



**CANADIAN  
GEOSCIENCE  
COUNCIL**

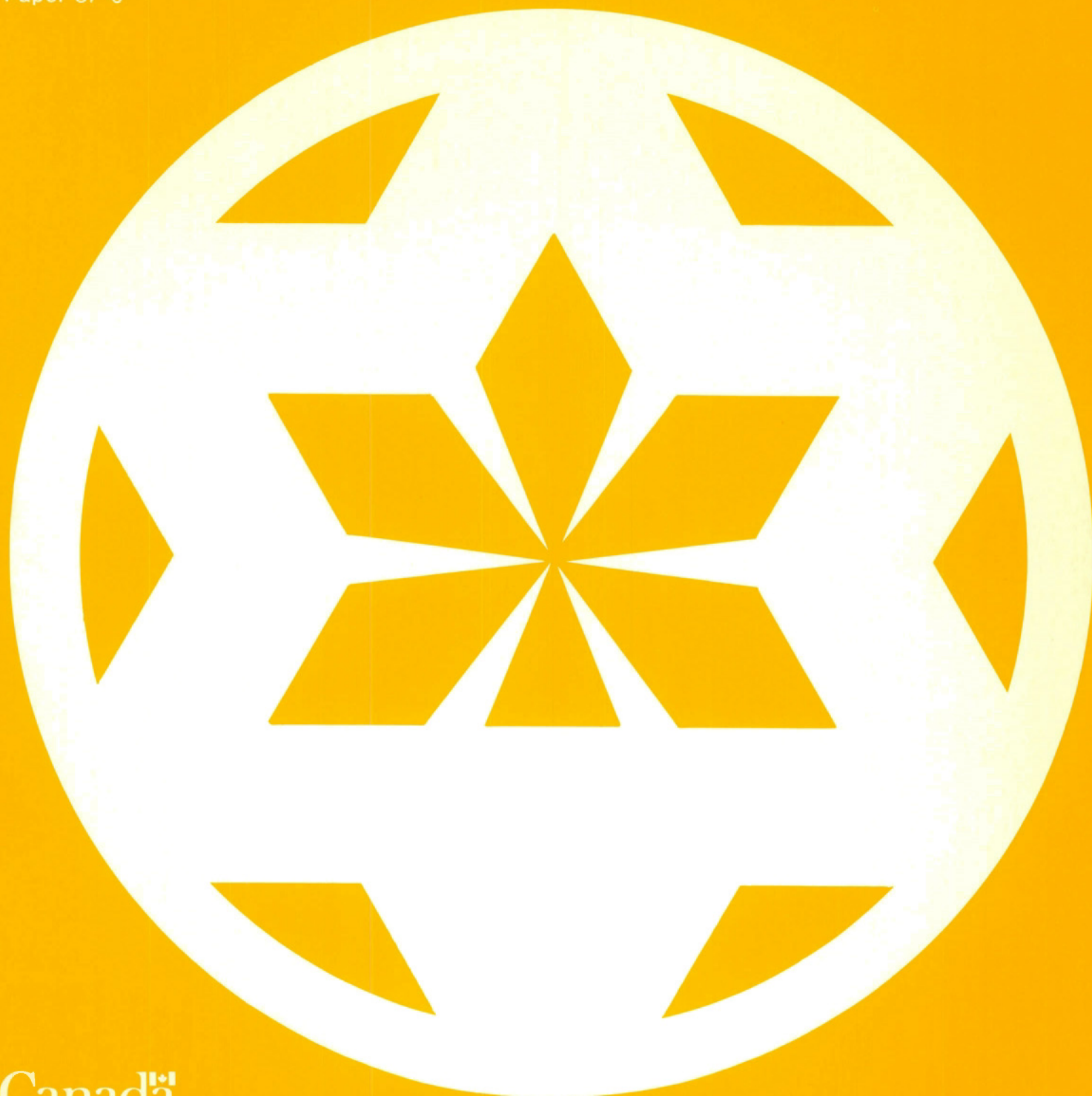
**THE GEOSCIENCES  
IN CANADA, 1986**

**ANNUAL REPORT**

Prepared by  
The Canadian Geoscience Council

Published for the Council by the  
Geological Survey of Canada as  
Paper 87-6

Edited by D.F. VanDINE



## ACRONYMS COMMONLY USED IN THIS REPORT

<b>AECL</b>	Atomic Energy Canada Limited	<b>GAC</b>	Geological Association of Canada
<b>AEG</b>	Association of Exploration Geochemists	<b>GSA</b>	Geological Society of America
<b>AGID</b>	Association of Geoscientists for International Development	<b>GSC</b>	Geological Survey of Canada
<b>APEGGA</b>	Association of Professional Engineers, Geologists and Geophysicists of Alberta	<b>ICL</b>	Inter-Union Commission on the Lithosphere
<b>CANQUA</b>	Canadian Quaternary Association	<b>IGCP</b>	International Geological Correlation Program
<b>CCCESD</b>	Council of Chairman of Canadian Earth Science Departments	<b>IGU</b>	International Geographical Union
<b>CGC</b>	Canadian Geoscience Council	<b>IMA</b>	International Mineralogical Association
<b>CGS</b>	Canadian Geotechnical Society	<b>INQUA</b>	International Union for Quaternary Research
<b>CGU</b>	Canadian Geophysical Union	<b>IUGG</b>	International Union for Geodesy and Geophysics
<b>CIM</b>	Canadian Institute of Mining and Metallurgy	<b>IUGS</b>	International Union of Geological Sciences
<b>CSEG</b>	Canadian Society of Exploration Geophysicists	<b>MAC</b>	Mineralogical Association of Canada
<b>CSPG</b>	Canadian Society of Petroleum Geologists	<b>NSERC</b>	Natural Sciences and Engineering Research Council of Canada
<b>EMR</b>	Department of Energy, Mines and Resources (Canada)	<b>ODP</b>	Ocean Drilling Program
<b>EPB</b>	Earth Physics Branch (EMR)	<b>UNESCO</b>	United Nations Educational, Scientific and Cultural Organization

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PAPER 87-6

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1987



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## REPORT OF THE PRESIDENT

### *Introduction*

The Canadian Geoscience Council is a forum of representatives of major Canadian earth science societies, universities, and government agencies, working co-operatively to encourage the development of the geosciences in the best interests of the nation and of the geoscience professions. Council also provides useful advice to governments on geoscience policy, and works toward the continued health of geoscience in Canada.

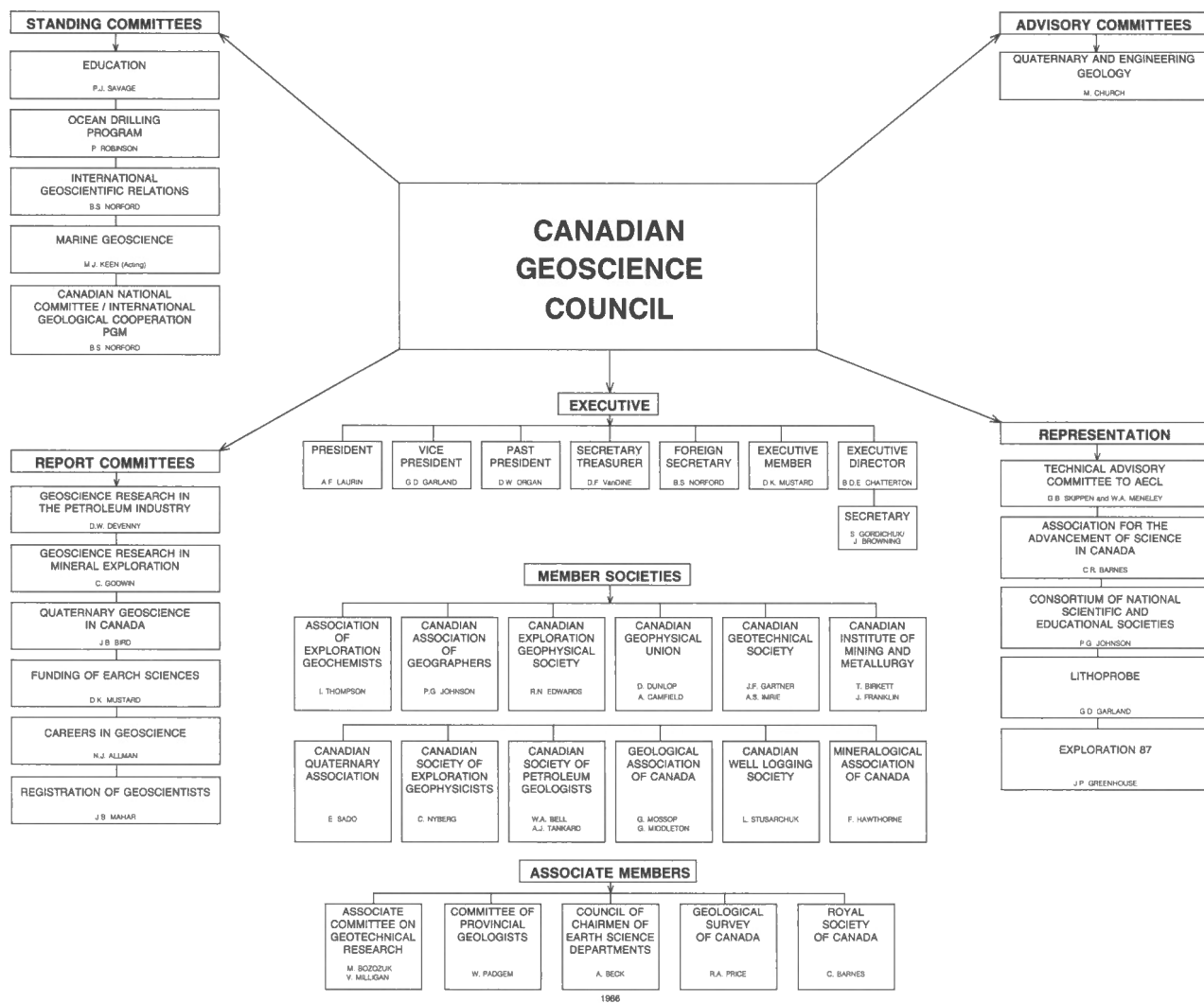
The year 1986 saw some important changes which are of great concern to the geoscience community in Canada: a fall in world oil prices; increase in gold prices; and preoccupation of governments to control their expenses. The fall in world oil prices means that exploration in frontier regions and research and development in the petroleum industry will be substantially reduced over the next few years. The strengthening of gold prices is welcome news for increased mineral exploration in Canada. At a time when governments are determined to cut costs by various measures, it is vital that senior management have guidance and counsel, from organizations such as the CGC, on which activities should be conducted by the governments and how best they be conducted.

Council met four times in 1986; March, in conjunction with the Prospectors and Developers Convention in Toronto; in May in Québec City, immediately after the annual GAC/MAC joint meeting in Ottawa; in September at the Tyrrell Museum in Drumheller, Alberta, following the Mines Minister's Conference in Banff; and the annual meeting of Council with representatives of EMR, in Ottawa, in December.



**Plate 1.**  
Councillors at the September 1986 Meeting, Tyrrell Museum

**Table 1.** Organization chart and CGC representatives, 1986



### ***Publications***

These reports of Advisory Committees were submitted during 1986.

1. Mapping the Landscape — Report of the Advisory Committee to the Geological Survey of Canada on Outputs in Quaternary and Engineering Geology. (Dr. M. Church, Chairman)
2. An Overview of Geoscience Research and Development in the Canadian Petroleum Industry. Conducted on behalf of the CGC, GSC, and the Canadian Petroleum Association. (Dr. D.W. Devenny, Chairman)
3. Quaternary Geoscience in Canada — A review carried out on behalf of the CGC. (Dr. J.B. Bird, Chairman)

These reports will be available from Council Headquarters in Edmonton when published.

### ***Major Studies in Progress***

The following two major studies are in progress.

1. Comparative Study on Funding of Earth Sciences in Canada (D.K. Mustard, Chairman). Council has commissioned an independent comparative study on levels of geoscience funding in Canada. The study will be contracted to the Centre for Resource Studies at Queen's University to be carried out under the direction of Dr. Margo Wojciechowski. It is perceived that in relation to their fundamental importance to the security and economic well-being of Canada, the earth sciences are inadequately funded where compared to other industries such as forestry, agriculture and fisheries, and as compared to other scientific disciplines.
2. Geological Registration. Council has created a committee, chaired by John Maher, representing different geographic regions of Canada. The committee will liaise with groups writing legislation on registration of earth scientists to ensure that transferability of registration between regions be incorporated in the legislation, and as a long term goal examine professional registration on a wider basis. Council must provide a role in bringing together the provinces that are legislating earth scientists and groups that are opposed to registration, to discuss the problems, and work towards the best scheme possible for all.

### ***Advisory Committees***

Council has acted as a central body providing geoscience advice in a number of areas.

1. At the request of the Director General of the GSC, Council has recently appointed an External Advisory Committee on Geophysics to the "new" Geological Survey of Canada. The committee will begin its work early in 1987 and is expected to function over two years. The committee has been asked to examine the geophysical activities in the "new" GSC, and advise on the scope and effectiveness of its geophysical activities.
2. In addition to overseeing the Lithoprobe Program, the Lithoprobe Committee has also been planning for the establishment of a Canadian Continental Scientific Drilling Program. The Lithoprobe Program conducts deep crustal studies using land and marine seismic surveys and other geophysical techniques. The committee chairman is Dr. G.D. Garland.
3. The Marine Geoscience Committee reports to Council on problems of major facilities for the marine geoscience in Canada, and on the interactions between industry, government and universities. M.J. Keen is acting — Chairman until a new Chairman has been appointed.
4. Council has played a leading role in initiating and establishing a Technical Advisory Committee to the Atomic Energy of Canada Ltd. (AECL) on Nuclear Fuel Waste Management Program. Council representatives on this committee are Dr. G.D. Skippen and Dr. W.A. Meneley.
5. Council assisted in forming the Advisory Committee to the Frontier Geoscience Program of the Geological Survey of Canada.

### *Ocean Drilling Program*

Since 1985, Canada has been a full participant in this international program engaged in world-wide deep sea drilling for scientific information. The membership of JOIDES includes U.S.A., Canada, Federal Republic of Germany, France, U.K., Japan, and European Science Foundation (consortium of Iceland, Sweden, Finland, Norway, Denmark, Netherlands, Belgium, Switzerland, Italy, Greece, Turkey and Spain). USSR may join in early 1987. Canadians are on all JOIDES Advisory Panels. Australia has been approached to share the Canadian costs in this program. In 1986 four drilling legs were completed. A committee of Council, chaired by Dr. P.T. Robinson, of the Canadian National Committee for ODP, provides scientific advice for this program. In the last few years there have been a number of remarkable successes offshore and information of high quality has been obtained. All this geological and geophysical information will be highly useful not only to the mining and petroleum industries, but also to the fishing industry, defence agencies, and to those concerned with environmental studies.

### *International Affairs*

Council is a sponsoring and participating agency in all major geoscience projects on the national and international levels. Dr. B.S. Norford is the Foreign Secretary of Council. Council has assumed the role of the Canadian National Committee for Geology and acts as the adhering body to the International Union of Geological Sciences (IUGS) and the International Geological Congress. Council is also responsible for Canadian participation in the International Geological Correlation Program (IGCP) (financed by UNESCO) and the International Lithosphere Program. Despite cuts in the UNESCO overall budget as a result of the withdrawal of the U.S.A., the IGCP budget was increased by 13 per cent. The prospects for 1987 are not as optimistic.

Council is also cooperating with the American Geological Institute's survey on geoscience manpower in North America. Council also participates in the work of the World Commission on Environment and Development. This commission has the task of reporting to the U.N. General Assembly on critical problems that face the world in these two areas.

Geoscientific Conferences to be hosted by Canada in 1987 are:

1. International Quaternary Association (INQUA) — Ottawa.
2. International Union of Geology and Geophysics — Vancouver.
3. International Rock Mechanics Society — Montreal.
4. Exploration '87 — International Conference on Geophysical and Geochemical Exploration for Minerals and Groundwater — Toronto.
5. Oceans '87 — The Ocean: An International Workplace — 12th Anniversary Joint Meeting of the Marine Technology Society and the Institute for Electrical and Electronics Engineers/Oceanic Engineering Society — Halifax.

### *Administration*

The headquarters of Council are at the University of Alberta in Edmonton. Dr. B.D.E. Chatterton is the CGC Executive Director.

A revised Constitution and By-Laws of the CGC were prepared by Dr. C.H. Smith and in early 1986 Council was incorporated.

Council remains in sound financial health. In order to remain financially solvent it will need to continue to monitor expenses carefully.

### *Commentary*

Canada is one of the few countries with a large population of geoscientists who have distinguished themselves in diverse fields both nationally and internationally. Council has always shown leadership in promoting, coordinating and conducting research programs built and pursued around multidisciplinary investigations that have promise for advancing geosciences such as: the Ocean Drilling Program, Lithoprobe, Geoscientific Drilling, etc. For example, the knowledge and the understanding of the geology of the ocean basins and their margins will prove most useful in interpreting and understanding the geological evolution of the continents through time.

