CANADA

DEPARTMENT OF ENERGY,

MINES AND RESOURCES

GEOLOGICAL SURVEY OF CANADA

ANNUAL REPORT

APRIL 1, 1979 TO MARCH 31, 1980

FOR DEPARTMENTAL USE ONLY

OTTAWA

1980

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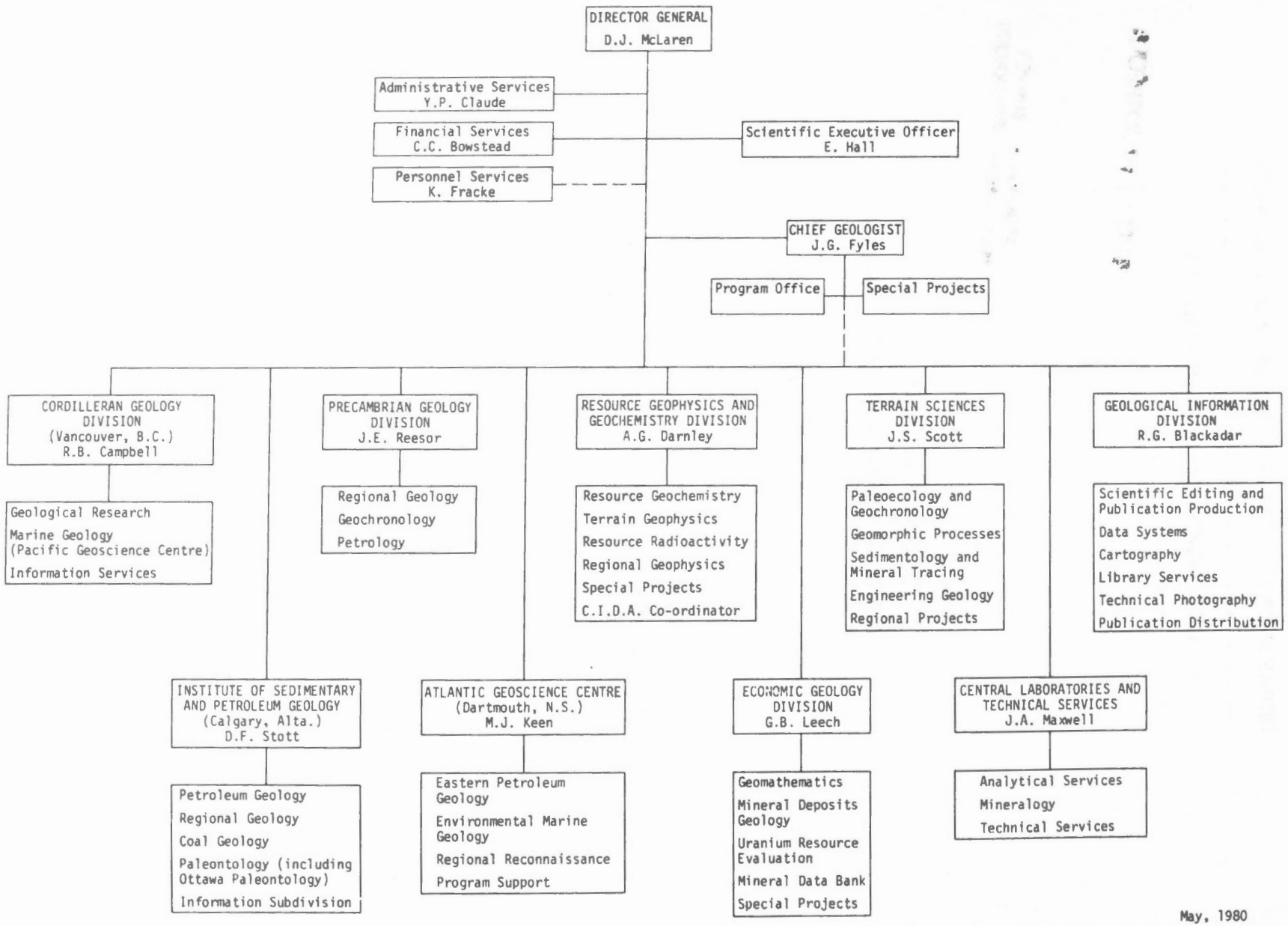

May, 1980

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REORGANICATION

Though not officially completed until the start of fiscal year 1980-81 the largest division of the Geological Survey, the Regional and Economic Geology Division, was reorganized during the fall of 1979 into three new Divisions:

Precambrian Geology Division

Economic Geology Division

Cordilleran Geology Division

At the same time the Appalachian Geology Section was disbanded as an administrative unit and responsibility for the Eastern Paleontology Section was transferred to the Institute of Sedimentary and Petroleum Geology.

At the end of the fiscal year the name of the Central Laboratories and Administrative Services Division was changed to Central Laboratories and Technical Services Division when each of Finance and Administration assumed a direct reporting relationship to the Director General.

OFFICE OF THE DIRECTOR GENERAL

D.J. McLaren

Attendance at Meetings, Conferences and Courses

Visiting Committee, University of Toronto, Toronto, April 1979.

Conference on "The Continental Crust and its Mineral Deposits", University of Toronto, Toronto, May 1979.

GAC/MAC Annual Meeting, Quebec City, May 1979.

CSEG-CSPG Exploration Update '79, Calgary, June 1979.

Forum A, Preliminary to United Nations Conference on Science & Technology for Development, Vienna, Austria, August 1979.

Visiting Committee, University of Alberta, Edmonton, October 1979.

USGS International Centennial Symposium, Reston, Virginia, October 1979.

GSA Annual Meeting, San Diego, California, November 1979.

IGCP Board Meeting, Paris, France, February/March 1979.

Canadian Geoscience Council Meeting, Toronto, March 1979.

Membership on Committees

Chairman of the Board, International Geological Correlation Programme, sponsored: UNESCO and IUGS.

Member, Canadian Geological Foundation.

Foreign Associate, NAS.

Talks

"Earth Science and Government, a Canadian Perspective", presented at the Symposium on Perspectives on Government and Science: Occasioned by the Centennial of the USGS, GSA Annual Meeting, San Diego, California, November 1979.

"Discussion - Resources for the Twenty-First Century", presented at USGS International Centennial Symposium, Reston, Virginia, October 1979.

DEPUTY DIRECTOR GENERAL - CHIEF GEOLOGIST

J.O. Wheeler

On September 4, 1979, J.O. Wheeler relinquished the position of Deputy Director General to resume scientific duties with the Cordilleran Geology Division in Vancouver. He was replaced, through competition, by J.G. Fyles.

J.G. Fyles

Attendance at Meetings, Conferences and Courses

Annual Conference of Provincial Ministers of Mines, Winnipeg, Manitoba, September 8-11, 1979.

Northern Geoscience Forums, Whitehorse and Yellowknife, December 1-8, 1979.

PROGRAM OFFICE

J.E. Brindle

Program Office evaluates the work of the Branch from the viewpoint of its effectiveness in meeting Branch objectives, the Program Office Head being senior staff adviser to Branch management. The system used in the Branch for the management of the scientific and technical program is highly documented. Proposed projects require the approval of all levels of management up to and including the Chief Geologist as being appropriate and timely contributions to the work of the Branch. The same levels of management monitor annual progress and assess the final results of projects. Some of the information handled by Program Office could justifiably be computerized to give greater speed and reduced costs. Work with Data Systems Group in erection of a system to do this continued, and by the end of the year had reached a stage where systems work was complete and computer programs had been written and tested.

The Branch Program for 1980-81 was reviewed on a Division by Division basis in October and November by the Chief Geologist and the Program Office Head. Strategic Objectives and Long Term Plans for the Branch were written and compiled, and Operational Plans and Activity Approval Documents for the Branch for 1980-81 compiled and submitted for review by the Executive Committee. The 1978-79 year-end and the 1979-80 mid-year Performance reports were prepared for submission to the ADM (Science and Technology). Assistance was given in the preparation of Program Forecast for 1981-82.

The information accumulated by Program Office also forms the source of replies to the complex questionnaires from other departments and agencies (MOSST, STATCAN, INA, etc.) as well as to parliamentary questions and to questions from other sectors. A complete catalogue of scientific and technical projects is prepared and published each year as well as lists of proposed field work in Provinces and the

North. These are sent to Provinces and to other interested federal agencies. An annual report on forthcoming program is prepared for the Government Activities in the North report. Topographic map requirements for the Branch are also compiled annually by Program Office for Surveys and Mapping Branch.

The unsolicited proposals coming to the Branch from the S&T Sector Office are all channelled through Program Office for referral to appropriate divisions. These proposals continued to reach us in large numbers during the year.

SPECIAL PROJECTS

T.E. Bolton

Attendance at Meetings, Conferences and Courses

Annual Meeting, Geological Association of Canada, Quebec City, Quebec, May 1979.

Canadian Paleontology and Biostratigraphy Seminar, Edmonton, Alberta, September 1979.

Joint Annual Meeting, New York State Geological Association-New England Intercollegiate Geological Conference, Troy, New York, October 1979.

Annual Meeting, Northeastern Section, Geological Society of America, Philadelphia, Pennsylvania, March 1980.

Membership on Committees

Member, Canadian Geoscience Council, Standing Committee on International Scientific Relations.

Special Talks and Lectures

"Introduction to the Stratigraphy-Biostratigraphy of Anticosti Island, Quebec", Annual Meeting, Geological Association of Canada, Quebec City, Quebec, May 23, 1979.

R.J.W. Douglas

Prior to his untimely death on November 1, 1979, the principal responsibility of R.J.W. Douglas was the co-ordinator of the 1:1 Million geological atlas. This role involved consultation with individual authors in various centres and close liaison with the cartographic group in Ottawa.

INTERNATIONAL UNION OF GEOLOGICAL SCIENCES

The International Union of Geological Sciences (IUGS) is the largest international, non-governmental scientific organization responsible for facilitating and co-ordinating geoscientific projects aimed primarily at establishing standards and formulating new concepts as a framework for resource development. A significant part of the scientific work has been conducted through the Inter-Union Commission on Geodynamics (in co-operation with the International Union of Geodesy and Geophysics and the International Council of Scientific Unions) and, even more extensively, through the International Geological Correlation Programme (in conjunction with UNESCO). Ongoing scientific work has been carried out through five commissions, five committees and fourteen affiliated organizations, while the day-to-day administrative work and general communications are the responsibility of the Secretariat, housed in Ottawa since February 1978 in the Geological Survey of Canada.

During the report year, new initiatives included establishment of a Steering Committee for a new inter-union programme focussing on the lithosphere, planning and organization of a Symposium and Workshop on "Metallogenesis in Latin America", successful completion of a contract with UN (ESCAP) for storing and retrieving petroleum well data in S.E. Asia, establishment of a new IUGS publication series, compilation of a comprehensive IUGS Directory, and involvement in the organization of the 26th International Geological Congress. The Secretariat produced four issues of EPISODES, provided information on IUGS at major international and national gatherings, processing of correspondence averaging 40 items per day, and organization of the annual Executive Committee meeting and the Metallogenesis Symposium preceding it. In addition, forty-six contracts were drawn up with UNESCO and administered on behalf of the Union.

Attendance at Meetings, Conferences and Courses

W.W. Hutchison

AAPG, Houston, Texas, April, 1979
CODATA Executive Committee Meeting, Paris, April, 1979
Canadian Conference Preparing for UNCSTD, IDRC, Toronto, May, 1979
Geological Association of Canada, Québec City, May, 1979
4th Latin American Congress, Port of Spain, July, 1979
International Astronomical Union, Congress, Montreal, August, 1979
VII International Mediterranean Neogene Congress, Athens, September, 1979
5th International Congress on African Geology, Cairo, October, 1979
U.S. Geological Survey's Centennial Symposium, Reston, VA., October, 1979
Geological Society of America, San Diego, November, 1979
Metallogenesis in Latin America, Symposium and Workshop, Mexico City, February, 1980.
XXIst Session, IUGS Executive Committee, Mexico City, February, 1980
8th Session, IGCP Board, Paris, February, 1980
Committee Meetings planning Metallogenesis Symposium and Projects in Latin America:
Mexico City, April and October, 1979, Port of Spain, July, 1979, Washington, August and October, 1979, San Diego, November, 1979
Meetings planning 26th International Geological Congress:

Houston, April, 1979
Paris, September, 1979
San Diego, November, 1979

V. Lafferty

AAPG, Houston, Texas, April, 1979
Geological Association of Canada, Québec City, May, 1979
VII International Mediterranean Neogene Congress, Athens, September, 1979
U.S. Geological Survey's Centennial Symposium, Reston, VA., October, 1979
Geological Society of America, San Diego, November, 1979
Metallogenesis in Latin America, Symposium and Workshop, Mexico City, February, 1980.
XXIst Session, IUGS Executive Committee, Mexico City, February, 1980
Committee Meetings planning Metallogenesis Symposium and Projects in Latin America:
Washington, October, 1979, San Diego, November, 1979
Meetings planning 26th International Geological Congress:
Houston, April, 1979
Paris, September, 1979
San Diego, November, 1979

Memberhip on Committees

W.W. Hutchison

Secretary General, International Union of Geological Sciences (IUGS)
Member, IUGS Constitution Committee
Member, IUGS Nominating Committee
Member, IUGS Advisory Board for Publication
Member, IUGS Finance Committee
Secretary, Program Committee "Metallogenesis in Latin America"

Ex-officio Member of Board, International Geological Correlation Programme

Member, Steering Committee, 26th International Geological Congress

Scientific Editor, EPISODES

Co-Chairman, VII International CODATA Conference, Kyoto, Japan

V. Lafferty

Editor, EPISODES
Member, IUGS Advisory Board for Publication
Member, Commission des Relations Extérieures du 26 ème CGI

IUGS Secretariat Staff as of March 31, 1980.

GSC Staff:
W.W. Hutchison and V. Lafferty

IUGS Staff:
B. Collis, D. Dessureault and A. Hussain (part-time)

ATLANTIC GEOSCIENCE CENTRE

M. J. KEEN

The Division objectives are to ensure the availability of geological information and expertise on that area of Canada comprising the Atlantic and Arctic offshore regions and the sedimentary basins of the Appalachian region, for the identification of the resource base, the formulation of energy and mineral policy, and to facilitate exploration and exploitation of Canadian resources.

We meet these objectives by: undertaking geological, geophysical and geochemical research and surveys to national standards; regional interpretation and synthesis of the processes and history of geological evolution; establishment of appropriate national and international standards for geological chronology, correlation, reference materials and surveys; identification of the characteristics and probable locations of occurrence of coal, oil and gas resource and estimates of their abundance; identification of the characteristics of the terrain offshore for its safe and proper use; development of methods and technologies to improve the effectiveness of marine geoscience surveys, discovery of resources and the determination of terrain properties; the dissemination of information.

The Division is organized into five Subdivisions: Administration, Eastern Petroleum Geology, Environmental Marine Geology, Regional Reconnaissance and Program Support. The staff consists of 3 Research Managers, 42 Research Scientists, Physical Scientists and Engineers; 36 Scientific and Technical Support staff; 10 Administrative, Secretarial and Clerical staff.

ADMINISTRATION SUBDIVISION

The objectives of the Administration Subdivision are to provide efficient and effective financial, personnel and general administrative guidance and support to the Atlantic Geoscience Centre. The Subdivision consists of the Director's Office, Personnel Office and Finance Office with each section supplying the general administration support necessary to ensure a smooth operation.

Highlights

- The AGC Finance Office input directly to the FIS for the full year. It was a great success, saving time in reconciliation and picking up errors.
- Preparations for the May, 1980 BIO Open House started in May, 1979. Displays, exhibits, etc. received attention from throughout the Division.
- The final move from the VanSteenberg Wing to the Murray Wing was completed with as little disruption as possible.
- A Technical Writing Course for 17 scientific and technical staff was conducted by David Roberts from Loyalist College of Applied Arts and Technology.
- The PSC established a French Language training program at BIO in September 1979, in which approximately 20 AGC staff participated during the year.

Personnel Notes

The Subdivision consists of a permanent staff of 1 Director and Secretary; 1 Administrative Officer, 2 Financial Clerks, 1 Personnel Clerk and 1 Secretary.

P. Dennis joined AGC as the Secretary for Administration and Program Support.

Attendance at Meetings, Conferences, Courses

M. J. Keen

Attended Visiting Committee, University of Saskatoon, April 1 & 2, 1979.

Attended C.G.C. Committee to Memorial University, St. John's, Newfoundland, April 19-21, 1979.

Attended meeting on DFO/EMR Guiding Committee on Offshore Surveys in Ottawa, April 24, 1979.

1979 GAC-MAC Joint Annual Meeting in Quebec, May 25, 1979.

Attended meeting at Pacific Geoscience Centre, B.C. on B.C. Coastal Programs, August 8-10, 1979.

Attended meeting of International Project of Ocean Drilling (IPOD) in Ottawa, August 7, 1979.

Acted as adjudicator of papers given at the Atlantic Universities Geological Meeting, an annual meeting of geology students from the Atlantic Provinces, in St. John's, Newfoundland, October 26-28, 1979.

Attended meeting with Chinese Oceanographic & Geological Institutes People's Republic of China, November 7 to December 3, 1979.

Attended Financial Management meeting in Ottawa, December 18, 1979.

Attended GSC Advisory Board meeting in Ottawa, December 12, 1979.

Attended meeting of Strategic Grants Ocean Workshop in Montreal, January 3-4, 1980.

Attended NSERC Interdisciplinary Grant Selection Committee Meeting in Ottawa, February 10-13, 1980.

Attended J. Tuzo Wilson Conference in Toronto, May 14-16, 1979.

Attended CGU Conference in Fredericton, N.B. to chair a session and to attend executive committee as Vice-chairman.

Attended Sir Edward Bullard Conference at Scripps Institution, San Diego, January 10-13, 1980.

P. G. Stewart

Modern Safety Management Fundamentals, June 1979.

Membership on Committees

M. J. Keen

Atlantic Subcommittee on Oceanography

EMR/DFO Offshore Survey Guiding Committee

BIO Directors Committee

Associate Editor, Canadian Journal of Earth Sciences

Associate Editor, Marine Geology

Dalhousie University, Adjunct Professor

National Sciences Engineering Research Committee,
Interdisciplinary Advisory Panel on Strategic Grants on Oceans

Canadian Geological Foundation

O&AS (Atlantic) Management Committee

P. G. Stewart

AGC/BIO Open House Committee

AGC/BIO Safety Committee

AGC Staff List for August 1, 1979 - Breakdown by Categories

EN-ENG	1
Physical Science	20
Research Science	21
Research Manager	3
Technical Support	36
Admin. Support	10
	91

PROGRAM SUPPORT SUBDIVISION

K. S. Manchester

The objectives of the Program Support Subdivision are directed towards providing an efficient central technical support facility for the Division. This support is organized in three sections.

The Marine Geological Technical Services Section is responsible for providing, operating and maintaining all the marine geological sampling equipment which includes piston, gravity, rock corers and vibrocorers, Shipek and Eckman grab samplers, rock dredges and small winches. The Section provides the Division's primary logistic support for all field projects by providing field vehicles, ATV's, trailers, launches, boats and freight containers. It also provides and operates small boat sidescan sonar systems, echo sounders and high resolution seismic systems.

The Systems Development Section is responsible for developing, designing and testing new equipment and instruments or updating and/or modifying present instruments and equipment to meet new or special Division specific objectives. This is accomplished by initial discussions with Division staff as to requirements, formulating proposals to meet the requirements, then designing, constructing, documenting and testing these in the field to make certain they meet the specific requirements.

The Data Management Section is responsible for co-ordinating the requirements and planning the efficient use of the Institute computer facilities by Division staff. It is responsible for assisting in processing data in the field, entering field data into and maintaining permanent data files for the Division's research purposes, preparing data for release to outside requestors by Open File, and filling individual requests for data. Special programs and data file catalogues and output routines are produced and maintained for AGC use. This Section also, in co-operation with Research Management and Conservation Branch, provides curation services for the entire Division for core, dredge, grab and other marine geological samples. It also manages a contract for the routine soft sediment analysis for the Division and provides a regional sample repository for marine geological samples collected by university and industrial concerns that are donated to the Division.

Highlights

Systems Development Section

- Heffler and Locke participated very successfully in FRAM I using AGC Ocean Bottom Seismometers (OBS's) on a joint refraction project with MIT on a project funded and logistically supported by the U.S. Naval Oceanographic Office.

- Ralph (a sediment dynamics monitor - project 790036) was tested on the Labrador Coast cruise during the summer of 1979 and in Halifax Harbour later in the year, providing very good quality data. Heffler presented a paper on its development at the ACROSES Workshop. Further testing and development is continuing in Halifax Harbour.

- A new, longer (2,000') tow cable was installed and used successfully on the BIO sidescan system, allowing operation in deeper areas of slope and shelf, such as the bottom of the Laurentian Channel.

- The OBS (ocean bottom seismometer - project 790037; previously 750031) did the following:

    a) OBS's were used successfully on FRAM I project.
    b) OBS's were used on the Hudson Labrador Sea cruise. However, due to a thought-to-be faulty flotation problem, four were lost.
    c) Six new OBS's were constructed, tested and used very successfully on the LADLE project during January and February, 1980.
    d) A paper was published in Marine Geophysical Researches covering construction and use of AGC OBS's to date.

Data Management Section

- Geoffrey (geophysical data management system; project 790039). The feasibility study phase is completed. It is now proceeding into the development and implementation phase, with anticipated completion during 1980.

- BIO received a new CDC Cyber 171-6, replacing the fourteen year old CDC 3150 main Institute computer. This, with the addition of the new AGC Terminal Room, has allowed much more efficient data processing and software development to proceed more rapidly than anticipated, with AGC using a much larger share of the BIO capability than planned for.

- The MRI System 2000 general data base management system was acquired by AGC and installed on the main BIO computer. This will provide a modern and efficient method of storing and retrieving sixteen years of marine geoscience data collected at AGC.

- Range File - a new software package for management and correction of palynology data has been nearly completed, largely by contract. This will greatly assist AGC palynologists in their research projects.

Marine Geological Technical Services Section

- Jodrey and Murphy participated in the LOREX project, along with other AGC staff.

- Ten other AGC field or shipboard projects were logistically and/or operationally supported during the reporting period.

- The design of a new single cable umbilical system for use by the BIO rock core drill and AGC vibrocorer was completed with acquisition and testing planned for May/June 1980. This was done in conjunction with Dalhousie University and Metrology Division of the Department of Fisheries & Oceans. This improvement will allow more effective sampling operations in deeper water, ultimately to 3,000 meter depths by 1981.

- New, heated equipment storage areas have been acquired with the addition of a 3,000 sq. ft. heated storage building, formerly the AGC geological sample repository. When the sample repository was moved into the new 10,000 sq. ft. joint RMB and AGC curation facility, the space became available for equipment and supply storage.

- Manchester has been working actively on a project with Department of Fisheries & Oceans, Ships Division, to investigate problems, recommend modifications and/or acquisition of BIO oceanographic winches, a vital necessity to a successful marine geological sampling program.

Personnel Notes

The Subdivision presently consists of five professional, eleven technical and two support staff members.

D. Thorpe left the staff of the Subdivision to return to university.

The Subdivision is staffed to its full authorized allotment.

Attendance at Meetings, Conferences, Courses

K. Manchester

Business Looks at Ocean Industry in Atlantic Canada, Halifax, March 1980.

D. Heffler

FRAM II Briefing, Washington, D.C., June, 1979.

Mosaics Program Meeting, Huntec in Toronto, November 1979

Instrumentation in the Nearshore Zone Workshop, Ottawa, October 1979

M. Gorveatt

Annual EMR Safety Seminar, Ottawa, February 1980

Job Evaluation Course, Ottawa, December 1979

Project Management Course, Halifax, January 1980

A. Fricker

System 2000 Natural Language, Ottawa, December 1979

System 2000 Procedural Language, Ottawa, December 1979

A. G. Sherin

Canadian System 2000 Users Association Meeting, January 1980

Memberships on Committees

K. Manchester

BIO Marine Advisory Committee

A. Sherin

BIO Computer Users Advisory Committee

M. Gorveatt

AGC Safety Committee

R. Sparkes

AGC/BIO Open House Committee

D. Heffler

Side Scan Mosaics Committee

Subdivision Manuscripts

Manuscripts for two outside papers were completed.

Data Requests

Requests for Data or Services from Within the Division

Data Requests	- General information	1
	- Data	61
	- Samples	15
	- Open Files	4
Service Requests	- Subsampling	8
	- Reproduction	12
	- Stationary	2
	- Miscellaneous	2

Requests for Data or Services from Organizations Outside the Division

Data Requests	- General Information	1
	- Data	20
	- Samples	6
	- Open Files	3
Service Requests	- Subsampling	1
	- Reproduction	4

Regional Reconnaissance Subdivision

R.T. Haworth (Head)

The objective of the Regional Reconnaissance Subdivision is to understand the structure and evolution of the continental margins and adjacent ocean basins of eastern Canada and the Arctic; and to make a contribution to global understanding of margins and basins. To do this geophysical and geological data are collected from BIO ships on a regional basis from Nova Scotia, north as far as northern Baffin Bay, and from ice camps in the Arctic Basin. Detailed studies are carried out in key areas. Scientists interpret this acquired data and integrate it with data from other sources such as offshore oilwells, cruises of other institutions, and publications. International contacts and joint work are an important part of the work.

The Subdivision, comprising fifteen scientists and nine scientific support technicians, is divided into sections organized according to both geography and discipline. The Arctic Marine Studies section is a geographically defined section because of the logistical problems in mounting operations in the Arctic. All scientific operations both of AGC and the scientific units of other departments at Bedford Institute of Oceanography have to be coordinated in order to effectively use the only research vessel capable of operating in the Arctic. The Labrador Sea Studies section is also geographically defined for similar reasons. The Ocean Basins and Margins section is concerned with determining the structure of the present continental margin, and those processes within the ocean basins that control its development. Systematic geological mapping of the continental margin is carried out by the Bedrock and Surficial Geology section, while the Geophysical Surveys section primarily carries out its mapping in conjunction with surveys of the Canadian Hydrographic Service. A group of 6 technicians provides seismic, gravity and magnetic survey support to the whole of AGC, although Regional Reconnaissance Subdivision scientists are the primary users.

The Subdivision is administered by a Secretary.

Highlights

Ocean Basins and Margins

Quantitative analysis of the subsidence history from subsided basins at rifted continental margins yields information about the nature, timing and thermal consequences of tectonic processes associated with basin formation. The subsidence history of the Nova Scotian and Labrador shelves, determined from deep exploratory well data, indicates that these regions underwent extension during rifting in the Early Jurassic and Late Tertiary, respectively, and have since subsided passively due to conductive cooling of the lithosphere. The timing of the extension process is consistent with the ages of the oldest sea floor adjacent to these margins. The magnitudes of extension determined solely from the subsidence history are in good agreement with observed crustal thicknesses obtained from seismic refraction data, and yield a present thermal gradient almost identical with that measured in the offshore wells. The paleo-temperatures

within the sediments suggest that thermal conditions have been favourable for hydrocarbon generation in some of the older strata.

In order to determine the structure of 100 My old oceanic lithosphere of an age similar to that adjacent to the Nova Scotian margin, a 1500 km seismic refraction line was completed in the western Atlantic north of the Lesser Antilles. The experiment entitled LADLE (Lesser Antilles Deep Lithospheric Experiment) was carried out from CSS DAWSON and the British research vessel RRS DISCOVERY in cooperation with British, French and West Indian scientists.

An 800 km refraction line in 9 My old oceanic crust adjacent to the Reykjanes Ridge south of Iceland observed typically low velocity (7.7 km s^{-1}) mantle at a depth of 6 km, increasing to a more normal upper velocity mantle of 8.2 km s^{-1} at a depth of 16 km. Anisotropy with depth in the upper mantle was observed suggesting that the preferential orientation of the olivine causing velocity anisotropy adjacent to this ridge may be caused by a deep outflow from a "mantle plume" under Iceland.

Arctic Marine Studies

Two ice stations, LOREX and FRAM 1 were established in the Spring of 1979 to investigate two distinct features of the Arctic Ocean basin, the Lomonosov Ridge, and the region adjacent to the Nansen (or Gakkel) Ridge. Research was multidiscipline but the marine geology and geophysics for LOREX included bathymetric and shallow seismic reflection profiling, sediment sampling, and seabed photography; while at FRAM 1 deep seismic reflection and OBS crustal refraction were carried out. At FRAM 1 the seismic reflection data indicate the existence of up to 1.5 seconds of sediment infilling depressions between outcropping basement highs within 80 km of the Nansen Ridge axis. Nine crustal refraction lines, 40 to 120 km in length reveal an oceanic crustal structure which is no more than 4 km thick. The arrivals from the M discontinuity are well defined and break over early limiting the crustal thickness. A strong shear wave arrival from P-S conversion at the sediment-basement surface is apparent in sediment covered areas.

In Baffin Bay-Davis Strait region, mapping of the bedrock and surficial geology of the Hudson Strait to Cape Dyer area and in the Scott-Buchan area has increased in detail on the basis of further study of the reconnaissance seismic reflection and sidescan data previously collected. Of particular interest was a preliminary analysis of the iceberg scouring of the Baffin Island shelf which shows that in general, scouring has been much more severe than that seen on the Greenland margin or off Labrador.

Labrador Sea

A seismic refraction experiment to deduce the crustal structure of the Greenland margin in Labrador Sea as an adjunct to the seismic reflection program completed in 1977 was unsuccessful in that 3 out of 4 of the OBS (ocean bottom seismometers) were lost during the early part of the cruise. Five reversed 50 km long sonobuoy refraction lines were however completed parallel to the West Green-

land Shelf in the vicinity of 60°N, 50°W to provide the detailed velocity structure for comparison with the reflection data. Gravity measurements were collected on transit lines located so as to provide control for an overall adjustment of gravity data in Labrador Sea being carried out using the ASSOB system of Earth Physics Branch.

Deep shelf and slope terraces observed on Saglek Bank may record the grounding lines of thick floating ice shelves rather than having a subaereal beach origin. Successive stages of deglaciation from the late Wisconsin maximum ice extent in the bank have been placed in the interval 11000 to 8000 years BP. During this time period great quantities of glacial meltwater entered the Labrador Sea depositing thick sequences of muds in shelf basins and supporting unique foraminiferal and radiolarian fauna.

Bedrock and Surficial Geology - Scotian Shelf and Grand Banks

Up to 8000 m of Cambrian to mid-Silurian rocks which stratigraphically overlap the sequence exposed on Bell Island have been mapped east of the Avalon Peninsula, Newfoundland. The extent and structural relationships of this sequence may be significant in relating the geological history of the Grand Banks to that of Newfoundland.

A map of the surficial sediments of the northern Scotian Shelf and southern Grand Banks was placed on Open File. Morainic material on the outer Scotian Shelf was deposited from an ice shelf which grounded on the shallower banks. Samples were obtained from the "Emerald Silt" unit where it both overlies and underlies the Wisconsinan till in order to bracket the age of the last ice advance on the continental shelf. A similar situation exists along most of the Canadian Atlantic margin.

Mapping the reflectivity of the sea floor using the acoustic reflectivity module (ARM) of the Huntec Deep Tow System has been shown to provide an excellent objective and quantified base from which to interpret the geologic character of the sea floor.

Personnel Notes

The Subdivision presently consists of a permanent staff of 15 scientists, 9 technicians and a secretary; 3 term employees and 2 visiting fellows.

Dr. John Woodside, Marine Geophysicist with the Offshore Surveys Group, was appointed in November 1979 on secondment for a year to the position of Senior Marine Geophysicist with the UN Committee for Coordination of Joint Prospecting for Mineral Resources in Asian Offshore areas in Bangkok, Thailand.

Dr. Richard Haworth assumed the duties as Head of the Subdivision on January 1, 1980, relieving Dr. Robin Falconer who has been Acting Head for the rest of the year.

Borden Chapman joined RR as Electronics Technician on May 22, 1979. He is working with the Geophysical Equipment Group.

Dr. R. "Becky" Jamieson, Visiting Fellow, left in June to take up a position as Assistant Professor in the Geology Department at Dalhousie University.

Dr. Michael Snoek, also a Visiting Fellow, left in September to return to the University of Hamburg in West Germany.

Attendance at Meetings, Conferences and Courses

G.B. Fader

International Meeting on Holocene Marine Sedimentation in the North Sea Basin in Texel, The Netherlands, September 17-23, 1979.

Fundy Environmental Studies Committee Annual Workshop, Biological Station, Department of Fisheries and Oceans, St. Andrews, N.B., November 14-16, 1979. Presented paper.

R.K.H. Falconer

American Geophysical Union, Washington, D.C., May 28 - June 1, 1979. Presented three papers.

Canadian Society of Petroleum Geologists North Atlantic Borderlands Workshop, St. John's, Newfoundland, June 17-20, 1979. Presented paper.

Interdepartmental Offshore Multiparameter Survey Planning Meeting, Burlington, Ontario, November 8, 1979.

R.H. Fillon

Geological Society of America Meeting, San Diego, November 5-8, 1979.

R.A. Folinsbee

Hydrography II Course. Lecturer on Geophysics, Ottawa, Ontario, November 21-23, 1979.

R.T. Haworth

Geological Association of Canada Annual Meeting, Quebec City, May 22-25, 1979.

Canadian Scoiety of Petroleum Geologists North Atlantic Borderlands Workshop, St. John's, Newfoundland, June 17-20, 1979.

International Geological Correlation Program, Working Group Project 27 Meeting and Field Trip in Massachussetts; and IGCP Symposium in Blacksburg, Virginia, August 27 to September 15, 1979.

R.T. Haworth (cont'd)

Geodynamics Transects Program, Convenor's Session, San Diego, California, November 2-4, 1979. Presented 2 papers.

International Union of Geodesy and Geophysics, 17th General Assembly, Canberra, Australia, December 3-15, 1979.

M.D. Hughes

Customer Acceptance Trials at Bodenseewerk Geosystems in Uberlinsen, West Germany, March 22-29, 1980.

C.E. Keen

Canadian Geodynamics Committee Meeting, Ottawa, Ontario, February 15, 1980.

Geological Society America Northeast Section Annual Meeting, Philadelphia, March 13-14, 1980. Presented paper.

Geological Association of Canada Conference, Quebec City, May 22-25, 1979.

Canadian Geophysical Union Conference, Fredericton, N.B., June 3-6, 1979. Presented 2 papers.

Geological Association of Canada Council Meeting, Victoria, B.C., October 12, 1979.

International Union of Geodesy and Geophysics Meeting, Canberra, Australia, November 30 to December 15, 1979. Presented paper.

D. Livingstone

Canadian Hydrographic Conference, Halifax, N.S., March 18-21, 1980.

B.D. Loncarevic

Joint IOC-IHO Guiding Committee for GEBCO, Ottawa, Ontario, May 21-23, 1979.

B. MacLean

Canadian Society of Petroleum Geologists/Canadian Society of Exploration Geophysicists Meeting, Calgary, Alberta, June 10-13, 1979. Presented 2 papers.

Canadian Society of Petroleum Geologists North Atlantic Borderlands Workshop, St. John's, Newfoundland, June 17-20, 1979.

S.P. Srivastava

Alfred Wegener Symposium, Berlin, West Germany, February 24-28, 1980.

Membership on Committees

R.K.H. Falconer

Chairman, Geophysics Section, Committee for 5-year Eastern Arctic Research Plan.

Intergovernmental Oceanographic Commission. General Bathymetric Chart of the Oceans (GEBCO) Committee, Coordination for Sheet 5.14.

R.H. Fillon

Atlantic Provinces Subgroup of the Canadian Working Group on Quaternary Glaciations in the Northern Hemisphere (IUGS-UNESCO-USGP).

International Geological Correlation Program Project 73124 - Quaternary Glaciations in the Northern Hemisphere, Canadian Working Group.

Canadian National Committee for INQUA.

R.T. Haworth

Physical Interpretation of Gravity Anomalies Special Study Group 5.46 of the International Gravity Commission.

International Geological Correlation Program, Prcject 27 (Caledonide Orogen). Canadian Working Group and International Special Study Group on Geophysics and Geologic Correlation.

Continental Margin Transect Working Group of the Canadian and U.S. Geodynamics Committee.

C.E. Keen

Working Group 8 of the International Commission on Geodynamics and Study Group Chairman on Continental Margin of Eastern North America.

Councillor, Geological Association of Canada.

Canadian Geodynamics Committee and NE Appalachian Working Group on Plate Margins Transect.

Chairman, Canadian Lithosphere Project.

Ex-officio Member of Canadian National Committee of the International Union of Geodesy and Geophysics.

L.H. King

Research Associate, Department of Geology, Dalhousie University.

B.D. Loncarevic

Scientific Advisory Committee of the International Geological Correlation Project (IGCP).

Canadian National Committee for SCOR.

Editor-in-Chief, Marine Geophysical Researches.

Chairman, Digital Bathymetry Subcommittee of the IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans.

S.P. Srivastava

Working Group I-4. "Magnetic Anomalies". Division 1 of the International Association of Geomagnetism and Aeronomy.

Working Group I-1. "International Geomagnetic Reference Field". Division 1 of the International Association of Geomagnetism and Aeronomy.

J.M. Woodside

Member of Board of Directors of the International Gravity Bureau, International Gravity Commission.

Special Talks and Lectures

G.B. Fader

"Surficial Geology of the Bay of Fundy and Gulf of Maine". Presented at the Biological Station, Department of Fisheries and Oceans, St. Andrews, N.B., November 14-16, 1979.

R.K.H. Falconer

"Review of Plate Tectonic Models of the Evolution of the Arctic Basin". Presented at the American Geophysical Union Meeting, Washington, D.C., May 28 to June 1, 1979.

"Baffin Bay Magnetic and Gravity Lineations and Crustal Structure". Presented at the American Geophysical Union Meeting, Washington, D.C., May 28 to June 1, 1979.

"Changes in Pacific/Indian/Antarctic Plate Motions Over the Last Ten Million Years". Presented at the American Geophysical Union Meeting, Washington, D.C., May 28 to June 1, 1979.

"Labrador Sea, Davis Strait, Baffin Bay Geology and Structural Evolution". Presented at the Canadian Society of Petroleum Geologists North Atlantic Borderlands Workshop, St. John's, Newfoundland, June 17-20, 1979.

R.H. Fillon

"High Resolution Subbottom Profiles on the Northern Labrador Shelf - Do They Provide Evidence of Glaciation". Presented seminar at (a) Pacific Geoscience Centre, Sidney, B.C., November 2, 1979; and (b) University of Colorado, INSTAAR, November 9, 1979.

R.A. Folinsbee

"Geophysics". Presented lecture at the Hydrography II Course, Ottawa, Ontario, November 21-23, 1979.

R.T. Haworth

"Geophysical Expression of Appalachian Caledonide Structures on the Continental margins of the North Atlantic". Canadian Society of Petroleum Geologists North Atlantic Borderlands Workshop, St. John's, Newfoundland, June 17-20, 1979.

"Geophysical Elements of the Canadian Appalachians As An Aid to Interpolation Between the Caledonides of the USA and Europe". Presented at Workshop "Caledonides of the USA", Blacksburg, Virginia, September 7, 1979.

"A Geophysicist's View of Problems in Appalachian Geology". Presented seminar at Dalhousie University, Depts. of Geology and Oceanography, Halifax, N.S., October 11, 1979.

"Appalachian Development in Light of Paleomagnetically Derived and Geologically Interpreted Plate Motions During Early Paleozoic". Presented at the International Union of Geodesy and Geophysics Symposium 16, Global Reconstructions and the Geomagnetic Field During the Paleozoic, Canberra, Australia, December 10, 1979.

"The Combined Interpretation of Gravity and Magnetic Anomalies Over Ophiolites Using Our Interactive Computer Graphics Systems". Presented at International Union of Geodesy and Geophysics/International Association of Geomagnetism Symposium 1-9. Correlation between anomalies of potential fields, Canberra, Australia, December 14, 1979.

C.E. Keen

"Mesozoic and Cenozoic Plate Tectonics Off Eastern Canada". Presented at Canadian Geophysical Union Conference, Fredericton, N.B., June 3-6, 1979.

"Calculation of Paleotemperatures in Sedimentary Basins at Passive Continental Margins: Implications for Petrcleum Generation". Also presented at Canadian Geophysical Union Conference, Fredericton, N.B., June 3-6, 1979.

"Thermal Evolution of Rifted Continental Margins: Subsidence, Paleotemperature and Hydrocarbon Cookery". Presented Geophysics Seminar at Dalhousie University, Halifax, N.S., October 4, 1979.

C.E. Keen (cont'd)

"Crustal Thinning, Subsidence and Thermal History of Sedimentary Basins at Rifted Margins". Presented at the International Union of Geodesy and Geophysics XVII General Assembly, Canberra, Australia, December 2-15, 1979.

"Thermal and Tectonic Reconstructions of the Eastern Canadian Continental Margins Determined from Subsidence History". Presented at Geological Society of America NE Section Meeting, Philadelphia, March 13-14, 1980.

B. MacLean

"Regional Geological and Chemical Studies in the Scott Inlet Oil Seep Area and Buchan Gulf, Baffin Island Continental Shelf". Presented at Canadian Society of Petroleum Geologists/Canadian Society Exploration Geophysicists Meeting, Calgary, Alberta, June 10-13, 1979.

"Baffin Island Shelf: Results from Marine Geophysical and Geological Studies". Also presented at CSPG/CSEG Meeting, Calgary, June 10-13, 1979.

Subdivision Manuscripts

During the fiscal year April 1, 1979 to March 31, 1980 the Subdivision produced eleven manuscripts for outside journals; sixteen "Abstract Only" and four GSC papers.

Eastern Petroleum Geology Subdivision

G.L. Williams

The Eastern Petroleum Geology Subdivision carries out geological and geophysical studies of the sedimentary basins of onshore and offshore eastern Canada. Onshore studies are primarily directed towards the Upper Paleozoic basins of New Brunswick and Nova Scotia, using as a data base surface sections, mine and well data. Offshore investigations are based on core holes, hydrocarbon exploration wells, and industry data, both geophysical and geological. Such studies not only permit a better understanding of this vast region, but also allow more accurate appraisals of hydrocarbon reserves. The latter is necessary if we are to maintain our input into the Interdepartmental hydrocarbon inventory which must be continuously updated. Other facets of our concern with resources are the coal, oil shale and evaporite programs.

Geographically, the Subdivision's sphere of interest covers some 1,700,000 square miles ranging from the Scotian Shelf in the south to Baffin Bay in the North. The vastness of the area demands a selective approach to the studies, which in part parallel industry activity. Present efforts are directed towards the Scotian Basin, East Newfoundland Basin and the Labrador Shelf.

Scientific studies within the subdivision must be integrated to achieve maximum effect. The specific disciplines include lithostratigraphy, biostratigraphy, geophysics and coal petrology, with overall syntheses being the responsibility of the regional geologists. There is a twofold approach to geological investigations by the individual specialists. The first is a separation by age (not of the geologist, but of the rocks). Paleozoic studies form one category, Mesozoic-Cenozoic studies the other. Superimposed upon this are geographic restraints, so that the Labrador Shelf may be the domain of one group, the Scotian Shelf the sphere of influence of another. Fortunately, the categories are not strictly adhered to resulting in a more versatile and knowledgeable group.

Highlights

Highlights of the past year's studies within the subdivision are:

Computer plots of all the lithostratigraphic, biostratigraphic, organic geochemistry, visual kerogen, and vitrinite reflectance data from more than 90 offshore wells are now available to Subdivision scientists. This new program, Eastfile, provides maximum flexibility in manipulation of data. Results and plots from 55 wells will soon be published as a Branch Open File report. Eastfile is closely related to Rangefile, a program which provides manipulation of palynological data from over 60 east coast offshore wells.

Lower Carboniferous continental plate reconstructions for eastern Canada and western Europe have been revised; this is necessitated by the discovery that the foraminiferal and algal assemblages of the southern Labrador Shelf and northeastern Newfoundland differ considerably from coeval assemblages of western Europe.

Paleogeographic reconstructions and facies maps for the Albert Formation, a bituminous shale in New Brunswick, highlight previously unexplored areas which have hydrocarbon potential.

An updated geological appraisal of the Sydney Coal Basin has been based on results of the offshore coal drilling program, new shallow seismic data, and coal petrology studies of samples. Observed regional increases in ranks of individual coal seams occur with depth and towards the east. Similar trends are also noted in the coking properties of the coals.

A new lateral fractionation model has been proposed to explain the predominantly halite composition of the Late Triassic Osprey evaporites on the Grand Banks. The presence of these deposits necessitates reinterpretation of initial rifting models.

Refinement of the Late Jurassic foraminiferal-ostracod zonation of the Scotian Basin has permitted more precise correlation of the Abenaki Formation which is predominantly a carbonate bank.

It is now recognized that the deep oil window originally postulated for the Scotian Basin does not agree with the known liquid hydrocarbon occurrences. Deeper drilling will therefore encounter only gas; this considerably modifies the estimates of oil and gas reserves in the Scotian basin.

Detailed lithostratigraphic studies of the Wyandot Formation in 20 Scotian Shelf wells has shed new light on sedimentation and subsidence rates, compaction trends and provenance.

The Subdivision is presently undertaking an interdisciplinary study of the East Newfoundland Basin. Input will be from biostratigraphers, lithostratigraphers, geochemists, geophysicists and regional geologists. The completed study should resolve the problem of the source rocks in the Hibernia field.

The abundant nannofossil assemblages in the Late Cretaceous of the Adolphus well permit delineation of eighteen zones ranging in age from Cenomanian to Maastrichtian. The applicability of this zonation has been tested in the correlation of Scotian Shelf, Grand Banks and Labrador Shelf wells.

Stratigraphic data from the Labrador Shelf wells confirm the existence of an Early Cretaceous unconformity and late Miocene erosional surface, as originally determined from studies of multichannel reflection seismic data. Such interpretations are in conflict with existing plate tectonic models of the Labrador Sea region.

Foraminiferal studies of Labrador Shelf wells indicate that the Late Cretaceous-Eocene transgression coincides with the postulated time of opening of the Labrador Sea. There is strong evidence for a seaway linking the Arctic and Atlantic Oceans through the Labrador Sea-Davis Strait-Baffin Bay regions. Dinoflagellate studies on samples from west Greenland, Bylot Island and Buchan Trough support this hypothesis.

The Late Cretaceous-Paleogene agglutinated foraminifera of the Labrador Sea, East Newfoundland Basin and North Sea have been shown to be closely related and biostratigraphically useful, and have a more extensive paleobathymetric distribution ($\sim$ 200 m to 4 km) than previously suspected.

A statistical zonation for Cenozoic benthonic and planktonic foraminifera has been utilized in 22 wells on the Canadian Atlantic continental margin.

1350 Late Cretaceous-Tertiary samples from North Atlantic core holes have been analyzed for organic matter type and maturation. The hydrocarbon potential of the deep ocean basins is generally poor because of low maturation values.

Palynological analyses of samples recovered on the LOREX Expedition indicated a mid-Cretaceous age for onset of the Nansen Ridge spreading.

The Krempfile, a retrieval computer program containing over 9000 published scientific works in palynology, is now fully operational.

A proposed model for the evolution of dinoflagellates enhances their usefulness as biostratigraphic fossils.

The Subdivision continues to be a major contributor to the Hydrocarbon Inventory Committee. We have introduced refinements in reservoir modelling which allow increased accuracy in pool size distributions and potential totals. A reassessment of the hydrocarbon potential of the Labrador Shelf is now completed and will be published this year. Currently the East Newfoundland Basin is being evaluated.

Personnel Notes

The Subdivision has a staff of thirteen scientists, six technicians and three support staff. A visiting fellow, Mr. Piet Doeven, is presently completing the second year of a two year study of Late Cretaceous nannofossils of offshore eastern Canada.

Peter Hacquebard was the eleventh recipient of the coveted Thiessen Medal, awarded by the International Committee of Coal Petrology in recognition of Peter's contributions to coal petrology, palynology and coal genesis. The award was made at the closing session of the ninth meeting of the International Congress of Carboniferous Stratigraphy and Geology, May 26, 1979, at the University of Illinois, Urbana, by MacKenzie Gordon Jr., President of the Congress.

This was Peter's year for awards. In November he was presented with the Gilbert H. Cady Award, a biennial award by the Coal Geology Division of the Geological Society of America. This was for his achievements in coal geology and related subjects in North America.

Felix Gradstein returned from Woods Hole Oceanographic Institute in June where he had been on a change-of-work station for six months. While there, he was engaged in a study of agglutinated foraminifera from the Labrador Shelf, North Sea, and Poland; this was a cooperative venture with Bill Berggren.

Iris Hardy left the Subdivision at the end of March to join the Regional Reconnaissance Subdivision. She will be studying the Quaternary of the Labrador Shelf.

Attendance at Meetings, Conferences and Courses

P. Ascoli

Symposium, "Ecologic and paleoecologic aspects of offshore marine deposition in the Atlantic Ocean", London, England, May 23, 1979.

First Canadian Workshop, International Geological Correlation Program - Project 148: Quantitative Stratigraphic Correlation, Dartmouth, Nova Scotia, August 27-28, 1979.

M. Avery

Flourescent Microscopy Workshop, June 17-22, Calgary, Alberta.

M.S. Barss

First Canadian Workshop, International Geological Correlation Program - Project 148: Quantitative Stratigraphic Correlation, Dartmouth, Nova Scotia, August 27-28, 1979.

Meeting of the Kremp Steering Committee, Dallas, Texas, October 30, 1979.

Annual Meeting of the American Association of Stratigraphic Palynologists, Dallas, Texas, November 2-3, 1979.

