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Part 1: An Examination of the Output of the Geological Survey of Canada

J.A. Coope, B. D'Anglejan, P.L. Gordy, D.W. Strangway
A. Sutherland Brown and M.G. Tanguay

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GEOLOGICAL SURVEY
PAPER 82-6, PART 1

THE GEOSCIENCES IN CANADA, 1982

Part 1: An Examination of the Output of the Geological Survey of Canada

By the

Advisory Committee to the
Geological Survey of Canada

Chairman: J.A. Coope
Members: B. D'Anglejan, P.L. Gordy, D.W. Strangway
A. Sutherland Brown and M.G. Tanguay

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PART 1

FOREWORD

Canada's geological data base, coupled with its political stability and sometimes difficult, but workable natural resource legislation, has proved to be an essential ingredient of natural resource development. This same geological data base has also established that Canada has a major and exciting natural resource potential which will form the basis of the country's ongoing development, growth and prosperity. The continuing study of geoscience and the advancement of our understanding of geological environments is fundamental to Canada's future.

Following are Conclusions and Recommendations prepared by the Advisory Committee to the Geological Survey of Canada following an examination of the published and informal output of the GSC. The Committee was appointed in October 1979 by the Canadian Geoscience Council at the request of the Geological Survey.

Part 2 of this report contains a summary of the Committee's activities and findings leading to the Conclusions and Recommendations that are presented. During the course of the report preparation, the members of the Committee have reviewed draft copies with the Survey management and more detailed subcommittee reports have been submitted to the then Acting Director General (see Section 1).

Both parts of this report were submitted to Dr. W.W. Hutchison, Assistant Deputy Minister, Earth Sciences (EMR) in late 1982 and together with the Geological Survey's Commentary, were reviewed by the Executive Committee of the Canadian Geoscience Council prior to the Council's Annual Meeting in December 1982. Subsequently the text was reviewed by the full Council and at Council's May 1983 meeting it was approved and the Geological Survey of Canada was asked to arrange for the publication of both English and French editions.

CONCLUSIONS

C1. During its 140 year history, the Geological Survey of Canada has amassed a huge and impressive amount of data on the geological framework of Canada and its resources and has established itself as one of the leading geological surveys internationally and as an important, productive contributor to the economy of Canada.

C2. A sound knowledge of Canada's geological data base is an essential ingredient for effective resource appraisals and is fundamental to the country's efficient economic development. Furthermore, the continuing study of geoscience and the advancement of our understanding of geological environments contributes substantially to the enhancement of the quality of Canadian life.

C3. Changing social, economic, political and technological pressures are influencing the responsibilities of the Geological Survey of Canada and the demands on its output. The GSC continues to develop the necessary flexibility to fulfill its important role in this changing environment.

C4. Most of the lay-public in Canada are unaware of the Geological Survey of Canada's programs and the economic importance of its output.

C5. A difficult management environment exists within the Geological Survey of Canada. Some management concepts employed contrast markedly with management exercised in the private sector, and GSC management is frequently required to accommodate rather than eliminate levels of inefficiency and nonproductivity which affect the Survey output.

C6. Current Research, Outside Journal and Open File production by the bedrock mapping divisions of the GSC has increased in recent years at the expense of Memoirs and Papers. The specialist divisions have established a decreasing pattern in Current Research, Outside Journal, Memoir, Bulletin and Paper production, in contrast to an increasing Open File output.

C7. Within the very broad framework defined by the objectives of the Geological Survey of Canada, the orientation of research in some divisions is strongly influenced by the initiatives of individual scientists.

C8. Communication on the one-to-one level between Geological Survey scientists and their counterparts in other sectors and estates, once developed, is commonly co-operative and productive. Despite this there are inadequacies in communication at other organizational and management levels.

C9. Integration of disciplines is endorsed by many at the Survey and some programs embrace this concept. However, the benefits of integration are not always utilized to advantage.

C10. The Geological Information Division's current printing budget of $275 000 (1980 dollars) is adequate to publish all Geological Survey output presented for publication.

C11. The work of the Geological Survey of Canada is ineffective without a well-sustained Geological Information Division.

C12. The degree of use of Geological Survey of Canada data in other sectors of the Department of Energy Mines and Resources and other federal agencies is quite variable. There is agreement that the GSC contribution is often a vital data source for these other sectors and the quality of output is excellent. However, criticism is focused on its orientation and timeliness.

C13. Data obtained from a questionnaire survey indicate that slightly more than 90 per cent of the Canadian geoscientific public use the Geological Survey's published and informal output. The consensus of these users is that this GSC product is irreplaceable.

C14. The dominant interest and/or activity of the respondents to the questionnaire is the exploration for mineral and energy resources. This group obtains an invaluable indirect economic benefit from the Geological Survey of Canada's output.

C15. The geoscientific public is almost unanimously complimentary of the format of the Geological Survey of Canada's publications.

C16. The most frequently used publications are Bedrock Maps, Memoirs, Bulletins and Papers.

C17. Microfiche is becoming slowly accepted by Canadian geoscientists but data tapes are not yet widely used.

C18. The four regions of greatest interest to geoscientists in Canada are the Western Cordillera, the Precambrian Shield, the Western Canada Sedimentary Basin and the Appalachian Region.

C19. Disciplines of greatest interest and use are Reconnaissance, Detailed and Regional Geological Mapping; Metallogenic Studies; Surveys and Appraisals of Metal Mineral Resources; and Geochemical and Geophysical Surveys and Technology.

C20. Standards of accuracy, reliability and scientific quality of Geological Survey of Canada output in all regions and disciplines are high. This established reputation for quality promotes the use of the GSC published output.

C21. In essentially all regions and disciplines, the Geological Survey of Canada output serves the needs of the Canadian geoscientific public "acceptably" to "well".

C22. The dominant ratings of the Geological Survey of Canada's timeliness of production of data on regions and disciplines is acceptable. Notwithstanding, this aspect of the GSC output production is widely criticized.

C23. Geological Survey of Canada management is aware of the geoscientific public's criticism of the GSC's timeliness of production. In recent years, the greater emphasis placed on Open File and Current Research publications at the expense of more traditional formal output has not significantly lessened this criticism.

The introduction of the Open File and Current Research formats has been welcomed and applauded. However, final reports of GSC projects (the formal output) constitute the most desired and widely used product of GSC activity.

C24. Opinion on the duration of usefulness of Geological Survey of Canada output has a bimodal distribution. The predominant rating is "greater than 20 years" with a secondary rating of "10 to 15 years". Resource Surveys and Appraisals characteristically have shorter durations of usefulness.

C25. The Canadian geoscientific public finds that the informal interaction with Geological Survey of Canada scientists at national and international conferences, symposia and workshops is productive.

C26. The publication of papers by Geological Survey of Canada scientists in outside journals exposes the output to review by specialists in other estates and institutions. This broader exposure contributes to the maintenance of high geoscientific standards of output.

C27. With very few exceptions, the published output of the Geological Survey of Canada is refereed in-house.

C28. There is a continuing but variable demand for certain out-of-print Geological Survey of Canada publications.

C29. Geological Survey of Canada Maps and other formal output are extensively used at the undergraduate and graduate university levels. The GSC product is frequently acknowledged as a data base for thesis and other research projects and is frequently chosen as the standard of excellence for data and case-history presentation. Open File and Microfiche output are unsuitable teaching aids.

C30. Engineers and planners consider basic Terrain Science Data produced by the Geological Survey of Canada to be vital for land use studies. However, coverage and rate of production of maps is not meeting present demands.

RECOMMENDATIONS

R1. The Advisory Committee recommends that the Geological Survey of Canada should continue to strongly emphasize its core program of mapping and related research designed to improve and expand the knowledge of the geological data base as it relates to the Canadian landmass. This is a reaffirmation of one of the principal recommendations of the previous Advisory Committee (Weir et al., 1979 in GSC Paper 79-6).

R2. The Advisory Committee recommends that the present management environment in the Geological Survey of Canada be subject to review.

R3. The Geological Survey of Canada and the management of the Department of Energy Mines and Resources should place greater importance on increasing the public's awareness of GSC activities and on the dissemination of the significant results from geoscientific studies regarding resources, natural environments, geological hazards and other topics of national importance.

R4. The Geological Survey of Canada should also devote a greater effort to communication with geoscientists through open houses, conference participation, integrated projects and exchange of personnel.

R5. The Geological Survey of Canada should place greater emphasis on the publication of final reports and the restoration of a balance between its formal output and its response to the demands for timeliness through the publication of Open File reports and Current Research volumes.

R6. The Geological Survey of Canada management should carefully control the initiation of new projects and introduce procedures which will ensure a regular and timely flow of information from these projects to the public.

R7. Geological Survey of Canada policy should require that important, innovative, formal GSC publications introducing new concepts and ideas be subject to external review.

R8. The information services and activities in the Geological Survey of Canada should be well sustained so as to provide the leverage that will facilitate the full and efficient production of publications.

R9. The Geological Survey of Canada should take an active and leading role in promoting and effecting interdisciplinary co-operation between agencies and sectors in the Federal Government responsible for geoscientific disciplines (such as groundwater studies and many aspects of geophysics) which are not presently included in the GSC mandate.

R10. The Geological Survey of Canada should continue to encourage co-operative activity and the development of programs with provincial surveys, universities and with industry in order to make the most effective use both of available funds and of the pool of geoscience talent in Canada.

R11. The Geological Survey of Canada should continue its important function of utilizing and evaluating new disciplines and technology to establish their usefulness and application in Canadian geoscience.

R12. In those disciplines where budget restraints and excessive costs preclude a truly effective role for the GSC, opportunities should be selected which would allow the Survey to make productive contributions and meet its objectives without duplicating costly quality data and expertise available in other Canadian organizations.

R13. Through the established National Geological Surveys Committee, the Geological Survey should explore the potential benefits of liaison with other established associations representing the mineral resource industries and geotechnical groups.

R14. The Geological Survey of Canada should encourage, possibly through the National Geological Surveys Committee, the creation of more outlets across Canada for the sale of GSC publications. Such outlets could also distribute provincially as well as federally derived geoscientific literature and also maintain indices, and possibly supplies, of available topographic, air photograph and satellite photograph coverage.

R15. The libraries of the Geological Survey of Canada should be nurtured as a significant resource for the nation.

R16. The Advisory Committee recommends that consideration be given to the initiation of an annual subscription for information publications produced regularly by the Geological Survey of Canada. Such publications should include the Monthly Information Circular, the GSC Yearly Index, the Cumulative Index, the Volume of Abstracts and Current Research volumes.

R17. The Geological Information Division should investigate procedures for the economical reproduction of out-of-print GSC publications and impliment a program of reprinting publications of established merit and demand.

COMMENTARY BY THE GEOLOGICAL SURVEY OF CANADA ON THE REPORT OF THE CGC ADVISORY COMMITTEE: AN EXAMINATION OF THE OUTPUT OF THE GEOLOGICAL SURVEY OF CANADA

This final version of the report was received in June 1982, after an earlier draft had been reviewed by the management of the Geological Survey. It is a credit to the dedicated efforts of the Committee, first in developing procedures for carrying out the task assigned to them by the Canadian Geoscience Council "to make an examination of the published and unpublished output of the Geological Survey of Canada with respect to its scientific quality and presentation, relevance to the Departmental mission, usefulness to users, timeliness, format and efficiency of production", then in assembling and synthesizing information, and finally, in working so closely with the management of the Geological Survey that they and the Committee are either clearly in agreement or else have distinctly different opinions concerning the various issues raised in the report.

The following comments are addressed primarily to the Committee's recommendations. In addition, Conclusion 12 is singled out for comment because of the importance of GSC outputs for other federal agencies. Finally, there is a comment on proposals made by the Committee on timeliness of project completion and publication in Section 7 of the report.

Comments on Individual Recommendations

R.1 *The Advisory Committee recommends that the Geological Survey of Canada should continue to strongly emphasize its core programme of mapping and related research designed to improve and expand the knowledge of the geological data base as it relates to the Canadian landmass. This is a reaffirmation of one of the principal recommendations of the previous Advisory Committee (Weir et al., 1979).*

The Geological Survey agrees.

R.2 *The Advisory Committee recommends that the present management environment in the Geological Survey of Canada be subject to review.*

This recommendation relates to the basic concern of the Advisory Committee – and the Geological Survey – that the output of GSC projects be communicated to potential users as quickly as possible. Geological Survey Management continues to devote itself to this end and is reviewing procedures in the context of the recommendations of the Advisory Committee.

R.3 *The Geological Survey of Canada and the management of the Department of Energy, Mines and Resources should place greater importance on increasing the public's awareness of GSC activities and on the dissemination of the significant results from geoscientific studies regarding resources, natural environments, geological hazards and other topics of national importance.*

Increased activity and new initiatives of this nature are obviously desirable. However, management must face the challenge of balancing expenditures for such communication against those required to achieve program objectives. This recommendation involves both increasing awareness by the public of the Geological Survey and increasing dissemination of geoscientific information to the public. Steps have recently been taken or are being planned to increase public awareness of the Geological Survey and the Earth Sciences Sector by issue of annual reports, release of brochures (e.g. new Institute of Sedimentary and Petroleum Geology brochure), and publicity in the news media (e.g. "Career" advertisements in Canadian periodicals). Of course, the continuing annual sales of more than 8000 rock and mineral sets is a major contribution to increasing public awareness of the GSC and the services it offers to Canadians. On the other hand, a significant level of dissemination of the results of geoscientific studies presented in a form suitable for the lay public, rather than only to geoscientists and professional user publics, would be costly and time consuming. The current move to increase the circulation of GEOS is an initial positive move in this regard.

R.4 *The Geological Survey of Canada should also devote a greater effort to communicate with geoscientists through open houses, conference participation, integrated projects and exchange of personnel.*

A GSC open house was held in Ottawa in January 1982 and will be repeated in 1983. The Institute of Sedimentary and Petroleum Geology will hold an open house in Calgary in November 1982. The Atlantic Geoscience Centre continues to play an important role in the Bedford Institute open house activities at Halifax/Dartmouth. The GSC Vancouver office uses the annual conference of the Geological Association of Canada in Vancouver as an opportunity to inform the mineral industry of current progress. GSC personnel recently have served terms of employment with the Department of Indian and Northern Affairs, the International Development Research Centre, Environment Canada, the Newfoundland Department of Mines, and the University of Ottawa. Examples of current multidisciplinary, interagency projects are those in the Wopmay Orogen between the Precambrian Geology Division, the Earth Physics Branch and several universities; the coordination of geology and aeromagnetic interpretation between Precambrian Geology and Resource Geophysics and Geochemistry divisions and also in Wopmay Orogen, and coordination

of work among the Atlantic Geoscience Centre, NRC and industry on new technology for submarine geoscience studies. Cooperative geoscience programs arranged between the GSC and the Newfoundland and Nova Scotia Geological Surveys are further examples.

R.5 *The Geological Survey of Canada should place greater emphasis on the publication of final reports and the restoration of a balance between its formal output and its response to the demands for timeliness through the publication of Open File reports and Current Research volumes.*

The Geological Survey agrees with the Committee on the long-term value of memoirs and bulletins, particularly to geologists involved in mineral exploration, but has found that other less expensive and less time-consuming forms of final publication are appropriate for many kinds of Survey projects. For example, the large amount of geochemical data released to industry during 1976-79 in the form of Open Files (often within 6 to 12 months of the start of field work) is now being used as the basis for a series of interpretative overview papers and coloured compilation maps. Far from considering that external demands interrupt the planned program, the GSC considers that such demands offer opportunities to expand and accelerate activities within the core program.

Many projects do not require a traditional final report prepared at considerable cost in time and published at a considerable monetary cost. Publication in scientific journals can be cost effective and because translation charges are not incurred such publications can be more quickly released. As the direction of the studies undertaken by the branch changes in response to external needs, it is likely that fewer and fewer terminal monographs will be published. The Branch Management Committee has established an ad hoc subcommittee to examine the format that can be used most effectively to make the results of our research program available to users.

Although the futuristic concepts expressed by phrases such as the "paperless society" may never be fully realized, and "hard copy" reports will continue to play a major role in communications, the demands for space that many libraries now face mean that a parallel method of compact data storage will be developed. This may be in the form of computer processable tapes, discs, etc. or microforms. Furthermore, many users will want access to raw data in order to carry out the syntheses now done by a GSC staff member and presented in GSC final reports, and thus also will require the use of new information storage and retrieval technology.

Thus, in response to this recommendation, the Geological Survey is attempting to serve its various customers effectively not only by providing rapid releases and progress reports but with longer term and "final" publications in a variety of forms designed to meet current needs and to recognize current capabilities.

R.6 *The Geological Survey of Canada management should carefully control the initiation of new projects and introduce procedures which will ensure a regular and timely flow of information from these projects to the public.*

Additional procedures "to ensure a regular and timely flow of information to the public" are being developed by GSC and additional care is being applied in approving new projects, but flexibility in the style of management is essential in project initiation. Development of effective GSC programs requires participation of both those who manage and those who carry out research. Research scientists must be encouraged to propose projects but research managers must ensure that all projects that are approved are appropriate to the current objectives and priorities and work schedules of the organization.

GSC projects frequently are changed formally in importance, orientation, or scope as they progress, both in response to the results of the project itself and to external forces and concerns affecting the project officer or the organization. The GSC must have the flexibility to start new projects in response to emerging needs and demands, even if existing projects will be delayed or abandoned. This flexibility is limited by the multi-year nature of GSC projects; but the GSC must respond to new scientific challenges and opportunities, and prepare to meet current or anticipated needs of government. As a result there are inevitable shifts in priorities, and delays in completing some projects in order to get on with others. The resulting delays in the completion of projects and in the release of final reports is knowingly accepted. This is a conscious element of our management style.

R.7 *Geological Survey of Canada policy should require that important, innovative, formal GSC publications introducing new concepts and ideas be subject to external review.*

The GSC comprises the largest and most diverse group of earth scientists in Canada, and management considers that this pool permits vigorous internal critical review. This is generally at least as thorough as outside journal review, and indeed may be considerably more thorough because it is done "within the family". Where expertise does not exist, or is not currently available in the GSC, outside reviewers are used. Moreover, a section of the GSC publication "Current Research" is devoted to discussion and critical comment of GSC reports by any interested readers. It provides a public forum that complements the reveiw process.

R.8 *The information services and activities in the Geological Survey of Canada should be well sustained so as to provide the leverage that will facilitate the full and efficient production of publications.*

Agreed.

R.9 *The Geological Survey of Canada should take an active and leading role in promoting and effecting interdisciplinary cooperation between agencies and sectors in the federal government responsible for geoscientific disciplines (such as groundwater studies and many aspects of geophysics) which are not presently included in the GSC mandate.*

The Geological Survey maintains contact with those federal agencies that have the mandate to carry out related geoscience disciplines and tries to generate or respond to proposals for scientific cooperation as resources permit. On the other hand, the programs of the government geoscientific agencies, including GSC, result primarily from the mandates and priorities of the organizations of which they are a part: scientific cooperation per se is a "by product" of these programs.

Examples of current interagency scientific cooperative projects are those between Earth Physics Branch and the Geological Survey in the Pacific offshore, and the "Wopmay orogen"; between the Geological Survey, NRC and industry on new technology for submarine geoscience; and between Geological Survey and Environment Canada on Radiometric Surveys.

R.10 *The Geological Survey of Canada should continue to encourage cooperative activity and the development of programs with provincial surveys, universities and with industry in order to make the most effective use both of available funds and of the pool of geoscience talent in Canada.*

The Geological Survey agrees. A number of new cooperative projects are in place such as the new programs with Nova Scotia and Newfoundland, and new projects in cooperation with Ontario and Manitoba.

R.11 *The Geological Survey of Canada should continue its important function of utilizing and evaluating new disciplines and technology to establish their usefulness and application in Canadian geoscience.*

The Geological Survey agrees.

R.12 *In those disciplines where budget restraints and excessive costs preclude a truly effective role for the GSC, opportunities should be selected which would allow the Survey to make productive contributions and meet its objectives without duplicating costly quality data and expertise available in other Canadian organizations.*

In planning projects, the Geological Survey attempts to select topics that do not duplicate investigations undertaken under other auspices and to cooperate with those involved in closely related work. Where priorities require that investigations be undertaken on topics involving unpublished data (e.g. industrial data), the Survey attempts to gain access to such data, to assess its relevance, and then to make appropriate adjustment to its own projects.

R.13 *Through the established National Geological Surveys Committee, the Geological Survey should explore the potential benefits of liaison with other established associations representing the mineral resource industries and geotechnical groups.*

In fostering professional contacts outside of the Federal Government, the Geological Survey develops and maintains contact with a large number of individuals and companies and, in addition, takes advantage of the liaison and communication opportunities afforded by the Canadian Geoscience Council, the National Geological Surveys Committee, and the new Industrial Advisory Committee to EMR on Earth Sciences.

R.14 *The Geological Survey of Canada should encourage, possibly through the National Geological Surveys Committee, the creation of more outlets across Canada for the sale of GSC publications. Such outlets could also distribute provincially as well as federally derived geoscientific literature and also maintain indices, and possibly supplies, of available topographic, air photograph and satellite photograph coverage.*

The GSC will explore with provincial agencies the recommendation that it encourage, possibly through the National Geological Surveys Committee, the creation of more publication sales outlets. We are well aware that users would welcome additional outlets. However, the cost of such a service would not be negligible and where no infrastructure exists would be high. Maintaining and managing an inventory that is made up of a large number of items for which there are limited annual sale (many GSC reports sell less than 20 copies per year) is expensive and may explain why the private sector have never been interested in marketing our output (except for selected items such as "Prospecting in Canada").

R.15 *The libraries of the Geological Survey of Canada should be nurtured as a significant resource for the nation.*

The Geological Survey is in agreement with this recommendation.

R.16 *The Advisory Committee recommends that consideration be given to the initiation of an annual subscription for information publications produced regularly by the Geological Survey of Canada. Such publications should include the Monthly Information Circular, the GSC Yearly Index, the Cumulative Index, the Volume of Abstracts and Current Research volumes.*

The feasibility of the proposal for an annual subscription for GSC Information Publications will be investigated with the Department of Supply and Services (the official government Publisher) although the GSC considers that the Monthly Information Circular should remain a free service.

R.17 *The Geological Information Division should investigate procedures for the economical reproduction of out-of-print GSC publications and implement a program of reprinting of publications of established merit and demand.*

Out-of-print reports for which there is a proven demand are commonly reprinted by DSS at their expense. Reports for which there is only a modest demand (less than 50 copies per year) must be reprinted at GSC expense; and with a limited publication budget this may be at the expense of publishing new work. The statement that reprinting could be profitable is somewhat misleading because the Branch at present does not retain revenues from the sale of publications. Microfiche copies of many out-of-print GSC reports concerned with the Territories have been prepared by Indian and Northern Affairs, and are distributed by ISPG.

During 1981-82, 8 reports were reprinted (2 memoirs, 1 bulletin, 3 Economic Geology reports and 2 papers) as were 5 maps. Up to June 30, 1982 51 copies of Memoir 402 had been sold, most during the two months following the announcement of its release in early 1982. In contrast an average of 100 copies per year are sold of Memoir 284, a compilation of reports on the Yukon first published in 1957 and subsequently reprinted several times. For all items sold by the GSC, whether original or reprints, sales are limited by the relatively small constituency served, and thus unit costs will always be high.

Conclusion on Output for Other Agencies of Government

A substantial and important part of the output of the Geological Survey is prepared in response to requests by or needs of other agencies of the Government of Canada both in the Department of Energy, Mines and Resources and in other Departments. The CGC Advisory Committee presents a single conclusion concerning this form of output:

C12 *The degree of use of Geological Survey of Canada data in other sectors of the Department of Energy, Mines and Resources and other federal agencies is quite variable. There is agreement that the GSC contribution is often a vital data source for these other sectors and the quality of output is excellent. However, criticism is focussed on its orientation and timeliness.*

Formal information on this subject is not easy to obtain through the recipient agencies, and the contacts made by the Committee members appear to have generated mainly comments on personal interfaces with officers or groups in the Geological Survey. Important as this one aspect is in the output of the Branch for other government agencies, the formal "products" deserve at least equal mention. Although some of these products are published or open filed and thus become part of the public output of the Survey, others are in the form of memoranda, briefing papers, internal reports, data sets, analytical services, verbal presentations, committee activities, and secondments of specialist staff. Some examples are listed below:

- Oil and gas resource assessments prepared for the Interdepartmental Petroleum Resource Appraisal Panel;
- Coal resource assessments contributed to the National Coal Inventory (EMR);
- Uranium resource assessments prepared as inputs to the EMR Annual Report on Uranium in Canada;
- Written and verbal commentaries, committee functions and project management on behalf of the Mineral Policy Sector of EMR (and DREE) in connection with Federal/Provincial mineral agreements;
- Reports for or by agreement with the Department of Indian Affairs and Northern Development on resource and environmental questions – (e.g. resource assessments for proposed northern parks and for areas involved in Native Claims; input to Lancaster Sound "Green Paper");
- Reports to Parks Canada on geological aspects of National Parks;
- Commentaries, reports, and membership on panels for the Federal Environmental Assessment and Review Office (commonly through the EMR Environmental Affairs Office);
- Secondment of a prominent geologist for two years to the Department of Indian Affairs and Northern Resources as Yukon Geologist.

One of the challenges faced by managers in the Geological Survey in providing these short-term outputs for other government agencies is to do so effectively and in the required time-frame while, at the same time, maintaining the long-term program of geological research and surveys that provides the knowledge base which is required to meet these and a variety of other needs. Insofar as possible, the long-term scientific program is adjusted so as to anticipate the short-term needs of government, but such adjustments add to the complexity of project management (see Recommendation 2).