As mentioned, Council is concerned with the present level of exploration in mineral resource and petroleum industries due mainly to uncertainties in world prices. Under such circumstances the only way to survive is to develop and apply new technology. The traditional approaches to R and D are often too slow to handle sudden plunges in values of commodities. Canada must increase its efforts for research in applied technology. Such R and D is vital if Canada's earth science industries are to survive in the uncertain economic climate. Consequently, the momentum must be maintained in R and D so that new results are available to the industry when needed in a few years time. This momentum will have to be maintained by concerted action by industry, universities and government agencies.

At a time when industry cannot afford to do a lot of things, it is important for the government, and the federal and provincial geological surveys to take the lead and do the work.

To regain our competitive edge in the world markets, it is imperative that unions cooperate with industry to reduce costs and increase productivity. Otherwise, we will be slaves to the world prices which are quite unpredictable.

It is my strong belief that Council will continue to undertake and accomplish all its tasks successfully as it has done in the past. Council will continue to serve as a reasonable, dispassionate critic of provincial and federal government earth science organisms, providing useful advice and performing independent appraisals, and equally act as a useful forum for debate on major projects.

The geosciences will continue to make a very significant contribution to Canada and its well-being in the future.

### *Acknowledgments*

It is a pleasure to acknowledge all the work done and excellent assistance provided by the Executive Director, Dr. B.D.E. Chatterton, during the year. The advice received from the past — President, Mr. D.W. Organ, is also highly appreciated. Special thanks are due to Dr. R.A. Price, Director General of GSC, for commenting on the draft of the Keynote Speech delivered by me on behalf of the CGC and CIMM at the Plenary Session of the Council of Mining and Metallurgical Institutions in Singapore in May 1986. Council thanks Dr. C.H. Smith for his work in assisting the CGC through the process of incorporation.

*A.F. Laurin*



## REPORT OF THE EXECUTIVE DIRECTOR

The Canadian Geoscience Council's office was housed in the Department of Geology, University of Alberta for the full year. Renovations to the Earth Science Building and the resignation of Susan Gordichuk, secretary to the Executive Director, and her replacement by Judy Browning caused no more than minor disruptions to the office work.

Sales of publications from the office dwindled during the year as the supply of the English version of the booklet *Careers in Geoscience* approached zero. It is unlikely that this situation will change until the new careers booklet is printed. The demand for copies of *Future Directions of Mineral Deposits Research in Canada* was sporadic. Over 200 copies of the *Annual Report of the Canadian Geoscience Council, The Geosciences in Canada, 1985*, Geological Survey of Canada Paper 86-6, edited by D.F. VanDine, were circulated to institutions across and outside Canada.

During the year, a large amount of mail was received by the CGC office. Apart from some very specific enquiries, this could be assigned to the following categories (not in order of importance or magnitude): 1) enquiries about careers in geoscience (including requests for the booklet); 2) enquiries about the nature and role of the CGC; 3) enquiries about the availability or location of particular types of geoscience information in Canada; 4) correspondence from member societies; 5) correspondence from other national or international scientific and/or educational groups; 6) correspondence about or with the CGC advisory, standing or report committees; and 7) information released by national and international scientific organizations (mainly information on meetings and news releases).

In early 1986 Council received the seal and incorporation documents (including the Letters Patent) from the Minister of Consumer and Corporate Affairs. Members of the Executive are particularly grateful to Charles Smith (President of the CGC for 1984) for all of his work in this regard.



Plate 2

The Executive of the Canadian Geoscience Council, 1986

Left to right: D.W. Organ (Past-President), D.F. VanDine (Secretary-Treasurer), B.D.E. Chatterton (Executive Director), A.F. Laurin (President), D.K. Mustard (Executive Member), G.D. Garland (Vice-President), B.S. Norford (Foreign Secretary).

During 1986 the topics that Council spent the most time discussing included: a) funding for research and development in the earth sciences; and b) registration and accreditation of geoscientists across Canada. Members of Council concluded that the Canadian Geoscience Council should become more political by meeting politicians and emphasizing the importance of adequate funding for research and development in the earth sciences, by stressing our support for such programs as Lithoprobe and the Ocean Drilling Program, and by discussing our concerns about some of the problems created by legislation involving registration of earth scientists at the provincial level.

Topics discussed in the Minutes of the CGC meetings (copies of which may be obtained by writing to the Executive Director at the office of the Canadian Geoscience Council) include (the numbers of the meetings where they were discussed are in brackets following the items): Incorporation of the CGC (56); Registration and/or Accreditation (56-59); American Geological Institute Manpower Survey (56-58); Reorganization of EMR (56); Land based Geoscientific Drilling in Canada (56); Funding for Geoscience R. & D. in Canada (57); Future Directions of the CGC (56, also under Other Business in later meetings); Agenda for meeting with appropriate government ministers (59); President's Report (59); Treasurer's reports (57-59); Appointment of Auditors (58); Audit for 1985/1986 (59); Draft Budget for 1986/1987 (58); Budget for 1986/1987 (59); Annual Report (58, 59); Nominations for NSERC Committees (58); Meeting with EMR (59). Reports of CGC Standing Committees: Careers in Geosciences Booklet (56-59); Marine Geosciences (56-59); International Geoscientific Relations (56-59); Education — Edgeo (57, 58); Reports from Report Committees: Geoscience R & D in the Petroleum Industry (56-58); Funding for R & D in the Geosciences in Canada (58, 59); Reports of Advisory Committees: Quaternary and Engineering Geology at the GSC (56-59); Geophysics at the GSC (58, 59); Frontier Geoscience Program (59); Reports from CGC representatives on other committees, including Associate Members: Council of Chairpersons of Canadian Earth Science Departments (56, 59); Association for the Advancement of Science in Canada (58, 59); Royal Society of Canada (58, 59); Technical Advisory Committee to AECL (59); National Consortium of Scientific and Educational Societies (56, 59); Exploration '87 (59); Committee of Provincial Geologists (56, 59); Associate Committee on Geotechnical Research (59); Lithoprobe (56, 58, 59); Ocean Drilling Program (58, 59).

*B.D.E. Chatterton*

## REPORT OF THE TREASURER

**Table 2.** Approved budget, 1985-1986

<u>EXPENSES</u>	<u>APPROVED</u>
Mineral Research Committee	\$ 6 000
Quaternary Studies Committee	6 000
Marine Geoscience Committee	1 650
CNC/IUGS	3 000
International Geological Congress	3 000
Incorporation	1 000
EdGeo Workshops	7 000
Secretarial services	5 500
Postage, stationery, office supplies	7 800 <sup>1</sup>
Printing and Distribution:	
Updated flyers	2 500
<u>Careers in Geoscience</u>	25 000 <sup>2</sup>
Executive travel	3 000
Council meetings	2 400
Youth Science Foundation,	
AGID and AASC memberships	400
Miscellaneous	300
Total Expenses	74 550
 <u>INCOME</u>	
EMR: IGC Grant	\$ 3 000
CNC/IUGS	3 000
Operating Grant	11 000
Provincial grants	4 000
Membership dues	4 950
Bank interest	7 000
Publication sales	1 000
EdGeo donations	2 000
Total Income	35 950
Excess or (Shortfall)	
Income minus Expenses	(\$38 600)

**Notes:**

<sup>1</sup> Office expenses for Executive Director and Treasurer

<sup>2</sup> These funds require further authorization from the Council before spending

D.F. VanDine  
Treasurer CGC  
2 December 1985

**Table 3.** Statement of income and expenses<sup>1</sup>  
Fiscal year 1985-1986, ending 30 September 1986

<u>INCOME</u>	<u>85-86</u>	<u>84-85</u>
EMR: IGC Grant	\$ 3 000.00	\$ 3 000.00
CNC/IUGS Grant	3 000.00	3 000.00
Operating Grant	11 000.00	17 000.00
Provincial grants	7 200.00	7 000.00
Membership fees	4 815.25	1 708.13
Interest	5 335.22	7 560.21
Publication sales	723.50	1 192.50
EdGeo refunds	1 210.45	-
EMR Petroleum Research Grant	7 500.00	-
CPA Petroleum Research Grant	-	22 500.00
Ont. Gov't Contract 1805	-	3 000.00
Miscellaneous	24.99	-
<u>ACCOUNTS RECEIVABLE</u>		
Membership fees	-	\$ 1 922.07 <sup>2</sup>
<b>TOTAL INCOME</b>	<b>\$43 809.41</b>	<b>\$67 882.91</b>
 <u>EXPENSES</u>		
	<u>85-86</u>	<u>84-85</u>
Mineral Research Committee	\$ 883.31	-
Petroleum Research Committee	-	\$ 37 035.24
Quaternary Studies Committee	5 558.83	1 650.70
Geoscience Funding Study	1 203.65	-
CNC/IUGS	3 000.00	-
International Geological Congress	3 000.00	-
EdGeo Workshops	1 500.00	4 600.00
Secretarial services	3 103.79	2 258.00
Postage, stationery, office supplies	4 176.46	3 258.83
Printing of CGC flyers	2 742.30	-
Council meetings	1 551.62	1 117.80
Executive travel	4 803.42	2 296.18
Incorporation	991.44	500.00
YSF, AGID and AASC memberships	205.23	253.12
Miscellaneous	66.90	84.22
<u>ACCOUNTS PAYABLE</u>		
Petroleum Research Committee	-	\$ 7 085.35
Quaternary Studies Committee	986.05	55.60
CNC/IUGS	-	3 000.00
International Geological Congress	-	3 000.00
Postage, stationery, office supplies	-	246.43
Council meetings	412.50	210.25
YSF, AGID and AASC memberships	-	100.00
<b>TOTAL EXPENSES</b>	<b>\$34 185.50</b>	<b>\$66 751.72</b>
<u>EXCESS OF INCOME OVER EXPENDITURES</u>	<u>\$ 9 623.91</u>	<u>\$ 1 131.19</u>

Note:

<sup>1</sup> Foreign Secretary's Accounts reported separately

<sup>2</sup> Incorrectly reported as \$3 107.62 in 84-85 Statement

**Table 4. Balance sheet**  
Fiscal year 1985-1986, ending 30 September 1986

<u>ASSETS</u>	<u>85-86</u>	<u>84-85</u>
Victoria		
Chequing account	\$ 801.78	\$ 2 437.58
Savings account	2 082.28	14 364.34
Term deposits	99 263.69	84 396.41
University of Alberta		
Operating account	830.77	2 533.29
Total accounts	<u>\$102 978.52</u>	<u>\$103 731.62</u>
Accounts receivable (listed with income and expenses)		1 922.07
<b>TOTAL ASSETS</b>	<u>\$102 978.52</u>	<u>\$105 653.69</u>
 <u>LIABILITIES</u>		
Accounts Payable (listed with income and expenses)	\$ 1 398.55	\$ 13 697.63
<b>TOTAL LIABILITIES</b>	<u>\$ 1 398.55</u>	<u>\$ 13 697.63</u>
 <u>ACCUMULATED SURPLUS</u>	 \$101 579.97	 \$ 91 956.06

18 November 1986

**TO: MEMBERS OF THE CANADIAN GEOSCIENCE COUNCIL**

We have examined the financial records of the Council (Treasurer's ledger, cancelled cheques, bank statements, etc.) for the year ending 30 September 1986.

All records are in order and we believe the financial standing of the Canadian Geoscience Council to be correctly represented on the accompanying Statement, Balance and Accumulated Surplus or Deficit Sheets dated 3 November 1986.

This report is not to be considered an audit but rather an examination directed by the Council of its records by the undersigned.

H.W. Nasmith, P. Eng.  
Member CGS, GAC, CANQUA

G. McArthur  
Member GAC, CIMM

**Table 5.** Statement of accumulated surplus  
Fiscal year 1985-1986, ending 30 September 1986

Surplus at beginning of year (1 October 1985)	\$ 91 956.06
Excess of income over expenditures	<u>9 623.91</u>
Surplus at end of year (30 September 1986)	\$101 579.97

**Table 6.** Foreign Secretary's Account  
Fiscal year 1985-1986, ending 30 September 1986

CNC/IUGS account — Statement of Accumulated Surplus

Surplus at beginning of year (1 October 1985)	\$3 741.79
Income	\$6 250.96
Expenses	1 294.08
Excess of income over expenditures	<u>4 956.88</u>
Surplus at end of year (30 September 1986)	\$8 698.67

International Geological Congress Account  
Statement of Accumulated Surplus

Surplus at beginning of year (1 October 1985)	\$ ----
Income	\$6 000.00
Expenses	---
Excess of income over expenditures	<u>6 000.00</u>
Surplus at end of year (30 September 1986)	\$6 000.00

D.F. VanDine  
Treasurer, Canadian Geoscience Council  
3 November 1986

## REPORT OF THE FOREIGN SECRETARY

The Foreign Secretary acts as a link between the Canadian Geoscience Council and international non-governmental organizations with geoscientific activities that involve Canada. This liaison is achieved through the Standing Committee on International Geoscientific Relations (SCIGR) and the Canadian National Committee for the International Union of Geological Sciences (CNC/IUGS) both chaired by the Foreign Secretary. The SCIGR held its annual meeting in Ottawa, on December 5, 1986 and this was followed on the same day by the annual meeting of the CNC/IUGS. Minutes of both meetings are available from the Foreign Secretary or the CGC Executive Director. The reports which follow are based on these minutes and incorporate some subsequent developments.

### *Standing Committee on International Geoscientific Relations*

The Standing Committee is an advisory body on international geoscientific activities distinct from those of the IUGS and the International Geological Congress (IGC). SCIGR acts as a reporting forum to the CGC from Canadian organizations involved in such activities, and recommends to the CGC responses to international initiatives.

The 1986 meeting was attended by 12 representatives from most of the relevant earth science associations. Others sent written submissions.

#### **1. Association of Exploration Geochemists (R.G. Garrett)**

With Cordilleran Section of the Geological Association of Canada, AEG sponsored GEOEXPO '86 in Vancouver, an international symposium focused on exploration geochemical and geological frameworks. AEG also supported symposia on exploration geochemistry in Greece and the People's Republic of China. Another international meeting will be held in Orleans, France, in April 1987, co-sponsored with the Bureau de recherches géologiques et minières. Special Volume 12 (*Writing Geochemical Reports*) of AEG was distributed during 1986 and presents guidelines for report writing, particularly for surficial geochemical surveys. AEG endorsed a proposal to the International Geological Correlation Program for a new project to construct a global geochemical map.

#### **2. Association of Geoscientists for International Development (A.R. Berger)**

The association held regional meetings in various parts of the world and is considering sponsoring workshops focusing on small-scale mining operations. One of the continuing problems in many countries is sustaining earth science libraries. Canada is involved in a program of collecting donations of journals and books and forwarding them to such libraries (Dr. John Moore, Carleton University is one of the catalysts). The Geological Association of Canada regularly supplies 100 copies of *Geoscience Canada* for such distribution. In 1986, AGID continued to receive substantial funding from the Canadian International Development Agency.

#### **3. Decade of North American Geology (J.O. Wheeler)**

One volume (Quaternary Geology of Canada and Greenland) will be going to press in late 1987. Completion of the other national topic volumes (Mineral Deposits of Canada and Geology of Canada) is not expected until all other volumes are at press. All six regional volumes (Continental Margin of Eastern Canada, Appalachian and Caledonide Orogen, Precambrian Shield, Innuitian Orogen and Arctic Platform, Sedimentary Cover of the Craton, and Cordilleran Orogen) are expected to be submitted to the editors between mid-1987 and 1988.

#### **4. International Association of Engineering Geologists (J. Locat)**

The Engineering Geology Division of the Canadian Geotechnical Society is the national body for IAEG. At the 1986 General Assembly, Owen White (Ontario Geological Survey) became President of the Association for 1986-1990. The programs of IAEG's fourteen commissions are being evaluated, some are extremely active, others are not. For UNESCO, the Mapping Commission produced a guide for the preparation of engineering geology maps and this commission is developing a specialization in applications of remote sensing to engineering geology. In 1986, a symposium in Barry, Italy, focused on seismicity and engineering geology. In 1987, the Commission on Offshore Appli-

cations will be sponsoring a symposium in the USSR; two Canadians, P. Kurfurst and J. Locat will participate in this commission. IAEG also is planning a symposium in the People's Republic of China concerning development in mountainous areas and related hazards. The Canadian division of IAEG is planning a 1987 symposium in Montreal dealing with technological transfer. The provision of funds for delegates from less developed countries to participate in this meeting is an area of some concern.

#### **5. International Association of the Genesis of Ore Deposits (R.W. Boyle)**

About four hundred people participated in the seventh quadrennial symposium held in Sweden in August 1986, sponsored by the Scandinavian countries. Some two hundred presentations covered a wide range of subjects, including gold occurrences in Precambrian Shield areas, fluorite and barite deposits, manganese deposits, mineralization associated with granitoids, tin and tungsten deposits, tectonics of ore deposits, skarn deposits, massive sulphide deposits, ore-forming fluids in inclusions and paragenesis. The next such symposium will be held in Canada (probably at Carleton University) in August 1990. The proceedings of the IAGOD co-sponsored symposium *Geology and conditions of formation of copper deposits* went to press in 1986.

#### **6. International Association of Hydrologists**

A meeting in Kalowvary in September focused on groundwater contamination and a new commission of IAH was established on contamination of groundwater by hazardous wastes.

