems, Associate Committee on Geotechnical Research
- Member, Working Group on Engineering Geology of Karst Terrain, International Association of Engineering Geologists
- Member, Granular Materials Working Group, Mackenzie Highway
- Member, Panel on E.B. Burwell, Jr. Award, Engineering Geology Division, Geol. Soc. Amer.
- Departmental representative, Interdepartmental Group on National Land Use Policy

SPECIAL PROJECTS UNIT

Senior scientific staff of the Division assigned to this unit are involved in regional compilations of surficial geology, studies of unique Quaternary geological features, and provision of scientific and technical advice to the Division and other government agencies. Work is continuing on compilations of Quaternary geology of the Prairie region and Lower Fraser River valley. New studies have begun on the occurrence and origin of glacially displaced massive blocks of bedrock in the Prairies, and on the distribution and origin of Cochrane till in northern Ontario and Quebec. Staff of the unit provided scientific and technical advice to the Mackenzie Valley Pipeline Application Assessment Group and to the Department of Indian and Northern Affairs on matters pertaining to application of the Territorial Land Use Regulations.

Attendance at Meetings, Conferences and Courses

J.E. Armstrong: attended the Glacial Till Conference held in Ottawa in February 1975.

V.K. Prest: attended the Symposium on Waste Recycling and the Environment held in Ottawa, April 1974; the International Symposium on Quaternary Environments held in Toronto, May 1974; and presented a paper and participated in field trips at the 3rd Biennial Meeting of the American Quaternary Association in Wisconsin and Iowa, August, 1974. Presented a paper at the Penrose Conference (G.S.A.) Pleistocene Stratigraphy in the Northeast held in Amherst, Massachusetts, October 1974; and served as Chairman of a session at the Geological Society of America Meeting - Northeastern Section held in Syracuse, N.Y., March 1975.

A.M. Stalker: attended the International Symposium on Quaternary Environments sponsored by C.A.G. held in Toronto in May 1974.

Special Talks or Lectures

O.L. Hughes: gave a talk on the distirbution and recognition of ground ice and related features, at the University of Alberta in Edmonton in May 1974.

E.B. Owen: gave a talk on terrain damage along buried hot gas pipeline between Pointed Mountain, N.W.T. and Beaver River, B.C. to the Northern Development Branch, D.I.N.A. in Ottawa in July 1974; and the same talk again in December 1974 to personnel of D.I.N.A. from the N.W.T. and Y.T. in Ottawa.

V.K. Prest: gave a talk on growth and decay of the Laurentide ice-sheet, to the professors and graduate student seminar at the University of Quebec in March 1975.

A.M. Stalker: gave a talk on Quaternary stratigraphy on the Canadian Prairies to the graduate student seminar at the University of Quebec in February 1975.

Membership on Committees

J.E. Armstrong	- Secretary-General, 24th International Geological Congress - Chairman, Commission on Statutes of International Geological Congress - Member, Honorary Advisory Committee of the 13th Pacific Science Congress - Member, INQUA Subcommission on North American Stratigraphy - Chairman, Co-ordinating Committee for joint G.A.C.-M.A.C.-S.E.G. Meeting in Vancouver in 1977
O.L. Hughes	- Member, Permafrost Subcommittee, National Research Council
V.K. Prest	- Member, INQUA Subcommission on North American Quaternary Stratigraphy - Member, Commission on Paleogeographic Atlas of the Quaternary
A.M. Stalker	- Member, Interdepartmental Committee on Salvage Archaeology - Member, Associate Committee on Quaternary Research of the National Research Council of Canada

Quaternary Discussion Group

The Quaternary Discussion Group was chaired by J.E. Harrison prior to the appointment of J.V. Matthews, Jr. in October 1974. The following papers were given during April 1974 to March 1975.

Dr. Roger Slatt, Memorial University - Sedimentology and geochemistry of bottom deposits on the Newfoundland shelf and adjacent inlets.

Dr. Christian Schlüchter, Brock University - Interstadial deposits of Mid-Wisconsin age, Aare Valley, Switzerland.

Drs. N.R. Gadd, D.R. Grant and V.K. Prest, Terrain Sciences Division - Late glacial events in eastern Canada.

Dr. E.A. Christiansen, Saskatchewan Research Council - Quaternary stratigraphy and the collapse and thrusting processes.

Dr. J.T. Andrews, INSTAAR, Boulder, Colorado - Facts and fancies concerning the Wisconsin glaciation of eastern Baffin Island.

Dr. D.M. Hopkins, U.S.G.S., Menlo Park, Calif. - Modern and ancient thermokarst in western Alaska.

Dr. D.M. Hopkins, U.S.G.S., Menlo Park, Calif. - Type and magnitude of vegetational change in Beringian sector of N.W. North America and N.E. Siberia during late Wisconsin and Holocene time. Also on - Latest evidence concerning survival and migration of certain plant species.

Dr. Vyacheslav Konishchev, Moscow State University - Some aspects of the origin of Cenozoic sediments of the lower Yana River Valley (Northeast Siberia).

Dr. D.C. Ford, McMaster University - Uranium-series dating and paleotemperature analysis of speleothems in North American caves.

Dr. R. Souchez, Université de Bruxelles - The chemical composition of glacier ice and glacier erosion.

GEOTECHNICAL SUBDIVISION

B.C. McDonald (A/Head)

The program of the Geotechnical Subdivision is directed primarily towards analysis of those dynamic and geotechnical attributes of surface and near-surface materials that influence land use decisions. Information is provided on stream, lake, and mass wasting processes as they affect terrain stability, and on engineering and thermal properties of materials as they bear on the performance of the terrain under a variety of natural and man-induced conditions.

The accelerated program of work in the Mackenzie Valley Transportation Corridor was completed and similar work was commenced in the Arctic Islands Archipelago. Application of the urban geoscience data bank to the problems of selected cities across Canada was continued. Preparation of a prototype urban geoscience atlas of the National Capital Region is nearing completion and is being complemented by a comprehensive study of terrain stability problems associated with marine clays in the region.

The program of using surface sediments as an aid to mineral prospecting is being expanded and has led to a number of reports that improve our ability to apply this technique to the search for new mineral resources.

SEDIMENTOLOGY AND MINERAL TRACING SECTION

W.W. Shilts (Head)

This Section undertakes research to define and elucidate geomorphological processes (particularly in areas of permafrost), physical and chemical aspects of fresh water (fluvial and lacustrine) sedimentation, physical and chemical aspects of fresh and weathered glacial sediments (particularly till), and mineral prospecting techniques that use glacial drift as a prospecting medium. Laboratory functions that support these and other analytical requirements of the Division also are administered through this Section.

Limited field work on drift prospecting was carried out in southeastern Quebec where models were developed to describe local mechanisms of glacial dispersal of trace elements in eskers and till. Laboratory work continued to define the chemical and physical properties of glacial sediments collected in the District of Keewatin, particularly in regard to their potential value as a geochemical prospecting medium.

A reconnaissance survey of fluvial processes on Banks Island, N.W.T. was completed and forms the basis for a detailed study of fluvial dispersion and sedimentation to be carried out on that island in 1975-76.

Analyses and tests in support of sedimentological and engineering activities are undertaken at the Spencer Street Laboratory in Ottawa. Processing and analyses of samples for chemical and mineralogical studies, primarily within the mineral-tracing program, are carried out at another Ottawa laboratory at Booth Street.

Personnel Notes

D.M. Campbell: resigned from the Geological Survey in September 1974 to return to University.

T.J. Day: joined the Geological Survey in July 1974 from the staff of the Department of Geography, University of Canterbury, New Zealand.

C.D. McFarlane: joined the permanent staff in August 1974 after having worked with the Division as a term-casual. Took over supervision of Mineral-Tracing Laboratory at Booth Street.