Proposals (Section 7) to Improve Timeliness of Output

The Committee makes the following three proposals designed to accelerate publication of the results of projects:

1. A progress report for every project is to be published every two years;
2. Final project reports are to be submitted within a specified time (e.g. one year) of completion of field work or data collection;
3. Both critical reading of manuscripts and the author's subsequent revision are to be completed within a fixed time frame (eight weeks for each stage).

The Geological Survey agrees wholeheartedly with the objectives of the Advisory Committee in making these proposals to achieve more rapid publication of both preliminary and final output of projects. However, Branch Managers consider that rigid application of the proposed schedules routinely to all projects is impractical (see section of this commentary dealing with Management Style). Present procedures set publication targets for each project at the beginning of each fiscal year, monitor progress at the Divisional level at mid year, and require submission and review of a statement of progress at year end. Within this framework, the Survey intends to issue the scheduling proposals of the Advisory Committee to both project officers and managers as guidelines for manuscript preparation.

The same section of the Advisory Committee report suggests that "Current Research" should annually list and indicate the status of all Geological Survey projects as a means of informing the geoscientific public of work in progress. The Branch recognizes the usefulness of a public listing of the total program. At the present stage of evolution of "Current Research" as a scientific publication, a program list seems out of place and, therefore, other mechanisms are being explored.

PART 2

AN EXAMINATION OF THE OUTPUT OF THE GEOLOGICAL SURVEY OF CANADA

"The Geological Survey of Canada...is subject to all the political, economical, geographical, cultural and technological pressures which buffet our society today"[1]

1. INTRODUCTION

The Geological Survey of Canada (GSC) has two broad objectives. Firstly, it is concerned with collecting information pertaining to the geological framework of the Canadian landmass (including the continental margins), its properties, evolution and development. Secondly, it is concerned with resource identification and resource development. Both objectives are interdependent. Information on bedrock geology, its geochemical, geophysical and other geoscientific characteristics, obtained through systematic surveys, regional studies and compilations, is essential to the identification and appraisal of resources. Studies of the nature and evolution of the Canadian landscape, its surficial materials, terrain properties, processes, hazards and use capabilities are integral in the evaluation of the effects of resource development.

Numerous happenings during the 1960s and the 1970s have focused attention on the importance of geoscience in the future of civilization. These include (i) the growing public awareness of the natural environment, (ii) the revolution in Earth Sciences primarily related to the evolution of plate tectonic theory, (iii) the public debates on the availability and the management of nonrenewable resources, (iv) the space program, (v) the impressive development of technological expertise, (vi) the impact of the energy crisis and of major energy and pipeline projects, and (vii) the escalating prices of fuels. The impact of these events on social, economic and political activities and developments has been profound. The uninformed and the unprepared have reacted hastily (and often wrongly), or not at all and the present public and political conception of geoscience is confused and very often misunderstood.

These concerns have created urgent public demands for more specialized data on this country's geological framework, on its mineral resources, on its natural environments and on geoscientific standards of reference. In turn, these pressures have had a pronounced influence on governments and political policies. The net result is that the demands on the output of the Geological Survey of Canada are changing.

Increasingly, during the past two decades, a major output of the Geological Survey of Canada has been the provision of scientific advice and data to regulatory agencies within the Government of Canada. This has put major stresses on the Survey's traditional role of core geological mapping and research involving the gathering, analysis, collation and interpretation of geoscientific data.

Understandably, the more practical data-gathering programs of the Geological Survey of Canada have been interpreted by some in the private sector as an unwarranted and unwelcome incursion of government into mineral exploration and other fields which, in previous years have been, traditionally, the preserve of private enterprise. The present-day environment of the Geological Survey is therefore a complex and difficult one. Along with other sectors of the Department of Energy, Mines and Resources, and government in general, the Geological Survey of Canada is adjusting and evolving to fill an expanding role necessitated by increasing public awareness and concern related to natural resources and the environment.

These demands not only focus attention on the Geological Survey from without, but have significantly modified its responsibilities. The Survey is now charged with fulfilling an expanding role in communication with other public servants and taxpayers at large, while at the same time, its effectiveness is squeezed by inflationary pressures on budgets and by a decrease in its conceived importance in its own Ministry.

The Advisory Committee and Its Terms of Reference

A proposal that the output of the GSC be examined and appraised was included in the report of the First Advisory Committee to the Geological Survey of Canada (Weir et al., 1979). This recommendation coincided with the initiation of a Department of Energy, Mines and Resources (EMR) evaluation of the program of the Geological Survey forming part of a larger, ongoing evaluation of all Federal Government programs. The Canadian Geoscience Council (CGC) was requested to provide a peer evaluation of the GSC output and, in October 1979, a new Committee of six geoscientists commenced such an examination. The six Committee members, representing several disciplines within the Academic Sector, the Provincial Government Sector and the Mining and Petroleum Industries[2], were nominated by member societies of the Canadian Geoscience Council and appointed upon recommendation by the Geological Survey of Canada. B.S. Norford, GSC Advisor, has ably and willingly assisted the Committee during the course of its work.

The specific terms of reference of the current Advisory Committee were prepared as follows:-

> " Examination of published and unpublished output of the Geological Survey of Canada with respect to its scientific quality and presentation, relevance to the departmental mission, usefulness to users, timeliness, format and efficiency of production.
>
> Output would be evaluated by the Committee by means of interviews with, and surveys of, users of GSC output with respect to the following;

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[1] Weir et al., 1979, A Report Concerning the Geological Survey of Canada, in GSC Paper 79-6.

[2] J. Alan Coope, Newmont Exploration of Canada Ltd., Toronto, Chairman.
B. D'Anglejan, Institute of Oceanography, McGill University, Montreal.
P.L. Gordy, Shell Canada Resources Limited, Calgary.
D.W. Strangway, University of Toronto, Toronto.
A. Sutherland Brown, British Columbia Ministry of Energy, Mines & Petroleum Resources, Victoria.
M.G. Tanguay, Mineral Engineering, Ecole Polytechnique, Montreal.

Scientific Quality and Performance

Examine quality of data, adherence to standards, significance and impact of new concepts and methodologists, and adequacy of regional correlation and synthesis and disciplinary reviews. Is the GSC doing good science and presenting the results clearly and concisely?

Relevance and Usefulness to Departmental Mission and to Users of GSC Information

1. Does GSC output, resulting from geoscience mapping – mainly at 1:250 000 and smaller scales – and related regional and topical studies, provide information suitable to describe, portray and explain the geological framework of Canada?

2. Does GSC output from nonrenewable resource studies – resource geology, identification of the resource base and resource appraisals – meet the needs of EMR resource policy?

3. Does all the above output provide useful information to the mineral and petroleum industry concerned with exploration and exploitation of Canadian mineral and energy resources?

4. Does GSC output meet the needs of engineers and planners concerning land-use, particularly the identification of natural hazards and the impact of development on terrain?

5. How useful is GSC output to the teaching of the earth sciences in universities?

General Questions

1. Is the information timely and relevant?
2. Is it useful to and in a format suitable for users?
3. What innovations should be explored?
4. Are the methods used to produce information efficient?
5. How effective are the GSC outputs in meeting department objectives?"

Activities of the Advisory Committee

Geoscience is important. The Introduction to this report details some of the events and situations that have focused attention and heightened interest in fields of geoscience in recent years. One can confidently predict that awareness of geoscience will progressively increase with time as the demands of the population increase and dependence on a proper understanding of earth resources becomes absolute.

The Committee has addressed itself to four main activities:-

1) to an examination of published data production within the GSC and the activities of the Geological Information Division (GID).

2) through interviews with senior personnel, the determination of how the individual GSC Divisions view the quality of their product, the present and future needs of their public and how geological information is generated.

3) by forming three subcommittees, the review of both published and unpublished GSC output, its quality, value and timeliness with personnel in other agencies of EMR including the Mineral Policy Sector (MPS), the Energy Policy Sector (EPS), the Atomic Energy Control Board (AECB), Earth Physics Branch and the Canada Centre for Mineral and Energy Technology (CANMET), and in other departments of the Federal Government including the Departments of Agriculture, Public Works, and Indian Affairs and Northern Development (DIAND).

Other interviews have sought opinion from private industry, Ontario Hydro, private consultants and university staffs.

4) through a detailed questionnaire, prepared on behalf of the Committee by Atholl Sutherland Brown, the sampling of opinion and data on GSC output from companies, individuals and consultants involved in mining and mineral exploration, the geotechnical and utility fields and the petroleum production and exploration industries. In addition, personnel employed by provincial survey and mines departments, other geoscience agencies and university geoscience departments were polled. A control group of individual geoscientists, randomly selected from the membership of CGC member societies, was also included in the distribution. Of 838 questionnaires distributed, 395 were returned, for a response of 47.1 per cent. This level of response is considered to be unusually high by statisticians familiar with opinion surveys. The response also indicates that the questionnaire was well received and that there is a high level of interest among Canadian geoscientists in GSC programs.

The increasing importance of geoscience to Canadians in all walks of life, dictates that no enquiry into the published and unpublished output of the Geological Survey of Canada can ever be absolutely complete. However, a careful and extensive review of all the information gained from its enquiries, has provided the Committee with a reasonably balanced insight into fact and opinion in pursuit of its mandate.

Despite the evident high quality of the GSC output, some difficulties and problems have been identified and this report presents several recommendations for consideration.

2. OBJECTIVES OF THE GEOLOGICAL SURVEY OF CANADA

The introductory section to this report contains a paraphrased summary of the general objectives of the Geological Survey of Canada. These objectives are revised from time to time and are subject to the approval of the EMR and other levels of the Federal Government. The following tabulation, under the heading "Geological Surveys Activity", presents the more complete summary submitted in 1981. Additional details with long term plans are included in Appendix B (available for consultation as GSC Open File 946).

Geological Surveys Activity:

Activity Objective

To ensure the availability of comprehensive knowledge, technology and expertise pertaining to the geology of Canada (onshore and offshore), including geological aspects of mineral and energy resources and the geological conditions affecting land and seabed use; in order to estimate the resource base of Canada, and provide assistance in the formulation of mineral and energy policy, resource exploration and exploitation, and the effective management of land and resources.

Sub-Activity Objectives

1. Cordilleran Geology – to ensure the availability of comprehensive knowledge, technology and expertise on the bedrock geology and mineral resources of the western Cordillera and on the marine geology of the Pacific continental margin.

2. Sedimentary and Petroleum Geology – to ensure the availability of comprehensive knowledge, technology and expertise on the geology and resource potential of the sedimentary basins of western and northern mainland Canada, the Arctic Islands, and the Arctic offshore regions. Oil and gas assessment responsibilities are national in scope and will be carried out in co-operation with other components in the Activity.

3. Precambrian Geology – to ensure the availability of comprehensive knowledge, technology, and expertise on the bedrock geology and mineral resources of the Canadian Precambrian Shield.

4. Atlantic Geoscience – to ensure the availability of comprehensive knowledge, technology and expertise on the geology (including resources) of the Atlantic and Arctic offshore regions of Canada and the sedimentary basins of the Appalachian region.

5. Terrain Sciences – to ensure the availability of comprehensive knowledge, technology and expertise on the surficial geology, geomorphic processes and natural terrain hazards of the Canadian landmass and on the capability of the terrain to support human activities.

6. Economic Geology – to ensure the availability of comprehensive geological knowledge, technology and expertise concerning the nature and occurrence of metallic and other mineral deposits, and to determine the probable distribution and potential abundance of Canadian mineral resources to facilitate exploration, land-use planning and formulation of policy.

7. Resource Geophysics and Geochemistry – to provide geophysical and geochemical information on a nationally consistent basis (a) to facilitate the discovery, evaluation and transportation of Canada's mineral (principally metalliferous) resources, and (b) to improve knowledge of the country's subsurface geology:

   - by conducting appropriate R&D relating to existing and new methods of exploration technology, data interpretation and presentation;
   - by undertaking the R&D necessary to establish national measurement and reporting standards in exploration geophysics and geochemistry;
   - by obtaining and compiling geophysical and geochemical data for systematic national or regional surveys;
   - by integrating all relevant geoscience data to provide comprehensive interpretations.

8. Geological Information – to ensure that the scientific results of the Branch's scientific programs are made available to users through the timely scientific and production editing, text preparation, printing and distribution of reports and maps; that the library of the Geological Survey is maintained at a high level to meet its role as the principal earth science library in Canada and that a Branch public information service is provided.

9. Central Laboratories and Technical Services – to ensure, through laboratory operation and chemical and mineralogical research, the provision of compositional analyses of rocks, minerals, ores and other geological materials suitable for use in Branch scientific projects, and the provision of mineralogical information to the public.

These objectives have obvious applicability to the study of the output of the GSC. The principal emphasis in the Activity Objective is to ensure the availability of a comprehensive knowledge of the geology and resources of Canada. Furthermore, one of the nine sub-activities is devoted entirely to the presentation of geological information.

3. THE OUTPUT OF THE GEOLOGICAL SURVEY OF CANADA: NATURE, QUANTITY, AND CHANGING TRENDS

The Output

In addition to its familiar publications (formal output) and Open Files (collectively, the published output), the GSC prepares and distributes geoscientific information to other sectors of government, universities, industry and the public at large, through formal memoranda, lectures, participation in workshops, as advisors under the Department of Regional Economic Expansion (DREE) and the Canadian International Development Agency (CIDA) programs, as reviewers of documents, through committee membership and symposia participation and during informal meetings and discussions (informal or unpublished output). This total contribution of unpublished output is considerable. In some instances, e.g. communication with other departments in the Federal Government, liaison with provincial government surveys and in one-on-one exchanges with industry, university and other personnel, the Geological Survey of Canada makes major contributions to the understanding and dissemination of geoscientific information which does not become part of the published record.

The published output can be summarized as follows:-

Memoirs: comprehensive reports on all aspects of the geology of an area. Memoirs commonly incorporate coloured maps and other large graphics.

Bulletins: final reports on specific topics.

Papers: represent miscellaneous types of publications including preliminary results of ongoing studies, collections of symposia contributions and other volumes.

Three Current Research volumes are published each year as part of the Papers series and contain summaries of GSC programs in progress.

Economic Geology Reports: present results of studies of specific mineral commodities or mineral related studies.

"A" Series Maps: coloured maps. These may illustrate reports but are also issued separately. The 1:1 000 000 atlas series is an example of the latter.

"G" Series Maps: aeromagnetic and radiometric maps. Variety of scales of presentation (see Table 3.2).

Preliminary Maps: uncoloured; may present geological, geophysical or geochemical data. The large number of parameters applied to data in the geophysical and geochemical fields results in hundreds of line items being produced each year and many of these maps are released only on microfiche.

Open Files: the means whereby public access is given to manuscript material. Copies are usually made available through commercial copying outlets at the user's expense. An item may be a single map or it may comprise hundreds of pages of text, geochemical and geophysical survey results or computer-stored data. Has included extensive data collected as part of the Uranium Reconnaissance Program. Some Open File releases are not published, or republished, in any other format.

Offshore resource data produced by marine geoscientists at the Atlantic Geoscience Centre (AGC), are published by the Canadian Hydrographic Service. The GSC contribution to these Natural Resource Charts is predominantly gravity and

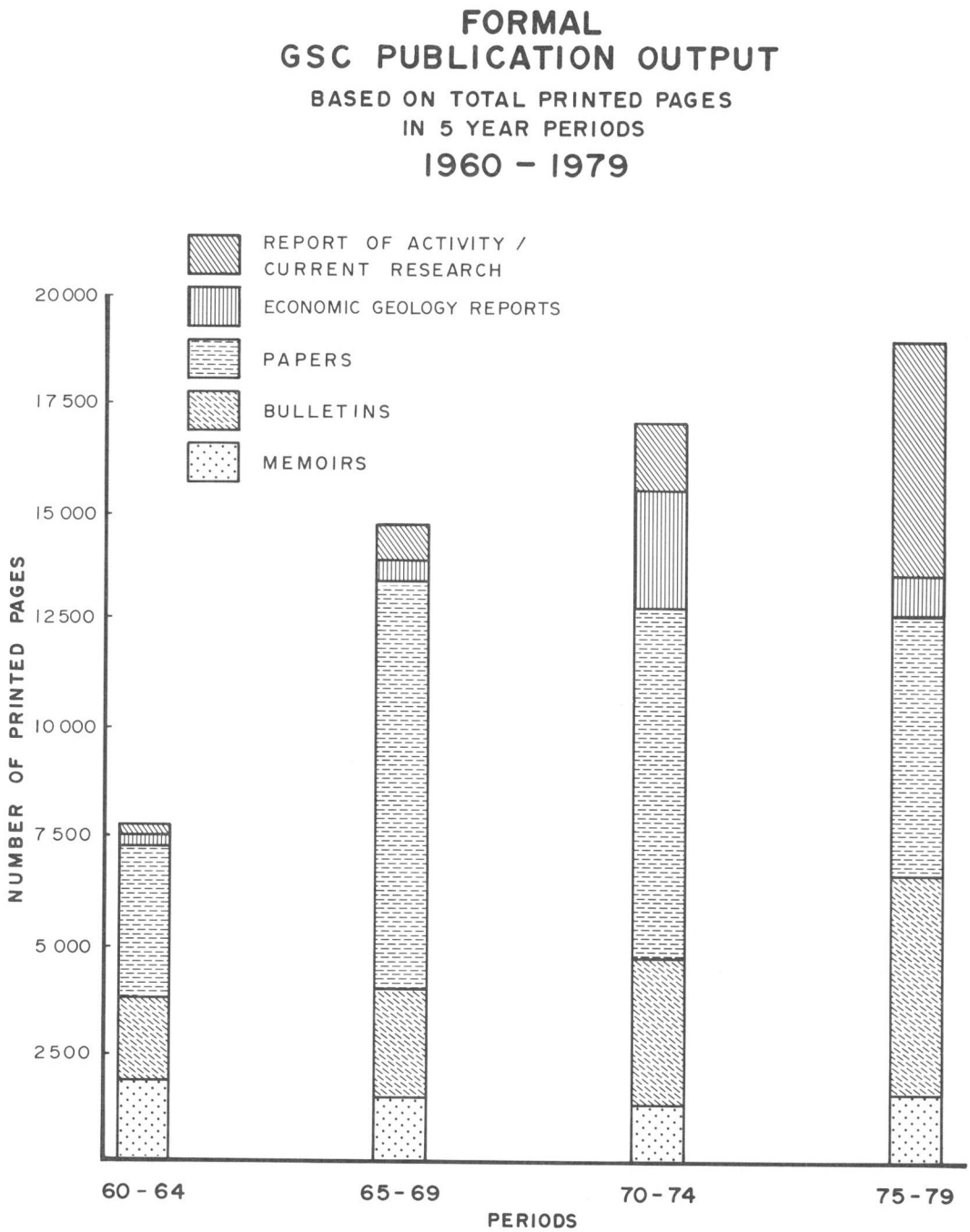
Table 3.1

PUBLICATION OUTPUT 1959-1980

	Memoirs	Bulletins	Papers	Report of Activities	Economic Geology Rep.	"A"-Series Maps	Prelim. Maps	Open Files	Total Printed Pages	Remarks
1959	9 (448)	9 (273)	16 (184)	--	--	16	39		(905)	
1960	5 (407)	10 (265)	33 (486)	--	1 (73)	16	52	--	(1231)	
1961	3 (277)	11 (351)	32 (488)	--	--	6	43	--	(1016)	
1962	5 (218)	11 (522)	38 (510)	(12)	--	13	49	--	(1262)	
1963	9 (890)	11 (372)	47 (1016)	(75)	1 (173)	21	60	--	(2526)	Prelimary maps include many single-element geochemical maps
1964	2 (167)	15 (309)	56 (1082)	(110)	--	12	36	--	(1668)	
1965	4 (477)	10 (560)	41 (786)	(127)	2 (162)	21	56	--	(2112)	
1966	4 (129)	17 (507)	59 (2312)	(147)	--	15	21	--	(3095)	Three Upper Mantle Symposia included in Paper Series; also a volume on Geochemical Prospecting
1967	13 (619)	11 (391)	65 (2378)	(163)	2 (176)	22	26	--	(3727)	
1968	2 (94)	8 (548)	70 (2289)	(166)	2 (150)	18	19	6	(3247)	Two Symposia volumes in Paper Series; 25 scientific manyears diverted to preparation of "Geol. and Ec. Minerals" (between 1967-1969). May be reflected in drop in output
1969	3 (157)	12 (612)	54 (1556)	(178)	1 (92)	15	15	11	(2595)	Includes Catalogue of Canadian Minerals
1970	--	6 (308)	68 (1850)	(182)	3 (2540)	17	28	30	(4880)	Prospecting in Canada, Geology and Economic Minerals of Canada, and Mining and Groundwater Geophysics Symposium all published in Ec. Geol. Series
1971	5 (296)	18 (831)	50 (1365)	(204)	--	29	11	31	(2696)	
1972	3 (282)	6 (331)	48 (1186)	(193)	--	36	14	56	(1992)	Int. Geol. Congress activities diverted staff
1973	7 (354)	8 (462)	37 (1322)	(266)	1 (62)	17	6	59	(2366)	
1974	5 (499)	13 (1394)	61 (2287)	(693)	1 (157)	15	--	69	(5030)	New format introduced for Report of Activities; larger page size allowed maps to be included; R of A comprises 246 items
1975	3 (422)	10 (962)	39 (1256)	(1304)	--	9	2	59	(3944)	R of A comprises 285 items
1976	4 (451)	17 (1558)	27 (838)	(1236)	--	9	4	111	(4083)	R of A comprises 232 items
1977	2 (115)	8 (766)	28 (1002)	(922)	--	20	--	92	(2805)	R of A comprises 185 items
1978	1 (84)	9 (482)	27 (1686)	(922)	--	35	16	96	(3174)	R of A renamed "Current Research"; 176 items
1979	4 (416)	15 (1463)	28 (1160)	(952)	1 (811)	20	14	110	(4802)	Current Research comprises 147 items
1980	3 (235)	18 (1169)	36 (2000)	(945)	--	15	11	72	(4349)	Current Research comprises 149 items

[1] *numbers in brackets are total pages. Publications prior to 1974 have been converted to large-size format. Coversion factor 0.52*

Figure 3.1



magnetic data together with surficial geological maps and texts covering East Coast offshore areas. Since 1972, approximately 90 charts, each 1 degree by 2 degrees have been contributed to this series. The GSC places the data on which these charts are based on Open File.

Each month the GSC distributes an Information Circular to approximately 4800 addresses of which about half are in Canada. All publications of the GSC for the previous month are listed in the circular.

Through input into the Canadian Centre for Geoscience Data, the GSC publishes an annual Index to all publications issued in the preceding year.

In addition to the formal output, GSC officers are encouraged to publish in the open literature. An Abstract Volume is published annually as a Paper (79-4, 80-4, 81-4 etc.) in which abstracts of all papers published by GSC staff members in scientific journals are listed.

A significant part of the published output of the GSC, totalling 63 705 printed pages, 919 'A' Series and Preliminary Maps and 802 Open Files for the period 1959 to 1980 inclusive, is detailed in Table 3.1. The number of pages published by the GSC in 5 year periods from 1960 to 1979, with breakdown into publication types, is shown in histogram format in Figure 3.1. Figure 3.2 presents 'A' Series and

Preliminary Map production together with the Open File bedrock and surficial map publications for the period 1959-1980. Figure 3.3 depicts the geophysical and geochemical map production of the GSC for the same period. Domestic and foreign (CIDA) publications are shown and the output is described more specifically in Table 3.2. Total GSC map output, represented in these two tables for the 22 year period to and including 1980, exceeds 14 275 sheets.

During the years 1970 to 1980, GSC scientists published at least 982 papers in refereed scientific journals. Further details and abstracts are to be found in GSC Papers 70-4 through 80-4 inclusive. The outside publication production of the GSC, in terms of numbers of publications and the number of published pages is shown in Figure 3.4.

The Geological Information Division and the Publication Process

The principal objective of the Geological Information Division (GID) is the communication of the results of the scientific program of the Geological Survey to users and potential users. The work of the GSC would be ineffective without the GID. Furthermore, to some degree, relatively small applications of funds to the publication process exert considerable leverage in enabling the Survey to achieve many of its principal objectives.

Some information services and activities are included in other divisions. Of the total GSC information services budget of approximately $4.0 million (1980 dollars), the GID's Ottawa-based activity amounts to slightly more than $3.1 million. The balance is allocated to certain drafting, library, editorial and sales services in other divisions both in Ottawa and in other locations across the country. Person-years within the GID in 1980-81 totalled 97. The information services and activities in the other divisions include an additional 28.5 person years.

Capabilities and facilities for scientific editing, cartography and technical photography are established in Ottawa and Calgary. A major scientific library is maintained in Ottawa and smaller ones are at the GSC offices in Vancouver, at the Pacific Geoscience Centre (PGC), Sidney, B.C., at the Institute of Sedimentary and Petroleum Geology (ISPG) in Calgary and at the Atlantic Geoscience Centre (AGC) in Dartmouth, N.S. Over the counter sales facilities are maintained in Ottawa, Calgary and Vancouver. The GID provides a geoscientific data system information service to the public and is responsible for publication production and distribution. It supplies camera-ready copy to printers who are awarded contracts annually by Supplies and Services, Canada (DSS).

The Survey has been producing reports since 1845. Many of the early publications rate among the classics of Canadian scientific literature recording observations on geology, anthropology and natural history as Geological Survey officers moved back the frontiers and began documenting the Canadian landmass. Over the years, the Survey has established an enviable, worldwide reputation for innovation of survey methods and high standards of professional quality of output in the science of geology.

In early 1969, Bureau of Management consultants conducted a study of publication policy and procedures in the Geological Survey.

Since the publication of this consultants' report in 1970, considerable attention has been devoted to streamlining the publication process and the fuller utilization of word-processing procedures so minimizing publication delays. Figures 3.2, 3.3, 3.5, 3.6 and 3.7 illustrate the expanded production of Open File and Current Research publications during the 1970s reflecting the Survey's increasing emphasis on more timely release of information.