#### **7. International Council of Scientific Unions and National Research Council Committee on International Scientific and Technological Affiliations (R.A. Price)**

In September, the General Assembly of ICSU decided to sponsor a major long-term project, "International Geosphere — Biosphere Program: A Study of Global Change". IGBP co-sponsors include IUGS, UNESCO's Man and the Biosphere Program, and the World Meteorological Organization's World Climate Research Program. The General Assembly also established a Scientific Committee on Biotechnology to coordinate ICSU's diverse activities in the area and to communicate with industrial groups working in biotechnology. A report on toxic waste disposal (Chairperson, J.M. Harrison, Ottawa) drew attention to the study of old waste disposal sites as a means of assessing techniques for the isolation of toxic wastes from the environment. An open symposium on the environmental consequences of nuclear war concluded that the indirect effects of a large-scale nuclear war on world population, particularly the climate effects caused by smoke, could be potentially more consequential globally than the direct effects.

The Study of Global Change has the objective of assessing future conditions on the Earth for the next one hundred years, with an emphasis on processes that change on time scales of decades to centuries. It will be a program of basic research with almost immediate practical applications in the management of resources at national and international levels and as a means of improving the reliability of warnings of global change of significance to our environment and to humankind. The program will be tightly focused, with emphasis on interactive processes that are not addressed by other existing programs. Topics suggested for early emphasis in IGBP include:

Studies of biogeochemical cycles

Studies of the ocean euphotic zone

Studies of soil dynamics and soil chemistry

Studies of variable solar inputs to the Earth.

Emphasis is also placed on the need for development of an adequate global data and information system, which must be an integral part of the program. ICSU is creating a Scientific Committee for the IGBP with responsibility for initiating a preparatory phase lasting about four years and for the implementation of an operational phase beginning in the early 1990's. The operational phase will last at least ten years. A primary responsibility of the Scientific Committee will be to ensure that the objectives of the program are well designed and that it complements other current and planned international scientific programs. The Committee will also be responsible for liaison with international and national organizations responsible for related programs.



During 1986, ICSU received reports from five working groups concerning this program: on terrestrial ecosystems and atmospheric interactions; marine ecosystems and atmospheric interactions; the upper atmosphere and nearspace environments; remote sensing; and geological processes past and present. R.A. Price (GSC) chaired the last group. In December, the Royal Society of Canada organized a one-day meeting to coordinate Canadian activities concerning global change. Working groups were established for the main land mass, for arctic regions, for off-shore and near-shore environments, for remote sensing, for the upper atmosphere, for earth sciences and for data management.

CISTA continues to stress to the Department of External Affairs the importance of entry visas being available to bonafide scientists from foreign countries wishing to visit Canada. CISTA also recognizes the continuing problem of scientists having difficulties in receiving financial support for such travel that, in many cases, is beneficial to Canada.

#### **8. International Federation of Palynological Societies (D.C. McGregor)**

Planning is well underway for the 7th (1988) International Palynological Congress to be held in Brisbane and with field excursions to various parts of Australia and New Zealand. The symposia will cover the whole spectrum of applications of palynology, including such subjects as palynomorphology, allergy studies, evolution, paleoecology, paleogeography, environmental quality, climatic change, floral history, biostratigraphy, hydrocarbon source-rock analysis, archeology, and forensic studies. IFPS is now sufficiently mature to require the appointment of Dr. Alfred Traverse (USA) as the official archivist-historian for the federation.

#### **9. International Geographical Union (P.G. Johnson)**

Eighteen Canadian scientists are members of the various commissions, working groups and other committees of the IGU, three of these chair such groups and one (L.A. Kosinski) is IGU's Secretary General. IGU activities are reported regularly in the professional journal of the Canadian Association of Geographers.

The many international activities by Canadian scientists include resource surveys of the Sokoto Basin, Nigeria (University of Waterloo and University of Lagos); Quaternary studies of the Mount Kenya region (York University, University of Lethbridge and University of Marburg, F.R.G.); and studies of glaciers, snow regimen, water and hydroelectric resources of the Upper Indus Basin, Pakistan (University of Waterloo, Wilfred Laurier University, Environment Canada and Manchester University, U.K.). In Cameroon, archeologists and geologists (University of Calgary, University of Lethbridge, O.R.S.T.O.-M. Paris, and I.S.H. Cameroon) have established a chronology for paleohydrologic events concerning the Lake Chad Basin. Episodes of abbreviation and entrenchment of rivers can be linked to changes of lake levels. A delegation from CAG visited the People's Republic of China to discuss remote sensing and geographic information systems. A new project is under consideration for research on the loess plateau of central China and the associated Quaternary sedimentary record (University of Lethbridge, York University).

#### **10. International Geological Correlation Program (D.G. Benson)**

Requests for funding to assist Canadian participation substantially exceed funds available. The amount \$13 300 was allocated, giving preference to attendance of Canadian participants to international meetings and for support of foreign (preferably third world) attendance at Canadian meetings. Several projects included preparations for major meetings in 1987: a field symposium in Atlantic Canada and Maine on late-Quaternary sea-level correlation plus contributions to the INQUA meeting by Project 200 under D.B. Scott; a joint INQUA-Project 158-B meeting on Late Quaternary Paleohydrology in Canada; the Newfoundland meeting (W.H. Fritz) of the Precambrian-Cambrian Boundary Working Group to examine the proposed stratotype section on Burin Peninsula; and the symposium on the Trans-Hudson Orogen (J. Lewry) to be held at the GAC-MAC annual meeting.

Dr. N.W. Rutter (University of Alberta) was appointed to a five-year term on CNC/IGCP and Dr. A.J. Naldrett (University of Toronto) was appointed to the International Board of IGCP. Projects of special interest to Canadian geoscientists include:

- 24 Quaternary glaciations in the northern hemisphere
- 29 Precambrian-Cambrian Boundary
- 53 Ecostratigraphy
- 91 Metallogeny of the Precambrian
- 148 Evaluation and development of quantitative correlation techniques
- 156 Phosphorites
- 158 Paleohydrology of the Temperate Zone during the last 15 000 years
- 160 Precambrian exogenic processes
- 161 Sulphide deposits in mafic and ultramafic rocks
- 166 Correlation of coal-bearing formations
- 171 Circum-Pacific Jurassic
- 179 Stratigraphic methods as applied to the Proterozoic record
- 187 Siliceous deposits
- 195 Ophiolites and lithosphere of marginal seas
- 197 Metallogeny of ophiolites
- 199 Rare events in geology
- 200 Sea level correlation and applications
- 203 Permo-Triassic events of eastern Tethys and their intercontinental correlation
- 215 Proterozoic fold belts
- 216 Global Biological events in earth history
- 217 Proterozoic geochemistry
- 219 Comparative lacustrine sedimentology in space and time
- 233 Terranes in the Circum-Atlantic Paleozoic orogens

Eight new projects were approved by IGCP in 1986 and Canadian scientists are encouraged to participate:

- 226 Correlation of manganese sedimentation with paleoenvironments
- 237 Gondwana floras
- 242 Cretaceous of Latin America
- 245 Non-marine Cretaceous correlations
- 246 Pacific Neogene events in time and space
- 247 Precambrian ore deposits and tectonics
- 249 Andean magmatism
- 250 Regional crustal stability and geological hazards

Proposals under consideration include:

- A. Ore mineralization associated with black shales: I.R. Jonasson (GSC) is involved
- B. Global correlation and tectonic interpretation of Precambrian dyke swarms and comparison with Phanerozoic swarms: H.C. Hall (University of Toronto)
- C. International geochemical mapping: criteria and standards for international surficial geochemical mapping: A.G. Darnley (GSC)

#### **11. International Mineralogical Association (D.G.W. Smith)**

The Mineralogical Association of Canada is the national body for IMA, which has working groups concerned with cosmic mineralogy, inclusions in minerals, organic minerals, thermodynamics and kinetics of minerals and ten formal commissions:

- Applied Mineralogy (Chairmen, A.J. Naldrett, University of Toronto)
- Classification of Minerals
- Crystal Growth of Minerals
- Gem Materials
- Electron Microscopy Applied to Mineralogy
- History and Teaching
- Museums
- New Minerals and Mineral Names (Chairmen, J.A. Mandarino, R.O.M.)
- Ore Mineralogy
- Physics of Minerals

The year 1986 was a year of intense activity for IMA culminating in the highly successful and well organized 14th General Meeting, held at Stanford University, California in July. Canadian participation was, as usual, prominent. The Commission on Applied Mineralogy immediately established four subdivisions at the inaugural business meetings at Stanford. IMA is expected to become much more involved in applied mineralogy in future years and this diversification should lend strength and authority to the association as well as attracting a substantial number of new participants to future General Meetings. The 15th General Meeting of IMA is scheduled to take place in Beijing, P.R.C. in 1990.

The Commission on New Minerals and New Mineral Names, was very active in 1986. Out of more than 100 proposals, some 65 new names have been formally considered and 58 of these were accepted. A number of other previously published names have been revised or discredited.

## **12. International Palaeontological Association (T.E. Bolton and B.D.E. Chatterton)**

The International Palaeontological Association plans to publish the 5th edition of the Directory of Palaeontologists of the World in 1989. (compiler: Dr. Rex Doescher, Palaeobiology, Natural History, U.S.N.M., Washington 20560, U.S.A.). The association is involved strongly with IGCP 216, Global Biological Events in Earth History. T.E. Bolton (GSC) continues as chairman of the Association of North American Paleontological Societies that sponsored NAPC IV, Boulder, U.S.A., in August 1986 with about 350 delegates. NAPC V probably will be held in Chicago, U.S.A. in 1993 in conjunction with the celebrations of the centennial of the Field Museum of Natural History.

## **13. International Permafrost Association (N. Kalmanovitch)**

IPA has grown from the four founding countries of 1983 to a total of fifteen. The secretariat is based at the University of British Columbia (J.R. Mackay). IPA will hold a council meeting in Ottawa in August concurrently with the 12th Congress of INQUA. The 5th International Conference on Permafrost will take place in Trondheim, Norway, August 2-5, 1988. Conference themes are:

Permafrost Science	Site investigation and terrain analysis
Thermal aspects	Petroleum engineering
Geocryology past and present	Geothermal considerations
Frozen ground physics and chemistry	Municipal engineering
Regional permafrost studies	Geothermal properties
Hydrology	Mining engineering
Ecology of natural and disturbed areas	Geotechnical engineering
Permafrost engineering	

During 1987, conferences related to permafrost are scheduled as follows: Sixth International Symposium on Offshore Mechanics and Arctic Engineering, Houston, U.S.A. (February); International Symposium on Cold Regions Heat Transfer, Edmonton, (June); Comparative Studies of Present-day and Fossil Periglacial Phenomena, Ottawa, (August); XII INQUA Congress Joint Session with IGU Periglacial Commission, Ottawa, (August); Antarctic Glaciology, Bremerhaven, F.R.G. (September).

## **14. International Rock Mechanics Society (R. Chapuis)**

The society, represented in Canada by the Canadian Geotechnical Society and CIM, is sponsoring the Sixth International Congress on Rock Mechanics, in Montreal, August 30 — September 3, 1987. Technical sessions and workshops feature the following topics:

Monitoring and interpretation techniques for mining induced seismicity	Constitutive laws for salt rock
Fluid flow and waste isolation	Numerical methods as a practical tool
Rock foundations and slopes	Failure mechanisms around underground workings
Rock blasting and excavation	Rock cuttability and drillability
Excavations in overstressed rock	Rock testing and testing standards
Swelling rock	

#### **15. International Society of Soil Mechanics and Foundation Engineering (M.B. Bozozuk)**

The Canadian Geotechnical Society is sponsoring two Technical Committees for ISSMFE. C.B. Crawford (Ottawa) is chairman of the Committee on Research Cooperation and P. LaRochelle (Quebec City) is chairman of the Committee on Landslides. In addition, members of CGS represent Canada on the following fourteen Technical Committees:

Balu Iyer, Mississauga Expansive Soils	L.E. Goodrich, Gatineau Frost
R.G. Campanella, Vancouver Penetration Testing	O. Hungr, Vancouver Indurated Soils and Weak Rocks
R.P. Chapuis, Montreal Environmental Control and Waste Disposal	J-M. Konrad, Waterloo Mechanics of Granular Soils
D.M. Cruden, Edmonton Landslides	R.J. Mitchell, Kingston Centrifuge Testing
B.H. Fellenius, Ottawa Pile Driving	G.P. Raymond, Kingston Geotextiles
B.H. Fellenius, Ottawa Penetrability and Driveability of Piles	D. Shields, Winnipeg Offshore Geotechnical Engineering
L. Finn, Vancouver Earthquake Geotechnical Engineering	J.C. Joshi, Calgary Land Subsidence

ISSMFE sponsored a conference on soil mechanics and foundation engineering (Nuremberg, F.R.G.) in 1986 and will sponsor or co-sponsor six conferences in 1987 on:

Applications of Statistics and Probability in Soil and Structural Engineering, Vancouver, May 25-29.

Soil Mechanics and Foundation Engineering, Kyoto, Japan, July 20-24.

Geotechnical Engineering in Developing Countries, Cartagena, Columbia, August 16-21.

Groundwater Effects in Geotechnical Engineering, Dublin, Ireland, August 31-September 4.

Rock Mechanics, Montreal, Canada, August 30-September 3.

Conference to Commemorate 20th Anniversary of the South East Asian Geotechnical Society, Bangkok, Thailand, December 7-11.

#### **16. International Tunnelling Association (J.A. Ramsay)**

At the 1986 ITA Congress in Italy, TAC's proposal was accepted for Canada to host the 1989 ITA General Assembly and the International Tunnelling Congress. These will be held in Toronto in September 1989, co-sponsored by TAC and the National Research Council of Canada.

#### **17. International Union of Geodesy and Geophysics (M.J. Berry)**

Preparations continued for the 19th general assembly of IUGG to be held in Vancouver in August 1987. This will be a large international meeting with numerous symposia including a two-day Sputnik Commemorative Symposium dealing with Comparative Planetology.

#### **18. International Union of Geological Sciences (W.W. Hutchinson)**

The Executive Committee of IUGS met in February and President W.W. Hutchinson (EMR, Ottawa) commented on new initiatives. These include establishing: a program on resource assessment of sedimentary basins, a Circum-Atlantic Project and a standing committee on remote sensing. Funding constraints are expected to limit some of the activities of IUGS and additional sources of financial support are being explored, including individual membership for scientists and institutions.

*18a. IUGS Commission for Comparative Planetology (R.A.F. Grieve)*

Dr. Grieve (GSC) is secretary of this IUGS commission that has completed its second year of operation and has the overall objectives of stimulating studies comparing planets and the interaction of planetary geoscience with geoscience of the Earth. In March, CCP co-sponsored the 17th Lunar and Interplanetary Science Conference at Houston, U.S.A. that featured international co-operative enterprises investigating Halley's Comet and exploring Mars and Venus (Episodes, v. 9, p. 116-117, June 1986). Venus, as the sister planet to Earth, is of particular relevance in comparative planetology. Evidence indicates compressional and extensional tectonics and possibly large scale strike-slip deformation. There seems to be no evidence for earth-like lithospheric recycling but the relatively young surface of Venus (about 1000 million years old) may indicate some major resurfacing process. Other international meetings were held in Toulouse, France; Kiel, F.R.G.; and London, U.K. Meetings for 1987 are scheduled for Paris, Houston and Vancouver (in association with IUGG). During 1986, questionnaires were circulated to Canadian universities to survey the status of planetary geology in Earth Science programs. Responses indicated high levels of interest in planetary geology among students and about a third of the universities responding provide specific courses in the area. CCP is developing a set of slides and accompanying text as a teaching aid for university instruction. A global map depicting the locations of impact craters on Earth and pertinent scientific details will be published early in 1987. Also in 1987, the U.S. National Academy of Sciences will publish *Mission to the Planet Earth*.

*18b. IUGS Commission for Experimental Petrology at High Pressures and Temperatures*

During 1986, the name was changed to *Commission on Igneous and Metamorphic Petrogenesis* (CIMP, Chairman A.J. Naldrett, University of Toronto), a symposium on granites, pegmatites and skarns was held in Stanford, U.S.A. and CIMP expects to sponsor another symposium on structures of silicate melts at high pressures and temperatures within the IUGG Vancouver meeting in August 1987.

*18c. IUGS Commission for the Geological Map of the World (J.O. Wheeler)*

Some of the commission's Circum-Pacific maps are now published and proposals have been made to compile Circum-Atlantic maps in a similar style. Canada's contributions to such maps would be based on compilations recently made for the Decade of North American Geology project. The commission also plans to commence work on a Plate Tectonic Map of the World and a Geological World wall-map.

*18d. IUGS Commission on Storage, Automatic Processing and Retrieval of Geological Data (R.G. Garrett)*

The main activity of this commission centred on four working groups with regional symposia held in Europe, the U.S.S.R. and Peru.

**19. International Union for Quaternary Research**

Some 5000 participants are expected at the 1987 Congress in Ottawa (July 31 to August 9) with N.W. Rutter (University of Alberta) as chairman and A.V. Morgan (University of Waterloo) as secretary.