Annual Meeting of the Geological Survey of Canada's Palynologists, Calgary, Alberta, January 22-24, 1980.

J.P. Bujak

Meeting of Microplankton Section, British Micropalaeontological Society, Leeds, England, April 18, 1979.

First Canadian Workshop, International Geological Correlation Program - Project 148: Quantitative Stratigraphic Correlation, Dartmouth, Nova Scotia, August 27-28, 1979.

Workshop on Acritarch Taxonomy, Biostratigraphy and Paleoecology, Baton Rouge, Louisiana, October 9-13, 1979.

Annual Meeting of the American Association of Stratigraphic Palynologists, Dallas, Texas, November 2-3, 1979.

Annual Meeting of the Geological Survey of Canada's Palynologists, Calgary, Alberta, January 22-24, 1980.

G. Cook

Annual Meeting, Ontario Institute of Chartered Cartographers, Toronto, Ontario, May 22-24, 1979.

P. Doeven

First Canadian Workshop, International Geological Correlation Program - Project 148: Quantitative Stratigraphic Correlation, Dartmouth, Nova Scotia, August 27-28, 1979.

Second Canadian Workshop, International Geological Correlation Program - Project 148: Quantitative Stratigraphic Correlation, Ottawa, Ontario, February 14-15, 1980.

F.M. Gradstein

Annual Meeting, American Association of Petroleum Geologists, Houston, Texas, April 1-4, 1979.

First Canadian Workshop, International Geological Correlation Program - Project 148: Quantitative Stratigraphic Correlation, Dartmouth, Nova Scotia, August 27-28, 1979.

Annual Meeting, Geological Society of America, San Diego, California, November 5-7, 1979.

Symposium, "Ancient Sea Level Changes", Lamont Geological Observatory, November 19-20, 1979.

Second Canadian Workshop, International Geological Correlation Program - Project 148: Quantitative Stratigraphic Correlation, Ottawa, Ontario, February 14-15, 1980.

Conference, "Petroleum Geology of the Continental Shelf of North-West Europe", London, England, March 4-5, 1980.

A.C. Grant

Annual Spring Meeting, American Geophysical Union, Washington, D.C., May 28-June 1, 1979.

Annual Meeting, Canadian Geophysical Union, Fredericton, New Brunswick, June 4-6, 1979.

International Workshop, "Geologic Atlas of the North Atlantic Borderlands", St. John's, Newfoundland, June 17-20, 1979.

Symposium, "Ancient Sea Level Changes", Lamont Geological Observatory, November 19-20, 1979.

G.M. Grant

Meeting of Geological Survey of Canada's Cartographic Supervisors, Ottawa, Ontario, May 28-30, 1979.

P.A. Hacquebard

Ninth International Congress of Carboniferous Stratigraphy and Geology, Urbana, Illinois, U.S.A., May 17-25, 1979.

Annual Meeting, Mining Society of Nova Scotia, Ingonish, Nova Scotia, June 1979.

Annual Meeting, Geological Society of America, San Diego, California, November 5-7, 1979.

Meeting of the Canadian Coal Petrologists' Group, Calgary, Alberta, November 22-23, 1979.

R.D. Howie

Ninth International Congress of Carboniferous Stratigraphy and Geology, Urbana, Illinois, U.S.A., May 17-25, 1979.

Canadian-New Brunswick Minerals and Fuels Committee, Dartmouth, Nova Scotia, June 28, 1979.

Canadian-New Brunswick Minerals and Fuels Committee, Fredericton, New Brunswick, January 23, 1980.

L.F. Jansa

Annual Meeting, American Association of Petroleum Geologists, Houston, Texas, April 1-4, 1979.

International Workshop, "Geologic Atlas of the North Atlantic Borderlands", St. John's, Newfoundland, June 17-20, 1979.

Joint Oceanographic Institutions, Ocean Margin Drilling Planning Meeting, Houston, Texas, March 3-6, 1980.

D.C. Umpleby

Meeting of E.P.G. and R.M.B. Members of the Interdepartmental Subcommittee on Geological Potential, Ottawa, Ontario, October 24-25, 1979.

Interdepartmental Subcommittee on Geological Potential, Dartmouth, Nova Scotia, November 15-16, 1979.

Meeting of E.P.G. and R.M.B. Members of the Interdepartmental Subcommittee on Geological Potential, Ottawa, Ontario, November 22-23, 1979.

Meeting of E.P.G. and I.S.P.G. Members of the Interdepartmental Subcommittee on Geological Potential, Calgary, Alberta, December 10-14, 1979.

Interdepartmental Subcommittee on Geological Potential, Dartmouth, Nova Scotia, February 6-8, 1980.

Newfoundland Section, Geological Association of Canada, Annual Spring Meeting, St. John's, Newfoundland, March 6-7, 1980.

J.A. Wade

International Workshop, "Geologic Atlas of the North Atlantic Borderlands", St. John's. Newfoundland, June 17-20, 1979.

Meeting of E.P.G. and R.M.B. Members of the Interdepartmental Subcommittee on Geological Potential, Ottawa, Ontario, October 24-25, 1979.

Interdepartmental Subcommittee on Geological Potential, Dartmouth, Nova Scotia, November 15-16, 1979.

Meeting of E.P.G. and I.S.P.G. Members of the Interdepartmental Subcommittee on Geological Potential, Calgary, Alberta, December 10-14, 1979.

Interdepartmental Subcommittee on Geological Potential, Dartmouth, Nova Scotia, February 6-8, 1980.

Newfoundland Section, Geological Association of Canada, Annual Spring Meeting, St. John's, Newfoundland, Marcy 6-7, 1980.

G.L. Williams

Annual Meeting, Geological Association of Canada, Qeubec City, Quebec, May 22-25, 1979.

Symposium, "Landmark Events in the Evolution of Plants", Ottawa, Ontario, June 21, 1979.

Interdepartmental Subcommittee on Geological Potential, Dartmouth, Nova Scotia, February 6-8, 1980.

Annual Meeting, Canadian National Committee, International Union of Geological Sciences, Ottawa, Ontario, February 14, 1980.

Symposium, "Petroleum Geology", Fredericton, New Brunswick, March 22, 1980.

Membership on Committees

P. Ascoli

Member of Subgroup on Smaller Benthonic Foraminifera, Working Group 9, International Geological Correlation Program.

Member of the Organizing Committee, First Canadian Workshop, Working Group 148, International Geological Correlation Program.

M.S. Barss

G.S.C. representative on Steering Committee, Kremp Palynological Computer Research Project.

Member of Transportation Committee, 1980 Annual Meeting, Halifax, Geological Association of Canada.

J.P. Bujak

Co-chairman of the A.G.S. Nova Scotia Geological Highway Map Committee.

Councillor, American Association of Stratigraphic Palynologists.

Newsletter Editor, Canadian Association of Palynologists.

F.M. Gradstein

Member, Seminar Committee, Bedford Institute of Oceanography.

Member of Mid-Cretaceous Events Project, Working Group 58, International Geological Correlation Program.

Member of Quantitative Stratigraphic Correlation Technqiues Project, Working Group 148, International Geological Correlation Program.

A.C. Grant

Member of Field Trip Committee and Associate Editor of Field Guides, 1980 Annual Meeting, Halifax, Geological Association of Canada.

Member of Seismic Committee, Atlantic Geoscience Centre.

Associate Editor, Bulletin of Canadian Petroleum Geology.

P.A. Hacquebard

Member, Management Subcommittee of Joint D.R.E.E.-E.M.R.-N.S. Dept of Mines and Energy, Coal Drilling Project in Nova Scotia.

Chairman, Canadian Coal Petrologists' Group.

Vice-Chairman, Mining Society of Nova Scotia.

Chairman, Halifax Branch, Mining Society of Nova Scotia.

Member, International Commission on Coal Petrology.

I.A. Hardy

Member, Library Committee, Bedford Institute of Oceanography.

R.D. Howie

Chairman, Committee for GAC '80 Display, Atlantic Geoscience Centre.

Member Canadian-New Brunswick Minerals and Fuels Committee.

L.F. Jansa

Member, Canadian National Committee, International Geological Correlation Program.

East Coast Representative, Canadian Society of Petroleum Geologists.

Member, Examination Committee for Graduate School, Dalhousie University.

D.C. Umpleby

Member, Interdepartmental Subcommittee on Geological Potential.

Councillor, Atlantic Geoscience Society.

J.A. Wade

Member, Interdepartmental Subcommittee on Geological Potential.

G.L. Williams

Editor of Geolog, Geological Association of Canada Newsletter.

Member, Editorial Committee, Geological Association of Canada.

Chairman, Paleontology Division, Geological Association of Canada.

Member of Steering Committe, 1980 Annual Meeting Halifax, Geological Association of Canada (Entertainments Chairman).

Associate Editor, Marine Micropaleontology.

Member, Canadian National Committee, International Geological Correlation program.

Member, Canadian Paleontology Task Force.

Special Talks and Lectures

P. Ascoli

"Offshore eastern Canada: the Late Jurassic-earliest Cretaceous biostratigraphy, paleoenvironment and paleo-oceanography", London, England, May, 1979.

M.S. Barss

"Rangefile", First Canadian Workshop, International Geological Correlation Program, Dartmouth, Nova Scotia, August, 1979.

"A pragmatic approach to visual kerogen studies", Organic Maturation Symposium, American Association of Stratigraphic Palynologists, Dallas, Texas, October, 1979.

J.P. Bujak

"Eocene dinoflagellate zonation in the London and Hampshire Basins, England", British Micropalaeontological Society, Leeds, England, April, 1979.

F.M. Gradstein

"Some unprincipled principles and examples of benthic foraminiferal paleobathymetry", Lamont, New York, April, 1979.

Lecture, "Flysch-type agglutinated Foraminifera", Shell Oil, Houston, Texas, April, 1979.

Lecture, "Flysch-type agglutinated Foraminifera in the Mesozoic sediments of the Labrador Shelf and North Sea", Woods Hole, Massachusetts, May, 1979.

Lectures with W. Berggren, "Flysch-type agglutinated foraminiferal studies and industrial application", Shell Oil Co., The Hague, Holland; E.P.R. and Total, Bordeaux, France; Elf, Boussens, France; Norwegian Petroleum Directorate, Stavangar; and Robertson Research, North Wales; all in July, 1979.

"Probabilistic stratigraphy and industrial application", First Canadian Workshop, International Geological Correlation Program, Dartmouth, Nova Scotia, August, 1979.

"Platform and flysch-type agglutinated Foraminifera in the Cretaceous and Paleogene of the Soviet Union, Central Europe, North Sea and Labrador Sea: stratigraphic and paleoenvironmental significance", G.S.A. Annual Meeting, San Diego, California, November, 1979.

Cretaceous-Early Tertiary agglutinated benthic Foraminifera in the deep ocean and Atlantic margin", G.S.A. Annual Meeting, San Diego, California, November, 1979.

Lecture, "Mesozoic-Cenozoic depositional history of the Canadian Atlantic margin, Cities Service, Tulsa, Oklahoma, November, 1979.

Lecture, "Mesozoic-Cenozoic flysch-type agglutinated Foraminifera", Cities Service, Tulsa, Oklahoma, November, 1979.

"Limits of micropaleontology in mid-latitude Mesozoic-Cenozoic passive margin (well) sections", Lamont, New York, November, 1979.

"Quantitative biostratigraphical application to data from exploratory wells in Canadian frontier regions, Second Canadian Workshop, International Geological Correlation Program, Ottawa, Ontario, February, 1980.

Lecture, "Cenozoic foraminiferal stratigraphy, northwest Atlantic margin", Ottawa, Ontario, February, 1980.

"Agglutinated benthic foraminiferal assemblages in the Paleogene of the central North Sea", London, England, March, 1980.

Lecture, "One hundred million years history of the Labrador Sea", Amsterdam Free University, Amsterdam, Holland, March, 1980.

Lecture, "Arenaceous Foraminifera in clayey basins", Amsterdam Free University, Amsterdam, Holland, March, 1980.

A.C. Grant

"The continent-ocean crustal boundary in the western Labrador Sea", Annual Meeting, A.G.U., Washington, May, 1979.

"Late Tertiary crustal movements affecting the Labrador Shelf", Annual Meeting, C.G.U., Fredericton, June, 1979.

P.A. Hacquebard

Lecture on Coal Geology and Coal Petrology, Oklahoma University, November, 1979.

Lectures, "Sydney Coal Basin", University of New Brunswick, Fredericton; Mount Allison University, Sackville; Acadia University, Wolfville; St. F.X. University, Antigonish; Dalhousie University, Halifax; and Memorial University, St. John's.

R.D. Howie

"Carboniferous evaporites in Atlantic Canada", Ninth International Carboniferous Congress, Urbana, Illinois, May, 1979.

Lecture, "Carboniferous evaporites in Atlantic Canada", University of New Brunswick, Fredericton, N.B.; and Mount Allison University, Sackville, N.B., February, 1980.

L.F. Jansa

"Mesozoic-Cenozoic strata of the North Atlantic and their significance for plate tectonic reconstructions", International Workshop, Geologic Atlas of the North Atlantic Borderlands, St. John's, Newfoundland, June, 1979.

"Comparison of shelf and deep sea sedimentary formations in the North American Basin and North American Shelf", A.A.P.G. Annual Meeting, Houston, Texas, April, 1979.

Lecture, "North Atlantic Basin", Shell Oil Co., Houston, Texas, April, 1979.

D.C. Umpleby

"Geology of the Labrador Shelf", Newfoundland Section, G.A.C., St. John's, Newfoundland, March, 1980.

J.A. Wade

"Geology of the Canadian Atlantic Margin from Georges Bank to the Grand Banks", International Workshop, Geologic Atlas of the North Atlantic Borderlands, St. John's, Newfoundland, June, 1979.

"Geology and hydrocarbon potential of the Scotian Basin", Newfoundland Section, G.A.C., St. John's, Newfoundland, March, 1980.

G.L. Williams

"Evolution of dinoflagellates", C.B.A. Annual Meeting, Ottawa, June, 1979.

Lecture, "Geology and hydrocarbon potential of offshore eastern Canada", University of Toronto, March, 1980.

Lecture, "Geology and hydrocarbon potential of the Scotian Shelf", University of New Brunswick, Fredericton, N.B., March, 1980.

Subdivision Manuscripts

The Subdivision staff produced 1 G.S.C. Paper, 1 G.S.C. Open File Report, 10 outside papers and 22 "abstract only" manuscripts during 1979-80. In addition, 63 biostratigraphic reports on wells, D.S.D.P. cores and outcrop samples, 4 reports on organic matter type and thermal alteration, 2 reports on vitrinite reflectance and 88 lithostratigraphic reports on offshore wells were completed during the same period.

Laboratory Statistics

Drafting

Original Figures	207
Revisions in man hours	657

Micropaleontology

Samples picked	1170
Slides prepared	2299
S.E.M. photographs	630

Palynology

Samples processed	1971
Organic matter samples	783
Slides prepared	5715
S.E.M. photographs	50

Coal Petrology

Reflectance analyses	197
Maceral analyses	115

Sedimentary Petrology

Thin sections	723
Photographs	400

ENVIRONMENTAL MARINE GEOLOGY SUBDIVISION

K.R. Robertson

The objectives of the subdivision are directed toward improving the knowledge of modern marine geological processes encompassing the fields of sedimentology, geomorphology, geochemistry and paleontology. Studies emphasize aspects of coastal and nearshore marine areas of the Eastern and Arctic jurisdictions of Canada, but also include international areas of interest into Canada. The geological time frame is mainly Quaternary. The purpose of these studies, in addition to providing improved knowledge of present day processes, is to provide timely and accurate advice concerning the rational management of the marine environment in the identification, conservation and development of natural resources.

In 1979 and 1980 Environmental Marine Geology began diversions from its traditional areas of operation to the deep ocean. Coastal Geodynamics participated in the LOREX program, Paleoecology ventured to the continental slope northeast of Newfoundland and Geochemistry began studies in environmental geology of the deep ocean on the Nares Abyssal Plain in conjunction with the LADLE experiment. These offshore activities will continue with cooperative national and international projects.

Scientists within the subdivision are organized in three major discipline groups, but some staff from each of these groups contribute to multidisciplinary tasks or studies. The discipline groups are Coastal Geodynamics, consisting of coastal geomorphologists, sedimentologists and geophysicists; Paleoecology, consisting of micropaleontologists specializing in foraminifera studies and a macropaleontologist specializing in the study of molluscs; and Geochemistry consisting of specialists in organic and inorganic geochemistry.

Highlights

Coastal Geodynamics

- Preliminary evaluation of geological/geophysical data collected from a drifting ice floe over the Lomonosov Ridge near the North Pole in the spring of 1979 more clearly suggests the ridge to be continental in origin and character.

- Initiation of joint government-industry project to synthesis the surficial geology of the Beaufort Sea continental shelf. Development of a surficial geologic model to resolve questions relating to offshore permafrost and hydrates, pingo distribution, seabed ice scouring, and sediment stability.

- In the Sverdrup Basin baseline coastal information was compiled for Cornwall, King Christian, South Ellef Ringes and Cameron Islands in the form of a report (150 pp.), continuous oblique aerial photography and maps. Potential marine terminal sites for the transportation of oil and gas to southern markets were chosen on the basis of the above coastal information and submitted to Transport Canada.

- Field studies were completed along the shores of Lancaster Sound and northeast Baffin Island to map the coastal types and assess their sensitivity to oil spills.

- Studies continue along the Cape Breton Island coast from Chedabucto Bay to Aspy Bay to map the coastal characteristics and assess the effects of the KURDISTAN oil and its cleanup on coastal stability and natural seasonal processes.

- Coastal baseline mapping Atlantic coast mainland Nova Scotia completed designating coastal morphodynamic units.

Paleoecology

- Paleoclimatology - Climatic and energy use trends are closely associated. In temperate environments, climate can be related to annual river discharge which, in turn, controls certain marine sedimentation processes. Depositional events can be detected in lead-210-dated sediment core samples. This time-controlled record facilitated reconstruction of the 20th century paleoriverine history of the Saguenay Fjord, Quebec. The application of this approach to climate-ocean coupling problems is academic.

- Deep ocean contour currents that occur in a water depth of about 2700 m off Newfoundland enhance the size of a component of the marine protozoan population and also eliminate intensive mixing of modern sediments by promoting unfavorable conditions (food-deficient) for larger bioturbating macroinvertebrates. The rate of flow of these currents is also indicative of the potential transport rate of toxic substances in the eastern Canadian offshore.

- In Miramichi Estuary established circulation models to assist geochemical and paleontological interpretations. On Labrador Shelf conducted sea floor survey and sediment coring cruise to establish inner shelf dynamics and Launrentide ice margins. In Lake Melville diverse arenaceous foraminifera were found in thick Holocene sediments. In Hamilton Inlet, Late Glacial faunas were found close to seabed surface indicating very slow sedimentation on Labrador inner shelf.

Geochemistry

- A new project was begun to study deep sea sediments in terms of their stratigraphic, physical and chemical properties. These studies are aimed at evaluating criterion for the possible use of deep sea clays as a disposal medium for high level nuclear waste. The first area investigated was the Nares Abyssal Plain, southeast of Bermuda. New methods for detection of trace elements in pore water have been developed.

Personnel Notes

The subdivision presently consists of 11 scientists, 1 Visiting Fellow, 7 technicians and 1 support staff. The subdivision is not staffed to its full authorized allotment.

D.E. Buckley stepped aside as Head, Environmental Marine Geology on June 29, 1979, to return to science research.

Dr. B.J. Topliss, a Visiting Fellow from Marine Science Laboratories, University College North Wales, Bangor, U.K., joined the subdivision July 30, 1979.

Dr. G.E. Reinson left the subdivision on September 14, 1979, to take up a position at the Institute of Sedimentary and Petroleum Geology, Calgary, in Clastic Sedimentology.

Attendance at Meetings, Conferences, Courses

C. Amos

Geological Association of Canada 1980 Short Course Organizers Meeting, Hamilton, Ontario, June 25-26, 1979.

Departmental Committee on Ocean Mining Meeting, RMCB, Ottawa, January 8-9, 1980.

IAC (1982) Conference Committee Meeting, Toronto, January 17-18, 1980.

S. Blasco

APOA Ice Scour Meeting, BIO, July 4, 1979.

LOREX Workshop, Ottawa, October 14-16, 1979.

Industry-Government Meeting, Calgary, February 19, 1980.

APOA Permafrost-Hydrate Meeting, Calgary, February 21, 1980.

Canadian Hydrographic Conference, Halifax, March 17-20, 1980.

D. Buckley

Environmental Technology Advisory Committee Meeting, College of Cape Breton, Sydney, N.S., May 15, 1979.

NRC Associate Committee for Research on Shoreline Erosion and Sedimentation Meeting, Charlottetown, P.E.I., June 13-15, 1979.

Environmental Technology Advisory Committee Meeting, College of Cape Breton, Sydney, N.S., September 22-23, 1979.

NRC Associate Committee for Research on Shoreline Erosion and Sedimentation Meeting, Ottawa, Ontario, November 7, 1979.

Fall Workshop on Environmental Studies of Bay of Fundy, Fall Meeting of Fundy Environmental Studies Committee, and Working Group on Suspended Sediment Determinations and Sediment Dynamics, St. Andrews, New Brunswick, November 13-16, 1979.

Nuclear Energy Agency, Seabed Working Group Meeting, Bristol, England, March 3-6, 1980.

F. Cole

Two-Week Course in Micropaleontology at University of Nebraska, Lincoln, Nebraska, June 3-16, 1979.

R. Cranston

Marine Chemistry in the 80's Conference, Victoria, B.C., May 31 to June 1, 1979.

Fjord Workshop, Institute of Ocean Sciences, Sidney, B.C., June 4-8, 1979.

Technical Writing Course, BIO, February 25-29, 1980.

Nuclear Energy Agency, Seabed Working Group, Sediment and Rock Task Group Meetings, Bristol, England, March 3-6, 1980.

B. Deonarine

Fourth Latin American Geological Congress, Trinidad and Tobago, July 8-15, 1979.

D. Frobel

Workshop on Research in the Labrador Coastal Offshore Regions, St. John's, Newfoundland, May 7-10, 1979.

R. Jubb

Structural Geology 413.0, St. Mary's University, Halifax, N.S.

W. LeBlanc

One-Day Seminar Sponsored by Perkin Elmer, Halifax, N.S., February 26, 1980.

C.F.M. Lewis

Joint Industry-Government Working Group on Ice Scour Research, Calgary, April 23-24, 1979.

First Canadian Conference on Marine Geotechnical Engineering, Calgary, April 25-27, 1979.

Iceberg Dynamics Symposium, St. John's, Nfld., June 4-5, 1979.

Joint Industry-Government Working Group on Ice Scour Research, Dartmouth, July 4, 1979.

M.A. Rashid

Institut National de la Recherche Scientifique, Quebec, October 22-24, 1979.

G.E. Reinson

Organizational Committee, IAS International Convention 1982, Houston, Texas, April 1-5, 1979.

Workshop on Research in the Labrador Coastal Offshore Regions, St. John's, Nfld., May 7-10, 1979.

K. Robertson

Annual EMR Safety Seminar, Ottawa, January 15-16, 1980.

Chemical Technology Advisory Board Committee Meeting, College of Cape Breton, Sydney, N.S., February 5, 1980.

C. Schafer

Symposium on Gulf of Mexico Paleoceanography, Department of Geology, Louisiana State University, Baton Rouge, L.A., March 3, 1980.

R. Taylor

Petro Canada Workshop, Calgary, April 25-27, 1979.

KURDISTAN Science Workshop, BIO, Dartmouth, June 26-27, 1979.

NRC Workshop on Instrumentation for Currents and Sediments, Ottawa, October 24-26, 1979.

B. Topliss

Change of Work Station to Canada Centre for Remote Sensing, Ottawa, February 18 to April 19, 1980.

Great Lakes Remote Sensing Experiment Meeting, NASA, Lewis, Cleveland, March 20-21, 1980.

Conference on the U.S. Operational Land Remote Sensing Satellite Program, Washington, D.C., March 25, 1980.

G. Vilks

Workshop on Research in the Labrador Coastal Offshore Regions, St. John's, Nfld., May 7-10, 1979.

Transfer of Work Station to University of Aarhus, Aarhus, Denmark, November 11 to December 18, 1979.

Nuclear Energy Agency, Seabed Working Group Meeting, Bristol, England, March 3-6, 1980.

Membership on Committees

C. Amos

Bedford Institute of Oceanography Remote Sensing Committee

Departmental Committee on Ocean Mining

Nova Scotia Remote Sensing Committee

S. Blasco

Beaufort Sea Surficial Geology "Ad Hoc" Committee

BIO-Dalhousie Alpha Ridge Committee

Ice Scour Working Group (Industry-Government)

Industrial Liaison Committee (BIO)

Permafrost and Hydrates Working Group (Industry-Government)

D. Buckley

Atlantic Geoscience Centre Management Committee

Associate Committee for Research on Shoreline Erosion and Sedimentation

BIO Chemical Advisory Committee

BIO Safety Committee

College of Cape Breton Advisory Committee on Chemical Technology

College of Cape Breton Advisory Committee Environmental Technology Program

Department of Environment, Environmental Impact of Spilled Oil Committee

Department of Environment, Field Laboratory Coordinating Committee

Departmental Committee on Ocean Mining

Field and Short Course Organizing Committee - GAC/MAC Meeting 1980

Fundy Tidal Power Environmental Committee

Long Range Transport of Air Pollutants - Atlantic Region

Miramichi Environmental Advisory Committee

NEA Seabed Working Group - Site Criteria Task

R. Cranston

Atlantic Laboratory Coordinating Committee

BIO Library Committee

C.F.M. Lewis

Joint Industry-Government Working Group on Ice Scour Research (Co-Chairman)

M.A. Rashid

Regional Environmental Emergency Team

G.E. Reinson

Departmental Committee on Ocean Mining

Eastern Passage Advisory Committee

Master's Thesis Committee for Three Dalhousie University Graduate Students

K. Robertson

Atlantic Geoscience Centre Safety Committee

C. Schafer

Environmental Factors Committee, American Society of Photogrammetry

R. Taylor

Sable Island Environmental Advisory Committee

B. Topliss

BIO Remote Sensing Committee

G. Vilks

Seabed Working Group, Radioactive Waste Management Committee of OECD/NEA

F. Wagner

Member of the Scientific Council for the Publication "Géographic Physique Quaternaire", Montreal, Quebec

Special Talks and Lectures

C. Amos

Presented paper entitled "Verification and Application of a System for Automated Multidate Landsat Measurement of Suspended Sediment", William Pecora Conference on Remote Sensing, Sioux Falls, S. Dakota, June 10-15, 1979.

S. Blasco

Discussion of LOREX Expedition presented to the Atlantic Subcommittee on Oceanography, June 6, 1979.

Presentation of LOREX Project to Senior Management Development Program, June 28, 1979.

Presented talk entitled "The Surficial Geology of the Lomonosov Ridge", Logan Club, Ottawa, October 17, 1979.

Presented talk entitled "Surficial Geology and Geomorphology of the Lomonosov Ridge, Central Arctic Basin", Canada Centre for Inland Waters Geology Seminar Series, Burlington, Ontario, October 18, 1979.

Presentation of LOREX Expedition at the Canadian Embassy in Washington, D.C., February 13, 1980.

R. Cranston

Defended Ph.D. Dissertation entitled "Cr Species in Natural Waters", University of Washington, Seattle, May 25, 1979.

Presented paper entitled "Cr Species in Saanich and Jervis Inlets", Fjord Workshop, Institute of Ocean Sciences, Sidney, B.C., June 4-8, 1979.

M.A. Rashid

Presented an invited paper entitled "Identification of Source of Sedimentary Organic Matter from the Diagenetic History and Composition of Kerogen", Chemical Congress, American Chemical Society and Chemical Society of Japan, Honolulu, Hawaii, April 2-7, 1979.

G.E. Reinson

Presented poster paper entitled "Depositional Sequence in a Subarctic Sandy Beach, AAPG/SEPM Annual Meeting, Houston, Texas, April 1-5, 1979.

C. Schafer

Presented paper entitled "Time-Lapse Photography as an Adjunct to Diver and Underwater Vehicle Observations", Defence and Civil Institute of Environmental Medicine, October 22-25, 1979.

Presented paper entitled "Significance of Bioturbation of Surficial Sediments on the Continental Slope East of Newfoundland", Louisiana State University, Baton Rouge, L.A., March 3, 1980.

B. Topliss

Presented seminar entitled "Optical Monitoring of Coastal Waters", Department of Oceanography, Dalhousie University, Halifax, October 16, 1979.

Subdivision Manuscripts

During the year 1979-80, the staff of the subdivision produced 19 outside publications, 5 internal publications and 11 abstracts.

Laboratory Statistics

Inorganic Geochemistry

The Inorganic Geochemistry Laboratory was not fully operational until December 1979 following the move to its new facilities in the Murray Building at BIO. However, over 1750 trace element analyses were completed on pore water and sea water as well as 1600 analyses on marine sediments.

Organic Geochemistry

The Organic Geochemistry Laboratory analyzed 79 samples including 20 KURDISTAN oil samples requiring 140 analyses and 59 sediments requiring 825 analyses.

Sedimentology

The Sedimentology Laboratory performed size analyses on 491 marine sediments.

CENTRAL LABORATORIES AND TECHNICAL SERVICES DIVISION

J.A. Maxwell, Director

The success with which the Branch meets its scientific objectives is governed to a large extent by the contributions of its internal support units, among which is the Central Laboratories and Administrative Services Division*. This division provides chemical and mineralogical scientific support, mechanical and electronic technical support, and coordinates the operations of the Branch administrative, financial and personnel services. In addition, the division encourages a greater interest in Canada's mineral resources by Canadians through the preparation and sale of sets of rocks, minerals and ores, through the provision of free mineralogical examination of specimens submitted by the public, and through the preparation and publication of guidebooks to those Canadian mineral areas of most interest to mineral collectors.

Among its laboratory facilities are those for the analysis and study of the varied and plentiful supply of rocks and minerals collected and submitted by Branch scientists, including chemical, x-ray fluorescence (both wavelength and energy dispersive), emission spectrographic, atomic absorption, x-ray diffraction, electron microprobe and scanning electron microscope. Sample preparation and mineral separation facilities are also included. In order to meet Branch requirements for chemical and mineralogical data, the division pursues a modest program of instrument and method development, adaptation and modification commensurate with the current state of the art.

Earth science reference standards are a prerequisite to the recognition, identification and analysis of rocks and minerals and of much importance in the scientific research of the Branch. This division is concerned with maintaining and extending the Systematic Reference Series of the National Mineral Collection, the National Meteorite Collection, a reference and study collection of representative Canadian rocks and a library of x-ray powder diffraction patterns of minerals. Officers of the division play a leading role in the national and international study and certification of standard reference materials for chemical analysis.

Technical support, both machine shop and electronic, is provided through the Instrument Development Shop and Electronic Laboratory.

Paralleling the scientific and technical support units in contribution to the achievement of Branch objectives are the staffs of the Branch administrative, financial and personnel units who carry out the unsung but vital tasks of daily operations, including such services as word processing, messenger, accommodation, accounts, financial control, inventory, registry, purchasing and stores.

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*As of 1 April 1980, the Central Laboratories and Technical Services Division; the Branch Administrative Services and Financial Services units will become part of the Director General's Office.

Division Administration

Personnel Notes

Mr. J.H. Lapp retired as Division Administrative Officer after ten years of service in the Branch (during which the name of the division changed four times!) and a total of thirty-five years in the Public Service.

Membership on Committees

J.A. Maxwell

Branch Management Committee
Chairman, Branch Administrative Officers Committee (to January, 1980)
Departmental Coordinating Committee, Official Languages Requirements
Departmental Committee on Energy Conservation
Liaison Officer, Canada/Federal Republic of Germany Scientific Exchange Agreement
Thunder Bay Relocation Steering Committee (to August 1979)
Departmental Committee on Native Peoples Program

J.E. Clemmer

Branch Administrative Officers Committee (from January, 1980)
Floor Warden, Building Emergency Committee

Analytical Chemistry

Sydney Abbey

Despite financial cutbacks, loss of staff and deterioration of obsolescent equipment, the Section achieved a creditable performance in the general areas of chemical analysis, x-ray fluorescence spectroscopy and arc emission spectroscopy. Compositional data have been provided in support of Branch scientific projects, new techniques and instrumentation have been investigated and applied, contributions have been made to international studies on reference materials, and consultation has been provided for the benefit of many organizations in Canada and abroad.

Highlights

Judging from requests for information and assistance received from various services, there is apparently a growing world-wide recognition of the work done by individuals within the Section on inter-element influence coefficients in x-ray fluorescence spectroscopy; on the combustion-infrared scheme for simultaneous determination of water, carbon and sulfur; and on various aspects of reference materials. Advice and information were provided on these and other topics for our own Terrain Sciences Division, the National Research Council, Environment Canada, Atomic Energy

of Canada, four provincial Departments, two Canadian universities, four commercial laboratories, six Canadian industries and various groups in the United States, Jamaica, the United Kingdom, France, West Germany and Kenya. Our laboratories were visited by scientists from Atomic Energy of Canada, Parks Canada, the Newfoundland Department of Mines and Energy, a commercial laboratory, a chemical manufacturer and organizations in the United Kingdom, Portugal, India, Malaysia and China.

Additional compositional data were provided for the three newest reference samples of rocks originating in the United States Geological Survey and for three others (an anorthosite, a basalt and a granite) originating with the Association Nationale de la Recherche Technique in France. A comprehensive report was prepared on the three Canadian reference rocks (two syenites and a gabbro) and is now in press, as is also an updated compilation of background information and usable concentration values on samples from many sources that can be used as reference materials in rock analysis.

A series of informal seminars was inaugurated, to provide a medium in which specialists in various analytical fields can explain their work to other analysts. Most of the speakers were from this Section, but contributions were also made from the Mineralogy and Geochronology Sections, and from the Chemistry Division of the National Research Council. Although originally intended for our own staff, the seminars have attracted a number of field geologists and workers in other G.S.C. laboratories.

Personnel Notes

Sean Going, seconded to our spectrographic laboratory for over a year, returned to his regular position in Mineralogy.

Gisèle Proulx and Nicole Roxburgh left the spectrographic laboratory on expiry of their term positions.

Jocelyne Watson was temporarily seconded to the Division office on a part-time basis.

Attendance at Meetings, Conferences and Courses

W.H. Champ

Workshop on inductively coupled plasma spectroscopy, Toronto.

G.R. Lachance

Denver X-ray Conference, Denver, Colorado.
Workshop on Elemental Analysis of Rocks and Ores by XRF, Denver, Colorado.
Summer course in x-ray fluorescence, State University of New York (Albany) (invited resource person)
Visit to Mining and Metallurgy Department, Laval University, Québec.

Sydney Abbey

International Conference on Atomic Spectroscopy and Colloquium Spectroscopicum Internationale, Cambridge, England (attended at own expense).
Coordinating Committee, Canadian Certified Reference Materials Project, annual meeting, Ottawa.
Workshop, Quality Control in Environmental Analysis, Halifax (invited keynote speaker).
Visits to Mines and Energy Departments of Nova Scotia (Halifax) and Newfoundland (St. John's) as invited consultant on laboratory operations.
Visits (at own expense, as part of personal travels) to the Institute for Crystalography and Petrography, Central Technical University, Zurich, Switzerland, and to the Geological Sciences Department, University of Regina, Saskatchewan.

Membership on Committees

W.H. Champ

Editorial Committee, Canadian Journal of Spectroscopy

G.R. Lachance

Branch Computer Facilities Committee

J.G. Sen Gupta

Branch Safety Committee

Sydney Abbey

Canadian Certified Reference Material Project - Member of Coordinating Committee and Co-ordinator of Task Force on Rock Samples
International Study Group on Reference Materials
Geostandards Newsletter - Regional Editor for Canada

Special Talks and Lectures

G.R. Lachance

"The Use of Fundamental Coefficients" - Workshop on Elemental Analysis of Rocks and Ores by XRF, Denver, Colorado.

"A Practical Relation between Atomic Numbers and Alpha Coefficients" - Denver X-ray Conference.
"A Comprehensive Alpha Coefficient Algorithm" (with F. Claisse, Laval University) - Denver X-ray Conference.

Sydney Abbey

"Round Robins and Other Queer Birds" - Workshop in Quality Control in Environmental Analysis, Halifax.

The following talks were given by members of the Section staff as part of our informal analytical seminars:

R.M. Rousseau: "Analysis by X-ray fluorescence"
G.R. Lachance: "Energy-Dispersive X-ray Fluorescence"
J.L. Bouvier : "Chemical and Special Atomic Absorption Methods"
W.H. Champ : "Optical Emission Spectroscopy"
P.G. Bélanger and R.A. Meeds: "Computation in Optical Emission Spectroscopy"
J.G. Sen Gupta: "Determination of the Rare Earths"
Sydney Abbey : "Rock Analysis, Atomic Absorption and Reference Samples".

Manuscripts

Manuscripts for three GSC and three outside publications were submitted by Section staff and accepted by the Division.

Laboratory Notes

Chemical and X-ray Fluorescence

Samples received for analysis were 78 per cent more numerous than in the preceding year; those completed were down by less than three per cent. Paradoxically, chemical determinations done increased by nearly 19 per cent, while those by X-ray fluorescence decreased by 25 per cent. A combination of factors brought about this state of affairs. Firstly, the new simultaneous method for water, carbon and sulfur helped to increase the numbers of chemical determinations. Secondly, varied complex compositions in some samples restricted the number that could be done by XRF and required additional chemical work. Thirdly, the x-ray spectrometer suffered a number of breakdowns that resulted in delays (but fortunately not in a curtailment of work done).

The large increase in numbers and increasingly complex compositions of samples received combined to raise the backlog of samples at the end of the fiscal year by more than 132 per cent over that at the end of the preceding year.

Thus the "turn of the tide" referred to in the 1978-79 report has once more been reversed to the "losing battle" situation mentioned in the 1977-78 report.

Method Development and Special Analyses

(Chemical and XRF)

The new combustion-infrared method for water and carbon in rocks was extended to include simultaneous determination of sulphur, by adding tungsten anhydride to the vanadium pentoxide flux and changing the carrier gas from oxygen to nitrogen. A new highly automatic titrator, purchased originally for an "improved" method for ferrous

iron which failed to live up to expectations, has been applied to an existing method with a substantial increase in productivity. Further improvements are contemplated. Encouraging preliminary work was done in an effort at expanding the scope of the "threaded-rod" method for introducing solid samples into an atomic absorption flame. A new, micro-processor-equipped atomic absorption spectrometer, with double-beam and background-correction facilities, was acquired near the end of the fiscal year. It is anticipated that the new instrument will serve to expedite analysis for many additional trace elements (by both threaded-rod and aqueous solution sampling), to simplify the alternative method for major and minor constituents and to permit relatively rapid determination of many unusual elements that occur with increasing frequency in samples received.

Determination of the rare-earth elements was improved by introducing non-flame atomization in a graphite furnace. This development permitted the inclusion of several additional elements and also extended the working range downward for others. Unfortunately, the work required the use of borrowed equipment from other sections. Funds used in acquisition of the new atomic absorption instrument were insufficient to include a graphite furnace.

Development work in X-ray fluorescence concentrated on further refinements in evaluation of inter-element corrections, extension of calibrations and corrections to additional elements to permit analysis of more complex samples, improvement of precision and accuracy in the determination of the elements required for geochronology, integration of data processing with that used on supporting chemical data and a few minor instrumental modifications. Considerable effort went into studies on the nature of inter-element influence coefficients and on possible application of energy-dispersive x-ray fluorescence in rock and mineral analysis. The latter work was handicapped by the need to share part of the equipment with another section. Nevertheless, considerable progress was made in assessing the potential and the limitations of the technique. Acquisition of additional equipment and new software toward the end of the fiscal year is expected to help further studies in this area.

Spectrographic

The laboratory began the year with a staff of eight. As mentioned in the Personnel Notes, three of those were lost, mainly as the result of "financial restraints" Thus, although 38 per cent more samples were received than in the preceding year, far fewer human resources were available to produce the results. Further, because of increased complexity, fewer samples were amenable to analysis by the direct reader, and of those that did not fit that system, many did not fit even the new general trace-element photographic scheme. Increasing use was therefore made of the semi-quantitative method, which loses in speed and accuracy as much as it gains in versatility Although extensions and refinements of that method were introduced, they only served to make it slower still. There was, as a result, a 23 per cent drop in samples completed and a 29 per cent decrease in determinations done, in comparison with the preceding year. The overall effect was an 86 per cent increase in the backlog.

The loss in productivity might have been worse had it not been for the extensive use of the new densitometer and the microcomputer acquired late in 1978-79, for the refinements in the computation steps in the direct-reading system and the increased use of the new photographic method.

As often happens, a breakdown in the air-conditioning system (this time resulting from a power failure) created havoc in the spectrographic laboratory. In this case, the air became so hot and humid that it was impossible to do any precise work. All major instruments were out of action for three days and three days more were needed to restore some semblance of normality; some of the damage may be permanent.

Method Development and Special Analysis

(Spectrographic)

Data processing for the photographic methods was greatly simplified by programming the microcomputer to convert the digital densitometer readings to relative intensities. Direct conversion to concentration values is the next goal.

Similarly, modifications in the data processing for the direct-reader served to simplify drift detection and correction. Limitations of the direct-reader operating program have led to automatic rejection of many samples of unusual composition. In an effort to capitalize on the versatility of the semi-quantitative method, improvements have been introduced by comparing spectra with those of "external" standards, by extending the number of elements covered as well as their concentration ranges, and by studies on possible interferences.

Development and application of the new general trace-element photographic method is well advanced but far from complete. Presence of other work and limited staff have prevented more effort in that direction, not to mention long-delayed but necessary additional work on the methods for volatile elements, for iron-base materials and for improved sensitivity for the rare earths. Nevertheless, attention was paid to current developments in the use of inductively-coupled plasmas as light sources, a technique which will likely be needed at some time in the future.

Among the "hardware" improvements during the year were the production of new master plates for the densitometers and modification of the automatic arc-gap control.

Production Statistics

1. Samples Processed

	Chemical and XRF	Spectro-graphic	Total
Carried from 1978-79	906	1493	2399
Received in 1979-80	5588	4164	9752
	6494	5657	12151
Completed in 1979-80	4243	2633	6876
Withdrawn, corrections	144	246	390
Carried to 1980-81	2107	2778	4885

Divisional Breakdown of Backlog	Chemical and XRF	Spectro-graphic	Total
Central Labs & Tech. Services	2	2	4
Cordilleran	109	50	159
Economic	425	1014	1439
Precambrian	534	988	1522
Resource Geophys. Geochem.	780	393	1173
Terrain Sciences	253	313	566
Others	4	18	22
	2107	2778	4885

2. Comparison with preceding year

	1978-1979	1979-1980
Samples received		
Chemical and XRF	3135	5588
Spectrographic	3013	4164
	6148	9752
Samples completed		
Chemical and XRF	4351	4242
Spectrographic	3435	2633
	7786	6875
Total spectrographic analyses		
Qualitative	0	4
Semi-quantitative	207	132
Quantitative	3282	2782
	3489	2918
Determinations		
Chemical	21242	25258
X-ray fluorescence	54306	40722
Spectrographic - semi-quantitative	6524	4382
- quantitative	93807	67186
	175879	114818
Spectrographic exposures		
Photographic - analytical	488	899
- development, control	2143	1185
Direct reader - analytical	4726	2899
- development, control	2345	1875
	9702	6858

Mineralogy

R.J. Traill

The Mineralogy Section provides the facilities and expertise for mineralogical studies in support of many Branch projects. These include the specialized fields of crystallography, X-ray diffraction and electron microbeam analysis (microprobe and scanning electron microscope). The Section also provides sample preparation and mineral-separating services; curation of four major collections of rocks, minerals and meteorites; liaison with and assistance to mineral collectors; preparation and sale of rock and mineral collections; and a free service of mineral identification and information for use by the public. The Section staff consists of 10 scientists, 11 technicians and up to two person-years of casual support.

Highlights

- Mineralogical data for two new minerals, lanthanite-(Nd) and gittinsite were submitted to and approved for publication by the International Mineralogical Association. New crystallographic data for the rare minerals phurcalite, strontiodresserite, alstonite and paralstonite were submitted to and accepted as reference standards by the International Joint Committee on Powder Diffraction Standards. The GSC reference collection of X-ray specimen mounts and standard powder patterns was increased by the addition of new data for 82 minerals.

- A study of the petrography and mineralogy, with emphasis on uranium mineralogy, of the Surprise Lake batholith, British Columbia, was completed as part of the "uranium in granites" project sponsored by IAEC. A study of the mineralogy of the Blizzard and Tyee uranium deposits, British Columbia, was almost completed; the rare mineral ningyoite was found to constitute a significant portion of the ores.

- Mineralogical study of the Francon Quarry, Montreal, was continued and 6 visits were made to collect specimens. The pamphlet "Information for Collectors" was revised and reprinted; about 10,000 copies were distributed.

- In addition to normal production the Mineral and Rock Sets Preparation Unit prepared special 120 specimen collections for presentation by the Department to a visiting delegation from China and to Sheik Yamani of Saudi Arabia. Special requests for specimens were filled for Eldorado Nuclear; CANMET; Deputy Minister's office, EMR; Atomic Energy of Canada; Canadian Unity Information Office; and office of Mrs. Erola, Minister of Mines. Field work involved more than 17,600 km of travel in 5 provinces and collection of 20 tonnes of minerals, rocks, ores and fossils from 49 localities.

- Excellent collections were made of whiteite, kulanite, goyazite and other rare phosphate minerals in the Rapid Creek area, Northern Yukon, and of gittinsite from the Kipawa alkalic complex, Villedieu Township, Quebec

- There was a marked improvement in access to, and use of, the petrographic collections as a result of their consolidation in the new storage facility at Tunney's Pasture.

- Electron microprobe and scanning electron microscope analytical studies were provided in support of 40 Branch projects and 11 outside projects. The studies encompassed a broad range of geological topics and included: mineral chemistry of the Blachford Lake alkaline plutonic complex; mineralogy of uranium in granite rocks; mineralogical study of bismuth selenide minerals from Kidd Creek, Ontario; composition of sillimanite from the Haughton impact structure, Devon Island; completion and publication of a major study on the chemistry of serpentine minerals; characterization of granitic rocks in support of the Radioactive Waste Disposal Program; and micropaleontological studies of diatoms, ostracods and conodonts. Method development included improved matrix corrections for Pb-Bi minerals, extension of quantitative analysis by energy dispersive spectrometry to matrices involving L and M X-ray lines, and establishment of procedures for videotape recording of SEM images.

Personnel Notes

S. Going rejoined the staff of the Sample Preparation and Mineral Separating Unit in January after a period of 18 months secondment to the Emission Spectrographic Analyses laboratory.

A.L. Littlejohn resigned as Rock Collection Curator to become Uranium Mineralogist on April 1, 1979.

J.C. Paris retired December 28, 1979, after completion of 35 years pensionable service.

Attendance at Meetings, Conferences and Courses

H.G. Ansell

- EMR Rifle and Shotgun Training Course, May.
- Greater Detroit Gem and Mineral Show, October.
- EMR Safety and Field Seminar, January.

M. Bonardi

- Mineralogical Association of Canada, Annual Meeting, Quebec City, May.

J.M. Larose

- Prospectors and Developers Association, Annual Meeting, Toronto, March.

A.G. Plant

- Series of meetings on establishment and management of an Ion Probe Laboratory in Canada, Ottawa and Toronto.

A.C. Roberts

- 2nd Canadian Crystallography Conference, Montreal, May.
- Symposium on Accuracy in Powder Diffraction, Maryland, June.
- Greater Detroit Gem and Mineral Show, October.

H.R. Steacy

- Tucson Gem and Mineral Show and meetings of Mineral Museums Advisory Council and Friends of Mineralogy, Tucson, February.
- Central Canadian Federation of Mineralogical Societies, Show and Convention, Scarborough, July.
- National Research Council Associate Committee on Meteorites, Ottawa, November and February.

Ann P. Stenson

- Mineralogical Association of Canada, Annual Meeting, Quebec City, May; Executive Meetings, Quebec City, May and Toronto, October.

Membership on Committees

A.G. Plant

- G.S.C. Classification Committees.
- Canadian representative to NEA/IAEA project committee on "Uranium Favourability by Mineral Analyses".
- Organizing Committee for establishment of an Ion Probe Laboratory in Canada.
- Mineralogical Association of Canada representative on the International Mineralogical Association Commission for Cosmic Mineralogy.
- Chairman, Microanalysis Group, and Director, Ottawa Valley Section, Spectroscopy Society of Canada.

A.C. Roberts

- Organizing Committee for the Twelfth Congress and General Assembly of the International Union of Crystallography, Carleton University, 1981.

H.R. Steacy

- Chairman, Education Subcommittee, National Research Council Associate Committee on Meteorites.
- Member, National Museums of Canada task force on computerizing earth science collections.
- Chairman, Publicity Committee, Mineralogical Association of Canada.
- Director, Friends of Mineralogy.
- Member, GSC Library Committee.
- Member, GSC Storage Committee.

Ann P. Stenson

- Treasurer, Mineralogical Association of Canada.
- GSC and Mineralogical Association of Canada representative on JCPDS- International Centre for Diffraction Data.

R.J. Traill

- Chairman, Research Subcommittee, National Research Council Associate Committee on Meteorites.
- Member, Departmental Classification Rating Committee.

Special Talks and Lectures

M. Bonardi

- "Compositional changes during electron probe analysis of dachiardite: contribution to zeolite study" at Mineralogical Association of Canada Annual Meeting, Quebec City, May.