The publication process currently followed at the Geological Survey of Canada is depicted in flow-chart form in Table 3.3. The process clearly defines the Division Director as having the responsibility of determining when and how research work is to be published. The establishment of priorities with respect to the order and final timing of publication is the responsibility of the Director of the Geological Information Division, who, in turn, is also responsible for the management of the publication budget.

The printing budget of the Geological Information Division increased from $225 000 in 1979 to $275 000 in 1980. In order to maintain production in 1979, it was necessary to transfer funds within the larger GSC budget so limiting other activities. The budget increase of $50 000 in the 1980 year, proved adequate for the Geological Information Division to process all the GSC output presented for publication at the acceptable level of quality characterized by current publication formats. This adequacy was achieved primarily by a total changeover, effected in 1980, from printing by letterpress to printing by camera-ready offset methods with a corresponding cost reduction of approximately one half. The average offset printing cost in 1980 was between $30.00 and $35.00 per page.

Generally, GSC publications are processed in order of submission. Priority, however, is given to the publication of proceedings of international meetings or symposia which have to meet advertised deadlines, to the production of reports and maps on sensitive topics of national importance (e.g. those pertinent to the acid rain problem), and to the regular and timely production of Current Research volumes.

With absolutely no delays, the Geological Information Division can produce a 75 page Bulletin in approximately 2½ months. However, publication production is not simple and sequential but involves parallel operations. Delays in one stream (e.g. cartography) may disrupt the entire process. The GID cannot meet peak loads without disruption to normal throughput.

The manuscripts for the 811-page Exploration '77 volume (Economic Geology Report 31) were received by the Chief Scientific Editor between September 1978 and April 1979 and the book was published in November 1979. Manuscripts for the Current Research, Part 1A volume are accepted through mid November and copy is sent to the printer in early December. The publication becomes available in mid-to-late January.

The longest delays experienced in the publication schedule are, commonly, during the critical reading stage, and, after receipt of the manuscripts by the Chief Scientific Editor, at the proofreading stage. Many reviewers and senior authors prolong these procedures, sometimes delaying final production considerably.

As previously noted, printing is contracted out on a yearly basis by Supplies and Services, Canada (DSS). Delays of several months caused by priorities set by others do occur at this stage, although, generally, there has been a satisfactory flow-through especially since the introduction of the offset technique. The DSS printing bureau in Hull, P.Q., prints the Current Research Part 1A volume.

The cartography section's activities are directed 95 per cent to production and 5 per cent to development. A multicolour 1:250 000 geological map with no priority rating is completed in approximately a one-half person year. Advances in computer-assisted production of maps and the use of flexible and economical colour systems are closely monitored. Worldwide experience to date indicates that only about 20 per cent of the cartographic operations can be effectively and economically automated. Geological maps with a plethora of symbols and complex legends require very complicated programing, often exceeding time requirements for manual production.

Table 3.2

Geophysical and Geochemical Maps:
completed and released 1970 to 1980 inclusive

(During the decade 1961 to 1970, inclusive, 4652 maps (99.8 per cent aeromagnetic) were produced (see Fig. 3). The major increase in radiometric and geochemical maps in the late 1970s reflects the output from the Uranium Reconnaissance Program)

	CANADA (Fed. & Fed.-Prov.)			OVERSEAS (CIDA)		TOTAL
Year	Aeromag.	Rad.	Geochem.	Aeromag.	Rad.	
1970	276	7	-	-	-	283
1971	364	14	-	125	-	503
1972	363	21	4	217	38	643
1973	311	77	7	335	-	730
1974	551	28	3	18	15	615
1975	191	77	56	20	-	344
1976	80	116	138	181	201	716
1977	105	357	211	169	169	1011
1978	268	267	266	73	49	923
1979	309	483	222	219	18	1251
1980	491	7	30	82	144	754
Totals	3309	1454	937	1439	634	7773

Column 1: Includes standard aeromagnetic maps published at various scales from 1:50 000 to 1" = 4 miles; also high sensitivity and magnetic gradient maps, at scales ranging from 1:25 000 to 1:50 000. Released as Open Files.

Column 2: Consists of high sensitivity airborne gamma-ray spectrometry maps; seven parameters on separate map sheets are normally produced for each area flown. (Scale mostly 1:250 000; some at scales down to 1:20 000). Released as Open Files.

Column 3: Consists of both regional and some detailed geochemical maps. Up to 16 parameters are presented on separate sheets for a given map area. Released as Open Files.

Column 4: Consists of CIDA sponsored standard aeromagnetic maps completed and delivered to 8 countries. Various scales. Not all maps released by countries concerned. GSC responsible for survey specifications, contract monitoring, inspection at all stages and final approval.

Column 5: Consists of CIDA sponsored radiometric maps. Prior to 1978 consisted of total count maps only; in Brazil, 3 separate parameters were presented for each map area. Scales range from 1:50 000 to 1:250 000.

To place the Geological Information Division's current printing budget of $275 000 (1980 dollars) into perspective, it should be recorded that the printing costs alone for R.W. Boyle's impressive and distinguished "Geochemistry of Gold and its Deposits" (Bulletin 280), published in 1979, exceeded $100 000. Memoir 387 entitled "Mesozoic and Tertiary Geology of Banks Island, Arctic Canada" by A.D. Miall runs to 235 pages plus numerous, appended maps. The cost of printing 1450 copies of this Memoir, again in 1979, was $27 500. Typesetting costs were approximately $10 000.

Economy measures currently in effect, in addition to those already noted, include the publication of supporting data in microfiche only accompanying the parent report. Scientific staff are being encouraged, wherever possible, to submit line drawings and maps of which parts or all can be reproduced without elaborate redrafting. Author's linework is commonly adequate for production copies of Preliminary Maps. Further, specialists' advice on how reports in their particular fields can be shortened is continually sought.

Supplies and Services Canada (DSS) is legally required to distribute approximately 125 copies of GSC publications to libraries and institutions across Canada, free of charge. In addition, the GSC distributes up to 500 free copies to other institutions throughout the world. In return, the GSC receives complimentary publications for its research libraries in Ottawa, Calgary, Vancouver and Dartmouth.

Six hundred free copies of Memoir 387 were distributed. An additional two hundred were held for sale by DSS, and the balance of 650 copies were held for sale by the GSC.

Of the 125 institutions and libraries receiving free GSC publications distributed by the DSS, 48 have 'Full Depository' status, and, as such, are required to maintain a complete library of Federal Government publications. A listing of these Full Depository libraries is attached as Appendix 'A'.

Table 3.3

Publication process flow chart
Geological Survey of Canada

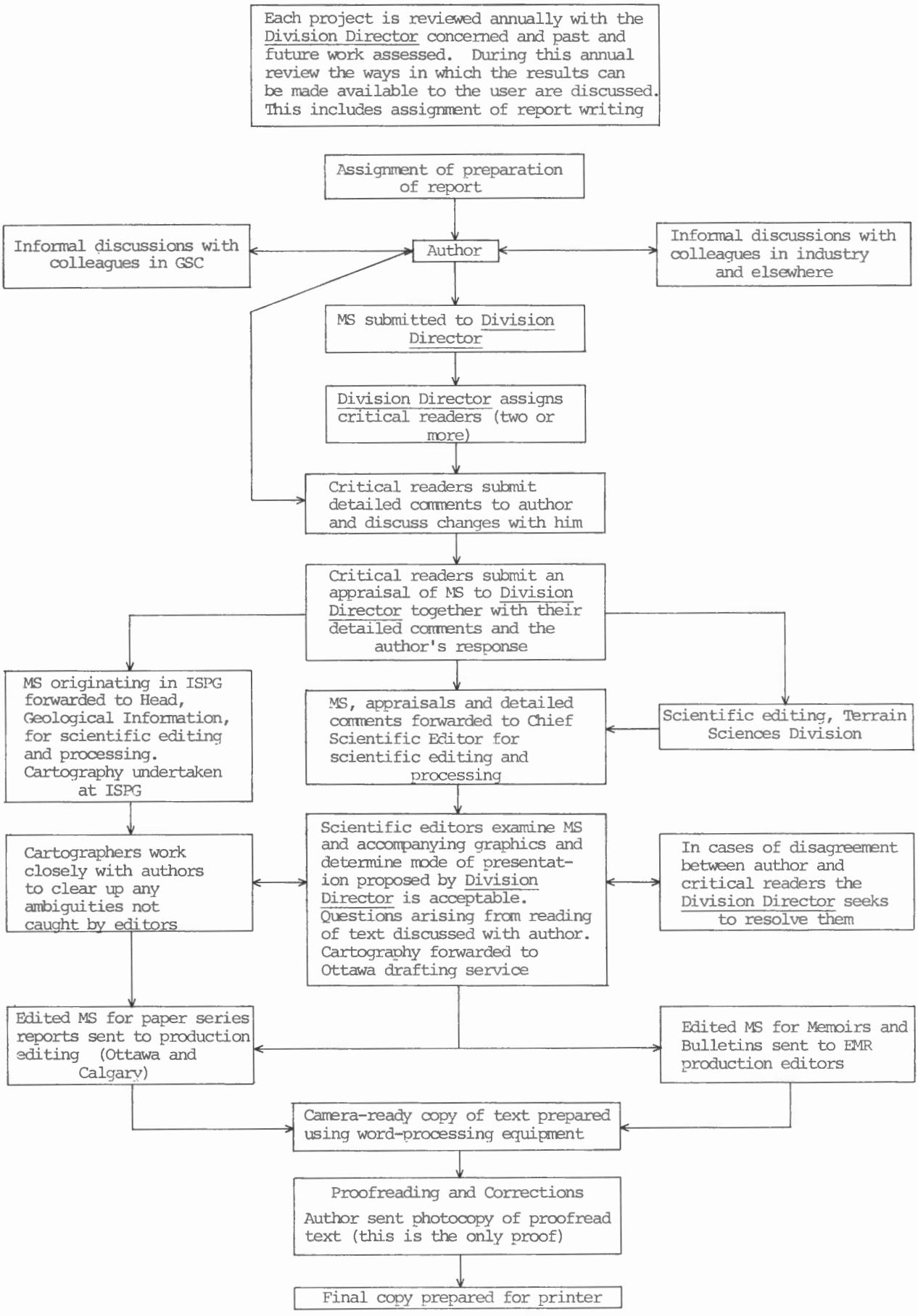
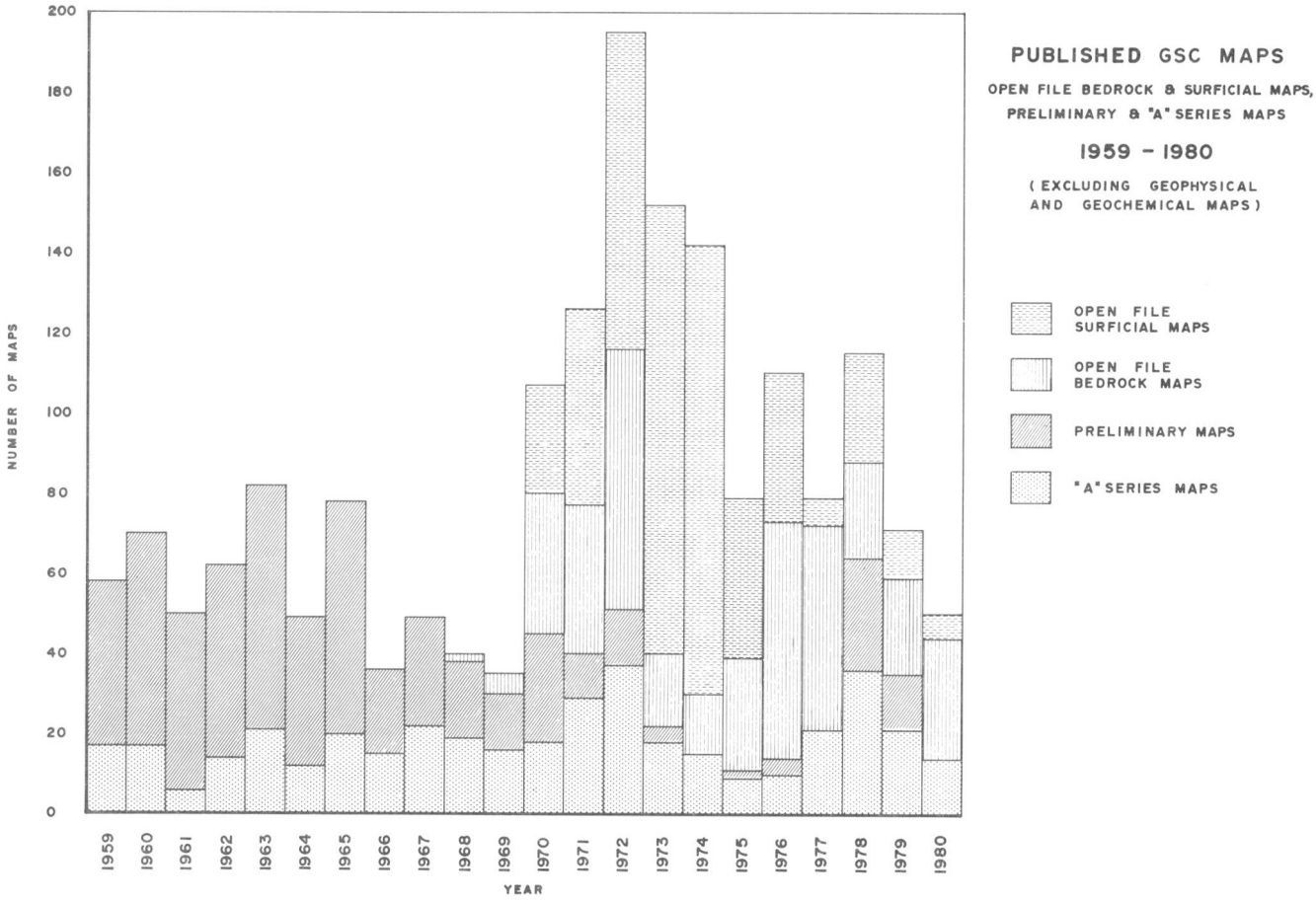


Figure 3.2



Changing Relationships Between the Published Output and Manpower of the Survey

The representation of published GSC output in Tables 3.1 and 3.2 and Figures 3.1 to 3.3 and 3.5 to 3.7 can be compared with the presentation of "Type of Task Performed" in Figure 3.8. From Figure 3.9, it can be seen that the total number of project scientists employed by the Survey increased from 133 in 1960 to 275 in 1980. The principal increase between 1970 and 1975 occurred in the fields of marine geology and economic geology (Fig. 3.9).

Table 3.1 and 3.2 compilations were prepared from records maintained by the Geological Information and the Resource Geophysics and Geochemistry divisions. Published output is presented in the form of the number of maps and publications, and in the number of printed pages. Total pages are given as a measure of productivity only. The GSC emphasizes, and the Advisory Committee agrees, that there is no particular merit in volume alone when dealing with science.

The numerous diagrams, sections etc., included in pockets in many reports are not included in the map totals. Such pocket items are produced by the cartographers in the Geological Information Division.

Resource Geochemistry and Geophysics scientists have contributed advisory, supervisory and other services to foreign countries under the CIDA program (Table 3.2; Fig. 3.3). This is legitimate output, reflecting government policy, but it should be noted that had this effort (equivalent to 27.7 per cent of the map output listed in Table 3.2 for the 1979-80 period) been directed to the Canadian aeromagnetic program (for example), almost the whole of the country would have been covered by these surveys by the end of 1980.

Reference to Table 3.1 reveals that, when GSC output is examined over 5 year periods, there has been a decrease in the total production of Memoirs, Bulletins and Papers in the late 1970s relative to earlier periods (222 in 1975-79; 335 in 1970-74; 373 in 1965-69; 288 in 1960-64). These data, together with other data portrayed in various ways in Figures 3.1 to 3.5 and 3.7 and Table 3.2 have been examined and supplemented by more detailed information on the data source from annual Indices published by the GSC. This information, for the period 1965 to 1979, is portrayed in Figures 3.10A and 3.10B.[1]

Prominent declines in Memoir and Paper output is evident for both the specialist and bedrock mapping groups of divisions.[2] Bulletin production by the bedrock mapping divisions shows a stable pattern whereas the specialist divisions' output is also declining.

[1] Figures 3.10A and 3.10B, comparing outputs of Memoirs, Bulletins, Papers, Open Files, Current Research and Outside Journal articles of the specialist divisions and the bedrock mapping divisions is based on inventories in annual Indices published by the GSC. Totals in Figures 3.10A and 3.10B are lower than the comprehensive figures presented in Table 3.1 because the latter lists nonscientific output such as CGC reports and annual Indices plus other Open Files authored by scientists not within the divisional structure.

[2] Bedrock mapping group of divisions – Precambrian; ISPG, Cordilleran Geology.

Specialist group of divisions – Atlantic Geoscience Centre; Central Laboratories and Technical Services; Economic Geology; Resource Geophysics and Geochemistry, and Terrain Science.