**20. Inter-Union Commission on the Lithosphere, International Lithosphere Program, and Canadian National Committee for the Dynamics and Evolution of the Lithosphere (M.J. Berry)**

In 1986 ICL sponsored a conference in Singapore on resources and energy resources of the Circum-Pacific region. In 1987, symposia will be organized within the IUGG general assembly in Vancouver. CANDEL will sponsor sessions at the GAC meeting (Saskatoon, May 1987) on continental drilling, Lithoprobe and ILP. ILP's major new initiative is the program of description and comparison of some 200 global transects to summarize geological and geophysical data along selected corridors that cross structures crucial to the understanding of the nature of the lithosphere and its history. J.W.H. Monger (GSC) is the Canadian coordinator. Other new initiatives are a world stress map and coordination of global digital seismograph networks.

## **21. United Nations Educational, Scientific and Cultural Organization (C.H. Smith)**

1986 marked the 40th anniversary of UNESCO and the decision of Director General Amadov-Mahtar M'Bow not to seek a third term as head of the organization. His successor is expected to be appointed in late 1987. Ian Clark will be ending his term as Canada's ambassador to UNESCO in 1987 and the appointment of Jean Drapeau as his successor was announced.

During 1986 the Canadian Commission announced its UNESCO/CIDA Assistance Program, a two-year program designed to provide partial support to Canadian non-government organizations, institutions and individuals, for activities within UNESCO program areas that relate to developing countries. November 14 was the deadline for applications for the first phase of the program and a large number of applications were received, more than a hundred of these were in the natural sciences.

In October 1987, a General Assembly of UNESCO will define the program and budget for 1988-1989 and will commence the preparation of UNESCO's Third Medium Term Plan for 1990-1996. The Assembly will be an opportunity for the re-direction of priorities and for the introduction of new programs, such as the International Geosphere-Biosphere Program. The Canadian Commission will be preparing items for consideration.

At present, the major UNESCO programs of interest to the Canadian Geoscience Council are the International Geological Correlation Program (IGCP), the International Hydrological Program (IHP), the inter-governmental Oceanographic Commission (IOC) and the Man and Biosphere Program (MAB).

UNESCO's Kalina Prize is for the popularization of science. In 1986 it was awarded to David Suzuki of the University of British Columbia.

### ***Canadian National Committee for the International Union of Geological Sciences***

The IUGS Secretariat provided a list of one hundred Canadian holding memberships or executive positions in the various commissions, subcommissions, working groups and other bodies of IUGS; many holding several such posts. Canadians chair thirteen IUGS committees, including Dr. Hutchinson as President of IUGS itself.

The terms of reference of CNC/IUGS specify appointment of Canadian delegations to councils of IUGS and IGC (International Geological Congress) and also communication of the activities of IUGS and IGC to CGC and to the geological community. The committee also has the responsibility to provide input to IUGS and to its Executive Committee concerning existing IUGS programs and perceived needs for expansion and reduction. CNC/IUGS made two such suggestions during 1986 concerning auditing of IUGS accounts and the scheduling of regular council meetings of IUGS separate from and between International Geological Congresses.

*B.S. Norford*

## REPORTS OF THE MEMBER SOCIETIES

### *1. Association of Exploration Geochemists (AEG)*

At the beginning of 1986, the Association of Exploration Geochemists recorded a 19.8 per cent decline in membership reflecting problems associated with international currency exchange and economic uncertainties within the mining industry. However, total membership reported in January 1986 of 1140 is still the second highest in the Association's history. In January 1986 the membership comprised 516 voting members, 484 affiliate members, 109 student members, 20 corporate members, 4 honorary members and 7 candidates under review by the Applications Committee. Also the number of countries represented by the Association had increased from 52 to 57.

In April 1986 the Association of Exploration Geochemists and the Cordilleran Section of the Geological Association of Canada co-sponsored a Symposium entitled GEOEXPO 86 in Vancouver, Canada. The meeting was attended by 350 delegates from Canada, the United States of America, Australia, Japan, China and the United Kingdom. Geological papers formed a network cementing exploration oriented presentations. One session was devoted to "black smokers" and how these recently discovered marine features are changing concepts of ore genesis. Other technical sessions and workshops described a variety of topics ranging from heavy minerals, exploration in desert environments, primary geochemistry, lead isotopes and organic geochemistry. The Symposium Committee plans to publish a proceedings volume in 1987. Other geochemical exploration meetings co-sponsored or supported by the Association during 1986 were the South European Symposium on Exploration Geochemistry held in November in Athens, Greece and the Third Chinese Exploration Geochemistry Symposia held in Guilin, China. The Association also organized the second in its Distinguished Lecturer series comprising a number of presentations delivered by the 1986-87 Distinguished Lecturer, Dr. Graham Closs at several universities in the southwestern United States. The second part of this lecture tour will involve universities in northwestern United States and western Canada and will be held in early 1987.

In 1986 the Association of Exploration Geochemists produced and distributed to all members Special Volume 12 entitled *Writing Geochemical Reports* written by Dr. S.J. Hoffman. This publication contains guidelines for preparing reports on surficial geochemical surveys. The Association is in the final stages of preparing a handbook for the AEG-SEG Short Course on Exploration Geochemistry to be given in Denver, Colorado early in 1987. Editing of papers presented at the *11th International Geochemical Exploration Symposium* was completed during the year and their publication in a single volume of the *Journal of Geochemical Exploration* is expected early in 1987.

R.E. Lett

### *2. Canadian Association of Geographers (CAG)*

The annual meeting of the Canadian Association of Geographers was held in Calgary June 18-24, 1986. Paper sessions were held on the 20th, 21st and 22nd and included 12 special sessions as well as theme sessions on various aspects of Ecology and Soils, Glacial Geomorphology, Cartography, Urban Systems, Historical Geography, Economic Geography, Tourism, Permafrost and the Arctic, Climatology, Resource Management, Demographic Change, Hydrology, Remote Sensing, Medical Geography, Karst, Marine Studies, Environmental Impact and the Status of Women in Geography. The sessions and the field excursions, representing most areas of the discipline, were extremely successful under the direction of the staff of the Department of Geography at the University of Calgary and its Chairman, Dr. L. Rosenvall.

Dr. B.M. Barr delivered the Past President's address at Calgary on "Canadian Geography in a Multi-Lingual World: The Implosion of Relevance". The Association's award for service to the profession was made to Professor J. Brian Bird of McGill University for his long service to McGill, to the CAG and to research, particularly in the northern regions of Canada. The award for scholarly distinction went to Professor T. Oke of the University of British Columbia for his work in climatology and in particular in urban climatology.

Regional meetings of the Association were held in Riding Mountain National Park (Prairie Division) organized by the University of Manitoba and at Carleton University (Ontario Division). The regional award presented at the Ontario regional meeting for service to Geography in Ontario was to Dr. R.W. Packer of the University of Western Ontario.

The association journal, *The Canadian Geographer*, continued to evolve in 1986 after the introduction of the new format in 1985. Notable additions are a Canadian Landforms series under the editorship of Dr. I.A. Brookes of York University and a Focus feature with guest editors. In 1986, Dr. H.M. French edited a focus on Permafrost Geomorphology, Dr. R.H. King on Soils and Archaeology, Dr. V. Konrad on Nationalism in the Landscape of Canada and the United States and Dr. R. Fincher on Historical Materialism in Canadian Human Geography.

1986 has been a year of preparation for the I.U.G.G. meetings in Vancouver and the INQUA meetings in Ottawa in 1987 for many of the Physical Geographers and for the Annual Meeting of the Association at McMaster University with the Learned Societies Conferences.

*P.G. Johnson*

### ***3. Canadian Exploration Geophysical Society (KEGS)***

No annual report was submitted.

### ***4. Canadian Geophysical Union (CGU)***

The CGU, with a current membership of about 300, held its annual meeting in 1986 in Ottawa in conjunction with the Geological Association of Canada and the Mineralogical Association of Canada. The Union contributed the following symposia, the range of which is indicative of the vitality of geophysics in Canada: Thirty Years of Paleomagnetism in Canada (Past, Present and Future); East-Coast Lithoprobe Studies; Geothermics and Hydrodynamics of Sedimentary Basins; Space Techniques for Positioning; Geotectonics and Hydrothermal Activity of the Juan de Fuca Ridge; and Geology and Geophysics of Permafrost Terrains.

At its annual luncheon, the Union presented the J. Tuzo Wilson Medal to Michael G. Rochester, Memorial University, in recognition of his contributions to the physical and mathematical analysis of global earth dynamics. In his acceptance, Dr. Rochester touched on the problems created in the university research community by NSERC's policy in recent years of directing its funding towards the "stars" in the community at the expense of those who are merely competent.

Prior to the meeting, the Union presented a short course "Interpretation of Gravity and Magnetic Anomalies for Non-Specialists". The course was well received by the 30 attendees. The same course was repeated later in the year at the Geological Survey of Canada as part of that agency's training program. The course notes are available from the Secretary-Treasurer of the CGU.

The Union has continued discussions internally and with its parent societies (the Geological Association of Canada and the Canadian Association of Physicists) on new organizational arrangements which, it is hoped, will allow the Union to grow in independence while retaining traditional ties.

*D.J. Dunlop*

### ***5. Canadian Geotechnical Society (CGS)***

The Canadian Geotechnical Society has had both a successful and busy year. The total membership numbered 1252, representing geotechnical engineers and engineering geologists across Canada. The Society currently has two divisions, the Rock Mechanics Division with 187 members and the Engineering Geology Division with 290 members.

During the year the Society held 90 technical meetings, in a variety of centres across the country including the Annual General Meeting in Ottawa. In addition, about 20 workshops, seminars, special courses and field trips were held.

Dr. B. Fellenius of Ottawa University was this year's Cross Canada Lecturer. He spoke to members in nine cities about the New Edition of the *Canadian Foundation Engineering Manual*.

Society members are active in the international field, having representation on 14 technical committees of the International Society of Soil Mechanics and Foundation Engineering.

The Society sponsored a task force on drilling and sampling, headed by Mr. Rick Pybus of Sir Sanford Fleming College.



The first printing of the new Edition of the *Canadian Foundation Engineering Manual* is almost sold out and a second printing is planned for 1987. The manual is being translated into French. The NRC continues to publish the *Canadian Geotechnical Journal*, and in the future it will be designated as the official technical publication of the CGS.

The CGS is now a self incorporated society, and the Secretariat with headquarters in Toronto is staffed with a full-time secretary.

*J.F. Gartner*

## **6. Canadian Institute of Mining and Metallurgy (CIM)**

The CIM is represented on CGC by the Geology Division. Of the total membership of approximately 11 000 in CIM, approximately 2750 are members of Geology Division. Division membership has decreased slightly in the last twelve-month period.

The 88th Annual General Meeting was held in Montreal, in May, in conjunction with a workshop entitled "Ore Reserve Estimation, Methods, Models, and Reality". The theme of the Annual General Meeting was "Productivity and Innovation — The Keys to a Viable Mineral Industry".

The Institute published its Special Volumes 32 (*Geology of Uranium Deposits*), and 33 (*Uranium Deposits of Canada*).

The Barlow Medal for the best paper published in the *CIM Bulletin* in 1985 was awarded at the 1986 Annual General Meeting to Professor Derek Wilton of Memorial University of Newfoundland for his paper "REE and Background Au/Ag Evidence Concerning the Origin of Hydrothermal Fluids in the Cape Ray Electrum Deposits, Southwestern Newfoundland".

The CIM continued to publish the *CIM Bulletin*, monthly; *The Journal of Canadian Petroleum Technology*, bi-monthly; *The Canadian Metallurgical Quarterly*, quarterly; *The CIM Directory*, annually; *CIM Reporter*, four times.

*T. Birkett*

## **7. Canadian Quaternary Association (CANQUA)**

CANQUA strives to maintain communications amongst a broad multi-disciplinary group of over 300 scientists who share a common interest in the Quaternary. Geology and geography are the core disciplines with biology, archaeology, engineering, mining, pedology, climatology and meteorology being well represented. CANQUA is prominent in organizing symposia and field excursions to examine major Quaternary problems in Canada. The Association holds biennial meetings independently or in association with other major scientific meetings, as appropriate. The Canadian Quaternary Association is affiliated with the Geological Association of Canada.

During 1986, the Association suffered from the sudden loss of its President, the late Conrad Gravenor. At the last executive meeting in May 1986, Jacques Thibault took over as Interim President in addition to his duties as the Secretary-Treasurer. Half of the CANQUA Council will be renewed in 1987.

A major activity during 1986 involved preparation for the XIIth International Congress and General Assembly of the International Union for Quaternary Research (INQUA) to be held in Ottawa, July 31-August 9, 1987. CANQUA is a co-sponsor of this meeting, the first ever held in Canada. Some 200 delegates from 72 countries are expected. During INQUA, the CANQUA Medal Committee chaired by Past President, William Mahaney will award the first "Johnston Medal" to a distinguished Quaternarist. The Medal, cast in pewter is named after William Albert Johnston (1894-1949) an outstanding Quaternary scientist.

Two newsletters were distributed during 1986 and the membership continues to actively support its official journal *Géographie physique et Quaternaire*.

*E.V. Sado*

## Correction

Several errors in the 1984 CANQUA annual report have been brought to the attention of the present editor. The 1984 President of CANQUA was W.C. Mahaney; J.J. Thibault was the Secretary-Treasurer. CANQUA membership in 1984 was approximately 200, not the reported 20 persons. J.J. Thibault did not contribute the 1984 annual report to CGC.

## 8. Canadian Society of Exploration Geophysicists (CSEG)

The livelihood of the most of CSEG members depends on the health of the oil exploration industry. The drastic fall in oil prices in early 1986 caused an equally drastic reduction in exploration and forced many early retirements and staff layoffs. There was some improvement in oil prices in late 1986 and this, combined with removal of the Federal PGRT tax, reduction in provincial royalties and the help of the Alberta Government Assistance Programs, produced some increase in exploration activity.

The society had an active year despite these problems. The convention in May was an outstanding success — a full display floor; well attended and well organized technical sessions; and an attendance almost as high as the 1985 record.

Ten luncheon technical sessions were held during 1986. Attendance ranged from 500 to 900 at these meetings. The best paper was awarded to Rob Stewart for "Seismic Tomography".

The CSEG through its Government Affairs Committee, measured industry unemployment and wrote to governments expressing our concerns. The society also offered advice to the Geophysical Assistance Program (GAP) of the Alberta Government in terms of technical standards to produce useful results.

The CSEG held its annual golf and tennis tournaments and curling bonspiel in 1986. The Annual dinner, with Dr. Joe MacInnis speaking on the discovery of *HMS Breadalbane*, and the Spring Dinner Dance, were both well attended.

Twenty-six scholarships were awarded to geophysics students. Funding for these scholarships is primarily from industry. The CSEG coordinates the funding, selects the students and contributes some of its own funds.

The CSEG and CSPG jointly started a Geophysical Reservoir Atlas project in 1986. Publication is due in 1988 and the committee has already received many seismic lines from industry to be used as examples.

In 1987, the society will hold a convention from May 12 to May 14 and will have ten luncheon technical meetings. The membership has dropped 10 per cent to 2100 and will likely drop even more in the difficult year ahead. However, the CSEG is financially sound and is able to continue all of its activities.

*J.D. Boyd*

## 9. Canadian Society of Petroleum Geologists (CSPG)

The CSPG, during 1986 experienced a decrease in membership, from 4077 to 4051. This decrease can be attributed to the disastrous downturn in the petroleum industry and the related massive layoffs of personnel. The society is also experiencing some financial problems, and would have had a deficit year had 2 publications been paid for during the year, as planned. Deferral of these publications will contribute to a deficit budget for 1987. The society is nonetheless very much alive and well. It is a dynamic society with an infrastructure of about 95 active committees dealing with various conferences, publications, scientific programs, awards, business activities, technical divisions, public service, and social events. In addition there are about 10 liaison functions related to other organizations, including the Canadian Geoscience Council. This impressive array of activities involves more than 475 volunteer functions, not including the volunteers that serve as field trip guides, session chairmen, speakers, and various support activities on larger committees.

During 1986 changes to the Executive Committee were approved by the membership. The two positions of Director have been changed to those of Director/Assistant-Treasurer and Director/Assistant-Business-Manager. These will share the work load of the Treasurer and Business Manager and normally will be sole nominees for those positions in the following year thus assuring greater continuity from one executive to the next.

The *Bulletin of Canadian Petroleum Geology* is published by the society quarterly. It has become increasingly popular with authors and currently has papers in place for all issues up to December 1987. A monthly newsletter, *The Reservoir* is also published. Two special publications were produced, *Palaeontographica Canadiana* No. 2, produced jointly with the GAC, and *Lexicons of Canadian Stratigraphy — Volume 6, Atlantic Canada*. Two other special volumes, Memoir 11, *Shelf Sands and Sandstones*, and *The Geology of the Calgary Area* will be released early in 1987.

The annual convention entitled "Reserves for the 21st Century" was held in Calgary in June 1986. In spite of the current recession about 1300 registrants benefitted from the excellent program. The convention was a technical and financial success.

One of the most successful scientific programs is the Technical Luncheon series. Scientific talks are presented about twice a month (excepting July and August). These are very well attended with an average attendance of 878 in 1986.