Attendance at Meetings, Conferences and Courses

B.C. McDonald: attended the Symposium on the Geological Action of the Drift Ice held in Quebec City, April 1974; and the Advisory Committee Meetings, the Investigators Conference and Arctic Drilling Seminar sponsored by the Beaufort Sea Project held in Calgary, January 1975.

W.W. Shilts: attended and was Chairman of a session of the Association of Exploration Geochemists Conference held in Vancouver, April 1974; presented a paper at the annual meeting of the Canadian Institute of Mining and Metallurgy held in Montreal, April 1974; and at the North-Central Section Meeting of the Geological Society of America held in Kent, Ohio in May 1974. Presented two papers, one co-authored with W. Dean and the other with I. Nicol and R. Klassen, at the International Association of Limnology Congress (SIL) held in Winnipeg, August 1974; In October 1974 he presented a paper at the Penrose Conference (G.S.A.) held in Amherst, Massachusetts and also attended the GRID course held in Cornwall.

Special Talks or Lectures

B.C. McDonald: gave a talk on soil survey and environmental impact studies to the Canadian Soil Survey Committee in Ottawa in April 1974.

W.W. Shilts: was visiting lecturer in October 1974 at the University of Western Ontario - lectured on (a) principles of drift prospecting and glacial dispersal, and (b) genesis of patterned ground. He led a field trip on geochemistry of glacial deposits in the Thetford Mines, P.Q. for the undergraduate geochemistry students in November 1974; and presented a lecture on principles of drift prospecting to the faculty and graduate student siminar in December 1974, at Queen's University. Presented invited keynote paper in February 1975 on "Glacial Till and Mineral Exploration" at the Glacial Till Conference, sponsored by the Royal Society, in Ottawa.

Membership on Committees

T.J. Day	- Member, Hydrotechnical Research Committee, Canadian Society of Civil Engineers
B.C. McDonald	- Chairman, Departmental Committee on Environmental Matters - E.M.R. Co-ordinator, Environmental-Social Program, Northern Pipelines - E.M.R. Co-ordinator, Beaufort Sea Project - Member, Hydraulic Design Task Force for Mackenzie Highway Environmental Working Group - Member, Mackenzie Highway Environmental Working Group
W.W. Shilts	- Member, Permafrost Subcommittee of the Associate Committee on Geotechnical Research - Member, Organizing Committee for Third International Conference on Permafrost

Sedimentology-Engineering Geology Laboratories

W.E. Podolak, W.W. Shilts

Analyses and tests are undertaken in three laboratories and are distributed according to equipment available, experience with any particular test, and techniques applied. For the most part, mechanical analyses and subordinate engineering tests are carried out at the Spencer Street laboratory; geochemistry-oriented sample preparations and mineralogical analyses are developed and carried out at the Booth Street laboratory; major engineering tests and analyses are performed at the D.P.W. laboratory.

At present, the Booth Street laboratory, supervised by C. McFarlane, and Spencer Street laboratory, supervised by R.G. Kelly, are undertaking a project to test, evaluate, and write-up various techniques to be used as standard procedures. The laboratories are also striving to adopt new analytical procedures to expand their scope.

Production in the laboratories is summarized below.

	Spencer St. Lab		Booth St. Lab	
OPERATION	1974-75	1973-74	1974-75	1973-74
Grain size analysis, sieve only (2mm-64μ)	201	243		
, complete sieve and pipette (2mm-64μ)	782	754		
, sand ratio by rapid sand analyser	—	748		
, sand, silt, clay ratio	348	—		
, pipette or hydrometer	—	258		
, other	—	725	900	1150
Natural Moisture Content			166+	480
Atterburg Limits	565	518	126	390
Carbonate Ratio (Chittick)	165	121		
Total and Organic Carbon (Ashing)	148	220		
Heavy Mineral, separation	183	50	781	200
, slides	410		781	200
, grinding and magnetic separation			781	200
, magnetic weight %	—	—	781	200
Clay Minerals, slide preparation	288	152	138	30
, centrifuge separation for chemical analysis			1977	2600
Sample Preparation (dry, sieve, etc.)	1485		3000	3000+
pH	8	56	—	560

OPERATION	Spencer St. Lab 1974-75	Spencer St. Lab 1973-74	Booth St. Lab 1974-75	Booth St. Lab 1973-74
Bulk Density	44	—	—	—
Specific Gravity	163	52	—	—
Sample Pre-treatment, HCl-H_2O_2	3	1949		
, freeze drying	1152			
Unified Soil Classification	149			
Munsell Colour Determination	82			
Natural Water Content	273			

ENGINEERING AND ENVIRONMENTAL GEOLOGY SECTION

P.A. Carr (Head)

This Section undertakes studies of the physical and engineering properties of soil and rock materials in order to evaluate the geological processes that are hazardous to man and to the terrain, and to recommend the best environmental use of the terrain.

In northern Canada part of the activities of this Section are concerned with the highway and proposed pipeline of the Mackenzie Valley, and the gas pipeline from the Arctic Islands. A mile by mile assessment of the alignment and the engineering design of the highway is being made in order to ensure that minimum terrain disturbance will result from construction. A geotechnical data bank for the Mackenzie Valley is being compiled from the logs of more than 10,000 boreholes; this information will permit the relationships between various geological and geotechnical parameters to be studied. A listing of thermal readings from more than 300 thermistors in shallow boreholes situated in permafrost zones is being prepared for publication.

A preliminary reconnaissance was made in the Arctic Islands of the terrain response to such man-made disturbances as airfields and oil well sites. This study should provide background data and insight that will be useful in the environmental evaluation of the proposed Arctic Gas Pipeline.

In the east Kootenay area of British Columbia, a three-year project to examine the environmental impact of coal mining in mountainous terrain is in its final stages. The portion of the study concerned with coal waste dump stability has been completed, and final reports and maps on the geological and geotechnical aspects of land use problems await the completion of laboratory analysis.

Another major activity of the Section is the study of landslide hazards in the sensitive clays of eastern Canada. A compilation of the areal extent of all silts and clays of the Champlain Sea and an inventory of their associated landslides is being made in the Ottawa Valley. It is hoped that this compilation will provide a regional overview, which will be useful to planners and geotechnical consultants.

Personnel Notes

J.A. Heginbottom: was seconded to the Department of Indian and Northern Affairs in February 1975 to work for a short time on Dr. Fyles' Inquiry Appraisal Team and will then direct his time toward Mackenzie Highway projects.

R.M. Isaacs: resigned from the Geological Survey in May 1974 to accept a senior position with Mechanics Research Incorporated in Alaska.

D.E. Lawrence: transferred to the Department of Indian and Northern Affairs in January 1975 as an Environmental Geologist.

R.A. O'Neil: joined the Geological Survey in June 1974 from the staff of the Department of Environment as a Postdoctorate Fellow.

Attendance at Meetings, Conferences and Courses

P.A. Carr: attended a workshop and colloquim on "Approaches to Environmental Geology" held in Austin, Texas, and also the joint annual meetings of the G.A.C. and M.A.C. held in Newfoundland in May 1974; the 27th Canadian Geotechnical Conference held in Edmonton, November 1974; and the Glacial Till Conference held in Ottawa, February 1975.

N.R. Gadd: presented a paper at the Penrose Conference (G.S.A.) held in Amherst, Massachusetts in October 1974.

J.A. Heginbottom: attended the 27th Canadian Geotechnical Conference held in Edmonton in November 1974 and participated in the field excursion to the Athabascar tar sands.

P.J. Kurfurst: attended the 27th Canadian Geotechnical Conference held in Edmonton in November 1974; and the Polar Gas Pipeline Seminar held in Winnipeg in March 1975.