Figure 3.3

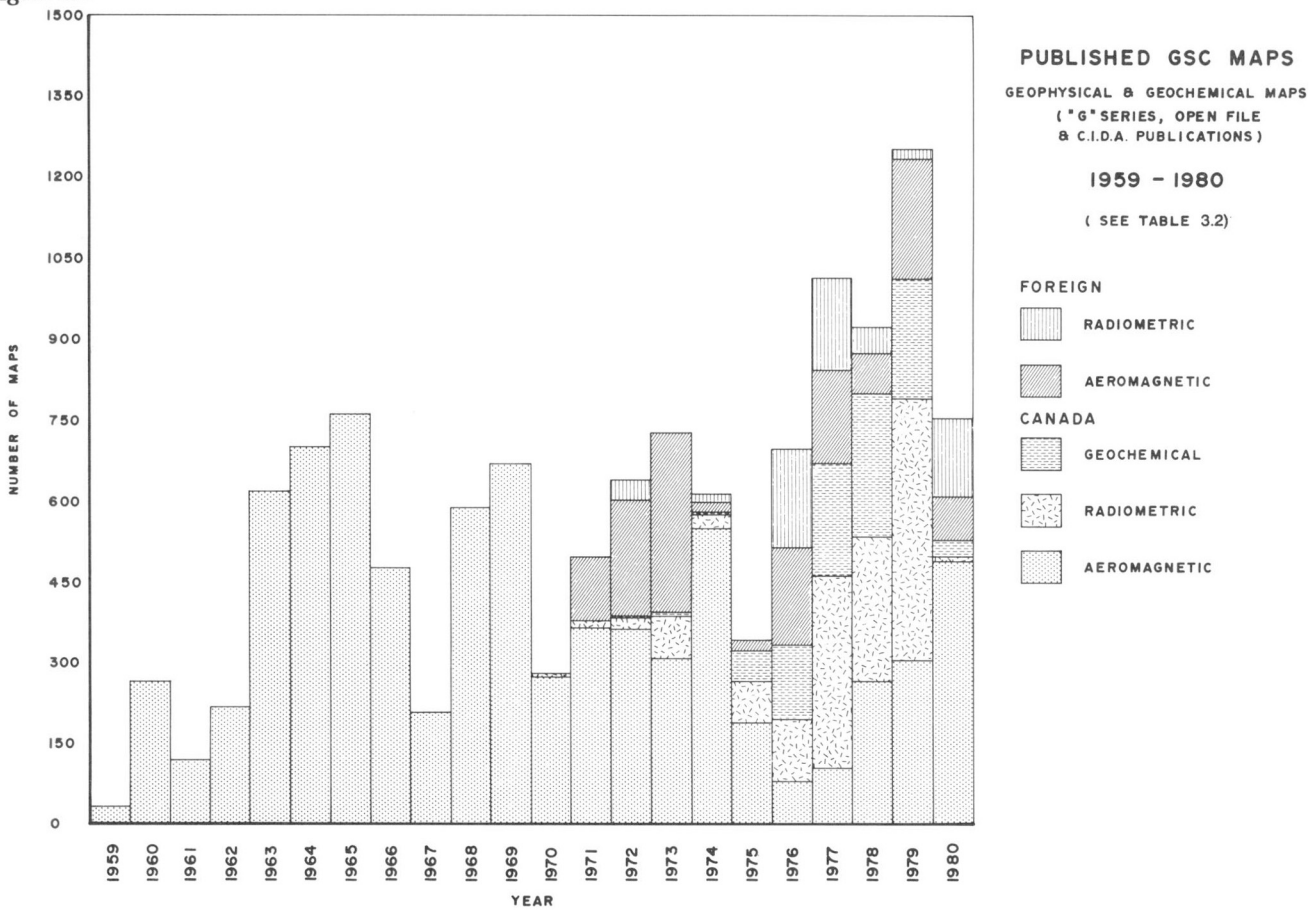


Figure 3.4

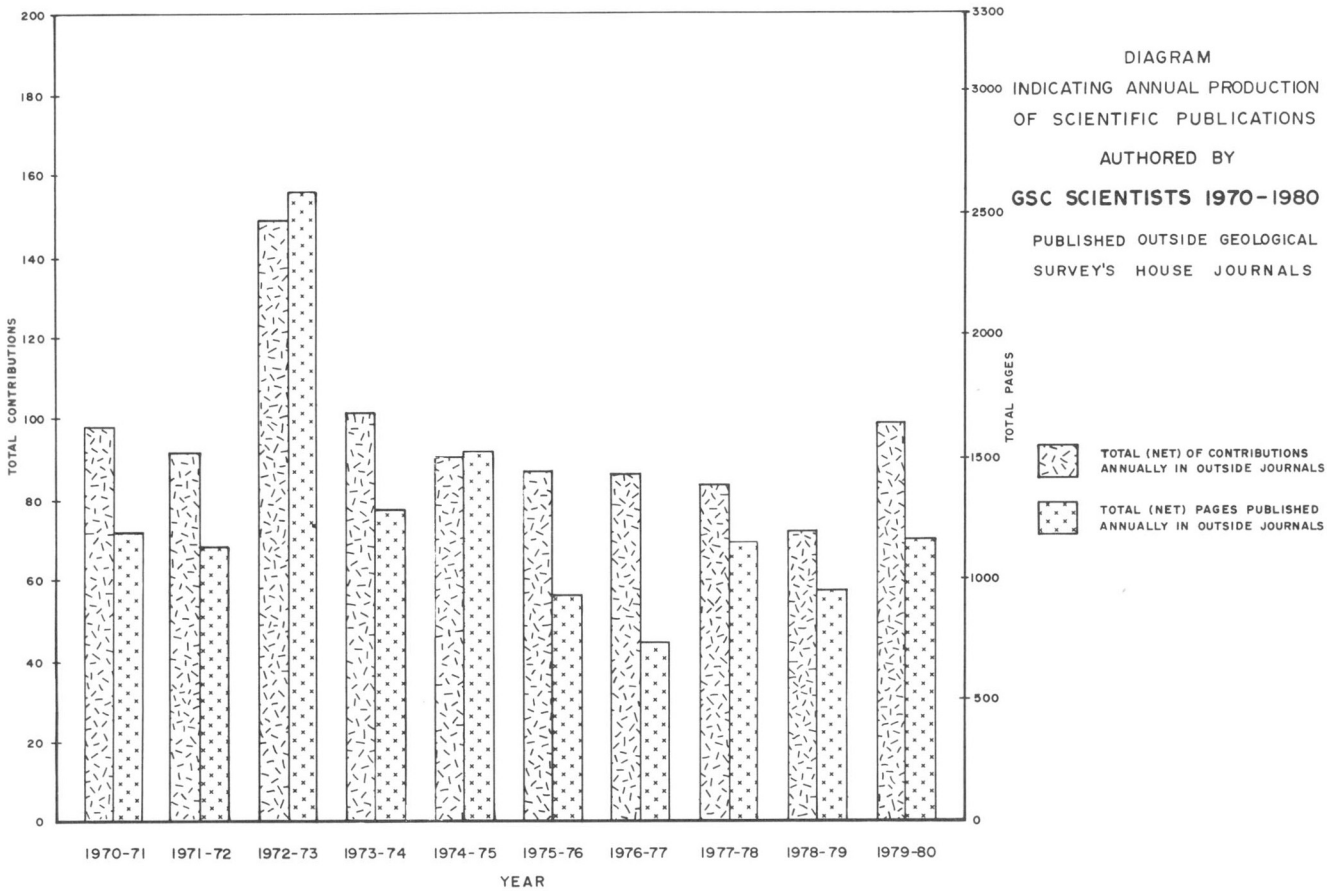


Figure 3.5

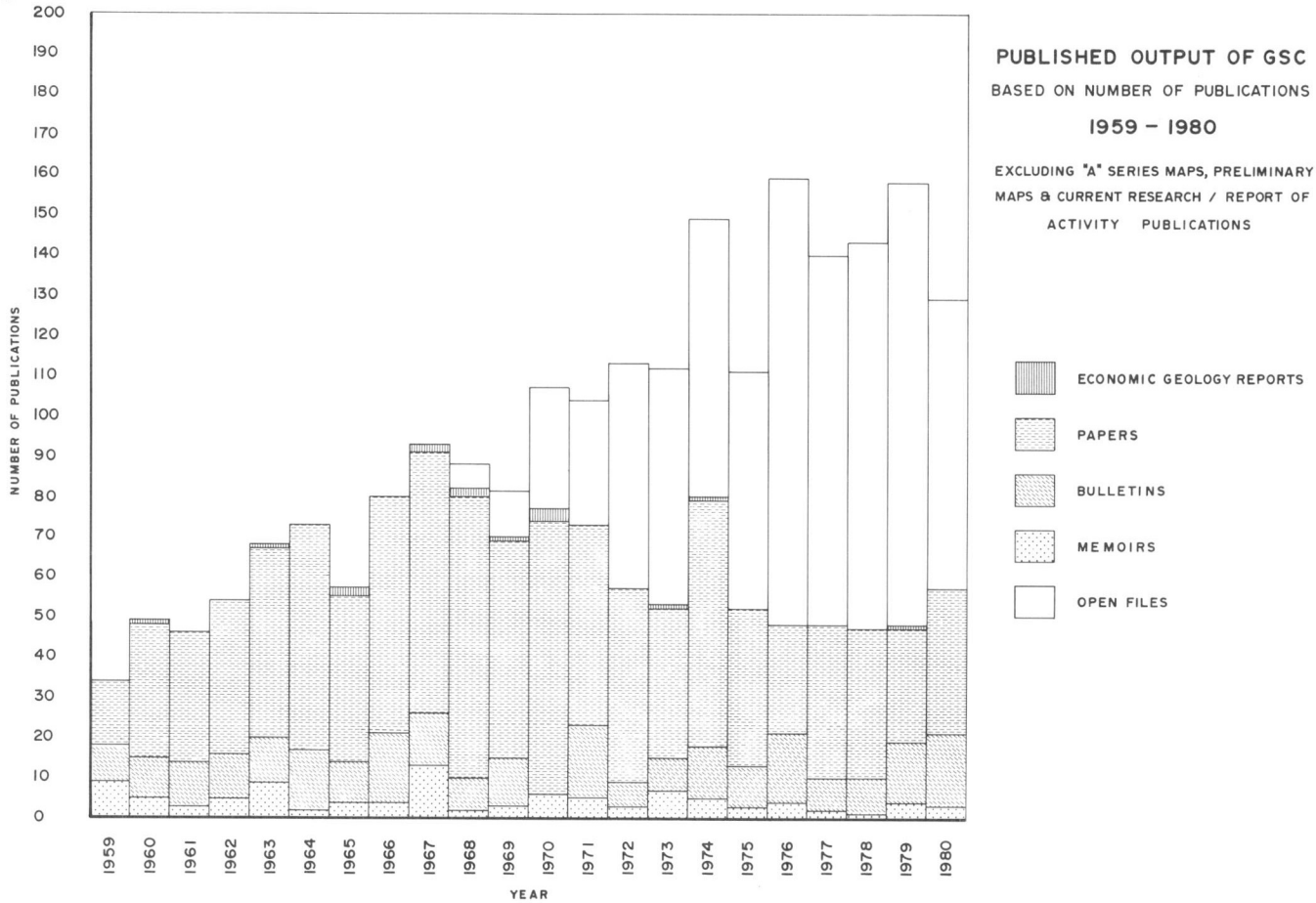


Figure 3.6

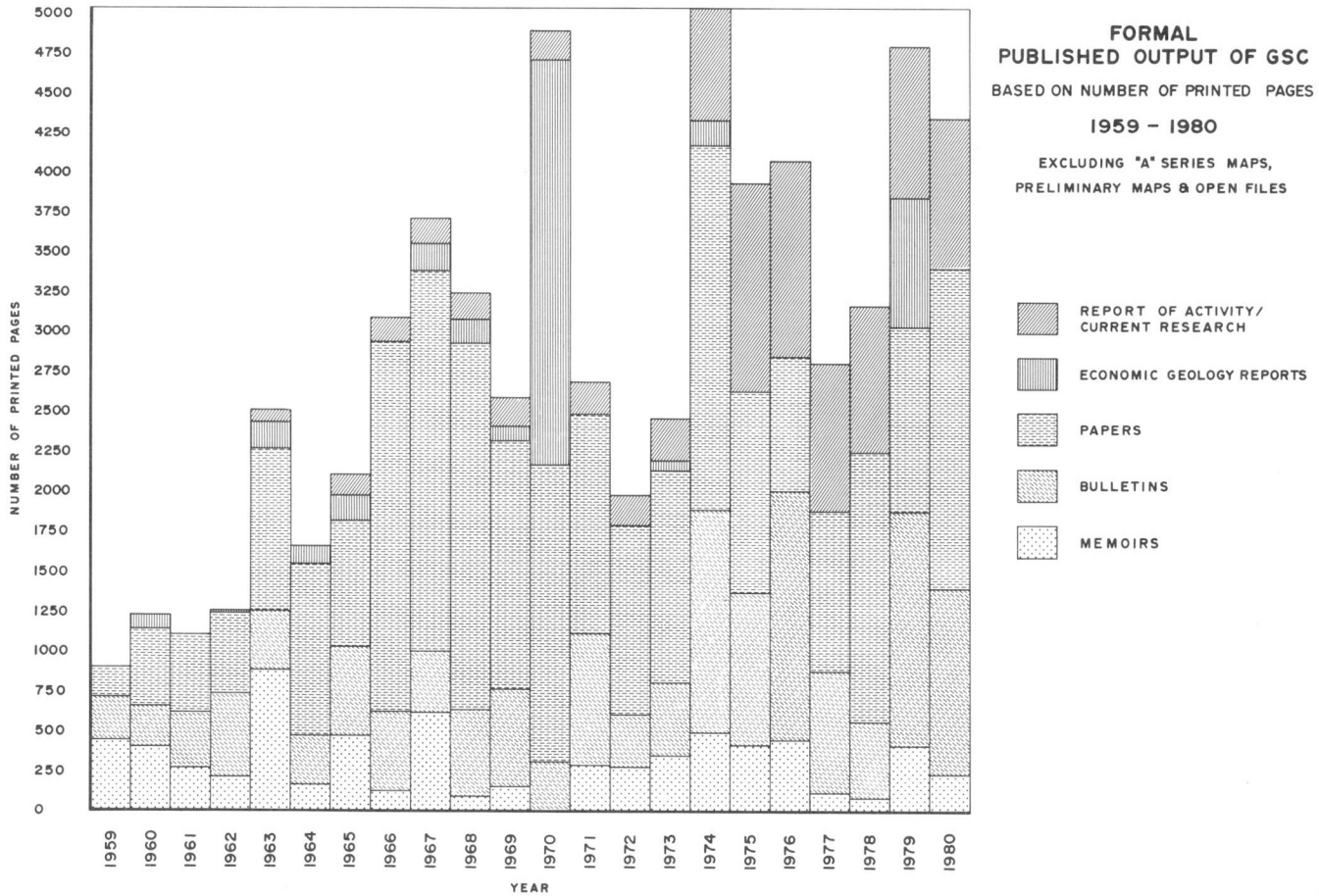
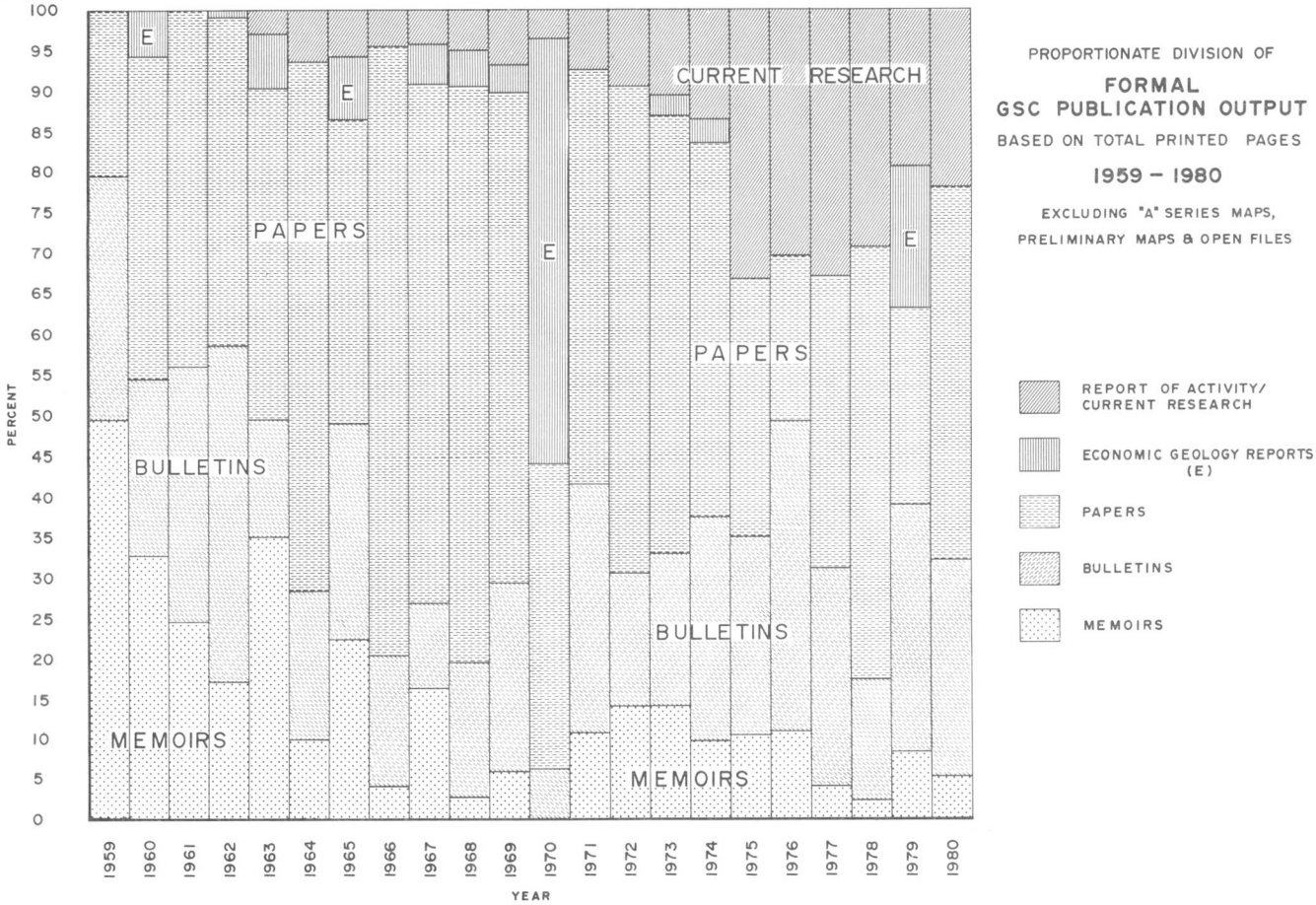


Figure 3.7



The International Geological Congress held in Montreal in 1972, and other events and circumstances, have obviously influenced the production of Outside Journal and Current Research output. However, trends developed show a gently increasing Outside Journal productivity for the bedrock mapping divisions, whereas the specialist divisions' output shows more of a declining pattern. Trends for the Current Research output indicate a relatively stable production pattern for the bedrock mapping divisions. The specialist divisions, discounting the major surge in production between 1973 and 1976, illustrate a declining trend in the most recent years continuing into 1980.

Figure 3.5 and Table 3.2 illustrate a prominent increase in Open File production in the latter years. This increase is greatest with the specialist divisions, although both groups show increasing trends through the 1970s (Fig. 3.10A, 3.10B).

Generally, therefore, there is evidence of stable to gently increasing trends in Current Research and Outside Journal production and a major increase in Open File output by the bedrock mapping group of divisions in recent years at the relative expense of the traditional Memoirs and Papers. During the same period, the specialist groups have established decreasing patterns in Current Research, Outside Journal, Memoir, Bulletin and Paper production, in contrast to a prominent increase in Open File output.

Figure 3.9 indicates that the number of project scientists employed by the GSC increased from 133 to 180 between 1960 and 1964, and 260 to 275 between 1975 and 1979. Correction factors related to this increase in the project scientist population, applied to the output patterns described would accentuate declining trends and decrease or nullify increasing trends. However, before these manpower increases are compared directly with total Memoir, Bulletin and Paper production or the individual output trends illustrated in Figures 3.10A and 3.10B, aspects related to the changing role of the Geological Survey of Canada warrant consideration.

The demands for resource appraisal information by other sectors in the Federal Government has required that a significant number of petroleum, mineral and terrain geoscientists be involved in studies that have not led to conventional publications. For example, 7 scientists are involved in the compilation of uranium resource information, and another 15 are similarly occupied with oil, gas, coal and peat resources. Environmental studies related to potential pipeline routes and other major developments are commonly less than one person year in duration and data from these studies are presented through Open Files.

These changing roles obviously affect the type of output of certain Divisions within the GSC, but it is apparent that these are not the only factors limiting formal output.

An examination of the various programs of the Geological Survey reveals that many scientists, irrespective of their Division, are involved in one or more projects, each competing for the scientists' available time.

The net result of all these circumstances has been a real, overall decline in formal output production.

The Advisory Committee did not investigate the influence of scientist turnover on project completion. It is an unfortunate fact that important data sometimes remain unpublished when a scientist resigns, is promoted, is transferred or dies before a project assignment is concluded.

Figure 3.8

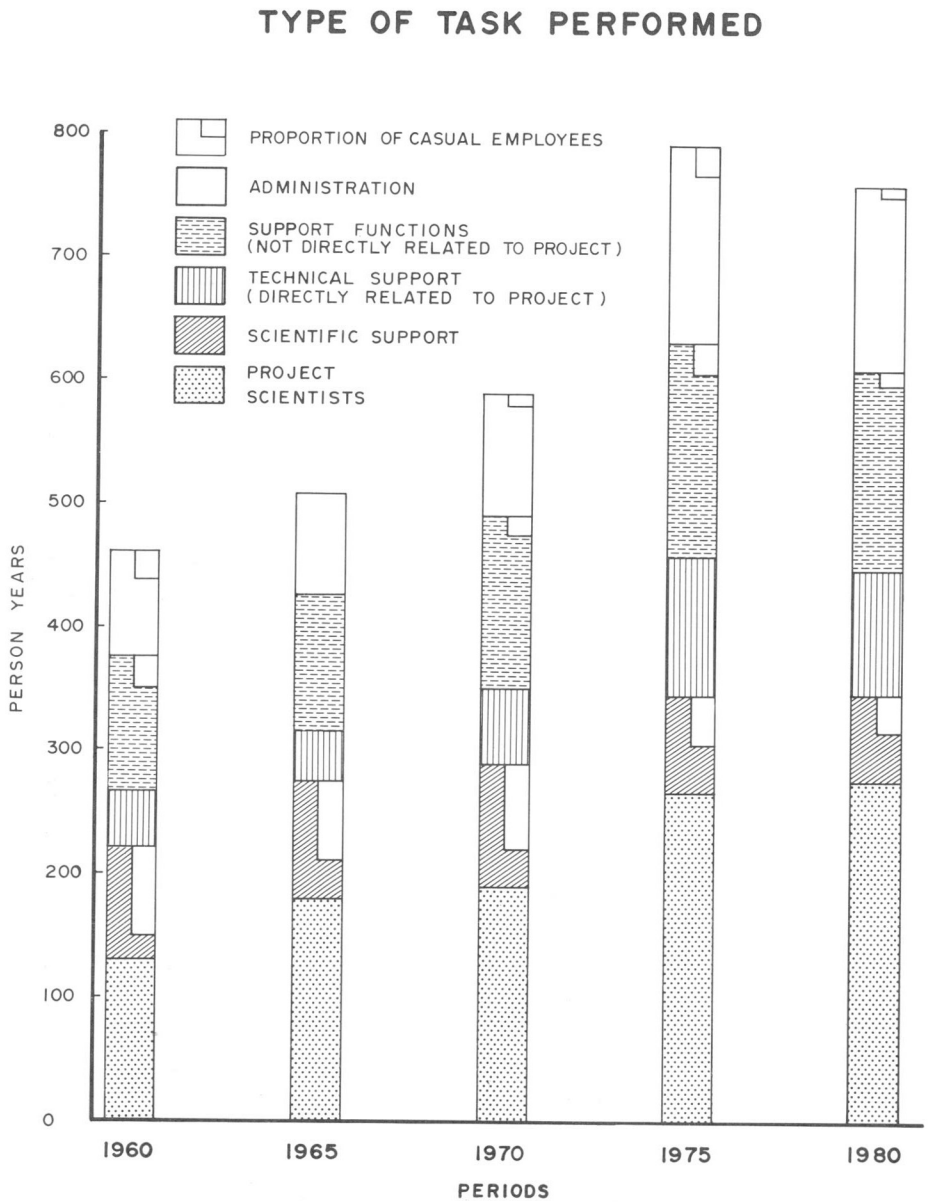


Figure 3.9

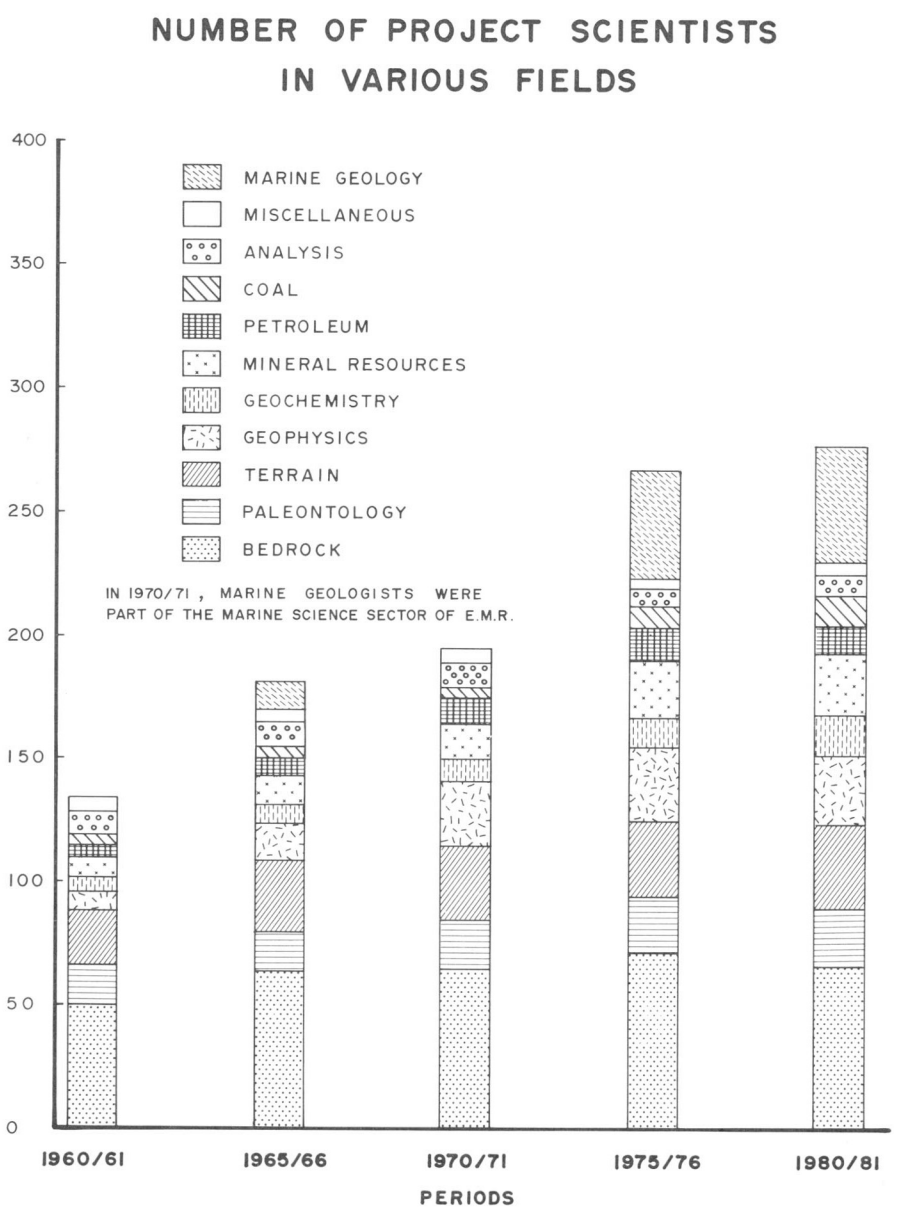
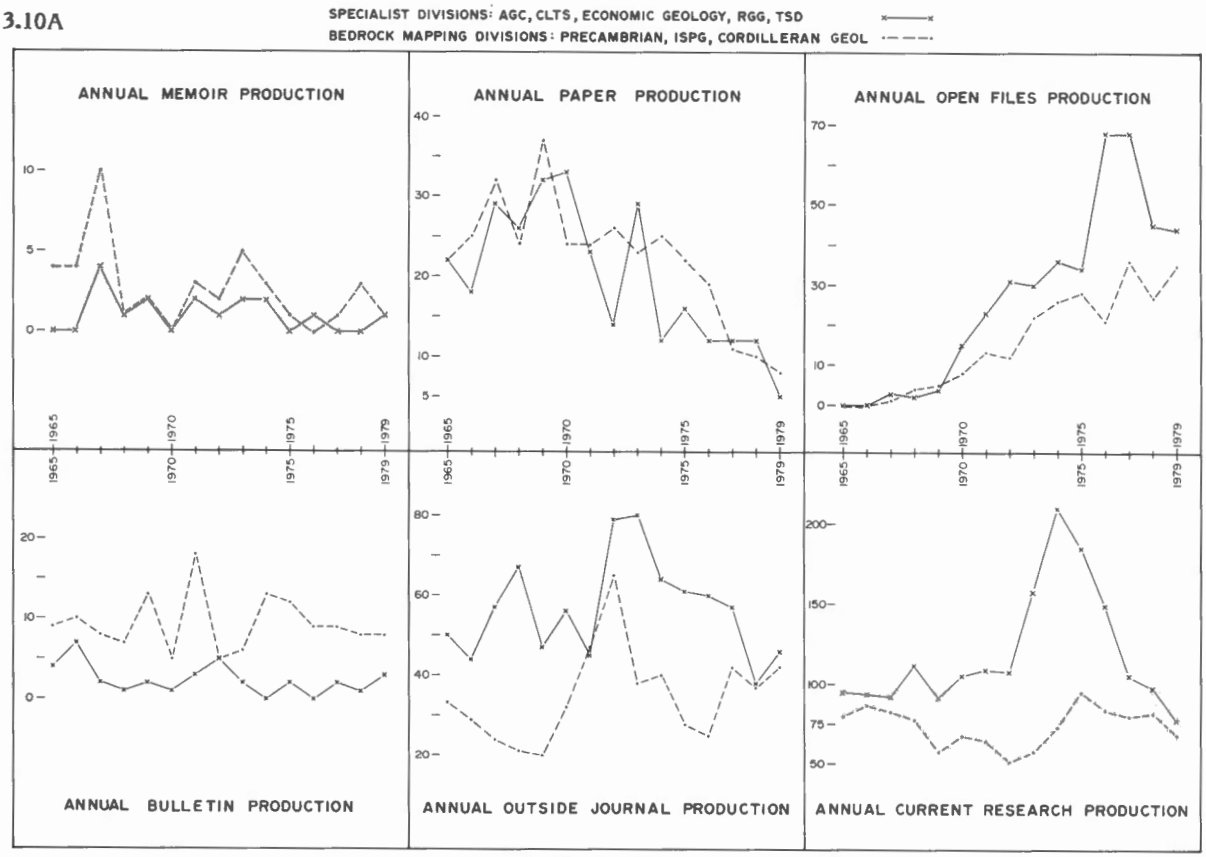
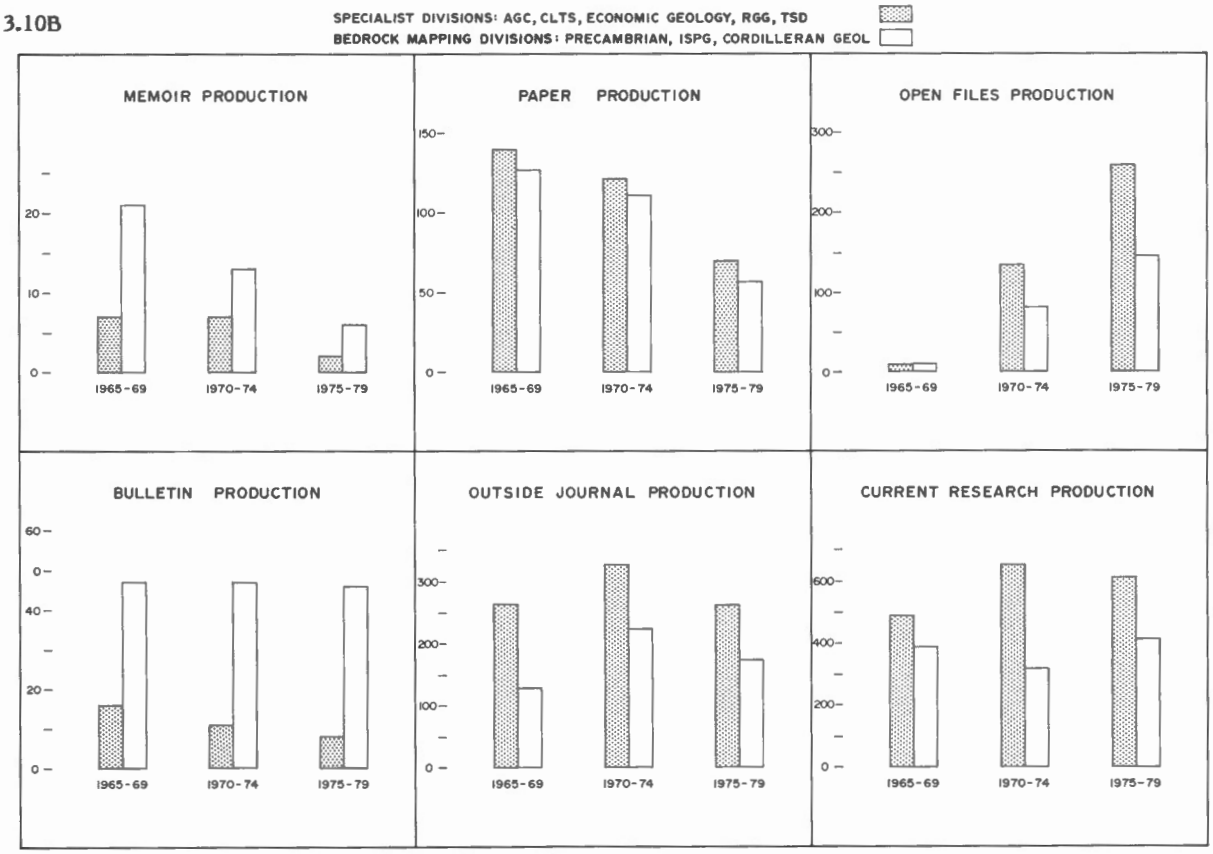


Figure 3.10A



GSC PUBLICATION PRODUCTION BY SPECIALIST AND BEDROCK MAPPING DIVISIONS 1965-1979

Figure 3.10B



GSC PUBLICATION PRODUCTION BY SPECIALIST AND BEDROCK MAPPING DIVISIONS (CUMULATIVE 5 YEAR TOTALS) 1965-1979

Memoirs, as the final product of regional mapping, mostly at the 1:250 000 scale, Bulletins, representing final reports on specific topics, and Papers are shown by the questionnaire results to be three of the most desired and used products of the GSC (see Section 6), having long periods of usefulness spanning several decades. The declining or near-static production of these volumes is regretful in light of their usefulness and popularity. The increase in Open File and, by some divisions, Current Research production concurrent with the increase in Survey staff has improved the timeliness of the release of certain data but, unfortunately, at the expense of the traditional, fully documented Paper and importantly, the comprehensive, final reports in Memoirs and Bulletins.