On February 13, 1987 at an Awards Dinner and Dance the following awards were made: Honorary Memberships to Mike Hriskevich and Arne Nielson; Best M.Sc. Thesis to Frances Haidl; Best Ph.D. Thesis to Nancy Chow; The Link Award to Frank Stoakes and Steven Creaney; The President's Award to Herbert Sullivan; The Medal of Merit to Paul Jackson; and the R.J.W. Douglas Medal to Hans Trettin.

D.G. Cook

#### 10. Canadian Well Logging Society (CWLS)

The Canadian Well Logging Society enjoyed a successful year despite the violent changes experienced by our industry. The optimistic beginnings of 1986 were followed by the precipitous fall in oil prices and industrial activity, felt especially in North America. At year end we are continuously hopeful that more stable and prosperous times are ahead.

Vice-President, Eric Standen, arranged a wide variety of topics for the monthly luncheon meetings enjoyed by a high attendance of members. His co-ordination of speakers, luncheons and A.G.M. arrangements is greatly appreciated. Precipitated for the 1987 Symposium are well underway thanks to the efforts of Mel Blackburn.

With the upheavals experienced this year by the petroleum industry, it is gratifying to see that the overall membership is little varied from that of last. Thanks go to membership chairman, Don Zver. It is due to his efforts that the society gained the support of so many corporate members in this particularly difficult year.

This year, the executive elected H.N. (Neil) Collins as an Honorary Member of the Society. Neil has served on past executives in various positions including that of Vice President and President. He has also served on various symposium committees and represented the CWLS on the Canadian Geoscience Council. Neil Collins has authored and presented numerous technical papers on formation evaluation. His election as the tenth Honorary member is in recognition of his contributions to the well being of the Society.

The efforts of the Publications Chairman, Dave Ormon, are greatly appreciated and are evident in the success of the society's *Log Analysis Handbook*, the publication of the *Journal*, Volume 14, and the large distribution of material through the society's office. Work on the *Rw* catalogue has continued under the chairmanship of Casey Struyk with publication due in 1987. A note of thanks is given to Sharon Lyttle and her staff at the A.P.E.G.G.A. office who have assisted in publication sales, distribution and many other tasks.

The society has enjoyed financial health this year as reported by the treasurer Dave Curwen. A complete overhaul of the society's inventory was undertaken and a rigorous breakdown of revenues and expenses implemented. Dave's keen interest in the financial aspects of the society have greatly aided in the management of the Society's affairs.

The winner of the 1986 Presidents Award for best paper on formation evaluation was that of W.R. (Rick) Berry, entitled "An Organized Approach to Petrophysical Field Studies" presented at the May luncheon meeting. Ted Jennings and his President's Award committee are thanked for reviewing all the technical papers presented at the luncheons.

My thanks to Jim Reimer, this year's secretary, for a fine job done with such courteous diligence. The society thanks Lorne Slusarchuk who has served for a second year as our representative on the Canadian Geoscience Council; and to Al Lye, past president for his help and support during the year.

*D. Greenwood*

### *11. Geological Association of Canada (GAC)*

The Geological Association of Canada had a progressive year during 1986 realizing many of the goals set by Executive and Council. Since the last report, the Executive and Council met together in Ottawa and Saskatoon. Additional executive meetings were held in Toronto, Banff and Hamilton.

Membership of the Geological Association of Canada, as of year end 1986 is 3083 including all categories.

At the Annual Meeting held in conjunction with the Mineralogical Association of Canada in Ottawa, the association's medals were presented as follows: Logan Medal — M.J. Keen; Ambrose Medal — E.R.W. Neale; Past Presidents Medal — B.J. Fryer; and Duncan R. Derry Medal — R.W. Hodder.

Dr. A.R. Berger (Executive Director), Maureen Penney (Associate Secretary-Treasurer) and Karen Johnston (new Assistant Secretary-Treasurer) were joined by Rita Patterson. Under the direction of Maureen Penney, the business activities of the Association are now all handled by computer. The transfer of the ledger system to the computer has been a tremendous undertaking and Maureen Penney is to be congratulated on her success.

The Executive Director continued to work to increase awareness of the association. His efforts in increasing income from advertising for example, are visible to all who read *Geoscience Canada*. Tony was the focal point of new initiatives within the Association this year and has successfully taken GAC, through its mobile display, to a number of the larger geoscience meetings in North America. This position was supported by grants from EMR; the Government of Newfoundland and Labrador, and the Government of Ontario. Their contributions are gratefully acknowledged. Tony resigned his position as Executive Director as of September 1986, as his responsibilities increased in Ottawa.

The Finance Committee is chaired by John Hamilton. A major activity of the Committee was to advise on conversation of assets held in U.S. funds. A 20-year review of GAC's membership dues structure was undertaken. Council adopted a dues rise, of somewhat less than the inflation this has occurred since the previous one in 1981. *The Publication Committee* oversees the production of *Geoscience Canada*, *GEOLOG*, *GAC Special Papers* and other publications of the Association. It also advises the Editorial Board of the *Canadian Journal of Earth Sciences*.

A new committee under the chairmanship of Vice-President Gerry Middleton has been set up to produce long-term plans for the association. It will report regularly to Council. Clearly this committee is one of the most important that Council refers to in light of the increasing burden being placed on voluntary efforts to run an association of over 3000 members.

A number of divisions and sections and affiliated societies have acted upon the invitation given to all by Grant Mossop to attend Council Meetings. Grant Mossop and Tony Berger have encouraged closer contact between Sections and Divisions and the parent body, and summaries of activities and annual financial statements are now received from most. The present list of divisions is as follows: Canadian Geophysical Union, Environmental Earth Sciences, Mineral Deposits, Canadian Sedimentology Research Group, Palaeontology, Precambrian, Structural and Tectonics, Volcanology, CANQUA.

A recent addition is the formation of a Marine Geosciences Division which, with the present activity in offshore exploration and the Ocean Drilling Program of which Canada is a full partner, intends to be a division to which many members will be affiliated. Sections and Affiliated Societies include: Pacific Section, Cordilleran Section, Edmonton Geological Society, Winnipeg Section, Newfoundland Section, Atlantic Geoscience Society, Toronto Geological Discussion Group.

As part of an effort to increase awareness of the regional activities of the Association, a series of regional field conferences is planned. The first, Yellowknife '87 is in the final planning stages.

*J. Malpas*

## ***12. Mineralogical Association of Canada (MAC)***

The Mineralogical Association of Canada had a successful year in 1986 and continues to maintain a sound financial position due to the continuing efforts of the Treasurer and the Finance committee.

The 31st annual meeting of MAC was held May 19-21st, 1986, at Carleton University, Ottawa, in conjunction with the annual meeting of the Geological Association of Canada. Prior to the meeting the 12th MAC short course: "Silicate Melts; Their Properties and Structure applied to Problems in Geochemistry, Petrology, Economic Geology and Planetary Geology", organized by Chris Scarfe was held. Major symposia on "Layered Igneous Rocks and Sediment-Hosted Stratiform Copper Deposits" were outstanding. Special sessions on Current Developments in Microanalysis, Applied Clay Science, Ridge Systems and Hydrothermal Processes, Carbonatites, Granulites, and the Hemlo Gold Deposits were complemented by numerous general sessions in Mineralogy, Petrology, Economic Geology and Geochemistry. The MAC Presidential Address was given by Louis Cabri, who addressed the importance of modern analytical techniques to the optimization of ore processing. A successful program of field trips accompanied the meeting.

The *Canadian Mineralogist* is the quarterly journal of the Association, and continues to expand its coverage of all fields of mineralogy. This year featured a special issue on *Applied Mineralogy in Science and Technology*, selected papers from four special sessions held on this topic at the 1985 Annual Meeting; this initiative by the Association was to recognize the increase in the importance of mineralogy to a wide range of industrial activities. The final 1986 issue of the *Canadian Mineralogist* was a special issue to commemorate the 65th birthday and retirement of the well-known crystallographer Professor Robert B. Ferguson.

*F.C. Hawthorne*

## REPORTS OF THE ASSOCIATE MEMBERS

### *1. Associate Committee on Geotechnical Research (National Research Council (ACGR-NRC))*

- Third Meeting of the Subcommittee on Marine Geotechnical Engineering, Dartmouth, Nova Scotia, January 20, 1986.
- Sixty-Third Meeting of the Associate Committee on Geotechnical Research, Ottawa, Ontario, January 23-24, 1986.
- Submission of an unsolicited proposal to Supply and Services Canada by the National Task Force on Soil Barriers to Control Groundwater Contamination of the Subcommittee on Soil and Rock Engineering, January 1986.
- Workshop on Geotechnical in situ Testing for Canadian Offshore, Dartmouth, Nova Scotia, January 27-28, 1986.
- Thirtieth Meeting of the Snow and Ice Subcommittee, Ottawa, Ontario, January 31, 1986.
- Thirty-Sixth Meeting of the Peatlands Subcommittee, Ottawa, Ontario, April 16, 1986.
- Snow and Ice Subcommittee sponsored short course on “Snow Engineering”, Banff, Alberta, April 21-25, 1986.
- Snow and Ice Subcommittee sponsored short course on “Remote Sensing of Ice”, Edmonton, Alberta, April 28-May 2, 1986.
- Meeting of the Executive Committee of the Associate Committee on Geotechnical Research, Toronto, Ontario, May 6, 1986.
- Fifteenth Meeting of the Subcommittee on Urban Engineering Terrain Problems, Dartmouth, Nova Scotia, May 8, 1986.
- Thirtieth Meeting of the Permafrost Subcommittee, Ottawa, Ontario, May 22, 1986.
- Third Canadian Conference on Marine Geotechnical Engineering, St. John's, Newfoundland, June 11-13, 1986.
- Fourth Meeting of the Subcommittee on Marine Geotechnical Engineering, St. John's, Newfoundland, June 13 and 14, 1986.
- Conference “Advances in Peatlands Engineering”, Carleton University, Ottawa, Ontario, August 25-26, 1986.
- Thirty-Seventh Meeting of the Peatlands Subcommittee, Ottawa, Ontario, August 26, 1986.
- Meeting of the Executive Committee of the Associate Committee on Geotechnical Research, Ottawa, Ontario, August 27, 1986.
- Informal Meeting of the Subcommittee on Marine Geotechnical Engineering, Ottawa, Ontario, August 28, 1986.
- Meeting of National Task Force on Soil Barriers to Control Groundwater Contamination of the Subcommittee on Soil and Rock Engineering, to organize regional meetings, Toronto, Ontario, October 15, 1986.
- NRC Extreme Ice Features Workshop, Banff, Alberta, November 3-5, 1986.
- Thirty-First Meeting of the Snow and Ice Subcommittee, Banff, Alberta, November 4, 1986.
- Thirty-First Meeting of the Permafrost Subcommittee, Edmonton, Alberta, December 10-11, 1986.
- Approximately 500 copies of the *Urban and Terrain Problems* bulletin were prepared and distributed.

## 2. Committee of Provincial Geologists (CPG)

The Committee of Provincial Geologists was formed at the Meeting of the Provincial Mines Ministers in St. John's Newfoundland 10 years ago. The Chief Geologists or equivalent from each provincial and territorial Survey or Mineral Resources Division comprise the Committee. In anticipation of future devolution of mineral resource responsibilities for the northern territories, the Yukon and Northwest Territories governments were given observer status in 1985.

The Committee provides a forum for discussion of those geological and mineral resource exploration and development issues that lie within the jurisdiction of the provinces, and through contacts with private sector mineral-oriented organizations, maintains an effective and highly useful liaison with most of the components of the mineral industry. The committee, through its individual members is a major component of the National Geological Surveys Committee, through which a formal communication channel has been established with the Geological Survey of Canada. Committee representation on the Geoscience Council of Canada provides an effective window to many other facets of the earth science community in Canada.

The Committee meets twice a year: in March, just prior to the Prospectors and Developers Convention; and usually in September in conjunction with the Provincial Mines Ministers Conference. Various mining, exploration and related mineral industry groups and federal agencies are invited to discuss issues of current interest with the Committee.

A topic of high priority has been the maintenance, expansion and enhancement of Canada's geoscience data base. Mineral exploration and development, land use planning, and geotechnical hazard evaluation, a growing concern as our country becomes more and more urbanized, are all dependent on the success of this data base. Under the current economic restraint that affects all levels of the Canadian economy, the need to enhance the effectiveness of all geoscience investigations, and to preserve and ultimately to make available both the results and data generated by such investigations has become more apparent. Thus, among the topics of concern to the Committee, ones which are regularly discussed with private industry, academic and federal communities are:

- Computerization of the various types of data files that have been built up, and how these can be made available to potential users.
- Capture and preservation of geological data including drill core, produced by various industry activities, and data produced by geochemical and geophysical surveys.
- Review of government-supported geological programs to enhance their usefulness and relevance to private and public sector needs and to avoid, as far as possible, non-productive duplication of work.

To further these goals at the individual survey level, Mineral Exploration Liaison Committees have been formed to improve communications between the various provincial geoscience organizations and their client communities. Most of these committees are made up of industry, and academic representatives.

The committee published Volume 3 of the *Provincial Geologists Journal* in March 1986. This journal, by publicizing the work of the Committee and of the member organizations, provides a vehicle to acquaint the many client groups of provincial surveys with basic information on provincial survey operations.

The following are some of the 1986 achievements:

- A survey of geological data files was conducted to ascertain the status and variety of such data bases and their availability to industry and other public users.
- Consultations continued to develop and ensure the use of standard geological map symbols.
- A survey of the methods used in the discovery of Canadian mineral deposits was begun. First results, for mines that began production during the past 20 years, will be published in the next issue of the *Journal*.
- A Provincial Room, at which all provincial and territorial geological surveys displayed their products and advertised their current activities, was held at the Prospectors and Developers Convention held in Toronto in March. More than 1500 people viewed these exhibits.
- During Provincial Day at the PDA convention a number of papers were presented summarizing mineral developments in various provinces over the preceeding year.

### 3. Council of Chairmen of Canadian Earth Science Departments (CCCESD)

There was a delay in assembling and analyzing the results of student enrolment for 1985-1986, however, all member departments reported except UBC Department of Oceanography. The more complete coverage this year lead to some problems in interpreting the trends in data because last year, in addition to the two departments of Oceanography (at Dalhousie and UBC), two moderate to large departments of Geological Sciences in the West, and one small department in Ontario, did not report. The lack of data from the West in particular had a more important influence on interpreting trends than was previously thought. To resolve this problem, the numbers reported last year (for 1984-85) have been "adjusted" with both the adjusted numbers and the previously quoted numbers (in parentheses) being shown in Table 7. Similarly, in the figures showing the numbers of enrolments over the years, both the unadjusted numbers and the adjusted numbers are used to plot points, with the new trend lines (full) connecting the adjusted figures to the years on either side, the old trend lines being broken.