D.E. Lawrence: attended the 27th Canadian Geotechnical Conference held in Edmonton in November 1974.

R.A. O'Neil: attended the 27th Canadian Geotechnical Conference held in Edmonton in November 1974.

Special Talks or Lectures

N.R. Gadd: gave two talks in November 1974, (1) on St. Lawrence Valley stratigraphy and morainic systems to the seminar group, University of Sherbrooke in Sherbrooke, P.Q., and (2) on glacial history of the Ottawa Area to the general public at Carleton University in Ottawa; and in December 1974 he gave a talk on geological setting of Ottawa in relation to urban development to the West End Kiwanis in Ottawa. In January 1975 he was interviewed by C.B.C. on the geological background of the Champlain Sea, broadcast in two parts, in Ottawa, and gave a talk on "Histoire d'une glaciation" to the Seminar Master's program at the University of Quebec in Montreal, P.Q.

Membership on Committees

P.A. Carr	- Member, Departmental Committee for Radioactive Waste Disposal
N.R. Gadd	- Chairman, Branch Committee on Displays - Member, Departmental Committee on Displays - E.M.R. Tower
J.A. Heginbottom	- Member, Environmental Working Group, Mackenzie Highway, and the Consolidation and Future Studies Subgroups
R.A. O'Neil	- Member, Canadian Association of Physics - Member, American Institute of Physics Teachers - Member, International Glacialogical Society - Chairman, Divisional Computer Committee, as of June 1974

URBAN PROJECTS UNIT

J.E. Harrison (Head)

This Unit, formerly the Urban Projects Section, became part of the Engineering and Environmental Geology Section in November 1974. It is involved in investigation of land capability and geological hazards and resources of urban areas, and development of methods of data presentation for urban planning. At the present time, investigations are being carried out in Ottawa-Hull, Hamilton, and Victoria.

Preparations are nearing completion to make available to the public the subsurface data which has been gathered for 28 urban centres in Canada. This information, presently stored on magnetic tape, will be made available on microfiche. Computer drawn location maps are being produced to allow access to the microfiche file.

Both compilation and computer drawn maps have been prepared for inclusion in a report being prepared on the environmental geology of the Ottawa-Hull area. Maps in final manuscript form include bedrock geology, rock units defined by geotechnical properties, surficial geology, drift thickness, and bedrock contours. A similar set of maps is being prepared for the Hamilton area from available geotechnical information that has been compiled.

The Unit recently has become involved in a new activity - the nuclear waste storage program of Atomic Energy of Canada Limited. This program will involve studying the feasibility of underground containment in hard rock of solid nuclear wastes.

Personnel Notes

J.R. Bélanger: joined the permanent staff in April 1974 after having worked with the Division under a Personal Service Contract.

J.E. Harrison: assumed responsbility for the Unit in November 1974.

F.M. Morin: joined the permanent staff in February 1975 after having worked with the Division as a term-casual.

N.W. Rutter: transferred to the National Energy Board in October 1974.

Attendance at Meetings, Conferences and Courses

J.R. Bélanger: attended the Data Base Design Seminar held in Los Angeles in April 1974.

J.E. Harrison: attended the Coal and the Environment Conference held in Louisville, October 1974; and the GRID Course held in Cornwall, March 1975.

F.M. Morin: attended the Glacial Till Conference held in Ottawa in February 1975.

Special Talks or Lectures

N.W. Rutter: gave a talk on the environmental geology problem, Mackenzie Valley Transporation Corridor to Members of the Canadian Society of Petroleum Geologists in Calgary in June 1974.

Membership on Committees

J.E. Harrison
- Member, Selection Committee, Revegetation Project (Mines Branch)
- Athabasca Oil Sands Task Force, Prairie and Northern Region, Environment Canada

QUATERNARY SUBDIVISION

REGIONAL PROJECTS SECTION

R.J. Fulton (Head)

The activities of this Section are largely directed towards providing a Canada-wide inventory of the unconsolidated deposits and landforms and establishing their stratigraphic and environmental history. Mapping projects are undertaken at various scales chosen on the basis of the present state of knowledge and potential use. This information is of value to forestry, agriculture, engineering, construction, and the mineral industry and is used in land use and environmental impact studies.

The Regional Projects Section continued its accelerated terrain mapping program in the Arctic Islands and adjacent mainland areas. This area was given priority in order to provide surficial geology and terrain sensitivity information to aid in the implementation of the Territorial Land Use Regulation and to provide data for assessment of the environmental impact on areas that might be affected by pipeline construction. As part of this program inventory mapping was started on Banks Island by J.S. Vincent. This four-year project will provide surficial geology maps for the entire island and will include some characterization of vegetation cover in addition to descriptions of surficial materials and of their geotechnical properties. Field mapping of southern and central Ellesmere Island was completed by D.A. Hodgson. The results of this work will be released as they are compiled, and the first maps should be available May, 1975. Inventory mapping of terrain conditions on Boothia Peninsula was conducted by A.N. Boydell. Data resulting from this work should be available in June, 1975 and will include information on soils and vegetation that has been supplied by Soils Research Institute, Agriculture Canada through the participation of C. Tarnocai. Late in the year the main results of integrated, terrain-vegetation-wildlife studies carried out in eastern Melville Island were released.

J.J. Veillette continued testing and development of shallow drilling and sampling equipment while carrying out sampling programs for the northern field parties. This year it was possible to adapt a new, light, hydraulic drill to the permafrost coring program.

Terrain inventory and surficial geology studies were conducted in Kluane Park by V.N. Rampton. This work was done in conjunction with bedrock mapping of the Regional and Economic Geology Division. Parks Canada has requested the information for inclusion in their biophysical survey of the park, as an aid in preparation of interpretative information and to assist in park planning.

D.R. Grant continued field work in the Maritime provinces. This past summer, mapping of Cape Breton Island was completed and work on Newfoundland was brought to the point where it can be completed in two further field seasons.

Systematic mapping of the Ottawa Valley Lowland was continued by S.H. Richard. The Ontario part of the area that lies between Ottawa and the St. Lawrence River has now been completed.

Personnel Notes

A.N. Boydell: resigned from the Geological Survey in January 1975 to accept a senior position with the Environment and Land Use Committee Secretariat in Victoria, British Columbia.

J.J. Clague: joined the permanent staff in October 1974 after having worked with the Division as a Postdoctorate Fellow.

E.P. Henderson: retired from the Geological Survey in December 1974 after completing 23 years of dedicated service.

J.A. Netterville: joined the permanent staff in September 1974 after having worked with the Division as a term casual.

V.N. Rampton: resigned from the Geological Survey in September 1974 to go into business for himself.

J-S. Vincent: joined the permanent staff in September 1974 after having worked with the Division as a term-casual.

Attendance at Meetings, Conferences and Courses

D.M. Barnett: attended the Polar Gas Pipeline Seminar held in Winnipeg in March 1975.

A.N. Boydell: attended the Second Canadian Symposium on Remote Sensing held in Guelph, May 1974; presented a paper at the International Society for Photogrammetry, Commission VII Symposium held in Banff, October 1974; participated in the Biophysical Workshop Meeting of the Laurentide Forest Research Centre in Ste. Foy, Quebec and the Geoscience Working Group Meeting of the Canadian Advisory Committee on Remote Sensing in Calgary in October 1974. In November 1974 he attended, in an advisory capacity, the Geography Working Group Meeting of the Canadian Advisory Committee on Remote Sensing in Toronto; and in December 1974 he attended the meeting of the Subcommittee on Northern Soils and Resource Surveys held in Winnipeg.