The Advisory Committee's findings, documented in the body of this report, indicate that these changes in publication emphasis have not significantly lessened the geoscientific public's criticism of the GSC's timeliness of production of its output. Although an increase in the traditional output in proportion to the increase in the number of project scientists employed is not a realistic expectation in view of the changing Survey role and the increase in Open File production, there is, and the record indicates there will continue to be, an important demand for the traditional GSC product of Memoirs, Bulletins, Papers, etc., despite the fact that the introduction of the Open Files and the expansion of the Current Research volumes has been welcomed and applauded.

This apparent dilemma presents an important challenge to the GSC management. Where traditional publications have been de-emphasized, the importance of final publication completion has to be re-established. Elsewhere within the Survey, a closer management of productivity is required. Since the GID is currently coping adequately with the flow of manuscripts and printing delays are infrequent, improved formal productivity is, to a large degree, dependent on the Division Directors who approve projects and determine how and when data is to be published (Table 3.3). The situation is complex, but more rigidly enforced practices should improve the formal output and the Committee has formulated pertinent recommendations which are detailed later in this report.

4. INFORMATION GENERATION, PRIORITIES, AND COMMUNICATION

In a series of interviews with Division Directors and other senior scientists, the Advisory Committee examined various aspects of project definition, information generation and its dispersion within the Geological Survey and communications with outside groups.

Internal Activities

Within the Geological Survey itself, integration between Divisions was judged by Weir et al. (1979) to be poor. There have been some definite improvements in this aspect of GSC activity as illustrated by the recent launching of Intensive Multidisciplinary Pilot Projects (IMPP). However, a lack of communication and incomplete integration is still exemplified by the limited involvement of the Central Laboratories and Technical Services Division in Survey programs at an early stage. Technical developments are catalytic to geoscientific progress and any lack of appreciation of this and the benefits of integration within the Survey by division managers will prove to be detrimental.

Considerable variety is apparent in the way projects are initiated, defined and given priority both between and within divisions. The objectives of the GSC (Appendix 'B' and Section 2) are very broad and encyclopedic providing multitudinous opportunities for directions of research. In some divisions the orientation of the research is significantly influenced by the initiatives of individual scientists. In other divisions, management influences the integration of various programs and/or the encouragement of conceptual development and new directions. A principal problem for management is to provide an environment that both encourages initiatives from below but gives ultimate orientation to research. The success of the GSC is dependent to a large degree on self motivation by the individual scientists and their identification with the Survey objectives. It is evident from the exchange with the Division Directors that some scientists are loosely managed and that there is a marked tendency to favour directions defined by specialist expertise.

Management emphasizes that external demands, related primarily to resource and environmental concerns, interrupt and redirect the traditional research orientation of project scientists throughout the Survey. Such influences appear to be greatest on the Terrain Sciences, Economic Geology, Resource Geochemistry and Geophysics, and ISPG divisions.

With few reservations, Division Directors are satisfied with the way information is dispersed inhouse among their project scientists.

Whenever practised, individual communication with others outside the Survey, is usually very effective, but restrictions on conference travel place limits on attendance at scientific meetings at which much of this communication takes place.

Division Directors state that they place less weight on publication volume within the Survey, and greater emphasis on completeness and quality, despite the emphasis by some of them on Open File publication. The Committee concurs that this is not necessarily contradictory since Open Files (and Current Research) can be properly used for selected and progress reporting. Timeliness, however, is discussed later in this report.

In the opinion of several GSC Division Directors, the quality of GSC publication is maintained not so much by the use of outside reviewers of manuscripts destined to become Memoirs, Bulletins or Papers, but by exposure of scientists to the same population of reviewers through frequent

publication in refereed journals (approximately 30 per cent of the GSC's written output). Outside reviewers are invited to comment on GSC manuscripts when satisfactory expertise is not available among staff scientists. The Advisory Committee does not necessarily agree with this general policy. Whenever possible, the highest quality controls available should be applied in the production of the formal publications which represent the GSC's top level published product. Division Directors should develop policies whereby important, innovative formal publications introducing new concepts or ideas would normally receive external review.

There is consensus among the Division Directors that the Geological Information Division produces good quality texts and maps, and the only significant delays in publication production, identified by Division Directors, are in connection with the peer review and proofreading stages or with problems relating to the scheduling of complex publications.

Present Library facilities available within the Survey are of a very high standard. Not only does the Library provide ready reference to a large cross-section of available published geological literature, but also is the repository for the Central Technical Files containing valuable data and records, produced and received by the Survey, which are not available in the published record. The legitimate anxiety within the Survey concerning the effects of restrictions on the Library's ability to maintain its purchasing capacity and high standards in the current inflationary period has resulted in very recent budget improvements. The current Advisory Committee considers the GSC Library to be a national resource of significant importance and any imposed lower standards of storage and maintenance will eventually lead to the deterioration and loss of many documents to the detriment of the Canadian geoscience population as a whole.

External Communications

Concern was expressed by some Directors about communication weaknesses with sections of the public they have to serve. Industry, for example, appears to be disinterested or unaware of several programs relating to both energy and metallic minerals and more feedback on Survey projects from industry would be welcomed. Several Directors expressed the view that there should be more integration between sectors within the Department of Energy, Mines and Resources, implying that much of the GSC output and its potential contribution is not fully used or appreciated.

Many Divisions have close ties and provide services to other branches of government. An example would be the contacts between Terrain Sciences and the Department of the Environment and Public Works, Canada. Commonly, such ties facilitate a good exchange of information. However, where similar traditional contacts do not exist, GSC personnel believe that many other departments could use their data to better advantage.

Communication problems still exist between some GSC Divisions and Provincial Surveys (Weir et al., 1979) although, at the management level, progress has been made with the creation and successful functioning of the National Geological Surveys Committee (NGSC).

Good relationships exist between many university geoscience departments and several Divisions within the Survey. In some instances lack of feedback is, again, a perceived problem.

Following an evaluation of the various expressed opinions of Division management, the Committee recognizes common difficulties whenever scientists and management within a Division attempt communication with another group.

Similar communication problems exist in the Survey's relationships with other sectors of Energy, Mines and Resources and it is quite apparent that communication can be improved with other estates. These situations exist, despite the fact that communication between several project scientists on the one-on-one level with counterparts in the other groups is often very good, amicable and productive. These common difficulties, their probable cause and effect, and the Committee's recommendations are discussed more fully in a later part of this report.

5. RELATIONSHIPS AND USE OF GEOLOGICAL SURVEY OF CANADA OUTPUT BY OTHER SECTORS OF THE FEDERAL GOVERNMENT

In order to comprehensively sample opinions on the published and unpublished output of the Geological Survey, the Advisory Committee divided itself into three subcommittees charged with the evaluation of comment from the Energy Policy Sector, the Minerals Policy Sector, DIAND and various users of GSC data.

The Energy Policy and Minerals Policy Sectors, DIAND and the Departments of Agriculture and the Environment are major users of Geological Survey data. Communication between groups established in Ottawa and the GSC is mainly on an informal basis. The commonest and most effective interaction is on a one-on-one level. Consequently, the majority of data transferred is in an unpublished form.

The extent of use of GSC data varies with each department. The Mineral Policy Sector freely admits that it would not have the scope and range of activities it has without the support and contributions from the GSC's Economic Geology Division. Energy Policy relates frequently with ISPG and the Atlantic Geoscience Centre, and the Departments of Agriculture and the Environment communicate often with Terrain Sciences. All departments obtain geoscientific and resource data from other sources, principally from provincial surveys and industry, but also from universities and other federal bodies such as AECB, CANMET and the NEB.

There is a general agreement among the users surveyed, that the data provided by the GSC are of high quality and often superior to output from other sources. Most groups interviewed expressed general satisfaction that the GSC was providing needed data, although in some fields such as petroleum, natural gas and specific metals, the information flow was not satisfactory because of staffing problems at ISPG and, to a lesser extent, at AGC and in the Economic Geology Division. The concept of Open File presentations allowing rapid dispersion of data received favourable comment in several discussions.

Interaction at senior management levels within the sectors examined varies considerably. With the Energy Policy Sector, this communication is good through both formalized meetings and informal discussions. Senior management contacts are not so well developed with the Minerals Policy Sector who look for such contacts through relatively formal management meetings, held by the sectors, to which observers are invited. The Minerals Policy Sector has been able to communicate quite well with groups like CANMET through management meeting exchange.

The success of joint resource appraisal programs, the preparation of various publications including those related to Northern National Parks demonstrates that communication at the working level is achieved satisfactorily. However, such achievements and other results have not occurred without the development of some irritations. These conflicts are related to differing professional backgrounds within the sectors.

The staffs in the Energy Policy and Mineral Policy Sectors include a large proportion of economists and statisticians – contrasting sharply with the national science orientation of GSC geologists. In recent years geologists and mining engineers have been included in the Minerals Policy Sector staff facilitating easier communication.

The demands within the policy sectors are characteristically short term or immediate. Consequently, officers have to be flexible and available. Some GSC research scientists are not trained to be flexible and available, and responses to requests from the policy sectors are not always received as quickly as desired or expected. Thus the timeliness of GSC responses is a source of criticism. This problem can be overcome, in certain instances, by face-to-face discussions with GSC personnel but more detailed answers to more complex requests are frequently "delayed, lengthy and too geological". Such impressions foster a perceived lack of interest in the others' purpose and a sense of interference in the GSC scientists' preferred endeavour.

It is obvious that the differences in philosophy and interests between the GSC and EMR policy personnel translate into communication problems. A stronger economic orientation in the GSC and a greater geological orientation in the policy sectors would facilitate an easier exchange.

GSC geologists, generally, are beginning to accept that they have an important role to play in the mineral assessment process. The following are quotations from the report of a GSC geologist following a joint GSC-MPS excursion to mines in Eastern Canada;

> ".....my own interests and expertise complimented rather than duplicated those of other members of the team....."
>
> ".....I was able to provide substantial geological advise to MPS... general mineralogical, geochemical, grade, form, etc., characteristics of the deposit type....."
>
> ".....I was able to ask company personnel specific questions which arose from my knowledge of the deposit type, which may have been overlooked by other members of the team but were of economic significance e.g. details of associated trace metals"
>
> ".....the information on mining, milling, etc., organization methods and costs (was) very interesting and of benefit in appreciating the overall economic factors involved in making a mineral deposit a profitable mine. However, the information is not of direct applicability to my own project"
>
> "The comprehensive discussions help in focussing in on problems which geological research may help to solve, and hence is useful in indicating research topics that are of current interest to the mining industry"

These quotations reveal the experience and interests of personnel in both sectors, and clearly indicate the benefits to be gained from joint GSC-MPS activity. This combined experience, necessary for the economic evaluation of mineral deposits, is essential for proper terrain evaluation.

During the course of the Subcommittee's interviews suggested solutions to communication problems within EMR were discussed. The creation of an intermediate communication group between the GSC and the policy sectors is certainly not endorsed by the Advisory Committee, although the second suggestion of an interchange of personnel on two year assignments could be beneficial and deserves evaluation. Reciprocal open houses have been found by many to be satisfactory introductions to activities within the various government departments.

The "show and tell" approach is particularly favoured by DIAND personnel whose annual "Geoscience Forum" meetings have proved very successful. Also, DIAND and the GSC are participating in an exchange process in which a scientist from the GSC Cordilleran Section has been seconded to DIAND's Whitehorse Office for a two year period.

Despite some effective initiatives at the Atlantic Geoscience Centre, the Pacific Geoscience Centre and the Cordilleran Division, and the successful establishment of annual open houses by provincial geological surveys and departments of mines, many in the GSC have not always favoured this type of exchange. In response to the recommendations of this Advisory Committee, however, the GSC elected to hold an open house in Ottawa in early 1982.

Too few regular meetings occur between GSC and DIAND personnel. There are exchanges concerning some aspects of planning or policy, but a greater role by the GSC in long term planning of programs in relation to parks and other resource matters in the north would be beneficial to both groups.

It is apparent from interviews conducted by the Committee that there is a lack of communication between personnel in the Department of Agriculture, DIAND and the Terrain Sciences Division (TSD) on issues of mutual concern, e.g. soil classification and certain ecological matters. However, the output of the TSD is often praised and the other federal agencies find the Division to be generally responsive to their needs. Better co-ordination should exist, between the Terrain Sciences Division and the Land Resources group of the Department of Agriculture in the organization of their respective mapping programs and in the publication of surficial and soil maps by the two agencies. Other difficulties have developed between the GSC and the National Hydrological Research Institute (Department of the Environment). Groundwater studies, and other water-base scientific activities of EMR were transferred to the Department of the Environment on the argument that hydrological investigations, especially those relating to the nuclear waste disposal programs, are of an engineering nature rather than scientific studies. This move is widely criticised both in government and the private sector. Terrain Sciences personnel maintain that groundwater and surficial studies are complementary and should be studied together. Industry personnel are generally more critical of TSD performance than other Federal Government sectors, citing poor coverage of geotechnics and some aspects of permafrost environments. The slow pace of publications is noted by many groups – especially in relation to the nuclear waste program. However, many basic data have been placed in the public domain through AECL's Open File system.

The Advisory Committee believes that improvements in communication between the GSC and its public can and should be made, and some recommendations have been formulated.

6. SURVEY OF OPINION ON GEOLOGICAL SURVEY OF CANADA OUTPUT BY USERS OTHER THAN THE FEDERAL GOVERNMENT

The prime method chosen by the Committee to survey the large population of users of GSC published and unpublished data outside the Federal Government was by questionnaire (see Appendix "C"). This questionnaire was designed and prepared by A. Sutherland Brown following input by the Committee and following consultation and recommendations offered by Statistics Canada. Effective communications with Statistics Canada was arranged and co-ordinated by B.S. Norford of the GSC and I.S. Jaswal of EMR.

The questionnaire requested information and opinions as follows:-

1. Respondent's name and affiliation (Section A)
2. The interests of the Respondent (Section B)
3. The nature of the Respondent's use of GSC data (Section C)
4. Coverage, relevance, timeliness and accuracy of GSC data (Section D)
5. The format of GSC publications (Section E)
6. Access to GSC data (Section F)
7. The informal output of the GSC (Section G)
8. Comments on the Current Research volumes and any recommended new areas of activity for the GSC (Section H)

The questionnaire was distributed to a number of different constituencies of organizations that employ earth scientists: universities, provincial agencies, petroleum, mining, geotechnical and utility companies and consultants. For some of these constituencies, distribution was to all known organizations in Canada, for others to a judiciously selected cross-section. In addition, a distribution was made to another constituency, a randomly selected sample of individual geoscientists from the memberships of co-operating constituent societies of the Canadian Geoscience Council, in order to broaden the survey and to provide a control group of individual geoscientists in Canada. Response ratios differed markedly between the various constituencies sampled (see Table 6.1). Of 838 questionnaires distributed, a total of 395 were returned before results were collated. The percentage of this response is 47.1.

Each individual questionnaire was numbered and cross referenced against the person or institution invited to respond. Such cross-reference information and the details provided under Section A of the questionnaire was kept confidential to the Committee. Data returned in answer to the questions in Sections B through H were passed on to Statistics Canada. The major task of editing the responses was undertaken by B.S. Norford.

The format of the questionnaire allowed respondents to answer questions simply and easily so providing data for arithmetic tabulation. Space for comments invited more expansive comment, recommendations and opinions. The arithmetic data, condensed as percentages of the total of the 395 replies, is contained in Appendix "C". The comments are in Appendix "D" (this 218-page document is available for consultation as GSC Open File 946).

The Advisory Committee has appraised weighting responses to provide for disparities in response ratios and also to compensate for the differences in size and complexity of the organizations within a single constituency. Such weighting is highly complex and requires a number of pragmatic decisions. The Committee compared the results of synthesis of unweighted data for several constituencies and found remarkable similarities in their responses to many questions. Therefore, the decision was made to use unweighted data throughout the report, judging that the shortcomings of this procedure would be less than those that might be introduced by the pragmatic decisions inherent in the introduction of weighting.

Table 6.1

Summary of the questionnaire distribution and returns

Constituency	Questionnaires Distributed	Questionnaires Returned	% Response
University Geoscience Departments	47	20	42.6
Provincial Surveys and Mines Dept.	12	10	83.3
Other Provincial Agencies	11	8	72.7
Petroleum Companies	57	35	61.4
Petroleum Consultants	14	2	14.3
Geotechnical and Utility Companies and Consultants	57	22	38.6
Mining and Mineral Exploration Companies	129	81	62.8
Mining and Mineral Exploration Consultants	46	27	58.7
Individual Geoscientists	465	190	40.9
TOTAL	838	395	47.1

Data were synthesized for each constituency and, in addition, cumulative arithmetic scores are presented for all the returned questionnaires. This list provides a ready reference to total opinion, but, being unweighted, allows the opinion of an individual geoscientist to have input equal to that of a large company active in resource exploration and production and employing scores of scientists.

Very prominent trends are present in the arithmetic data and such trends are often common to several constituencies. Significantly, there is a strong parallelism between the opinion of randomly selected Individual Geoscientists and that of the Total Respondents (see Table 6.2). Utilizing this random sample as control, it is evident that the total sample is not distorted. In fact, the distribution in the random sample is proportionately almost identical to that of the Total Respondents.

There are also several common themes evident in the expressed comments from the various constituencies and the group of Individual Geoscientists (Appendix "D"). This serves to accentuate the concerns and needs of the geoscientific public.

For details, the reader is referred to the Appendices. This text will identify, comment on and interpret prominent features apparent from the data.

The dominant interest and/or activity of all respondents is exploration (83.78 per cent), with more than half of these (46.83 per cent), engaged in the search for metals (Appendix "C"). Slightly less than one quarter work in a service or consulting capacity and 21.24 per cent are involved in the production of our natural mineral resources. 12.65 per cent are employed by government agencies and 13.62 per cent by educational institutions (see Fig. 6.1).

The six most popular geographic areas of interest among the respondents are:-

1. Western Cordillera (57.21%)
2. Precambrian Shield (55.19%)
3. Western Sedimentary Basin (42.27%)
4. Appalachian Region (36.20%)
5. Atlantic and Eastern Offshore (23.79%)
6. Arctic Islands (22.07%)

Computer printouts provided by Statistics Canada have made it possible for the members of the Committee to examine responses from different constituencies. A selection of these responses are summarized in Table 6.2. It is evident that a very high proportion of geoscientists use GSC data. This proportion reaches 98.5 per cent for geoscientists interested in the Appalachian Region. Among personnel engaged in the exploration and production of metals and related mineral resources across Canada, the proportion exceeds 96.0 per cent. The average for the Total Respondents is 90.37 per cent.

Use of Geological Survey of Canada Data and its Communication

The majority of respondents rate themselves as moderate users of GSC data (Table 6.2). Among geoscientists expressing interest in the four geographic regions included in Table 6.2, those concerned with the Cordilleran region are the most frequent users. Excluding Provincial Surveys and Agencies, the most prominent users of GSC data among the other constituencies listed are those interested in the Exploration and Production of Metals and Related Minerals. Least frequent users among the mixed constituencies are the Individual Geoscientists and the Educators. Respectively, 28.9 per cent and 26.4 per cent of these two populations are minor to rare users of GSC data. There is an apparent close relationship – although not direct – between frequency of use of GSC data, and consultation of the GSC Indices and the Monthly Information Circular. With the exception of the Provincial Agencies there is also a crude correlation between use and access to GSC information. GEOSCAN and GEOREF are consulted by less than 20 per cent of Canadian geoscientists, with educators making relatively greater use of the GEOREF files than all but provincial geologists.

While the percentage using tapes is low, the respondents are major companies who have organized their data handling to accommodate tapes.

The most important public source of GSC documents are the libraries of the employing companies or institutions. The most commonly used alternative sources among industrial geoscientists are the provincial and federal government libraries. Provincial respondents and the education constituency indicate that their personal libraries constitute their second most important source of GSC publications. In the Appalachian region, university libraries are an important second source of GSC information.

It has been noted that the Individual Geoscientist constituency is the least frequent user of GSC published output. This group is also distinctive because individuals communicate less frequently and make considerably less use than other geoscientists of the Monthly Circular and other indices (Table 6.2). Examination of the population makes it clear that the most likely explanation of these low responses is the inclusion in the Canadian Geoscience Council membership lists of scientists whose dependence on geological data is very slight.

Public libraries are hardly used at all by professional geoscientists. This could be a reflection of the unavailability of GSC documents in some public libraries as indicated by comments from the questionnaire, but the Committee believes that geoscientists, as a group, do not use public libraries for access to GSC publications.

The favoured means of communication between geoscientists and GSC personnel is by telephone. Consultation at conferences, workshops and in GSC offices is also quite popular. Contacts by mail or in the field are not uncommon but are considerably less frequent. The effectiveness of all means of communication, is judged to be high, indicative of an adequate attention by GSC scientists to proffered enquiries and discussion.

Facilities for reading microfiche and GSC computer tapes are not widely available. However, proportionately more geoscientists use microfiche than the geochemical, geophysical and GEOSCAN data tapes. It is evident from the responses that several major companies have reorganized their data handling facilities to accommodate GSC data tapes. A weighted data presentation would reflect this, but the proportion of geoscientists with data-tape access would still be significantly less than those having access to less expensive microfiche equipment.

Use of Geological Survey of Canada Publications

The most frequently used GSC publications (Question C-3) are Bedrock Geological Maps. However, when monthly as well as weekly and daily use is taken into account, reference to GSC Papers, Bulletins and Memoirs is cumulatively comparable to the use of the bedrock maps and within the range 62.5 per cent to 66.5 per cent. Other publications with a cumulative frequency of daily, weekly and monthly use in excess of 40.0 per cent are Regional Compilation maps, Open File maps and reports, Current Research volumes, the Economic Geology series and Aeromagnetic Maps. Least used publications are Open File data tapes and microfiche, Offshore Multiparameter Maps and Airborne Radiometric Maps, reflecting, in the first two instances, availability of facilities and convenience, and, in the latter instance, general interest and perceived application. GSC hard copy and maps are used primarily as basic reference sources (Question C-4). The Current Research volumes and the Regional Synthesis maps are effective in the stimulation of ideas.

The geoscientific public is almost unanimously complimentary of the format of GSC hard copy and maps (Question E-1). The favoured rating is "good" without being "too elaborate".

Use of Other Geological Survey of Canada Output

Most respondents (73.67 per cent) use other GSC output by attending conferences, requesting verbal or written advice and by reading other publications on an average of monthly to yearly intervals. Accessibility and exposure of GSC scientists to their geoscientific peers is obviously an important and effective activity.

Relative Degree of Interest of Respondents

Only respondents with an interest in the regions and the disciplines listed in Questions D-1 and D-2 estimated ratings. Although there was a widely variable response relative to the listed disciplines or regions, the number responding to each question posed for any particular discipline or region is remarkably consistent. For example, for the Total Respondents, the variation in the number of answers to the questions on needs, accuracy, timeliness and duration of usefulness for all listed regions and disciplines ranges from a maximum of 0.25 per cent to a maximum 3.5 per cent of the population total. The consistency of these responses has enabled the Committee to prepare a series of histograms illustrating the relative degree of interest and/or use of selected geoscientific populations in the identified regions and disciplines.