The "adjustment" was simple. The numbers in all general categories reported for this year were added to last year's data. The results of this should be fairly accurate for most faculty and support staff categories since they are seen to be a fairly stable population. Student enrolment is more volatile and the "adjusted" numbers for all categories of students are likely to be less reliable. Nevertheless, the "adjusted" numbers should give a better idea of trends than unadjusted numbers. In this context it can be seen that the undergraduate student population (years II to IV) was stable for 1983-84 to 1984-85 but has suffered about a 25 per cent decline in 85-86. This brings the numbers back to the slower long term increasing, almost linear, trend of the past decade. If there is a further significant decrease over the next few years, there may be an unfortunate impact

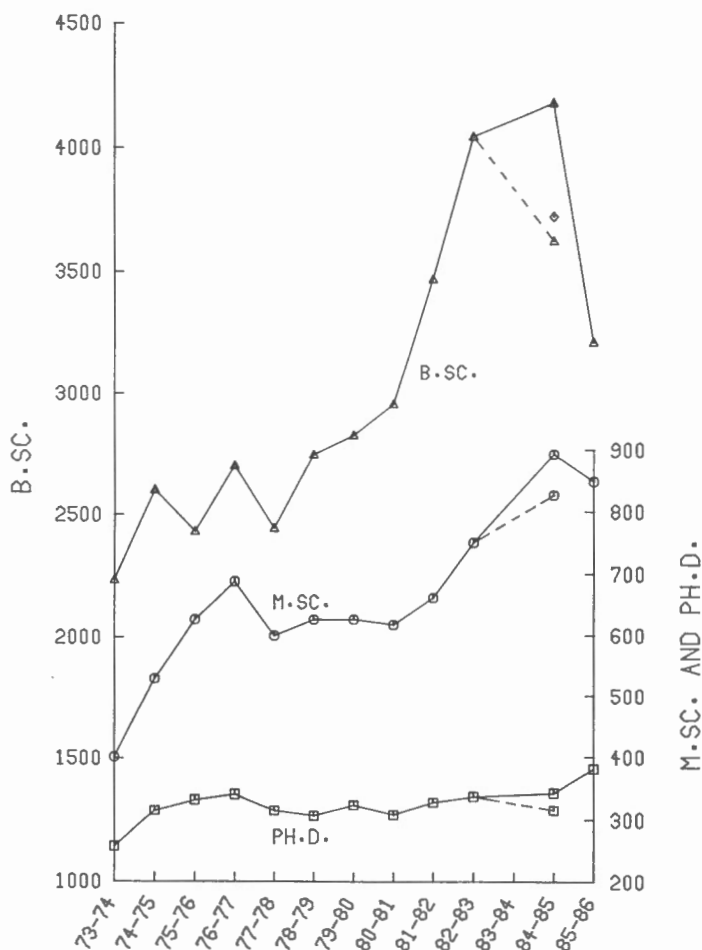


Figure 1. Student enrolment 1973-1986

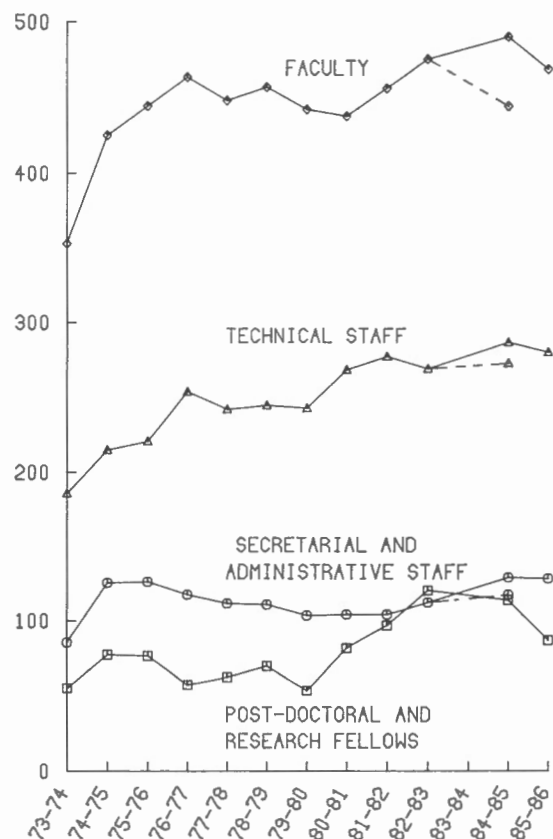


Figure 2. Faculty and Support staff 1973-1986



**Table 7.** Student and staff members in Canadian Earth Science departments, 1980-86. For 1985-86 data, second figure of a pair is % female (Revised 86 04 20)

Group	Year	Atl. <sup>1</sup>	Que.	Ont. <sup>2</sup>	West <sup>3,4</sup>	Total <sup>5</sup>
All students taking 1st year courses and service courses	80-81	1048	102	3992	4058	9200
	81-82	1142	116	4661	3770	9689
	82-83	1402	142	4595	4067	10206
	84-85	685	73	3343(3334)	2969(2526)	7061(6618)
	85-86	1363	335	3095	2109	6902
2nd year majors: Arts & Science & Engineers	80-81	150	150	490	386	1176
	81-82	192	132	593	447	1364
	82-83	208	169	721	469	1567
	84-85	156	259	427(421)	422(304)	1458(1340)
	85-86	151 20	230 26	300 23	323 18	1004 20
3rd year majors: Arts & Science & Engineers	80-81	82	145	379	305	911
	81-82	121	157	421	378	1077
	82-83	174	147	544	439	1304
	84-85	147	234	469(459)	434(317)	1274(1157)
	85-86	116 21	189 27 48	339 22 65	341 18 15	985 21 128 25~
4th year majors: Arts & Science & Engineers	80-81	94	96	269	267	726
	81-82	92	125	307	345	869
	82-83	125	134	387	389	1035
	84-85	186	252	518(515)	533(333)	1486(1286)
	85-86	122 20	169 24	358 24	451 14	1100 19
M.Sc.(full-time & part-time)	80-81	46	137	282	158	623
	81-82	51	158	299	157	665
	82-83	55	180	320	199	754
	84-85	97	222	378(374)	202(136)	899(829)
	85-86	99 25	175 21	340 24	242 22	856 24
Ph.D.(full-time & part-time)	80-81	26	35	157	92	310
	81-82	29	41	165	95	330
	82-83	33	43	178	90	344
	84-85	42	41	174(170)	91(65)	348(318)
	85-86	46 22	58 14	175 21	105 14	384 18
PDF & Research Associates	80-81	7	8	31.5	36	82.5
	81-82	8	6	44	41	99
	82-83	9	8	51.5	53	121.5
	84-85	4/13	6/14	6/45	1/27(1/26)	17/99(17/98)*
	85-86	3/8	4/20	4/34	6/9	17/71
Faculty, full-time	80-81	52	75	175.5	135	437.5
	81-82	65	79	177	136	457
	82-83	69	80	188.5	138	475.5
	84-85	96/3(93/3)	84/2	185(181)	118(79/4)	483/9(437/9*)
	85-86	82/3	79/1	178/1	128/0	470/5
URF's	85-86	2	2	7	1	12
Faculty, part-time	80-81	6	6	19	14	45
	81-82	6	6	13	16	41
	82-83	7	2	10	22	41
	84-85	12	6	34/6	6/4	58/10*
Adjuncts	85-86	15	2	36	2	62
Secretaries & Admin.Assts.	80-81	15	17	38	34.5	104.5
	81-82	16	15	39.5	34	104.5
	82-83	16	16	46	35.5	113.5
	84-85	20/13	21/1	36/14	29/5(18/5)	106/23(95/23)*
	85-86	17/3	24/2	37/9	31/3	109/17
Technicians	80-81	30.5	38	101.5	100.5	270.5
	81-82	33.5	37	107.5	99.5	277.5
	82-83	38.5	37	96	96.5	268
	84-85	38/39	28/9	63/41(62/41)	41/32(29/28)	170/121(157/117)*
	85-86	32/27	25/14	60/53	48/26	165/120
Instructors & Demon.	84-85	9	6	11	12(8)	34
	85-86	6	12/1	7	9	34/1
<p>1 - Figures in brackets do not include Dalhousie Oceanography which did not report.  2 - Figures in brackets do not include data from Guelph which did not report.  3 - Figures in brackets do not include data from Saskatchewan, UBC Geological Science and UBC Oceanography which did not report. Reported figures for 1984-85 have been adjusted (non bracketted figures) using 1985-86 data to allow more realistic assessment of trends; see text.  4 - No data for 1985-86 from UBC Oceanography.  5 - Figures in brackets match those in previous columns.  * - Divided into University funded and non-university funded positions respectively.  ~ - Three year B.Sc.</p>						

on the graduate programs as administrators reduce demonstrating funds in line with undergraduate enrolments. The only other category in which there appears to be a significant decrease is the postdoctoral associate range, which has suffered a 15 per cent decline; these are people who are normally hired on grants at the postdoctoral level and presumably the decline reflects a decline in the value of grants and therefore in the ability of the grantee to employ such people. A similar decline has been noted by the Canadian Association of Physicists. Although there has been a decrease in M.Sc. registrations there has been a very significant increase in the number of Ph.D. registrations. There has been a slight decrease in the number of faculty and support staff but the ratios remain stable.

A slight change in reporting procedure is evident in all tables except 10 and 11. Instead of giving total numbers of male and female students, the results are reported in the form of total numbers of students in each category and the proportion of those who are female. Similarly, an attempt has been made to obtain an overall picture of the proportion of visa students at the graduate level. Unfortunately, a number of universities did not supply a breakdown into male and female nor into Ph.D. and M.Sc. so the picture is not as complete as it might be. However, it is well-known that the percentage of female visa students to all visa students is smaller than the corresponding figure for non-visa students.

In the process of assembling the data and applying the "adjustments", it became evident that in some subject areas at the graduate level there were far fewer students than might have been expected — for example in geomorphology. It was realized that the enrolment survey does not

**Table 8.** Summary of student data for 1985 (Revised 86 04 20) by program, gender, region and visa or non-visa

Region	B.Sc. (Yrs. 2-4)		M.Sc.		Ph.D.		M.Sc. + Ph.D.		
(a) Enrolled (1985-86)	All	%F	All	%F	All	%F	All	%F	%Visa~
Atlantic Region	389	20	99	25	46	22	145	25	20
Quebec	636	25	175	21	58	14	233	19	12
Ontario	1062	22	340	24	175	21	515	23	23
Western Canada	1130	17	242	25	105	14	347	22	27
Total	3217	20	856	24	384	18	1240	22	18
(b) Graduated (1984-85)	All	%F	All	%F	All	%F	All	%F	%Visa
Atlantic Region	127	26	18	11	2	0	20	9	20
Quebec	158	22	68	22	13	0	81	19	12
Ontario	418	22	109	22	33	12	143	20	27
Western Canada	379	16	37	19	12	8	49	16	29
Total	1155	20	231	21	60	8	293	18	20
~ Graduate Students only									

**Table 9.** Summary of B.Sc. registrations and graduations for 1985 (Revised 86 04 20) by discipline area, region and gender

Discipline area	Atlantic		Quebec		Ontario		West		Total	
(a) Registered (1985-86)	All	%F	All	%F	All	%F	All	%F	All	%F
Geology	327	21	446	29	801	29	711	20	2228	23
Geophysics	23	17	37	11	116	21	195	13	371	15
Geological Engineering	27	4	93	17	179	16	176	19	475	13
Other	12	33	60	18	23	17	48	15	143	18
Total	389	20	636	25	1062	22	1130	17	3217	20
(b) Graduated (1984-85)	All	%F	All	%F	All	%F	All	%F	All	%F
Geology	115	25	104	24	287	24	347	17	853	22
Geophysics	7	29	3	0	48	15	42	10	100	13
Geological Engineering	5	40	39	18	75	16	63	14	182	16
Other	0	0	12	25	8	38	0	0	20	30
Total	127	26	158	25	418	22	452	16	1155	20

Table 10. Graduate students graduated 1984-85 by subdiscipline (Revised 86 04 20)

GEOLOGY	Atlantic				Quebec				Ontario				West				Total
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
Coal Geology																	1
Economic Geology	3				7	1	2	-	19	4	4	-	2	1	2		45
General & Regional Geology					4	1	1	-	3	2	1	-					12
Geochemistry - Exploration	1						1		2				2				6
- Physical			1						6	3	9	1					20
- Organic									1	1		1					2
- Other					1	1	1		1								4
Geochronology																	-
Geological Engineering					1								2	1		1	5
Geomorphology					3				4	1							8
Geomathematics					1		1										2
Hydrogeology																	0
Limnology					4				8	2	2		1	1			18
Marine Geology	1																1
Mineralogy & Crystallography																	-
Paleontology	3	1			2				1	3			1		1		6
Paleontology					1		3		2		1						13
Paleontology									4	1		1					6
Petroleum Geology													1		1		2
Petrology	1				7	1			7	3			2	1	1		23
Quaternary Geology					1	1	1		4	1	1		1		2		12
Remote Sensing																	0
Sedimentology	2	1			3	2	1		7	1	6		8	2			33
Stratigraphy					1				2								4
Structural Geology & Tectonics	1				4	1	1		2	4		1	5		1		19
Volcanology					2		2		1								5
Other: Specify					9	1	-										10
<b>Total Geology</b>	12	2	1	-	51	13	10	-	72	24	27	4	25	6	9	1	257
<b>GEOPHYSICS</b>																	
Exploration Geophysics	1				1	1			6	1				2			12
Geodesy																	0
Geodynamics	1						2										3
Geomagnetism & Paleomagnetism	1				1	1	1		3		1		2				10
Geothermal			1								1		1				3
Glaciology																	0
Gravity																	-
Marine Geophysics									2								2
Remote Sensing	1												1				2
Seismology									1				1	1			0
Other: Specify									1								3
<b>Total Geophysics</b>	4	-	1		2	2	3		13	1	2	-	5	1	2		36
Number Canadian Students					47	14	10		65	16	20	3	26	7	10	1	234
Number VISA Students					6	1	3		20	9	9	1	4	0	1	0	59(20#V)
<b>TOTAL NUMBER STUDENTS</b>	16	2	2	0	53	15	13	0	85	25	29	4	30	7	11	1	293(18#F)

\*Visa and non-visa students not separated into M.Sc. and Ph.D., or M and F.

Table 11. Graduate students currently enrolled by subdiscipline (Revised 86 04 20)

GEOLOGY	Atlantic						Quebec						Ontario						West						Total
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F					
Coal Geology	1																								8
Economic Geology	15	5	5	3	18	4	11	4	11	1	57	13	28	10	24	6	7	1							208
General & Regional Geology	4	1			10	2	5				6	1	6		1	1									37
Geochemistry - Exploration	1				2	1					4		1		3	4	3	1							20
- Physical			2		1		2				21	10	18	9	3										66
- Organic	2	1			1							6			1										12
- Other					2	2	1				1	4	1												11
Geochronology																									
Geological Engineering	3	1	2		14	2	4				2	3	3		5	2									20
Geomorphology					1		1			1			2		2										7
Geomathematics					4	1	2				2		2												12
Hydrogeology					2	1	1				18	8	8	3	7	2	7								57
Limnology																									0
Marine Geology	2	1	1											2											6
Mineralogy & Crystallography																									
Paleontology	7	5	3	2	4	1	1				7	2	3	2	1	1	4								18
Palynology	2					1					6	3	8	2	5	1	3	2							52
Petroleum Geology	2										1				3	3	2								16
Petrology	9	6	5	2	13	2	4			2	16	6	5	2	10	4	7								22
Quaternary Geology	2				12	3					7	2	2		6	5	3	3							93
Remote Sensing																									
Sedimentology	11	2	6	2	9	2	4				3		13	4	20	15	8	1							5
Stratigraphy	3	1			4		2			1	33		1		11										133
Structural Geology & Tectonics	6	2	5	1	8	6	9			1	17	6	11	1	18	8	5	2							106
Volcanology	1		1		3	1				1	1	1	2		1										15
Other: Specify	1		1		11	2				2	2	3	2	2											24
Total Geology	72	25	32	10	125	34	46	6	220	75	119	35	141	54	63	13									1070
GEOPHYSICS																									
Exploration Geophysics	1				11	1	3	1	12	1	5		18	2	5	1									61
Geodesy																									0
Geodynamics			2				1	1	6	2	1														13
Geomagnetism & Paleomagnetism	1		1				1		6	1	6		2	1	7										26
Geothermal							1				2	1													4
Glaciology														2	3										5
Gravity																									
Marine Geophysics			1								1			1	2	2									1
Remote Sensing														1											1
Seismology					2				6		3	1	9		9	1									13
Other: Specify									8	1	2	7	2	1											21
Total Geophysics	2		4		13	3	4	2	38	7	19	2	40	7	27	2									170
Number Canadian Students					114*				120	35	41	8	211	71	88	25	150	51	58	12					984
Number VISA Students					31*				18	2	9	0	47	11	50	12	31	10	32	3					256 (21%V)
TOTAL NUMBER STUDENTS	74	25	36	10	138	37	50	8	258	82	138	37	181	61	90	15									1240 (22%F)
*Visa and non-visa students not separated into M.Sc. and Ph.D., or M and F.																									

**Table 12.** Summary of support staff/Faculty ratios for 1985-86 (Revised 86 04 20)

First value is for Faculty only, second value includes URF's and Research Associates in Faculty complement						
(a) <u>University Funded</u>						
Region	Tech/Fac		Clerical/Fac		All/Fac*	
Atlantic	0.38	0.36	0.20	0.19	0.65	0.59
Quebec	0.32	0.30	0.30	0.29	0.77	0.73
Ontario	0.34	0.33	0.21	0.20	0.54	0.57
Western Canada	0.37	0.36	0.24	0.23	0.69	0.66
National	0.35	0.34	0.23	0.22	0.66	0.63
(b) <u>All Sources</u>						
Atlantic Canada	0.67	0.58	0.23	0.20	0.96	0.84
Quebec	0.49	0.37	0.33	0.25	0.98	0.74
Ontario	0.62	0.50	0.25	0.21	0.91	0.74
Western Canada	0.58	0.51	0.27	0.24	0.91	0.81
National	0.60	0.50	0.27	0.22	0.94	0.78
All* = Technical + Clerical + Demonstrators.						

canvass a large segment of the university community that perhaps should be included — namely, the physical geographers. This is perhaps not surprising given the title of the Council and its constitution. Nevertheless, it would seem advisable to give some consideration to including in our collection of data for graduate students and faculty (and support staff) those groups in Geography Departments who are eligible to apply to NSERC for Operating Grants. There is not particular reason why we should mirror the boundaries set by NSERC but some of the discipline areas listed in our questionnaire are, in fact, often to be found in Geography Departments.

*A.E. Beck*

#### **4. Geological Survey of Canada (GSC)**

The Geological Survey of Canada and the Earth Physics Branch of the Department of Energy, Mines and Resources were merged into one unit on April 1, 1986. The preceding months involved a number of consultations and discussions which resulted in a new Geological Survey comprising four regionally based multidisciplinary divisions and four specialist divisions with national responsibilities. The reorganization has provided new opportunities for bringing together, within individual divisions, certain complementary scientific disciplines that had previously been managed separately; and for coordinating activities between and among divisions.

The objective of the “new” Geological Survey of Canada is to ensure the availability of comprehensive geological, geophysical and geochemical knowledge, technology and expertise concerning the Canadian landmass and offshore areas, including the mineral and energy resources and the conditions affecting land and seabed use, as required for effective exploitation of mineral and energy resources, estimation of the resource base of Canada, land use, public safety and security, and formulation of policies.