R.J. Fulton: during September 1974 took part in two I.G.C.P. field excursions (1) Salzburg to Vienna, and (2) Middle and Lower Rhine, took part in the INQUA Loess Commission excursion of the Danube-Main area, and visited and presented a talk to the Istituto di Geografia Università in Padvo, Italy. In October 1974 he attended the Biophysical Land Classification Workshop Meeting of the Canadian Forestry Institute held in Ste. Foy, Quebec; and in February 1974 he attended the Glacial Till Conference held in Ottawa.

D.R. Grant: presented a paper at the Working Group Meeting of the I.G.C.P. Project "Sea-level Changes" held in Haarlem, Netherlands, September 1974; at the Penrose Conference (G.S.A.) held in Amherst, Massachusetts, October 1974; and at the Geological Society of America Meeting held in Miami, Florida, November 1974. Chaired a session on Quaternary geology and presented a paper at the Northeastern Sectional Meeting of the Geological Society of America held in Syracuse, N.Y., March 1975.

R.W. Klassen: attended the Glacial Till Conference held in Ottawa in February 1975.

J.A. Netterville: attended the Glacial Till Conference held in Ottawa in Feburary 1975; and the Polar Gas Pipeline Seminar held in Winnipeg in March 1975.

R.G. Skinner: presented a paper at the annual meeting of the Canadian Institute of Mining and Metallurgy held in Montreal in April 1974.

J.J. Veillette: attended the Glacial Till Conference held in Ottawa in February 1975.

J-S. Vincent: attended the Glacial Till Conference held in Ottawa in Feburary 1975.

Special Talks or Lectures

D.M. Barnett: in conjunction with S.A. Edlund, D.C. Thomas and L.S. Prevett gave a talk on the Melville Island mapping project to the Environmental-Social Program, Northern Pipelines in Ottawa, February 1975. In March 1975 he gave a talk on terrain classification and evaluation of Melville Island to the Director, Deputy Director and Division Chief of R.E.G. Division at G.S.C. in Ottawa.

J.J. Clague: gave a talk on the geology of Vancouver to the general public in Reifel Waterfowl Refuge in August 1974; and on geology to the general public while on a field excursion in October 1974.

R.J. Fulton: gave a talk on mapping Canada's Northland on terrain mapping in northern environments to the workshop session in Toronto in April 1974; and on Olympia interglaciation in southern B.C. to the B.C. Environment and Land Use Secretariat in Victoria in November 1974.

R.W. Klassen: gave a talk on Quaternary climates to students and faculty of Brandon University in Brandon in January 1975.

Membership on Committees

D.M. Barnett
- Liaison member for federal government with Ontario Association of Geomorphologists

A.N. Boydell
- Member, Northern Soils Subcommittee, C.S.S.C.
- Member, Geoscience Working Group

R.J. Fulton
- Member, Subcommittee on the Classification of Landforms of the Canada Soil Survey Committee
- Member, Geological Survey of Canada Radiocarbon Dating Committee
- Member, Working Group, UNESCO-IGCP Project

D.R. Grant
- Secretary, Subcommittee for the Americas, INQUA Shorelines Commission
- Member, Atlantic Provinces Soil Survey Committee, Atlantic Provinces Agricultural Services Co-ordinating Committee
- Member, Working Group, UNESCO-IGCP Project

PALEOECOLOGY AND GEOCHRONOLOGY SECTION

W. Blake, Jr. (Head)

This unit comprises a group concerned with Quaternary Paleoecology and the Radiocarbon Dating Laboratory. It provides analyses of fossil materials (e.g., pollen, diatoms, insects, wood, cones, seeds and mosses) and radiocarbon dates as a service to other units and individuals; a particular effort is made to identify all materials dated by the radiocarbon laboratory. The unit also determines variations in radiocarbon content of modern materials as background for other research, and investigates the chronology of fossil-bearing deposits. Research on changes in environment and in the distribution of plants, insects and marine invertebrates during the Quaternary is being conducted.

Field Work

T.W. Anderson participated in two cruises from C.C.I.W. to carry out acoustic profiling and sediment coring in the Great Lakes; one, aboard M.V. Limnos, was to Georgian Bay in May, the other, aboard M.V. Martin Karlsen, comprised a survey of Lakes Erie and Ontario in July. W. Blake, Jr. undertook studies of glacial stratigraphy in northwestern Greenland, and together with C.F.M. Lewis participated in the Arctic cruise of C.S.S. Hudson, in order to obtain sediment cores and bathymetric data in the Arctic Archipelago. J.V. Matthews, Jr. collected samples for plant macrofossils and insects in the Yukon and eastern Alaska. Coring of lake sediments was carried out by R.J. Mott in both Ontario and Quebec, and additional work of this nature was undertaken on Banks Island, N.W.T., in support of mapping operations by J-S. Vincent.

Personnel Notes

S.M. Chartrand: joined the permanent staff in April 1974 after having worked with the Division as a term-casual.

Attendance at Meetings, Conferences and Courses

T.W. Anderson: attended the American Quaternary Association Conference held in Madison, Wisconsin, which included a two-day post-conference field trip to western Iowa, in July 1974; and presented a paper at the 17th Conference on Great Lakes Research held in Hamilton in August 1974.

W. Blake, Jr.: attended Section IV of the SCOR/SCAR Polar Oceans Conference held in Montreal, May 1974; and the Glacial Till Conference held in Ottawa, February 1975. In October 1974 Blake served as one member of the jury judging a doctoral seminar by S. Occhietti entitled "Systeme BADG pour l'analyse des radiodatations de la vallée du Saint-Laurent", presented to the Dept. of Geography and Regional Planning, University of Ottawa.

S. Federovich: attended the XIX Congress of the International Association of Limnology held in Winnipeg, August 1974; the 2nd North American Symposium on Diatom Systematics and Ecology at the Ohio State University, Columbus, in September 1974; and the 7th Annual Meeting of American Association of Stratigraphic Palynologists held in Calgary, October 1974. In addition Dr. Federovich underwent training in the study of freshwater diatoms at Scarborough College, University of Toronto, in July; and took a short course in Cenozoic Palynology at Louisana State University, Baton Rouge, in January 1975.

R.J. Mott: attended the 7th Annual Meeting of American Association of Stratigraphic Palynologists held in Calgary in October 1974.

Special Talks and Lectures

T.W. Anderson: gave a talk on paleoecology and chronology of buried peats in the Great Lakes to the Quaternary Discussion Group in Waterloo in December 1974.

W. Blake, Jr.: gave a general talk on the Arctic, with special reference to glacial geological studies, to students in a field course from Lisgar Collegiate Institute in Gatineau Park, October 1974.

Membership on Comittees

W. Blake, Jr.
- Member, IGCP National Committee
- Member, INQUA Subcommission on North American Quaternary Stratigraphy
- Member, Program Committee, 1976 Meeting of the American Quaternary Association
- Chairman, Geological Survey Radiocarbon Dating Committee
- Chairman, Terrain Sciences Committee on Sea Level Changes

J.A. Lowdon - Member, Geological Survey Radiocarbon Dating Committee

J.V. Matthews, Jr. - Member, Beringian Committee

Production Statistics

Paleoecology

Organization and maintenance of the Pleistocene Palynology Laboratory is under the supervision of R.J. Mott, with technical assistance provided by L.D. Wilson. A total of 10 palynological reports were produced during 1974-75.

T.W. Anderson carried out palynological work in support of field projects by P.F. Karrow (University of Waterloo) and B. St. John (Pacific Environmental Institute, DOE). In addition he continued to provide support for various C.C.I.W. projects and to act as a consultant in regard to sedimentation rates in the Great Lakes. S. Federovich continued palynological work on core and surface samples from the Devon Island Ice Cap for R.M. Koerner and W.S.B. Paterson of the Polar Continental Shelf Project and also provided pollen analyses on samples collected by W. Blake, Jr. and J.E. Harrison. R.J. Mott, in addition to continuing work on cores of lake sediments that he had collected in previous field seasons, carried out laboratory work on the pollen content of samples collected by D.R. Grant, P.F. Karrow (University of Waterloo), J.V. Wright (National Museum of Man), and C.C. Kennedy (Ottawa). L.D. Wilson did palynological analysis on a sample collected by E. Nielsen (Dalhousie University).