Table 6.2

Selected Responses Constituencies and Regions — Advisory Committee Questionnaire

Response and Question Number / Constituency or Region as % of Population of 395		Total Respondents (100%)	Individual Geoscientists (48.1%)	Cordilleran Region (57.21%)	Precambrian Shield (55.19%)	Appalachian Region (36.2%)	Western Canada Sedimentary Basin (42.27%)	Exploration and/or Production of Metals and Related Minerals (48.35%)	Exploration and/or Production of Oil & Gas (20.5%)	Education (13.4%)	Provincial Surveys and Mines Depts. (2.53%)	Provincial Agencies (4.55%)
Proportion of Constituency using GSC published or informal output?	C-2	90.37	84.7	95.6	93.6	98.5	90.91	96.3	84.0	94.3	100.0	100.0
Do you consider yourself:												
a major user?	C-2	11.39	9.5	16.7	13.3	12.0	12.57	12.6	7.4	17.0	30.0	16.7
an important user?	C-2	23.03 } 68.09	15.3 } 55.3	32.4 } 85.2	26.1 } 72.9	27.0 } 75.00	22.16 } 68.26	30.9 } 79.6	19.8 } 60.5	18.9 } 66.1	70.0 } 100.0	55.5 } 77.7
a moderate user?	C-2	33.67	30.5	36.1	33.5	36.0	33.53	36.1	33.3	30.2	0.0	5.5
a minor user?	C-2	19.49	25.8	12.5	17.4	18.0	19.70	15.2	19.8	26.4	0.0	22.2
a rare user?	C-2	2.28	3.1	0.9	2.3	3.0	2.39	1.0	4.9		0.0	
Proportion having adequate access to GSC Information	F-2	73.92	65.8	88.8	78.9	82.00	76.05	79.1	73.84	77.36	90.00	88.9
Proportion using the following:-												
GSC Monthly Information Circular	F-3	62.27	48.4	75.7	65.6	66.0	65.27	73.8	58.0	56.6	90.00	83.3
GSC Yearly Index	F-3	53.92	42.1	65.5	61.9	61.0	53.89	66.0	48.1	50.9	60.00	61.1
GSC Cumulative Index	F-3	46.83	37.4	58.0	56.0	50.6	46.11	62.3	35.8	32.1	50.00	38.8
GEOSCAN	F-3	12.15	8.9	11.9	16.0	13.6	10.18	11.5	6.2	18.9	50.00	33.3
GEOREF	F-3	18.48	17.9	19.9	20.2	24.0	17.36	17.3	13.6	35.9	50.00	27.8
Information Services - GSC Offices	F-3	37.72	28.4	49.6	39.4	33.2	42.52	46.6	37.0	20.8	50.00	33.3
GSC Volume of Abstracts	F-4	38.98	29.5	46.0	44.0	55.2	32.50*	43.5	32.1	45.2	80.00	66.7
Most Important source of GSC Documents	F-1	Company Library 45.31	Company Library 34.2	Company Library 57.1	Company Library 46.8	Company Library 52.0	Company Library 49.04	Company Library 63.9	Company Library 64.3	University Library 78.0	Government Library 80.00	Government Library 72.2
Second most important source of GSC Documents	F-1	Government Library 28.35	Government Library 23.1	Government Library 43.9	Government Library 28.4	University Library 28.6	Government Library 17.96	Government Library 36.1	Government Library 34.4	Individual Library 45.0	Individual Library 40.0	University Library 33.3
Proportion having facilities for reading microfiche	E-2	53.92	51.0	53.5	56.0	65.0	63.16*	44.0	60.5	77.3	100.0	88.9
Proportion having facilities for direct use of GSC computer tapes	E-5	29.36	28.4	29.6	28.0	32.9	24.68*	23.6	23.5	47.2	100.0	66.7
Proportion using Microfiche (commonly and rarely)	E-3	60.12	43.7	54.4	56.0	64.3	55.26*	47.6	53.1	60.4	100.0	88.9
Proportion using GSC computer tapes of:												
GEOCHEM DATA	E-6	8.35	7.4	8.8	10.5	13.3	2.63*	11.0	2.5	5.7	50.0	27.8
GEOPHYS DATA	E-6	6.83	4.7	7.5	9.6	11.9	3.94*	9.4	3.7	3.8	30.0	16.7
GEOSCAN	E-6	5.82	4.2	4.4	8.7	7.7	0.00*	5.8	0.0	5.7	60.0	33.3
Frequency of communication:-												
Frequently	G-1	16.96	14.7	21.2	17.9	18.1	12.44	18.8	6.2	24.5	60.0	38.9
Moderately	G-1	40.76	32.1	48.2	43.6	51.0	44.90	47.6	39.5	41.5	30.0	33.3
Rarely	G-1	28.61	32.1	23.9	27.5	25.9	28.13	25.6	34.6	24.5	10.0	22.2
Never	G-1	3.29	4.2	1.3	4.1	2.8	2.39	3.1	2.5	3.8	0.0	5.5
Places of communication:-												
In the Field	G-2	36.96	30.5	45.6	39.4	41.3	31.12	48.2	17.3	39.6	80.0	61.1
In GSC Offices	G-2	58.98	48.9	72.6	57.8	67.8	64.55	66.5	61.7	50.9	90.0	66.7
At Workshops, Conferences	G-2	55.69	48.4	63.7	61.0	72.0	56.29	65.4	44.4	50.9	100.0	77.8
By Telephone	G-2	64.05	55.8	72.6	67.0	74.1	65.87	69.6	60.5	67.9	100.0	88.9
By Mail	G-2	38.23	31.6	39.4	41.7	49.6	36.52	38.2	22.2	58.5	90.0	83.3

Figures in body of table represent proportion responding. The proportion relative to the total population of 395 is presented as a percentage figure in the upper legend title block.

Figure 6.1

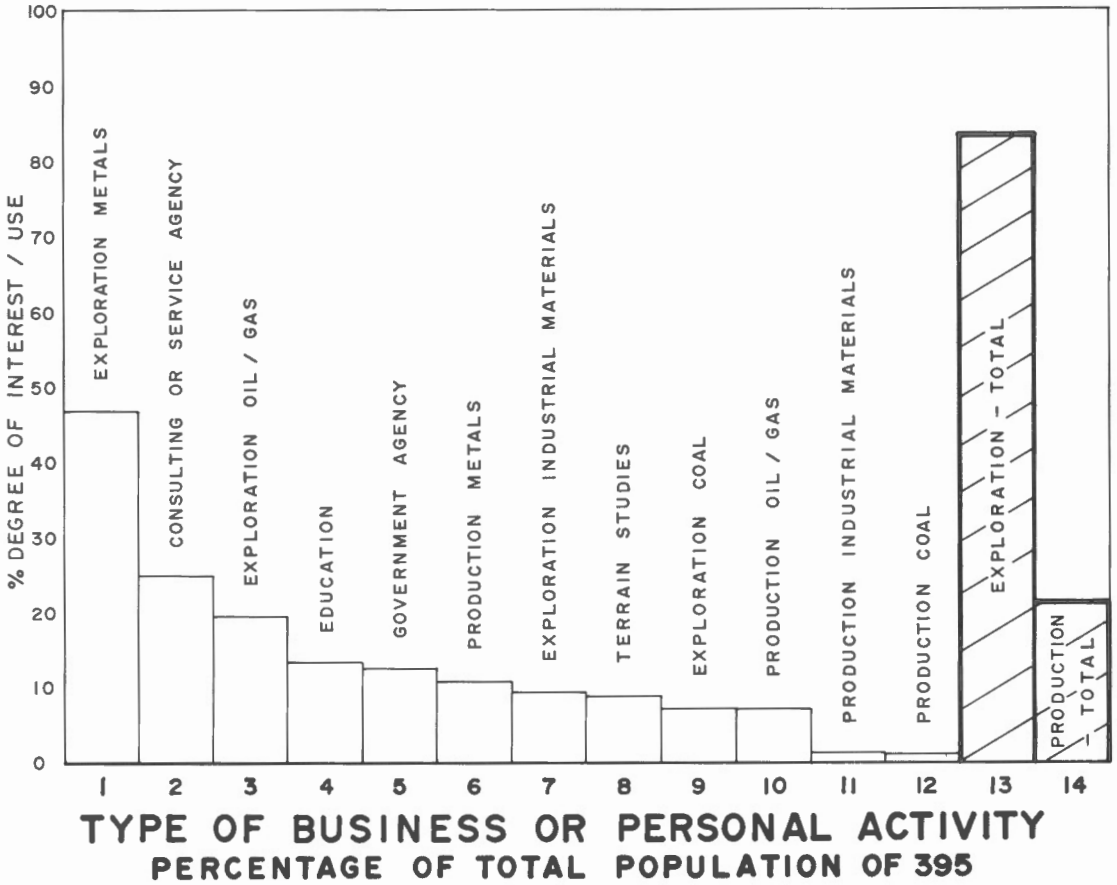


Figure 6.2

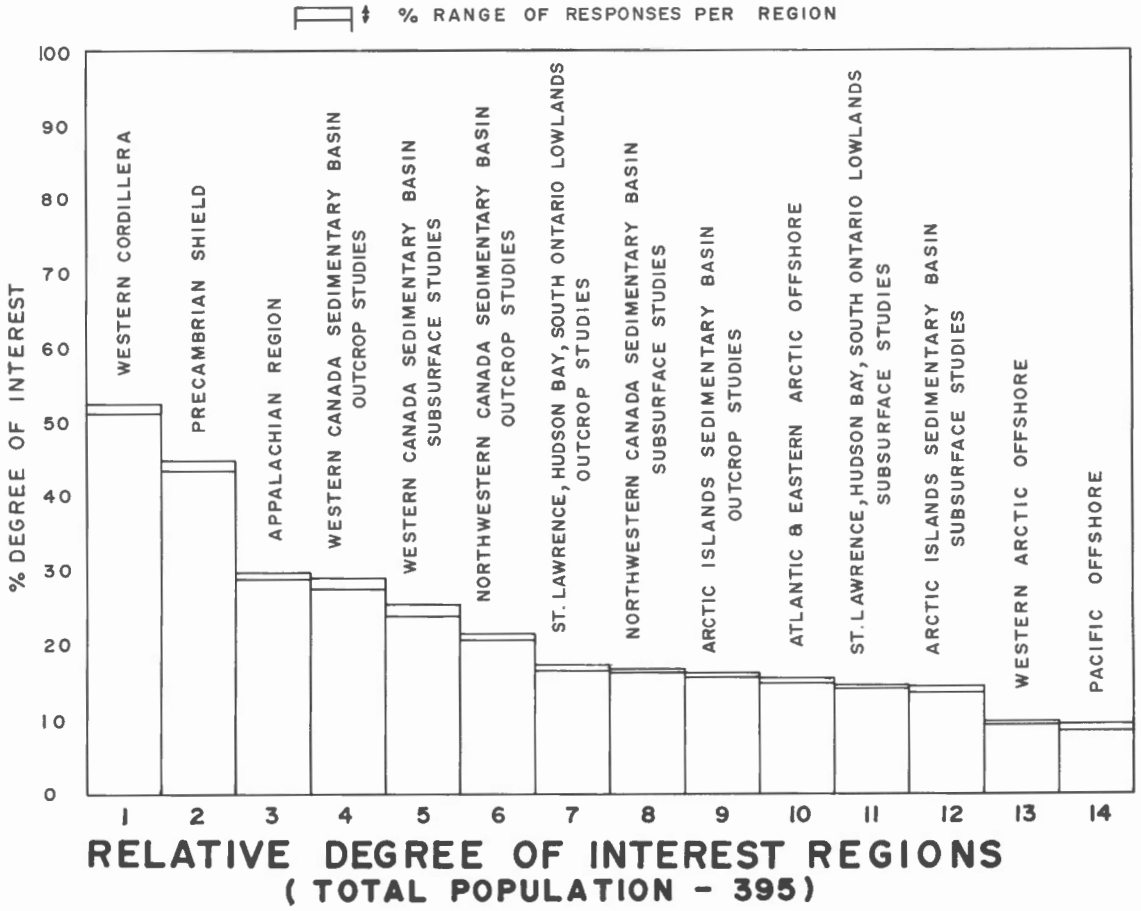
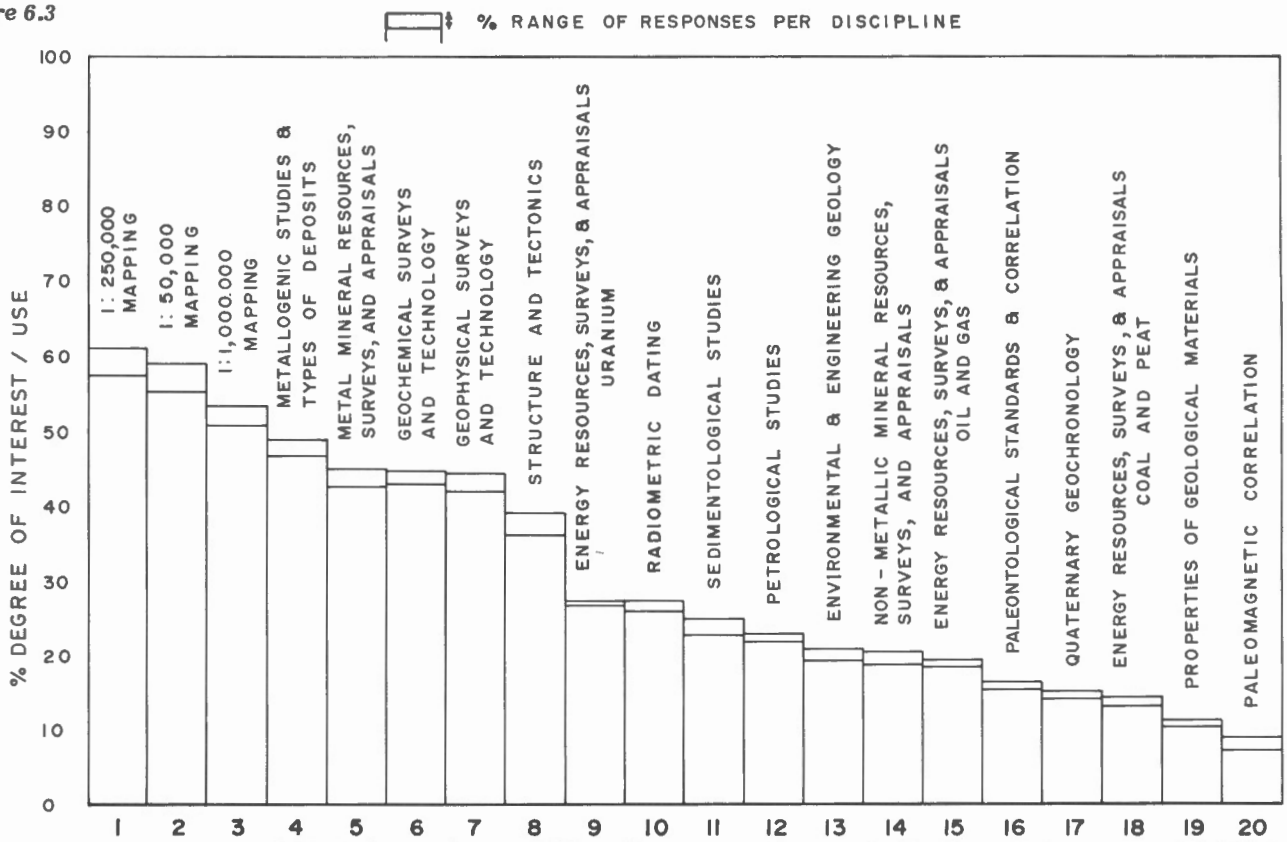
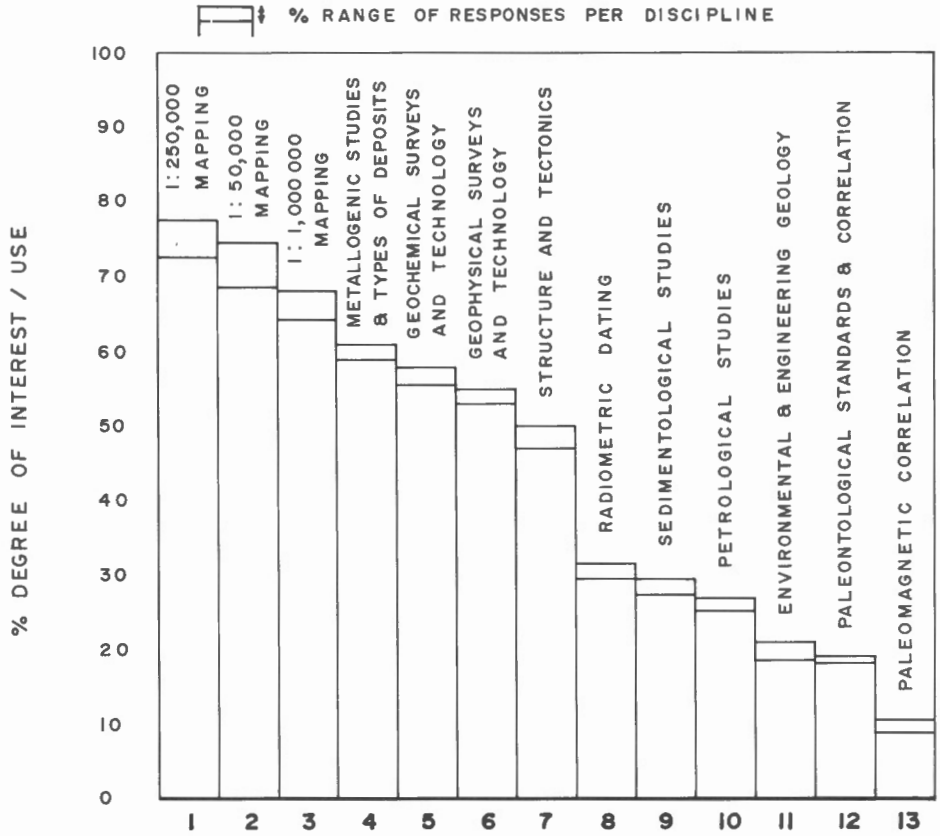


Figure 6.3



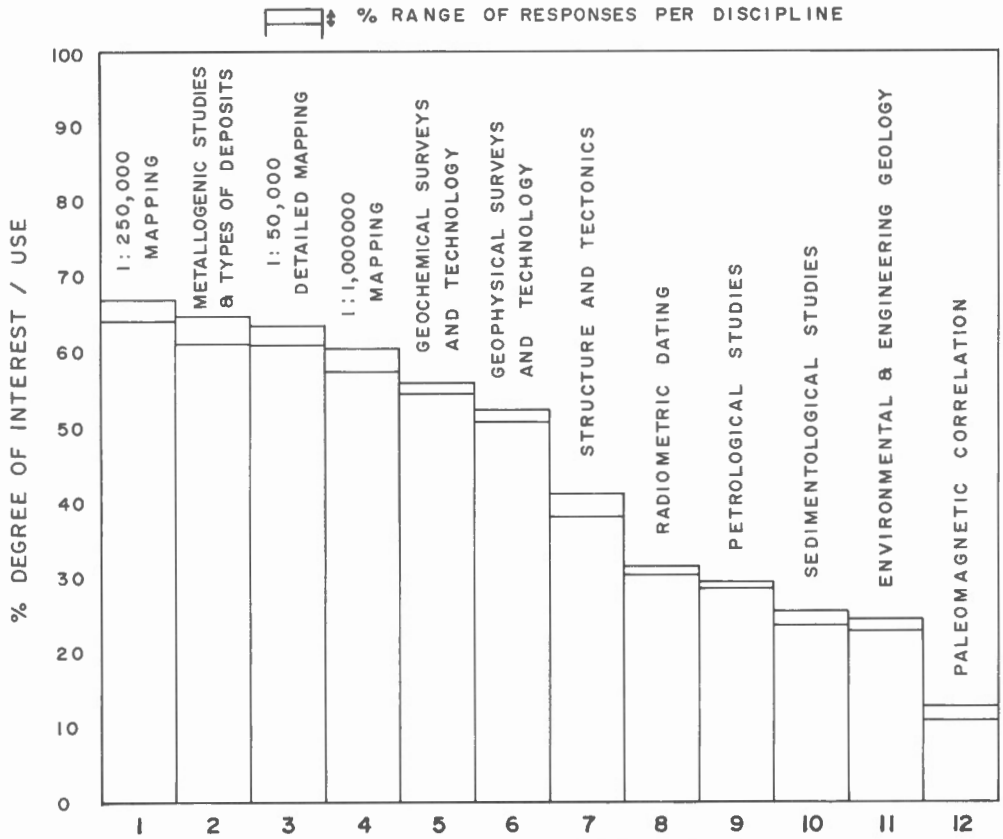
RELATIVE DEGREE OF INTEREST AND USE OF DISCIPLINES
(BY WHOLE POPULATION - 395)

Figure 6.4



RELATIVE DEGREE OF INTEREST AND USE OF DISCIPLINES
ORGANIZATIONS AND INDIVIDUALS STUDYING
CORDILLERAN REGIONS OF CANADA

Figure 6.5



RELATIVE DEGREE OF INTEREST AND USE OF DISCIPLINES

ORGANIZATIONS AND INDIVIDUALS STUDYING

THE PRECAMBRIAN SHIELD

Figure 6.2 is the relative interest plot for the various regions defined in Question D-1 based on the total population of 395. The range of relative interest varies from a high of 50.80 - 52.15 for the Western Cordillera to a low of 8.61 - 9.82 for the Pacific Offshore[1].

Western Cordilleran and Precambrian Shield regions command the highest geoscientific interest followed by the Appalachian Region and the Western Canadian Sedimentary Basin (Fig. 6.2). This order reflects the preponderance of exploration oriented personnel in the total population.

Figure 6.3 is the relative interest and/or use plot for all disciplines, again, based on all 395 respondents.

Of the twenty disciplines plotted in Figure 6.3, Reconnaissance (1:250 000), Detailed (1:50 000) and Regional (1:1 000 000) Mapping have the highest interest indices followed by Metallogenic Studies and Types of Deposits, Metal Mineral Resources Surveys and Appraisals, Geochemical Surveys and Technology, Geophysical Surveys and Technology, and Structure and Tectonics. Again, this reflects exploration interest, particularly in metallic mineral resources.

Figures 6.4 and 6.5 are the degree of interest and/or use plots of disciplines for the two largest regional populations of the Western Cordillera and the Precambrian Shield. Gross similarities are apparent but with the Precambrian group indicating a higher relative interest in Metallogenic Studies and the Cordilleran group placing a relatively greater interest on Detailed and Regional Mapping. Reconnaissance (1:250 000) Mapping is of greatest interest and use in both regions.

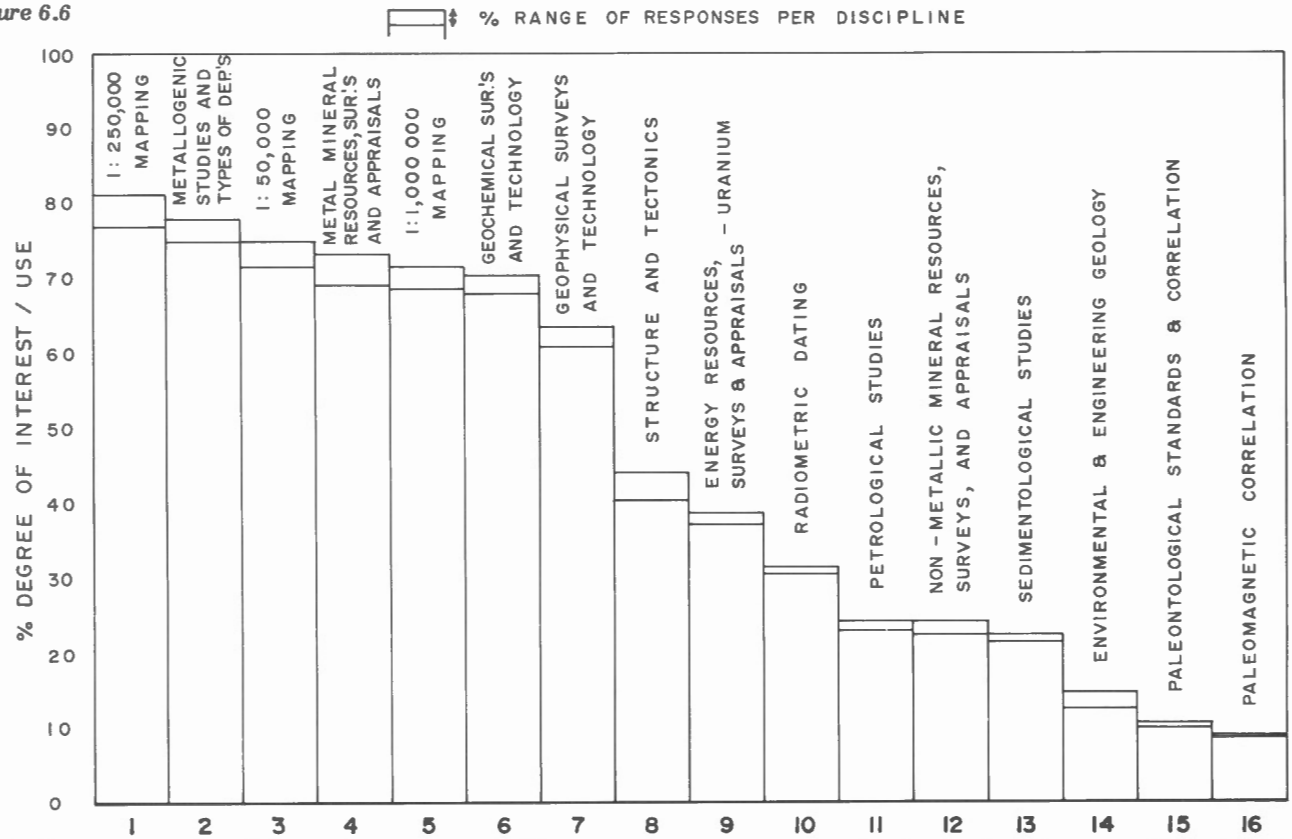
An expected emphasis on Metallogenic Studies and Metal Mineral Resources is illustrated in the relative interest plot of data provided by those engaged in the exploration and production of metallic and related mineral resources (Fig. 6.6). A significant proportion of this population (191) are present within the Western Cordilleran (226) and the Precambrian Shield (218) populations and this influence tends to dominate the relative order of disciplines in the two regional populations.

The Education constituency and the Oil and Gas Exploration and Production group do have priority interests which differ from those of the Total Respondents. The levels of interest of the Oil and Gas Exploration and Production Group are predictable. The Western, Northwestern and Arctic Islands sedimentary basins are, of course, high priority areas (Fig. 6.7). The Western Cordilleran region also rates very highly. Similarly, the disciplines of Energy Resources, Surveys and Appraisals – oil and gas, Structure and Tectonics, Sedimentological Studies and Paleontological Standards and Correlation have a high interest and utilization rating (Fig. 6.8). Geological Mapping, particularly on the 1:50 000 and 1:250 000 scales, has a prime importance among the Oil and Gas Exploration and Production Group essentially comparable with other constituencies.