The four regional Divisions are:

**Atlantic Geoscience (Dartmouth, N.S.)**

Composition: unchanged (approximately 122 persons-years).

Responsibilities: geological, geophysical and geochemical studies in the Atlantic and Arctic off-shore areas to assist in the search for hydrocarbon resources and resource evaluations, in protection of the marine environment and in improving the safety of coastal and offshore engineering structures.

Organization: five subdivisions — Administration, Eastern Petroleum Geology, Environmental Marine Geology, Regional Reconnaissance, and Program Support.

**Lithosphere and Canadian Shield (Ottawa)**

Composition: The former Precambrian Geology Division of GSC, the Crustal Structure Group of the former Seismology and Geomagnetism Division of EPB, part of the Crustal Studies Group of the former Gravity, Geothermics and Geodynamics Division of EPB, and the former Resource Geophysics and Geochemistry Division of GSC (approximately 108 person-years).

Responsibilities: the composition, structure and evolution of the Canadian lithosphere as exposed in the Canadian Shield and represented in the subsurface beneath the sedimentary rocks; geochronology; paleomagnetism; igneous and metamorphic petrology.

Organization: three regional-interest sections, four sections concerned with nation-wide studies and a Special Project Group with advisory and national responsibilities: Bear-Slave, Northern Churchill and Superior-Grenville sections; Paleomagnetism, Geochronology, Petrology and Lithosphere Geophysics sections.

**Sedimentary and Petroleum Geology (Calgary)**

Composition: unchanged except for additional expertise in geothermics for basin studies (approximately 166 person-years).

Responsibilities: conduct of mapping and topical studies to establish the geoscience base for the sedimentary basins of western and Arctic Canada; evaluation programs for petroleum and coal resources.

Organization: six subdivisions — Regional Geology, Paleontology, Coal Geology, Petroleum Geology, Geological Publications, Administration.

**Cordilleran and Pacific Margin (Vancouver and Sidney, B.C.)**

Composition: former Cordilleran Geology Division of GSC (Vancouver) including the Marine Geology Subdivision (Pacific Geoscience Centre, Sidney, B.C.) of former EPB. Until reorganization is complete the Director, Cordilleran Geology Division and the Director, Pacific Geophysics Division report to Director General (approximately 75 person-years).

Responsibilities: Seismology of Cordilleran and Offshore regions to assist in identification, elucidation and mitigation of earthquake hazards; studies in neotectonics; nature, origin and evolution of the lithosphere of the Cordilleran and Offshore regions and their mineral and hydrocarbon resources; assessment of volcanic and terrain hazards to facilitate land-use planning and development.

Organization: six units — Cordilleran Geology and Tectonics, Earthquake Seismology, Marine Geology and Geophysics, Gravity and Geodynamics, Geomagnetism, Information Services.

The four specialist Divisions are:

**Terrain Sciences (Ottawa)**

Composition: The former Terrain Sciences Division of GSC, the Terrain Geophysics Section of the former Resource Geophysics Section of the former Resource Geophysics and Geochemistry Division of GSC, the Permafrost Research Group from Gravity, Geothermics and Geodynamics Division of EPB and the Glaciology Section from Polar Continental Shelf Project (approximately 97 person-years).

Responsibilities: to provide geoscientific data and interpretive information on the surficial geology and geomorphic processes of the Canadian landmass and for geotechnical aspects of surficial and bedrock materials that have a bearing on the use of the terrain.

Organization: three subdivisions: Quaternary Environments, Terrain Dynamics, and a Sedimentology Research unit.

### **Geophysics (Ottawa)**

Composition: Parts of the Seismology and Geomagnetism Division and the Gravity, Geothermics and Geodynamics Division of Earth Physics Branch together with most of the Regional Geophysics Subdivision (Aeromagnetic Surveys) of Resource Geophysics and Geochemistry Division of GSC (approximately 115 person-years).

Responsibilities: physics of the solid earth with special reference to the large-scale structure of the lithosphere-asthenosphere system in Canada; seismicity and seismic risk; national seismological geomagnetic and geodynamic observatory networks; national gravity and aeromagnetic mapping programs; national geophysical databases and methodology for manipulation and display.

Organization: Geodynamics Program, Gravity Program, Seismicity Program, Aeromagnetism Program, Geomagnetic Program; in addition special studies and geophysical instrumentation.

### **Mineral Resources (Ottawa)**

Composition: the Resource Geophysics and Resource Geochemistry Subdivisions of the former GSC Resource Geophysics and Geochemistry Division, and the former GSC Economic Geology and Mineralogy Division (approximately 166 person-years).

Responsibilities: research on the formation of mineral deposits and their relationships to Canada's principal geological regions; development of guidelines to assist mineral exploration and resource management and land-use planning; provision of analytical and mineralogical services to support Branch programs; curation of national mineral and ore research collections; research on geochemical processes and development, application and evaluation of methods to assist in mineral exploration and resource assessments; development and application of mathematical and statistical methods for geoscience data; development, application and evaluation of geophysical methods to assist in mineral exploration and geological mapping.

Organization: four subdivisions: Mineral Deposits, Mineralogy and Chemistry, Exploration Geochemistry, Exploration Geophysics.

### **Geoscience Information (Ottawa)**

Composition: Essentially unchanged. Two positions have been transferred to this division from Earth Physics Branch and will be used by Library Services to support the Geophysics Collection (97 person-years).

Responsibilities: to ensure that results of Branch scientific programs are made available to users in a timely and cost effective manner; to maintain the GSC Library as the geoscience component of the National Library; to manage GEOSCAN, the federal/provincial/industry geoscience bibliographic database; to coordinate Branch informatics applications and provide advice on data systems.

Organization: four sections; Scientific Editing and Publication Production and Distribution; Library Services; Cartographic Services; Data Systems.

As noted in previous reports, the Geological Survey is responsible for a number of major special programs. A brief description of these was included in the 1985 CGC report. The following are some highlight results for 1986.

*Frontier Geoscience Program:* On the East Coast, refraction data were used to map the ocean-continent transition off the eastern Grand Banks and deep seismic reflection data were obtained in the Gulf of St. Lawrence. In the western Arctic a major regional gravity survey in Yukon was completed under contract. A seismic refraction program from the Ice Island was completed in April. On the West Coast, preliminary aeromagnetic maps over the Queen Charlotte Islands have been received and are now being interpreted.

*Federal Provincial Mineral Development Agreements (MDAs):* The GSC is currently implementing projects in eight mineral development agreements. In four provinces, industrial advisory committees have been established to review projects. A new MDA is being developed for the Northwest Territories. Under similar federal programs, the Survey is implementing two projects in Quebec, the Asbestos Initiative and the Gaspé and lower St. Lawrence program. These both include airborne geophysical studies, geochemical and Quaternary mapping activities.

*Ocean Drilling Program:* Activities under this program continued during the year with the preparation of drilling proposals for the Juan de Fuca Ridge, Vancouver Island margin and the Queen Charlotte Islands margin. These have been submitted for consideration in the 1989-90 drilling schedule when the ship will be working in the North Pacific.

*Lithoprobe:* A revised project proposal for Lithosphere Phase II was prepared with the assistance of GSC staff and submitted to NSERC in May 1986. NSERC approved the project in principle in November. Modifications of the interpretation of the Lithoprobe results across Vancouver Island are continuing with an improved reconciliation of seismological and electrical results for the configuration of the structure of the descending Juan de Fuca plate. EM studies were carried out across the Kapuskasing Transect. A major, multi-channel seismic reflection survey was completed in Lakes Superior, Michigan and Huron as part of a joint project with the U.S. Geological Survey (GLIMPCE).

Highlights for the Divisions in 1986 are summarized below:

*Atlantic Geoscience Division:* Interpretation of aeromagnetic data acquired in 1985 has shown that the extensional basins developed along the continental margin south and east of Newfoundland were controlled by 'transfer' faults colinear with the transform faults seen in the adjacent ocean floor. The hydrocarbon potential of the disputed St. Pierre-Miquelon area was assessed using geophysical data acquired under the Boundary Disputes program. Coastal surveys, including video coverage, were carried out along the Beaufort Sea coast, the Arctic Islands and around Newfoundland. Surficial geology was mapped on the Grand Banks and in the Arctic Islands channels. A notable highlight in the Laurentian Fan was a diving program using the U.S. Submersible ALVIN which provided unique pictures of the turbidite flows triggered by the 1929 Grand Banks earthquake and located communities of giant clams living on pore waters expressed from the flows.

*Lithosphere and Canadian Shield:* Field work relating to 49 projects was completed on schedule during the summer. Highlights include the confirmation of dextral transcurrent shearing the Wager Bay Shear Zone, continuing studies in the Cape Smith Belt, Thelon Tectonic Zone and Wopmay Orogen. In the maritimes, mapping continued in Newfoundland, Nova Scotia and New Brunswick. The Geochronology unit has doubled its output of U-Pb zircon analyses and greatly improved its success rate in achieving accurate age determinations. Mapping projects closely integrated with geochronology were carried out in the Yukon-Tanana terrane and the southern Omineca Belt. New ages were obtained for rocks in the lowest Great Bear Zone, eastern Abitibi Superprovince, Bienville Superprovince and near the Grenville Front. The Geophysics Section completed magnetotelluric surveys across the Kapuskasing structure as part of LITHPROBE and participated in the joint USGS/Canada Great Lakes Seismic Project.

*Sedimentary and Petroleum Geology:* In the Arctic Islands, a seismic refraction program from the Ice Island was completed and seismic reflection data donated by industry is being processed. Of note is the dating of extensive volcanic strata on northern Ellesmere Island as mid-late Cretaceous suggesting a connection with the Alpha Ridge in the Arctic ocean basin. On the northern mainland, highlights include interpretation of the Innuvik-Tukoyaktuk seismic line and the completion of a comprehensive report on the petroleum and resource potential of the boundary region of the western Beaufort-Mackenzie area. Work on biomarkers has identified the source of Norman Wells oil and suggests new concepts for tar sands and heavy oil origins in the Alberta Basin. A major effort in the Peace River arch is continuing in cooperation with the universities of British Columbia and Saskatchewan and the Alberta Geological Survey. Recent studies of major coal bearing strata in northeastern British Columbia, southern Rocky Mountain foothills, plains of Alberta and Arctic Islands are facilitating assessment of coal potential. Coal resource evaluation studies continue to address national coal potential using computer-based coal deposit models developed from exploration data.



*Cordilleran and Pacific Margin:* Quaternary volcanic activity was studied in extensions of the Garibaldi Belt and in the Skeena Mountains. Mapping continued in a number of areas such as Dawson, the Selwyn Basin, Carmacks, Spatsizi and the Bowser Basin. Submarine slope failures and potential hazards were studied in Queen Charlotte Sound and in the Fraser Delta. New evidence of Jurassic hydrocarbon source beds on the Queen Charlotte Islands may be important in assessing Hecate Strait petroleum potential. From the Pacific Geoscience Centre, 10 cruises were undertaken including major studies, with PISCES diving, on parts of the Juan de Fuca Ridge. A highlight was the discovery of black smokers and hydrothermal sulphide deposits in the thickly sedimented Middle Valley of the Ridge. An intensive program of geodynamic measurements (leveling, triangulation, micro-gravity) was carried out on Vancouver Island to attempt to monitor deformation which may be associated with the cycle of very large earthquakes.

*Terrain Sciences:* Systematic mapping of glacial deposits continued in the Northwest, Yukon and the Arctic Islands. Studies of drift dispersion in the Dryden area of Ontario will alter strategies in terms of locating gold and other mineral deposit sources. Field work on permafrost was carried out in the Mackenzie Valley along the Norman Wells — Zama oil pipeline right-of-way. The large landslide triggered by the October 1985 Nahanni earthquake was studied in co-operation with staff of other Divisions and the University of Alberta. The use of Landsat imagery continues to show potential particularly in identifying bedrock lineaments related to mineralized zones in Saskatchewan and monitoring geologically related vegetation stress near Thetford Mines, Quebec. Work under the Manitoba Mineral Development Agreement continues to provide basic data in support of mineral exploration in north western Manitoba.

*Geophysics:* In seismology, work continues in the Nahanni earthquake area. Eleven months after the first earthquake, 300 events up to magnitude 4.5 were recorded in a two-week field period. Upgrading of the Yellowknife seismic facilities was begun. In geomagnetism, significant improvements in forecasting and a major international workshop in instrumentation were highlights of the year. Gravity surveys continued in a number of areas; the production of continent scale maps of gradient and other parameters is proving a powerful tool in identifying major features. Geodynamic highlights were the use of GPS receivers in measurements in the Vancouver Island strain network and the first Canadian Long Baseline Interferometry experiments between Algonquin Park and Penticton. The GSC's first helicopter-borne gradiometer maps were issued in 1986 and a major aeromagnetic survey of Lake Huron in cooperation with the USGS completed during the summer.

*Mineral Resources:* This Division is heavily involved in work under the Federal-Provincial Mineral Development agreements and had field operations in 1986, ranging from regional geochemistry to mineral deposit studies, in six provinces and the Yukon Territory. Field work and laboratory studies were also undertaken under the federal Asbestos Initiatives and Gaspé Program in Quebec. Highlights in mineral deposits studies include the evaluation of a massive submarine zinc-copper sulphide occurrence on Juan de Fuca Ridge, evaluation of relations between gold deposits and tectonics and enhanced platinum group element exploration. In exploration geochemistry, regional surveys were carried out in Newfoundland, New Brunswick, Ontario, Manitoba, Saskatchewan, British Columbia and the Yukon. Biogeochemical methods are being tested in a number of gold areas. A new radioactivity map of Canada was released and work on three radioelement maps of Newfoundland is continuing.

*Geoscience Information:* This Division continued to publish the results of the GSC scientists programs. Delays in map production are being reduced and some contract printing of MDA maps was carried out. In the first 6 months of 1986, 2800 pages of scientific data had been forwarded for printing, an increase of 15 per cent over the same period in the previous year. In those 6 months a total of 248 bulletins, papers, maps, open files etc. were issued. In the library, a major activity was the merging of the GSC and former EPB catalogues and holdings.

*R. Riddihough*

### *5. Royal Society of Canada (Earth Sciences Division)*

One of the most significant future scientific programs, Global Change, is the responsibility of the Royal Society of Canada, under the Geosphere-Biosphere Program of the International Council of Scientific Unions (ICSU). The Canadian program is being organized by a group chaired by William S. Fyfe (University of Western Ontario). Global Change will be a principal symposium theme at the 1987 Annual Meeting of the Royal Society of Canada to be held in Hamilton, June 1-3, 1987.

The President-Elect, Digby McLaren, and the Executive-Secretary-Elect, Michael Dence, are distinguished earth scientists who not only have keen interests in the Global Change program but have begun an active year to raise the activities, profile, and the financial strength of the society.

The Rutherford Lectures are jointly sponsored by the Royal Society of Canada and the Royal Society of London and are held in alternate years in Canada and UK. The 1986 Rutherford Lecturer, Professor R. Keith O'Nions (University of Cambridge), toured Canada from St. John's to Vancouver from October 12 to 27, 1986, presenting his lecture on "The Incorporation and Loss of Volatiles by the Earth" together with other research seminars.

The 1986 Brancroft Award was presented to Derek York (University of Toronto) in recognition of his outstanding contributions to research and public awareness in the geosciences. The award was presented at the Annual Meeting in Winnipeg where new earth scientists inducted into the society were Drs. Jan Veizer (University of Ottawa), Steve Scott (University of Toronto), and Richard Peltier (University of Toronto).

Officers of the Earth Sciences Division for 1986-88 are Chris Barnes (Memorial University) convenor; Michael Rochester (Memorial University), rapporteur; and Hugh Greenwood (University of British Columbia), executive member.

*C.R. Barnes*

## REPORTS OF STANDING COMMITTEES

### *1. Education Committee (EdGeo)*

This was a low year for Edgeo programs. The main organizer in Edmonton was transferred and no program was planned or held. Winnipeg held a successful program.

Waterloo had only seven registrants, and will try again in 1987. Sault Ste. Marie had the misfortune to hold their first Edgeo program during exam week — when the School Board said was the best time. Only two participants showed up. Sault Ste. Marie have not lost enthusiasm and will try again next year. Brandon may try to hold another program in 1988.

*P.J. Savage*

### *2. Marine Geoscience Committee*

The Marine Geoscience Committee re-organized, to make a smaller, less cumbersome group. The new group met to define its course of actions. It does not yet have a permanent Chairman, but actions are underway to rectify this.

Activities of the committee of the past are bearing fruit, in the successful participation by Canada in the Ocean Drilling Program (see separate report).

Attention will be paid in the near future to: the effects on the marine research community of recent cutbacks in the Department of Fisheries and Oceans; the effect on the marine research community of the withdrawal of Strategic Grants in the fields of "Oceans" and "Energy".