A.G. Plant

- "Electron beam microanalysis and its application to geological studies" at Analytical Branch Seminar, Atomic Energy of Canada Limited, Pinawa, Manitoba, January.
- "Meteorites" to geology class, Bell High School, March.

H.R. Steacy

- "Heritage minerals in the National Mineral Collection" at Ottawa Valley Mineral Association Meeting, April; and joint meeting of Central Federation and Ottawa Valley Mineral Association, July.
- "Geology of the National Capital Region" at Greenbank Public School, May.
- "Curator's view of the Tucson Mineral Show" at Ottawa Valley Mineral Show meeting, February.

Ann P. Stenson

- Participated in a workshop meeting on the minerals of the Francon Quarry for the Montreal Gem and Mineral Club in Montreal, September.

Manuscripts

Manuscripts for 4 GSC papers and 7 papers for outside journals were approved for publication by the Division.

Laboratory Statistics

X-ray Diffraction and General Mineralogy

Studies were made in support of 49 Branch projects and outside agencies. X-ray diffraction analyses involved 1455 Debye-Scherrer and 11 Gandolfi camera mineral identifications; preparation of 82 reference standard patterns; 741 X-ray diffractometer chart recordings. Microscopic examinations and X-ray diffractometer analyses of 141 mineral concentrates were completed in support of the radiometric age determination program. Studies in uranium mineralogy were completed in support of 16 Branch projects involving preparation of 909 radioluxographs (630 rocks, 228 thin sections and 51 mineral separates).

Assistance to the Public

A total of 143 requests for information regarding mineral occurrences were handled by letter, telephone and personal visits. Mineralogical services to the public required the identification of 267 specimens of minerals and rocks with the results being communicated in 47 written and 66 verbal reports.

Mineral Sets Preparation

Sales of Prospector's Sets of Mineral and Rock Chips amounted to 6070, comparable with 6082 in the previous year. Distribution of these across Canada was as follows:

	1978-79	1979-80
Alberta	901	763
British Columbia	1361	1600
Manitoba	40	48
New Brunswick	778	369
Newfoundland	16	29
Nova Scotia	228	131
Northwest Territories	230	45
Ontario	1160	1448
Prince Edward Island	1	0
Quebec	346	302
Saskatchewan	118	181
Yukon	302	250
GSC Ottawa	282	349
EMR Ottawa	247	511
Others	72	44

Sales of the 120 specimen Collection Representing the Raw Materials of Canada's Mineral Industry amounted to 173, an increase of 40 over the previous year. At the request of the National Film Board, 60 collections were supplied to accompany Earth Science Filmstrip Kits. Revenue from the sale of all sets and collections, payable to the Receiver General, was $33,230.00.

Electron Beam Microanalysis

Analytical studies were provided in support of 40 Branch projects and 11 projects that originated outside of the Branch. The work output was close to that of last year and a somewhat greater amount of time was spent on development of improved methods and techniques.

Mineral Separating Unit

A substantial increase in sample preparation work for the Analytical Chemistry Section led to increased productivity as compared to the previous year.

	1978-79	1979-80
Samples received	2935	5111
Samples completed	2740	5233
Crushed and ground	4514	7762
Heavy liquid separation	4120	3903
Magnetic separations	2349	1694
Superpanner separations	1467	724
Wilfley table separations	117	67
Final concentrates	337	295

Curation of Collections

Accessions to the mineral collection amounted to 276, including 52 species new to the collection, increasing the total representation to about 1900, or three-quarters of all known species. 192 specimens were supplied in response to 59 requests from Branch scientists and other researchers mainly in the geosciences. 330 specimens were fully catalogued, including most type specimens. Consultative services and advice on mineralogical matters outside the Branch consumed two man-weeks of project time. Maintenance and services of the petrographic collections continued, but loss of the curator hindered progress on computerization and development of the collection. The inauguration of a National Mineral Deposits Collection by the National Museum of Natural Sciences prompted re-examination of GSC endeavours to build an ore collection and a study of the feasibility of collaborating with the Museum in joint development of the collection. One new find, Nuevo Mercurio from Zacatecas, Mexico, was added to the National Meteorite Collection. Twenty-one suspected meteorites were examined for the public and all were found to be of terrestrial origin.

Comparison of Annual Mineralogical Service Charges

An internal costing system has been used for several years to record, evaluate and compare services provided to Branch scientists by the three main support service projects of the Section. The dollar values assessed to the services are unreal in the sense that they were assigned arbitrarily in 1970 to approximate minimum costs and have not been reviewed to reflect increased costs as the result of inflation.

The figures are of interest in that they indicate the relative amounts of support we provide annually to the various divisions. Work for outsiders is included in CLTS.

	1978-1979 $	1979-1980 $
Sample Preparation (770054)		
Economic Geology	271	4221
Precambrian	32274	22494
Geophysics and Geochemistry	162	1390
Terrain Sciences	24	36
Central Laboratories and others	12961	20681
Total	45692	48822
XRD and Mineralogy (680023)		
Economic Geology	6415	11190
Precambrian	4730	4550
Geophysics and Geochemistry	2925	8810
Terrain Sciences	3370	1930
Central Laboratories	15750	7820
Total	33190	34300
Electron Microbeam (620308)		
Economic Geology	5900	14925
Precambrian	29125	33825
Geophysics and Geochemistry	13250	6100
Terrain Sciences	15775	15675
Central Laboratories and others	23750	15650
Total	87700	86175
Totals		
Economic Geology	16286	30336
Precambrian	62329	60869
Geophysics and Geochemistry	16337	16300
Terrain Sciences	19169	17641
Central Laboratories and others	52461	44151
Total	166582	169297

Technical Services Section

G.A. Meilleur

The Section provides machine shop and electronic service support, including the design, fabrication, modification and maintenance of scientific and technical equipment, for laboratory and field projects of the Branch.

Highlights

During the year a total of 175 work orders were received (an increase of 15 per cent over 1978/79), of which 158 were completed and 17 carried over. These totals do not include a significant number of "small" daily and emergency requests for services and materials not covered by the requisitioning procedure.

Statistics

The distribution of the work load by Division, based upon work orders received, is:

Central Laboratories and Administrative Services	- 45.7%
Regional and Economic Geology	- 21.7%
Resource Geophysics and Geochemistry	- 20.0%
Geological Information	- 7.4%
Terrain Sciences	- 5.1%

Branch Financial Services

C.C. Bowstead

The Branch Financial Services in the Geological Survey consists of the Branch Finance Office and the Accounting Services Office, both of which are the responsibility of the Branch Financial Comptroller.

The Branch Finance Office coordinates the annual Program Forecast and Main Estimates exercises, coordinates and reviews the forecasting of expenditures, ensures that Treasury Board guidelines and departmental procedures are implemented as they apply to financial matters, provides the link with the Financial Services Branch, and generally provides functional guidance to divisions on all financial matters.

The Accounting Services Office is the most visible unit of Branch Financial Services. The staff is charged with making travel arrangements, auditing and processing field accounts, travel and removal claims for all divisions of the GSC and the payment of all invoices for the Director General's office and Branch administration. The payment of such items as freight, express, telephone and taxis are also handled by this group.

The following staff changes took place in Financial Services during the 1979-80 year:

Going, Mary	- December 1979	- retired after 33 years service
Greenspon, Sam	- May 1979	- transferred to CANMET
Lucas, Donna	- December 1979	- resigned to raise family
Stapledon, Jeff	- May 1979	- transferred from Health & Welfare
Scully, Stephanie	- Oct. to March 1979	- from industry to Ecomomic Geology
Eastham, Angela	- March 1979	- from industry

Administrative Services

Y.-P. Claude

Administrative Services in the Geological Survey is comprised of four Units namely the Procurement, Chemicals and Stationery Stores; Building Maintenance, Inventory and Vehicles Services; Branch Records and Messenger Services and the Secretarial and Word Processing Centre. The responsibility of these sections is to provide administrative support to the Ottawa based Divisions as well as functional guidance and advice to the Regional Offices.

Administrative Services also provides administrative guidance and advice to the Geological Survey on related administrative matters by assessing the implications of Treasury Board policy and guideline and department directives upon the administrative support staff and the operational Divisional and implementing them as they relate to the GSC. The Units also co-ordinate and administer the renovation plans; the Branch Energy Conservation Program; Security/Safety and Emergency Disaster programs as well as the Branch Parking allocation.

Memberships on Committees

Departmental Administrative Committee
Departmental Safety Committee
Departmental Parking Committee
Departmental Suggestion Award Committee
Departmental Energy Conservation Committee
Departmental Form Management Committee
Departmental Catering Committee
GSC Administrative Officer Committee
GSC Safety Committee
GSC Emergency Organization

Personnel Notes

On April 20, 1979, Fern Casey left her position as Head, Administrative Services for a position with Agriculture Canada. Yvon Claude, formerly with Terrain Sciences Division was appointed to the position. Janet Legere, Supervisor, Secretarial and Word Processing Centre undertook language training and Debbie Busby is acting during her absence. Douglas St. Dennis, Supervisor, Shipping and Receiving, is also on language training and Larry Bonavia is acting in his position. Other staff changes were - departure - Steve Palombo, Bert Winges, Shipping and Receiving; Carol Barnard, Jane McAllister, Word Processing Centre; Robert Robillard, Supervisor, Branch Records and Messenger Services. New comers were Jane Desautels, Madeleine Aiken, Judy Côté, Susan Gagnon, Word Processing Centre; Randy Hamilton, Ron Falls, Shipping & Receiving; and Richard Deschamps giving a helping hand with the Branch Inventory.

Branch Personnel Unit

K. Fracke

Highlights

The major role of the Personnel Unit in the Geological Survey during 1979/80 has, as in previous years in response to Branch demands, been in the field of recruitment and promotion of employees through the competition process and the processing of classification actions, including job description writing of positions. Staff relations actions involved the interpretation of collective agreements and the grievance procedure. The performance appraisal system is working effectively and all employees of the Geological Survey are being appraised on an annual basis.

Statistics

The following is a numerical breakdown of classification and staffing actions processed by the Personnel Unit during 1979/80.

Classification Activity

Positions Classified	Positions Cancelled	Classification Decisions Permanent	Term	Total
273	156	153	276	429

Staffing Activity

Type 1 Appointments - Term and Full-Time Continuing

Scientific and Professional	-	75
Technical	-	70
Admin and Foreign Service	-	0
Admin Support	-	82
Operational	-	6
		233

Type 2 Appointments - Term and Full-Time Continuing

Scientific and Professional	-	45
Technical	-	31
Admin and Foreign Service	-	2
Admin Support	-	40
Operational	-	8
		126

COSEP Students: 150

Total = 359

CORDILLERAN GEOLOGY DIVISION

R.B. Campbell

In October, 1979 reorganization within the Geological Survey established the Cordilleran Division, based in Vancouver, from what had formerly been the Cordilleran and Pacific Margin Subdivision of the Regional and Economic Geology Division.

The Cordilleran Division is responsible for geological studies in most of the Canadian Cordillera and the adjacent offshore regions. These studies are aimed at increasing the knowledge of the composition, age, distribution and origin of regionally mappable rock units to assess mineral and hydrocarbon potential, to guide mineral exploration and to aid in the planning of the orderly development of land utilization.

The Division includes a Marine Geology Section based at the Pacific Geoscience Centre, Sidney, Vancouver Island. Its scientists carry out stratigraphic, biostratigraphic, sedimentological and structural studies of the Pacific Continental Shelf and adjacent areas with particular emphasis on assessing hydrocarbon potential; seismic and magnetic studies in conjunction with investigations by the Earth Physics Branch to determine the disposition of shallow to deep crustal layers on the Pacific continental shelf and slope; magnetic investigations in the Beaufort Sea region and terrain sciences projects dealing with surficial sediments in the offshore areas and geomorphic processes along the coasts to aid in coastal management. The Vancouver based part of the Division is involved in a broad spectrum of research in those parts of the Cordillera mainly southwest and west of the areas of major hydrocarbon potential. Therefore, emphasis is placed on projects that are important for mineral exploration and assessment. An Information Services Unit is part of the Cordilleran Division and integrates the functions of a sales office and a library.

Highlights

Two violent natural events, debris torrents near Muncho Lake in northern British Columbia and landslides near Vancouver are the subject of two papers, based on first-hand observation of the processes and of the aftermaths, that will be useful contributions to the geotechnical literature.

Klippe of Devono-Mississippian rocks overlying Triassic strata in northern British Columbia suggest the southern extension of structures previously recognized in southern Yukon where vast allochthonous sheets were thrust over rocks deposited on the edge of the ancient North American continent. In the same region parts of the Cache Creek Group are shown to be a dismembered ophiolite.

In Nahanni map-area, site of an Integrated Multi-disciplinary Pilot Project, bedrock studies have revealed several unconformities that cut out strata basinward and die-out toward the platform. These unconformities are important in tracing potential ore-bearing horizons and will bear on interpretation of geochemical data.

Continued exploration of the Meager Mountain geothermal prospect has provided encouraging evidence of a potential resource. Rock temperature was found to be 200°C near 300 metres depth.

Consultation with experts in the United States and in the private sector in Canada has resolved serious difficulties in the interpretation of magnetic data from the Beaufort Sea. This will permit completion of this phase of the geophysical study of the Beaufort Sea and publication of the results.

Some structures involving Tertiary strata in the offshore of Vancouver Island are now interpretated as shallow surficial features above flat thrust faults or slides. This interpretation will have a significant influence on geophysical interpretation and on the selection of sites for hydrocarbon exploration.

The establishment of an adequate reference hypotype collection of west coast Tertiary foraminifers will permit better interpretations of depositional and tectonic histories of parts of the shelf-slope and deep sea basins.

Personnel Notes

The Division consists of a permanent staff of 35, comprising 20 scientists and 15 technical support, administrative, library and sales office personnel. Eighty-seven person-months are allotted to cover casual employees for a total strength of 42 1/3 person years. Two post doctoral fellows (Dr. J. Harper and Dr. R. Gillies) were supported for the full year and a third (Dr. M. Orchard) for part of the year. In addition office space and services are provided for Dr. K.M. Dawson (Economic Geology Division) and Dr. J.J. Clague (Terrain Sciences Division). Several student thesis, EMR Research Agreement projects, and research contracts were supported by the Division.

In June, 1979 Dr. H. Gabrielse relinquished his administrative duties as head of The Cordilleran and Pacific Margin Subdivision and was replaced by Dr. R.B. Campbell. In September, 1979, Dr. D.L. Tiffin stepped down as head of The Marine Geology Section and his duties were subsequently assumed by Dr. C.J. Yorath.

In October Dr. J.O. Wheeler rejoined the Division after spending 10 years at headquarters in Ottawa. Dr. D.J. Tempelman-Kluit assumed the office of Regional Geologist at Whitehorse, Yukon in January. He will be seconded to The Department of Indian and Northern Affairs for 2 years. In January and February Dr. B.D. Bornhold participated as an invited scientist on Leg 71 of the Deep Sea Drilling Project in the southwestern Atlantic Ocean. Arrangements were completed for Dr. R.I. Thompson and Dr. P. McLaren to join the staff at Vancouver and Patricia Bay respectively near the end of the fiscal year.

Miss Judith Velker resigned in August and her position in the sales office was taken by Mrs. Olga Langenhaun. Mrs. Langenhaun's previous position was taken by Mrs. Zdena Hajek.

Attendance at Meetings, Conferences, Courses

R.B. Campbell

Binational Field Trip, G.S.C.-U.S.G.S., SE Alaska, September 1979.

Cordilleran Section, Geological Association of Canada, Vancouver, B.C. January 25-26, 1980.

B.C. Ministry of Mines, Open House, Victoria, B.C., February 8, 1980.

R.G. Currie

A.G.U., Pacific Northwest Regional Meeting, Bend, Oregon, September 17-18, 1979.

H. Gabrielse

Penrose Conference on "The Antler Orogeny", Elko, Nevada, September 9-15, 1979.

Geological Society of America; Annual Meeting, San Diego, California, November 4-7, 1979.

Workshop on Tectonic Studies in the Southeastern Canadian Cordillera, Queen's University, Kingston, Ontario, January 18-19, 1980.

Cordilleran Section, Geological Association of Canada, Annual Meeting, Vancouver, British Columbia, January 25-26, 1980.

S.P. Gordey

Penrose Conference on "The Antler Orogeny", Elko, Nevada, September 9-14, 1979.

Seventh Geoscience Forum, "A look at current geological work in Alaska and Yukon, with emphasis on mineral exploration activity, but with some presentations by G.S.C. and University geologists, Whitehorse, Yukon, December 2-4, 1979.

Geological Association of Canada, "Volcanogenic deposits and their Regional Setting in the Canadian Cordillera", Vancouver, British Columbia, January 25-26, 1980.

J.W.H. Monger

Ninth International Congress of Carboniferous Stratigraphy and Geology, Symposium on "Carboniferous biogeography and geotectonics in the Pacific region", Urbana, Illinois, May 10-June 2, 1979.

Pacific Division of the American Association for the Advancement of Science, Symposium on "Frontiers of Western Geological Exploration", Moscow, Idaho.

Penrose Conference, "Mesozoic and Cenozoic Microplate Tectonics of Western North America", Lopez Island, Washington.

1979 Annual Meeting, Geological Society of America, Symposium on "Mesozoic and Cenozoic Microplate Tectonics of the Pacific Continental Margins", San Diego, California.

Geological Association of Canada, Cordilleran Section, Symposium on "Volcanogenic deposits and their regional setting in the Canadian Cordillera", Vancouver, British Columbia, January 26, 27, 1979.

Cornell Program for Study of the Continents, Ithaca, New York, January 29-30, 1979.

J.E. Muller

Joint U.S.G.S.-G.S.C. Excursion, southeast Alaska, Fall 1979.

G.A.C. Cordilleran Section Meeting, January 1980.

J.A. Roddick

G.S.A. Cordilleran Section Meeting, San Jose, California, April 1979.

XIV Pacific Science Congress, Khabarousk, U.S.S.R., August 1979 and Field Excursion X, late Mesozoic granitoids in the Yana-Kolyma folded systems.

J.G. Souther

G.A.C. Cordilleran Section, Annual Meeting, Vancouver, British Columbia, January 25-26, 1980.

Cascade Workshop, U.S.G.S., Menlo Park, California, February 19-21, 1980.

D.L. Tiffin

First Canadian Conference on Marine Geotechnical Engineering, Calgary, Alberta, April 1979-Panel Member.

H.W. Tipper

G.A.C., Symposium, January 1980, Vancouver.

J.O. Wheeler

J. Tuzo Wilson, Workshop "Continental Crust and its Mineral Deposits", Toronto, Ontario, May 15-16, 1979.

Federal-Provincial Geological Surveys Meeting, Quebec City, Quebec, May 24, 1979.

France-Canada Exchange Structural Geology Seminar, French Alps, October 2-16, 1979.

Meeting of G.S.A., Centennial Project Planning Committee, San Diego, California, November 5, 1979.

Meeting of G.S.A. Centennial Project Planning Committee, San Francisco, California, December 4, 1979.

Cordilleran Geological Workshop, Queen's University, Kingston, Ontario, January 18-19, 1980.

Cordilleran Section, Geological Association of Canada Meeting, Vancouver, British Columbia, January 25-26, 1980.

Meeting of Steering Committee and G.S.A. Centennial Project, Boulder, Colorado, January 29-30, 1980.

B.C. Ministry of Mines, Open House, Victoria, British Columbia, February 8, 1980.

Meeting of Canadian Geoscience Council, Toronto, Ontario, March 12, 1980.

Meeting of Advisory Council to Department of Geological and Geophysical Sciences, Princeton University, Princeton, New Jersey, March 14-15, 1980.

G.J. Woodsworth

Geol. Assoc. Canada, Cordilleran Section Annual Symposium. Gave paper "Stratigraphic setting of the Coast Plutonic Complex" with H.W. Tipper, January 1980.

Canadian Permanent Committee on Geographic Names, Annual Meeting, Victoria, British Columbia, September 1979.

C.J. Yorath

First binational field trip to southeast Alaska-U.S.G.S. and G.S.C., September 1980.

Penrose Conference; Microplate Tectonics, Lopez Island, Washington, October 1980.

Geological Society of America, Annual Meeting, San Diego, California, November 1980.

Geological Association of Canada, Cordilleran Section Annual Meeting, Vancouver, British Columbia, February 1980.

Membership on Committee

B.D. Bornhold

Departmental Committee on Ocean Mining-Shelf Working Group.

R.B. Campbell

Advisory Committee, British Columbia and Yukon Chamber of Mines, Member.

Parks Committee and Education Committee, British Columbia & Yukon Chamber of Mines, Member.

Associate Editor, Canadian Journal Earth Sciences.

H. Gabrielse

Code Committee, North American Committee, Stratigraphic Nomenclature, Member.

Canadian Subcommittee for Geodynamics February 15, 1979, Member.

Canadian Committee for International Lithosphere Project, Member.

J.L. Luternauer

(Various) Fraser Delta Environmental Assessment Committees struck to examine potential impact of proposed man-imposed changes on Fraser River Delta.

Nanaimo Estuary Task Force, Member.

Estuary Working Group, Member.

Coastal Zone Folio Committee, Member.

PhD. Thesis Committee-Mr. David Swimbanks, UBC Geological Sciences.

J.W.H. Monger

Vice President, Cordilleran Section, Geological Association of Canada from December 1979.

Canadian-U.S. Continent-Ocean Transects Program, Member.

J.A. Roddick

Editor, Circum-Pacific Plutonism Project; International Union of Geological Sciences-International Geological Correlations Program.

J.G. Souther

Steering Committee and Working Group for geothermal research and development in B.C., Member.

D.L. Tiffin

1978-80, Canadian National Committee for Scientific Committee on Oceanographic Research (International Council of Scientific Unions), Member.

Department Representative, Pacific Subcommittee on Oceanography.

Departmental Committee on Ocean Mining, Member.

H.W. Tipper

North American Representative, International Subcommission on Jurassic Stratigraphy.

J.O. Wheeler

Vice President, Canadian Geoscience Council, 1980.

Steering Committee, Geological Society of America, Centennial Project, Member.

Director, Canadian Geological Foundation.

Advisory Council, Dept. of Geological and Geophysical Sciences, Princeton University, Princeton, New Jersey, Member.

G.J. Woodsworth

Councillor, Geological Association of Canada, Cordilleran Section.

Advisory Committee on Glaciological and Alpine Nomenclature, Canadian Permanent Committee on Geographic Names, Member.

C.J. Yorath

North American Commission on Stratigraphic Nomenclature, Retiring Member.

Transects Committee, International Geodynamics Program, Member.

Canadian National Committee for the International Program on the Lithosphere, Member.

President, Victoria Section, Geological Association of Canada.

Technical Program Chairman, 1983 National Meeting, Geological Association of Canada.

Special Talks or Lectures

R.B. Campbell

"Terranes of the Saint Elias Mountains, Yukon, British Columbia and Alaska"; Cordilleran Section, Geological Association of Canada, Vancouver, British Columbia, January 25-26, 1980.

G.H. Eisbacher

"Windermere Supergroup" - University of Calgary
- University of Wyoming.

"Successor Basins of the Cordillera" - University of Wyoming.

"Rock Avalanches" - University of Wyoming.

"Slope Stability Hazards" - Simon Fraser University.

"Debris Torrents near Muncho Lake" - SFU Slope Hazards Workshop.

H. Gabrielse

"Antler" related events in the Canadian Cordillera; Penrose Conference on Antler Orogeny, Elko, Nevada, September 10, 1979.

"Structural Styles and Timing of Deformations", northern Cordillera, Queen's University Workshop, Kingston, Ontario, January 19, 1980.

S.P. Gordey

A talk on "Depositional History and Tectonic Significance of Antler age clastics in the Yukon"; Penrose Conference, Elko, Nevada, September 1979 (20 min.).

A talk on "Structure and Stratigraphy of the Nahanni area, Yukon-N.W.T."; Seventh Geoscience Forum, Whitehorse, Yukon, December 1979 (30 min.).

J.L. Luternauer

"A review of G.S.C. estuarine/marine delta studies in British Columbia" presented at University of British Columbia graduate sedimentology seminar.

"Role of geological studies in estuarine rehabilitation programs" presented at Nanaimo Biological Station Habitat Restoration Workshop.

"Mapping sea-floor Characteristics of a continental shelf commercial groundfish habitat" presented at Pacific Northwest Marine Sciences Workshop held at Pacific Geoscience Centre.

J.W.H. Monger

"Upper Paleozoic geography and tectonism in the western Cordillera of North America"; Ninth International Congress of Carboniferous Stratigraphy and Geology, Urbana, Illinois, May 10-June 2, 1979.

"Evolving concepts of the tectonics of the North American Cordillera"; Pacific Division of the American Association for the Advancement of Science, Moscow, Idaho.

"The Canadian Cordilleran Collage"; 1979 Annual Meeting, Geological Society of America, San Diego, California.

"Allochthonous terranes in the North American Cordillera"; Cornell Program for Study of the Continents, Ithaca, New York, January, 1979.

Talk to Structural Geology Section, Alberta Society of Petroleum Geologists in Calgary, 25th of September on "State of the Tectonic art in the Cordillera" with Ted Irving; same talk next day at University of Calgary.

"Paleontology, paleongraphics and paleoplate tectonics" at Pacific Science Centre, 13th December 1979.

Talks on "Allochthonous terranes in the Canadian Cordillera" at U.S. Geological Survey, Stanford University and University of California at Santa Cruz, 4, 5 and 6, March 1980.

J.E. Muller

Talk on "Early Paleozoic volcanics of Vancouver Island and other Cordilleran regions", at Geol. Assoc. of Canada Cordilleran Section Meeting, Vancouver, January 1980.

J.A. Roddick

"Evolution of the Coast Plutonic Complex of British Columbia"; presented to the XIV Pacific Science Congress, Khabarousk, U.S.S.R., August 1979.

J.G. Souther

"Meager Mtn., a Geothermal Energy Resource"; U.B.C. Colloquim Lecture Series, March 30.

"Geothermal Resources of the Garibaldi Volcanic Belt"; G.A.C. Cordilleran Section Annual Meeting, Vancouver, January 25-26, 1980.

"Geothermal Potential of the Garibaldi Belt"; Cascade Workshop, U.S.G.S. Menlo Park, California, February 19, 1980.

D.L. Tiffin

"Impact of Ocean Mining on Canada's Mining Industry"-Invited Speaker at Open Public Conference on Canada and the Sea, Nanaimo, February 1980.

H.W. Tipper

Co-authored with Woodsworth, "Stratigraphic Framework of the Coast Plutonic Complex, Western B.C."; G.A.C. Symposium, January 1980, Vancouver, B.C.

G.J. Woodsworth

Co-authored with H.W. Tipper, "Stratigraphic Framework of the Coast Plutonic Complex, Western B.C."; G.A.C. Smyposium, January 1980, Vancouver, B.C.

Invited lecture "Stratigraphy and Structure of the Coast Mountains" at University of Washington.

C.J. Yorath

"Some aspects of the geology and structural style of the Vancouver Island continental margin", by C.J. Yorath and R.G. Currie. Presented at Geological Association of Canada, Cordilleran Section Annual Meeting, Vancouver, February 1980.

Organized and participated in a series of public lectures on Earthquakes; held at the Newcombe Auditorium, B.C. Provincial Museum, March 1980, "Geological framework of western North America".
Co-sponsored by the Victoria section of the Geological Association of Canada and the British Columbia Provincial Museum.

Completed Manuscripts

B.D. Bornhold

Blasco, S.M., Bornhold, B.D. and Lewis, C.F.M.
1979: Preliminary results of surficial geology and geomorphology studies of the Lomonosov Ridge, Central Arctic Basin; in Current Research, Part C, Geol. Surv., Canada, Paper 79-1C, pp. 73-83.

Bornhold, B.D., Clague, J.J. and Bell-Irving, R.
1979: Reconnaissance coastal geology - Eastern Vancouver Islands; Geol. Surv., Canada, Open File 651.

Barrie, W., Bornhold, B.D., Hodgson, D., Jubb, R., McLaren, P. and Taylor, R.B.
1979: Coastal reconnaissance for Marine Terminal Planning in the High Arctic, District of Franklin; Geol. Surv., Canada, Open File 633.

Bornhold, B.D., Tiffin, D.L. and Currie, R.G.
(in press) Trace metal geochemistry of sediments, northeast Pacific.

R.B. Campbell

Plafker, G. and Campbell, R.B.
1979: The Border Ranges fault in the Saint Elias Mountains; U.S.G.S. Circ. 804-B, P. B102-B104.

R.G. Currie

Auld, D.R., Law, L.K. and Currie, R.G.
4(1979) Cross-over error and marine magnetic surveys; Marine Geophysical Researches, p. 167-179.

Riddihough, R.P., Currie, R.G. and Hyndman, R.D.
The Dellwood Knolls and their role in triple junction tectonics off northern Vancouver Island. (accepted CJES).

Bornhold, B.D., Tiffin, D.L. and Currie, R.G.
Trace Metal Geochemistry of sediments, Northeast Pacific. (submitted CJES).

G.H. Eisbacher

Submitted: "Debris Torrents near Muncho Lake". Canadian Geotechnical Journal.

"Urban landslides in the Vancouver area, with special reference to the rainstorm of December 1979" (with J. Clague); in Slope Stability Problems in Urban Areas, Can. Geotechnical Jour., Special Conf., 1980, Toronto, Ontario.

H. Gabrielse

Gabrielse, H., Wanless, R.K., Armstrong, R.L. and Erdman, L.R.
1980: "Isotopic Dating of early Jurassic volcanism and plutonism in north central British Columbia; in Current Research, Part A, Geol. Surv., Canada, Paper 80-1A, p. 27-32.

"Operation Finlay"; Geol. Surv., Canada, Paper 80-1A, p. 348.

"Operation Dease"; Geol. Surv., Canada, Paper 80-1A, p. 347.

Structural Style in northeastern Cry Lake map-area, north central British Columbia, Geol. Surv., Canada, Paper 80-1A, p. 33-35.

S.P. Gordey

Gordey, S.P.
1980: Stratigraphic cross-section, Selwyn Basin to MacKenzie Platform, Nahanni map-area, Yukon Territory and District of MacKenzie; Geol. Surv., Canada, Paper 80-1A, Current Research, p. 353-355.

Gordey, S.P.
1980: Nahanni map-area, Y.T. and N.W.T.; Geol. Surv., Canada, Open File 689; (file includes 1:125,000 geological map of parts of Nahanni area, structural cross-section, legend, stratigraphic correlation diagram, geologic maps at 1:50,000 scale for NTS 105I6, I7, I8, I9, I10 and I16).

J.L. Luternauer

Leroux, J. and Luternauer, J.L.
1979: Comprehensive compilation of airphoto indices for the Fraser Delta foreshore (Pt. Grey to Tsawwassen) 1922-1978: (co-author). Geol. Surv., Canada, Open File 625.

J.W.H. Monger

Monger, J.W.H. and Ross, C.A.
(in press) Upper Paleozoic volcanosedimentary assemblages of the western North American Cordillera. To appear in the transactions of the Ninth International Congress on Carboniferous Stratigraphy. 31 typewritten pages, 6 figures.

Monger, J.W.H. and Davis, G.A.
1979: Tectonic concepts of the North American Cordillera; American Association for the Advancement of Science, Pacific Division, 60th Annual meeting, Moscow, Idaho; program and abstracts.

Monger, J.W.H. and Davis, G.A.
(in press) Evolving concepts of the tectonics of the North American Cordillera. American Association for the Advancement of Science, Pacific Division, symposium volume celebrating the Centennial of the founding of the U.S. Geological Survey. 74 typewritten pages, 10 figures.

Monger, J.W.H., Irving, E. and Yole, R.A.
(in press) New paleomagnetic evidence for displaced terranes in British Columbia. 30 typewritten pages, 6 figures. A symposium volume in honour of J. Tuzo Wilson.

Monger, J.W.H. and Irving, E.
(in press) Northward displacement of north-central British Columbia. Nature. 18 typewritten pages, 5 figures.

Monger, J.W.H. and Irving, E.
1979: The Canadian Cordilleran Collage. Geological Society of America, Abstracts with Programs, Vol. II, p. 482.

Monger, J.W.H.
(in press) Upper Triassic stratigraphy, Dease Lake and Tulsequah map-areas, north western British Columbia, Geol. Surv., Canada, Paper 804-1B, 16 pages, 4 figures.

J.E. Muller

Muller, J.E.
(in press) The Paleozoic Sicker Group of Vancouver Island; Geol. Surv. Canada Paper, accepted for publication.

Muller, J.E.
(in press) Chemistry and origin of the Eocene Metachosin Volcanics, Vancouver Island, British Columbia; Can. Journ. Earth Sci., February 1980.

Schwartz, E.J. and Muller, J.E.
(in press) Paleomagnetism of the Karmutsen basalts from southeast Vancouver Island. Can. Journ. Earth Sci., 1980.

J.A. Roddick

Canadian Cordillera part of compilation Map of Circum-Pacific Plutonism, Scale 1:10 million plus 1:1 million inset map crossing the Coast Plutonic Complex. Editor L.I. Krashy, U.S.S.R., June 1979.

Evolution of the Coast Plutonic Complex of British Columbia; XIV Pacific Science Congress, Abstract of papers, p. 54-55.

J.G. Souther

Geothermal Resources of the Garibaldi Volcanic Belt (abs.) in Programme and Abstracts, Volcanogenic Deposits and their Setting in the Canadian Cordillera, GAC Cordilleran Section, Jan. 25-26, 1980, Vancouver, B.C.

Souther, J.G.
1980: Geothermal Reconnaissance in the Central Garibaldi Belt, B.C., in Current Research, Part A, Geol. Surv., Canada, Paper 80-1A, p. 1-11.

D.L. Tiffin

Bornhold, B.D., Tiffin, D.L. and Currie, R.G.
"Trace Metal Geochemistry of Sediments, Northeast Pacific".

C.J. Yorath

Yorath, C.J.
(in press) The Apollo structure in Tofino Basin, Canadian Pacific continental shelf. Can. Journ. Earth Sci.

INFORMATION SERVICES UNIT

RESEARCH LIBRARY

The Library continues to expand its holdings to accommodate the needs of the research staff as well as those of the mining and academic communities. Its holdings now include 103,000 volumes; 1,500 serials and periodicals; 500 thesis covering the geology of the Canadian Cordillera; 5,800 maps and 2,500 microfiche. Note: The 1978-79 figures are incorrect, i.e. too low.

Services to the Public (excluding in-house staff)

Inter-library Loans	=	435
Telephone Calls (Reference)	=	2,438
Visitors	=	3,950

Plans are underway to physically move the library to the 5th floor. The new space allocation will provide 47 additional bays of shelving; an expanded reading area, and a work area for technical processing. The library will also be able to suitably house the geological map collection.

Membership on Committees

M.K. Akehurst, Librarian

G.S.C. Information Services representative, Organizing Committee, Federal Information Network in Greater Vancouver area.

British Columbia & Yukon Chamber of Mines, Library Committee.

PUBLICATIONS & MAP SALES OFFICE

Activities

The office is responsible for the sale and distribution of published reports and maps issued by the Dept. of Energy, Mines and Resources; the B.C. Ministry of Mines and Petroleum Resources, and the Geological Association of Canada, Cordilleran Section.

The statistics show that the total value of sales during the past year increased from $ 85,200.51 to $103,592.42 (increase of $18,391.91 or 18%).

The following Open Files were released and sold by this office during the period April 1, 1979 - March 31, 1980:

O.F. 606 - Geological Map of Trutch (94G) and Ware East Half (94F, E1/2) map-areas, Northeastern B.C. by G.C. Taylor. Scale 1:125,000.

610 - Geology of Cry Lake map-area (NTS 104I), B.C. compiled by H. Gabrielse. Scale 1:125,000.

611 - Geology of Vancouver West Half (92G) and the mainland part of Alberni (92F) map-areas compiled by J.A. Roddick and G.J. Woodsworth. Scale 1:125,000.

O.F. 622 - Magnetic Anomaly Map of the Pacific Ocean West and Northwest of Vancouver Island, B.C. by R.G. Currie, D. Seemann and D.L. Tiffin. Scale 1:500,000

630 - Geological Map of Monkman Pass (93I) map-area, Northeastern B.C. by G.C. Taylor and D.F. Stott. Scale 1:125,000.

634 - Geological Map of Kananaskis Lakes, West Half (NTS 82J, W½), B.C. and Alberta compiled by G.B. Leech. Scale: one inch to two miles.

637 - Geology and Mineral Occurrences of the Thompson-Shuswap-Okanagan Region, South-Central B.C. by A.V. Okulitch. Scale 1:250,000.

650 - Packhorse Tracks by H.S. Bostock. (244 p., maps, photographs, sketches).

651 - Reconnaissance Coastal Geology-Eastern Vancouver Island by B.D. Bornhold and J.J. Clague (G.S.C.) and R. Bell-Irving (Fisheries & Oceans Canada). Scale 1:50,000.

658 - Geology and Mineral Deposits, Eastern part of Vernon East Half (NTS 82L/1, 8, 9, 16) by P.B. Read. Scale 1:100,000.

659 - Geological Map of Cenozoic Rocks in Western Canadian Cordillera of B.C. and Y.T. by G.A. Noel (G.A. Noel & Associates Inc., Vancouver, B.C.). Scale 1:2,000,000.

672 - Gas Resources of Western Canada by R.M. Procter and R.G. McCrossan.

673 - Geological Map of Toad River map-area, B.C. (NTS 94N) compiled by G.C. Taylor and D.F. Stott. Scale 1:250,000.

684 - Bathymetric Map of Dixon Entrance, B.C. by D.A. Seemann and D.L. Tiffin. Scale 1:250,000.

688 - Surficial Geology, Southern Yukon (Part 3) by S.R. Morison and R.W. Klassen. Scale 1:100,000.

689 - Geological Maps of Nahanni map-area, Y.T. and N.W.T. (NTS 105I) by S. Gordey. Scale 1:125,000 and Scale 1:50,000.

The present policy of selling Open Files pertaining to the geology of the Canadian Cordillera continues to be well received by the public.

ECONOMIC GEOLOGY DIVISION

G.B. Leech, Director

The Economic Geology Division is responsible for providing information on the non-hydrocarbon mineral resources of Canada: information on the geology of Canadian mineral deposits, on the probable distribution, character and abundance of resources additional to reserves, and on aids to their discovery. The Division provides appraisals of individual commodities, e.g. uranium resources of Canada, and comprehensive appraisals of specific regions. Except for uranium the appraisals are on an intermittent, increasing, demand basis.

The Division's main activities to carry out this national role are: development of a national data base on the geology of mineral deposits; studies to determine the critical characteristics of individual deposit types and to relate them to those of their local and regional geological environments; development of concepts and methods for evaluating the potential of various regions to contain mineral deposits and guides to their discovery. Interaction with industry, other federal and provincial agencies, and universities is an important aspect of these activities.

The Division comprises five operational groups: Mineral Deposits Geology Section, Uranium Resource Evaluation Section, Geomathematics Section, Mineral Data Bank Unit and a Divisional Headquarters and Special Projects unit. Its staff of 47 continuing positions and 3 casual person-years includes 24 research scientists, 16 physical scientists, 1 mathematical statistician, and 5 in administrative and technical support.

The Mineral Deposits Geology Section carries the main program of commodity and regional metallogeny other than in uranium. In commodity metallogeny the geology of specific mineral commodities is studied on a national basis. Major metal commodities receive ongoing study whereas other commodities, selected on the basis of economic and strategic priorities, are studied on a term basis. Regional metallogenic studies, which relate the mineral deposits to the geological features in selected large regions, involve numerous commodities.

The Uranium Resource Evaluation Section specializes in the metallogeny of uranium, which affords links with a number of other commodities through related depositional environments and polymetallic deposits. The Section is responsible for an annual appraisal of Canadian uranium and thorium resources additional to reserves and for assisting in CANMET's companion appraisal of reserves.

The Geomathematics Section develops and applies methods for the quantification and statistical treatment of geoscience data in support of projects throughout the Geological Survey. Its main thrust is on mathematical models and statistical techniques applicable to mineral resource evaluation based on the deposit-type approach.

The Mineral Data Bank's main activity is the computerization of mineral deposit data, especially the development of a broad-coverage index-level file (CANMINDEX). It assists in the building and use of commodity-specific files, e.g. for iron which "hang" from the common index-level file, and special purpose files, e.g. for lead isotopes.

The Special Projects Unit undertakes responsibilities in matters such as regional resource evaluations, federal-provincial mineral agreements, and interbranch activities on industrial minerals and deep-sea mineral resources.

Highlights

Highlights of this year's achievements are reported in the succeeding sectional reports but two collective ones can appropriately be noted here.

The Canada-Manitoba Non-Renewable Resource Evaluation Program (NREP) was successfully completed. In this five-year program, a prototype joint federal-provincial metallic mineral resource appraisal study, projects were carried out by Manitoba's permanent and contract personnel in collaboration with staff of the Economic Geology Division. Interim results were released as Manitoba Open File reports. Seven final reports are being published in Manitoba's Economic Geology and Geological Papers series.

The report "Non-Hydrocarbon Mineral Resources of Parts of Northern Canada", prepared in response to an unscheduled demand, is channelled for Open File release. The title "parts of northern Canada" is conservative in that the report embraces essentially all of the federal territories north of the tree line. The production of such a report, especially on short notice, is possible only because of expertise and maturity of judgement borne of continuity of effort in metallogenic studies and data-base building. Continual sacrifice of this essential but generally unspectacular foundation work to short term pressures will court adversity.

Personnel Notes

Raymond A. Gaudreau became the Division's first Administrative Officer. A graduate of the University of Ottawa, he brings experience from the Department of Supply and Services and EMR's Technical Field Support Services and Property Planning and Management Division.

W.H. Poole joined the Division, Special Projects, in October.

MINERAL DEPOSITS GEOLOGY SECTION

R.I. Thorpe

The major objectives of the Mineral Deposits Geology Section are to:

(a) develop and maintain mineral deposits expertise on a national basis so that questions regarding resource potential or adequacy, whether posed on a national commodity or on a regional basis, can be answered, and

(b) contribute to the success of exploration efforts by the mineral industry.

To achieve these objectives, staff of the Section

(1) acquire and synthesize data on Canadian mineral deposit types, other than uranium, so that their common characteristics and critical differences are more fully appreciated,

(2) develop and improve genetic models, particularly for major deposit types, and test these models by further observation and research,

(3) study deposits of numerous types on a regional basis in order to better understand their formation in terms of the overall geological evolution of the region,

(4) improve the techniques and criteria used in making appraisals of mineral potential,

(5) assess regions as to their mineral potential.

The first two of these activities are generally pursued through commodity geology projects on a national basis. Major metal commodities receive ongoing study whereas other commodities, selected on the basis of economic and strategic priorities and availability of staff, are studied on a term basis.

The third activity is pursued, currently, in a small number of regional metallogeny projects. These integrate the data and conceptual models developed through commodity metallogenic studies with regional geological information available from published and unpublished sources and generated in the projects by directed field studies.

These Section studies are based on extensive fieldwork supplemented by laboratory studies and by monitoring the national and international literature on mineral deposit geology. Visits to foreign deposits contribute importantly to the ability to appraise mineral potential and to suggest geological settings or target areas in Canada that might warrant exploration.

The resource appraisals are conducted on an ad hoc basis in response to intermittant demands, which necessarily results in some disruption of the commodity-regional metallogeny program.

Mineral Deposits Laboratory

C.R. McLeod

The Mineral Deposits Laboratory prepares specimens for study, provides facilities for microscopy, photomicrography, particularly with regard to opaque minerals, and for special mineral separations in preparation for analyses. Its services are available to all Divisions.

Specimens are slabbed (sawn) for three main purposes: to provide a flat, fresh surface for examination, to divide the sample for various further uses, e.g. chemical analysis, and as a step toward further preparation, e.g. by polishing.

Preparation of polished sections involves cutting, mounting, grinding, impregnation and regrinding and three stages of machine polishing of the ground surfaces. Sections are polished for conventional ore microscopic study and for electron microprobe study.

Production statistics for the year are:

Specimens slabbed for:	
Economic Geology Division	1977
Resource Geophysics and Geochemistry Division	611
Central Laboratories and Administrative Services Division	9
Total	2597
Slabbed specimens polished for:	
Economic Geology Division	333
Resource Geophysics and Geochemistry Division	282
Total	615
Polished sections prepared for:	
Economic Geology Division	256
Resource Geophysics and Geochemistry Division	2
Central Laboratories and Administrative Services Division	5
Precambrian Geology Division	10
Total	273

Highlights

The Section was the core contributor to the report "The Non-Hydrocarbon Mineral Resources of Parts of Northern Canada". Assessments were made deposit type by deposit type for each of the numerous geologically defined sub-areas. They were based on analogies between the information on geology and mineral occurrences in the sub-area and the worldwide data base on mineral deposit geology.

Some quantitative characteristics of volcanogenic massive sulphide deposits were analyzed in a paper published this year. The study, based on eight districts in Canada and Japan, revealed a consistency in the size, metal content and deposit-size distribution of this deposit type. Deposits occur in clusters (average number is 12) associated with felsic volcanics at what, in most if not all cases, is a volcanic centre. The total base metal tonnage per volcanic centre has a remarkably narrow range (much narrower than the ore tonnage). About two-thirds of the metal lies in a single deposit. The second largest deposit contains about 13% and the others form a successively decreasing sequence. This kind of deposit modelling is an important input to mineral resource appraisal and has important implications for mineral exploration.

By combining field and laboratory data on base metal deposits with computer modelling of hydrothermal systems it has been possible to improve the genetic model for massive sulphide deposits. A conclusion is that the ore-metal chemistry of the hydrothermal fluids is governed not by the abundance of these metals in the source rocks but rather by the rock-forming mineralogy of that reservoir.

A bibliography on stratabound sulphide deposits in the Caledonian-Appalachian Orogen was contributed to and prepared for publication in support of the IGCP Caledonian Stratabound Sulphide Project.

An interpretative report on deposits visited in Mexico was prepared for that government's Consejo de Recursos Minerales. In response to one of the recommendations in the report, two of their staff visited Canada to study volcanic-associated massive sulphide deposits under G.S.C. guidance.

Studies on stratabound base metal occurrences in Carboniferous sequences in Nova Scotia and New Brunswick show that, in the Lower Windsor, minor conformable copper occurrences in paralic marine rocks are restricted to the basal contact of Lower Windsor limestone where it overlies continental red beds of the Horton or stratigraphically equivalent groups. In the Upper Windsor, on the other hand, somewhat similar copper occurrences are in oolitic, stromatolitic, and/or micritic limestones that are both underlain and overlain by red beds.

Lead isotope studies prove that the Rochon Lake (Ennadai Lake, N.W.T.) massive sulphide occurrence, which lies within the Churchill Province and could be either Archean or Aphebian, is Archean. The lead isotope studies suggest a Helikian age for strata-bound vein-like mineralization in volcanic rocks of presumed Archean age at Deadhorse Creek, north shore of Lake Superior. This opens the question of a possible Helikian age for the volcanics. For the North Shore of Lake Huron region, lead isotope studies have extended into Archean and Huronian terranes the known distribution of Keweenawan age base and precious metal mineralization.

The Dumont intrusion, northwest Quebec, has been subdivided into a lower Ultramafic Zone, consisting of Lower Peridotite, Dunite, and Upper Peridotite members, and an upper Mafic Zone. The stratigraphic position of the main Ni-sulphide-bearing horizon has been identified as the lower half of the Dunite member.

Petrological-chemical and computer modelling studies of the Dumont intrusion, northwestern Quebec, provide unequivocal evidence that gabbroic liquids containing as little as 5% MgO can be derived by fractional crystallization from peridotitic magmas containing more than 26% MgO.

Personnel Notes

E.R. Rose, who transferred from the Geological Survey of Newfoundland to the G.S.C. at the time Newfoundland joined Canada in 1949, retired at the end of 1979.

Arne Bjørlykke, a visiting scientist from the Geological Survey of Norway, arrived at the beginning of October, 1979, for a stay of about a year. His work has focussed on sandstone-hosted lead deposits and he is collaborating in G.S.C. on a review of this deposit type.

URANIUM RESOURCE EVALUATION SECTION

V. Ruzicka

The Uranium Resource Evaluation Section gathers, generates and interprets information on the geology or uranium-bearing deposits. It is responsible for an annual appraisal of Canadian uranium and thorium resources additional to reserves and for advising CANMET on geological questions related to its companion appraisal of reserves (reasonably assured resources). The appraisal encompasses a range from inferred extensions to reserves of producing mines and other well-identified deposits to prognosticated and speculative resources of less-explored uranium-bearing regions and to areas assumed on geological grounds to be favourable for uranium mineralization. Emphasis is on uranium; thorium resources are evaluated only where they are associated with uranium. The appraisals are based on extensive field and laboratory studies and on information supplied by the mineral industry from its exploration and exploitation activity. The appraisal, conducted in cooperation with provinces and Department of Indian and Northern Development, is an input to the management of Canada's uranium and nuclear energy policy.

Highlights

Appraisal of Canada's uranium and thorium resources additional to reserves (reasonably assured resources) as of 1978 was completed for 27 areas where resources are associated with identified deposits.

An additional 31 areas with speculative resources or favourable for the occurrence of uranium deposits were geologically appraised. The resulting internal report of some 300 pages was submitted on schedule to EMR's Uranium Resource Appraisal Group. Information from it was incorporated in the EMR publication "1978 Assessment of Canada's Uranium Supply and Demand". Again this year the report encompassed additional frontier areas, e.g. Arctic Islands.