Prominent among the responses from the Education population is the comparatively greater interest in the Atlantic and Eastern Arctic Offshore, the St. Lawrence, Hudson Bay and South Ontario Lowlands and the Arctic Islands Sedimentary Basin than the total population (Fig. 6.9). Among the disciplines, Radiometric Dating rates a very prominent third in interest and use behind 1:50 000 Mapping and Metallogenic Studies and Types of Deposits (Fig. 6.10).

[1] The difference of 1.26 between 50.89 and 52.15 and 1.21 between 8.61 and 9.82 represents the difference (range) in percentage units between the largest and smallest number of responses to the individual questions on 'needs', 'timeliness', 'accuracy' and 'duration', relative to the population of the Total Respondents constituency.

Figure 6.6



RELATIVE DEGREE OF INTEREST AND USE OF DISCIPLINES

ORGANIZATIONS AND INDIVIDUALS ENGAGED IN THE EXPLORATION AND PRODUCTION OF CANADIAN METALLIC AND RELATED MINERAL RESOURCES

Structure and Tectonics, Petrological Studies and Paleontological Standards and Correlations also have a relatively higher rating among the Education Group.

Certain features in these data indicate that the relative interest in specific disciplines could vary significantly with time. For example, the interest in Energy Resources, Surveys and Appraisals – Uranium, stands ninth in Figure 6.3. During the boom years in uranium exploration (1977 through 1979) a similar survey would likely have given this discipline a higher rating. More broadly defined disciplines can be expected to have considerably more stable interest rankings with time. However, significant advances or scientific breakthroughs in any discipline will enhance its use resulting in an increased relative interest and use rating over a few years. Similarly, the relative interest in a geographic region will be influenced by significant situations. The Pacific Offshore, for example, has the lowest interest rating among the defined regions (Fig. 6.2). This very likely is due to the existing moratorium on exploration and development of resources off the west coast. A mineral or other geological discovery which, in some cases, could be related to GSC activity, will considerably enhance an area's rating.

It is emphasized, therefore, that a relatively low interest rating of a discipline or a region is not necessarily an indication of its future use, application or potential.

In this context, it is pertinent to note that the first Advisory Committee (Weir et al., 1979) placed an emphasis, which the present Committee endorses, on the GSC's important function of utilizing and evaluating new disciplines and technology to ascertain their application in Canadian geoscience or geoscience in general. Such investigations, as has been the case with airborne magnetometer and regional geochemical surveys, may establish the importance and popularity of a developing discipline, leading to the enhancement of the Canadian data base and the better understanding of the landmass and its resources. Such pioneering activity by the GSC in the geoscientific disciplines is an essential activity and fundamental to progress.

Coverage, Relevance, Timeliness, and Accuracy

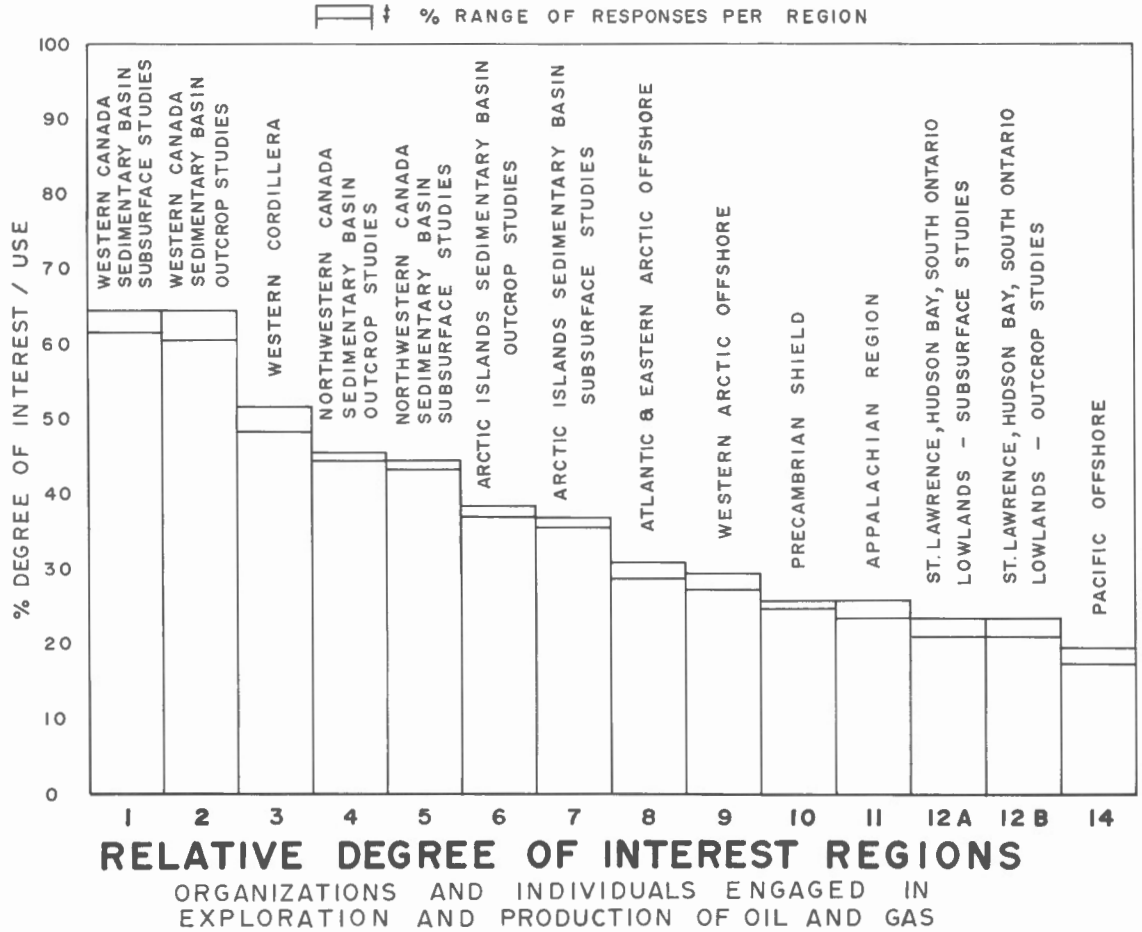
Regions

The responses to this part of the questionnaire (Question D-1) indicate that the purpose of the subsection enquiries was interpreted consistently. Comments on "needs" relate, primarily, to "coverage", and "duration of usefulness" reflect a broad perspective rather than the immediate need. Overall, the data present a valuable opinion of the GSC performance in the past and its perceived role in advancing Canadian geoscience.

There are prominent similarities in trends and opinion which can be adequately described by general reference.

It is also apparent, from a comparative study of replies from the Total Respondents and the Individual Geoscientists that there is a close overall similarity between the opinions of the control group and the total population. The four histograms in Figure 6.11 aggregate the percentage responses for the rating categories "poorly" through "excellently" (see Question D-1; Appendix "C") for coverage, timeliness, accuracy, and duration of usefulness, for the total sample and

Figure 6.7



the control group and afford a comparison of the responses from both populations. The aggregated numbers, themselves, are not particularly meaningful but they do illustrate a systematic lower response in the random sample. However, the distribution of opinion illustrated is very similar for each topic, confirming the validity of the data.

Figure 6.11 is a convenient reference for the following discussion. Details are included in Appendix "C".

In all regions, the Total Population and the Metallic Mineral Exploration and Production personnel consider their needs to be "acceptably" to "well" served by GSC formal output. For the Total Population, the highest ratings are for the Western Cordilleran region and for outcrop studies in the Western, Northwestern and Arctic Islands Sedimentary Basins. In all other regions "marginally" was checked more frequently than "excellently" indicating a skewness in the direction of the lower ratings.

The opinions of the Metallic Mineral Exploration and Production group reflect a slightly greater satisfaction with GSC coverage than the Total Population. Of seven regions surveyed, needs are predominantly "well" served in the Western Cordillera, the Precambrian Shield and the Western, Northwestern and Arctic Islands Sedimentary Basins. The predominant rating in the Appalachian Region and St. Lawrence, Hudson Bay and South Ontario Lowlands is "acceptably". With the exception of the Precambrian Shield, the St. Lawrence, Hudson Bay and South Ontario Lowlands, and the Appalachian Region, the category "excellently" was checked more often than the combined "poorly" and "marginally" categories.

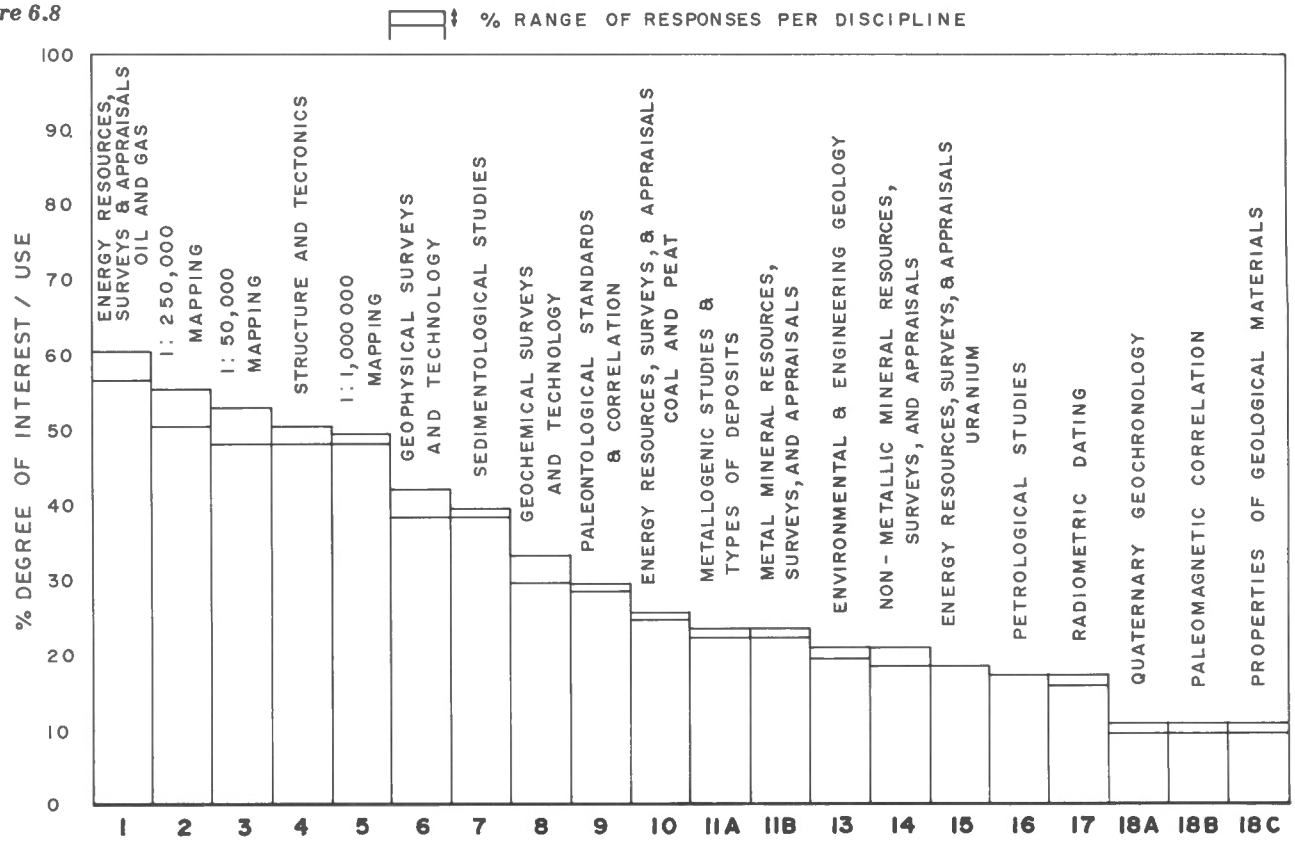
The majority of Oil and Gas respondents rate coverage to be acceptable or better for all regions except the Pacific Offshore. Subsurface studies received significantly lower ratings than outcrop studies.

The Total Population places the mode rating for timeliness of production in all regions in the acceptable category. The Oil and Gas respondents checked "marginally" more frequently than "excellently" except for the Arctic and Northwestern Sedimentary Basins – outcrop studies. The same opinions are expressed by the Metallic Mineral Exploration and Production population, whose dissatisfaction with timeliness is emphasized by the fact that the "poorly" and "marginally" categories were checked more often than "well" and "excellently" in the mineral-rich Western Cordilleran, Precambrian Shield and Appalachian Regions. Most respondents in the Oil and Gas population rated timeliness to be acceptable or better in most regions. However, some dissatisfaction is expressed by lower timeliness scores for the Pacific Offshore, and subsurface studies in the Eastern Lowlands and the Western Canadian Sedimentary Basin.

Standards of accuracy, reliability and scientific quality in all regions are high. The favoured mode category is "well", with the "excellently" rating exceeding the "acceptably" rating in the Western Cordillera, Western, Northwestern and Arctic Islands and Sedimentary Basins (outcrop studies), and Precambrian Shield regions.

There is a prominent tendency to bimodality in the duration of usefulness data. With the only exception of the Pacific Offshore, the most prominent mode indicates that the GSC formal output has a duration of usefulness of "greater than 20 years". The second bimodal peak marks the "10 to 15 years" category with the exception of the Atlantic and Eastern Arctic and Western Arctic Offshore, and subsurface studies in the Western Canadian Sedimentary Basin where the secondary bimodal peak is found in the "5 to 10 years" category.

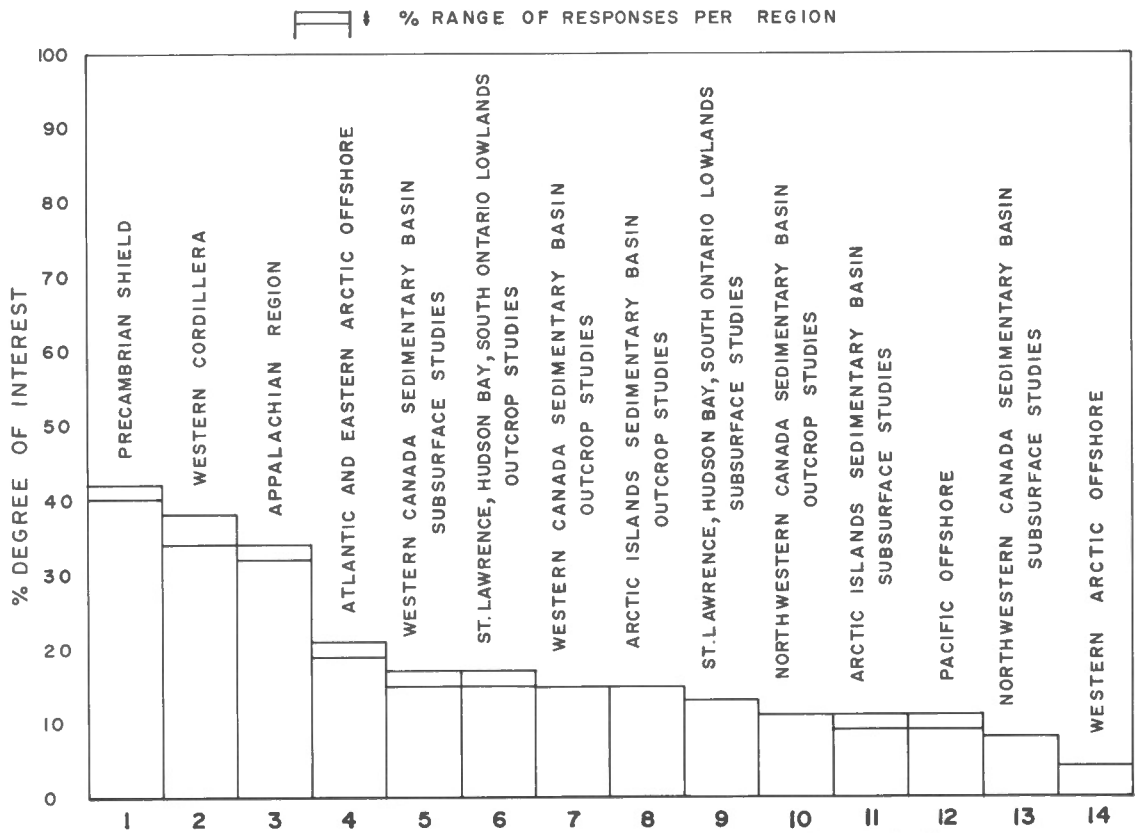
Figure 6.8



RELATIVE DEGREE OF INTEREST AND USE OF DISCIPLINES

ORGANIZATIONS AND INDIVIDUALS ENGAGED IN EXPLORATION AND PRODUCTION OF OIL AND GAS

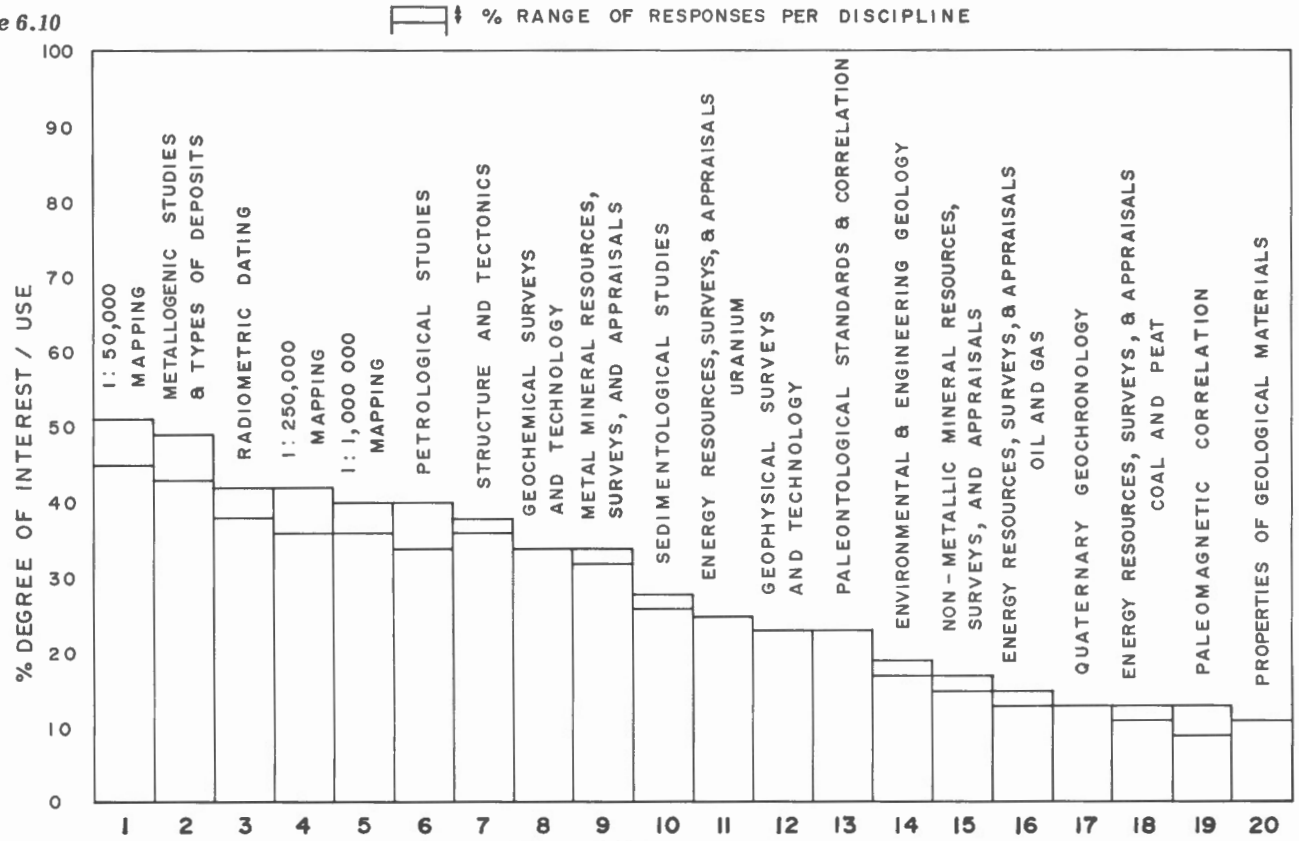
Figure 6.9



RELATIVE DEGREE OF INTEREST REGIONS

ORGANIZATIONS AND INDIVIDUALS INVOLVED IN EDUCATION

Figure 6.10



RELATIVE DEGREE OF INTEREST AND USE OF DISCIPLINES

ORGANIZATIONS AND INDIVIDUALS INVOLVED IN EDUCATION

The Metallic Mineral population also identifies several bimodal patterns. In all regions the "greater than 20 years" category exceeds the combined totals for "0 to 5 years" and "5 to 10 years" categories. The Oil and Gas group's ratings are more evenly spread, with, again, lowest time ratings being assessed against subsurface studies.

Generally the geoscientific groups acknowledge high quality and lasting value in GSC productions in most regions of Canada.

Disciplines

The performance scores of GSC formal output with respect to coverage, relevance, timeliness and accuracy in the various disciplines generally compare closely with those described for the defined Regions.

Figure 6.12 affords a comparison of responses from the Total Population and the random sample of Individual Geoscientists. Two disciplines – (a) Reconnaissance Mapping, 1:250 000 and (b) Metallogenic Studies and Types of Deposits have been chosen to illustrate the close similarities between the opinions expressed by the two populations.

The following analysis includes a study of the Total Population and selected groups representing the Western Cordillera, the Precambrian Shield, the Appalachians, Educators, Individual Scientists and the Exploration and Production respondents in the Oil and Gas Metallic Mineral constituencies.

Modal points indicate that needs are served "acceptably" or "well" in all disciplines by the Total Population. High modes are recorded for Metallogenic Studies, all three scales of Mapping, Paleontological Standards, Properties of Geological Materials and Petrological Studies by the Total Population. Modal points for the three scales of Mapping by the Western Cordilleran group are slightly lower than the "well" opinion of the Precambrian and the Metallic Mineral Exploration and Production groups. Geophysical surveys are rated "excellently" more frequently than "poorly" and "marginally" combined by the latter population. Environmental and Engineering Studies serve the needs of the Precambrian group only "marginally" to "acceptably". Oil and Gas personnel note a relative inadequacy in Energy Resource Appraisals and a larger proportion of this population than average consider 1:50 000 coverage to be "poor" to "marginal".

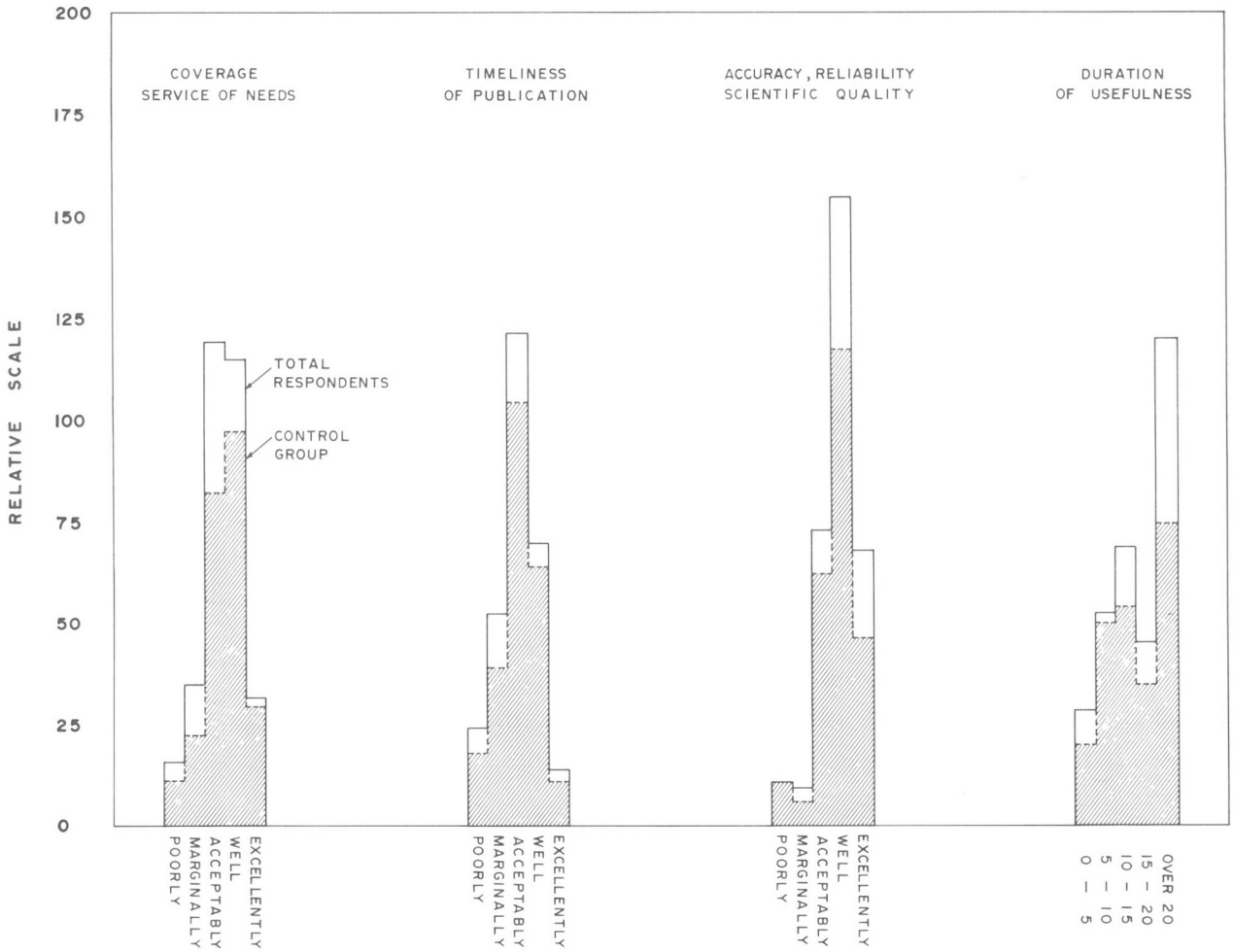
The Education sector expresses a need for more output particularly in Environmental and Engineering Geology, Properties of Geological Materials, Coal and Peat Resource Evaluation, Radiometric Dating and Paleomagnetic Correlation.