*M.J. Keen*

### *3. Ocean Drilling Program*

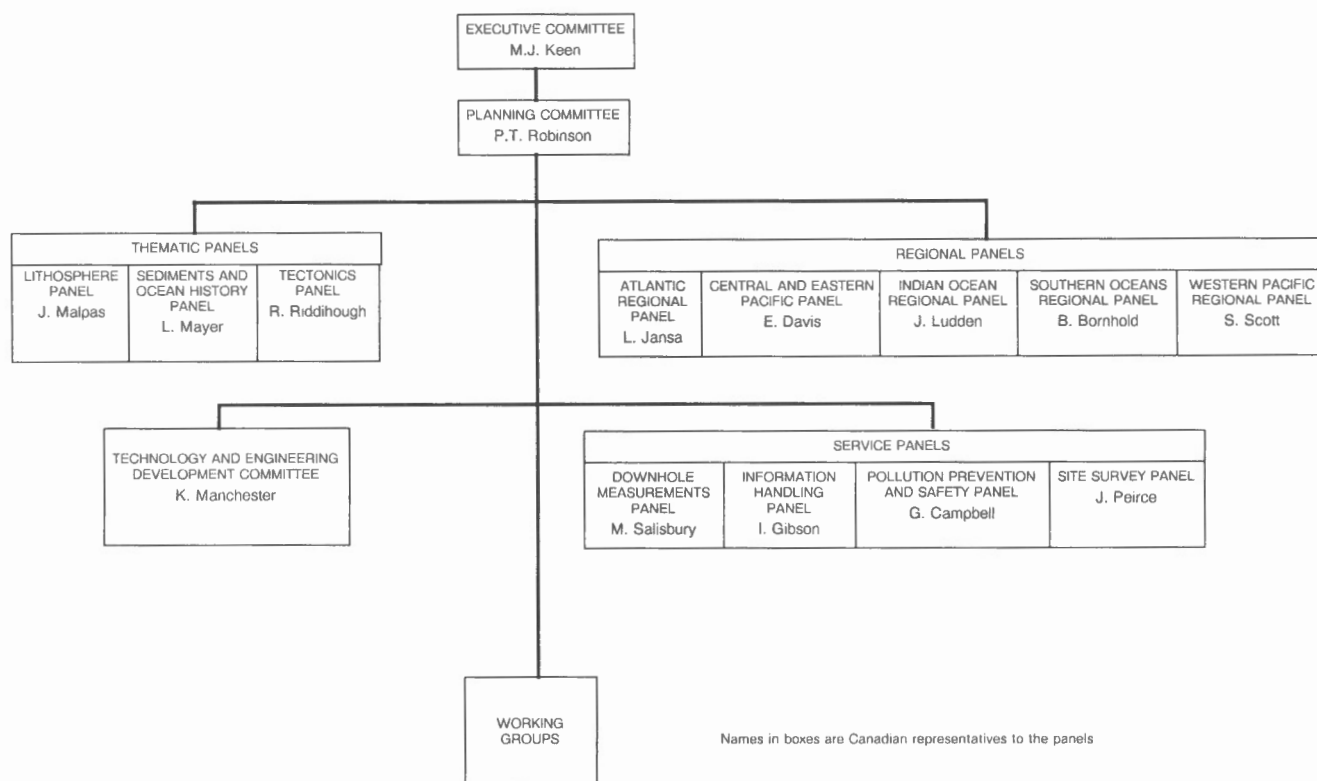
The Ocean Drilling Program has been underway since January of 1985 and is structured as a continuous series of scientific cruises, each approximately two months in duration. Of prime interest is the retrieval of rock and sediment cores from geologically important regions of the ocean basins. These core samples provide a wealth of information on the structure, composition, and history of the seafloor, allowing valuable insight into the processes of ocean basin formation, continental drift, the internal structure of the earth, the evolution of life in the oceans and the history of world-wide climatic changes. This in turn allows scientists to comprehend more fully the structure of the planet. In addition to core samples, a variety of sophisticated down-hole geophysical investigations are carried out, further adding to our growing understanding of the ocean basins.

The National Science Foundation (NSF), an agency of the U.S. government, has designated the Joint Oceanographic Institutions Inc. (JOI) as program manager for the ODP. JOI is a non-profit consortium of 10 major U.S. oceanographic institutions, including Texas A & M University (TAMU), the science operator for the program. TAMU provides planning, technical and logistical support for operations at sea and is responsible for staffing the cruises. On shore, the university manages scientific activities after each cruise, curates cores, distributes samples, and coordinates the editing and publishing of the scientific results. Lamont-Doherty Geological Observatory of Columbia University coordinates the ship's logging operations.

Scientific direction for the program is provided by the Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES), through a series of panels and committees, composed of earth scientists from the U.S.A. and other participating nations. In addition to Executive and Planning Committees, there are regional, thematic and service panels that establish the objectives and priorities of the program. Because Canada is a full member of ODP, we have representatives serving on all of these panels and committees (Table 13).

Canadian involvement in the ODP is overseen by a Council and a National Committee. The Council represents Canada on a government-to-government level and is responsible for overall policy and financing. The Canadian National Committee deals largely with the scientific and technological aspects of the program and is responsible for appointing members to JOIDES panels, recommending scientists for cruises and communicating with the scientific and technological communities about the program. A Secretariat assists the Council and National Committee and acts as

**Table 13. JOIDES Panel Structure**



### Canadian Representatives on Joides Panels

#### Executive Committee – EXCOM

Michael Keen, GSC

#### Planning Committee – PCOM

Paul T. Robinson, Dalhousie University

#### Technology and Engineering Development Committee – TEDCOM

Keith Manchester, GSC

#### Thematic Panels

##### Lithosphere Panel – LITHP

John Malpas, Memorial University

##### Sediments and Ocean History Panel – SOHP

Larry Mayer (Chairman), Dalhousie University

##### Tectonics Panel – TECP

Robin Riddihough, GSC

#### Regional Panels

##### Atlantic Regional Panel – ARP

Lubomir Jansa, GSC

##### Central and Eastern Pacific Panel – CEPAC

Earl Davis, P.G.C.

##### Indian Ocean Regional Panel – IOP

John Ludden, Université de Montréal

##### Southern Oceans Regional Panel – SOP

Brian Bornhold, GSC

##### Western Pacific Regional Panel – WPAC

Steve Scott, University of Toronto

#### Service Panels

##### Downhole Measurements Panel – DMP

Matthew Salisbury (Chairman), Dalhousie

##### Information Handling Panel – IHP

Ian Gibson, University of Waterloo

##### Pollution Prevention and Safety Panel – PPSP

Graham Campbell, EMR, Ottawa

##### Site Survey Panel – SSP

John Peirce (Chairman), Petro-Canada

a focal point for the program in Canada. The Chairman of the CNC is normally the Canadian representative to the JOIDES Planning Committee and the Director of the Secretariat. Until March, 1988 the Secretariat is located at Dalhousie University but it is anticipated that it will rotate among interested institutions on a three-year basis.

Six cruises took place in 1986 and eight Canadians participated in them. These are summarized in Table 14. Nominations for participants in the Weddell Sea, South Atlantic and Indian Ocean legs were made and Paul Robinson accepted an invitation to be Co-Chief Scientist on the Southwest Indian Leg (118) in 1987. John Peirce (Petro-Canada) was invited to be a Co-Chief for Leg 116 in the Indian Ocean but had to decline.

Canadian scientific activities increased significantly in 1986 with many more Canadians becoming aware of the program. A master list of ODP-related scientific activities was compiled by the Secretariat and is published in every newsletter.

The Canadian National Committee met twice in 1986 — in February at U.B.C. and in September in Calgary. A major result of the February meeting was a recommendation that more representation from the resource industry be encouraged on JOIDES panels and committees.

An important event associated with the second CNC meeting was a one-day workshop for petroleum geologists and geophysicists. This session and an information article by John Peirce on "Why Should the Exploration Industry Support Canada's Participation in ODP?" were useful in encouraging more involvement from that group. As noted above, Pat McLellan from Petro-Canada participated in Leg 110 and was the first Canadian industry representative to take part in an ODP cruise.

In September, the CNC hosted a national ODP Workshop in Montreal that was attended by about 90 scientists from across the country. Felix Gradstein was chairman of the organizing committee. This meeting led to the development of future themes for ocean drilling to be submitted to Conference on Scientific Ocean Drilling (COSOD II) and to the formulation of over 25 detailed drilling proposals. It also allowed scientists from government, industry and universities to discuss mutual research interests and plan coordinated studies. It is hoped that this workshop can become an annual event. An NSERC workshop grant helped with expenses associated with the meeting.

The Canadian Council for ODP met twice in 1986 — in April in Calgary and in October in the Pacific Geoscience Centre in Sidney, B.C. Funding of the program within Canada was a major topic of discussion at both meetings. The ODP subscription fee for 1986 was paid from EMR (GSC), NSERC, NRC, DRIE and DFO. Internal funding of Canadian operations, including Secretariat expenses and travel expenses to JOIDES meetings for university scientists came from an NSERC award and industry contributions from Shell, BP, Petro-Canada and Chevron.

The Secretariat continued to maintain records on all aspects of Canadian operations. The mailing list increased to include over 600 persons and Newsletters were distributed in February, May and October. A major public relations activity involved production of a poster, featuring a photograph of an iceberg taken from the drillship during Leg 105 in Baffin Bay. This poster has been widely distributed in Canada and many copies have gone to other countries. The display was taken to numerous conferences, including: 1) the Prospectors and Developers Association in Toronto in March; 2) the Canadian Society of Exploration Geologists meeting in Calgary in May, where P. Robinson gave a talk; 3) the GAC/MAC in Ottawa in May where a Special ODP session was held; 4) the Canadian Society of Petroleum Geologists meeting in Calgary in June, where S. Srivastava spoke on Leg 105; 5) a Geotechnical Society meeting in St. John's in June, to which K. Moran took the display; and 6) the Arctic Offshore Technology Conference in Calgary in October, at which P. Robinson gave a luncheon address. P. Robinson also gave talks at several GAC section meetings, the University of British Columbia, St. Mary's University and at a meeting of the Continental Drilling Group. Several news items were published including short articles in *Geolog* (v. 15, p. 2), *Atlantic Science* (March-April), *CSPG Reservoir* (July) and an article about the NSERC award for the Secretariat in the *Dal News* at Dalhousie University. National publicity for ODP will result from a children's television science program, "Wonderstruck" for which Matt Salisbury and Larry Mayer were filmed in the fall. Local publicity for ODP also resulted from a Mini-Symposium held at Dalhousie in March for area scientists. In August, Louisa Horne, together with numerous administrative personnel from U.S.A., took part in a transit cruise from Barbados to Panama City on board the JOIDES Resolution.

Canadian representatives on JOIDES Panels attended approximately 45 meetings in the various member countries and five of these were hosted by Canadians: Site Survey Panel in Vancouver in April, Central and Eastern Pacific Panel in Sidney in June, Planning Committee in Corner Brook in August, Executive Committee in October. Three Canadians were Chairmen of Panels in 1986 — Matt Salisbury (Dalhousie University), Downhole Measurements; Larry Mayer (Dalhousie University), Sediments and Ocean History; and John Peirce (Petro-Canada), Site Survey.

A second Conference on Scientific Ocean Drilling (COSOD II) will be held in July 1987 in Strasbourg, France. Ray Price, Director General of the Geological Survey of Canada is the Canadian representative on the Steering Committee. He attended the first meeting of that group in September in Strasbourg at which four other Canadians were appointed to four of the five working groups to plan the conference: Brian Bornhold (PGC), Global Environmental Change; Earl Davis (PGC), Fluid Circulation and Global Chemical Budget; John Malpas (MUN), Mantle-Crust Interactions; and Glen Stockmal (AGC), Brittle-Ductile Deformation of the Lithosphere.

1986 was a year of increasing participation and activity in Canada and the organization of ODP in Canada was formalized. It was a successful and very busy year for all concerned.

*P. Robinson*

#### *4. International Geoscientific Relations*

*See Report of the Foreign Secretary.*

#### *5. Canadian National Committee, International Union of Geological Sciences*

*See Report of the Foreign Secretary.*

## REPORTS OF THE REPORT COMMITTEES

### *1. Geoscience Research in the Petroleum Industry*

The survey of Geoscience Research in the Petroleum Industry was essentially completed in 1986, and has been submitted for printing.

The study provides the first look into research and development in the industry sector and provides valuable insight. The outlook of the different sectors — oil and gas industry, service industry, government institutions and universities — is significantly different. The outlook of large trans-nationals is also different from that of the Canadian companies.

The survey documents conditions that existed in 1985. The drastic reduction in oil price in 1986 greatly altered that picture.

*D.W. Devenny*

### *2. Geoscience Research in Mineral Exploration*

The December 1986 meeting of the Canadian Geoscience Council in Ottawa officially disbanded the committee examining research and development in the mineral industry. This followed a presentation by Dr. Colin Godwin who pointed out that: (1) some parts of the earlier surveys had become dated, (2) putting the report together required a time commitment best undertaken under contract, and (3) individual chairmen of the various subcommittees of the project might be willing to separately publish results from their work following approval of same by the Canadian Geoscience Council.

*C. Godwin*

### *3. Quaternary Geoscience in Canada*

The committee established by the Canadian Geoscience Council to examine the role and status of Quaternary Geoscience in Canada, revised a preliminary draft of its final report in the early part of the year. An English version was submitted to the Council at its May meeting. During the summer a French text was prepared and all components of both versions were received by the Geoscience Information Division, Geological Survey of Canada early in 1987 for publication by the time of the Twelfth International Congress of INQUA. Delegates to the Congress will receive a leaflet describing in some detail the principal conclusions of the report (as outlined in the 1985 report to the Committee) and information on where to purchase the full report.

*J.B. Bird*

### *4. Comparative Study on Funding of Earth Sciences in Canada*

A committee was formed by the Canadian Geoscience Council to establish terms of references for an independent comparative study of levels of geoscience funding in Canada. The study, to be carried out by the Queen's University Centre for Resource Studies, will commence on January 1, 1987 and a final report is anticipated in the Spring of 1988. Levels of geoscience funding in Canada will be compared with other scientific disciplines, other developed nations and other industry related scientific expenditures.

Seed funding for the study was provided by the CGC but full funding is to be derived from both levels of government, industry and geoscience related associations.

*D.K. Mustard*

### *5. Careers in Geoscience Booklet*

Work on a revised version of the *Careers in Geoscience* booklet continued during the year by a committee consisting of Norah J. Allman, E.B. Freeman and E.V. Sado.

*N.J. Allman*

## ***6. Registration of Geoscientists Committee***

The past year was an exciting one regarding the evaluation of a Canada-wide Accreditation and Registration system for the Geosciences. The community was on a rapid learning curve as to the concerns of various sectors.

The geological sciences have changed significantly from: the days of Hutton and Lyell, when these academic geologists were considered to be near or beyond the edge of social realm to the swashbuckling Klondike and Spindletop era to present day when a majority of society is concerned about the environmental impact of a new mine, a sour gas well, a new building, and the ethics of their educated leaders.

Although our scientific community has a variety of attitudes which reflect our heritage, a common thread of interest has developed. There seems to be unanimous agreement that should registration procedures be implemented in the territories and provinces, individuals once registered in any area should have the ability to transfer registration to another area.

It has therefore become the major objective of the committee to focus upon transferability from area to area for registered geologists. To accomplish this objective a small committee has been established. As evolution proceeds, the social pressures for the development, growth, and control of an expanding registration system will undoubtedly require the formation of several sub-committees.

The current representatives are Robert S. Hewton, Exploration Manager, Brinco Mining Ltd., Vancouver, British Columbia, Dr. Hugh Miller, Memorial University, St. John's, Newfoundland, and John B. Maher, Polaris Petroleums Ltd., Calgary, Alberta.

*J.B. Maher*



## REPORTS OF THE ADVISORY AND STEERING COMMITTEES

### *1. Advisory Committee to the Geological Survey of Canada on Outputs in Quaternary and Engineering Geology*

The draft final report of the committee was submitted to GSC Director General, R.A. Price, at the end of September, 1986, and to the Canadian Geoscience Council. Comments and questions were received from the Geological Survey at the end of December. It is anticipated that the final report will be submitted to the GSC by the end of January, 1987.

*M. Church*

### *2. Lithoprobe Steering Committee*

At the beginning of 1986, the Steering Committee was still awaiting the outcome of the review which NSERC had carried out of the initial proposal. Following the January 1986 meeting of NSERC, the Steering Committee was informed that while the review was basically positive, a new submission would be required, to address a number of issues which, it was felt, had not received sufficient attention initially. Funds were made available to the Steering Committee to permit it to produce this revised submission. The new proposal was completed in May, 1986 in an attractive format and in sufficient numbers for distribution to the Canadian geoscience community as well as to NSERC and EMR.

Following a further review, the NSERC council at its meeting of October, 1986, resolved in principle that Lithoprobe should be supported at a viable level. Again, a number of detailed questions on organizational structure and funding were directed back to the Steering Committee, and the month of November saw intensive study by the Committee and three ad hoc working groups. The required information was made available to NSERC in December.

At its meeting on January 13, 1987, NSERC decided to fund Lithoprobe at \$2 500 000 for the first year, with an additional \$700 000 to be provided if it can be matched with direct contributions from the private sector. A commitment in principle was given for future years, subject to satisfactory progress as determined by peer review. At a press conference held on January 20, 1987, Minister of State for Science and Technology, Frank Oberle, and Minister of State for Forestry and Mines, Gerald Merrithew, announced that the funding (NSERC and EMR) would be \$25 000 000 for five years. Lithoprobe is the largest project in any discipline yet funded by NSERC.

*G.D. Garland*