Work on building up a diatom reference collection was continued by S. Federovich, and samples submitted by J.E. Armstrong, W. Blake, Jr., D.R. Grant, and L.D. Wilson were analyzed during the year. Progress was also made, in conjunction with J.V. Matthews, Jr., in building up a reference collection of seeds and other plant macrofossils; T.W. Anderson is developing a similar collection in Burlington. During the year J.V. Matthews, Jr. produced four Plant Macrofossil reports on samples collected by N.F. Alley, B. Gordon (National Museum of Man), N.M. Simmons (Canadian Wildlife Service), and J.T. Andrews (University of Colorado).

During the year M. Kuc prepared 51 Bryological Reports; these included data on vascular plants and other organic remains as well as on mosses.

R.J. Mott and L.D. Wilson continued their work with the identification of wood samples, oncluding nearly all of the samples submitted to the Radiocarbon Dating Laboratory for age determinations. During the year they produced 48 reports on 134 samples.

J.V. Matthews, Jr. produced four Fossil Arthropod Reports on samples collected by T.W. Anderson, G. Hattersley-Smith (formerly Defence Research Board Ottawa), C.R. Harington (National Museum of Natural Sciences), and J.T. Andrews (University of Colorado).

Radiocarbon Dating

Laboratory: The Radiocarbon Dating Laboratory is under the supervision of J.A. Lowdon, with technical assistance by I.M. Robertson and S.M. Chartrand. The laboratory has at its disposal three proportional counters, any two of which may be used at the same time. The 1-L counter was not operated during 1974-75; the 2-L counter was operated for five months, and the 5-L for eleven months, including three months at "high pressure" to handle very old samples. Continuing problems with the stability of results from the 2-L counter, in large part due to voltage fluctuations resulting from temperature and humidity changes in Room B-50, occasioned the several months of down time.

Age calculations are carried out monthly by a C.D.C. 6400 computer. This has replaced the C.D.C. 3100 used from January 1963 through December 1972. Previously, all radiocarbon age determinations reported by the Radiocarbon Laboratory quoted an age error which included an error term to account for the average variation of $\pm 1.5\%$ in the 14_C concentration of the atmosphere over the past 1100 years. Recent work on bristlecone pine by laboratories at the University of Arizona and the University of Pennsylvania, among others, have now furnished sufficient data to provide a conversion table from radiocarbon years to tree ring (calendar) years for the last 7500 years. This data takes into account the variations in the 14_C concentration (up to 15%) in the atmosphere during this period. Thus, since January 1973, no correction factors for fluctuations of the atmospheric 14_C concentration are being applied.

In addition to the continuing program of monitoring atmospheric fluctuations of radiocarbon at Ottawa and Vancouver another research project involves testing the validity of dates obtained from various fractions of bone (collagen, bone apatite, etc.). Reference samples for cross checking purposes continue to be prepared for new laboratories which are starting up. Also, check age determinations were carried out for comparison with dates produced by: Brock University, St. Catharines, Ontario; Gakushuin University, Tokyo, Japan; and the Radiological Dating Laboratory, Trondheim, Norway.

Program: Samples for age determination in the Radiocarbon Dating Laboratory were selected by an informal committee, headed by W. Blake, Jr., in consultation with J.A. Lowdon and R.J. Fulton, as well as with other members of the staff as appropriate to the samples under consideration. Most of the samples analyzed were selected to provide data for current research projects in the field of Quaternary chronology and related glacial events, to shed light on crustal movement, and to provide information on the rates of geological processes such as sedimentaion and solifluction. A total of 132 age determinations were carried out; of these 115 were on geological samples, 6 were on samples from archeological sites (mostly submitted by the National Museum of Canada), and in addition 11 analyses were carried out on geochemical samples. Because of the pressure of other work in the Geochronology Section, Regional and Economic Geology Division, it was not possible to submit any samples for determination of $13_C/12_C$ ratios during the fiscal year.

Results of age determinations from the laboratory are no longer being published first in Radiocarbon and then reprinted by the Geological Survey in the Paper series. Instead, starting with list XII (1972), laboratory results are being published directly as G.S.C. Papers, so as to permit the information to be made available more rapidly and to allow more leeway in the presentation of data. List XIV (G.S.C. Paper 74-7) reports 25 age determinations on 25 archeologic samples.

MARINE AND COASTAL SECTION

C.F.M. Lewis (Head)

Activities of the Geological Survey concerning the seafloor and coasts of the Pacific region, Great Lakes region, and Arctic Island channels and liaison activities with other groups and agencies undertaking related work are the responsiblity of this Section. Projects are designed to contribute inventory information about the seafloor and coast, their stratigraphic sequence, and environmental history and to develop regional understanding of geodynamic, geomorphic, sedimentary, and geochemical processes and the engineering attributes that control the stability and character of coastline, seafloor, and sediments. Such information will be utilized in offshore and coastal engineering planning for pipeline and cable routes, anchoring and wellhead completion problems, environmental and ecological studies, dredging and waste disposal management, mineral resource estimates including aggregate sources, fishery management, and in defence considerations.

In the Pacific region the program of environmental marine geology, operated from the Vancouver office of the Geological Survey, was continued with studies of sedimentation in the Fraser Delta and Quaternary geology of northern Strait of Georgia.

Studies of Great Lakes sediments were continued by palynological investigations of sediment sequences and buried marsh zones, stratigraphic coring, core description, and X-radiography. Much of this work was done at Burlington, Ontario, co-operatively with staff and facilities of Canada Centre for Inland Waters.

Staff of the Section participated in the industry-funded Beaufort Sea Environmental Studies Program which is operated under the project management of the Department of Environment. Logistics support provided by *M.V. Pandora*, *M.V. Pressure Ridge*, and submersible *Pisces* was employed in studies of the distribution of offshore permafrost and the occurrence of bottom scour by sea ice in the Beaufort Sea. Studies also were made of the susceptibility of the Beaufort Sea coast to oil spills.

Studies in the eastern Arctic were co-ordinated with Atlantic Geoscience Centre operations aboard *CSS Hudson* to provide information on bottom sediments and bathymetry in northern Baffin Bay, Nares Strait, Parry Channel, Lancaster Sound, and Barrow Strait. Palynological analysis of bottom cores from Maxwell Bay, southwestern Devon Island suggests the presence of Tertiary-Cretaceous sediments previously unknown in this area.

Novel approaches to the study of arctic marine geology were employed in Cunningham Inlet, northern Somerset Island through the use of a 31-foot landing craft transported to the area aboard *CSS Hudson*, and by SCUBA diving to observe and sample bottom sediments off Melville Island. These studies provided information on coastal processes, permafrost, drift ice phenomena, and coastal stability of significance to potential gas pipeline construction.

Personnel Notes

B.D. Bornhold: joined the Geological Survey in January 1975 from the staff of the University of Toronto where he worked as a Lecturer in the Department of Geology.

P. McLaren: joined the permanent staff in October 1974 after having worked with the Division as term-casual.

D.L. Tiffin: of R.E.G. Division has been Acting Head of the Pacific Unit of this Section in Vancouver since June 1974.

Attendance at Meetings, Conferences and Courses

B.D. Bornhold: attended the Polar Gas Pipeline Seminar held in Winnipeg in March 1975.