Detailed mineralogical research on uranium and thorium mineralization related to granitic rocks has documented the sites and modes of occurrence of U and Th in, especially, ultra fine grained and amorphous parts of ores and protores. It demonstrated mechanisms, e.g. the formation and re-arrangement of complexes with elements such as Zr, Ti, Y and P, through which U and Th are mobile in response to even minor changes in geological environment. New applications of the scanning electron microscope were fostered in the course of this research.

Alteration studies on granitic rocks drew attention to transformations that promote a "self-sealing" cycle that decreases the rock permiability, useful in categorizing fractured plutons for nuclear waste management purposes.

The computerized file on uranium now includes more than 1800 occurrences. The entries were adapted this year to the international NEA/IAEA classification, in addition to being compatible with the rest of CANMINDEX.

The establishment of new quarters for storage and preparation of radioactive samples increased the safety and efficiency of the uranium program in G.S.C.

Recognition of relationships between uranium mineralization and the so-called "white alteration" (kaolinization) contributed to an advance in modelling of the unconformity-related deposit type.

Fieldwork in the Arctic Islands decreased the area rated as favourable for uranium mineralization. Specialized examination of various districts previously regarded as favourable on the basis of reconnaissance geological information showed that they lack features critical for the deposit type in question. "Negative discoveries" such as this are an important aspect of resource evaluation.

The Uranium Resource Evaluation Section contributed substantially to the report on the non-hydrocarbon mineral potential of parts of northern Canada, the section on Baffin Island in particular being a new frontier for evaluation.

Personnel Notes

J.A. Booth terminated her duties as clerk of the Uranium Resource Evaluation Section in August, 1979 to move with her family to Edmonton.

Stephanie A. Scully joined the Uranium Resource Evaluation Section as clerk in March, 1980. Her duties include, in addition to clerical work, custody of files from Atomic Energy Control Board on uranium exploration activity in Canada.

F.F. Langford, a visiting scientist from University of Saskatchewan, arrived on January 16, 1980 to work on uranium deposit studies during his sabbatical leave.

GEOMATHEMATICS SECTION

F.P. Agterberg

The Geomathematics Section's objective is to develop and apply methods for the quantification and statistical treatment of geoscience data in support of projects throughout the Geological Survey. Emphasis is on mathematical models and statistical techniques applicable to mineral resource determination through the deposit-type approach.

The Section was engaged during the year in the development of geostatistical crustal abundance models by means of which the grade-tonnage data for mineral deposits in large regions may be related to the corresponding metal concentration values in common rocks. Techniques for the automated quantification and multivariate statistical analysis of geoscience map data were further developed. Methods for the statistical ranking and scaling of biostratigraphic events were tested on Cenozoic foraminifera and Cretaceous nannofossils.

Highlights

Lognormal and exponential frequency distribution models have been applied to copper, zinc and other metals contained in mineral deposits of the Appalachian Region, the Abitibi Volcanic Belt of the Superior Province, and Canadian stratiform massive sulphide deposits. The results of these studies, as documented in three outside papers, have enhanced the viability of assessing the subeconomic mineral resources in large regions.

Mineral deposit data and rock units on unpublished geological compilation maps were automatically digitized by using equipment of the Geological Survey and at National Research Council Canada in order to obtain data bases amenable to numerical manipulations. A pilot study to integrate occurrences of mineralization with lithological information through multivariate statistical analysis was carried out for the southern parts of District of Keewatin.

A geostatistical method for the study of spatial clustering of mineral deposits and occurrences was developed and tested on a set of 1311 large and small gold deposits in the Abitibi area of the Canadian Shield. A separate event method and Jackknife verification procedure for correlating occurrences of mineral deposits of a specific type

with cell data quantified from maps was proposed and demonstrated on massive sulphide deposits in Newfoundland.

Probabilistic biostratigraphic correlation techniques were developed and applied to data on highest occurrences of foraminifera in wells on the Labrador Shelf and Grand Banks northeast of Newfoundland. Computer programs for the ranking and scaling of biostratigraphic events were implemented at the Atlantic Geoscience Centre in Dartmouth, N.S., and elsewhere in Canada as part of the Canadian contribution to project 148 (Quantitative Stratigraphic Correlation Techniques) of the International Geological Correlation Programme.

Personnel Notes

C.B. Hudson, a visiting scientist from the University of South Carolina, arrived in August for a 1-year stay.

F.P. Agterberg and A.G. Fabbri received an award from the International Association for Mathematical Geology for "Spatial Correlation of Stratigraphic Units Quantified from Geological Maps", selected as the best of the papers in the Journal of Mathematical Geology and the Journal of Computers and Geosciences.

MINERAL DATA BANK UNIT

D.D. Picklyk

The Mineral Data Bank retains overall responsibility for all commodity and metallogenic files of the Economic Geology Division. Curation and maintenance of rock and mineral suites used in research by officers of the Division is also a function of the Data Bank. The main building of document files and related collections takes place in the commodity and regional projects and of course remain in control of the project officer during that period. At present the main activities of the unit are the assembly, maintenance, retrieval and manipulation of a computerized mineral deposit data file called CANMINDEX and the curating of specimens collected for projects now completed.

Highlights

Much of the work of the Mineral Data Bank is in support of other projects and contributed to some of the highlights mentioned elsewhere, including the evaluation of the mineral potential of northern Canada.

Fifteen hundred new records were added to CANMINDEX and 2400 previous records were updated. The file now contains 12,000 records.

The advances this year include incorporation of the Manitoba file developed under NREP, update of all New Brunswick records, the acquisition through a co-operative program of more than 2,000 records from Quebec, and completion of the coding of the large copper file.

Reorganization and documentation of Economic Geology's extensive working collection of ores and host rocks is well under way.

An index of all Northwest Territories and Yukon mineral occurrences on file was provided to the Department of Indian Affairs and Northern Development.

Personnel Notes

L.M. "Bud" Cumming transferred to Mineral Data Bank in October.

Patricia Mann, an expert coder, left in June to move to Alberta but no further casual time was provided in replacement.

Patricia Ford of Canterbury High School was with us for the week of her school break, in March, as part of a work experience program.

D.D. Picklyk was appointed to head the Mineral Data Bank in June.

Attendance at Meetings, Conferences and Courses

F.P. Agterberg

Eighth Geochautauqua, Syracuse, NY, October, 1979.

American Institute of Mining Engineers, Society of Mining Engineers Fall Meeting, Tucson, Arizona, October, 1979.

United States Geological Survey Workshop on Mineral Resource Appraisal, Denver, Colorado, December, 1979.

Workshop on quantitative stratigraphic correlation techniques; International Geological Correlation Programme Project 148, Ottawa, February, 1980.

American Institute of Mining Engineers, Society of Economic Geologists meeting, Las Vegas, Nevada, February, 1980.

R.T. Bell

Prospectors and Developers Annual Meeting, Toronto, March, 1980.

C.F. Chung

Computer Science and Statistics: 12th Annual Symposium on the Interface, University of Waterloo, Waterloo, Ontario, May, 1979.

Joint Meetings of American Statistical Association, The Institute of Mathematical Statistics and the Biometric Society, Washington, D.C., August, 1979.

Eighth Geochautauqua, Syracuse, N.Y., October, 1979.

Workshop on quantitative stratigraphic correlation techniques; International Geological Correlation Programme Project 148, Ottawa, February, 1980.

L.M. Cumming

Youth Science Foundation, Annual Meeting, Ottawa, October, 1979.

K.M. Dawson

Society of Economic Geologists Field Conference and field tour on porphyry copper deposits in Tucson, Arizona, April, 1979.

Canadian Institute of Mining and Metallurgy District 6 Meeting, Vancouver, October, 1979.

Geoscience Forum, Whitehorse, December, 1979.

British Columbia-Yukon Chamber of Mines Annual Meeting, January, 1980

Geological Association of Canada, Cordilleran Section Symposium, Vancouver, January, 1980.

S.R. Divi

Computer Applications in the Earth Sciences - an Update of the 70's, Syracuse University, Syracuse, N.Y., October, 1979.

Workshop on quantitative stratigraphic correlation techniques; International Geological Correlation Programme Project 148, Ottawa, February, 1980.

American Institute of Mining Engineers - Society of Economic Geologists joint meeting, Las Vegas, Nevada, February, 1980.

J.M. Duke

Geological Association of Canada/Mineralogical Association of Canada Joint Annual Meeting, Quebec City, P.Q., May, 1979.

H.E. Dunsmore

Prospectors and Developers Association Annual Meeting, Toronto, March, 1980.

O.R. Eckstrand

Geological Society of America Penrose Conference, Komatiites, Abitibi region, Ontario, August, 1979.

A.G. Fabbri

5th International Congress for Stereology, Salzburg, Austria, September, 1979.

Computer applications in the Earth Sciences - an update of the 70's, Eighth Geochautauqua, Syracuse, NY, October, 1979.

Workshop on quantitative stratigraphic correlation techniques; International Geological Correlation Programme Project 148, Ottawa, February, 1980.

D.C. Findlay

Fundamental Issues in Management, Oxford Centre for Management Studies, Oxford, England, April-May, 1979.

J.M. Franklin

Institute on Lake Superior Geology, Duluth, Minnesota, May, 1979.

Ontario Geological Survey Symposium on Research and Mapping Activities, Toronto, December, 1979.

Geological Association of Canada/Mineralogical Association of Canada Joint Annual Meeting, Quebec, May, 1979.

D.F. Garson

Scientific Information Retrieval System (SIR), Energy, Mines and Resources Computer Science Centre course, Ottawa, November, 1979.

CYBER Control Language, Energy, Mines and Resources Computer Science Centre course, February, 1980.

Prospectors and Developers Association Annual Meeting, Toronto, March, 1980.

G.A. Gross

One of four principal resource leaders for the Commonwealth Geological Liaison Office Seminar on the Evaluation, Assessment, and Calculation of Mineral Resources, Bangalore, India, 26 March, 1979 to 04 April, 1979 for Geological Survey staff of Commonwealth countries of Southeast Asia, and provided about eight hours of lectures on resource appraisal methods exemplified by experience from the Geological Survey of Canada.

Geological Association of Canada/Mineralogical Association of Canada Joint Annual Meeting, Quebec, May, 1979.

United States Geological Survey Workshop on Mineral Resource Appraisal, Denver, Colorado, December, 1979.

M.N. Henderson

Wilson Symposium, Toronto, May, 1979.

Grenville Club Field Trip to La Malbaie, Quebec, September, 1979.

J.A. Kerswill

Newfoundland Department of Mines and Energy Third Annual Open House, St. John's, Newfoundland, November, 1979.

Scientific Information Retrieval System (SIR), Energy, Mines and Resources Computer Science Centre course, Ottawa, November, 1979.

R.V. Kirkham

Geological Association of Canada/Mineralogical Association of Canada Joint Annual Meeting, Quebec, May, 1979.

United States Geological Survey Workshop on Mineral Resource Appraisal, Denver, Colorado, December, 1979.

Ninth International Congress of Carboniferous Stratigraphy and Geology, Urbana, Illinois, May, 1979.

G.B. Leech

United States Geological Survey Workshop on Mineral Resource Appraisal, Denver, Colorado, December, 1979.

Prospectors and Developers Association Annual Meeting, Toronto, March, 1980.

C.R. McLeod

Institute on Lake Superior Geology, Duluth, Minnesota, May, 1979.

Scientific Information Retrieval System (SIR), Energy, Mines and Resources Computer Science Centre course, Ottawa, June, 1979.

A.R. Miller

Geological Association of Canada/Mineralogical Association of Canada Joint Annual Meeting, Quebec, May, 1979.

P. Moyd

Canadian Institute of Mining and Metallurgy Annual Meeting, Montreal, April, 1979.

Geological Society of America-Society of Economic Geologists, San Diego, California, November, 1979.

D.D. Picklyk

International Geological Correlation Programme Project 98: "Standards for Computer Applications in Resource Studies", 4th International Conference, Ixtapa, Mexico, April, 1979.

Career Assignment Program, Energy, Mines and Resources Opportunity for Management Training, Touraine, Quebec, June, 1979.

Managerial Grid Course, Energy, Mines and Resources Training and Development course, Ottawa, March, 1980.

N. Prasad

Scientific Information Retrieval System (SIR), Energy, Mines and Resources Computer Science Centre course, Ottawa, November, 1979.

W.H. Poole

Public Service of Canada symposium on "Impact of Science and Technology in Government and Department Policies and Legislation, Touraine, Quebec, April, 1979.

International Geological Correlation Program, Caledonide Orogen Project 27, International Meeting, Blacksburg, Virginia and field trips, August-September, 1979.

Canada-Nova Scotia Mineral Development Subsidiary Agreement, Geotechnical Subcommittee meetings, Halifax, Nova Scotia, October, 1979.

Canada-Newfoundland Mineral Development Subsidiary Agreement, Geological Mapping Subcommittee meetings, St. John's, Newfoundland, October, 1979 and January, 1980.

International Geological Correlation Programe, Caledonide Orogen Project 27, Canadian Working Committee meeting, Halifax, Nova Scotia, January, 1980.

Advisory Council on Engineering, Queen's University, Kingston, Ontario, February, 1980.

Geological Society of America, Northeastern Section Annual Meeting, Philadelphia, PA, March, 1980.

J.Y.H. Rimsaite

Geological Association of Canada/Mineralogical Association of Canada Joint Annual Meeting, Quebec, May, 1979.

International Atomic Energy Agency Technical Committee Meeting on Geology of Vein- and Similar-Type Uranium Deposits, Lisbon, Portugal, September, 1979.

Geochemistry of Nuclear Waste Management Workshop, Pinawa, Manitoba, October, 1979.

S.M. Roscoe

Geoscience Forum and Gold Workshop, Yellowknife, December, 1979.

Prospectors and Developers Association Annual Meeting, Toronto, March, 1980.

V. Ruzicka

Organization for Economic Cooperation and Development Nuclear Energy Agency/International Atomic Energy Agency (OECD NEA/IAEA) meeting on Project 7 "Recognition of Uranium Provinces" sponsored by the Institute of Geological Sciences; London, England, December, 1979.

D.F. Sangster

Wilson Symposium, Toronto, May, 1979.

International Geological Correlation Programme Project 60, Correlation of Caledonian Stratabound Sulphides Symposium, Norway, September, 1979.

W.D. Sinclair

Geological Association of Canada/Mineralogical Association of Canada Joint Annual Meeting, Quebec, May, 1979.

R.I. Thorpe

1980 Symposium on Archean Volcanic-Hosted Gold Deposits, Waterloo, Ontario, March, 1980.

L.P. Tremblay

Canadian Institute of Mining and Metallurgy Annual Meeting, Montreal, Quebec, April, 1979.

Saskatchewan Geological Survey Open House, Regina, Saskatchewan, October, 1979.

Colloque sur l'industrie minerale au Quebec, University of Quebec in Chicoutimi, November, 1979.

Special Talks or Lectures

F.P. Agterberg

Conducted sessions on geostatistics and Canadian case history studies of mineral resource estimation (with G. Gross) during Commonwealth Geological Liaison Office-sponsored workshop in Bangalore, India, March-April, 1979.

"Cenozoic continental margin foraminiferal stratigraphy - A Statistical Approach", talk presented at University of Utrecht, Holland, April, 1979.

"Probabilistic stratigraphy and industrial applications" (with F. Gradstein), presented at International Geological Correlation Programme Project 148 meeting at Bedford Institute of Oceanography, Dartmouth, Nova Scotia, August, 1979.

"Geochemical crustal abundance models", invited talk presented at American Institute of Mining Engineers meeting in Tucson, Arizona, October, 1979.

"Computers as an aid in mineral-resources evaluation", invited talk presented at the Eighth Geochautauqua in Syracuse, NY, October, 1979.

"Application of image analysis and multivariate analysis to mineral resource appraisal", invited talk presented at Society of Economic Geologists meeting, Las Vegas, Nevada, February, 1980.

"Ordering and clustering of biostratigraphic events: Model verification methods"; talk presented at International Geological Correlation Programme Project 148 meeting, Ottawa, February, 1980.

"Spatial Analysis"; course GOL860 taught at Syracuse University, February-March, 1980.

"Statistics in Geology"; course GE03100 taught at University of Ottawa, January-April, 1980.

R.T. Bell

"Uranium in Western Canada"; informal (1½ hr) talk to Power Reactor and Nuclear Fuel Development Corporation staff in Tokyo Japan, October 11, 1979 and again to their branch staff in Toko-ri, Chubu, Japan, October 12, 1970.

C.F. Chung

"A system of interactive graphic computer programs for multivariate statistical analysis for geological data"; presented at Computer Science and Statistics: 12th Annual Symposium on the Interface, University of Waterloo, Waterloo, Ontario, May, 1979.

"Regression models for estimating mineral resources from geological map data"; presented at Joint Meetings of American Statistical Association, the Institute of Mathematical Statistics and the Biometric Society, Washington, DC, August, 1979.

"Use of multivariate statistical analysis for resource analysis"; Office of Resource Analysis, U.S. Geological Survey, Reston, VA, October, 1979.

L.M. Cumming

Series of talks on geology of National Parks and foreign lands at Extendicare, Ottawa, Baffin Island and Kejimkujik, November, 1979; Iran, January, 1980; India, February, 1980; Gros Morne, February, 1980.

"Field Operations of the Regional Geology and Economic Geology Divisions of the Geological Survey of Canada", Alice Wilson Hall to visiting university students from Montreal, February, 1980.

K.M. Dawson

"1978 Exploration activity in northern Cordillera"; presented a review to Geological Survey of Canada staff in Calgary and Ottawa, April, 1979.

...

"1979 Exploration in Northern Cordillera"; talk presented to the Mining Exploration Group, Calgary, March, 1980.

S.R. Divi

"Application of Discriminant Analysis to Evaluate Compositional Controls of Stratiform Massive Sulphide Deposits in Canada"; Office of Resource Analyses, U.S. Geological Survey, Reston, VA, October, 1979.

"Resource Evaluation of Stratiform Massive Sulphide Deposits in Canada by Means of Discriminant Analysis"; Society of Economic Geologists Symposium on Mineral Resource Appraisal, Las Vegas, Nevada, February, 1980.

J.M. Duke

"Genetic Models of Magmatic Sulphide Deposits"; lecture given to Geological Survey of Canada staff, Ottawa, April, 1979.

"Ultramafic Metavolcanic Rocks"; short course on metavolcanic rocks (with O.R. Eckstrand) at Carleton University, Ottawa, May, 1979.

O.R. Eckstrand

Workshop presentation at Carleton University on field aspects of ultramafic flows, Ottawa, April, 1979.

A.G. Fabbri

"Image processing of geological map patterns and biological specimens"; lecture presented at International Geological Correlation Program, Project 148 meeting (with K. Merritt), Ottawa, February, 1980.

J.M. Franklin

"Massive Sulphide Genetic Processes"; presented at the United States Geological Survey, Denver, CO, May, 1979.

"Beidelman Bay Porphyry Cu-Au", Geological Association of Canada/Mineralogical Association of Canada Joint Annual Meeting, Quebec, May, 1979.

"Precambrian VMS deposits"; Institute on Lake Superior Geology, Duluth, May, 1979.

"Massive Sulphide Genetic Processes"; as Canadian Institute on Mining and Metallurgy Visiting Lecturer gave this talk to University of Alberta, University of Manitoba, Brandon University and University of Saskatchewan students, October, 1979.

...

"Geological Survey of Canada bedrock geoscience program in relation to resources evaluation", Mineral and Energy Policy Sector, February, 1980

"Submarine Debris Flows", Carleton University.

"Physical volcanology in relation to massive sulphide deposits", Carleton University.

G.A. Gross

Organized a Special Session on the Mineralogy and Petrology of the Quebec-Labrador Iron-formations for the Annual meeting of the Mineralogical Association of Canada which included 16 papers, two being presented by G.A. Gross, Quebec, May, 1979:

"A Classification of Iron-Formation Related to Depositional Environments";

"A preliminary assessment of the Chemical Composition of Iron-Formations in Canada (with C.R. McLeod)"

Scientific program Coordinator and Tour Director for the visit of Minister Sun Daguan and his delegation of 11 senior executives from the Bureau of Geology, Peoples Republic of China, with responsibility for program organization involving government, industry, and universities, April-May, 1979.

R.V. Kirkham

Addressed delegation from the People's Republic of China, Ottawa, April, 1979.

"Base metal distribution along the Windsor-Horton contact (Visean) Atlantic provinces, Canada", Ninth International Congress of Carboniferous Stratigraphy and Geology, Urbana, Illinois, May, 1979.

Presented introductory talks on porphyry deposits in the Canadian Shield and Canadian Appalachians at Geological Association of Canada/Mineralogical Association of Canada Joint Annual Meeting, Quebec, May, 1979.

G.B. Leech

"The Geological Survey of Canada's program in Economic Geology", talk presented to Director General and senior scientists of State Bureau of Geology, People's Republic of China, Ottawa, May, 1979.

"Synopsis of Canada's mineral resource geology", talk presented to delegation on applied geology, Ministry of Machine Building, People's Republic of China, Ottawa, September, 1979.

A.R. Miller

"Geochemical expression of Proterozoic uranium occurrences, Richmond Gulf, New Quebec and Baker Lake, N.W.T., Canada", Geological Association of Canada/Mineralogical Association of Canada Joint Annual Meeting, Quebec, May, 1979.

"Uranium geology of the Baker Lake and Thelon Basins, N.W.T. with comparisons to the Beaverlodge-Athabasca Bains, Saskatchewan", University of Ottawa, March, 1980.

J.Y.H. Rimsaite

"Isotopic studies of lead-depleted pitchblende, secondary radioactive minerals and sulphides from the Rabbit Lake uranium deposit, Saskatchewan", coauthored with L.M. Cumming and presented by J.Y.H. Rimsaite at the Geological Association of Canada/ Mineralogical Association of Canada Joint Annual Meeting, Quebec, May, 1979.

"Chemical and Isotopic evolution of radioactive minerals in remobilized vein-type uranium deposits, Saskatchewan, Canada", International Atomic Energy Agency, Technical Committee Meeting on Geology of Vein-and Similar-type uranium deposits, Lisbon, Portugal, September, 1979.

"Low temperature hydrothermal alteration of minerals in granitic rocks", Geochemistry of Nuclear Waste Management Workshop, Pinawa, Manitoba, October, 1979.

S.M. Roscoe

"Regional metallogenic studies", talk presented to delegation from State Bureau of Geology, People's Republic of China, Ottawa, May, 1979.

V. Ruzicka

"Geology and metallogeny of uranium related to exploration in Canada", talk presented to the Delegation of the State Bureau of Geology from the People's Republic of China, Ottawa, May, 1979.

"Metallic elemental assemblages in Canadian uranium deposits", Geological Association of Canada/Mineralogical Association of Canada Joint Annual Meeting, Quebec, May, 1979.

"Types of uranium deposits, concepts in resource evaluation and reserve estimates in British Columbia relative to Canada and the world", presented at the Royal Commission of Inquiry into uranium mining in British Columbia, Vancouver, September, 1979.

"World uranium resources in prospect", presented at the Canadian Energy Research Institute, Calgary, October, 1979.

D.F. Sangster

"Distribution and origin of Precambrian Massive Sulphide Deposits within the North American continent", Wilson Symposium, Toronto, May, 1979.

"Correlation of stratabound sulphide deposits in the North American Appalachians: A discussion", presented at Correlation of Caledonian Stratabound Sulphides Symposium, Trondheim, Norway, September, 1979.

"Metal content and size distribution of massive sulphide deposits in volcanic centres", presented at Bundesanstalt fur Geowissenschaften und Rohstoffe (Federal Institute for Geosciences and Natural Resources), Hannover, West Germany, August, 1979.

"Overview of shale-hosted Pb-Zn deposits" presented at McGill University, Montreal, January, 1980.

"Geological characteristics of sediment-hosted Pb-Zn deposits with possible applications to Quebec", presented at the Institut national de la recherche scientifique - Pétrole, Quebéc, January, 1980.

W.D. Sinclair

"Porphyry copper-molybdenum mineralization in the Matachewan area, Ontario", Geological Association of Canada/Mineralogical Association of Canada Joint Annual Meeting, Quebec, May, 1979.

L.P. Tremblay

"Factors affecting uranium exploration in Canada", informal talk to a group of scientists from European Economic Communities, June, 1979.

"Athabasca unconformity deposits, Saskatchewan, Canada", informal talk to delegation from People's Republic of China, September, 1979.

"Geologie de la Region de Beaverlodge et comparaison des gîtes Beaverlodge et discordance", given on the occasion of the Colloque du l'industrie minerale au Quebéc, Université du Quebéc in Chicoutimi, November, 1979.

"Comparison of Beaverlodge and Unconformity Deposits in Saskatchewan", informal talk given to the geology students of the Université du Quebéc à Chicoutimi, February, 1980.

Membership on Committees

F.P. Agterberg

Canadian Mining and Metallurgical Bulletin, Associate Editor for Mathematical Geology and Geostatistics as of May, 1979.

Commission on Tectonics of Ore Deposits Working Group No. 3, Chairman.

Computers and Geosciences, Editorial Advisory Board.

Geo-Processing, Editorial Board.

International Association for Mathematical Geology, Councillor.

International Geological Correlation Program Project 148, Quantitative Stratigraphic Correlation Techniques, Director, as of October, 1979.

Syracuse University, Adjoint Professor of Geology.

University of Ottawa, Non-resident Professor and Graduate School member.

J.J. Carriere

Geological Survey of Canada Christmas Party Committee, member, 1979.

C.F. Chung

Branch Computer Facilities Committee, member.

Journal of the International Association for Mathematical Geology, Editorial Correspondent.

L.M. Cumming

Geological Association of Canada, Youth Science Foundation Committee, member.

18th Canada-wide Science Fair, Judge of Earth Science exhibits.

K.M. Dawson

Circum-Pacific Map Project, Metallogenic Map Committee, Canadian Cordillera, representative.

Geological Association of Canada, Mineral Deposits Division, Newsletter editor.

Geological Association of Canada, Mineral Deposits Division, Duncan Derry Medal Committee, member.

J.M. Duke

Canadian Geoscience Council Committee on International Scientific Relations, member.

Canadian Institute of Mining and Metallurgy, Ottawa Branch, Sessions and Services Chairman.

International Geological Correlation Programme, Project 161 "Sulfide deposits in mafic and ultramafic rocks", participant.

Mineralogical Association of Canada, secretary.

O.R. Eckstrand

Canada-Manitoba Non-Renewable Resource Evaluation Program, Geotechnical Advisory Subcommittee, member.

Mineralogical Association of Canada, Hawley Award Committee, member.

A.G. Fabbri

International Association on the Genesis of Ore Deposits: Commission on the Tectonics of Ore Deposits, secretary-treasurer.

International Association on the Genesis of Ore Deposits: Working Group 3 - Statistical Treatment of Tectonics and Mineral Deposit Data, secretary.

D.C. Findlay

Ad Hoc Committee for Management of the Departmental Minerals Program, secretary.

Canada-Federal Republic of Germany Agreement on Science and Technology, representative for Canada during discussions.

Canada-Manitoba Non-Renewable Resource Evaluation Program, Management Committee, cochairman.

Canada-Newfoundland DREE-EMR Mineral Development Agreement, Evaluation Subcommittee, member.

Canada-Saskatchewan DREE-EMR Mineral Development Agreement, Management Committee, member.

Canadian Institute of Mining and Metallurgy, Ottawa Branch, executive.

Centre for Engineering, Scientific and Learned Societies, secretary.

J.M. Franklin

Canada-Manitoba Non-Renewable Resource Evaluation Program, Geotechnical Advisory Subcommittee, member.

Canada-Saskatchewan Mineral Exploration and Development Subsidiary Agreement, Geotechnical Advisory Committee, member.

Canadian Institute on Mining and Metallurgy, Ottawa Branch Executive Committee, member.

Canadian Institute of Mining and Metallurgy, Organizing Committee for Geology Division Field Conference (Val d'Or-Timmins), member.

Geological Association of Canada, Special Volume on "Precambrian Stratiform Ore Deposits, co-editor.

Geoscience Canada, Associate Editor.

Economic Geology, Associate Editor.

G.A. Gross

Canadian Working Group in Applied Geology, Canada-USSR Mixed Commission on Economic, Industrial, Scientific and Technical Cooperation, Coordinator.

Energy, Mines and Resources Coordinating Committee on Ocean Mining (DCOM), member.

International Geological Correlation Programme, Project 91 - Metallogeny of the Precambrian, coordinator; Project 132 - Basins of Iron Formation Deposition, coordinator; Project 111 - Canadian Liaison, Genesis of Manganese Ore deposits, coordinator.

Precambrian Research, Editorial Board.

R.V. Kirkham

Canada-Nova Scotia Mineral Development Subsidiary Agreement, Geotechnical Advisory Subcommittee, member.

R.M. Laramee

Energy, Mines and Resources Computer Science Centre Data Management User's Group.

G.B. Leech

Energy, Mines and Resources Uranium Resource Appraisal Group, member.

Commission for the Tectonics of Ore Deposits, International Association on the Genesis of Ore Deposits, member.

Committee for the Metallogenic Map of North America, member.

International Association on the Genesis of Ore deposits, Assistant Secretary General.

C.R. McLeod

Energy, Mines and Resources Committee for Ocean Mining, Working Group for Deep Ocean Mining, member.

Geological Survey of Canada, Safety Committee, member.

P. Moyd

Canadian Institute of Mining and Metallurgy, Geology Division Special Volumes Committee, representative.

Energy, Mines and Resources Intradepartmental Liaison-Industrial Minerals (ILIM), chairman.

Geological Survey of Canada, Library Policy Committee, member.

Industrial Minerals Division, Nominating Committee, chairman; Membership Committee, chairman.

D.D. Picklyk

Branch Computer Facilities Committee, cochairman.

Canada-Manitoba Non-Renewable Resources Evaluation Program, Geotechnical Advisory Subcommittee, member.

Canada-Newfoundland Mineral Development Agreement, Advisory Committee on matters relating to data processing, member.

Canada-Saskatchewan Mineral Exploration and Development Subsidiary Agreement, Geotechnical Advisory Committee, member.

Departmental Computer Working Committee, member.

Departmental Data Management User's Group, chairman.

Geological Survey of Canada Petrographic Collection Advisory Committee, member.

International Geological Correlation Programme, Project 98 - Standards for Computer Applications in Resource Studies, executive member and Canadian contact.

W.H. Poole

Canada-Newfoundland Mineral Development Program, Geological Mapping Subcommittee, member.

Canada-Nova Scotia Mineral Development Program, Geotechnical Subcommittee, member.

Geological Society of America, Northeastern Section, chairman.

International Geological Correlation Programme, Project 27 - Caledonide Orogen, Canadian Working Committee, secretary.

Queen's University Advisory Council on Engineering, Geological Engineering Subcommittee, chairman.

J.Y.H. Rimsaite

Clay Minerals Society, Ad Hoc Committee Clay Data Handbook, member.

V. Ruzicka

Energy, Mines and Resources Uranium Resource Appraisal Subcommittee on Estimated Additional Resources, chairman.

Steering Committee for Nuclear Energy (Organization for Economic Cooperation and Development Nuclear Energy Agency) Steering Group on Uranium Resources, member; Working Party on Uranium Resources, member.

Working Group for Research and Development of the Organization for Economic Cooperation and Development, Nuclear Energy Agency and International Atomic Energy Agency (OECD NEA/IAEA), Sub-group 7C - Metallogeny of Uranium Provinces, chairman.

D.F. Sangster

Carleton University, Ottawa, Honorary Adjunct Professor.

Geological Association of Canada, Mineral Deposits Division, Program Chairman.

International Association on the Genesis of Ore Deposits, Chief Treasurer.

International Geological Correlation Programme, Project 60 - Correlation of Caledonian Stratabound Sulphides, Canadian National Representative.

Université du Quebéc à Chicoutimi, M.Sc. Graduate Program Committee, member.

Canada-Germany Scientific-Technical Cooperation Project 3.2.1.7 - Massive and stratiform Cu-Pb-Zn-barite deposits, Canadian Project Leader.

L.P. Tremblay

Quebec Department of Education FAC (Formation de chercheurs et action concertee) Committee, member.

Canada-Saskatchewan Mineral Exploration DREE Program, Technical Advisory Subcommittee, member.

GEOLOGICAL INFORMATION DIVISION

R.G. Blackadar

Most parts of the Science and Technology Sector of the Department are concerned with providing information. Our sector is not a regulatory body nor is it concerned with providing direct service to the public. The data collected by Geological Survey staff must in most cases be processed to make them useable by our clients whether in government, industry or by the general public. The dissemination of scientific knowledge is the objective of this division. We meet it by a publication and information program that includes the preparation of text for printing and Open File release, the production of geological and other thematic maps, a monthly notification system that informs about 4 800 addresses of new releases, and the maintenance of Canada's largest earth science library.

Input into our publication program is governed by the output of the operating divisions but as our work force is essentially fixed and works at capacity, not too much is gained by forecasting a major bulge in work one or two years ahead, although it is most useful to know in advance of specific large jobs.

The division provides a comprehensive scientific publication program by means of Geological Survey Memoirs, Bulletins, Economic Geology Reports, Papers, Maps and Open Files requiring in-house capabilities in scientific editing, manuscript preparation, geological cartography and associated photomechanical services and technical photography. We maintain Canada's principal earth science library as a data base for the Survey's research program and for the geoscience community. Information on the Survey's program is disseminated by selling and distributing Geological Survey reports and maps and exchanging them with other institutions; by displays at national and international meetings; by informing the user public of the release of Geological Survey publications and other information releases by means of regular information circulars; and by meeting specific requests for information from the public by means of written communications, publications and direct telephone response on listed technical enquiry number.

During the reporting period a major change was initiated in the method by which our formal publications are processed. Traditionally scientifically edited copy was forwarded through the EMR Departmental editors to contract printers for typesetting, layout and printing. This method was retained for most memoirs, bulletins and economic geology reports until 1979 when rapidly rising printing costs resulted in a complete switch to the use of Word Processing techniques for all reports. Papers have for some years been processed in-house at first using standard typewritters, but more recently an integrated Xerox 850 word-processing system. The complete shift away from conventional typesetting resulted in a much greater volume to be handled and part of the text processing is now contracted out to commercial

firms. The results of the first contract work are expected in May, 1980. Although there will no doubt be teething problems, the saving of nearly 50 per cent in the cost per printed page fully justifies the switch.

In December 1979 the 850-page Economic Geology Report 31 "Geophysics and Geochemistry in the Search for Metallic Ores" was published. This book was processed entirely in-house from text edited by Peter Hood of RGG Division. Much credit is due to the scientific editorial staff, to Leona Mahoney, Mike Kiel and Lorna Firth who carried out the production editing and layout work and to the staff of the Word-Processing unit under the direction of Debbie Busby and Sharon Parnham who processed the more than 2 000 pages of manuscript. Although we are proud of the result the effect of processing such a major report was to delay some aspects of our regular publication program for 6 months or more.

The restraint program announced by the Federal Government in June 1979, coupled with several unusually expensive "classical" printing jobs resulted in the publication budget being exhausted by mid-summer and until it was possible for Branch management to divert about $100 000 from divisional budgets no publications were sent for printing. As a result production appears somewhat low for 1979-80. When new funds became available early in 1980 jobs on hand were sent for printing and by April 1980 the normal publication flow had been resumed.

Other publishing highlights during the year were the release of Bulletin 280 "Geochemistry of gold and its deposits" by R.W. Boyle, the 3-part, 950-page "Current Research/Recherche en Cours" and the first five 1:1 000 000 geological atlas maps in English and French editions.

Peter Harker retired from the Public Service on June 29th and I acted as director of the division until mid-March 1980 when my appointment as director was announced by the Public Service Commission. Mrs. Lise Hyde, a term employee who had admirably filled the duties of divisional secretary left on maternity leave. Her departure coincided with a hiring freeze and Mrs. Jane Carr of the Program Office kindly agreed to assist us on a half day basis. This arrangement continued until early February when permission to staff the vacant secretarial position was obtained and Miss Diane Plourde joined our staff.

Reorganization of the Branch in 1979-80 resulted in a redefinition of the Data Systems Group's rôle. Ms. G.M. Martin and T. Scaga were transferred to this division and Ms. Martin continues to offer Branch scientists advice on computer programs.

STATUS OF GEOLOGICAL MANUSCRIPTS ON MARCH 31, 1980

WITH COMPARABLE FIGURES FOR 1976-77,77-78,78-79

Type of Report	In Process[1] 79-80	78-79	77-78	76-77	Published During Year 79-80	78-79	77-78	76-77
Memoirs	9	14	18	9	2	2	1	1
Bulletins	32	40	53	21	16	11	9	14
Economic Geology Reports	1	2	1	0	1	1	1	-
Miscellaneous Reports	0	0	2	1	1	1	0	1
Multicolour Maps*	-	-	-	-	15	20[2]	28	10
2-Colour Maps	-	-	-	-	6	-	-	-
Papers	32	23	58	20	20	29	34	50
Open File Reports			0	0	110	96	92	111
Geophysical maps (microfiche)		40	34		105			

[1] Includes I.S.P.G. and T.S. editorial units and reports with Info. EMR for editing and printing.

[2] Includes only separately available items.

* For maps see report of Cartographic Unit.

MEMBERSHIP ON COMMITTEES

R.G. Blackadar

Branch Management Committee
EMR Publishing Study
Chairman, GEOSCAN Subcommittee, NGSC
Branch co-ordinator, Metric Conversion
Branch Library Committee

P.J. Griffin

Branch Handicapped People Program
Department Subcommittee on 1:1 million maps

LIBRARY SERVICES

A.E. Bourgeois

MANAGEMENT ACTIVITIES

The library has had to reevaluate its collection policy and cut back its purchasing to eliminate most of the peripheral literature. As a result 250 periodical subscriptions were cancelled and monographs were purchased on an urgent basis only.

The introduction of automated systems was planned and workflow patterns amended to meet the new requirements of the systems.

TECHNICAL SERVICES ACTIVITIES

GSC Periodicals List

The periodicals holdings records were brought up-to-date and a major coding project finished. The automated list of serials will be produced early in the new fiscal year.

Automated Cataloguing Support System

The library is now participating in an automated support System through the University of Toronto Library Automated Systems (UTLAS) network. The cataloguing staff has been trained in coding and on-line inputting; equipment has been installed and the coding backlog has been reduced to a minimum.

AACR2

The new revised Anglo-American Cataloguing Rules (AACR2) has been studied as to its effect on the library's cataloguing practices. Partial implementation has begun and further analysis will be carried out.

INFORMATION SERVICES ACTIVITIES

The Map Library

The map library has finally made the transition from a map reading room to a library with full services. A Map Librarian was hired and a major reorganization is now underway. The physical organization and identification of the collection was planned, and the first phase has begun. The recording of map series, the repair of damaged maps and the filling in of gaps in series are all underway.

Russian Monographs

A project of identifying and listing the Russian monographs was undertaken and an updated list of Russian monographs held in the library is now under preparation. New titles added to the collection will be announced in the Library's Accession List.

GSC Annual Reports

A project to document more fully the branch's annual reports to identify the various series and fill in missing issues has been carried out,

CAN/SDI

A major revision in CISTI's pricing policy for CAN/SDI services caused unprecedented demands on the CAN/SDI staff. A project was undertaken to inform clients of the changes and revise profiles so that they would be more cost-effective.

Georef

The library was instrumental in acquiring the Georef data base for inclusion in CAN/OLE, Cisti's on-line service. The result will mean more economical searches for the geological community in Canada.

PERSONNEL CHANGES

Ms. Tara Naraynsingh was appointed to the position of Map-Librarian.

COMMITTEE MEMBERSHIPS

Annette E. Bourgeois

- Editor for the Association of Chief Librarians of National Geological Surveys
- Branch representatives on the Standing Committee of Chief Librarians of EMR
- Member of the Council of Federal Libraries

David Reade

- Library's representative on the CAN/SDI Committee

Alan Wilcox

- Branch representative on the Geoscan Advisory Committee

Myra Owen

- Member of the Committee on Conservation/Preservation of Library materials, Council of Federal Libraries

Elizabeth Frebold

- Member of the Working Group on Service to External Users, Reader Services Committee, Council of Federal Libraries

CONFERENCES ATTENDED

Annette E. Bourgeois

Canadian Library Association, Annual Conference, 1979, Ottawa

David Reade

Canadian Library Association, Annual Conference, 1979, Ottawa

Alicia Prata

Canadian Library Association, Annual Conference, 1979, Ottawa

Myra Owen

Canadian Association of Information Science, 1979, Banff

Liz Frebold

Canadian Association of Map Libraries, 1979, St. Catherines

STATISTICS 1979-1980

1.	REFERENCE	
	1.1 Library enquiries	3845
	1.2 Automated retrospective searches	509
2.	CIRCULATION	
	2.1 Monographs and serials	
	2.1.1 To GSC staff	15065
	2.1.2 To other individuals	2146
	2.2 Table of contents	2068
	2.3 Maps	612
	2.4 Open-files/central technical files	423
3.	INTERLIBRARY LOANS	
	3.1 Lending	4851
	3.2 Borrowing	895
4.	CAN/SDI PROFILES	
	4.1 Added	15
	4.2 Cancelled	17
	4.3 Updated	108
5.	COLLECTION GROWTH	
	5.1 Monographs (volumes)	978
	5.2 Serials (issues)	12172
	5.3 Open files	300
	5.4 Maps (sheets)	1184
	5.5 Microforms (reels or fiche sets)	91
	5.6 Withdrawals (volumes)	3200
6.	CATALOGUING (titles)	
	6.1 Monographs	894
	6.2 Serials	113
	6.3 Microforms	74
	6.4 Analytics	74
	6.5 Maps, open files, central technical files	891
	6.6 Items indexed for GEOSCAN data base	2213

7.	ACQUISITIONS	
	7.1 Monographs	575
	7.2 Serials	
	7.2.1 New subscriptions	36
	7.2.2 Renewals	147
	7.2.3 Total	183
	7.3 Microforms	1114
	7.4 Maps	478
8.	TRANSLATIONS	
	8.1 Requests processed	165
9.	EXCHANGE AGREEMENTS	
	9.1 Added	58
	9.2 Revised	311
	9.3 Cancelled	7

DATA SYSTEMS

G.M. Martin

Early in the year, the Data Systems Group was moved from the Director General's Office and staff reassigned to other Divisions. Don Picklyk was transferred to Economic Geology Division; Terry Gordon continued to work on problems in handling spatial data within the Precambrian Division. The Group was reformed in Geological Information Division and now consists of Gwynneth Martin and Teja Scaga. The objectives of the Group are unchanged, namely to act as specialist consultants to Divisions, to advise Branch management on computer use and to provide continuing administration of the operation of Branch systems.

The primary consulting task during the year has been to produce a feasible system design for the management of marine geophysical data at the Atlantic Geoscience Centre. This is due for completion in May 1980 and includes progress towards System development. Other work was done to assist Survey staff in the production of various types of graphic output.

The Group continued to provide for the operation of the EAI plotter and upgraded the relevant software to be compatible with that for other display devices now available in the Department. The annual EDP Report and Plan was compiled and the Branch response to the 1981 Departmental Study of Computing Requirements co-ordinated and delivered to the Study team. Subsequent to this, Gwynneth Martin was seconded to Planning and Evaluation to assist in the Study on a part-time basis.

MEMBERSHIP ON COMMITTEES

Gwynneth M. Martin

Member, COGEODATA Committee on data Capture and Data Display

Member, COGEODATA Committee on Data Structures and Data Management

GEOLOGICAL CARTOGRAPHY SECTION

J.G. Roberts

The major internal thrust during the reporting year was to decrease project throughput time by streamlining some operations and deleting others without incurring a significant loss of quality in the final printed product. Efforts in this direction were partially successful and output was improved, however this is not reflected in the production statistics due to project carryovers from previous years.

The job progress reporting system implemented on April 1, 1979 has proven adequate and we now have statistical records of actual time spent by draftsmen for all jobs worked on during the fiscal year. At years end it was expanded to include the photo-mechanical operations and materials. In the future this system will provide yardsticks for job time/cost estimating and productivity monitoring.

The aim of all of the above is that under normal circumstances the elapsed time from receipt of authors manuscripts to final publication should not exceed 1 year for most maps.

Of growing concern throughout the year was the lengthy time required to produce "B" series terrain maps. The original estimate of 70 hours per sheet ballooned to a high of 588 hrs for one sheet and averaged more than 240 hours for the 43 sheets worked on. This was largely due to replacement of non-legible reference letter symbolization on many of the first group of maps submitted and some problems with graphic patterns delineating special features. Terrain Science Division and authors are aware of these problems and have taken steps to ensure that future map sheets are compiled for direct reproduction.

In February/March 1980 4 experimental aeromagnetic maps and one geochemical map were printed using "Applicon" imagery prepared by R.G.G. Division. The repro-graphics including plating and printing expended less than 40 hours per sheet. These test maps were still at user appraisal stage on March 31.

Multicolour Map production by automation continued in a "pause" situation throughout the year, mainly due to assessment of current state-of-the art and practicability of enhancement of our system for Graphic output. However, the hardware was fully utilized for point and line digitizing of geochemical and geophysical data. The main emphasize was on digitizing map sheets for the Magnetic Anomalies map of the Arctic Islands. We ended

the year on target having produced for this project, 160 map tapes in as many days. Other miscellaneous projects account for a further 26 days of point digitizing time.

In May/79 G.S.C. Cartography Supervisors, Checkers and Specialists from A.G.C., I.S.P.G. and headquarters held a two day workshop in Ottawa. A wide range of topics was covered including special regional requirements for NTS base maps, typesetting, map production methodology and photo-mechanical techniques. It was unanimously agreed that the presentations on advances in technology and the exchange of ideas were highly beneficial to all. It was recommended that this become a biennual event to ensure current and consistent expertise in all Branch cartography offices.

As the result of an idea discussed at the workshop the Photo-Mechanical unit with the assistance of the cartographers developed an economical three colour printing system which will be tested early in the 1980-81 F/Y for possible use on bedrock and surficial geology maps.

The Section lost 2 positions in the overall staff cut back last Spring, both of which were at the staffing stage. One was a new CS position for further development of automation, the other a senior unit supervisory job which required considerable reshuffling of responsibilities and that particular unit has been working under a handicap for the past year.

Section strength was 54 M/Y's and all positions were occupied for the full year. Basically manpower disposition remained the same as reported in 1978-79.

There were 267 miscellaneous drafting jobs completed during the year expending 7,874 man hours and special projects, reprints and Open File production took 5600 man hours. The Photo-mechanical unit provided complete reproduction service for all maps and additionally processed 831 miscellaneous jobs.

A total of 327 requisitions for Linofilm typesetting for Calgary and Ottawa Cartographers were forwarded to Surveys and Mapping, however it should be noted that turn around time was longer than in the past, probably due to our heavy demands for service and no doubt partially due to failures in their obsolete equipment.

Additionally 652 master negative packages for maps at various scales were requisitioned from Surveys and Mapping negative stores. These were required for map production and supplying authors with field sheets and compilation copies. This service was provided to all divisions at Ottawa, Calgary, Vancouver and occasionally Dartmouth.

MEMBERSHIP ON COMMITTEE

J. Bill	- Member, Cartography Suggestions Award Sub Committee
F. Heney	- Member, Branch Safety Committee

PRODUCTION DATA

Maps and illustrations received during the fiscal year:

	1978-79	1979-80
Multicoloured geological maps	17	14
'B' Series maps	22	31
Figure illustrations (pocket)	25	11
Figure illustrations (page)	231	263
Open File maps	238	244

Maps, illustrations and photo-mechanical work completed by the Cartography Section:

	1978-79	1979-80
Multicoloured geological maps	19	23
'B' Series maps	1	7
Figure illustrations (pocket)	12	22
Figure illustrations (page)	207	312
Open File maps	238	244
Multicoloured maps reprinted	5	10
Indexes to Publications revised	0	24
Applicon Experimental Maps	0	5
Camera	4,222	6,858
Contacts		
Films and papers	17,573	19,160
Colour Keys	435	710
Peelcoats	316	238
Scribetches	19	1
Colour Proofs	123	136
Whiteprints	8,307	9,117

Carry-over of maps and illustrations in progress at the end of fiscal year:

	1978-79	1979-80
Multicoloured geological maps	32	49
'B' Series maps	23	46
Figure illustrations (pocket)	72	28
Figure illustrations (page)	230	273

PUBLICATIONS-INFORMATION OFFICE

J.L.L. Touchette

The following publications were received during the year:

Economic Geology Series	1
Economic Geology Series (Reprinted)	2
Memoirs	4
Memoirs (Reprinted)	3
Bulletins	19
Bulletins (Reprinted)	1
Preliminary Papers	24
Preliminary Papers (Reprinted)	5
Misc. Report Series	1
Misc. Report Series (Reprinted)	1
Miscellaneous Geology	17
Open Files	3
Open Files (Reprinted)	2
Microfiche	44
Maps "A" Series	20
Maps "A" Series (Reprinted)	6
Preliminary Maps	7
Preliminary Maps (Reprinted)	1
Geophysical Series	270
Geophysical Series (Reprinted)	36
Revised Indices to Maps	23
DISTRIBUTION DATA	
Maps	71304
Reports	40859
Indices, listings, posters, etc.	97964
Total distribution (free and paid)	210127

Other Data

Requests for information, publications rock and mineral sets, etc.	12615
Visitors (cash sale 1320) (others 2040).....	3360
Notification Lists sent out	17

REVENUE

Derived from sales of reports, maps, rock and mineral sets, photographs, etc.	* $140 075.39

* Unadjusted

($ value) products supplied to regional offices	33 209.50
TOTAL SALES VALUE	$173 284.89

PHOTOGRAPHIC SERVICES

J.W. Kempt

During the year 1979-1980 the activities of the Geological Survey were on "hold" for the greater part of the year. Lack of money held up new projects and slowed down completion of old ones.