C.F.M. Lewis: attended the Symposium on the Geological Action of Drift Ice held in Quebec City, April 1974; and participated as a panel member in the Seventh GEOP Research Conference held in Columbus, Ohio, June 1974. In October 1974 he attended the Arctic Environmental Seminar sponsored by the Canadian Petroleum Association held in Whitehorse; and presented a paper at the Beaufort Sea Investigators Conference held in Calgary, January 1975.

C.P. Lewis: presented a paper at the Beaufort Sea Investigators Conference held in Calgary in January 1975.

J.L. Luternauer: acted as panelist for the Pacific Northwest Oceanography Conference held in Parksville, B.C. in February 1975.

P. McLaren: attended the Oceans Canada, Technical Day Symposium held in Toronto in November 1974.

R.B. Taylor: presented a paper at the Symposium on the Geological Action of Drift Ice held in Quebec City in April 1974.

Special Talks or Lectures

J.J. Clague: gave an informal talk on geology of the Vancouver area, sponsored by the Canadian Wildlife Service, in July 1974, to a group of teachers interested in earth sciences.

C.F.M. Lewis: gave a talk on the last 15,000 years in Osgoode Township to the Vernon Historical Soceity in Vernon in June 1974.

P. McLaren: gave a talk on coastal processes and related geology in a high Arctic environment to the Logan Club in Ottawa in November 1974; and the same talk to the Atlantic Geoscience Centre in Dartmouth in March 1975.

R.B. Taylor: gave a talk on coastal work in the Arctic Islands to the Geographical Society Meeting held in Hamilton in February 1975.

Membership on Committees

C.F.M. Lewis
- Member, Joint DOE/EMR Guiding Committee on Offshore Surveys
- Member, Ad hoc Committee on EMR's Northern Program in Science and Technology

C.P. Lewis
- Chairman, Divisional Computer Committee, until May 1974

APPENDIX I

STAFF LIST

Geological Survey of Canada

(as supplied by reporting units; June 15, 1975.)

DIRECTOR GENERAL'S OFFICE

McLaren, D.J., Director General
Hodgins, Mrs. L., Secretary
Wheeler, Dr. J.O., Deputy Director General
Birtch, Mrs. E.J., Secretary
Fyles, Dr. J.G.
Carr, Mrs. E.J., Secretary
Hall, E.

Special Projects

Douglas, R.J.W.
Bolton, T.E.

Data Management Systems Group

Hutchison, Dr. W.W.
Scaga, T.
Martin, Ms. G.
Bigras, Mrs. B.D., Secretary

Program Office

Brindle, J.E.
Stalker, D.

ATLANTIC GEOSCIENCE CENTRE

Loncarevic, B.D., Director
Penney, Mrs. E., Secretary
Hacquebard, P.A.

Administration

Eden, R.A., Administrative Officer
McCoombs, Mrs. F., Secretary
Racine, Mrs. C., Personnel
Campbell, Mrs. D., Accounts
Henderson, T.

Department of Environment (Secondment)

Charest, Mrs. J., Library
Sibley, R., Drafting
Mazerall, A., Library

Environmental Marine Geology

Buckley, D.E.
Clark, Mrs. C., Secretary
Joice, G.H.E.

Coastal Geodynamics

Owens, E.H.
Frobel, D.

Marine Geochemistry

Rashid, M.A.
Cranston, R.
Winters, G.
Fitzgerald, R.A.
Leonard, J.D.
Robertson, K.R.
Fanjoy, R.
Leblanc, K.W.G.

Paleoecology

Schafer, C.T.
Vilks, G.
Walker, D.
Wagner, F.
Deonarine, B.
Cole, F.

Eastern Petroleum Geology

Purcell, L.P.
Trapnell, Mrs. M.

Drafting

Grant, G.
Cook, G.

Stratigraphy Sedimentology

Howie, R.D.
Barss, M.S.

Palynology Lab

MacMillan, W.
Crilley, B.

Sedimentology Lab

Clattenburg, D.A.

Stratigraphy Sedimentology

Hardy, I.A.
Williams, G.L.
Gradstein, F.
Jansa, L.
Ascoli, P.
Girouard, P.

Regional Stratigraphy Basin Synthesis

Wade, J.A.
Grant, A.
Harris, I.
Jackson, A.

Regional Reconnaissance

Ross, D.I.
Myers, Miss J.M., Secretary

Surficial and Bedrock Geology

King, L.H.
MacLean, B.
Fader, G
Miller, B.

Eastern Arctic Offshore Geology

Falconer, R.

Labrador Sea Studies

van der Linden, W.J.M.
Srivastava, S.
Fillon, R.
Stevens, C.F.

Ocean Basins and Margins

Keen, C.E.
Barrett, D.L.
Jackson, R.

Geophysical Surveys

Haworth, R.T.
MacIntyre, J.B.
Follinsbee, R.A.

Program Support

Manchester, K.S.

Systems Development

Heffler, D.
Godden, C.A.
Locke, D.

Data Systems

Shih, K.G.
Johnston, B.L.
Sparkes, R.
Beaver, D.E.
Sherin, A.

Equipment Services

Corbett, T.J.
Ewing, F.
Gorveatt, M.E.
Nielsen, J.A.
Coady, V.F.
Hughes, M.D.
Courtney, T.F.
Boyce, W.A.
Inkpen, B.F.
Murphy, R.J.
Jodrey, F.D.

CENTRAL LABORATORIES AND ADMINISTRATIVE SERVICES

Maxwell, J.A., Director
Traill, R.J., Assistant Director
Lapp, J.H., Administrative Officer
Clemmer, J.E., Secretary
Petre, Miss M.A., Technical & Administrative Assistant

Branch Administrative Services

Casey, Mrs. M.A.F., Head

Purchasing, Supplies, Chemical & Stationery Stores

Bourque, J.R.
Charlebois, G.J.
Davidson, D.O.
McBryde, L., Miss
Moreau, V.
St. Dennis, D.J.

Accommodation, Building Maintenance, Inventory Vehicles & Equipment

Salter, I.C.
Rozon, R.

Secretarial Services

Metz, J.L., Ms.
Anderson, W.E.
Barnard, C.G., Mrs.
Busby, D.A., Miss
DiCredico, J., Mrs.

Secretarial Services (cont'd)

Gilliland, J., Mrs.
Parnham, S.J., Mrs.
Whitford, M.S., Mrs.
Wiskemann, K.J., Mrs.

Branch Registry & Messenger Service

Robillard, R.D.
Balderston, N.J., Mrs.
Carrigg, F.J.
McQuaig, D.I.

Financial Services

Azar, J.W., Comptroller
Cooke, W.E.

Accounts

Going, M.I., Mrs.
Deslauriers, Mrs.
Hadowanec, M.B., Mrs.
Lisle, E., Mrs.

Analytical Chemistry

Abbey, Sydney

Chemical Laboratories

Courville, S.
Sen Gupta, J.G.
Bouvier, J.L.
Seymour, L.J., Miss
Watson, F.J., Mrs.
Grushman, V., Mrs.
Guillas, R.J.

Spectrographic Laboratories

Champ, W.H.
Church, K.A.
Bender, G.A.
Brown, D.A.
Belanger, P.G.
Meeds, C.F.

Mineralogy

Traill, R.J.

Mineralogical Studies

Lachance, G.R.
Plant, A.G.
Stenson, A.P., Mrs.
Pringle, G.J.
Delabio, R.N.
Bonardi, M.
Gravel, J.
Roberts, A.C.

Mineral Separation and Sample Preparation

Paris, J.C.
Machin, B.D.
Christie, R.
Blake, C.
Huot, J.M.R.

National Collections

Steacy, H.R.
Ansell, H.G.

Mineral and Rock Set Preparations

Larose, J.M.
Racine, T.H.

Mechanical Services and Instrument Development Shop

Meilleur, G.A.
Cregheur, A.Y.
Fournier, J.P.
Walker, B.A.

Electronic Services and Equipment Development

Jones, F.W.
Coté, O.L.

GEOLOGICAL INFORMATION PROCESSING DIVISION

Harker, P., Director
Blackadar, R.G., Assistant Director

Geological Information Processing Division (Cont'd)

Claude, Y.P., Admin. Officer
Griffin, P.J.
Koops, Mrs. A.F.V.
Mahoney, Mrs. L.R.
Nadon, Mrs. L.A.
Vincent, L.E.

Publications and Information

Touchette, J.L.
Clarke, C.R.
Drapeau, Mrs. G.M.
Dubeau, E.M.
Huard, F.E.
Letang, E.G.
Murphy, B.P.
Rail, E.J.
Rawlings, Mrs. J.C.

Photographic Services

Kempt, J.W.
Beckstead, D.C.
Chapman, W.
Hodge, C.C.
Stafford, W.G.
White, J.I.

Library, Central Tech. Files, Data Processing

Sutherland, Mrs. D.M.
Brodeur, J.
Eyre, W.H.
LaHam, Miss M.
Laurendeau, P.E.
Nichol, Miss S.A.
Sabourin, Miss G.
Segall, Miss C.D.
Stewart, Miss T.G.
Thompson, M.
Williams, M.E.
Yee, Mrs. I.S.

Cartography

Roberts, J.G.
Champagne, L.
Di Millo, Mrs. M.

Drafting Unit A

Nunn, E.P.
Barbary, G.J.
Corriveau, J.P.
Coulthart, I.A.
Debain, P.C.
Grenier, N.
Lavigne, G.H.
Mainville, B.
Papps, T.L.
Pratt, J.A.
St. Pierre, M.
St. Pierre, Miss Y.
Saffin, R.E.
Sauvageau, J.A.R.
Thomson, H.A.
Williams, J.B.F.

Drafting Unit B

Allard, R.
Babcock, L.W.
Corrigan, P.
Daugherty, R.F.
Fairfield, R.D.J.
Fouchard, G.W.
Heney, F.J
Heyendal, H.A.
Hill, R.S.
Kovachic, Mrs. H.
Leader, R.E.
McCracken, J.N.
McKenzie, N.M.
Raddatz, Miss M.A.
Simonds, Mrs. B.J.
Yelle, J.S.

Drafting Unit C

Dumbrell, E.A.
Brown, D.G.
Daley, L.A.
Enright, M.L.

Drafting Unit C (Cont'd)

Finn, H.J.
Gagnon, J.G.E.
Hill, B.G.
King, J.A.
Perron, R.R.
Potvin, R.Y.
Yeager, F.S.
Young, W.G.

Photomechanical Unit

Buck, N.E.
de la Fontaine, M.E.
Mackenzie, R.J.G.
Major, A.C.
McNeill, D.G.
Wilkinson, R.W.
Wylie, W.G.

INSTITUTE OF SEDIMENTARY AND PETROLEUM GEOLOGY

Institute Director

Stott, D.F.
Fenwick, Ann E., Secretary

Administrative Services

Brusso, A.W., Admin. Officer

Office Services

Jamieson, A.
Rose, Irene A.
Ajram, M.
Penley, W.L.
Case, Brenda M.
Peatman, D.
Unger, J.
Fiddes, L.V.
Blunden, Vicki
Brookwell, Irene
Esau, Gwen
McIntyre, Joan
Parkins, A.R.

Building and Engineering Services

Peterkin, G.M.
Delay, B.G.
Bridges, G.E.
Clayton, E.M.

Regional Geology Subdivision

Taylor, G.C., Subdivision Head
Garner, Irene J., Secretary

Arctic Islands Section

Thorsteinsson, R.
Christie, R.L.
Kerr, J.W.
Trettin, H.P.
Balkwill, H.R.
Davies, G.R.
Miall, A.D.
Reinson, G.E.
Wilson, D.G.
Mayr, U.

Northern Mainland Section

Cook, D.G.
Norris, D.K.
Young, F.G.
Myhr, D.W.
Aitken, J.D.

Southern Mainland Section

Macqueen, R.W.
Ollerenshaw, N.C.
Gibson, D.W.
Pugh, D.C.
Thompson, R.I.
Morrow, D.W.
Meijer-Drees, N.C.
Williams, G.K.

Marine Geology

Yorath, C.J.

Curation and Technical Services

Price, L.L.
McKenzie, M.A.
Broadfield, R.J.

Core and Sample Repository

Banning, W.W.
Bjarnason, A.

Sedimentological Laboratories

McEwan, W.O.

Geological Technician

Moncrieff, D.M.

Paleontology Subdivision

Norford, B.S., Subdivision Head
Garner, Irene J., Secretary

Macropaleontology Section

Norris, A.W.
Bamber, E.W.
Nassichuk, W.W.
Pedder, A.E.H.
Poulton, T.P.

Micropaleontology Section

Uyeno, T.T.
Brideaux, W.W.
Chamney, T.P.
Hopkins, W.S.
Sweet, A.R.
Wall, J.H.

Ottawa Paleontology Section

Tozer, E.T.
Jeletzky, J.A.
McLachlin, M.F.

Paleontological Laboratories

Michie, R.D.
Haden, D.F.
Heisler, Linda
Pickering, S.A.
Tomica, Maria

Energy Subdivision

McCrossan, R.G., Subdivision Head
Procter, R.M., Subdivision Assistant Head
Evis, Kim A.M., Secretary

Geochemistry Section

Powell, T.G.
Foscolos, A.E.
Snowdon, L.R.
Heinrich, A.
Barefoot, R.R.
Northcott, E.M.
Khan, M.R.
Humphries, D.A.

Geology of Petroleum Section

Roy, K.J.
Haimila, N.E.
Van Elsberg, J.N.
Drake, G.
Der, K.F.

Geology of Coal Section

Latour, B.A.
Irvine, J.A.
Cormier, B.R.
Cameron, A.R.
Gunther, P.R.
Birmingham, T.F.
Gange-Harris, C.

Geophysics Section

Walker, R.G.
Bosgra, C.R.

Data Management

Ott, S.L.

Geological Information Subdivision

Irish, E.J.W., Subdivision Head
Findlay, C.E., Editorial Assistant

Geological Cartography Section

MacLachlan, L.
Thomson, J.W.
Walter, D.J.
Ortman, B.
Gill, S.E.
Wardle, L.
Vermette, W.P.
Browne, J.A.
Siewert, S.M.
Ortman, K.M.
Beaver, M.

Library

Jones, M.
Graff, J.C.
Greener, P.
Dykes, E.A.

Publications and Air Photo Section

Brooks, M.
Cormier, D.A.
Woolf, A.E.

Photography Section

Lawrence, D.G.
Rutley, B.C.

REGIONAL AND ECONOMIC GEOLOGY DIVISION

Reesor, J.E., Director
Stevenson, I.M., Assistant Director
Arnold, J.G., Admin. Officer
Gougeon, C.L., Mrs., Secretary
Cox, B.F., Mrs.
Wereley, D., Mrs.
Lennox, R.L.L., Mrs.
Houston, W.N.
Greer, J.M.