Administrative Orientation

The Treasury Board's request for "accountability" has resulted in a change in our administrative procedures.

All work must be accompanied by an authorized requisition and be presented to the Supervisor for recording and distribution. If he wishes, requisitioner may accompany work to photographer, to give accurate instructions, as to correct orientation of legends, or overlays, etc.

Work Load

The demands on the colour laboratory are constantly increasing. The requests for slides are up as is the requisitioning of colour prints, (Cibachrome, Ektachrome) for displays, and publications.

Demands for colour prints are subject to certain restrictions. The Photographic Section reserves the right to refuse a request for colour prints if it deems it is an obstacle in the way of the completion of other jobs. In such cases, the Photographic Section will arrange, to have the work completed in the Government of Canada Photographic Section at Tunney's Pasture at the expense of the requisitioner's division.

The work load on the rest of the Section is variable with the following changes noted.

Thin Sections photographed.....	increase
Rock Specimens photographed.....	increase
Mineral Specimens photographed	increase
B&W Slides photographed.....	increase
Colour Slides photographed.....	increase
Duplicate Colour Slides photographed.....	down
Internegatives photographed.....	down
Field Rolls	down
Fossil Specimens	down

New Equipment

The personnel of Photographic Section has decreased over the past ten years. As a result, we have turned more and more to automation to overcome our difficulties and to streamline our operation.

The recent acquisition and installation of an Ilford 2000 print processor is another step in this direction. The processor will give us the

ability to produce quality prints and enlargements at a much more rapid rate than previously possible.

The purchase of a Nikkon 135 mm camera "system" will enable us to photograph everything from close ups of small gem stones and minerals to an aircraft in flight with a minimum of inconvenience to geologist or photographer.

Photographic Technological Changes

In the past five years, in particular, there have been phenomenal advances in the photographic field. The fully automated camera has arrived. This change has carried over to other aspects of photography, such as fully automated processors and sensitometric equipment. It has also meant changes in the manufacture and production of photographic papers.

We are in the process of changing over to resin coated (R.C.) paper to make our prints and enlargements. R.C. paper, is a plastic coated paper, which produces high quality prints and enlargements with a much shorter processing time than that of fibre based papers. The life expectancy of plastic coated papers is equivalent to that of fibre based products.

It will be noticed as well, that the appearance of the final image will be much improved as there will be an absence of oyster shell marks, streaks or mottled surface.

At this time, no producer of photographic products manufactures a resin coated contact printing paper. This situation has meant we have had to modify one of our contact printers in order to use the paper. This was accomplished by the kindness of Mr. Gary Freda and Mr. Ken Christie of Resource Geophysics and Geochemistry Division.

G.S.C. PHOTOGRAPHIC SECTION

ANNUAL REPORT

PRODUCTION REPORT

Supervisor

Month 12 months Year 1979-1980

PHOTOGRAPHS PRODUCED	B/W NEGS	COLOUR NEGS	COLOUR TRANSP	TOTAL EXPOSED
Equipment-Labs-Portraits-Passports	203		108	311
Continuous tone maps-charts	1067		3116	4183
Line copies	1380		12	3392
Rock & mineral Specimens	156		985	1141
Thin Sections	427	264	96	787
Polished Specimens	2			2
Auto-Radiographs	149			149
Requisition Processing COL. ROLLS			3208	3208
Requisition Processing B/W ROLLS	944			944
Duplicate Slides			1485	1485
B/W Negs from Colour Slides	1066			1066
Fossil Negatives	1382			1382
TOTAL PROCESSED	6776	264	9010	18050

PRINTS & ENLARGEMENTS	EXPOSED	PROCESS	DRIED	
Black and White	14099	14099	14099	
Colour	565	565	565	TOTAL
	14664	14664	14664	43992

Prints & Enlargements Numbered & Stamped	9606	
Prints & Enlargements to outside Agencies	390	
Colour Slides	5076	
B & W Slides	1625	
Slides mounted	6093	
Negatives Opagued	1241	
Negatives Retouched	400	
Prints spotted	570	
		TOTAL
	2500	59101

					GRAND TOTAL	103093

INSTITUTE OF SEDIMENTARY AND PETROLEUM GEOLOGY

D.F. Stott

INTRODUCTION

The Institute is responsible for the establishment of a sound geoscience base for the sedimentary basins of Western and Arctic Canada, which occupy one-third the area of the country and contain most of Canada's oil, natural gas, and coal resources as well as major deposits of strata-bound minerals. In addition, units of the Division are charged with responsibility for the appraisal of the hydrocarbon and coal resource potential of the country.

The geological framework is being broadly outlined by current mapping and topical studies. These studies, together with paleontological investigations, support exploration for, and assessment of, the non-renewable resources of Western and Northern Canada. Emphasis on energy resources has resulted in development of evaluation programs in both petroleum and coal, each supported by petrological and geochemical research in addition to the regional and paleontological investigations. The geological evaluations contribute to the national inventories on the resources of petroleum and coal.

The Institute is organized into six subdivisions, each comprising several sections: Regional Geology, Paleontology, Coal Geology, Petroleum Geology, Geological Information and Administration.

Regional Geology is charged with carrying out standard mapping, lithostratigraphic and sedimentological studies in the principal sedimentary basins of Western Canada, Northern Mainland, Arctic Islands and adjacent offshore areas. Paleontology ensures precise and consistent biostratigraphic correlation, by refinement, through detailed taxonomic and stratigraphic studies, of the biochronologic scale which serves as the basis for biostratigraphic correlation. The Coal Geology Subdivision is responsible for providing the estimates of Canada's coal resources, for development of the National Coal File by accumulation of data, and for the development of regional models of coal occurrence. The Petroleum Geology Subdivision objectives are to identify the oil and gas resource base of Canada and to determine the probable distribution and potential abundance of oil and gas resources. The Geological Information Subdivision is concerned with processing, publication and dissemination of information on Canada's sedimentary basins and resources. In 1979-80, the Division produced one GSC Memoir, 15 GSC Bulletins, 9 Papers, 8 A-Series maps, 17 reports on Current Research, 33 outside publications, and 26 Open File Reports and Notes.

The Administration Office provides financial services, central registry, stationery and supplies, and office services including the typing office. ISPG maintains and administers its building, owned by the Department of Energy, Mines and Resources, and as a result building and engineering services are an important component within Administration.

The present establishment of the Institute comprises 141 permanent positions and 7.75 casual man-years. It includes 71 scientific and professional positions, including research and physical scientists, specializing in structural geology, stratigraphy, sedimentology, paleontology, mineralogy, geochemistry, geophysics, coal and petroleum geology; it also includes 8 operational, 35 technical, 3 administrative and 25 administrative support positions.

A repository is maintained for samples, core and other data resulting from both onshore and offshore exploration drilling by industry in the Yukon Territory, the Northwest Territories, including the Arctic Islands and for samples from all provinces and continental shelves of Western Canada. Most of the material is available to the public for free examination and is used by the ISPG in their research.

Personnel Notes

The disruptions caused by the high rate of turnover of scientific and support staff was further aggravated by the hiring restraints of summer, 1979. Only toward the end of the fiscal year was much progress made in staffing, and several positions remain unfilled after being vacant almost a year. Thirty-one resignations occurred within the fiscal year and 28 appointments were made.

With the re-organization of many units in Ottawa during the year the Ottawa Paleontology Section was transferred to the ISPG administration. We welcome M.J. Copeland, W.H. Fritz, D.C. McGregor, G.S. Nowlan to our scientific staff and R.L. Lennoz, E. Sandi, A. Whitehead, and G.P. Martin to the support staff. M.J. Copeland has been named head of the section, which includes E.T. Tozer and J.A. Jeletzky who previously were part of the ISPG.

Major changes occurred in the management of the ISPG during the year. G.C. Taylor has returned to scientific research after more than six years as Head, Regional Geology Subdivision. R.G. McCrossan resigned in August as Head of the Energy Subdivision (now Petroleum Geology Subdivision). Appointment to these two positions will likely be made in May 1980.

The Administrative group experienced a number of changes during the year.

Bob Munson, Office Manager, resigned in March 1980 to accept a position with the Department of Agriculture.

Joanne Drake resigned as Accounts Clerk in October 1979. She was replaced by D.A. Budvarson, formally a term employee with Publications Distribution.

The Typing Office as usual experienced a number of changes. Val Chipper won the competition for a position as ISPG library clerk. E. Pazur and J. Spirritts worked in the Typing Office during the year. J.E. Plintz and M.L. Varalta recently joined the staff.

In the Building and Engineering Services, Art Hoffman, the Building Foreman, resigned to accept a position with Petro-Canada. George Brydges, of our Building staff, was the successful candidate in the following competition, and Earl Clayton, also of our staff, then assumed George's post. After those changes we were fortunate to hire R.B. Elahee to fill the last vacancy in the unit.

After a considerable delay, B.D. Then was appointed to the Machine Shop, and he spent two months on leave of absence as part of his apprentice training.

Attendance at Meetings, Conferences and Courses

D.F. Stott

Financial Management for Senior Executives,
Staff Development Centre, Touraine, Quebec, October 9-13, 1979.

Workshop on British Columbia Coal Deposits, sponsored by British Columbia Ministry of Energy, Mines and Resources, Qualicum Beach, February 10–12, 1980.

Visited Peace River Canyon with D.W. Gibson to consult with vertebrate paleontologists from Alberta Natural History Museum on ancient environments with associated dinosaur tracks, June 4-5, 1979.

Tuzo Wilson Symposium, Toronto, Ontario, May 14-16, 1979.

J. Andrechuk

The Secretary as a Professional, Calgary, Alberta, June 14-16, 1979.

A. Hennessey

Personnel - Pay Input Form 2517, Calgary, Alberta, November 8-9, 1979.

Xerox Maintenance, Key Operator Course, Calgary, Alberta, May 1979.

M. Stadnyk

Pay - New Method (Project 542), Calgary, Alberta, March 1980.

Membership on Committees

D.F. Stott

Canadian Society of Petroleum geologists, 1979

Past President
Chairman, Nominating Committee
Chairman, Tracks Awards
Member, Calendar Committee
Chairman, Discipline Committee

REGIONAL GEOLOGY SUBDIVISION

D.G. Cook

The objectives of the Regional Geology Subdivision are directed toward the increased understanding of the depositional and deformational history of Proterozoic and Phanerozoic sedimentary rocks of Western and Arctic Canada. The investigations provide the data base essential for the appraisal of the potentialities of these sedimentary suites, both as reservoirs for, and sources of oil and gas, and as host rocks for other economic deposits including coal, potash, lead, zinc and copper.

The Regional Geology Subdivision is organized along geographic lines, partly in response to similar geological problems and partly because of similar logistical problems. It comprises two sections. The Arctic Islands Section is responsible for the sedimentary areas of the Arctic Islands with geological investigations being concerned mainly with Proterozoic and Phanerozoic rocks of the Franklinian Geosyncline, Stable Platform, and Sverdrup Basin. The Mainland Section is concerned with sedimentary regions lying within the prairie provinces, and eastern British Columbia, the Yukon and Mainland Northwest Territories, including the Mackenzie Delta and Beaufort Sea.

The Subdivision also includes the Curation and Technical Services unit which provides curation services for the entire division including rock, fossil, and coal samples. It also monitors and effects the loan of curated materials to the public as directed by the responsible scientific authorities. The technical service mainly relates to the preparation of rock sections for microscopic examination.

The Institute is the repository for cutting samples, cores, and other data resulting from both onshore and offshore exploration drilling by industry in Yukon Territory, Northwest Territories, including the Arctic Islands and for samples from all provinces and continental shelves of Western Canada. Some nine (9) million samples are stored at the Institute, and this number increases by about 300,000 each year. With the exception of samples from wells in Alberta, all are available to the public for free examination. Files are maintained of all the logs and other data related to more than 70,000 wells drilled in Western and Arctic Canada.

Highlights

- Main phase of field work related to study of Helikian Little Dal Group (Purcell equivalent) in the Mackenzie Mountains was completed. One significant outcome is the clarification of relationships important to the understanding of major occurrences of stratabound copper occurring in the region. Another is that the known occurrence of the macrofossil Tawuia was extended stratigraphically, geographically and in depositional facies. The genus, named from Little Dal material, has now been reported from rocks about 900 m.y. old in mainland China.

- Field work was completed for a study of Silurian and Devonian strata in the Mackenzie Mountains. Clarification of stratigraphic relationships throughout the Mackenzie Mountains permits the unravelling of the influence of Redstone Arch and Root Basin on Silurian-Devonian sedimentation. The study has resulted in the definition of Prairie Creek Embayment, a deep-water embayment which represents the southern limit of the Root Basin.

- A similar, but older, Lower Paleozoic embayment of Selwyn Basin in the Lower Paleozoic Platform was defined and named (Misty Creek Embayment). Facies relationships from shelf shallow water carbonates to embayment deep water shales and argillaceous carbonates were established. Geology of the surrounding region was compiled on a 1:500,000 scale map.

- A major subsurface study of pre-Mesozoic geology of part of the Yukon and Northwest Territories was completed. This study correlates Paleozoic units of Peel Plateau and Plain with those of Eagle Plain. It establishes stratigraphic and facies relationships from shelf carbonates in the east to deep water argillaceous deposits in Richardson Trough, to shelf carbonates in the west.

- In the Richards Island area of the Mackenzie Delta a subsurface sedimentological analysis showed that the Eocene gas-bearing strata of the Taglu gas field were deposited in a river-dominated delta.

- A report on salt deposits of the Lloydminster area of Saskatchewan was completed. It discusses the geology of the area with emphasis on the salt deposits and their potential for a nuclear-waste disposal site.

- A review and re-interpretation of the Devonian barrier complex of the Great Slave Lake area was completed.

- Two geological maps at 1:250,000 scale (NTS 93-I and 94-N) in northeastern British Columbia were completed and placed on open file.

- The plate tectonic history of the Arctic Islands was interpreted in a series of three papers.

- A comprehensive report was completed on the Lower Paleozoic Stratigraphy of Somerset Island and Boothia Peninsula.

- A study of Permian rocks of the Cache Creek Group in the Clinton Area, British Columbia, was completed.

Personnel Notes

The Subdivision presently consists of a permanent roster of 20 scientists, 2 technicians and 5 support staff.

G.C. Taylor has relinquished his position as Head, Regional Geology Subdivision in order to resume research activities on a full-time basis. He has returned to structural and tectonic studies in the northern Rocky Mountains. D.G. Cook has been appointed Acting Head of the subdivision.

A.V. Okulitch, a research scientist, transferred to ISPG from Regional and Economic Geology Division, Ottawa, in September 1979. He will study structure and tectonics of the Arctic Islands commencing in southern Ellesmere Island.

H.H.J. Geldsetzer, a research scientist, transferred to ISPG from Regional and Economic Geology Division, Ottawa in August 1979. He has commenced studies of Devonian stratigraphy and sedimentology in the northern Rocky Mountains.

G.E. Reinson, a research scientist, transferred to ISPG from Atlantic Geoscience Centre in September 1979. He is studying depositional environments and diagenesis of Cretaceous sandstone reservoirs in west-central Alberta.

R.I. Thompson, a research scientist, has accepted a transfer from ISPG to the Cordilleran Division, Vancouver.

A.D. Miall resigned his position as a research scientist in July 1979. He has accepted a teaching position at the University of Toronto.

D.H. McLean resigned his position as storesman in the Core and Sample Repository area in October 1979, and was replaced by J.A.P. Meilleur in November 1979.

D.R. Armstrong resigned her position as a geological clerk in March 1980 and has joined the National Energy Board.

Attendance at Meetings, Conferences and Courses

J.D. Aitken

Geological Society of America, annual meeting, San Diego, California, November 1979.

American Association of Petroleum Geologists, annual meeting, Houston, Texas, April 1979.

M.P. Cecile

Evidence for the Antler Orogeny; Geological Society of America, Penrose Conference, Elko, Nevada, September 1979.

R.L. Christie

International Geological Correlation Project; Project 156 (phosphates), field workshop and seminar, Wyoming, Idaho, and Utah, August 1979.

Symposium on Comparative Geology and Phosphate and Oil Deposits, hosted by Bureau de Recherches Géologiques et Minières, Orléans, France, November 1979.

D.G. Cook

Exploration Update; joint convention of Canadian Society of Petroleum Geologists and Canadian Society of Exploration Geophysicists, Calgary, Alberta, June 1979.

Geological Society of America, annual meeting, San Diego, California, November 1979.

Structural Excursion to the French Alps; Canada-France scientific exchange, October 1979.

J. Dixon

Exploration Update; joint convention of Canadian Society of Petroleum Geologists and Canadian Society of Exploration Geophysicists, Calgary, Alberta, June 1979.

Quality of Sandstone Reservoirs; a course given in Calgary by D.K. Davies, Texas Tech., June 1979.

A.F. Embry

Exploration Update; joint convention of Canadian Society of Petroleum Geologists and Canadian Society of Exploration Geophysicists, Calgary Alberta, June 1979.

J.W. Kerr

The Crust of the Earth and its Mineral Deposits (in honour of J.T. Wilson); University of Toronto, Ontario, May 1979.

Geological Atlas of the North Atlantic Borderlands; joint symposium of Canadian Society of Petroleum Geologists and Petroleum Exploration Society of Great Britain, St. John's Newfoundland, June 1979.

U. Mayr

Exploration Update; joint convention of Canadian Society of Petroleum Geologists and Canadian Society of Exploration Geophysicists, Calgary, Alberta, June 1979.

D.W. Morrow

Recent Advances in Carbonate Sedimentology in Canada; Canadian Society of Petroleum Geologists' symposium in honour of A.D. Baillie, Calgary, Alberta, September 1979.

G.C. Taylor

Structural excursion to the French Alps; Canada-France scientific exchange, October 1979.

R.I. Thompson

Thrust and Nappe Tectonics; a symposium of the Geological Society of London, England, April 1979.

Structural excursion to the French Alps; Canada-France scientific exchange, October 1979.

H.P. Trettin

Evidence for the Antler Orogeny; Geological Society of America Penrose Conference, Elko, Nevada, September 1979.

Membership on Committees

J.D. Aitken

Chairman, Subcommittee on Lithostratigraphic Units, Project to Revise the Code of Stratigraphic Nomenclature, American Commission on Stratigraphic Nomenclature.

Corresponding Member, Precambrian-Cambrian Boundary Working Group, International Union of Geological Sciences.

Member, Canadian Working Group on Precambrian Stratigraphy.

M.P. Cecile

Member, ISPG Exhibits Committee.

Member, Arctic Lexicon Committee, Canadian Society Petroleum Geophysicists.

Member, Northwest Territories-Yukon Lexicon Committee, Canadian Society of Petroleum Geologists.

Member, Historical Committee, Canadian Society of Petroleum Geophysicists.

R.L. Christie

Co-Chairman, Arctic Lexicon Committee, Canadian Society of Petroleum Geologists.

Member, Committee for 3rd Arctic Symposium, Canadian Society of Petroleum Geologists.

Co-organizer, Halifax 1980 session on Canadian Arctic Islands and Arctic Ocean, Geological Association of Canada.

D.G. Cook

Chairman, ISPG Stratigraphic Nomenclature Committee.

Director, Canadian Society of Petroleum Geologists.

Commissioner, American Commission on Stratigraphic Nomenclature.

Member, Earth Science Advisory Committee, National Earth Science Conference, Banff, University of Alberta/Canadian Society of Petroleum Geologists.

J. Dixon

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

Program Organizer, Sedimentology Division, Canadian Society of Petroleum Geologists.

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

A.F. Embry

Member, ISPG Stratigraphic Nomenclature Committee.

Member and Editor, Technical Committee, 3rd Arctic Symposium, Canadian Society of Petroleum Geologists.

Co-editor, Arctic Lexicon Committee, Canadian Society of Petroleum Geologists.

Chairman, Sedimentology Division, Canadian Society of Petroleum Geologists.

J.W. Kerr

Member, Advisory Committee, Research Council of Alberta.

Editor, North Atlantic Project, Canadian Society of Petroleum Geologists.

D.W. Morrow

Member, Lexicon of Stratigraphic Names Committee, Canadian Society of Petroleum Geologists.

G.E. Reinson

Associate Editor, Maritime Sediments.

Committee on Status of Maritime Geoscience in Canada (Canadian Geoscience Council).

R.I. Thompson

Chairman, Structure Group, Canadian Society of Petroleum Geologists.

Member, Organizing Committee, 1981 Conference, Geological Association of Canada.

H.P. Trettin

Corresponding Member, Canadian Geodynamics Committee.

Member, Twenhofel Medal Selection Committee, Society of Economic Paleontologists and Mineralogists.

Subdivision Manuscripts

Manuscripts for one GSC Bulletin, three GSC Papers, seven outside papers, one abstract, two Current Research Papers, four Open File reports and two Open File Maps were submitted for publication or distribution by the subdivision staff during 1979-80. Scientists of the subdivision also submitted geological formation tops to the Department of Indian and Northern Affairs for all northern wells released from confidential status during the report year.

Laboratory Statistics

Curation

"C" numbers issued	6,450
New collections (surface)	6,430
New collections (subsurface)	2,500
Transferred from Ottawa	3,000
Collections catalogued, recorded and shelved	± 18,380

Lapidary

Thin Sections, standard	2,124
Thin Sections, large	19
Thin Sections, stained	154
Epoxy impregnation unconsolidated grains and well cuttings	47
Epoxy preliminary impregnation samples	827
Cut and polished specimens	52
Miscellaneous	71

Core and Sample Repository

Well samples (washed) received:	
Alberta	245,745
British Columbia	85,900
Saskatchewan	16,695
Northwest Territories	12,596
Manitoba	-
	360,936
Mechanical logs received:	
Alberta	12,456
British Columbia	1,099
Saskatchewan	2,183
Northwest Territories	141
Manitoba	12
	15,891
Territories core received	**197 boxes**
Visitors requiring core, samples, or related information	**1,640**

There was a total of 2,460 boxes of core made available for examination, and samples from some 950 wells were requested.

PALEONTOLOGY SUBDIVISION

W.W. Nassichuk

The Paleontology Subdivision is concerned with interpretation of the fossil record preserved in the crust of the earth and is responsible for scientific studies in biostratigraphy, paleoecology and systematic paleontology. These investigations provide data that support regional mapping and stratigraphic studies, and the exploration for and assessment of hydrocarbon, base metal and other non-renewable resources in Western and Northern Canada. Most of the Subdivision's activities are centered in the Northwest Territories, including the Mackenzie Delta, Beaufort Sea and Arctic Islands regions but an increasingly broader participation in British Columbia and Alberta is being realized. In all these areas, paleontology assumes an extraordinary importance in the evaluation of energy reserves and in the search for stratigraphically controlled mineral deposits.

The Paleontology Subdivision is charged with maintaining standards for effective intrabasinal and interbasinal correlation and is exploring means for improving zonal schemes and improving interpretations of paleo-environments. Fossil groups that display relatively rapid evolutionary changes are important for establishment of models showing significant refinements of time-scales. Similarly, relatively little known fossil groups are being tested within the Subdivision for biostratigraphic potential and application. A large part of the program involves dating, correlation and determination 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.

The Subdivision consists of three scientific sections. The Micropaleontology Section, through detailed study of microfaunas and microfloras, develops and applies models of biostratigraphic and paleoecological zonations to refine knowledge of the stratigraphy of Phanerozoic rocks of Canada, which contain all of Canada's fossils fuels and a significant proportion of its mineral deposits. The Macropaleontology Section and the Ottawa Paleontology Section conduct research for the same purposes, using macrofossils.

Research and service programs within the Subdivision are closely coordinated 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 and the United States, France and the United Kingdom. A substantial portion of the functions of the Subdivision is conducted through contract by consulting companies and by university scientists who are, nonetheless, supervised by the Subdivision. In addition, a number of EMR Research Agreements, arranged with scientists outside the Survey, are administered by the Subdivision.

Highlights

- Studies in the Nahanni map-area, Yukon-Mackenzie, showed that the host rocks for the XY lead-zinc deposit in the Road River Formation at Howard's Pass underlie late Early Silurian beds. Lateral correlation to outcrops near Summit Lake 25 km southwest of Howard's Pass indicates that the host rocks are younger than some middle Early Silurian strata. The XY is thought to be a strata-bound deposit and thus its dating as middle to late Early Silurian (*Monograptus gregarius* Zone to *Monograptus spiralis* Zone) will assist exploration for similar deposits in the region.

- Taxonomic description of trilobites from the Silurian Attawapiskat Formation provided a benchmark for biostratigraphic correlation in central and northern Canada and dated these reefal limestones of the Hudson Platform as latest Early or early Middle Silurian.

- The recovery of foraminifers, ostracodes, charophytes, thecamoebians(?) and other microfossils from many Lower Cretaceous sections in the Alberta Foothills has shown a complex pattern of environments related to the advance and withdrawal of the boreal, early Albian Moosebar Sea. This important new data is particularly significant for establishing depositional models for hydrocarbon accumulation in Mesozoic strata in the Western Canada Basin.

- A zonation scheme for siliceous microfossils (diatoms and radiolarians) and foraminifers was established for the Cretaceous Kanguk Formation in the eastern Arctic Islands. A comparative study of these fossils with assemblages from Siberia and Alberta has indicated a time span from late Turonian to late Campanian.

- A comparison of the western Canadian Middle Devonian rugose coral faunas with those of comparable age in other parts of the world was completed. Regardless of facies, the western Canadian faunas are remarkably different. For example, the western European coral faunas comprise 109 species, assigned to 36 genera; contemporaneous western Canadian faunas include 100 species, assigned to 23 genera, and only one species is common to both regions. It is proposed to name the western Canadian coral province the Mackenzie Coral Province.

- A comprehensive bulletin dealing with Cenozoic stratigraphy of the Mackenzie Delta, Northwest Territories, was completed. Six formations, four of which are new, comprise the sequence. Six foraminiferal assemblages with various biofacies variations are described in combination with a synthesis of palynological data compiled from consultant's reports.

- In the Beaufort Sea, eight biostratigraphic divisions were identified in the Dome-Gulf et al. Kopanoar M-13 discovery well. A rich assemblage of agglutinated foraminifers spans the oil-bearing zone and is of prime interest. These fossils have provided important new data for environmental, biostratigraphic and chrono-stratigraphic interpretations.

- A detailed study was made on the subsurface stratigraphy and conodont zonation of the lower Paleozoic succession of the Arctic Platform. Refined datings and correlations revealed that a major unconformity exists below the Allen Bay Formation (Late Ordovician-Early Silurian age) in most parts of the southern Arctic Archipelago.

- Detailed conodont zonation of Devonian strata in southwestern Ontario provided refined datings and correlations locally and intercontinentally. The provincial aspect of associated megafaunas has hampered such refinement in the past. The study of the Ontario sequence allowed closer comparison of the Devonian successions between the Michigan Basin to the west and the Allegheny Basin to the east and southeast.

- Brachiopods in beds of the Devonian Waterways Formation outcropping on Birch River in northeastern Alberta indicate correlation with the upper Calumet and lower Christina Members of the Waterways Formation of the Athabasca-Clearwater River area. Associated conodonts belong in the Lower *asymmetricus* Zone of the lower Upper Devonian (lower Frasnian).

- A cross-section was completed through Lower Carboniferous rocks of the Monkman Pass map-area (NTS 93-I), showing detailed east-west stratigraphic and facies relationships, with supporting biostratigraphic data. The areal extent and configuration of a potential major petroleum reservoir within this succession was determined.

- A comprehensive report on the Lower and Middle Jurassic rocks of northern Richardson Mountains was completed. Sub units of the highly variable Bug Creek Formation were formally described. Sandstone tongues extending far westward into the Kingak Shale were recognized. A portion of the Kingak Shale equivalent to the Husky Formation was differentiated lithologically. Strata representing basin to marginal sandstone facies in the Lower and Middle Jurassic in the northern Ogilvie Mountains are either extremely thin or absent. No western source is indicated for Lower and Middle Jurassic rocks of the northern Yukon as indicated by previous authors.

- The recovery of new conodont taxa from Upper Ordovician strata in Anticosti Island and Gaspé Peninsula and elsewhere facilitates the correlation of North American sequences with the latest Ordovician Hirnantian Stage of Europe. This correlation enhances Anticosti Island as a potential Ordovician-Silurian boundary stratotype.

- A new zonation for Silurian and Devonian nonmarine strata in the northern hemisphere has been developed and Canadian sequences have been proposed as standard references for several zones.

Personnel Notes

During the fiscal year the Subdivision consisted of 19 scientists, 8 technicians, two secretaries and on occasion, temporary assistants. Included are 10 positions in the Eastern Paleontology Section which was transferred from Regional and Economic Geology Division to ISPG in October. The lapidary and paleontology laboratories in Ottawa were amalgamated and moved to refurnished quarters on the ground floor of 601 Booth Street. Additionally, Type and Reference fossil collections were moved to the ground floor of 601 Booth Street. During the fiscal year the Subdivision monitored 8 EMR Research Agreements and 12 contracts, with university, industrial and independent personnel.

Type specimens catalogued in 1979

Publications	PC.	Camb.	Ord.	Sil.	Dev.	Carb.-Perm.	Trias.	Cret.	Tert.-Rec.	Total	E. Nfld.	E. Coast	N.B.	Que.	Ont.	B.C.	Yukon	NWT	Foreign
GSC Bulletins																			
Bull. 253 (Forams)								139		139							X		
Bull. 284 (Acritarchs, Trilobites)			58							58	X								
Bull. 290 (Trilobites)			65							65	X								
Bull. 297 (Palynomorphs)								43		43		X							
Bull. 299 (Ammonites)								31		31								X	
Bull. 303 (Forams)									4	4		X							
Bull. 312 (Trilobites)			450							450								X	
Paper 79-1A (Plants, Arthropods, Conodonts)			2		21				6	29								X	
79-1B (Corals, Ammonites, Trilobites, Conodonts, Spores)	75	7	39		96		34		21	272	X			X		X		X	X
79-19 (Ammonites)								14		14								X	
Subtotals	75	7	614	-	117	-	34	227	31	1105									
Can. J. Earth Sci. (Conodonts, Stromatoporoids, Graptolites, Ammonites, Pseudofossils)	25		41	21	8		1			96			X				X	X	X
J. Pal. (Corals, Sponges, Forams, Brachiopods)			52	76	50				104	282				X	X		X	X	
Other (General)		40	253	182	102	12				589				X	X	X	X	X	X
Subtotals	25	40	346	279	160	12	1	-	104	967									
Total	100	47	960	279	277	12	35	227	135	2072									

Type Fossil Collection

Thomas E. Bolton continued as Curator of the National Type Collection of Invertebrate and Plant fossils. A total of 2072 type specimens described in both Geological Survey of Canada (1105) and outside (967) publications were added to the collection in 1979.

E.T. Tozer was awarded the Willet G. Miller Medal of the Royal Society of Canada for outstanding contributions to Triassic paleontology and biostratigraphy.

A 5-man delegation of scientists from the People's Republic of China visited Canada for one month as guests of the Geological Survey to discuss Permian/Triassic biostratigraphy. The delegation examined Permian and Triassic strata in the field in British Columbia, Alberta and Nova Scotia. Comprehensive discussions were held with Survey officers W.W. Nassichuk, E.T. Tozer, J.W.H. Monger, E.W. Bamber and R. Thorsteinsson as well as numerous scientists affiliated with industry, universities and other governmental institutions across the country.

Drs. Rong, Jia-Yu and Laio, Wei-hua (Nanking Institute of Geology and Paleontolgy, Nanking, China) visited Calgary and Ottawa in June.

W.H. Fritz accompanied members of the Working Group for the Precambrian-Cambrian Boundary (IUGS Commission on Stratigraphy) on an excursion to the Mackenzie Mountains to investigate Precambrian and Cambrian stratigraphy.

Dr. C. Harper (U. of Oklahoma) studied brachiopods from Anticosti Island, Quebec, in Ottawa (Oct.-Dec. 1979).

C. Stelck from the University of Alberta visited Ottawa for several weeks to study Cretaceous molluscs from western Canada with J.A. Jeletzky.

D. Campbell left a position as macropaleontological technician early in the fiscal year to join the Petroleum Geology Subdivision.

G. Brown vacated a position as palynological technician to join Amoco Canada Ltd.

M. Mangin joined the Subdivision as a palynological technician.

Attendance at Meetings, Conferences and Courses

E.W. Bamber

IX International Congress on Carboniferous Stratigraphy and Geology, Urbana, Illinois, May 20-26, 1979.

M.J. Copeland

Geological Association of Canada annual meeting, Quebec City, Quebec (May). Northeastern Section, Geological Society of America, Philadelphia, Pennsylvania (March).

International Congress on Ostracoda, Belgrade, Yugoslavia (July).

W.H. Fritz

ICCP Precambrian-Cambrian Boundary Commission Field Conference in Western Canada (August).

W.S. Hopkins, Jr.

Attended workshop on fossil fungal spore morphology and classification, Kent State University, Ohio, May 9-11, 1979.

Annual Meeting of GSC Palynologists, held in Calgary, Alberta, January 21–23, 1979.

J.A. Jeletzky

International Symposium on Ammonoidea, York, England (August).

International Commission on Stratigraphy - Mid Cretaceous events project, York, England (August).

International meeting on Transgression and Regression, London, England (September).

D.C. McGregor

Devonian Subcommission Field Conference, Spain and France (September).

Devonian Subcommission Field Conference, China (June).

Geological Survey of Canada Palynologists meeting, Calgary, Alberta (January).

D.H. McNeil

G.S.A. Annual Meeting, San Diego, California, November 5-8, 1979.

W.W. Nassichuk

Subcommission on Permian Stratigraphy meeting, Washington, D.C., May 17 and 18, 1979.

IX International Congress on Carboniferous Stratigraphy and Geology, Urbana, Illinois, May 20-26, 1979.

B.S. Norford

Canadian Paleontology and Biostratigraphy Seminar, Edmonton, Alberta, September 22-24, 1979.

A.W. Norris

Subcommission on Devonian Stratigraphy field excursions and meetings in Spain and France, September 15-26, 1979.

G.S. Nowlan

Geological Association of Canada annual meeting, Quebec City, Quebec (May).

A.E.H. Pedder

Subcommission on Devonian Stratigraphy field meeting in Spain, September 1979.

Third International Symposium on Fossil Cnidarians in Warsaw, Poland, September, 1979.

A.R. Sweet

Attended workshop on fossil fungal spore morphology and classification, Kent State University, Ohio, May 9-11, 1979.

Annual Meeting of GSC Palynologists, held in Calgary, Alberta, January 21–23, 1979.

E.T. Tozer

International Symposium on Ammonoidea, York, England (August).

Assereto-Pisa Memorial Symposium ICCP Project 4, Italy (June).

J.H. Wall

C.S.P.G. Paleontology Division Field Conference, Gleichen and Bassano Districts, September 29, 1979, co-leader and co-author of guidebook.

G.S.A. Annual Meeting, San Diego, California, November 5-8, 1979; presented poster session on Late Cretaceous microfossils from the Kanguk Formation, Canadian Arctic Archipelago.

Membership on Committees

E.W. Bamber

North American Study Group, International Subcommission on Permian Stratigraphy, Member.

Dinantian Working Group, International Subcommission on Carboniferous Stratigraphy, Member.

M.J. Copeland

Geological Survey of Canada Library Committee

Geological Survey of Canada GEOGRAM Committee

Geological Survey of Canada Earth Science Literature Committee (Chairman).

International Research Group on Paleozoic Ostracodes (President).

Paleontology task force, National Inventory Programme, National Museums of Canada.

North American Paleontology Convention III Committee.

Cultural Property Export and Import Act, Expert Examiner (Paleontology).

W.H. Fritz

Precambrian-Cambrian Boundary Working Group, International Union of Geological Sciences/International Geological Correlation Program, Member.

Cambrian Subcommission, International Union of Geological Sciences, Member.

N.S. Ioannides

Tour Committee, I.S.P.G., Member.

J.A. Jeletzky

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

International Union of Geological Sciences, Commission on Stratigraphy, Working Group on Jurassic-Cretaceous Boundary, Member.

Miller Medal Committee, Royal Society of Canada, Chairman.

Mid-Cretaceous events Project (IGCP), Member.

D.C. McGregor

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

Canadian Association of Palynologists, President.

International Commission for Palynology, Member of Council.

Commission Internationale de Microflore du Paléozoique (CIMP), Member of Executive and North American Secretary.

Hystricospore Working Group, Commission Internationale de Microflore du Paléozoique, Member.

North American Devonian Study Group, Member.

Palaeobotanical Symposium Committee, Canadian Botanical Association, Chairman.

Biostratigraphy Subcommittee for revision of North American Stratigraphic Code, Member.

D.H. McNeil

I.SP.G. Exhibits Committee, Member.

W.W. Nassichuk

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

International Union of Geological Sciences, Subcommission on Carboniferous Stratigraphy, Titular Member.

International Union of Geological Sciences, Subcommission on Carboniferous Stratigraphy, Working Group on Middle Pennsylvanian of North America, Chairman.

International Union of Geological Sciences, Subcommission on Permian Stratigraphy, Working Group on Permian stratigraphy on Boreal Regions, Co-chairman.

University of Toronto, Dean's Visiting Committee for the Department of Geology, Committee Member, 1980-1983.

Compte Rendu vol. on Carboniferous paleogeography and tectonics, IX International Congress on Carboniferous Stratigraphy and Geology, Editor.

Organizing Committee for 3rd North American Paleontological Convention, Montreal, 1982, Member.

B.S. Norford

Research Committee, Canadian Society of Petroleum Geologists, Chairman.

Working Group on Cambrian-Ordovician Boundary, International Commission on Stratigraphy, Voting Member.

Advisory Committee on Paleontological Resources, Province of Alberta, Department of Culture, Member.

Dean's Visiting Committee for the Department of Geology, Memorial University of Newfoundland, Chairman.

Senate of the University of Calgary, Senator; Member of Executive Committee; Member of Honorary Degrees Committee; Chairman of Spirit Task Force.

Paleontology Division, Billings Medal Committee, Geological Association of Canada, Member.

Canadian Geoscience Council Visiting Committee to the Geological Survey of Canada, liaison officer.

Energy, Mines and Resources, Committee for Evaluation of Earth Sciences Services Program, Geological Survey of Canada, Member.

A.W. Norris

Subcommission on Devonian Stratigraphy, International Union of Geological Sciences, Titular (voting) Member.

North American Devonian Study Group, Organizing Member.

G.S. Nowlan

Paleontology Division, Geological Association of Canada, Councillor.

Appalachian-Caledonian Orogen Project, Sedimentation/Faunal Provinces Working Group, International Geological Correlation Program, Corresponding Member.

A.E.H. Pedder

International Association for the Study of Fossil Cnidaria, Council Member.

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

North American Devonian Study Group, Member.

T.P. Poulton

I.S.P.G. Nomenclature Committee, Member.

E.T. Tozer

IGCP National Committee, Secretary.

T.T. Uyeno

North American Working Group on the Devonian System, Member.

J.H. Wall

I.S.P.G. Library Committee, Chairman.

Journal of Foraminiferal Research, Associate Editor.

Admissions Committee, Sigma Xi Chapter, University of Calgary, Member.

Paleontology Division 1979 field trip, Canadian Society of Petroleum Geology, Co-chairman.

C.S.P.G. Paleontology Division Subcommittee on Canadian Paleontological Monograph Series, Member.

Special Talks and Lectures

M.J. Copeland

"The history and status of ostracode paleontology in Canada", International Ostracode Congress, Belgrade, Yugoslavia, July.

J.A. Jeletzky

"New Ammonoid taxa from Middle Albian rocks of midwestern and Arctic Canada", International Symposium on Ammonoidea, York , England, August.

D.C. McGregor

Three lectures on Devonian Palynology, China, June.

D.H. McNeil

"The stratigraphy and paleogeography of the Cenomanian-Turonian Favel Formation in the Manitoba Escarpment and equivalent mid-basin rocks of Colorado and Kansas"; G.S.A. Annual meeting in San Diego, California, November 5, 1979.

W.W. Nassichuk

Middle Pennsylvanian biostratigraphy in Canada; meeting of IUGS Subcommission on Carboniferous Stratigraphy, Washington, D.C., May 17, 1979.

The Permian of China; meeting of IUGS Subcommission on Permian Stratigraphy, Washington, D.C., May 18, 1979.

B.S. Norford

The Cambrian-Ordovician Boundary in Canada; Paleontology Division of Canadian Society of Petroleum Geologists, February 26, 1980.

G.S. Nowlan

The Ordovician-Silurian Boundary on Anticosti Island in terms of conodonts; Geological Association of Canada, Quebec City, Quebec, May 1979.

A.E.H. Pedder

The Middle Devonian Mackenzie Coral Province of western Canada; 3rd International Symposium on Fossil Cnidarians, Warsaw, Poland, September 27, 1979.

E.T. Tozer

Three lectures on the evolution, systematics, geographic and stratigraphic distribution of Triassic Ammonoidea, International Symposium on Ammonoidea, York, England, August 1979.

Lectured on Norian-Rhaetian problem, Assereto-Pisa Memorial Symposium, ICCP Project 4, Italy, June 1979.

Laboratory Statistics

Foraminifer Laboratory

The foraminifer laboratory processed 1,346 surface and subsurface samples. Of the total samples processed, 1,178 were for scientific projects led by Drs. Wall and McNeil and the remaining 168 were for service work for other Institute projects.

Conodont Laboratory

The conodont laboratory processed 388 samples from the surface and subsurface during the report year. Of that total, 332 samples were processed as service work for ISPG field scientists and 56 samples were processed for the research of conodont specialist Uyeno. Conodonts were manually extracted or "picked" from ninety per cent of all processed samples.

Palynology Laboratory

The palynology laboratory processed 1,240 surface and subsurface samples. Of these, 1,137 were for miospore study and 103 for megaspore study. Of the total samples processed, 617 were for projects led by palynologists Hopkins, Sweet and Ioannides. The remaining 623 were for service work projects. Of these service work samples, 204 samples were examined by palynologists outside of the ISPG to fulfil contractual arrangements initiated by the Subdivision.

Macropaleontology Laboratory

The macropaleontology laboratory prepared 1,500 thin-sections during the course of the year and also completed 50 plaster casts, 40 acid residue separations and 70 polished sections.

All samples processed in the Paleontology laboratories were from sedimentary deposits from Arctic Islands, Yukon, District of Mackenzie, eastern and western sectors of Canada.

Ottawa Laboratories

Lapidary-Paleontology Laboratory	1978-79	1979-1980
Rock thin sections		
Standard, produced by laboratory	4571	3976
Standard, purchased by contract	701	985
Oriented	15	116
Large	366	207
Polished, produced by laboratory	267	3
Polished, purchased by contract	565	1100
Covered after staining	270	218
Polished rock surfaces	41	128
Rock saw cuts (trim and slab)	10743	12897
Levelled rock surfaces	674	6338
Fossil thin sections	101	206
Polished fossil surfaces	6	0
Rubber molds of fossils	40	118
Plaster casts of fossils	64	77
Parcels of fossils received	109	80
Parcels of fossils shipped	483	193
Fossil localities catalogued	755	865
Mementos prepared for presentation	15	15
Silicone casts of fossils		40

Additional specimens were prepared for electrical rock property studies, autoradiographs, chemical analyses, seismic velocity measurements, museum display, etc.

Conodont Laboratory	1978-79	1979-1980
Samples processed	232	439
Residues separated and picked	150	614
Paleopalynology Laboratory		
Samples processed	83	251
Slides prepared	102	271

COAL GEOLOGY SUBDIVISION

D.K. Norris

The role of the Coal Geology Subdivision is to establish a sound geoscience base in the coal measures throughout Canada and to provide and maintain a resource evaluation of Canadian coal deposits in collaboration with the Provinces, with industry and with the Atlantic Geoscience Centre. These activities are designed to meet policy, regulatory and information requirements of the Department of Energy, Mines and Resources.

To fulfil this role, the Subdivision is organized into three sections. The Geology of Coal Section conducts stratigraphic and structural studies of Canadian coal deposits that assist in the establishment of a geoscience data base from which resource evaluations can be made. Insofar as the bulk of increases in the future domestic demand for coal is expected to be for electrical power, a major thrust of the section is in the direction of the geology of low rank coal deposits in western and northern mainland Canada, and of the bituminous coals of Nova Scotia and New Brunswick. The Coal Technology Section is engaged mainly in studies of the petrographic character of coal seams and their application to seam identification, correlation and quality prediction. In addition, the section is studying the maturation of organic material, including coal, in fine-grained, clastic rocks for the prediction of the nature and quality of hydrocarbons. The Resource Evaluation Section is responsible, alone or jointly with the provinces, for the estimation of the coal resources of Canada in terms of their type of occurrence, nature, quantity, quality and mineability.

Highlights

- Excellent cooperation between the Geological Survey and the Saskatchewan Department of Mineral Resources, the B.C. Ministry of Mines and Petroleum Resources and with several coal companies resulted in significantly increased input of basic data for the National Coal Inventory. These included the successful completion of Phase I of the Canada - British Columbia joint coal assessment program whereby three magnetic tapes containing confidential, hard copy data on the coal resources of the province were completed for use in the National Coal Inventory. These and other data are necessary to meet policy, regulatory and information requirements of the Department in the planning of future development of Canada's coal resources.

- As part of the on-going coal assessment program, the Branch continues to co-operate with the coal producing provinces and with industry in the generation and processing of geoscience and resource data as input for the National Coal Inventory. Industry is particularly interested in the Branch's methodology for storing and manipulation of this information and continues to volunteer large amounts of data for processing.

- A mineral find (by a subdivision scientist) associated with the westward change from carbonate rocks to shales in upper Paleozoic rocks of northern Yukon Territory may herald renewed interest in stratabound iron, zinc and nickel potential of the region because of the widespread distribution of this facies change in the Ogilvie and Porcupine Mountains.

- Detailed studies of ancient depositional environments of the coal measures in western Canada are providing new exploration models associated with major strike slip faults and are relating recoverability of coal to specific depositional regimes. These investigations as well as those on surface oxidation are arousing considerable interest with coal companies because they are assisting in the delineation of mineable reserves and in long-range mine planning.

- Nine manuscripts relating to the geology and resource potential of Canada's coal deposits, prepared during the report year, were in various stages of critical reading, and 23 were published. The published works comprised 3 outside papers, 7 abstracts and 13 GSC papers. Among them were two important overviews of the geology and coal resource potential of central British Columbia and southern Yukon Territory.

Personnel Notes

The Subdivision presently consists of a permanent staff of 19 scientists, 2 technicians and one secretary.

Carol Boonstra was promoted to Secretary 2 in November 1979.

A.K. Cameron served as Chairman of the Coal Division of the Geological Society of America during 1979.

D.W. Gibson visited the B.C. Ministry of Mines and Petroleum Resources, Victoria, B.C., in May 1979 for consultation with geologists of the Ministry on B.C. coal deposits. He also participated in a one-day field trip to the Drumheller area with ISPG scientists to examine the sedimentology of the Upper Cretaceous coal measures there.

J.D. Hughes visited Luscar Ltd. in Edmonton and acquired drilling information for the Forestburg area, Alberta, for input to the National Coal Inventory.

B.A. Latour and J.A. Irvine attended meetings with the B.C. Ministry of Mines and Petroleum Resources, Victoria, B.C., to discuss data base construction for the National Coal Inventory.

D.L. Marchioni visited CSIRO, Newcastle University and B.H.P. laboratories, Australia, to discuss research on coking and liquefaction of bituminous coals in January 1980. In addition, he visited SEC laboratories and open pit mines in Victoria for comparative studies in brown coal petrography.

J.R. McLean, C.F. Stevens and S. Creaney resigned to take positons with industry in Calgary.

D.K. Norris was co-leader on a field trip for the Canadian Society of Petroleum Geologists to the Savanna Creek gas field and on a trip in support of the scientific exchange program on Precambrian stratigraphy with the Peoples Republic of China to Waterton Park and the Crowsnest Pass.

K.C. Pratt joined the Coal Technology Section to replace L. Marconi who resigned in June 1979.

Attendance at Meetings, Conferences and Courses

C. Boonstra

The Secretary as a Professional, Calgary, Alberta, June 13-15, 1979.

A.R. Cameron

Co-hosted and presided over a meeting of the Canadian Coal Petrographers held at I.S.P.G. in November 1979.

Geological Society of America, Annual Meeting, San Diego, California, November 1979 and participated in a coal geology field trip to the Black Mesa, Arizona, prior to these meetings.

IX Carboniferous Congress, Urbana, Illinois in May 1979 and the Annual Meeting of the International Commission for Coal Petrology held in conjunction with the Congress.

D.W. Gibson

Colloquium on Peace River Coalfield, sponsored by the B.C. Ministry of Mines and Petroleum Resources, Qualicum Beach, February 1980.

P.S.W. Graham

C.S.P.G.-C.S.E.G. Exploration Update '79, Calgary, Alberta, June 1979.

J.A. Irvine

Geological Society of America, Annual Meeting, San Diego, California, November 1979.

D.G.F. Long

Seventh Geoscience Forum, Whitehorse,Yukon, December 1979.

D.L. Marchioni

Co-hosted a meeting of the Canadian Coal Petrographers held at I.S.P.G. in November 1979 and conducted a workshop on fluorescent microscopy.

IX Carboniferous Congress, Urbana, Illinois in May 1979 and the Annual Meeting of the International Commission for Coal Petrology held in conjunction with the Congress.

Kerogen analysis symposium and workshop sponsored by the American Association of Stratigraphic Palynologists, Dallas, Texas, October 1979.

D.K. Norris

Conference on thrust and Nappe Tectonics, London, England, April 1979, sponsored by Imperial College, London.

Field trip to brown coal mines in southern Poland, sponsored by the University of Wroclaw, April 1979.

Seventh Geoscience Forum, Whitehorse, Yukon, December 1979.

Field trip to examine mesoscopic structures in the lower Paleozoic sedimentary rocks on the west coast of Cornwall and Devon, England, with Professor N.J. Price, Imperial College, London.

Special Talks or Lectures

A.R. Cameron

"Reflectance Measurements on Ulminite from Saskatchewan Lignites", Geological Society of America, Annual Meeting, November 1979.

D.W. Gibson

"Sedimentology and Depositional Environments of the Carbon Creek Coal Basin, northeast British Columbia"; Peace River Coalfield Colloquium, Qualicum Beach, February 1980.

P.S.W. Graham

"The Use of Rank as a Geologic Problem Solver in the upper Elk Valley, B.C."; informal presentation to Elko Mining Ltd., Calgary, Alberta, April 1979.

J.D. Hughes

"Application of Computer Evaluation Methodology to the Forestburg area, Alberta"; informal presentation to Luscar Ltd., Calgary, Alberta, March 1980.

J.A. Irvine

"Canadian Coal Resource Terminology and Evaluation Methodology"; Geological Society of America, Annual Meeting, November 1979.

D.G.F. Long

"Coals of the Yukon, their Depositional Environment, Tectonic Setting and Resource Potential"; Seventh Geoscience Forum, Whitehorse, Yukon, December 1979.

"Sedimentary and Tectonic Framework of Fresh-water Intermontane Coal Basins of the Canadian Cordillera"; Edmonton Geological Society, March 1980.

D.L. Marchioni

"Difficulties in Correlation and Strata Control Associated with Coals of the Fluvial Plain - an Example from the Sydney Basin, Australia"; IX International Congress of Carboniferous Stratigraphy and Geology, Urbana, Illinois, May 1979.

"Reflectance Studies in Brown Coals - an example from the Hat Creek Deposit of British Columbia"; IX International Congress of Carboniferous Stratigraphy and Geology, Urbana, Illinois, May 1979.

D.K. Norris

"The Canadian Coal Mining Industry"; Polish Academy of Science in the immediate presence of the Minister of Geology, Warsaw, Poland, April 1979.

"The Tectonic Evolution of the Canadian Cordillera"; Faculty of Geology, University of Wroclaw, Poland, April 1979.

"A new Mineral Occurrence of Unknown Economic Potential in northern Yukon Territory"; Seventh Geoscience Forum, Whitehorse, Yukon, December 1979.

Membership on Committees

A.R. Cameron

Coal Division, Geological Society of America, Chairman, 1979.

International Committee for Coal Petrology, Member.

D.W. Gibson

C.S.P.G. Thesis Awards Committee, 1979.

P.S.W. Graham

Tour Committee, I.S.P.G., Chairman.

J.A. Irvine

ERDS Technical Committee, Member.

Computer Committee, I.S.P.G., Member.

B.A. Latour

Coal Resource and Reserve Assessment Group, Department of Energy, Mines and Resources, Member.

D.G.F. Long

Library Committee, Member.

McConnell Club, Chairman.

D.L. Marchioni

Working committee of the International Committee for Coal Petrology, Member.

D.K. Norris

E.M.R. Coal Committee, Member.

N.C. Ollerenshaw

Stratigraphic Nomenclature Committee, I.S.P.G., Member.

Coal Technology Laboratory

About 510 pellets of coal and dispersed carbonaceous material were cast and polished. Approximately 40 samples were submitted to outside contractors for chemical analyses and rheological determinations. Additional time was spent by technical staff in updating files on the coal sample collection.

PETROLEUM GEOLOGY SUBDIVISION

The Petroleum Geology Subdivision is responsible for the Institute's programs on evaluation of oil and natural gas for the sedimentary basins of Arctic and Western Canada. Research is also conducted into the mode of origin and occurrence of these commodities to provide necessary background for the evaluation studies. The Subdivision's program of resource evaluation is interrelated with other programs of the Division and is coordinated with the work of other agencies within the Federal Government. The Subdivision is responsible for the petroleum inventory program which depends in part on basic geological work supplied by the Regional Geology Subdivision of the Institute. Responsibility for these programs is divided among three sections.

The Petroleum Resources Section is primarily responsible for the assessment of Western and Arctic Canada's potential petroleum resources, for conducting research on the habitat of oil, and on methods of resource evaluation. Development and maintenance of computer data files related to well data, oil and gas pool data, and other information are a secondary responsibility. Much of the work of the Section is coordinated through the Geological Subcommittee on Resource Potential with related activities within the Institute's programs, with scientists at Halifax (Atlantic Geoscience Centre) and Ottawa (Resource Management and Conservation Branch), and with the Department of Indian and Northern Affairs.

The Geochemistry Section provides scientific services to the Division, develops 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. Crude oil studies are also undertaken to determine oil-source relationships and to document geochemical changes in crude oil composition that occur in the reservoir. Most of these studies are carried out on material from the Arctic Islands, Mackenzie Delta region and East Coast offshore and provide data for the petroleum resource evaluation program.

The Data Management Section maintains a computer facility and provides systems analysis and programming services to the various subdivisions within the Institute.

Highlights

- An analysis of the gas resources of Western Canada was completed in June, 1979. The report which was prepared and submitted to Senior Departmental personnel included: treatment of reserves, appreciation, and undiscovered resources. In addition to the estimates themselves, the resource was categorized in terms of quality of reservoir, difficulty of discovery, cost of exploitation, and deliverabilty characteristics. This report was designed to assist departmental advisors with questions related to export of natural gas. The report was placed on open file in January, 1980.

- Two papers were prepared on the heavy oil (Lloydminster type) resources of Alberta. The inventory of heavy oil resources had been prepared as a result of contracted studies and focused on a very large, previously unreported, in-place resource. The resource had been identified in a variety of reservoir characteristics in 9,000 separate segments. Computer screening of the segments into various extraction technologies indicated a potential for recoverable oil from this resource of between 2.5 and 4 billion barrels, substantially more than had been previously estimated.

- Several other parts of Canada were assessed for potential oil and gas resources and final estimates were made. Costing data has been generated throughout the year to enable Energy Policy personnel to evaluate the fiscal implications of the resource estimates.

- Numerous advances were made in the design and implementation of computer programs to improve the resource evaluation methodology and specifically the development of a finding rate vs. exploration activity module. Major advances also occurred in the ability of extract play reservoir data from the pool file of British Columbia, Alberta and Saskatchewan. Some of this data has been instrumental in bringing the manuscript of the oil and gas fields of Western Canada map almost to completion.

- Oils and condensates from the Scotian Shelf have been divided into three genetic families based on their chemical composition. The distribution of these families suggests they were generated at or close to the stratigraphic level of their reservoirs.

- The composition of condensates from the Labrador Shelf indicates a deep-seated source for the gas-condensates in this area. This information suggests that additional reserves may be encountered in traps downdip of the present accumulations.

- A study of the relationship between organic geochemical and organic petrographic data has shown that misleading indications of oil source rock potential can be made if the interpretation is based solely on organic petrographic data.

- The Boundary Creek Formation in the Beaufort-Mackenzie Basin has been identified as an excellent potential petroleum source rock. However, it is generally too immature in the onland part of the basin for it to have generated large amounts of oil.

- Techniques for quantifying contamination from the x-ray tubes have been developed for x-ray fluorescence spectroscopy. These techniques will facilitate the analysis of sedimentary rocks for trace elements by x-ray fluorescence.

- Laboratory techniques have been devised and improved in the following areas: analysis of C_5 to C_8 hydrocarbons in shales and oils, dissolution of coal ash, trace element analysis using chelation techniques, establishment of computerized geochemical data base.

- The processes of incipient soil formation have been studied in Arctic rocks. The principal process is the microbial oxidation of pyrite by Thiobacillis ferroxidans to form sulphuric acid which reacts with mafic alumino silicates to form natrojarosite, ferrinatrite and aluminite.

- A Cambridge S150 Scanning Electron Microscope has been installed. It will be used to service SEM requirements of division scientists as well as in a research mode for the study of authigenic minerals in sandstones and coals.

Personnel Notes

The Petroleum Geology Subdivision employs a permanent staff of 18 scientists, 1 programmer/analyst, 10 technicians and 1 secretary. The following positions are vacant: Head, Petroleum Resources Section, Geologist (Arctic Islands), Geologist (Mackenzie Delta), Geophysicist (Mackenzie Delta), Geologist (Western Canada), Geologist (Uncon. Gas), and Geophysical Technician.

R.G. McCrossan resigned from his position as Head, Petroleum Geology Subdivision to join Esso Resources Canada Ltd.

R.M. Procter is A/Head, Petroleum Geology Subdivision.

N.G. Koch resigned as Geologist (Mackenzie Delta) for employment at PetroCan.

D.M. Campbell has joined our subdivision, first as Geophysical Technician and now as Operations Geologist working in the Petroleum Resources Section.

K.A. Evis resigned as Secretary, Petroleum Geology Subdivision to join MacCallum & Stewart Consulting Geologists.

N. Long has joined our staff as Secretary, Petroleum Geology Subdivision.

G. Jamro resigned as Inorganic Geochemistry Technologist.

R. Davidson was appointed as Inorganic Geochemistry Technologist.

S. D'Entremont was appointed as Organic Geochemistry Technologist.

P. Michael was appointed as Scanning Electron Microscope Technician.

Attendance at Meetings, Conferences and Courses

T.G. Powell

Symposium on "Organic Geochemical Correlation", GSA Meeting, San Diego, California, November 4th, 1979.

Symposium on "Petroleum Evolution", Gulf Research and Development Corporation, Pittsburg, Pennsylvania, October 15-18, 1979.

L.R. Snowdon

Symposium on "Organic Geochemical Correlation", GSA Meeting, San Diego, California, November 4th, 1979.

Milt Fuglem

CSPG-CSEG Exploration Update, Calgary, Alberta, June 10-13, 1979.

SPE-AIME Symposium on Low Permeability Gas Reserves, Denver, Colorado.

P.J. Lee

CSPG-CSEG Exploration Update, Calgary, Alberta, June 10-13, 1979.

A.A. Densmore

CSPG-CSEG Exploration Update, Calgary, Alberta, June 10-13, 1979.

Dianna Campbell

Basic Log Interpretation, Schlumberger, Calgary, Alberta, November 26-29, 1979.

Keitha Baer

Hewlett-Packard User's Group Course on Facilities Management, San Jose, California, February 25-29, 1980.

N.G. Koch

National Conference of Earth Sciences, Banff, Alberta, April 29-May 4th, 1979.

CSPG-CSEG Exploration Update, Calgary, Alberta, June 10-13, 1979.

1979 Annual AAPG Conference, Houston, Texas, April 1-5, 1979.

M. Raicar

30th Annual Technical Meeting, Banff, Alberta, May 8-11, 1979.

R.G. McCrossan

CSPG-CSEG Exploration Update, Calgary, Alberta, June 10-13, 1979.

R.M. Procter

CSPG-CSEG Exploration Update, Calgary, Alberta, June 10-13, 1979.

Karen Wallace-Dudley

Methods in Structural Geology, University of California, March 19-April 22, 1980.

Basic Log Interpretation, Schlumberger, Calgary, Alberta, November 26–29, 1979.

D.N. Skibo

CSPG-CSEG Exploration Update, Calgary, Alberta, June 10-13, 1979.

Special Talks or Lectures

T.G. Powell

"Intercorrelation of Organic Petrographic and Organic Geochemical Data", Symposium on Organic Geochemical Correlation, GSA Meeting, San Diego, California, November 4th, 1979.

"Geochemical Controls on Hydrocarbon generation in Canadian Sedimentary Basins", Gulf Oil, Pittsburg, Pennsylvania, October 15th, 1979.

Institut für Chemie, Kernforschungsanlage Julich, W. Germany, December 4th, Bundestalt für Geowissenschaftern und Rohstoffe, W. Germany, December 7th, Dept. of Chemistry, University of Bristol, England, December 17th.

"Hydrocarbon Generation in Canadian Arctic Basins", Institut Français du Pétrole, Paris, France, December 10th.

"Diagnenesis of Organic Matter and Clay minerals", Dept. of Geology, University of Sheffield, England, December 14th.

"Geochemistry of East Coast Oils and Condensates", Geochemistry Division, Canadian Society of Petroleum Geologists, Calgary, Alberta, January 22nd, 1980.

L.R. Snowdon

"Oil-oil and Oil-source Correlation in the Beaufort-Mackenzie Basin, Canada", Symposium on "Organic Geochemical Correlation", GSA Meeting, San Diego, California, November 4th, 1979.

"The Role of Cluster and Factor Analysis in Crude Oil Correlation", Geochemistry Division, Canadian Society of Petroleum Geolgists, Calgary, Alberta, January 22nd, 1980.

A.E. Foscolos

"Diagenesis of Clay Minerals in Shales and Implications for Formation of Authigenic Minerals in Sandstones", Amoco Research and Production, Tulsa, Oklahoma, Novermber 12th.

R.M. Procter

Co-author of paper and talk "Estimate of Oil Resources, Lloydminster Area, Alberta", by McCrossan, Procter and Ward - presented to First Unitar Conference on the Future of Heavy Crude and Tar Sands, Edmonton, Alberta, June 6th, 1979.

R.G. McCrossan

Co-author of paper and talk "Estimate of Oil Resources, Lloydminster Area, Alberta", by McCrossan, Procter and Ward - presented to First Unitar Conference on the Future of Heavy Crude and Tar Sands, Edmonton, Alberta, June 6th, 1979.

A.A. Densmore

"Description of Seismic Methods for Assisting in Potash Exploration" to East Indian Delegation, ISPG.

Membership on Committees

T.G. Powell

Canadian Society of Petroleum Geologists, Geochemistry Division, Chairman, Geochemical Society, Member Nominating Committee.

P.J. Lee

Editor of CSPG special volumes: Applied Exploration Mapping Methods.

M. Raicar

Computer Modelling Group.

Karen Wallace-Dudley

Library Committee, ISPG.

R.M. Procter

Chairman of Geological Potential Subcommittee - GSC.

EMR Member of Board Computer Modelling Group.

EMR Member of Technical Committee - Energy Resources Data System.

EMR Oil and Gas Coordinating Committee.

Laboratory Statistics

Organic Geochemistry

Analysis of light hydrocarbons and organic carbon:

	78/79	79/80
Light Hydrocarbon Analyses	2,616	3,220
Organic Carbon Analyses	1,882	4,095
Number of Wells	9	12

Extraction and separation of hydrocarbon fractions, rocks and oils:

	78/79	79/80
Extraction	190	240
Distillations	20	39
Separation	379	279
Gas Chromatographic Analysis	379	279

Kerogen Studies:

	78/79	79/80
Isolation	59	11
Elemental Analysis	190	15
Infra red analyses	-	68

Source Oil Correlation Studies:

	78/79	79/80
Gasoline range	36	60
Mass Spectrometry	214	50

Inorganic Geochemistry and Mineralogy

Research Projects

	78/79	79/80
X-ray diffraction mineral determinations	-	1,500
Infra red analyses	79	50
XRF analyses	-	1,000
Thermal analyses	102	432
Atomic absorption analyses	1,882	720

Requested Analytical Services to Division

	78/79	79/80
X-ray diffraction mineral determinations	2,421	2,335
X-ray fluorescence elemental analyses	60	-
Atomic absorption elemental analyses and phosphate	1,032	42
Miscellaneous analyses	480	50
SEM samples	-	30

GEOLOGICAL INFORMATION SUBDIVISION

E.R.W. Neale

This subdivision is responsible for communicating the results of the Institute's programs to government, industry, the universities and the general public. This is done chiefly through publications in the Geological Survey's own series and in established national and international scientific and technical journals. Some results are also made available through an Open File system. In support of this objective, the Subdivision maintains capabilities and facilities in scientific editing and information, cartography, technical photography, library services and publication distribution. The Subdivision also communicates with the public and the scientific community by responding to direct requests for information, by preparing semi-popular articles and displays, by sending news reports to technical and scientific journals and newsletters, by lectures, and by participation in the work of committees and associations.

During the past year, the two members of the editorial staff processed 42 reports in the Geological Survey series, 33 outside publications, 26 open file reports and 8 final maps. This involved selection of critical readers and evaluation of their reports, scientific editing, copy-editing and, in most cases, layout and proofreading.

Most maps and illustrations produced by Institute scientists for publication are prepared in the Cartographic Section. To expedite publication, some are now prepared by the scientists themselves with the advice and guidance of our draftspersons. This and other short-cuts helped to reduce the backlog to reasonable dimensions early in the year. Resignations in the Cartographic Section have left it with 20 per cent unfilled positions throughout most of the review year. This has coincided with the resignations of several of our most prolific scientists so that the growing backlog has not become as serious as it otherwise might have been. An influx of manuscript maps from Operation Porcupine began late in the past year and will impede the progress of other illustrations unless the Section can be restored to and maintained at full strength. The work of the Section includes both black-and-white and multicoloured illustrations in addition to photomechanical and reproduction work. The large cartographic process camera, installed 18 months ago, has successfully completed its shakedown period and has enhanced speed and quality of a great variety of our illustrative work. The Section also prepares slides for oral presentations and large graphic displays for workshops, meetings, and for information exchanges with universities. Good contacts are maintained with the local university and technical institute, lectures are given and students receive guided tours through our Cartographic complex as part of their course work.

The Photographic Section provides general and specialized photographic services for the Institute staff. Preparation of paleontological plates is possibly its most demanding and unique function. This entails photographing fossils from various key angles and, together with microphotography involves about 40 per cent of the Section's effort. Copy work accounts for close to 50 per cent of staff time. Production was down slightly this year as resignation of several key scientific personnel slackened demand. Previous backlogs have now been virtually eliminated and deadlines can again be met promptly. Miscellaneous activities include I.D. and passport photography and an increasing amount of publicity work illustrating personnel and equipment in action.

Our Library, the second largest geoscience library in Canada, has become established as the major public source in the West of information on energy resources, government policies and the geological data base. It serves both Institute scientists and the industrial and academic communities in many ways and handles requests from members of the public. During the past year the Library experienced serious staff shortages which, for the first time since the opening of the Institute, required some curtailment of its many services to the staff and to the public. It was again at full strength at the close of the year. Current level of service to burgeoning downtown industry and to other research institutions that are moving into the area will be difficult to maintain, however, without a net increase in man-hours in the year ahead. Library users from many walks of life in several countries continue to express their appreciation of research and information services rendered. The Library also displays its rare and unusual holdings on a rotating basis for the benefit of staff and visitors.

All publications of the Geological Survey, selected publications of the Surveys and Mapping Branch and certain other pertinent Departmental publications are sold and distributed from our Publications Section. This Section features a self-serve system for topographic maps and an automated selective system for products of the National Air Photo Library. General inquiries from schools, institutions and individuals are handled by this unit. To satisfy their demands, the Publication Section now carries almost all informational pamphlets published by the Department. The year in review saw a greatly increased demand for maps, reports and general information for regions beyond western Canada. The amenities and the courteous efficient service of the staff not only serve as a convenience to the petroleum industry and the general public but also as an advertisement for the scientific work of the Institute and, in fact, of the entire Department.

HIGHLIGHTS

- Over 10,000 people visited the Publications Section during the year. Most visitors purchased topographical maps or G.S.C. reports, establishing an annual sales record.

- The three I.S.P.G. supervisors attended the first cartographic supervisors workshop in Ottawa, May 1979. It was unanimously agreed that this long overdue event satisfactorily settled many differences of opinion on specifications, standards and techniques. It is hoped that similar workshops will be organized at reasonably regular intervals in the future.

- A handsome portrait of the late Dr. R.J.W. Douglas was proudly added to the gallery of famous western Canadian geologists in the I.S.P.G. Library.

- The annual Geological Survey exhibit was prepared this year by I.S.P.G. scientists and cartographers. Entitled "The G.S.C.'s Role in Fossil Fuel Exploration, 1842-1979" it attracted a great deal of attention at the annual meetings of the Geological Association (at Quebec) and the Petroleum Geologists (at Calgary). Subsequently, it has toured western Canadian universities and the G.S.C. office in Vancouver. It will be loaned to various government agencies and universities in eastern Canada during 1980.

- The Library tea celebrating I.S.P.G.'s 13th anniversary was attended by all surviving charter members and proclaimed the social highlight of the year. Bernie Latour cut the cake. Marian Jones eulogized the giants of the past.

PERSONNEL NOTES

Catherine Findlay resigned in April to accept an editorial post with the Alberta provincial government. Lynn Machan won the competition for her position, Assistant to the Editor, in November.

Suzanne Coutts took over Lynn's post as Library Clerk in March. Suzanne came to us from the City of Calgary library system.

Pam van Duffelen resigned as Library Acquisitions Clerk in April and was replaced by Valerie Chipper (of the Typing Office) in November.

Peter Roode resigned from the Cartography section in August to accept a post with industry. His and another vacant post in this section remained unfilled due to lack of suitable applicants.

Jean Spirritts left a permanent position in the Typing Office to accept the (continuing) temporary position in the Publications Section in December. She replaced Debbie Budvarson who won the competition for a post in Accounts and Finance.

Attendance at Meetings, Conferences and Courses

M. Jones

Visit to the GSC Library, Ottawa, in May to discuss mutual problems with the new librarian, Annette Bourgeois.

AACR II (Anglo-American Cataloguing Rules) workshop University of Calgary (March).

J.C. Graff

Annual CAIS (Canadian Association of Information Sciences) Conference, Banff (May).

Various monthly meetings of the local CASLIS group of the Canadian Library Association.

J.W. Thomson

Ontario Institute of Chartered Cartographers Annual Meeting in Toronto (May).

G.S.C. Cartographic Supervisors Workshop in Ottawa (May).

W.P. Vermette

Canadian Cartographic Association Annual Meeting in Ottawa (May).

G.S.C. Cartographic Supervisors Workshop in Ottawa (May).

L. MacLachlan

Canadian Cartographic Supervisors Workshop in Ottawa (May).

Six meeting's of Olds Community College, Advisory Committee on Cartography (December-March).

E.R.W. Neale

Meetings of Canadian Geoscience Council (Quebec-May, Calgary-September, Ottawa-December).

Canadian Society of Petroleum Geologists, Calgary (June).

Geological Association of Canada, Quebec (May).

Visits to Eastern Canadian Universities on behalf of C.G.C. - U.N.B., Dalhousie, St. Mary's, Acadia, Memorial (April).

Atlantic Universities Geological Conference - Adjudicator (October), St. John's, Newfoundland.

L. Machan

Monthly meetings of the local CASLIS group of C.L.A.

Three meetings of Equal Opportunities for Women (P.S.C.) in Edmonton (May, October and February).

Membership on Committees

L. MacLachan

Member, Exhibits Committee, 1979-80.

Member, Advisory Committee on Cartography, Olds College.

E.R.W. Neale

Canadian Journal of Earth Sciences, editor (resigned Dec.).

Geoscience Canada - associate editor.

University of Calgary - adjunct professor (until Dec.).

C.G.C. - Universities Appraisal Committee - co-chairman.

E.R.W. Neale (cont'd)

APICS - member Atlantic Young Scientists of the Year Committee.

G.A.C. Editorial Committee - member.

G.S.A. Publications Committee - member.

C.S.P.G. - Assoc. Program Chairman - Energy Audit of the 80's.

L. Machan

Equal Opportunities for Women (P.S.C.) - I.S.P.G. Rep.

Special Talks and Lectures

L. MacLachlan

Lecture on "Basics of Good Illustrations" to Field School Class, University of Calgary (March).

L. Machan

Lecture on "Style and Organization in Report Writing", Field School Class, University of Calgary (February).

E.R.W. Neale

4 Lectures on "Evolution of the Appalachians" - Structural Geology Class, University of Calgary (January-February).

4 Lectures on "Scientific Report Writing", Field School Class, University of Calgary.

STATISTICS ON SUBDIVISION ACTIVITIES

April 1, 1979 - March 31, 1980

Manuscripts Processing Section

Manuscripts & Publications
1/4/79 - 31/3/80

Format	Rec'd	To Ottawa	To Publ.	Printed
Memoirs	1	1 2 being processed ISPG		2
Bulletins	15	10		8
Papers	9	10		6
80-1B	8	8		-
80-1A	5	5		5
79-1C	4	4		4
Maps	8	3		7
Open files	26	-	-	26
Outside	33	-	22	-

Library

ACQUISITIONS

Books, etc. acquired by purchase	1,028
Books, etc. acquired by gift or exchange	1,754
Maps added	134

CIRCULATION

Books and periodicals (to staff only)	15,570

Inter-Library Loans

Borrowed	334
Loans and xerox copies provided	687

ON LINE SEARCHES 50

Publications and Air Photo Section

Breakdown of Deposits:

	1978-79	1979-80
Surveys and Mapping	$ 38,072.13	$ 48,574.44
National Air Photo Library	5,974.82	5,551.80
GSC Maps	8,821.75	10,427.00
Rock & Mineral Kits	1,356.00	1,290.00
Misc. GSC Materials	2,645.90	2,380.96
GSC Publications	15,156.20	22,556.35
Mineral Development	111.50	135.75
Gravity Maps	252.00	395.00
	$ 72,390.30	$ 91,311.30

Breakdown of Accounts:

	1978-79	1979-80
Credit Sales	$ 39,209.30	$ 47,699.25
Cash Sales	33,585.45	45,165.40
Rec'd on accounts	38,804.85	46,145.90

Air Photos:

A total of 214 orders were forwarded to Ottawa during the year. These consisted of:

9484 Black & White contact prints	33 Transparencies
9 Colour contact prints	11 Diapositives
13 Enlargements at 10" x 15"	41 Transparency enlargements
12 Enlargements at 15" x 15"	6 I.R. contact prints
23 Enlargements at 20" x 20"	38 Black & White Landsat mosaics
6 Enlargements at 30" x 20"	3 Colour landsat mosaics
9 Enlargements at 40" x 40"	297 Flight line maps

Approximately 11,000 phone calls were received during the year. Visitors to the office totalled 10,006 and 2,222 mail orders and enquiries were received.

PHOTOGRAPHIC SECTION

	1979-80
Total number of continuous tone 4 x 5 negatives	1700
Total number of black & white prints	7718
Total number of black and white Contact Sheets	804
Total number of colour negatives and prints	308
Total number of rolls (20 and 36 exposures) of colour slide film	153
Total number of rolls (5-40 exposures) of black and white negative film	173
Total number of rolls submitted (by staff members) for processing	118
Total number of high contrast line negative	40

GEOLOGICAL CARTOGRAPHY SECTION

Maps and figures prepared by the Cartographic Section and sent to Ottawa for printing between April 1, 1979 and March 31, 1980.

	1978-1979	1979-1980
Multicolour maps and section sheets	9	12
Figure illustrations (page)	481	319
Figure illustrations (pocket)	20	31

Manuscripts received	1978-1979	1979-1980
Multicolour geological maps	9	6
Figure illustrations (page)	369	165
Figure illustrations (pocket)	23	15

Maps & illustrations in progress at March 31, 1980

	1978-1979	1979-1980
Multicolour geological maps	6	7
Figure illustrations (page)	164	105
Figure illustrations (pocket)	37	21

Miscellaneous drafting which averaged approximately 9% of the total drafting time comprised 209 separate items.

Reproduction services

	1978-1979	1979-1980
Diazo prints	5011	4626
Diazo prints (frame shots)	388	1082
Di-chrome	84	155

Photomechanical sevices

Film (sheets, negatives & positive)	4062	3957
Drafting keys on scribecoat	141	95
Blueline on Cronaflex	163	123
Colour proofs	19	26
Peelcoats	152	128
C-1 prints	361	215
KC-5 prints	1405	1029
Autopositives (multiple exposure)	546	360
Sepia (dry erasable film)	268	125

Camera services

Film shots (line)	2425	3846
Film shots (halftone)	73	31
Paper	10	24

PRECAMBRIAN GEOLOGY DIVISION

J.E. Reesor, Director

INTRODUCTION

This Division is responsible for all aspects of the bedrock geological framework of the Precambrian Shield. In addition, units of the Division are charged with responsibility for isotope geochronological studies, for petrological studies and for paleomagnetic studies throughout Canada.

The objectives of the Division are: To provide a systematic study of the geological framework of the Canadian Shield to standards consistent with the needs for mineral resource discovery and evaluation of future resource potential; to provide isotope geochronology and paleomagnetic studies contributing to consistent correlation and to uniform presentation of the geology of Canada; to provide petrogenetic and metamorphic studies on major rock groups and metamorphic assemblages in Canada, directed toward solution of important regional problems.

The Division is organized into a regional geology subdivision consisting of three regional sections and a separate unit consisting of geochronology, petrology and paleomagnetic sections. The Regional Subdivision is responsible for the bedrock studies of the Canadian Shield and for reporting results on geological maps at various scales and in reports and scientific papers. The Geochronology, Petrology, and Paleomagnetic Sections provide isotopic and paleomagnetic and petrologic studies by which age relations and processes of formation of rock assemblages are established. Special studies in the Division involve bedrock studies in Newfoundland and the radioactive waste disposal program.

The Precambrian Division as it stands at present was established during 1979 through the reorganization of Regional and Economic Geology Division. The projected move to Thunder Bay was cancelled by the Government.

The establishment now consists of 62 continuing positions and 13 casual person-years, largely used for employment of students for summer field work in the Canadian Shield.

REGIONAL GEOLOGY SUBDIVISION

W.F. Fahrig

The objectives of the Regional Geology Subdivision are to determine the composition, structure, origin and evolution of the Canadian Shield and to relate the mineral deposits of the region to these features. The results of this research are documented in appropriate published geological maps, reports and scientific papers.

The Subdivision is comprised of 26 research scientists and two physical scientist support staff engaged in Precambrian studies; a secretary, and a draftsman. The unit is organized into three sections: Bear-Slave, Northern Churchill, and Superior-Grenville; three scientists are assigned to Special Projects.

Highlights

Bear Province

The Wopmay Orogen is in the central part of the Bear Province, to the west are the younger calc-alkaline volcanic and plutonic rocks of the Great Bear Batholith, and to the east is the foreland fold and thrust belt. Within the Wopmay Orogen syn- to post-tectonic plutons are clustered in two composite batholiths, Hepburn in the middle and Wentzel on the west side. Although granite is most abundant, the overall compositional range is from granite to pyroxenite. In general, the plutons become more basic and less deformed with time. The peak of metamorphism is related to the earliest granites, younger plutons being discordant with respect to the metamorphic isograds. Wentzel Batholith is the roof of a plutonic complex exposed in the core of a major anticlinorium. Hepburn Batholith comprises the floor and feeders to a pancake-shaped plutonic complex preserved in the keel of a synclinorium. The batholiths were emplaced during closure of these folds and after craton-vergent thrusting. Their setting is comparable to that of Cenozoic continental collision zones.

Slave Province

Studies in the eastern part of the Slave Province indicate that Yellowknife Supergroup rocks are widespread and include a major sequence of migmatitic intermediate volcanics and metasediments along the eastern border. Extensive plutonic and gneiss units range from granodiorite to diorite. The structural pattern produced by polyphase ductile deformation changes from complex and curvilinear in the west to north-trending linear zones in the east. Metamorphic grade of the low pressure type increases eastward from greenschist to upper amphibolite facies with relict kyanite indicating the greatest uplift in the highest grade zone. No changes in lithology, metamorphic grade,

or structural style in the zone previously delineated as the Thelon Front were found. Completion of mapping in the area is required before a revised definition and location of the structural province boundary can be proposed.

Central District of Keewatin

Field work at a scale of 1:250 000 southwest of Baker Lake has added new information about the development of intracratonic early Proterozoic basins filled by sediments and volcanics of the Dubawnt Group. Development began with basement uplift followed by deposition of red bed sequences in subsiding troughs. Red beds were buried by products of subaerial alkaline volcanic cycles that mark the initial stage in the igneous history of the basin. Wedges of volcaniclastic alluvial fan sediments overlie the alkaline lavas. Renewed igneous activity resulted in a bimodal association of acid and basic volcanic and plutonic rocks. Rhyolite flows are probably comagmatic with granite plutons that intrude central and southwest parts of the Baker Lake basin. The acid rocks are closely associated with small gabbroic intrusions and a few basalt flows.

Uranium mineralization is spatially related to unconformities at the base of the Dubawnt Group or to anomalously radioactive syenites and granites. Minor base-metal vein mineralization has been identified within the alkaline lavas.

Fury and Hecla Strait

A multidisciplinary study of late Precambrian sedimentary rocks and nearby subjacent radioactive gneiss of the Churchill Province was undertaken on northern Baffin Island. The flat-lying, unmetamorphosed Helikian and/or Hadrynian clastic sediments extend for about 150 km along the north shore of Fury and Hecla Strait and up to 50 km inland. The sequence is about 6000 m thick and has been divided into five conformable units, from the base upward consisting of: red sandstone, shale, conglomerate and dolomite; coarsening upward red shale and sandstone; pink quartzite; varicoloured sandstone-shale; and black shale. Both alluvial and marine depositional environments are represented in the sediments, and paleocurrents flowed broadly westward. Deformation is limited to faulting and gentle southward tilting.

Lying nonconformably beneath the sediments are granitic and gneissic rocks of Archean and/or Aphebian age. Mapping, concentrated about two large radiometric anomalies situated in the east and west of the area, showed them to be broadly coincident with weakly-deformed pink biotite-hornblende granite, cut by granitic pegmatite. The granite, present as a batholith in the east, is also present as smaller bodies in the west. The eastern granite is margined by pre- to syntectonic porphyritic monzonite(?) that cuts widespread surrounding tonalitic gneiss. Deformation in both areas is intense except in the case of the granite and pegmatite.

Northern Baffin and Bylot Islands

Work on late Proterozoic strata in northern Baffin and Bylot Islands has outlined more than 5600 m of late Proterozoic quartz-arenites, shales, stromatolitic and biohermal carbonates, arkoses, greywackes and conglomerates that were deposited in environments ranging from fluvial to subtidal. A delta-fan complex occurs in the lower part of the succession, coastal sabkha-type evaporites in the middle part, and an alluvial fan complex in the upper part. As much as 80 m of tholeiitic plateau basalts occur near the base of the succession.

Syndepositional faulting had a significant effect on the sedimentation pattern. Paleocurrent trends are varied, but most indicate northwesterly transport in central graben areas and in some horst areas. Transport away from fault zones active during sedimentation and toward central graben areas, is indicated in marginal trough areas. Rifting was probably related to a late Proterozoic ocean opening event to the northwest; perhaps an early phase of the Franklinian Geosyncline.

Personnel Notes

H.H. Bostock, research scientist in the former Correlations and Standards Subdivision, transferred to this Subdivision on reorganization of the former Regional and Economic Geology Division in October.

A. Ciesielski, who had worked extensively for the Quebec Ministry of Natural Resources, joined the Subdivision as a research scientist in April.

S. Tella occupied a term position as Support Geologist.

K. Attoh, post-doctorate fellow from Ghana, continued his research on a comparison of Ghanian and Canadian Shield greenstone belts and carried out field work in the Wawa area.

Attendance at Meetings, Conferences and Courses

W.R.A. Baragar

Geological Association of Canada, Volcanology Division field trip, Canary Islands, April 8-23, 1979.

Iceland Research Group, Post-drilling Conference, Halifax, N.S., May 17-18, 1979.

Geological Association of Canada and Mineralogical Association of Canada, Annual Meeting, Quebec City, Quebec, May 23-25, 1979.

International Union of Geodesy and Geophysics, Canadian National Committee Meeting, Ottawa, Ontario, September 28, 1979.

Geological Association of Canada council meeting, Halifax, N.S., February 15-16, 1980.

K.D. Card

Geological Association of Canada and Mineralogical Association of Canada, Annual Meeting, Quebec City, Quebec, May 23-25, 1979.

International Union of Geological Sciences, Subcommission on Precambrian Stratigraphy, meeting and field trip leader, Duluth, Minnesota, September 14-19, 1979.

A. Ciesielski

Geological Association of Canada and Mineralogical Association of Canada, Annual Meeting, Quebec City, Quebec, May 23-25, 1979.

A. Davidson

Geoscience Forum, Yellowknife, Northwest Territories, December 6-7, 1979.

I. Ermanovics

J.T. Wilson Symposium, Continental crust and its mineral deposits, workshop, University of Toronto, Ontario, May 14-16, 1979.

M.J. Frarey

International Union of Geological Sciences, Subcommission on Precambrian Stratigraphy, meeting and field trip, Duluth, Minnesota, September 14-19, 1979.

T. Frisch

Geological Society of America Annual Meeting, San Diego, November 5-8, 1979.

R.A. Frith

Geological Association of Canada and Mineralogical Association of Canada, Annual Meeting, Quebec City, Quebec, May 23-25, 1979.

J.R. Henderson

J.T. Wilson Symposium, Continental crust and its mineral deposits, workshop, University of Toronto, Toronto, Ontario, May 14-16, 1979.

P.F. Hoffman

J.T. Wilson Symposium, Continental crust and its mineral deposits, workshop, University of Toronto, Toronto, Ontario, May 14-16, 1979.

Geological Association of Canada and Mineralogical Association of Canada, Annual Meeting, Quebec City, Quebec, May 23-25, 1979.

International Union of Geological Sciences, Subcommission on Precambrian Stratigraphy, meeting and field trip, Duluth, Minnesota, September 14-19, 1979.

M.B. Lambert

Geological Society of America, Annual Meeting, San Diego, California, November 5-8, 1979.

North American Commission on Stratigraphic Nomenclature, Annual Meeting, San Diego, California, November 7, 1979.

A.N. LeCheminant

J.T. Wilson Symposium, Continental crust and its mineral deposits, workshop, University of Toronto, Toronto, Ontario, May 14-16, 1979.

Geological Association of Canada and Mineralogical Association of Canada, Annual Meeting, Quebec City, Quebec, May 23-25, 1979.

Geoscience Forum, Yellowknife, Northwest Territories, December 6-7, 1979.

J.H. Maley

International Union of Geological Sciences, Subcommission on Precambrian Stratigraphy, field trip, Duluth, Minnesota, September 14-19, 1979.

The 8th Geochautaugua Conference, Syracuse University, Syracuse, New York, October 26-27, 1979.

J.C. McGlynn

Geological Association of Canada and Mineralogical Association of Canada, Annual Meeting, Quebec City, Quebec, May 23-25, 1979.

F.C. Taylor

Canadian Society of Petroleum Geologists, International Workshop, "A Geological Atlas of the North Atlantic Borderlands", St. John's, Newfoundland, June 17-22, 1979.

Prospectors and Developers Association Convention, Toronto, Ontario, March 9-12, 1980.

Membership on Committees

W.R.A. Baragar

Geological Association of Canada, Councillor.

International Union of Geodesy and Geophysics, Canadian National Committee Member.

Graduate Studies Committee, Geology Department, Université de Québec à Chicoutimi.

Ph.D. Thesis Committee (Pierre Trudel), Ecole Polytechnique, Montreal, Quebec.

F.H.A. Campbell

Geoscience Canada, Associate Editor.

Geological Association of Canada, Convenor and Editor, Proterozoic Basins Symposium, Halifax, N.S. 1980.

Canadian Committee for the International Lithosphere Project, Member.

International Association of Sedimentologists, Co-chairman 1982 meeting, Archean Sedimentation, Hamilton, Ontario.

K.D. Card

Precambrian Division, Geological Association of Canada, President 1979-80.

International Union of Geological Sciences, Subcommittee on Precambrian Stratigraphy, Corresponding Member 1979-80.

GSC Precambrian Time Classification Committee, Member.

A. Davidson

Precambrian Subdivision Committee on Geochronology, Member.

GSC Precambrian Time Classification Committee, Member.

Canada-Ontario DREE Agreement, Mapping Subcommittee, Member.

I. Ermanovics

Canada-Newfoundland DREE Agreement, Mapping Subcommittee, Member

M.J. Frarey

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

GSC Committee on Precambrian Nomenclature, Chairman.

T. Frisch

GSC Library Committee, Member.

Committee on General Instructions for Field Parties, Member.

J.B. Henderson

North American Commission on Stratigraphic Nomenclautre, Advisory Group on Plutonic and Metamorphic Rocks, Member.

P.F. Hoffman

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

M.B. Lambert

North American Commission on Stratigraphic Nomenclature, Member.

Volcanology Division, Geological Association of Canada, Secretary-Treasurer.

Precambrian Subdivision Committee on Geochronology, Member.

Departmental Field Equipment Committee, GSC Representative.

A.N. LeCheminant

Precambrian Subdivision Committee on Geochronology, Chairman.

J.C. McGlynn

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

Northwest Territories Coordinating Committee on work in the North, Member.

Canadian Working Group on Precambrian Stratigraphy, Member.

Mikkel Schau

Precambrian Subdivision Committee on Geochronology, Member.

F.C. Taylor

Departmental Field Equipment Committee, Chairman.

Special Talks and Lectures

W.R.A. Baragar

"The Circum-Superior Belt: A Proterozoic Plate Margin?", Ottawa University, March 17, 1979.

F.H.A. Campbell

"Proterozoic Sedimentation in the Bathurst Inlet Area - a tale of Two Basins" at Universities of: Ottawa, Alberta and Calgary.

A. Davidson

"Blachford Lake Complex", Geoscience Forum, Yellowknife, December 7, 1979.

T. Frisch

"Geology of the eastern Arctic", Eastern Arctic Winter School, Boreal Institute of Northern Studies, Montreal, April, 1979.

"The Proterozoic Thule Group and its bearing on the question of movement between Ellesmere Island and Greenland", Toronto Geological Discussion Group, January, 1980.

P.F. Hoffman

"Tectonic Environments", seven-part lecture series, GSC Ottawa, January-February 1980.

"Precambrian Stratigraphy: Principles and Practice", three-part lecture series, Rice University, Houston, Texas, January 29-31, 1980.

"Wilson Cycle of Early Proterozoic Age", J.T. Wilson Symposium, Toronto, Ontario, May 15, 1979; Queen's University, September 27 1979; State University of New York, Albany, New York, September 28, 1979; and Carleton University, Ottawa, November 14, 1979.

G.D. Jackson

"The Crystalline Rocks of Baffin Island", Geology of Arctic Canada Seminar, University of Ottawa, Ottawa, January 23, 1980.

M.B. Lambert

Three lectures: "Subaerial Pyroclastic Flows", "Subaqueous Pyroclastic Flows" and "Calderas and the Bennett Lake Cauldron Subsidence Complex", part of a Short Course on Metavolcanic Rocks, Carleton University, Ottawa, November, 1979.

A.N. LeCheminant

"Geology of Tebesjuak Lake area", Geoscience Forum, Yellowknife, N.W.T., December 6, 1979.

Mikkel Schau

"Geological History of the Southern Edge of the Armit Lake Block, Northern Churchill Province, N.W.T.", University of Ottawa, Ottawa, November 18, 1979.

F.C. Taylor

"Precambrian Geology of the Canadian North Atlantic Borderlands", Canadian Society of Petroleum Geologists, International Workshop, A Geological Atlas of the North Atlantic Borderlands, St. John's, Newfoundland, June 18, 1979.

Subdivision Manuscripts

Manuscripts for 2 GSC Memoirs, 2 GSC Bulletins, 1 'A' Series Map, 13 Current Research Papers, 9 Open File Maps, 8 Outside Papers, 3 Abstracts, and 2 Technical Notes, Discussions or Comments were produced by the staff of the Subdivision during 1979-80.

GEOCHRONOLOGY SECTION

R.D. Stevens (Acting Head)

The Geochronology Section undertakes isotopic analyses and computations required for the determination of the geological age of rocks and minerals based on the K-Ar, Rb-Sr and U-Pb isotopic systems. Interpretation of the resulting information leads to an understanding of geological time and correlations which, in turn, constitute essential components in the geological mapping of Canada and evaluation of the national economic mineral potential.

In order to achieve its objectives the Section is equipped with two operational gas-source mass spectrometers for argon isotopic analysis, three operational solid-source mass spectrometers for the isotopic analysis of potassium, rubidium, strontium, uranium and lead, an additional solid-source instrument under construction and a very old, retired, gas-source machine which is scheduled for eventual refurbishing and modernization. These instruments are supported by associated chemical, mineralogical and electronic facilities within the Section and by external rock and mineral processing laboratories, XRF, XRD, spectrographic services and an instrument development machine shop. The Section staff comprises five scientists (1 RS, 3 PC's and 1 CH) and six technicians when at full strength.

Highlights

The most noteworthy developments during the fiscal year relate to computer-controlled automation of the solid-source mass spectrometers. A crucial decision point was reached when electromechanical control methods were abandoned in favour of totally electronic control. Thereafter, steady progress was achieved and, despite the unrelated failure of two power supplies, the development of an operating prototype control system on the 6" mass spectrometer (MS-4) "test bed" was completed. Subsequently, the prototype system was transferred to the 10" mass spectrometer (MS-2) which will be the first solid-source instrument to be fully automated. Appropriate computer programs were created, tested and modified to accomplish the automation with the desired options and alternatives, with the result that Rb isotopic analyses are now routinely carried out under automatic control. Automation of the Sr analysis operation, necessarily using somewhat different programs, will commence in a short while.

As a direct adjunct to Rb automation certain refinements in the sample preparation chemistry and filament loading techniques have been made and result in a notable improvement in ion emission stability. Also, as a result of the 6" MS-4 instrument having been used as a "test bed" for the prototype development, several improvements to its operating characteristics have been realized and the quality of isotope dilution potassium determination will consequently be upgraded.

Considerable effort was put into the development of a single filament technique for Rb isotopic analysis (as distinct from the "old" triple filament technique). In conjunction with an ion-exchange column process to improve the purity of Rb in the sample preparation chemistry stage this new technique works well and is an initial step in the future design of a multi-sample source assembly. The technique also results in a saving in filament construction time and material.

The use of teflon crucibles in place of platinum for Sr sample dissolution has reduced the Sr blank associated with the old Pt vessels (from 20 - 25 ng to 15 ng) and has incidentally decreased the platinum inventory requirements of the laboratory. Also, the greatly expanded use of laminar flow clean air cabinets has resulted in a considerable reduction of the Pb blank in zircon sample chemistry. The Pb blank has, in fact, been reduced to approximately one half of its previous level and now ranges between 0.5 to 2.0 ng per extraction.

Another technical advance has resulted from the installation of a liquid nitrogen cooled cold finger in the source of the 15" U-Pb mass spectrometer. This innovation provides faster pump-down before analysis and a better vacuum during analysis with consequent improved stability and sensitivity.

Considerably more time has been devoted to detailed zircon sample preparation within our own laboratory this year. This involved preparing selected grain-size fractions, micro-scale magnetic separations, and hand-picking according to specific characteristics. In many cases hese operations have been carried out in close consultation with the geologist concerned with a resultant benefit to all parties. One noteworthy outcome of this endeavour has been that we were able to obtain a zircon/monazite concordia age on one 2" pebble from a conglomerate using only 30 grains of zircon and 20 of monazite.

Personnel Notes

Dr. R.K. Wanless retired from the Geological Survey at the end of December 1979. R.D. Stevens has been designated Acting Head of the Geochronology Section pending the appointment of a senior research scientist to fill the position.

Field Activities

R.K. Wanless visited the field parties of K.E. Eade and A.N. LeCheminant in Keewatin to collect samples for age determination, primarily by the Rb-Sr isochron and zircon methods.

Attendance at Meetings, Conference and Courses

K. Santowski

Completed the standard First Aid course and obtained certificate, Feb. 11-15, 1980, EMR.

R.D. Stevens

Introductory S.I.R. data management course, EMR Computer Sciences Centre, June 18, 1979.

R.W. Sullivan

Introductory S.I.R. data management course, EMR Computer Sciences Centre, March 18, 1980.

Membership on Committees

R.D. Stevens

Member, Thunder Bay Relocation Project Team.

R.K. Wanless

Member, G.S.C. Age Determination Committee.

Chairman, Canada-Saskatchewan Advisory Board.

Special Talks or Lectures

W.D. Loveridge

Analytical chemistry seminar series; "Isotope Dilution Analysis", February 22, 1980.

R.D. Stevens

Analytical chemistry seminar series; "Geochronology", Feb. 8/80.

R.W. Sullivan

Analytical chemistry seminar series; "Contamination-free Chemistry", March 28, 1980.

Two groups of Quebec university students were given guided tours of the Section laboratories.

Section Manuscripts

Three manuscripts were prepared and submitted during the year. Two were for outside journals (Ray and Wanless, Ermanovics and Wanless) and one for the GSC Paper series (Wanless, Stevens, Lachance and Delabio). A fourth manuscript covering Rb-Sr and U-Pb age determinations is in preparation for the GSC Current Research series but will not be submitted until early in the 1980-81 year.

Laboratory Statistics

	1978-79	1979-80
Argon extractions	154	201
Argon analyses	175	202
Potassium by isotope dilution	29	43
K-Ar ages reported	139	181
Rb isotopic analyses	167	386
Sr isotopic analyses	241	30
Rb-Sr isochron projects	33	21
Rb-Sr isochron reports		11
Pb isotopic analyses	335	422
U isotopic analyses	137	154
Zircon fractions analyzed	83	127

Distinguished Visitors

Visitors to the Geochronology laboratories during the year included C. Brooks, J. Cole, D. Menagh, K. Collerson, K. O'Nions, D. Russell and groups of students from several Quebec universities.