Cordillera and Pacific Margins Subdivision

Gabrielse, H.
Jones, L.R., Admin. Officer
Eisbacher, G.
Souther, J.G.
Tipper, H.W.
Cameron, B.E.B.
Campbell, R.B.
Muller, J.E.
Roddick, J.A.
Blusson, S.L.
Monger, J.W.H.
Tempelman-Kluit, D.J.
Leaming, S.F.
Marble, A. Mrs.
Shurben, P.K. Mrs.
Tiffin, D.L.
Richards, T.A.
Currie, R.G.
Dnistransky, P.V.
Dodds, C.J.
Frydecky, I.I.
Heather, G., Mrs.
Seemann, D.V.
Banninger, S.
Dumas, G.R.
Akehurst, M., Miss

Precambrian Subdivision

Fahrig, W.F.
Skinner, R.
Frarey, M.J.
Morgan, W.C.
Eade, K.E.
Ridler, R.H.
Heywood, W.W.
Fraser, J.A.
McGlynn, J.G.
Jackson, G.D.
Davidson, A.
Chandler, F.W.
Hoffman, P.F,
Davison, W.L.
Baragar, W.R.A.
Bourne, J.H.
Bencik, K.
LeCheminant, A.N.
Ermanovics, I.F.
Taylor, F.C.

Precambrian Subdivision (cont'd)

Henderson, J.B.
Frisch, T.
Frith, T.
Lambert, M.B.
Schau, M.P.
Campbell, F.H.A.
Maley, J.

Paleomagnetism

Foster, J.H.
Schwarz, E.J.
Christie, K.W.
Freda, G.N.
Clark, K.R.

Correlation and Standards Subdivision

Poole, W.H.
Benson, D.C.

Petrology

Currie, K.L.
Froese, E.
Gordon, T.M.
Emslie, R.F.
ter Haar Romeny, W.U.
Okulitch, A.V.
Miller, A.L.

Geochronology

Wanless, R.K.
Stevens, R.D.
Loveridge, W.D.
Santowski, K.
Sullivan, R.W.
Quigg, F.B.
Seguin, R.J.G.
MacRae, J.L.
Bisson, J.G.
Reithmeier, C.G.
Bellerive, D., Mrs.

Appalachian, Eastern Lowlands and Atlantic Margin Section

Bostock, H.H.
Cumming, L.M.
Geldsetzer, H.
Sanford, B.V.

Eastern Paleontology

Dean, W.T.
McGregor, D.C.
Copeland, M.J.
Murphy, F.M., Mrs.
Fritz, W.H.
Webb, P.E. Ms.

Petrography-Paleontology Service

Botte, B.J.
Callahan, J.J.
Whitehead, A.G.
Demers, A.Y.
Beaulne, J.M.
Kerr, D.K., Ms.

Economic Geology Subdivision

Leech, G.B.
Anderson, F.D.
Findlay, D.C.
Moyd, P., Mrs.

Mineral Data Bank Unit

Whitmore, D.R.E.
Burns, E.M., Miss
Rose, D.C.

Special Projects

Gross, G.A.

Mineral Deposits Geology Section

Sangster, D.V.
Burke, R.D.
Carrière, J.J., Mrs.
Dawson, K.R.
Dawson, K.M.
Eckstrand, O.R.
Jambor, J.L.
Kirkham, R.V.
McLeod, C.R.
Mulligan, R.
Prasad, N.
Rose, E.R.
Soregaroli, A.E.
Thorpe, R.I.

Mineral Deposits Geology Section (cont'd)

Lancaster, R.D.
Franklin, J.M.
Vokes, F.M.

Geomathematics Unit

Agterberg, F.P.
Chung, C.F.
Fabbri, A.G.
Laramee, R.M.

Uranium Resource Evaluation Section

Little, H.W.
Rimsaite, J.Y.H.
Ruzicka, V.
Tremblay, L.P.
Boyer, A.
Turay, M., Mrs.
Bell, R.T.

RESOURCE GEOPHYSICS AND GEOCHEMISTRY DIVISION

Administration

Darnley, A.G.
Artichuk, A.
Goodman, N.D.
McDowell, J.K.
Morra, R.R.

Special Projects

Boyle, R.W.
Bristow, Q.
Manistre, B.E.

Contract Surveys

Larochelle, A.
Anderson, K.
Chretien, M.B.
Derouin, E.J.
Johnson, D.
Knappers, W.
Langlois, R.J.
Lawley, L.
Ready, E.E.

Electrical Methods

Collett, L.S.
Annan, A.P.
Butterfield, D.C.
Davis, J.L.
Dyck, A.V.
Frechette, J.P.
Gauvreau, C.
Katsube, T.J.
Scott, W.J.
Sinha, A.K.
Sloka, R.J.

Magnetic Methods

Hood, P.J.
Bower, M.E.
Dicaire, A.
Knapp, H.W.C.
Kornik, L.J.
McGrath, P.H.
Owens, K.H.
Washkurak, S.
Haley, E.L.
Reveler, D.A.

Radiation Methods

Richardson, K.A.
Blanchard, Y.
Bernius, G.R.
Cameron, G.W.
Carson, J.
Charbonneau, B.W.
Elliott, B.E.
Grasty, R.L.
Holman, P.B.
Killeen, P.G.
Slaney, V.R.

Seismic Methods

Burns, R.A.
Gagne, R.M.
Good, R.
Hunter, J.A.M.
MacAulay, H.A.
Overton, A.

Experimental Airborne Operations

Sawatzky, P.
Flint, T.R.
Olson, D.G.

Digital Compilation

Holroyd, M.T.
Abbinett, D.D.
Butt, I.
Dods, S.D.
Zieman, F.W.

Geochemistry

Cameron, E.M.
Alexander, W.
Aslin, G.E.M.
Chaffey, D.R.
Coker, W.B.
Durham, C.C.
Dyck, W.
Garrett, R.G.
Gauthier, G.
Hornbrook, E.W.H.
Horton, R.
Jonasson, I.R.
Lavergne, P.J.
Lund, N.G.
Lynch, J.J.
MacLaurin, A.
Maurice, Y.
Nelson, W.H.
Parker, J.
Pelchat, J.C.
Ruzgaitis, E.

TERRAIN SCIENCES DIVISION

Scott, J.S., Director
Craig, B.G., Assistant Director

Clerical and Secretarial Services

Morency, Miss L.S.
Meheden, Mrs. D.M.

Administrative and Financial Services

Jackson, L.A.
Cade, Mrs. M.R.
Miller, Mrs. D.

Scientific and Technical Services

Dumych, Ms. H.
Egan, D.J.
Mizerovsky, Mrs. G.
Proudfoot, D.A.
Shimizu, K.

Special Projects Unit

Armstrong, J.E.
Hughes, O.L.
Owen, E.B.
Prest, V.K.
Skinner, R.G.
Stalker, A.M.

Sedimentology and Mineral Tracing Section

Shilts, W.W., Head
Day, T.J.
Klassen, R.A.
McFarlane, C.D.
Morel, D.M.

Sedimentology Lab
Spencer St.

Podolak, W.E. (Supervisor)
Kelly, R.G. (in charge)
Field, D.E.

Engineering and Environmental Geology Section

Carr, P.A., Head
Bisson, J.G.
Gadd, N.R.
Gale, J.E.
Heginbottom, J.A.
Kurfurst, P.J.

Urban Projects Unit

Harrison, J.E., Head
Bélanger, J.R.
Morin, F.M.

Regional Projects Section

Fulton, R.J., Head
Barnett, D.M.
Clague, J.J.
Grant, D.R.
Hodgson, D.A.
Klassen, R.W.
Netterville, J.A.
Richard, S.H.
Veillette, J.J.
Vincent, J.S.

Paleoecology and Geochronology Section

Blake, W., Jr., Head
Anderson, T.W.
Federovich, S.
Matthews, J.V., Jr.

Paleoecology Laboratory

Mott, R.J. (in charge)
Wilson, Ms. L.

Radiocarbon Laboratory

Lowdon, J.A. (in charge)
Robertson, I.M.
Chartrand, Mrs. S.M.

Marine and Coastal Section

Lewis, C.F.M., Head
Bornhold, B.D.
Lewis, C.P.
Luternauer, J.L.
McLaren, P.
Taylor, R.B.