PETROLOGY SECTION

K.L. Currie (Head)

The Petrology Section analyzes mineral assemblages, in an attempt to understand and quantify the processes of rock formation and transformation. Detailed field studies both supply material for analysis and provide an opportunity for the application of models worked out in the laboratory. The section includes laboratories for the study of rock forming processes at high temperatures and pressures, and a petrographic laboratory which provides services, working space, and instruments for petrographic analysis.

Highlights

Re-examination of the classic late Precambrian-Cambrian terrane around St. John, N.B. suggests that much older rocks (Aphebian?) occur as narrow tectonic slivers. The late Precambrian volcanic succession promises to yield significant information on the processes of formation and destruction of the eastern margin of the Iapetus Ocean.

The 6000 m thick Fury and Hecla sequence is probably an Hadrynian mioclinal succession consisting of basal redbeds with intercalated volcanic flows, passing upward into marine quartz arenites and shales. The sequence likely correlates with the basal part of the Borden Peninsula succession 320 km to the north. Significant mineralization, is probably restricted to unconformity related vein-type deposits adjacent to the basal unconformity.

Solubility of nepheline, leucite, biotite and hornblende in supercritical water is dominated by Si, with lesser amounts of Na, K, and Al. Other elements are essentially insoluble. The variation in solute and relative contents of these elements shows that several solute species must be involved, apparently including NaOH and KOH.

Preliminary examination of the Mistastin batholith, Labrador shows it to be composite, with most constituent plutons exhibiting rapakivi texture. Granulite and pyroxene-bearing and olivine-bearing anorthosite inclusions were probably brought up from depth. Ferro-augite, ferro-pigeonite and fayalite-bearing diorite, monzonite and quartz monzonite form the older parts of the batholith, while biotite and biotite-hornblende granites with accessory fluorite form the younger parts.

Olivine-pyroxene-plagioclase assemblages from the Mealy Mountains Complex, Labrador form sensitive geobarometers for anorthosites and basic rocks. Igneous crystallization pressures can be deduced to better than 0.5 kilobars relative and 1.0 kilobars absolute. These estimates are in good agreement with other indicators, and provide a firmer base to estimate timing and amount of tectonic uplift, particularly in central Labrador, where the appropriate assemblages are widespread.

Preliminary work on the Ptarmigan Lake Complex, Labrador, suggests the magma parental to the anorthositic and monzonitic rocks was emplaced into an Aphebian or Archean granulite terrane at depths of 25 km or more. Subsequent retrogression is pervasive only near the cataclastic zones bounding the uplifted block, and locally cutting across it.

Further investigation of mineral stabilities has led to a P-T grid which ties together mafic and pelitic minerals. The grid appears to yield satisfactory predictions of mineral assemblages, but requires further testing. An initial application to volcanic and pelitic rocks at Snow Lake, Manitoba was successful.

Personnel Notes

At year end the section consisted of 5 Research Scientists. A.V. Okulitch transferred from Petrology Section to I.S.P.G.,Calgary in August 1979. F.W. Chandler transferred into Petrology Section from Appalachian Section, October, 1979. S.D. Adcock, University of Manchester, measured the solubility of selected silicates in supercritical water in the section's laboratories from August 1979 to March 1980.

Attendance at Meetings, Conference and Courses

K.L. Currie

2nd plenary session, IGCP Project 27, The Appalachian-Caledonide Orogen, Blacksburg, Va., 26 August-9 September 1979.

F.W. Chandler

GAC-MAC Annual Meeting, Quebec City, May 1979.

R.F. Emslie

GAC-MAC Annual Meeting, Quebec City, May 1979.

E. Froese

Annual Meeting of Mineral Resources Division, Manitoba Dept. of Mines, Natural Resources and Environment, Winnipeg, 20 November, 1979.

T. Gordon

Annual Meeting of Mineral Resources Division, Manitoba Dept. of Mines, Natural Resources and Environment, Winnipeg, 20 November, 1979.

8th Geochautauqua "Computer Applications in the Earth Sciences - an Update of the 70's" Syracuse, 26-27 October, 1979.

Membership on Committees

K.L. Currie

Associate Editor, Canadian Mineralogist.

Plutonic Working Group, IGCP Project 27, Member.

F.W. Chandler

INRS-Pétrole, ad hoc visiting committee, Member.

External advisor to Bryan Zaitlin, M.S. student, University of Ottawa.

R.F. Emslie

Nominating Committee for Logan Club Chairman, Chairman.

E. Froese

Adjunct Professor, Carleton University.

T.M. Gordon

Branch Computer Facilities Committee, Member.

Special Talks and Lectures

K.L. Currie

"Geochemical transport processes in crystalline rocks" Geochemical Discussion Group, Ottawa, April 1979.

F.W. Chandler

"Aphebian Geology of the Richmond Gulf area", GAC-MAC, Quebec, May 1979.
- Amended versions of this talk also given at the University of Quebec at Chicoutimi and the University of Ottawa.

"Base Camp Logistics" EMR Safety Seminar, January 1980.

R.F. Emslie

"Anorthositic massifs of the Mealy Mountains, southern Labrador" GAC-MAC, Quebec, May 1979.

"Rare earth abundances in the Harp Lake complex, Labrador" GAC-MAC, Quebec, 1979.

E. Froese

"Applications of thermodynamics in the study of mineral deposits".
Series of lectures presented at the University of Gottingen, Germany, May, 1979.

The above lecture series was repeated at Carleton University, Ottawa, in February-March 1980.

Section Manuscripts

Seven GSC Papers (including Current Research papers), 3 Outside Papers and 2 Open Files were submitted for publication by the staff during 1979-80.

PALEOMAGNETIC SECTION

E.J. Schwarz (Head)

The section continued its program of conducting paleomagnetic studies in conjunction with geological field studies in the Precambrian Shield.

Work on late Proterozoic sediments and basaltic flows of the Borden Basin, northern Baffin Island, shows stable and consistent magnetization and a number of reversals.

Studies on Proterozoic basalts, red beds and andesites from Richmond Gulf and the Manitounuk Islands (Quebec and Northwest Territories) show a consistent southeast-up direction of magnetization with a rather large spread in declination, whereas Proterozoic red beds from La Grande 4, Quebec show stable remanence with northeast to east-up direction.

The amount of uplift of the Canadian Shield during the last 2000 Ma is being evaluated using a new technique on dyke contacts in the Sudbury-Timmins area. Reasonably consistent results have been obtained for two contact zones of an Abitibi dyke (2100 Ma) and a different result is given by two contact zones across a Sudbury dyke (1220 Ma).

Attendance at Meetings, Conference and Courses

E.J. Schwarz

Canadian Geophysical Union, Annual Meeting, Fredericton, N.B., June 4-6, 1979.

Special Talks or Lectures

E.J. Schwarz

"Depth of burial from remnant magnetism", Canadian Geophysical Union, Fredericton, N.B., June 5, 1979.

Section Manuscripts

The section submitted manuscripts for 3 outside papers during the report year.

SPECIAL PROJECT

B.V. Sanford

B.V. Sanford continued to provide geological support services to the Atomic Energy of Canada,Ltd., in the host rock evaluation of salt, limestone, shale and plutonic igneous rocks for radioactive waste disposal. Studies of sedimentary terrane in Saskatchewan, Ontario and Nova Scotia were supported by scientists of the Institute of Sedimentary and Petroleum Geology, Calgary, Alberta and Atlantic Geoscience Centre, Dartmouth, N.S. Research investigations of crystalline rock terrane confined largely to Ontario were assisted by AECL scientists seconded to the Geological Survey of Canada, Ottawa.

Attendance at Meetings, Conferences, and Courses

B.V. Sanford

Ontario Petroleum Institute Annual Meeting, Toronto, Ontario, Oct. 14-16, 1979.

AECL Information Exchange Meetings - Toronto, Jan. 30-31 - Feb. 1; Pinawa, April 29-May 2; and Ottawa, Sept. 29-May 2.

Membership on Committees

B.V. Sanford

Member, Subcommittee on Undersea Feature Names of Canadian Permanent Council on Geographic Names.

Special Talks and Lectures

B.V. Sanford

"Geological Overview of the Nuclear Waste Disposal Program in Ontario", Ontario Petroleum Institute Annual Meeting - Toronto, Oct. 14-16, 1979.

RESOURCE GEOPHYSICS AND GEOCHEMISTRY DIVISION

A. G. Darnley, Director

The principal objective of the Resource Geophysics and Geochemistry Division continues to be to provide geophysical and geochemical information which will facilitate the discovery and evaluation of Canada's uranium and mineral resources. An important secondary objective is to undertake special investigations which relate to the exploitation and transportation of various types of resources. These include involvement in the AECL Radioactive Waste Disposal Program, and studies concerning the mapping of offshore permafrost.

The Division serves as a national centre for research and development into geophysical and geochemical methods relating to metalliferous exploration, economic, regional, engineering, and environmental geology. It provides advice on these matters at national and international levels. The foundation for this advisory function is provided by the continuing activities of the Division which include: the development, testing and experimental use of new geophysical and geochemical methods; the establishment of relevant calibration and standardization procedures; the progressive development of improved methods of presenting complex geophysical and geochemical data in an informative manner. The Division is thus in a position to design, manage, operate where necessary, and interpret geophysical and geochemical surveys for a wide variety of applications ranging from purely local to national requirements.

The organization of the division during the year has remained unchanged from that given in the Annual Report for the year ending March 31, 1979.

Commentary

This has been a year of re-orientation and transition. With more than half the division's resources previously devoted to URP, with emphasis on high-speed data production, 1979 provided the first opportunity to demonstrate the widespread application of the results. 99% of all outstanding URP data had been publicly released on Open File by the end of September 1979. URP data was seen to have relevance in unexpected directions, such as indicating the distribution of acid-rain in Ontario, or the presence of uraniferous groundwaters in populated areas of the Okanagan valley. On a deeper level, it was recognized that there is a coincidence between regional gravity "lows" and regional uranium "highs". This is significant both to mineral exploration, and possibly to geothermal power. In brief, the less obvious seeds of URP began to germinate.

As far as field operations were concerned, work in the Athabasca Test Area constituted the largest coordinated effort ever attempted by the Division, rivalling the department's Lorex 79 in the number of participating organizations and projects, as indicated in the list at the end of this section. The Athabasca Project will not be completed until 1982.

One of the most interesting new scientific achievements during the year was the recognition of the usefulness of the seismic tube-wave phenomenon as a means of indicating the position of fractures and zones of high permeability in boreholes. Another "first" was the use of the borehole radar system to obtain reflections from discontinuities up to a range of 20 m.

Two major publication-releases during the year were "Geophysics and Geochemistry in the Search for Metallic Ores" edited by Dr. P. J. Hood containing the proceedings of Exploration 77, and the very timely bulletin "The Geochemistry of Gold and its Deposits" by Dr. R. W. Boyle.

The general economic situation, and the consequent "no-growth" work environment contributed to the loss of 7 employees during the year, including several key scientists, as recorded elsewhere in this report. Some turn-over of staff is healthy and desirable, but not when it effectively terminates a very promising new line of research such as radar-probing.

NEA/IAEA Athabasca Basin Test Area Studies 1979-82

Objectives: To compare under standardized conditions a variety of existing and newly developed exploration techniques in an area that is being actively explored for uranium; to carry out geological, geochemical and geophysical studies that will contribute to an understanding of the genesis of the deposits which will, in turn, assist in the development of new approaches to exploration.

Sponsor organizations: Saskatchewan Geological Survey,
Geological Survey of Canada.

Co-chairman of study: L. S. Beck (S.G.S.),
E. M. Cameron (G.S.C.)

Other contributing organizations:
Earth Physics Branch (E.P.B.)
Saskatchewan Research Council (S.R.C.)
University of Saskatchewan
University of Regina
McMaster University
Alpha Nuclear Limited
Barringer Research
Bondar-Clegg and Co.
Gregory Geoscience
Terradex Inc.

A. Regional Studies

1. Geological Mapping - T. Sibbald and P. Ramaekers (S.G.S.)
2. Bedrock Geochemistry - T. Sibbald, P. Ramaekers, C. E. Dunn (S.G.S.)
3. Lake Sediment & Water Geochemistry - W. Coker (G.S.C.) C. E. Dunn (S.G.S.)
4. Quaternary Mapping - B. Schreiner (S.R.C.)
5. Quaternary Geochemistry - C. E. Dunn (S.G.S.)
6. Helium Isotopes in Lake Water - W. B. Clarke (McMaster)
7. Compilation of Colour Magnetic Density Map - P. J. Hood (G.S.C.)
8. Airborne Magnetic Gradiometry - L. J. Kornik (G.S.C.)
9. Airborne Gamma-Ray Spectrometry - K. A. Richardson (G.S.C.)
10. Gravity Survey and Interpretation - L. Sobczak and R. Gibb (E.P.B.)
11. Integrated Analysis of Landsat and other data - Gregory Geoscience
12. COTRAN E.M. Survey - Barringer Research and L. S. Collett (G.S.C.)
13. AFMAG (Audio Frequency Magnetics) - Phoenix Geophysics

B. Detailed Studies in Vicinity of Selected Uranium Deposits

1. Geology of Drill Core Including Isotopic and Other Geochemical Studies of Ore and Alteration Zone - T. Sibbald (S.G.S.) J. Hoeve, V. Sopuck (S.R.C.)
2. Spatial and Temporal Variation in Lake Water and Sediment Chemistry Including Gases - W. Dyck (G.S.C.)
3. Investigation of Drill Hole Gases and Fluids - W. Dyck (G.S.C.)
4. Soil Gas (Rn, He, including comparison of Terradex, Alpha-Nuclear and Bondar-Clegg methods of measuring radon in soil) - W. Dyck (G.S.C.)
5. Soil Chemistry - C. E. Dunn (S.G.S.), W. Dyck (G.S.C.)
6. Sampling and Analysis of Vegetation - C. E. Dunn (S.G.S.)
7. Till Geochemistry - V. Sopuck (S.R.C.)
8. Analysis of Variance Study of Lake Sediment Geochemistry - E.H.W. Hornbrook and N. G. Lund (G.S.C.)
9. Study of Peat Bogs - W. B. Coker (G.S.C.) and V. Sopuck (S.R.C.)
10. Borehole Gamma-Ray Spectrometry - P. Killeen (G.S.C.)
11. Surface Radiometric Profiles - K. A. Richardson (G.S.C.)
12. I.P. and Resistivity Profiles - H. Stolz (S.G.S.)
13. Heat Flow - H. Stolz (S.G.S.)
14. Deep E.M. Sounding - A. K. Sinha (G.S.C.)
15. Bore Hole E.M.- A. V. Dyck (G.S.C.)
16. Seismic Profiles - Z. Hajnal (U. of R.)

CIDA Advisory and Training Services

B. E. Manistre

Brazil

Following completion of the test drilling program, designed to determine the causes of selected geophysical and geochemical anomalies, the Brazilian organization in Goiania was gradually disbanded during the year. Concurrently, a steady,if belated, stream of printed airborne magnetic and radiometric maps was delivered by Northway Survey Corporation to Brazil and were immediately made available to the general public. An evaluation of the drilling results and the project in general was presented by Dr. D. R. Derry, acting as outside consultant. It is expected that this project will terminate during the present year.

Pakistan

The final report and maps of the airborne magnetic survey produced by Photosur in Montreal were approved and delivered. The products included 171 map sheets at 1:50,000 scale, 19 map sheets at 1:250,000 scale and a composite map at 1:1,000,000 scale. In September specifications for an interpretation study of the aeromagnetic maps were produced for CIDA. The selection of a contractor for this work is now proceeding.

Ivory Coast

Both the interpretation of the previous airborne magnetic survey and the photogeological mapping project continued during the year. Interpretation of the magnetic maps in the northern half of the country was completed and delivered by Paterson, Grant and Watson of Toronto. Work on the southern half is continuing. The photogeological maps and report were completed and delivered except for the French translation of the report. Additional phases of this project include an Input EM survey of eight small selected areas which was flown by Terra Surveys and is currently being evaluated at GSC.

Botswana

Following the interpretation phase of the airborne magnetic survey completed by Terra Surveys, the drilling phase is now in progress. The objective of the drilling phase is a geological investigation of the nature of the Precambrian rocks beneath the Kalahari sand and Kaver formations.

Kenya, Swaziland and Lesotho

These projects are now complete.

Nepal

Kenting Earth Sciences was awarded the contract for the land capability study now in progress. (This project includes soils, landuse and photogeological mapping of the western half of Nepal). GSC involvement is limited to consulting services.

General

With the appointment of a consulting geologist, the CIDA Natural Resources Branch now has three earth scientists on staff. Under new regulations, all earth science projects will be jointly managed by one of these

scientists as technical manager and a project officer from the Operations Branch as administrative manager. This change has particularly affected the Pakistan and Ivory Coast projects for which GSC was formerly the Technical Authority. The EMR/CIDA Memorandum of Understanding under which GSC gives technical advice to CIDA remains unchanged.

Training

Two Lesothan students were attached to the Geochemistry Subdivision for the summer of 1979 and one I.A.E.A. fellow from Portugal spent 6 months with the division. Requests continue to be received mainly from the IAEA and the U.N. through CIDA for attachments of individual recipients of fellowships. These are evaluated and accepted when practical.

Attendance at Meetings and Conferences

A. G. Darnley
- Branch Management Meeting, Halifax, N.S. May 8-9, 1979
- Tuzo Wilson Symposium, Toronto, May 15-16, 1979
- National Geological Surveys Committee, Quebec, P.Q. May 24, 1979
- Athabasca Test Area Meeting, Toronto, June 18, 1979
- Provincial Mines Ministers Conference, Winnipeg, September 9-11, 1979
- MERI, Directors Meeting, Montreal, September 25, 1979
- Ontario Geological Survey Research Seminar, Toronto December 5, 1979
- Prospectors and Developers Association Meeting, Toronto, March 10-11, 1980
- NEA/IAEA Uranium Exploration R & D Group:
  Fuel Cycle Committee, Paris, April 25-26, 1979
  Gases Workshop, Paris, October 9-10, 1979
  Group Meeting, Paris, October 11, 1979
  Field Trip, W. Germany, October 12-14, 1979
  Fuel Requirements Working Group, Paris, October 16, 1979
  Fuel Cycle Committee, Paris, October 17, 1979
  NEA Steering Committee, Paris, October 18, 1979

B. E. Manistre
- Canadian Symposium on Science and Technology for International Development, Toronto, May 10-13, 1979

Membership on Committees

A. G. Darnley
- Board of Directors, MERI, Montreal
- Chairman, NEA/IAEA Uranium Exploration R & D Group
- Member, EMR URAG Committee

B. E. Manistre
- Ad Hoc Interdepartmental Committee for the Commonwealth Science Council

Division Productivity

26 Outside Publications
12 Current Research Reports
17 Open File releases
235 Aeromagnetic maps
44 NTS 1:250,000 sheets radiometric coverage
17 NTS 1:250,000 sheets geochemical coverage
34 Oral Presentations

REGIONAL GEOPHYSICS SUBDIVISION

P. J. Hood

The primary objective of the Regional Geophysics Subdivision is to contribute to the understanding of the geological framework of Canada and to facilitate mineral exploration and development programs by providing a regional framework of basic geophysical data. The subdivision develops new instrumentation and techniques, conducts experimental surveys, devises new techniques for the computer processing, presentation and interpretation of geophysical data, prepares specifications for aeromagnetic surveys carried out under contract, monitors their execution, and supervises the publication of the resulting maps. Geological interpretations of the results are provided to the extent possible with available staff.

The Subdivision receives the support of four sections: Contract Aeromagnetic Surveys, Experimental Airborne Operations, Geophysical Data Processing and Regional Geophysical Interpretation.

Highlights

Standard-sensitivity aeromagnetic survey contracts under the terms of the Federal-Provincial aeromagnetic survey program were underway in two provinces (Quebec and Newfoundland) and the Northwest Territories, during 1979. Line kilometrage flown was 20,298 km bringing the grand total flown since the beginning of the program to 7,957,287 line km. Altogether 229 aeromagnetic maps were issued during the report year to bring the grand total of such maps issued so far to 8306. The first experimental coloured total field and vertical gradient maps utilizing the output of the Applicon colour plotter were printed and they proved to be much more effective in displaying the magnetic patterns produced by rock formations than the standard contoured aeromagnetic map.

As a contribution to the 1979 Lorex project organized by the Earth Physics Branch, an aeromagnetic reconnaissance and intermediate seismic

reflection survey were completed over the Lomonosov Ridge which crosses the Arctic Ocean near the North Pole. Excellent results were obtained in both cases and they clearly indicate that the Lomonosov Ridge has a distinctive magnetic signature and that it cannot therefore be composed entirely of sedimentary rocks, as previously thought. This aeromagnetic reconnaissance survey was carried out in cooperation with the National Aeronautical Establishment, using their newly equipped Convair 580 aircraft.

Regional Geophysics Statistics

The status of contract aeromagnetic surveys is summarized in the following table:

Survey Area	Kilometres Flown 1979/80	Kilometres Remaining	% Flying Complete	Maps Published in 1979/80 1:50,000	1:250,000
1. Labrador-	20,298	124,907	75%	0	0
Melville Pen.	-	0	100%	0	0
Coppermine	-	0	100%	72	2
2. New Quebec	-	0	100%	62	11
	20,298		Total	134	13

The flying component of the Labrador survey continued and the 20,298 line kilometres flown during 1979 brought the total line kilometrage flown for that survey to 380,437 line kilometres, which corresponds to 75% of the survey.

Compilation of a magnetic anomaly map of Arctic Canada was initiated during 1979. This new map will contain both G.S.C. aeromagnetic data as well as data contributed by the private sector through the Department of Indian and Northern Affairs. Target date for publication of this edition of the anomaly map is June 1981.

Two more 1:1 million scale digital aeromagnetic colour composite maps were produced (NTS 74 and 64) and it is intended to issue these during the next fiscal year. The regional geologists have shown great interest in this form of compilation. Another aeromagnetic map sheet (NTS 65) was digitized by a different method expected to produce greater resolution in the final product. Software is currently being developed to allow compilation of this map.

The first experimental printed colour maps of high resolution aeromagnetic and vertical gradient surveys were produced (Kasmere Lake and Killala Lake survey areas). The Applicon colour jet plotter was employed to produce 3 colour separation sheets of each map. When photographed these became the negatives for the colour printing. The auto-compilation and photo-mechanical techniques having been perfected, it is now possible to print contour maps within two months of completion of the survey flying.

Statistics for High Resolution Aeromagnetic Gradiometer Surveys

Area	Province	Client	Maps Total Field	Maps Vertical Gradient	Total
Kasmere Lake	Manitoba	MDEM	18	18	36
Athabasca Basin	Saskatchewan	SDMR	7	7	14
Southern Vancouver Is.	B.C.		32	-	32
		Totals			82

In addition to the above, the following aeromagnetic survey data resulting from Queenair survey operations were placed on open file:

Open File	Area	Province	Date of Release	Total Field	Vertical Gradient
616	Pinawa (Lac du Bonnet Pluton)	Manitoba	July 1979	6	6
629	St.Mary's River	N.S.	July 1979	32	-
		Totals		38	6

The Queenair aeromagnetic gradiometer system continues to be improved and the two new self-orienting cesium magnetometer sensors built under contract were installed and successfully utilized throughout the 1979 field season. A computer program was written for the field minicomputer system to produce finite difference profiles up to the sixth order from the aeromagnetic data. This technique permits errors in the data to be readily identified and also permits a reliable estimate of the noise level to be made.

Aeromagnetic gradiometer surveys were flown in the following areas during the 1979 field season using the GSC Queenair aircraft:

1. Chalk River, Ontario - a 825 line kilometre survey of a radioactive waste test site (RA-2) carried out on behalf of AECL.
2. Jan Lake, Saskatchewan - a 5768 line kilometre survey carried out on behalf of the Saskatchewan Department of Mineral Resources.
3. Wollaston Lake, Saskatchewan - a 5310 line kilometre survey flown as a contribution to the NEA/IAEA study.
4. Atikokan, Ontario - a 3121 line kilometre survey of a radioactive waste test site (RA-4) flown on behalf of AECL.

In addition, a 1350 line kilometre total field survey of the Prescott sheet (NTS 31 B/14) was carried out to complete the coverage of this area immediately adjacent to the U.S. border.

The semi-automated interactive computer modelling system was further improved and applied to the Key Lake, Saskatchewan, Queenair gradiometer data. This operation proved very helpful in delineating basement depths and structures which are important information in the search for economic uranium mineralizations in this area.

Personnel Notes

F. W. Zieman - We record with regret the death of F. W. Zieman on 29 August 1979. He retired from the Magnetic Methods Section 27 December 1975.

E. Haley - Resigned effective March 7, 1980, to join Questor Surveys Limited in Toronto

Attendance at Meetings, Conferences and Courses

P. J. Hood
- Provincial Mines Ministers Conference, Winnipeg, Sept. 11, 1979. Presented talk entitled "Aeromagnetic gradiometers - advantages and commercial application".
- Lorex Workshop, Earth Physics Branch, Ottawa, Oct. 15-16, 1979. Presented paper with M. E. Bower entitled "Lorex: Aeromagnetic Survey".
- 17th General Assembly, International Union of Geodesy and Geophysics, Canberra, Australia, Dec. 2-15, 1979. Presented paper entitled "Aeromagnetic surveys in Canada and their geological interpretation". Convener for IAGA session I-4 entitled "Lithospherical Mapping from Local Anomaly Charts"; also chaired IAGA session I-9 "Correlation between anomalies of potential fields".
- Prospectors and Developers Association Meeting, Toronto, March 9-12, 1980. Presented with R. W. Boyle paper entitled "Gold exploration techniques - geochemical and geophysical".

L. J. Kornik - Grid Organizational Development Course, Ottawa, March 1980.

P. H. McGrath - Canadian Geophysical Union Meeting, Fredericton, June 4-6, 1979.

V. R. Slaney
- Canadian Advisory Council on Remote Sensing, Arnprior, April 8012, 1979.
- Sursat Project Conference, Ottawa, Jan. 22-24, 1980.

D. J. Teskey - Canadian Geophysical Union Meeting, Fredericton, June 4-6, 1979.

Special Talks and Lectures

M. T. Holroyd - Automated compilation techniques: a seminar presented at Ottawa University, October 29, 1979.

P. J. Hood - Update on Exploration Geophysics Workshop, Adams Club, McGill University, Feb. 15, 1980. Presented paper entitled "Update on Magnetic Survey Methods".

L. J. Kornik - Interpretation of the aeromagnetic gradiometer results over the Lac du Bonnet pluton, Pinawa, Manitoba: Radwaste Workshop, Ottawa, February 25, 1980.

V. R. Slaney - Satellite and airborne radar - a review of sursat geology experiments, Sursat Project Conference, Ottawa, Jan.23,1980.

- Lithologic Discrimination on Radar Imagery: Sursat Project Conference, Ottawa, Jan. 23, 1980.

Membership on Committees

S. D. Dods - Chairman, Data Display Users Group, Computer Science Centre.

- Member, Branch Computer Facilities Committee.

P. J. Hood - Co-chairman, Working Group I-4, Division 1 (Magnetic Anomalies - Land and Sea), International Association of Geomagnetism and Aeronomy.

- Member, Geotechnical Subcommittee, Canada-Nova Scotia Subagreement on Mineral Development.

- Associate Member, Committee for a (U.S.) National Magnetic Anomaly Map.

V. R. Slaney - Chairman, Geoscience Working Group, Canadian Advisory Council on Remote Sensing.

- Member, Seasat-Sar team.

- Sursat Project Organizing Team.

- Remote Sensing Advisory Committee, Nova Scotia Land Survey Institute.

Subdivision Productivity

2 Outside Publications
1 Current Research
4 Open File releases
7 Oral Presentations

RESOURCE GEOCHEMISTRY SUBDIVISION

E. M. Cameron

The geochemistry component of the Resource Exploration subprogram is concerned with the search for and the appraisal of mineral resources. Nationally consistent, systematic, geochemical data are gathered from a variety of sampling media. These data are used by industry for mineral exploration; by governments for resource appraisal and to assist in geological mapping; and for environmental, health and other purposes. This data gathering activity is complemented by research on geochemical processes; by development of new methods of mineral exploration and resources appraisal; by study of new analytical techniques and geochemical instrumentation; and by software developed to facilitate interpretation.

The subdivision is administered in three sections: Method Development, Regional Surveys and Geochemical Laboratories.

Highlights

This year saw the publication of the last of the National Geochemical Reconnaissance (N.G.R.) maps and data that were obtained in support of the Uranium Reconnaissance Program. The N.G.R. was designed to collect basic geochemical data of long-term value for a variety of purposes, not simply to assist in exploration for uranium. It was, therefore, ironic that so soon after cancellation of the program yet another important use was found for the information. Dr. W. B. Coker demonstrated that the N.G.R. maps outlined areas that had been affected or were susceptible to acid precipitation. The data also indicate regions where acid precipitation may mobilize toxic metals within the surface environment.

Buried mineral deposits are increasingly becoming a challenge to the exploration geologist. They demand more sophisticated discovery techniques and the better integration of methods. In Canada the challenge is greatest over the Athabasca Sandstone. Rich uranium deposits were first found at shallow depth along the outcrop of the basal Athabasca unconformity. Since then attention has been focussed on the down-dip portions of the unconformity. Important deposits have been located at depths of up to 200 m and exploration is proceeding for mineralization at even greater depths. The area has been the scene of conflicting claims and uncertainty about the effectiveness of various exploration methods and these questions have been difficult to resolve because data may have been collected in unstandardized fashion.

To assist the exploration geologists of this area and exploration technology in general, the G.S.C. and the Saskatchewan Geological Survey proposed in late 1978 a program to test under standardized conditions both established and newly developed exploration techniques. A 1300 km^2 area, containing a number of the Athabasca uranium deposits was selected for studies and surveys to be carried out by scientists from government, university and industry organizations. Field work was commenced in 1979 and will continue in 1980 and 1981, with publication of data by 1982. A summary of the study is given elsewhere.

A good deal of the credit for the initial field season on the Athabasca Basin study must be given to Mr. C. C. Durham and supporting staff who organized a camp that was utilized by more than 50 persons in 1979. Among the highlights of the geochemical portion of the study was work carried out by Mr. W. B. Coker, Mr. W. Dyck and Mr. E.H.W. Hornbrook. Mr. Hornbrook carried out analysis of geochemical variance of lake sediments. This showed that the bulk of the variance is at the between-lake and regional sampling levels, and is not local variance within the lakes or at the sampling sites. This gives a scientific basis for the well known empirical observation that lake sediments are a very effective exploration method. Dr. Coker showed that both lake waters and lake sediments give an effective signature of uranium mineralization, but that it is important to recognize the very low geochemical background in the area. Mr. Dyck concentrated on geochemical signals that might be present in soils, sediments and subsurface waters in the vicinity of the ore deposits. This included a comparison of a variety of methods of detecting radon in soil gas.

The Athabasca Basin study is one of two "integrated" studies being carried out by the G.S.C. The second is in the Nahanni area of the Yukon and is described elsewhere in this report. Two members of this subdivision, Dr. W. D. Goodfellow and Dr. I. R. Jonasson, are actively involved in this work. Their studies concentrated on the geochemistry of the shales with emphasis on: (1) differentiating shales that lack fossils; (2) identifying shales that may have been influenced by the influx of metal-rich fluids along submarine vents; (3) determining the physico-chemical environment at the sediment interface in marine basins.

In British Columbia follow-up work on the geochemical reconnaissance continued. Dr. D. R. Boyle identified the paragenetic sequence saleeite - autunite - ningyoite in the Blizzard uranium deposits. Saleeite, which is a rare uranium - magnesium - phosphate mineral, is the principal uranyl mineral of the deposit. This is the first known occurrence where uranyl minerals (saleeite, autunite) form in advance of uranous minerals (ningyoite).

In Baffin Island, Dr. Y. T. Maurice and colleagues discovered interesting uranium concentrations associated with pegmatites and hydrothermally altered fracture zones in granites underlying the Fury and Hecla Formation of Proterozoic age.

In support of the Nahanni operation, Ms. G. Hall and colleagues in the Analytical Laboratories developed methods for the dissolution and analysis of baritic ores. She also identified uranyl-organic complexes in Canadian surface waters. These may be very important in facilitating the migration of uranium. In cooperation with Barringer Research, Mr. B. W. Smee studied the stability of anions in natural waters and also ion chromatography as a method for the analysis of F, Cl, Br, S and P in geological material. Mr. Smee concluded his studies of electrochemical processes around ore deposits with special reference to areas covered by lacustrine clay.

Dr. R. G. Garrett continued his studies of 2-Way Nested Mixed Effects ANOVA models with Dr. T. I. Goss. A paper on this topic was presented at the annual meeting of the American Statistical Association where it received a distinguished award. Dr. Garrett and Dr. Cameron also presented invited review papers at the annual meeting of the Geological Society of America.

Dr. D. R. Boyle and Dr. I. R. Jonasson prepared briefs and presented expert testimony before the Royal Commission of Inquiry into Uranium Mining in British Columbia.

Sample Preparation Laboratory

Sample preparation	
Number of Samples Prepared	7,421
Analyses	
Number of Samples Analysed	22,540
Number of Determinations	76,115
Samples prepared	8,010
Crushing/Grinding	4,600
Sieving	3,200
Ball Milling	7,570
Super Panner	1,600
Frantz	525
Heavy Liquid Separations	150

Trace Element Laboratory

Water Samples Analysed	3,311
Total Determinations on Water Samples	36,040
Rocks, Ores Analysed	3,615
Soils, Vegetation, Sediments Analysed	859
Total Determinations on Solid Samples	58,015

Attendance at Meetings, Conferences and Courses

S. B. Ballantyne
- 5th Annual CIM District 6 Meeting, Vancouver, British Columbia, October 25-27, 1979
- 48th Annual Prospectors and Developers Convention, Toronto, March 10-12, 1980.

D. R. Boyle
- Royal Commission of Inquiry into Uranium Mining in British Columbia, September 21-25, 1979.
- Canadian Institute of Mining and Metallurgy Annual Meeting, April 21-24, 1979.

E. M. Cameron
- Annual Meeting of the Geological Society of America, San Diego, California, November 5-8, 1979.

W. B. Coker
- Annual Meeting, Manitoba Department of Mines
- Annual Meeting, Saskatchewan Geological Survey
- Ontario Geological Survey's Geoscience Research Seminar
- Prospectors and Developers Convention, Toronto, March 10-12, 1980.

R. G. Garrett
- IGCP Project 98 (Standards for computer applications in resource studies) working meeting, Ixtapa, Mexico, April 23-May 2, 1979.
- 21st National Conference of the Canadian Operational Research Society, Montebello, Quebec, May 23, 1979.
- The joint statistical meetings of the American Statistical Association, Washington, D.C. August 13-16, 1979.
- Annual Meeting of the Geological Society of America, San Diego, California, November 5-8, 1979.

W. D. Goodfellow
- Visit to Hannover (BGR) and the Rammelsberg and Meggan sulphide deposits as part of a cooperative scientific and technological program on the study of massive and stratiform Cu-Pb-Zn-barite deposits. Oct. 1-8, 1979.
- Nahanni Organization Meeting, Vancouver, March 25, 1980.

I. R. Jonasson
- Royal Commission of Inquiry into Uranium Mining in British Columbia, September 21-25, 1979.

Y. T. Maurice
- Annual Meeting of CIM, Montreal, April 23-25, 1979.
- Workshop on Uranium Biogeochemistry, Lulea, Sweden, September 3-5, 1979.

Special Talks and Lectures

S. B. Ballantyne
- Witness and oral presentation at British Columbia Royal Commission on Uranium Mining, Public Hearings, Atlin, British Columbia, July 1979.
- "Geochemistry of Molybdenum, Tungsten and Tin in the Canadian Cordillera" at CIM District 6 meeting, Vancouver, B. C. October 25-27, 1979.

D. R. Boyle
- The Formation of Basa--Type Uranium Deposits in South Central British Columbia, CIM Conference, April 1979.
- Expert Witness, Royal Commission of Inquiry into Uranium Mining in British Columbia, September 1979.

R. W. Boyle
- Talk on gold in Canadian Shield to Gold Symposium, Yellowknife, December 1979.
- Talk to Edmonton Geological Society on Gold in Canada.
- Talk to Prospectors and Developers Meeting, Toronto, March 1980. Topic - Geochemical Prospecting for Gold.

E. M. Cameron
- Geochemical Exploration for Uranium in Northern Lakes. Annual Meeting of GSA, San Diego, November 1979.

W. Dyck
- Radioactive disequilibrium in surficial materials from uraniferous environments in northern Saskatchewan. 1979 GAC-MAC Joint Annual Meeting, Universite Laval, Quebec, May 23-25, 1979.
- Uranium, radon and helium in waters of the Kay Lake area, Saskatchewan, 1979 Annual Meeting of the CIM, Montreal, April 22-25, 1979.
- NEA/IAEA Athabasca Basin Study - Gaseous Geochemistry - 1979 summary. Organization meeting of the NEA/IAEA joint group of experts on R & D in uranium exploration, Paris, France, October 9-10, 1979.

R. G. Garrett
- "Geochemical Surveys within the Projeto Geofisico Brasil-Canada". R. G. Garrett and R. J. Brim (unpublished).
- "The planning and evaluation of search procedures in regional geochemical exploration for mineral resources". R. G. Garrett and T. I. Goss.
- "The appraisal of survey effectiveness in regional geochemical surveys of Canada's Uranium Reconnaissance Program". R. G. Garrett and T. I. Goss.
- "The management and analysis of regional geochemical data". R. G. Garrett, V. E. Kane and R. K. Zeigler.

W. D. Goodfellow
- "Geology, geochemistry and origin of the Brunswick No. 12 massive sulphide deposit, Bathurst, N.B.". Presented in Hannover to the Federal Institute for Geosciences and Natural Resources, October 6, 1979.
- "Geochemistry of the Tetagouche Group volcanic rocks holsting the Brunswick No. 12 massive sulphide deposit". Lecture given to geology students of Carleton University, February 1980.
- "Preliminary geochemical results from studies carried out on Howards Pass Pb-Zn deposits as part of the Nahanni I.M.P.P." Presented at the GSC in Vancouver, March 1980.

I. R. Jonasson
- Expert Witness, Royal Commission of Inquiry into Uranium Mining in British Columbia, September 1979.

Membership on Committees

D. R. Boyle
- Geochemical Subcommittee, Canada-Newfoundland Mineral Development Sub-Agreement.

R. W. Boyle
- Member Committee for Information on Mineral Problems, SEG.
- Regional Councillor (North America) IAGOD
- Member DELPHI Exercise Project 251-006 (EMR)
- Member Subcommittee on Scientific Criteria for Environmental Quality, NRC (Canada)
- Member Library Committee, GSC.

E. M. Cameron	- Editor-in-Chief, Journal of Geochemical Exploration.
	- Member, Geochemical Subcommittee, Canada-Newfoundland Mineral Development Sub-Agreement.
	- Co-chairman, IAEA/NEA Athabasca Basin Test Study.
W. B. Coker	- Councillor, Chairman New Membership Committee - Association of Exploration Geochemists.
R. G. Garrett	- Member of the 1981-86 Departmental EDP Needs Study Team.
	- Member of the Nova Scotia-DREE Geotechnical Committee
	- Secretary of the Association of Exploration Geochemists
	- Member of the Editorial Board of the Journal of Geochemical Exploration.

Subdivision Productivity

11 Outside Publications
4 Current Research
10 Open File releases
19 Oral Presentations

RESOURCE RADIOACTIVITY SUBDIVISION

K. A. Richardson

The objectives of this subdivision are directed toward the development, application and evaluation of radiometric methods of geophysics for mineral exploration and geological mapping. Research and development in instrumentation and geophysical exploration techniques are conducted in airborne, surface and borehole environments. The present emphasis is on gamma-ray spectrometric methods, while ancillary measurements are incorporated to assist in understanding and interpretation of the radiation measurements. Experimental surveys are conducted to demonstrate new developments and their application. Calibration facilities are maintained for use by industry, academic and government agencies; advice is provided to users of the facilities in order to improve the standardization of radiation measurements. Airborne survey results are compiled and interpreted with the objective of providing a data base for resource estimation.

Activities during the report period have included Uranium Reconnaissance Program (U.R.P.) follow-up investigations, experimental airborne surveys, national radiometric compilations and interpretations, maintenance of radiometric calibration facilities, and borehole technology development.

Results of airborne gamma-ray spectrometer surveys, flown in 1978 as part of the U.R.P. in Saskatchewan, Manitoba, Ontario and Northwest territories were published for a total of 36 NTS 1:250,000 scale map sheets. By the end of September 1979, results of all the U.R.P. airborne surveys had been published. U.R.P. follow-up investigations included detailed airborne spectrometer surveys flown with the GSC Skyvan in the area between Bancroft and Lake Simcoe (4,400 km^2) and between Thunder Bay and Lake Nipigon (2,500 km^2). Working with

Resource Geochemistry Subdivision and Precambrian Division staff, ground follow-up studies north of the Fury and Hecla Strait on Baffin Island revealed a number of new uranium occurrances. The uraniferous pegmatites in the Sharbot Lake area of Ontario were also investigated. Interpretations of uranium anomalies in the Maritimes, Ontario and Northwest Territories have been prepared for publication.

Other airborne gamma-ray spectrometer surveys were flown with the GSC Skyvan: (1) in the Athabasca area, Saskatchewan (1,800 km^2) as part of the NEA/IAEA test area project with GSC and provincial organizations; (2) Cape Breton Island, Nova Scotia (8,000 km^2); and (3) the Mistasin Batholith on the Quebec-Labrador border (5,000 km^2) as part of the NEA/IAEA related study of uranium in granites. Additional Skyvan flights in the Ottawa area collected data for use in developing techniques for incorporating complete gamma ray spectra in the data analysis process.

Work began on compiling all reconnaissance spectrometer surveys, from pre-U.R.P. Skyvan surveys through to the end of U.R.P., into a new data base. The compilation is aimed at the production of national radioelement distribution maps. Transcription of Skyvan survey data into the new format is completed, and early in 1980 the U.R.P. contract survey data will be converted to a format suitable for computer plotting of Applicon colour maps. Interpretation of airborne reconnaissance data continued with work on the computer classification of data according to radiometric signatures of the lithologic units within a survey area.

This Subdivision is responsible for G.S.C. radiometric calibration facilities, and provides advice and assistance to users from the exploration industry and other agencies. Four new model boreholes were constructed at Saskatoon by the Saskatchewan Research Council under G.S.C. direction, and two holes were drilled at Bancroft for continuing use as standard test holes. These complement the existing facilities at Ottawa for calibrating airborne, ground and borehole systems, at Calgary for ground systems and at Fredericton for borehole systems.

A microprocessor-based portable borehole logger was developed under an unsolicited proposal as a result of recommendations published by the Subdivision; the system was field tested and accepted by G.S.C. in 1980. Another advance in borehole logging was the development of a temperature probe with digital data transmission to the surface equipment. This will be evaluated as a technique with possible application to exploration for high grade uranium ore. Many of the interpretational problems of deconvolving borehole logs (effects of dipping ore zones, logging speed, sampling interval, detector length, and borehole diameter, fluid and casing) were solved and the results published in several papers. Initial logging tests were run in cooperation with CANMET to investigate migration of radionuclides within uranium mine tailings at Elliot Lake. The distribution of radioactivity with depth will continue to be monitored to determine temporal and spatial changes.

Personnel Notes

John A. Grant - Accepted a permanent position as a Physical Scientist.

Attendance at Meetings, Conferences, Courses

J. M. Carson
- American Nuclear Society Annual Meeting, Atlanta, Georgia, June 1979.

J. G. Conaway
- 81st Annual CIM Meeting, Montreal, April 1979.
- Twentieth Annual Meeting and Logging Symposium of the Society of Professional Well Log Analysists, Tulsa, Oklahoma, June 1979.
- Course to update knowledge of Eclipse system, Boston, Massachusetts, November 1979.

K. L. Ford
- Nova Scotia Department of Mines and Energy Third Annual Open House, Halifax, December 1979.

J. A. Grant
- Course to update knowledge of Eclipse system, Boston, Massachusetts, November 1979.

R. L. Grasty
- World Meteorological Organization Workshop on Remote Sensing of Snow and Soil Moisture by Nuclear Techniques, Voss, Norway, April 1979.
- North American Workshop on Airborne Radiation Snow Survey Techniques, Las Vegas, Nevada, September 1979.
- NEA/IAEA Workshop on Measurement of Natural Gamma Radiation, Risø, Denmark, September 1979.

P. G. Killeen
- 81st Annual CIM Meeting, Montreal, April 1979.
- Annual GAC/MAC Meeting, Quebec City, May 1979.
- SEG 49th Annual International Meeting, New Orleans, Louisiana, November 1979.
- Prospectors and Developers Association of Canada Meeting, Toronto, March 1980.

K. A. Richardson
- C.S.E.G. Meeting, Winnipeg, November 1979.
- Adams Club Symposium, Montreal, February 1980.

V. R. Slaney
- SAR Experiment Team Meeting, Pasadena, California, May 1979.

Special Talks and Lectures

J. M. Carson
- "Airborne gamma-ray spectrometer experiments - intercalibration and variation of calibration constants with altitude" Presented at American Nuclear Society Annual Meeting, Atlanta, Georgia, June 1979.

J. G. Conaway
- "Uranium ore concentrations from gamma-ray logs". Presented at 81st Annual CIM Meeting, Montreal, April 1979.

R. L. Grasty
- "One flight snow-water equivalent measurement by airborne gamma-ray spectrometry". Presented at World Meteorological Organization Workshop on Remote Sensing of Snow and Soil Moisture by Nuclear Techniques, Voss, Norway, April 1979.
- "The Search for Cosmos 954" Presented at University of Helsinki and at the Risø National Laboratory, Denmark, May 1979.
- "Airborne gamma-ray spectrometry". Presented at University of Helsinki, May 1979.

P. G. Killeen
- "Gamma ray logging problems in high grade uranium ore zones". Presented at 81st Annual CIM Meeting, Montreal, April 1979.
- "Radioactive disequilibrium and its significance in uranium exploration". Presented at Annual GAC/MAC Meeting, Quebec City, May 1979.
- "Application of gamma-ray spectral logging to uranium exploration". Presented at SEG 49th Annual International Meeting, New Orleans, Louisiana, November 1979.

K. A. Richardson
"Review of Uranium Reconnaissance Program". Presented at CSEG Meeting, Winnipeg, November 1979.
- "Airborne gamma-ray spectrometry". Presented at Adams Club Symposium, Montreal, February 1980.

Memberships on Committees

R. L. Grasty
- Member, IAEA Working Group on Improvements in the Measurement of Natural Gamma Radiation.

P. G. Killeen
- Chairman, IAEA Working Group on Borehole Logging in Uranium Exploration.

V. R. Slaney
- Chairman, Geology Working Group, Canadian Advisory Council on Remote Sensing.
- Member, Organizing Committee, CACRS 1980.
- Member, Interdepartmental Committee on Air Surveys Technical Sub-committee
- Member, Advisory Committee on Remote Sensing, Nova Scotia Land Survey Institute
- SEASAT-SAR (U.S.) Team Member
- Member, Sursat (Canada) Advisory Group
- Sursat Geology Projects Coordinator
- Member, International Geological Correlation Programme, Project 143 (Remote Sensing and Mineral Exploration).

Subdivision Productivity

4 Outside papers
5 Current Research
2 Open Files (1:50,000 NTS Radiometric Maps)
44 Geophysical Series Maps (1:250,000 NTS Radiometric Maps)
6 Oral Presentations

TERRAIN GEOPHYSICS SUBDIVISION

L. S. Collett

The objective of the Terrain Geophysics Subdivision is directed toward the development, application and evaluation of electrical and seismic geophysical methods for geological engineering, geological mapping and mineral exploration. The activities were mainly consolidated during the year on equipment and technique development with emphasis on the use of minicomputers for data processing and computer modelling. Involvement with the AECL Radioactive Waste Disposal Program increased during the year.

The Terrain Geophysics Subdivision consists of two sections, Electrical and Seismic, and one Special Project.

Highlights

The main emphasis during the year was directed to meeting the demands of the AECL Radioactive Waste Disposal Program. The most important breakthrough has been the discovery of the significance of the seismic tube wave generated in a borehole at Chalk River. The energy from a source on surface travels through the rock and enters the borehole at zones of high permeability or rock fractures. This dynamic means of determining regions of permeability within the rock checks well with hydrogeology. If further work proves successful, the seismic tube wave technique could be a valuable tool in the reduction of time and cost for the hydrogeologist.

Radar has been successfully tested in a borehole at Chalk River to a depth of 150 m. The microwave energy is sensitive to electrical parameters of the rock surrounding the hole which can be related to changes of fracture densities and rock type. Reflections up to a range of 20 m from the borehole were detected. Beyond 150 m depth, the borehole radar system requires a different approach and redesign.

Geological mapping at Chalk River and Atikokan Radwaste test sites has been aided by the use of surface VLF-EM method (15 - 20 KHz). Current channelling of electromagnetic energy in faults and fractures greatly enhances their detection and mapping.

Standard borehole geophysical logs acquired under contract at the test sites at Chalk River, Atikokan and Pinawa have been digitized and plotted to 1:500 scale. All data sets are stored in the Databank. Distribution of these geophysical logs to investigators should help the integration study of all available data for the study areas.

The diffusion studies in rock mass has generated a great deal of interest amongst AECL scientists. Also the use of the ion miller and the GSC scanning electron microscope (SEM) has been brought to the highest level of the art in North America for viewing cracks and pores in rocks. This development could be a future aid in the study of ore genesis.

In other work not connected with AECL, emphasis has been placed on the acquiring and use of minicomputers for applying corrections, processing and printing out seismic refraction and reflection data. The Lorex 79 data over the Lomonosov Ridge has been processed using a minicomputer. It is now feasible to process seismic reflection data in the field. This is a monumental step forward for light, portable equipment.

Seismic reflection and refraction surveys in the vicinity of Dome wells drilling in the Beaufort Sea can detect the top of the ice-bonded permafrost and variations in velocity within the permafrost zone which can be related to ice content. Fine and coarse-grained material can also be differentiated.

In the work for Dr. J. V. Matthews (Terrain Sciences Division) at McDougall Pass, Yukon-NWT border, seismic soundings have indicated a very deep channel (150 m) which confirms the predicted preglacial drainage pattern of the Old Crow Flat.

Due to the environmental restrictions on the use of dynamite as a seismic source of energy, work is proceeding on a portable sparker source for shallow seismic reflection and borehole surveys. As a result of an EMR Research Agreement, an electrically-driven vibrator has been acquired. Testing with both sources is proceeding using the high resolution seismic reflection technique.

A very serious set-back to the Electrical Methods Section during the year was the resignation of three geophysicists (Scott, Lobach and Davis) and a technician (Otorowski). Another geophysicist (Annan) resigned the year before. The latter part of the year was spent in planning the direction and reorganization of the section. It was decided to put the radar development into a "hold" position and strengthen the support for deep electromagnetic sounding techniques and borehole geophysics.

In preparation for deep electromagnetic sounding (> 300 m), a multifrequency EM System (Geoprobe Ltd.) was upgraded and a transient EM System (Geonics Ltd.) was acquired. One of the immediate applications is to test the systems over uraniferous deposits in the NEA/IAEA test area in the Athabasca Basin, Saskatchewan.

Computer programs for drillhole EM modelling of a rectangular plate and a sphere was developed and used to interpret field data from Sudbury and Noranda. A user's manual was prepared for public use through cooperation with University of Toronto (Prof. West) and the VAX computer.

The modification of the Crone Pulse EM System for borehole applications has proven to be a very successful development. This work was initiated by the Industry/Government Cooperative Borehole Geophysics Program set up in 1975.

Flight tests were made over the NEA/IAEA test area in the Athabasca Basin with the Barringer COTRAN system, an improved INPUT system. It was a technical success for the system.

Personnel Notes

J. L. Davis - Resigned January 25, 1980, to join Ensco Inc., Springfield Virginia.

A. V. Dyck - Completed second year of Education Leave (Ph.D.) at the University of Toronto, September 1, 1979.

J. Lobach - Resigned January 31, 1980 to join Hardy Associates (1978) Ltd., Calgary, Alberta.

J. Otorowski - Resigned May 7, 1979, from the Radar Group to take up residence in Fredericton, New Brunswick.

W. J. Scott - Resigned January 15, 1980, to become Senior Geophysicist, Hardy Associates (1978) Ltd., Calgary, Alberta.

Summer Students (G.S.C.)

David Derbecker, Jim Dirstein, Peter Gordon, Ted Harrison (seconded from PCSP), Anthony Kay, Todd Knight, Claude Provost, Rudi Rincker, Stephen Wardlaw.

Summer Students (A.E.C.L.)

Joan Anderson, Eric Dowd, Blain Grindal

Personnel (A.E.C.L.)

P. J. Chernis - started August 21, 1978

B. A. Chomyn - started January 16, 1980

G. Cummings - November 26, 1979 to January 11, 1980

J. Damon - September 11, 1979 to November 23, 1979

J. G. Hayles - started December 12, 1978

C. H. Hislop - January 16, 1980 to March 20, 1980

C. F. Huang - started August 1, 1978

J. Hume - started March 14, 1980

M. N. Radwan - November 7, 1979 to January 8, 1980

R. Rayner - October 1, 1978 to March 31, 1980

G. Shields - January 7, 1980 to April 25, 1980

M. M. Wadden - October 23, 1978 to September 5, 1979

Attendance at Meetings, Conferences, Courses

L. S. Collett

- International Workshop on the Remote Estimation of Sea Ice Thickness, St. John's, Newfoundland, Sept. 25-26, 1979
- International Meeting of Society of Exploration Geophysicists, New Orleans, November 4-8, 1979
- Member of Contract Arbitration Board, Ontario Geological Survey, Toronto, January 14, 1979
- Adams Club on "Update on Exploration Geophysics", Montreal, February 14-15, 1980
- AECL Geophysics Workshop, Ottawa, February 25-26, 1980

J. L. Davis

- American Geophysical Union, Washington, D.C., May 14-18, 1979; presented paper
- International Workshop on the Remote Estimation of Sea Ice Thickness, St. John's, Newfoundland, September 25-26, 1979. Presented paper.

A. V. Dyck

- International Meeting of Society of Exploration Geophysicists, New Orleans, November 4-8, 1979. Presented paper.
- AECL Geophysics Workshop, Ottawa, February 25-26, 1980. Presented paper.

C. Gauvreau

- Disaster Control Course, June 7, 1979.
- Intel Course on 2920 Signal processor, February 14, 1980.

J. A. Hunter

- First Canadian Conference on Marine Geotechnical Engineering, Calgary, April 25-27, 1979. Invited paper.
- NRC Permafrost Subcommittee Meeting, Quebec City, September 27-29, 1979; Winnipeg, January 11, 1980.
- Joint Industry/Government Working Group on Permafrost and Gas Hydrates, Ottawa, January 18, 1980; Calgary, Feb. 20, 1980.
- International Meeting of Society of Exploration Geophysicists, New Orleans, November 4-8, 1979.

T. J. Katsube

- AECL Seminar, Pinawa, Manitoba, June 24-26, 1979
- US/Canada Information Exchange Meeting on Radwaste Program, Columbus, Ohio, June 1979. Presented paper for G. E. Larocque.
- Workshop on Geochemistry of Nuclear Waste Management, Pinawa, Manitoba, October 3-5, 1979. Presented paper.
- AECL Geophysics Workshop, Ottawa, February 25-26, 1980. Presented paper.

A. K. Sinha - International Meeting of Society of Exploration Geophysicists, New Orleans, November 4-8, 1979.

Special Talks and Lectures

J. L. Davis - "Electromagnetic Determination of soil water content measurement in coaxial transmission lines" (with G. C. Topp and A. P. Annan), American Geophysical Spring Meeting, Washington, D.C., May 28-June 1, 1979.

- "Electrical property measurements of sea ice in-situ using borehole radar and TDR techniques", C-CORE International Workshop on the Remote Estimation of Sea Ice Thickness, September 25-26, 1979; also Rapporteur on Session II - Recent Sea Ice Studies.

A. V. Dyck - "The use of simple models in interpreting drillhole EM surveys in mineral exploration" (With G. F. West), presented at SEG 49th Annual International Meeting, New Orleans, November 4-8, 1979.

- "Standard logs", AECL Geophysics Workshop, Ottawa, February 25-26, 1980.

- "Plate/Sphere EM modelling programs", lecture and training session VAX computer, University of Toronto, March 4, 1980.

C. Gauvreau - Lecturer at CEGEP, Hull, Quebec, on course "Micro-ordinateur et Automatisme", 2nd term.

J. A. Hunter - "High resolution marine geophysics in Canada - a review" (with S. M. Blasco), invited paper at First Canadian Conference on Marine Geotechnical Engineering, Calgary, April 25-27, 1979.

- "Permafrost geophysics" Seminar talk, Department of Earth Science, University of Waterloo, Waterloo, Ontario, February 14, 1980.

- "Downhole seismic", AECL Geophysics Workshop, Ottawa, February 25-26, 1980.

T. J. Katsube - "Canadian rock property program" (for G. E. Larocque) US/Canada Information Exchange meeting, Columbis, Ohio, June 1979.

- "Pore structure and its effect on diffusion, permeability and retardation", Workshop on Nuclear Waste Management, Pinawa, Manitoba, October 3-5, 1979

- "Electrical properties and permeability", AECL Geophysics Workshop, Ottawa, February 25-26, 1980.

W. J. Scott - "Evidence for current channelling from VLF surveys at Chalk River, Ontario", KEGS meeting, Toronto, November 13, 1979; same talk at McGill-Ecole Polytechnique Joint Seminar Series, Montreal, November 30, 1979

- "Geophysical measurements of permafrost", Ottawa Geotechnical Group, Carleton University, December 4, 1979
- "Electric and EM interpretation", AECL Geophysics Workshop, Ottawa, February 25-26, 1980.

Membership on Committees

L. S. Collett
- Member, GSC Library Committee
- Coordinator, Geophysics Committee, NEA/IAEA Athabasca Basin Test Area.

C. Gauvreau
- Deputy Chief, Building Emergency Officer
- Member of Kuring Prize Committee, NRC/Algonquin College, 1980-85.

J. A. Hunter
- Member, Joint Industry/Government Working Group on Permafrost and Gas Hydrates
- Member, Permafrost Subcommittee of Associate Committee on Geotechnical Research (3 years)

A. K. Sinha
- Member of Reviews Committee, Society of Exploration Geophysicists.

Subdivision Productivity

8 Outside Publications
2 Current Research
1 Open File
4 Reports (GSC, numerous reports for AECL
14 Oral presentations
8 Papers submitted for publication (appear in 1980)

TERRAIN SCIENCES DIVISION

J.S. Scott, Director

Introduction

Responsibilities of the Division are directed toward the provision of geoscientific data and interpretive information on the surficial geology and geomorphic processes of the Canadian landmass and for such geotechnical aspects of the bedrock geology as may have a bearing on engineering use of the terrain. Management responsibility and provision of administrative services to the EMR Program for Disposal of High-Level Radioactive Waste is also centred within the Division.

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 acquire an understanding of past and present geomorphic processes; to identify and assess the occurrence and magnitude of natural terrain hazards; to provide geoscience information to assist in the use, 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.

The Division is organized into five sections. Regional Projects Section activities are directed largely toward geological investigations of the nature, origin and distribution of unconsolidated deposits and landforms, to provide geological maps of the areas investigated and to establish the stratigraphic and environmental history. Paleoecology and Geochronology Section is responsible for paleontological and paleoecological investigations of Quaternary fossil materials as an aid to stratigraphic correlation and determination of paleoenvironments and for the provision of ^{14}C dates on various organic materials. Sedimentology and Mineral Tracing Section is concerned with defining the mechanisms of glacial dispersal of bedrock components in glacial drift for the development of mineral prospecting techniques. Engineering Geology Section is responsible for studies of the engineering characteristics of geological materials for engineering or terrain use purposes although current activities are directed almost exclusively to the EMR Program for Radioactive Waste Disposal. Geomorphic Processes Section is concerned with the study of active geomorphological processes with emphasis on the permafrost environment, but including studies of terrain hazards in various regions of southern Canada.

At the end of the report-period the staff comprised 2 Research Managers, 21 Research Scientists, 18 Physical Scientists (1 term), 10 technical support (1 term) and 7 administrative support. Staff of the Division are based primarily in Ottawa with small operational units in Calgary at the Institute of Sedimentary and Petroleum Geology and in the Vancouver Office of the Geological Survey.

During the year the Division approved the following for G.S.C. publication: 4 Papers; 29 Maps; 8 Open Files; and 6 contributions to Current Research, 79-1 (Pt. C), 10 contributions to Current Research, 80-1 (Pt. A), and 9 contributions to Current Research, 80-1 (Pt. B). In addition 26 papers were approved for Outside Publication.

REPORTS ON SECTIONS

DIVISION HEADQUARTERS

Division Headquarters, in addition to the Director's office, comprises the Scientific and Technical Services Unit, which provides editorial and cartographic services, the Administrative and Financial Services Unit and the Secretarial and Clerical Services Unit. Also, included in Division Headquarters is one Staff Scientist who carries out research and provides advice to the Branch and other Departments on marine geoscience programs. Investigations to eliminate seepages occurring in the vicinity of the Coldstream Ranch Well that were reported early in the year are being undertaken by the Division Director. Credit is due to Loraine Morency for the assembly and compilation of much of the subsequent material in this report.

Personnel Notes

Division Headquarters consists of a permanent staff of 2 Research Managers, 1 Research Scientist, 1 Physical Scientist, and 8 support staff. The Unit also supported 1 contract project.

E.G. Bélec transferred to Terrain Sciences Division in April 1979 from the Department of Fisheries and the Environment and is working in the Scientific and Technical Services Unit as Divisional Draftsman.

A.J. Casey joined the Division in November 1979 as Administrative Officer and Supervisor of the Administrative and Financial Services Unit.

Y. Claude left the Division in October 1979 and is now Branch Administrative Officer for this Branch.

J. Cox left the Division in June 1979 and is now working for the Legal Services of this Department.

B.J. Grainger transferred to Terrain Sciences Division in July 1979 from the Personnel Office of this Branch and is now working in the Secretarial and Clerical Services Unit.

G. Mahony joined the Division in January 1980 as a continuing employee within the Secretarial and Clerical Services Unit after many years as a term-casual.

Attendance at Meetings, Conferences and Courses

B.R. Pelletier

Presented a paper at the First Canadian Conference on Marine Geotechnical Engineering, Calgary, April 1979.

J.S. Scott

First Canadian Conference on Marine Geotechnical Engineering, Calgary, April 1979; Chairman of Session I - Geological Aspects.

US/Canada Workshop on Radioactive Waste Disposal, Columbus, Ohio, June 1979.

Presented a paper at the IAEA Symposium on Radioactive Waste Disposal, Helsinki, Finland, July 1979.

Participated as a member at the meeting of the IAEA Advisory Working Group to review report "Site Investigations for Disposal of Solid Radioactive Waste in Deep Continental Geological Formations", Columbus, Ohio, October 1979.

Geological Society of America, Annual Meeting, San Diego, California, November 1979; Secretary-Treasurer, Engineering Geology Division.

Financial Management for Senior Executives Course, Touraine, P.Q., February 1980.

Membership on Committees

B.G. Craig

PC Classification Review Committee, Branch Representative

B.R. Pelletier

Intergovernmental Committee on Submersibles, Member

Maritime Sediments, Editor

Canadian Oceanographic Data System, Member

Lancaster Sound Regional Study Working Group, Member

J.S. Scott

Departmental Committee for Research Manager Classification, Member

Engineering Geology Division, Geological Society of America, Vice Chairman

NRC Associate Committee on Geotechnical Research, Member

Special Talks or Lectures

B.G. Craig

Gave a talk to the Land Resource Research Institute, Department of Agriculture to describe the work of the Division, Ottawa, July 1979.

B.R. Pelletier

A series of four talks on 'Bottom sampling, geology and engineering hazards in the Canadian offshore' to the Canadian Hydrographic Service - Hydrography II Training Course, Ottawa, November 1979.

'Paleocurrents' and 'Marine geology of the Beaufort Shelf' to the Geology Department, Queen's University, January 1980.

J.S. Scott

'Geoscience aspects of high level radioactive waste disposal' to the Ottawa Association of Science in Society, Ottawa, January 1980.

'Geoscience aspects of high level radioactive waste disposal' to the Toronto Section, American Nuclear Society, Toronto, February 1980.

Quaternary Discussion Group

The Quaternary Discussion Group was chaired by T.W. Anderson prior to the appointment of L.D. Dyke in October 1979. The following papers were given during April 1979 to March 1980.

Dr. R.E. Morlan, National Museum of Man, Ottawa — Pleistocene human occupations in Beringia.

Dr. A.S. Dyke, Terrain Sciences Division, GSC, Ottawa — Quaternary geology of the Somerset-Boothia area.

Dr. V.K. Prest, Geological Survey of Canada, Ottawa — Suggested outer limits, thickness, and flow directions of the 'last' ice sheet complex.

Professor Björn Berglund, University of Lund, Sweden — Deglaciation and environmental changes in South Scandinavia, 14,000 to 10,000 years B.P.

Professor P.J. Williams, Carleton University, Ottawa — Pipelines and permafrost.

Dr. A.N. Rencz, Terrain Sciences Division, GSC, Ottawa — Plants - The environmental integrator.

Dr. D.A. St-Onge, University of Ottawa, Ottawa — Glacial Lake Coppermine.

Dr. R. Churcher, University of Toronto, Toronto — Dakhleh Oasis: The Pleistocene-Holocene of an Egyptian Oasis.

Dr. T.J. Day, Terrain Sciences Division, GSC, Ottawa — An experimental study of the transport of graded sediments.

Dr. R.N. DiLabio, Terrain Sciences Division, GSC, Ottawa — A uraniferous peat bog in the Kasmere Lake area, Manitoba.

Dr. Fred Pollett, Environment Canada, St. John's, Nfld. — Mapping wetlands in Canada.

REGIONAL PROJECTS SECTION

R.J. Fulton (Head)

The prime objectives of the Regional Projects Section are to provide a Canada-wide inventory of surficial materials and landforms and to establish the stratigraphy and environmental history of Quaternary deposits. Projects are designed to provide information on the nature and distribution of surficial materials and on terrain conditions, to determine the geologic history of the Quaternary period and to furnish an understanding of the genesis of deposits and landforms. Terrain and surficial geology information is required for all land use activities in order to ensure that land resources are used economically, and that development will proceed without unacceptable deterioration of the environment. Important adjuncts of this work are preparation of regional syntheses, which explain the general nature and environmental history of Canada, and the development of expertise in terrain and environmental matters that can be tapped by other agencies.

Highlights

- Inventory mapping of northern New Brunswick continued. This year's work included the area around Big Bald Mountain where thick disintegrated granite occurs. Special emphasis was placed on the nature of this material because of the controversy that surrounds its origin and its position and significance in the geologic history of the area.

- Mapping continued in west Quebec between the Rouyn-Noranda region and the south end of Lake Timiskaming. In addition to information on the distribution of surficial materials, this work will provide new data relative to the extent and history of the large glacial lakes that extended north from this region and will provide information on the location of late glacial ice lobes and on the late ice flow pattern.

- Further work was done on the stratigraphy of Quaternary deposits exposed on the south coast of Nova Scotia. Earlier reconnaissance surveys had indicated that complicated stratigraphic sequences were present. This year's field work was aimed at gathering systematic data that could be used to elucidate the Quaternary history of the area and to help understand Quaternary events in the Atlantic Provinces.

- A compilation of radiocarbon dates was assembled for British Columbia. In addition to listing dates, providing data on each occurrence and indicating their geologic significance, this report uses the date information to describe the general Quaternary history framework of the province.

- Many members of the Regional Projects Section contributed regional expertise to compilation of the Paleo-Sea Level Map of Canada. This map will show the nature of materials lying between marine limit and the present coast, radiocarbon dates on marine materials, elevation of marine limit and uplift curves. It provides a significant supplement to the overview information already provided by the Glacial Map of Canada.

- The Section continued to be involved in and to co-ordinate compilation of 1:1 000 000 scale Quaternary maps of Southern Canada. This work is being done in conjunction with similar compilation in the United States. We have undertaken to provide Quaternary geology information for parts of 1:1 000 000 Map of the World sheets that lie astride the Canada-United States border. The burden of this compilation is shared with Provincial Government and university Quaternary geologists. The completed maps should give an excellent synoptic picture of the nature of surficial materials in Southern Canada.

Personnel Notes

The Regional Projects Section consists of a permanent staff of 10 Research Scientists and 6 Physical Scientists. The Section also supported 4 EMR Research Agreements, and 1 contract project.

Attendance at Meetings, Conferences and Courses

J.J. Clague

Meeting of Cordilleran Working Group, 1:1 000 000 Quaternary Map Project, Portland, Oregon, May 1979; G.S.C. representative.

Presented a paper at the Geological Society of America Annual Meeting, San Diego, California, November 1979.

R.J. Fulton

First Meeting of Quaternary Advisory Committee to American Commission on Stratigraphic Nomenclature, Houston, Texas, April 1979.

Meeting of Canadian Working Group IGCP Project 73/1/24, Toronto, May 1979.

Geological Association of Canada Annual Meeting, Quebec City, May 1979.

Geological Society of America Annual Meeting, San Diego, California, November 1979.

N.R. Gadd

Annual Meeting of the Eastern Friends of the Pleistocene, Wilmington, New York, May 1979.

D.R. Grant

Presented a paper at the Centre Nationale de la Recherche Scientifique; Conference: "Sea Level Around the World", Marseille, France, April 1979.

INQUA Shorelines Commission; field meeting "Quaternary Tyrrhenian Stratigraphy", Tunisia, April 1979.

Free University, Amsterdam; field meeting: "Mid-Quaternary Stratotypes", Netherlands-Germany, April 1979.

Quaternary Climatic Change Symposium, Toronto, May 1979.

Meeting of Canadian Working Group IGCP Project 73/1/24, Toronto, May 1979.

INQUA Commission on Genesis and Lithology of Quaternary Deposits field meeting, Norway, August 1979.

O.L. Hughes

Meeting of Environmental Assessment and Review Panel for Alaska Highway Pipeline, Whitehorse, Y.T., April 1979; public hearings.

M.F. Nixon

Quaternary Climatic Change Symposium, Toronto, May 1979.

S.H. Richard

Annual Meeting of the Eastern Friends of the Pleistocene, Wilmington, New York, May 1979.

A.M. Stalker

Quaternary Climatic Change Symposium, Toronto, May 1979.

Meeting of Canadian Working Group IGCP Project 73/1/24, Toronto, May 1979.

Membership on Committees

J.J. Clague

INQUA Commission on Genesis and Lithology of Quaternary Deposits, Corresponding Member

INQUA Subcommission on North American Quaternary Stratigraphy, Member

INQUA Commission on Quaternary Shorelines, Subcommission for the Americas, Member

A.S. Dyke

INQUA Commission on Quaternary Shorelines, Subcommission for the Americas, Member

IGCP Project 24, Arctic Canada Working Group, Member

S.A. Edlund

Canadian Committee on Ecological Land Classification, Northlands Ecoregion Working Group, Member

R.J. Fulton

Quaternary Advisory Group to North American Commission on Stratigraphic Nomenclature, Member

Geological Survey of Canada Radiocarbon Dating Committee, Member

Working Group, UNESCO-IGCP Project 73/1/24, Member

N.R. Gadd

Conseil Scientifique, Géographie Physique et Quaternaire, Member

D.R. Grant

INQUA Shorelines Commission, Secretary

Geoscience Canada, Associate Editor

Maritime Sediments, Associate Editor

Atlantic Provinces Soil Survey Co-ordinating Committee, Member

IGCP Project 61, International Working Group, Member

North American Working Group of the IAG Commission on Recent Crustal Movements, Member

IGCP Project 24, Atlantic Provinces Subgroup, Leader

O.L. Hughes

Environmental Assessment and Review Panel, Alaska Highway Gas Pipeline Project, Panel Member

A.M. Stalker

Associate Committee on Quaternary Research of the National Research Council of Canada, Chairman

INQUA Subcommittee on North American Quaternary Stratigraphy, Member

Canadian National Committee for INQUA, Chairman

Special Talks or Lectures

J.J. Clague

'Late Quaternary sea level fluctuations, Pacific Coast of Canada' to students of the Department of Geology, University of B.C., Vancouver, November 1979

'Geology hazards in the Canadian Cordillera' to students and faculty of the British Columbia Institute of Technology, Burnaby, B.C., November 1979.

J.J. Clague (cont'd.)

'Late Quaternary sea level fluctuations, Pacific Coast of Canada' to scientists of the Pacific Geoscience Centre, Sidney, B.C., December 1979.

'Landslides in the vicinity of Vancouver, B.C.' to GSC Cordilleran Division, Vancouver, February 1980.

R.J. Fulton

'Explanation of methods of surficial geology studies' to the Resource Inventory Workshop, Whiteshore, October 1979.

R.W. Klassen

'The Pleistocene stratigraphy and inferred history of the Hudson Bay Lowlands and Liard Plain, southern Yukon' to Quaternary Earth Science Interchange and Exhortation Society, University of Calgary, Calgary, February 1980.

J-S. Vincent

'Late Quaternary events and sediments of the area east and southeast of James Bay' Introductory Meeting, INQUA-IGCP Hudson Bay Field Meeting, Montreal, June 1979.

'Considérations générales sur les lacs glaciaires' to the Department of Geology, Univ. of Sherbrooke, Sherbrooke, November 1979.

'La cartographie des formations superficielles et les agences gouvernementales' to the Department of Earth Sciences, University of Quebec, Montreal, March 1980.

PALEOECOLOGY AND GEOCHRONOLOGY SECTION

W. Blake, Jr. (Head)

The work of the Paleoecology and Geochronology Section is mainly of a laboratory nature, but specialized field studies, such as the coring of lake sediments, are carried out by staff members. In 1979 field work was undertaken in Quebec, Ontario, and on Ellesmere Island in the Arctic Archipelago. These field investigations, together with laboratory studies of previously collected samples, provide information on past environments throughout Canada. Because the analyses of fossil diatoms, insects, marine invertebrates, pollen, seeds and wood are often coupled with radiocarbon age determinations, an appreciation is gained of the rates at which the environment is chanaging and of the rates at which processes are occurring.

Highlights

- The Yukon Refugium Project, in which the Section continues to participate (especially with regard to fossil insects, plant macrofossils, and radiocarbon dating) is a major interdisciplinary study involving G.S.C. staff members as well as personnel from the National Museum of Man, the National Museum of Natural Sciences, and the University of Alberta. During 1979 a major symposium was held at Burg Wartenstein, Austria, under the auspices of the Wenner-Gren Foundation.

- A second interdisciplinary project, also concerned with the extent of ice during the last glaciation, is focused on the east coast of Ellesmere Island; archeological studies by the Arctic Institute of North America are being carried out concurrently with studies of glacial history, fluctuations of sea level, botany, and rock weathering.

- A third area of emphasis involves palynological studies over a broad area extending from the Great Lakes to the Maritime Provinces. It is hoped that not only details of vegetation history will emerge from these investigations, but that cross-checking of radiocarbon dating between terrestrial and marine deposits will be possible. One of the chief aims of this project is to resolve certain chronological problems of the Champlain Sea, which formerly occupied the Ottawa-St. Lawrence Lowland.

- A major paleoecological study involving diatoms (southern Ellesmere Island) is nearing completion. Attention is now being focussed on a suite of samples from the Fraser River delta in British Columbia and on the general problem of lakes being affected by acid rain in Ontario and Quebec; in both cases diatoms should reflect changes in the environment.

Personnel Notes

The Paleoecology and Geochronology Section consists of a permanent staff of 4 Research Scientists, 3 Physical Scientists and 2 technicians. The Section also supported 4 EMR Research Agreements and 1 contract proposal.

J.A. Lowdon continued his half-time involvement with the EMR Program for Disposal of High-Level Radioactive Waste.

Attendance at Meetings, Conferences and Courses

T.W. Anderson

Quaternary Climatic Change Symposium, Toronto, May 1979.

Northeastern North America Palynological Workshop, Amherst, Mass., September 1979.

J.V. Matthews, Jr.

Co-Convenor of and presented a paper at Wenner Gren Symposium at Burg Wartenstein, Austria, June 1979.

R.J. Mott

Presented a paper (co-authored with T.W. Anderson and J.V. Matthews, Jr.) at the Quaternary Climatic Change Symposium, Toronto, May 1979.

Northeastern North America Palynological Workshop, Amherst, Mass., September 1979.

Membership on Committees

T.W. Anderson

Geological Survey of Canada Radiocarbon Dating Committee, Member

W. Blake, Jr.

Holocene Sub-Commission for the Americas and Greenland (INQUA), Member

Geological Survey of Canada Radiocarbon Dating Committee, Chairman

Geological Survey of Canada Library Policy Committee, Member

J.A. Lowdon

Geological Survey of Canada Radiocarbon Dating Committee, Member

J.V. Matthews, Jr.

Beringian Committee, Member

AMQUA Council, Member

Scientific Committee for a Biological Survey of the Insects of Canada, Member

Special Talks or Lectures

W. Blake, Jr.

'Geological evidence for the Climatic Optimum in the High Arctic' to the PCSP Climate Workshop for the non-meteorologist, EMR, Ottawa, November 1979.

'Informal presentation describing current activities of Paleoecology and Geochronology Section' to the NMNS Climatic Change Project Meeting, NMNS, Ottawa, December 1979.

'Glacial history, Arctic Archipelago' to graduate students at the Department of Geology, University of Ottawa, Ottawa, March 1980.

J.V. Matthews, Jr.

'Fossil insects and their role in interpreting the history of the tundra ecosystem' to entomologists and biologists at Carleton University, Ottawa, November 1979.

Laboratory and Technical Services Statistics

Paleoecology

Reports completed:

Diatom	7
Fossil Arthropod	6
Palynological	7
Plant Macrofossils	6
Wood	56

Geochronology

Determinations completed:

Radiocarbon ages (GSC)	
Geological samples	214
Geochemical samples	12
Carbon 13-Carbon 12 ratios (Univ. of Waterloo - contract)	140

SEDIMENTOLOGY AND MINERAL TRACING SECTION

W.W. Shilts (Head)

The primary task of the Section is to provide information on the physical and mineralogical-chemical properties of glacial and associated surficial sediments of Canada. Research is aimed at providing basic data on regional variations in drift properties and at developing techniques of using drift composition to aid in prospecting or evaluation of environmental or geotechnical problems. In addition, members of the Section do basic research on glacial and lacustrine sedimentation.

The Sedimentology-Engineering Geology laboratory, the Drift Composition laboratory, and technical support to the Sedimentation Flume are all administered within this Section. These laboratories provide research facilities and analyses as well as preparation of samples for Terrain Sciences Division staff and for other scientists within and outside of the Geological Survey.

Highlights

- Studies of the geochemistry of glacial sediments and post-glacial peat in close proximity to known zones of mineralization were continued in Nova Scotia, eastern Ontario and northern Manitoba. In the peat studies, carried out in co-operation with R.G.G. Division, more sites were found to be abnormally enriched in uranium, particularly near known uranium mineralization. Studies of the mechanisms of uranium uptake in peat continues and may yield important principles that can be applied to mineral exploration and containment of radioactive wastes.

- Canadian Coast Guard Ship "Pierre Radisson" transported two geologists to Coats and Mansel Islands at the mouth of Hudson Bay. Helicopter traverses were carried out from the ship over five-day periods at each island, marking the first time that the Quaternary deposits of these large, mostly Paleozoic limestone islands have ever been studied on the ground. Maps of the surficial deposits of both islands were prepared and observations were made of lithologies of glacial erratics and amount of isostatic rebound. The most important results of this work were the observations of abundant erratics of Dubawnt Group rocks, transported over 600 km from the Baker Lake area to Coats Island. No Dubawnt erratics were found on Mansel Island, but abundant erratics of greywacke,

basic volcanic rocks, and magnetite and hematite iron formation from the Quebec mainland were found there and on the east coast of Coats Island. These observations confirm the pattern, deduced from data on dispersal of erratics on the west-central and southwest coasts of Hudson Bay, of two major ice masses from Keewatin and Quebec meeting in the Hudson Bay basin and flowing for a long period of time from those glacier dispersal centres.

- Marine shells collected from cores and sections in and adjacent to the southwestern Hudson Bay and James Bay Lowlands have been subjected to amino acid "dating" under a co-operative project with the Institute of Arctic and Alpine Research at the University of Colorado. These shells were collected from interglacial or interstadial marine beds and from two or more post-Illinoian (post-Missinaibi) tills in which they occur as erratics. Because the mean annual temperature of this region is close to 0^{o} Celsius, the wide temperature fluctuations that have possibly affected the rates of racemization in high arctic shell collections are not expected to be important here. Preliminary data from these shells suggest that Hudson Bay may have been open at least twice during the Wisconsinan Glaciation, an observation which, if confirmed, will change the concepts of North American paleoclimate of the past 100 000 years considerably. The amino acid results combined with the ice sheet flow lines derived from dispersal patterns of erratics seem to be pointing toward a radical revamping of formerly held ideas about the growth and history of the Laurentide Ice Sheet.

- The main phase of the mapping of the surficial geology of Bylot Island and vicinity has been completed and is serving as the basis for a Ph.D. thesis which is expected to be finished in winter, 1981. Careful study of the distribution of fossiliferous Paleozoic erratics carried to Bylot Island from Baffin Island and possibly from the Arctic Archipelago has allowed a scheme to be developed whereby units deposited by ice from the local ice cap can be distinguished from those deposited by the Laurentide or Innuitian glaciers that impinged on the island. Using the same technique, maximum levels of inundation of the island by foreign ice masses has been determined. The high peaks of the island are deeply weathered and may never have been glaciated. A moraine on the north side of the island was built by continental ice and has a massive ice core which is possibly a remnant of a very old (>40 000 yr.) glacier. Although amino acid analysis of the abundant shelly units on the island is expected to yield considerable age and correlation data, it is already confirmed by C_{14} analyses that the great continental glaciations that

affected the island did so more than 40 000 years ago; since that time, the only known glacial events on Bylot Island have been related to fluctuations of its indigenous ice cap.

- Remote sensing studies have continued using the colour Applicon plotter to make surficial deposit maps at any desired scale from digital satellite data. It has been possible using summer images to produce maps that accurately portray 75-80% of the surficial units interpreted by air photographs in Keewatin. The technique is advanced to the point that we can consider some sort of standard open file release of these maps, which can portray some important surficial units in much greater detail than they can be portrayed by conventional airphoto interpretation.

- Surficial geology compilation in Keewatin has continued on contract. To date 21 sheets have been interpreted and compiled in considerable detail.

- During the fiscal year the Section has become involved in studying the potential reaction of glaciated terrain to acid precipitation. In a co-operative project with R.G.G. Division, the close relationship of lake pH to glacially transported calcareous drift on the Canadian Shield north of Lake Superior was documented and published. This work confirmed that where glaciers were moving from carbonate terrane onto non-carbonate terrane, the sheet of carbonate-rich glacial and associated lacustrine or marine deposits has provided significant buffering capacity to lakes on the Shield.

Personnel Notes

The Sedimentology and Mineral Tracing Section consists of a permanent staff of 3 Research Scientists, 3 Physical Scientists, and 6 technicians. The Section also supported 2 contract proposals, and 1 NRC Visiting Fellow.

D.E. Field retired in December 1979 after 30 years of service in the Sedimentology laboratories of the Division.

I.M. Kettles joined the staff of the Division as a term research assistant in November 1979, replacing M.F. Asselstine who has moved to Toronto.

R.A. Klassen returned from graduate studies at the University of Illinois.

A.N. Rencz's Visiting Fellowship has been renewed for a period of one year terminating on August 31, 1980.

B.A. Rivoire joined the Division in January 1980 as a continuing employee with the Sedimentology-Engineering Geology laboratories after many years as a term-casual.

Attendance and Meetings, Conferences and Courses

R.N.W. DiLabio

Presented a paper at the Institute of Mining and Metallurgy Conference on Permafrost in area of glaciated terrain, Dublin, Ireland, August 1979; participated in field trip.

Prospectors and Developers Association Annual Meeting, Toronto, March 1980.

R.A. Klassen

INSTAAR-sponsored "Arctic Workshop", Boulder, Colorado, May 1979.

W.W. Shilts

Friends of the Pleistocene, Peoria, Illinois, May 1979.

B.R.C.G. Meeting in North Carolina, February 1980.

Membership on Committees

J.R. Bélanger

Branch Computer Facilities Committee, Member

Terrain Sciences Divisional Computer Committee, Member

R.N.W. DiLabio

Branch General Instructions for Field Parties Committee, Member

Divisional Display Committee, Member

W.E. Podolak

Branch Safety Committee, Member

Branch Storage Committee, Member

W.W. Shilts

INQUA, Commission on Genesis and Lithology of Quaternary Deposits, Corresponding Member

INQUA, Working Group 9, Glacigene Deposits as Indicators of Glacial Movements, Member

International Geological Correlation Program (Quaternary Glaciations in the Northern Hemisphere), Member

Bilateral Research Consultation Group on Acid Rain (U.S.-Canada), Member

Acid Rain Research, Geological Survey, Co-ordinator

Laboratories

The Sedimentology and Engineering Geology Laboratory underwent a move from No. 5 Temporary Building to the former Food and Drug Building at Tunney's Pasture. Due to planned demolition of No. 5 Temporary Building, the move was made prematurely, although construction was not complete at the Food and Drug Building. Subsequent slow deliveries of equipment to D.P.W. and operational restrictions within D.P.W. account for the major portion of lost production. The remaining production shortage (compared to F.Y. 1978-79) is attributable to manpower shortages due to retirement and staff reduction.

ENGINEERING & SEDIMENTOLOGY LABORATORY

YEARLY REPORT APRIL 1, 1979 TO MARCH 31, 1980

	No. of Samples
Freeze Drying	822
Complete Sieve & Pipette	248
Gravel Sand Silt Clay	217
Hygroscopic Moisture Content	383
Atterberg Limits	207
Calcite Dolomite Ratio	45
Total Carbonate	490

	No. of Samples
Munsel Soil Colour Determination	72
Sample Preparation INCLUDES - sieving - splitting & weighing for various tests - labelling	508
Sample Preparation for Atterberg	207
Sample Preparation for Calcite Dolomite	41

The Drift Composition Laboratory completed fewer standard analyses in 1979-80 than in previous years partially because fewer samples were submitted and partially because one technician's services were shared with the Flume Laboratory due to a temporary shortage of personnel. Also, 2-3 months were spent in special sample preparation of modern lacustrine sediments.

Production Summary, F.Y. 1979-1980

	No. of Samples
Clay Separations	1500
Heavy Mineral Separations	500
Heavy Mineral Slides	500
Magnetic Susceptibility	500
Samples Sieved for -250 Mesh Fraction	300

Sample Coding for Storage Control - 2 months

The Flume Laboratory has been in use for the major portion of the fiscal year. Researchers from Ottawa University and from Wilfrid Laurier University as well as Dr. T.J. Day of this Division have run experiments. Interim operations of the Flume Laboratory consisted mainly of maintenance. J.R. Luscombe operates and maintains the facility on a part-time basis.

ENGINEERING GEOLOGY SECTION

E.B. Owen (Head)

The Section is concerned with studies of the physical and engineering characteristics of geological materials for engineering purposes and provides advice and consultation to various government agencies. During the year the Section continued to be almost exclusively involved in a major project to assist Atomic Energy of Canada Limited in determining the feasibility for disposal of high-level radioactive wastes in plutonic crystalline rocks primarily within the Province of Ontario.

Highlights

- Members of the Section contributed to the Radioactive Waste Disposal Program through co-ordination of field activities at Research Areas located at Chalk River and Atikokan, Ontario and Pinawa, Manitoba, curation of diamond drill core obtained from Research Areas, and operation of a borehole television logging system.

Personnel Notes

The Engineering Geology Section presently consists of a permanent staff of 1 Research Scientist, 1 Physical Scientist and 1 technologist.

Twelve scientists, 1 technologist and two clerical staff have been seconded from Atomic Energy of Canada to the Geological Survey of Canada for work on the Radioactive Waste Program.

J.G. Bisson continued his duties as Chief, Building Fire Inspection Officer for the building located at 401 Lebreton Street, Ottawa.

P.J. Kurfurst transferred from the Geomorphic Processes Section of the Division in April 1979.

F.M. Morin has taken a leave of absence from the Federal Government to take a contractual position with CIDA.

Attendance at Meetings, Conferences and Courses

P.J. Kurfurst

Review of the Swedish-U.S.A. Radioactive Waste Disposal Program, Canadian Geotechnical Society (Ottawa Group 1), April 1979.

Workshop "Discontinuities and their evaluation in Stripa granite", Berkeley, California, September 1979.

F.M. Morin

Presented a paper at the Annual Meeting of the GAC/MAC, Quebec City, Quebec, May 1979.

Membership on Committees

P.J. Kurfurst

EMR/AECL Drilling Committee, Chairman

Underground Research Laboratory Project Management Committee, Member

Underground Research Laboratory Site Evaluation Subcommittee, Chairman

E.B. Owen

Advisory Committee on Mine Tailings (Atomic Energy Control Board), Member

Special Talks or Lectures

P.J. Kurfurst

'Canadian Radioactive Waste Program/EMR Geoscience Program' to the Management Group, Earth Sciences Division, Lawrence Berkeley Laboratory, University of California, Berkeley, November 1979.

E.B. Owen

'Oil and gas exploration activities and pipeline construction, Canadian Arctic', St. Joseph High School, Ottawa, February 1980.

GEOMORPHIC PROCESSES SECTION

J.A. Heginbottom (Head)

The task of the Geomorphic Processes Section is to study the distribution, nature and rates of action of those surface and near surface processes that shape the Canadian land mass. Particular emphasis is placed on exogenic processes and on the study of processes in the permafrost environment of northern Canada. The work of the Section also includes studies related to resource development in the mountains of Western Canada and studies of fluvial processes. Facilities available in the Section include a cold room and an 8 m recirculating flume.

Highlights

- In co-operation with and at the request of the Northern Environmental Protection Branch, DIAND, undertook field studies of the effects on the terrain of summertime cross-country vehicle operation and diamond drilling in central Keewatin in preparation for possible revisions to the Territorial Land Use Regulations as they apply to mineral exploration activities on the Canadian Shield.

- Developed a definition of the initial motion characteristics for different size fractions in graded stream bed material, showing the dominant effect of position within the grading curve and the secondary effect of the grading itself.

- Provided information and advice to Parks Canada, Western Region, on problems of debris flows within the national parks of the Rocky Mountains.

Personnel Notes

The Geomorphic Processes Section consists of a permanent staff of 2 Research Scientists and 3 Physical Scientists. The Section also supported 1 contract proposal.

T.J. Day returned from 4-months work assignment at the U.K. Hydraulics Research Station, Department of the Environment, Wallingford, England in July 1979.

L.D. Dyke defended his thesis and completed the requirements for his Ph.D. at Texas A&M University, College Station, Texas in December 1979. His dissertation was entitled "Mechanisms of downhill creep in expansive soils".

L.E. Jackson's article on jökulhlaups (GEOS, Summer 1979) received an award of Excellence in the competition of the Eastern Ontario Chapter of the Society for Technical Communications, and has been submitted for an international competition in May 1980.

P.J. Kurfurst transferred to the Engineering Geology Section of the Division in April 1979.

Attendance at Meetings, Conferences and Courses

L.D. Dyke

Presented a paper at the Soil Water Problems in Cold Regions Conference, Calgary, September 1979.

J.A. Heginbottom

Performance Appraisal Workshop, April 1979.

Meetings of Environmental Assessment Panel for Dempster Highway Gas Pipeline, Vancouver, June 1979, and Whitehorse, September 1979.

Meeting of Permafrost Subcommittee, Quebec City, September 1979.

Meeting of Organizing Committee, Fourth Canadian Permafrost Conference, and Permafrost Subcommittee, Winnipeg, January 1980.

L.E. Jackson

Presented a paper at the Annual Meeting of the American Association for the Advancement of Science, Pacific Division, Moscow, Idaho, June 1979.

Membership on Committees

T.J. Day

Hydrotechnical Research Committee, Canadian Society of Civil Engineers, Member

L.D. Dyke

Branch Christmas Party Committee, Chairman

Quaternary Discussion Group, Chairman

J.A. Heginbottom

International Biological Program, Ecological Sites Working Group (DINA), Member

Terrain Sciences Division Displays Committee, Chairman

Environmental Assessment and Review Panel, Polar Gas Pipeline Project (DOE), Member

Environmental Assessment and Review Panel, Dempster Highway Pipeline Project (DOE), Member

Permafrost Subcommittee, Associate Committee on Geotechnical Research, Member

Environmental Assessment and Review Panel, Norman Wells Development Project (DOE), Member

L.E. Jackson

ISPG Library Committee, Member

Special Talks or Lectures

T.J. Day

'Armouring and hydraulic characteristics of steep channels' to Department of Geology, University of Reading, England, and to the Department of Geography, University of Southampton, England, April 1979.

L.D. Dyke

'Geomorphic processes in the permafrost environment' to Department of Geography, Wilfrid Laurier University, Waterloo, Ontario, March 1980.

P.A. Egginton

'Geomorphic process studies, central Keewatin' to various territorial government agencies and the mineral industry at the DINA Workshop, Yellowknife, N.W.T., November 1979.

L.E. Jackson

'Quaternary stratigraphy of the Kananaskis Lakes map area Alberta' to Quaternary Earth Sciences Interchange and Exhortation Society (QESIES), University of Calgary, November 1979.

'A jökulhlaup origin for the 1978 debris flow at the Spiral Tunnels, B.C.' at the Cordilleran Slope Hazards Workshop, Simon Fraser University, Burnaby, B.C., January 1980.

STAFF LIST

(to March 31, 1980 as supplied by reporting units)

DIRECTOR GENERAL'S OFFICE

McLaren, D.J., Director General
Smalldridge, Mrs. J., Secretary
Fyles, J.G., Chief Geologist
Birtch, Mrs. E.J., Secretary
Hall, E., Scientific Executive Officer

Special Projects

Bolton, T.E.

Program Office

Brindle, J.E.
Carr, Mrs. E.J., Secretary
Benson, D.G.
Petre, Ms. M.A.
Stalker, D.W.

International Union of Geological Sciences

Hutchison, W.W., Secretary General
Lafferty, Mrs. V., Executive Assistant

ATLANTIC GEOSCIENCE CENTRE

Keen, M.J., Director
MacDonald, Mrs. M.E., Secretary

Administrative

Stewart, P.G., Administrative Officer
Dennis, Mrs. P.E., Secretary
Racine, Mrs. C., Personnel
Campbell, Mrs. D., Accounts
Henderson, T., Accounts

Post-Doctorate Fellows

Doeven, P.
Topliss, B.

Seconded to Department of Fisheries and Oceans

Charest, Mrs. J., Library
Mazerall, A., Library
Hale, K., Drafting

Environmental Marine Geology Subdivision

Middleton, Mrs. C., Secretary
Robertson, K.R.

Coastal Geodynamics

Frobel, D.
Clattenburg, D.
Amos, C.L.
Lewis, C.F.M.
Jubb, R.
Blasco, S.
McLaren, P.
Taylor, R.B.
Asprey, K.W.

Marine Geochemistry

Buckley, D.E.
Rashid, M.A.
Cranston, R.
Winters, G.
Fitzgerald, R.A.
LeBlanc, K.W.G.

Paleocology

Schafer, C.T.
Vilks, G.
Wagner, F.
Deonarine, B.
Cole, F.

Eastern Petroleum Geology Subdivision

Williams, G.L.
Mitchell, Mrs. C.

Coal Petrology

Hacquebard, P.M.
Avery, M.

Drafting

Grant, G.
Cook, G.

Labrador - Baffin Group

Umpleby, D.
Hardy, I.
Grant, A.
Jackson, A.
Gradstein, F.
Thomas, F.C.

Paleozoic Basins

Howie, R.

Scotian Shelf
Grand Banks - Margin Group

Wade, J.
Jansa, L.
Ascoli, P.
Bujak, J.
Girouard, J.

Biostratigraphy

Barss, M.S.
MacMillan, W.
Crilley, B.

Regional Reconnaissance Subdivision

Haworth, R.T.
Fougere, Mrs. J., Secretary

Surficial and Bedrock Geology

King, L.H.
Fader, G.
Miller, R.
Josenhans, H.

Eastern Arctic Offshore Geology

MacLean, B.

Labrador Sea Studies

Srivastava, S.P.
Fillon, R.
Livingstone, D.
Harmes, R.A.

Ocean Basins and Margins

Keen, C.E.
Barrett, C.L.
Jackson, R.
Loncarevic, B.D.

Geophysical Surveys

MacIntyre, J.B.
Folinsbee, R.A.
Woodside, J.M. (LWOP)

Scismic Support

Chapman, C.B.
Neilsen, J.A.
Coady, V.F.
Inkpen, B.F.

Gravity Support

Hughes, M.

Program Support Subdivision

Manchester, K.S.

Systems Development

Heffler, D.E.
Locke, D.R.
Boyce, W.A.

Data Systems

Sherin, A.G.
Fricker, A.
Shih, K.G.
Sparkes, R.
Johnston, B.L.
Beaver, D.E.
Hubley, S.

Marine Geological Technical Services

Gorveatt, M.E.
Jodrey, F.D.
Murphy, R.J.
Ewing, F.D.

CENTRAL LABORATORIES AND TECHNICAL SERVICES

Maxwell, J.A., Director
Traill, R.J., Assistant Director
Clemmer, J.E., Senior Administrative Clerk

Branch Administrative Services

Claude, Y.
Gariepy, R.A.
Lacelle, K. (Mrs.)

Procurement, Chemicals and Stationery Stores

Blake, C.
Bonavia, L.V.
Davidson, D.O.
Falls, R.
Hamilton, R.
St. Dennis, D.J.
Thompson, L. (Mrs.)

Building and Vehicle Services

Deschamps, R.
Lagroix, W.J.
Rozon, R.J.A.
Salter, I.C.

Secretarial and Word Processing Centre

Aiken, M. (Mrs.)
Busby, D. (Miss)
Côté, J. (Mrs.)
Desautels, J. (Ms.)
Gagnon, S.M. (Mrs.)
Gilliland, J. (Mrs.)
Joly, T.H. (Mrs.)
Legere, J. (Miss)
Parnham, S.J. (Mrs.)

Branch Records and Messenger Services

Belair, P. (Mrs.)
Clark, J.K. (Miss)
Clarke, J.
Colterman, M.

Financial Services

Bowstead, C.C., Comptroller
Stapledon, J.D.

Accounts

Casey, R.B.
Deslauriers, I.M. (Mrs.)
Eastman, A.D.
MacDonald, M. (Ms.)
Taylor, R.S. (Miss)

Analytical Chemistry Section

Abbey, Sydney, Head

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