The modal peak for timeliness of publication for all disciplines falls within the "acceptably" category. However, the distributions for over half of these disciplines indicate that the combined "poorly" and "marginally" ratings exceed the combined "well" and "excellently" ratings. These include the prominent fields of 1:50 000 and 1:1 000 000 Mapping, Metallogenic Studies, Metal Mineral Resources, Nonmetallic Mineral Resources, Energy Resources – Oil and Gas and Radiometric Dating. Similar dissatisfaction is expressed by the other selected populations.

Accuracy, reliability and scientific quality, in contrast, receives much better ratings. The mode for all disciplines except Energy Resources – Coal and Peat is "well". In all fields except Properties of Geological Materials and Energy Resources – Oil and Gas, the "excellently" category was marked more often than the combined "poorly" and "marginally" categories. The same type of complimentary response is apparent in all smaller populations studied.

Figure 6.11 **COMPARISON OF AGGREGATED RESPONSES FROM TOTAL RESPONDENTS AND CONTROL GROUP OF INDIVIDUAL GEOSCIENTISTS REGIONS**

(QUESTION D-1, APPENDIX C)



A bimodal pattern is apparent in almost all responses on the duration of usefulness of the formal output. One peak, usually the strongest one, commonly identifies the "greater than 20 years" category and the second, smaller mode, the "10 to 15 years" category. Exceptions tend to identify Surveys and Appraisals of Metallic, Nonmetallic and Energy Resources where the highest modes are under 10 years. Metallogenic Studies, Geochemical Surveys and Environmental and Engineering Geology also have modal peaks in the under 10 year range.

Past experience and varying economic factors very likely explain the short life expectancy of Surveys and Appraisals of natural resources. It is more difficult to explain the secondary bimodal peak position for the Metallogenic and Geochemical and Environmental disciplines, but this may reflect some uncertainty in these fields which have advanced and changed rapidly in the recent past. The peaks in the "greater than 20 years" category are an indication of the lasting value of quality geoscientific studies and surveys.

Questionnaire Respondents' Written Comments – Summary

A large number of respondents have expressed their views, concerns, irritations and recommendations on the GSC output. A comprehensive listing of these comments is included as Appendix "D". This text summarizes the main points raised in these comments.

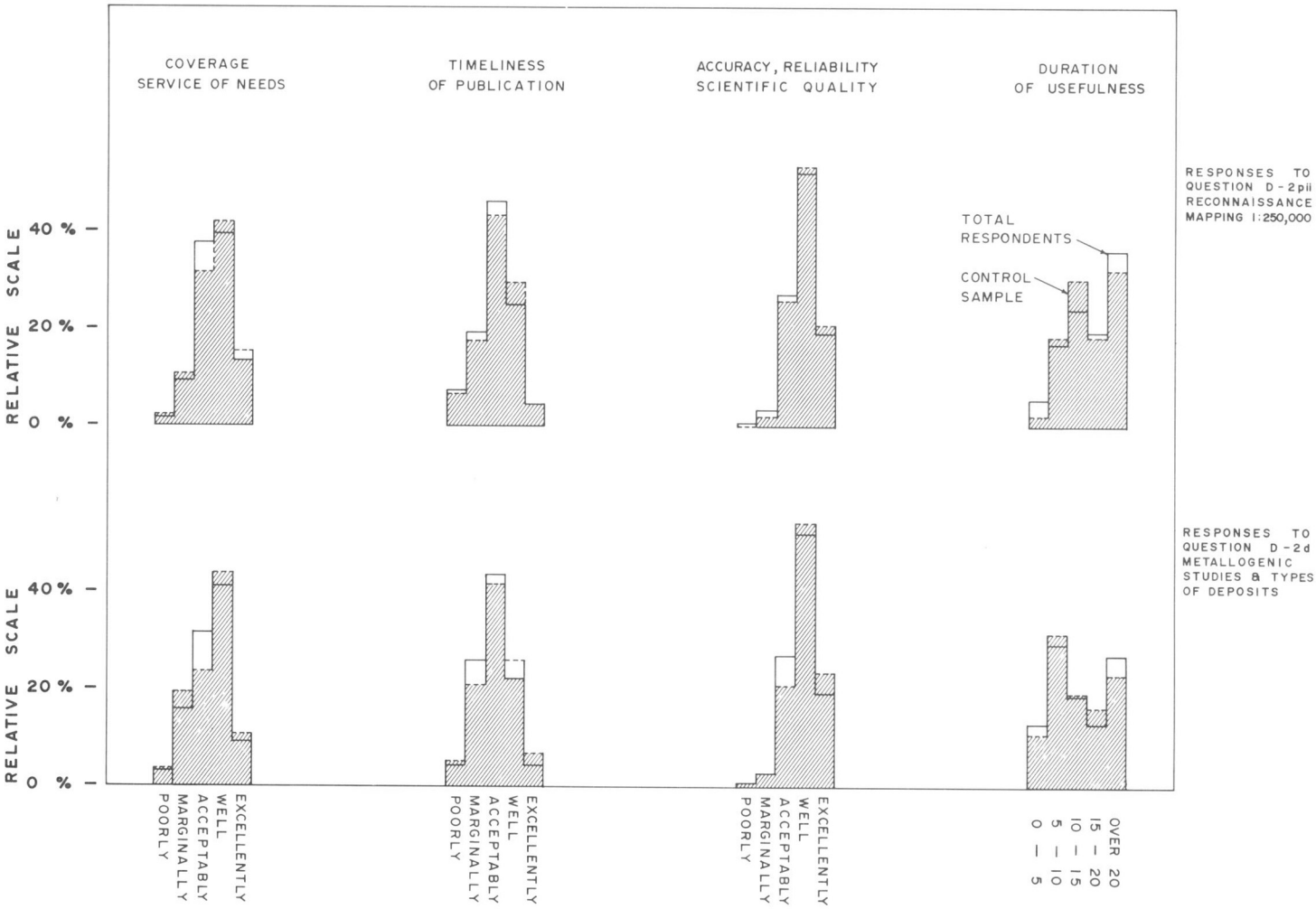
Comments in questionnaires tend to emphasize dissatisfaction rather than praise. Nevertheless, the availability of such comment is invaluable and Appendix "D" provides the GSC management and scientists with a variety of observations which can be used, selectively, as guides to future program planning, data collection and output preparation. Objective, critical, comment reflects a need. Criticism, while not always in good taste, is commonly rooted in dissatisfaction. Compliments and praise reflect respect and dependence.

Under Section C – What is the nature of your use of GSC data? – many respondents emphasized that the most useful GSC output consisted of basic factual presentations of geological (as geological maps), geochemical, geophysical and other geoscientific information. Mineral exploration personnel use this basic information to identify areas for exploration and the design of effective programs. Educators use the same information as a source of ideas and for the definition of research programs. In addition, universities and schools use GSC output as course and educational materials and consider many types of maps and reports to be standards of excellence in geoscientific terminology and data presentation.

Delayed publication of results and timeliness is a very prominent and common criticism. Several geoscientists are concerned about unavailability of older publications which are out of print.

Figure 6.12

COMPARISON OF RESPONSES FROM TOTAL RESPONDENTS AND CONTROL GROUP OF INDIVIDUAL GEOSCIENTISTS DISCIPLINES



Questions C6 to C9 enquire about the benefits of GSC output and the costs and difficulties of replacing this output. Overwhelmingly, the mineral exploration group described the basic factual information provided by the GSC to be of extreme value and of a major indirect economic benefit in mineral exploration. Words like "essential", "invaluable" and "irreplaceable" infer an underlying reliance and respect for this GSC work, especially the geological mapping product. The cost of replacing the GSC contribution, in terms of staff and time, would be unthinkable and prohibitive. One comment aptly summarizes a great majority of responses –

> "...The very concept of the national geological survey is so basic to modern mineral exploration that it is very difficult to envisage an alternative cost-effective and quality assured source of fundamental geological data..."

Individual geoscientists and university personnel also state that the basic core programs of the GSC would be virtually impossible to replace. Provincial geologists, on the other hand, state it could be replaced at a major cost, although there would still be a loss of regional compilations and correlations, a reduction in basic geoscientific research programs, fewer international contacts and less transfer of technology.

Estimates of the cost of replacement vary considerably and remarkably. It is apparent that respondents experienced considerable difficulty in quantifying the GSC output and the Committee feels that the dollar estimates, listed in Appendix "D", were, for the most part, hastily and casually estimated.

Mining company personnel state that the unavailability of the GSC generated data-base would restrict the search for minerals, result in considerable duplication of effort, and render exploration less productive.

The general consensus is that the GSC product, as a whole, is irreplaceable.

Section D invited comment on Coverage, relevance, timeliness and accuracy. The most notable feature is that criticism of GSC's accuracy, reliability and scientific quality is minimal. The most prominent inadequacy identified is the timeliness of production of publications although the statistical returns rated timeliness as 'acceptable' for all regions and disciplines. Many geoscientists cited surveys they knew had been conducted, some as much as 10 years previously, which had yet to be released. Comments on the emphasis on Open File and Current Research production are aptly summarized by the following quote –

> "The Open File is no substitute for an integrated report"

Other perceived areas of inadequacy mentioned by the respondents to the questionnaire include:-

a) Lack of surficial geological mapping.

b) Low environmental geology/engineering geology effort.

c) Low level of Quaternary, urban and related studies.

d) Low level of coverage of coal and peat geology.

e) Inadequate 1:50 000 geological mapping coverage north of 60°N, west of the Rockies and in well-mineralized areas.

f) Low level of study in mineral (ore) deposits.

g) Inadequate descriptions of mineral deposits and economic geology coverage in many publications.

h) Low level of integration of surficial and bedrock geological mapping.

i) Paucity of Economic Geology Series publications.

j) Declining GSC stature in radiometric dating studies. Geochronology laboratories are antiquated.

k) Declining Precambrian geology studies with leadership in this area passing to provinces and universities.

l) Low level of sedimentology studies in Western Cordillera.

Open File productions received little direct comment. The main concerns among industry personnel are quality of presentation of the Open File output and the apparent divorcing of geochemical and geophysical data from relevant orientation, precision, instrumental and data-quality information.

Several respondents stress that much of the GSC's traditional output has a useful life of several generations, whereas resource studies have a short to near-term life depending on changing economic and political conditions. This conforms with the interpretation of arithmetic data on the duration of usefulness of the GSC output.

Comments under Section E – Format – were not always relevant to the subject of the section. Although there is a general consensus that the format of GSC publications is good, some observed that the variety of publications was perhaps excessive. There is also conflicting opinion on map production. Some insist on coloured maps but others would use good quality black and white prints if timeliness of production would be improved. It was also observed that GSC maps should always be available separately.

Microfiche is being reluctantly accepted. It has been found to be difficult and inconvenient to use. More objective criticism notes that microfiche is not a teaching tool and is difficult to use in the field. Another strong criticism is the quality of hard copy reproductions. Obviously, improvement in the quality of microfiche enabling production of better hard copy together with technological improvement and greater portability of microfiche readers will speed acceptance.

There is little comment on computer tapes. This medium is rarely or never used by the majority of Canadian geoscientists because of the lack of handling facilities. It is quite apparent, however, that when these facilities are available – for example as inhouse equipment installed by certain oil and mining companies and other institutions – tapes are widely used by numerous employees. Progressive sophistication in geoscience, and in exploration in particular, will lead to more widespread usage in the future. The Committee was surprised and indeed disturbed to find that several respondents were unaware of the availability of data in tape-form. Parallel ignorance is also indicated by comments concerning the GEOSCAN and GEOREF files.

Access to GSC data has been covered quite adequately by the arithmetic responses to Section F. Comments in this section again indicate that many groups – especially the industry groups – are unaware of the availability of the GEOSCAN and GEOREF files. It is also noted that some public libraries are not familiar with GSC publications.

There is a general consensus that GSC personnel should participate more frequently in national and international, conferences, symposia and workshops. It is evident that informal interaction with GSC scientists in the field and office, as well as at organized meetings, is invariably cordial and productive. Geoscientists in industry generally feel a need for this interaction and are puzzled by the fact that "...some scientific officers have become totally invisible both in flesh and in print (while) others are enthusiastically in the front line...". The Committee is aware that budget restraints in recent years have reduced GSC participation at the numerous events frequented by industry and university geoscientists, but since such exposure is important both to GSC personnel and those utilizing their output it would be prudent to evaluate and institute properly organized and managed openhouses similar to the annual events arranged by most provincial geological surveys and mines departments.

Access to library facilities obviously influences opinion on the desirability of GSC scientists publishing papers in outside journals. There is little doubt that outside publication is desirable, both as a means of refereeing and maintenance of high geoscientific standards, and also as a means of creating meaningful exchange with scientists at the international level. However, there are differences of opinion concerning the types of papers that should be published outside the GSC. Provincial geologists recommend that such outside publications contain only ideas and discussion whereas more comprehensive presentations of data be included in GSC productions.

The invitation to suggest innovations in Section H did not produce many novel ideas. Respondents took the opportunity to restate many of the opinions previously expressed in the questionnaire.

Timeliness is a common concern.

There are also recurring requests for information on "What is going on?" and "What is available?". Although such requests may reflect a lack of initiative and aggressiveness on the part of some of the respondents, other recommendations for a stronger publicity effort by the GSC increasing public awareness of its activities and services would probably offset some of this frustration. Such a program would include special information booklets, wider advertising of already available circulars, indices and data files, lecture tours by GSC scientists, the organization of workshops and open houses and the promotion of more frequent consultation with outside users.

Some comments expressed concern that in some areas of geoscience the influence and leadership, once enjoyed by the GSC, has been taken over by provincial surveys and some universities.

Additional publication outlets making GSC publications more readily available would be welcomed. It is suggested that such outlets could also maintain lists of provincial publications and indices of air photograph availability in the relevant area of geographical interest. Educational audio-visual sets covering selected topics would serve to familiarize the public with various aspects of geoscience. One suggestion recommends an annual subscription for the Current Research volumes, the Monthly Information Circular, the GSC Yearly Index, the Cumulative Index and the Volume of Abstracts.

It is evident from the questionnaire that there is a continuing demand for certain out-of-print publications.

Regional synthesis studies and applied mineral deposit research are programs recommended for emphasis. In addition, several respondents emphasize that metallogenic and surficial mapping programs should be integrated into a strengthened, ongoing core geological mapping role.

7. DISCUSSION

Preliminary Statement

The foregoing text, supplemented by the series of appendices, tables and figures, summarizes the findings of the Committee following its investigation of the output of the Geological Survey of Canada. The Advisory Committee has collected a large amount of information which, in addition to providing the basic data in response to the Committee's mandate, will serve as a source of fact and documentation for ongoing and perhaps more specific and detailed investigations relating to the GSC and Canadian geoscience in general. As noted earlier, no enquiry of the nature required by the Advisory Committee's mandate can ever be absolutely complete. However, sufficient fact and opinion is now in for the Committee to be able to identify difficulties and problems and present several recommendations for consideration.

Throughout its 139 year history the Geological Survey of Canada has amassed a huge and impressive amount of data on the geological framework of Canada and has established itself as an important and productive sector within the Government of Canada. Historically, as a pioneering organization, and subsequently, as a documentor of the geology of the country and compiler of information relevant to the identification and appraisal of mineral resources, the Survey has provided and continues to provide basic data essential to the development and future well-being of Canada and its people.

At the international level the GSC has an enviable reputation. Many developing countries make eager use of GSC (and other Canadian) expertise offered as part of CIDA and other foreign-aid programs. The Survey also received many plaudits in the recent Canadian Geoscience Council examination of "The Geosciences in Canada" published as GSC Paper 80-6, Part 1.

Canada's geological data base, coupled with its political stability and sometimes difficult, but workable mineral resource legislation, has proven to be an essential ingredient of natural resource development. Basic GSC documentation of the geology of regions of Atlantic Canada, the Precambrian Shield, the Cordillera and the Arctic Islands has enabled the identification of many productive mineral environments which, through development, have established Canada as one of the major global producers of a wide variety of metals, industrial minerals and hydrocarbons. This same geological data base has also established that Canada has a major and exciting natural resource potential which will form the basis of the country's ongoing development, growth and prosperity. The continuing study of geoscience and the advancement of our understanding of geological environments is fundamental to Canada's future.

The Geological Survey of Canada, in co-ordination with other federal, provincial, academic and private institutions, has an important role to play in this future. The comments of Canadian geoscientists listed in Appendix "D" to this report documents the fundamental nature of the GSC's contribution. The following are particularly illustrative of the GSC's importance:-

> "The GSC mapping program is a vital asset of every mining company in mining exploration in Canada"
>
> "We consider the Survey publications to be our primary datum reference for geological information in Canada"
>
> "It is always possible to get a competent consultant to produce a report on a specific area or subject, but these almost invariably use GSC data as a base... It would be almost impossible to duplicate the GSC contribution to our data base"
>
> "We maintain a complete library of GSC material for public use and find it gets heavy use year round"

In the Introduction to this report, the Committee has emphasized the numerous pressures and constraints to which the GSC is subjected. These pressures and constraints relate to a changing social, economical, political and technological environment and the GSC must develop and maintain an increasing flexibility to fulfill its important role in the changing environment and sustain effective and productive output.

Management Practices

Management roles within the Survey, as they have evolved through traditional practices, have an important influence on output both in respect to productivity and its direction. The Committee did not delve into the management practices of the Survey because its mandate did not specify such an investigation. However, it is apparent to the Committee that management roles warrant the following comment.

It is evident that output is affected by:

a) The influence of all levels of GSC management on project initiation,

b) The lack of mechanisms to control inefficiency and nonproductivity and to reward the reverse, and,

c) Weaknesses, possibly, inherent in the rotational system of management.

The various ways in which management influences the initiation of projects has been discussed briefly in Section 4. It is essential that there be an effective interchange at all levels, from the senior management to the project scientists, in the definition of objectives and the initiation of projects. Strengths of management are vital to the achievement of the Survey's output goals.

The enforcement of disciplinary measures within government contrasts with common practice in industry. Dismissal is virtually impossible except in demonstrated instances of incompetence, and, consequently the management level is forced to accommodate rather than eliminate some levels of inefficiency and nonproductivity.

Further, concepts of management within the GSC vary considerably with management exercise in the private sector. The informal rotation system of management currently practised by the Survey allows the research scientists to assume a management role for a limited period of time. Unless leadership and management is a field of interest or ambition of an incumbent, there is a tendency for such an assignment in a management capacity to be regarded by both the scientist and the GSC, as a necessary diversion in the career-path of the GSC research scientist for the well-being of the organization. It is also appreciated that a long-serving manager having an unlimited tenure and whose abilities in leadership and the stimulation of subordinates are limited, can have a detrimental effect on productivity. Notwithstanding the fact that many GSC scientists do a conscientious job when it is their turn at management, less competent managers will create situations in which the direction, effectiveness and output of a group will suffer and deteriorate. Also, the GSC salary structure, provides no significant financial or perquisite incentives at management levels. In contrast, in private industry and certain prominent scientific institutions, management is a career in itself, with primary responsibilities and proportionate remuneration.

The management environment within the GSC is, therefore, a difficult one. The complexities in the GSC definitely require a high level of consistent management expertise. Since management practices can directly affect output, the Advisory Committee considers that the present management environment in the Geological Survey of Canada be subjected to review.

Timeliness of Project Completion and Publication

A degree of dissatisfaction by many Canadian geoscientists with the timeliness of publication of GSC documents is readily apparent from Questionnaire responses and the Committee's numerous interviews. In the investigation of the Geological Information Division (GID) it was learned that the GID printing budget of $275 000 (1980 dollars) is adequate to process all GSC output presented for formal publication at the minimum level of quality characterized by current publication formats. The Committee's observations on GSC formal output during the past 20 years described under the heading "Changing Relationships between the Published Output and Manpower of the Survey" (Section 3) supplemented by comments added to the Questionnaires, has indicated significant declines in this output in most divisions in relation to the increase in scientific research staff.

It has also been observed that the problem in the production of publications is, more frequently, one of manuscript completion than one of manuscript processing.

Table 3.3, which summarizes the publication process currently followed by the GSC, clearly defines the Division Director as having the responsibility of determining when and how research work is to be published. It follows, therefore, that the responsibilities related to manuscript completion rest, to a large degree, upon the shoulders of the Division Directors.

Project completion is inhibited by many factors including overcommittment by scientists, promotions, resignations and external demands for special studies. Many GSC scientists are involved in one or more ongoing projects at the same time. External demands for resource studies and other investigations complicate and delay project completion because these responsibilities have to be carried out by scientists already fully engaged. However, project generation in most Divisions is from within, based on proposals by scientists who themselves may be overcommitted.

The development and definition of the various GSC programs and the balanced involvement of scientists in programs and other activity requires careful management attention. Currently, there is a perceived tendency for the GSC to be seen to be covering science rather than documenting and completing programs of research. The Committee is of the opinion that, in some cases, more stringent management controls are necessary in the initiation, pursuit and completion of programs.

GSC management has the responsibility of formulating programs which are scientifically of a high standard and pertinent to the current needs of Canadian geoscience. All Division Directors, and other management personnel at the Survey, have to actively review such program directions based on information obtained from their own observations and through contacts outside the GSC in governments, universities and in industry. Such program directions, properly defined, then have to be communicated to the research scientific body within the Survey to ensure that future program proposals fit properly into the Divisional program and provide for, as much as possible, the effective use of available scientists and the integration of other, available and pertinent expertise.

Within this framework, and in these times requiring greater accountability, Division Directors must exercise effective control and judgement over the initiation of new studies and documentation of earlier investigations prior to permitting new projects to proceed.

The progress of any project should be reviewed in detail twice every year. Critical attention should be directed towards the progress of the program in addition to the scientific standards being attained.

Central to the following recommendations to improve timeliness is the Committee's observation that the GSC's problems in the production of publications are primarily those of manuscript completion. The requirements of the research scientist in the Survey with respect to such productivity should be clearly defined prior to project commencement and be made an integral part of required performance.

The variety of formats of GSC formal publications is quite adequate to accommodate the timely production of the GSC output. The Current Research volumes are a particularly useful means of informing the geoscientific public of programs in progress. The Committee, by consensus, suggests that procedures such as the following might be instituted to improve timeliness:

(a) The research scientist should produce an updated summary report on a project in progress at least once every two years for publication in Current Research. In the intervening years, Current Research should carry an announcement of the project, reference to earlier summary reports and a brief outline of the type of work being conducted.

(b) Dormant projects should be listed annually in Current Research. Additional information should explain the delay and the anticipated date of reactivation.

(c) The planning of projects should include provision for draft manuscripts of final project reports to be completed and submitted to Division Directors within a specified period (for example, one year) of the completion of fieldwork or pertinent data collection.

(d) Potential reviewers (both inside and outside the GSC) should be contacted well beforehand and asked to review documents within a time period of eight weeks. If a potential reviewer cannot guarantee such performance, another reviewer should be approached.

(e) Revision of manuscripts by senior authors following the review process should be completed within eight weeks of the receipt of all comment.

Such scheduling not only imposes a reasonable objective for the GSC scientist and his peers but also allows the GSC's public to inform themselves of the scope of the GSC program and the progress and purpose of the various individual research projects. Careful management of the schedule is obviously necessary.

Summary reports in Current Research should not be lengthy. Evolving conclusions and interpretations should be clearly stated although detailed documentation of all fact should be reserved for the final integrated report. Geoscientists outside the Survey will be able, upon receipt of the Current Research volumes, to contact research scientists to discuss topics pertaining to their region or discipline of interest. GSC management should continually emphasize that the Current Research summary reports (and Open File reports) are no substitute for the integrated final report.

Loss of GSC output as a result of promotion, transfer, resignation or death of a research scientist has not been fully investigated by the Committee, but it is apparent that if scientists observed the suggested scheduling detailed in these

paragraphs, those resigning or being promoted or transferred should be able to produce, within a reasonable period of time, a report describing their research which would be reproduced in the Open File format. This requirement should also be mandatory.

This discussion of timeliness and the increase of the formal output of the GSC has been pursued without reference to the implied additional costs of publication. The total cost of GSC information services and activities of approximately $4.0 million is slightly more than 13 per cent of the total GSC budget of approximately $30 000 000 (1980). An increase in the GSC formal output would proportionately increase information service expenditures but, relative to the GSC budget as a whole and in consideration of the expanded, visible productivity, such an increase should be readily justifiable and, perhaps, in part, accommodated by other adjustments. The increased printing requirement could be readily covered by contracting in the private sector.

Communication and Integration in Geoscience Research

The first Advisory Committee (Weir et al., 1979) focused attention on problems of communication and integration within the Geological Survey and with other geoscientific groups in the various estates. Poor communication reduces the opportunities for integration which, in turn, inhibits greater productivity. GSC management is actively studying ways and means of improving these various communication problems – several of which have been observed by the present Committee and documented in this report. The Committee has distinguished between communication as it relates to integration and co-operation in geoscientific research and communication with the public – a public relations exercise. Effective communication at all levels is an essential ingredient to a first class and productive Geological Survey and deserves managements' continuing attention.

The problems referred to under "External Communications" (Section 4) and "Relationships and Use of Geological Survey of Canada Output by Other Sectors of the Federal Government" (Section 5) are multifaceted and complex. Several outside the Federal Government contend that many of the GSC personnel are either retiring, or protective, although it is quite apparent from the Committee's findings that many communication difficulties are related to attitudes and idiosyncrasies of personnel in other sectors. These situations are real, however, despite the fact that there are innumerable examples of very good, amicable and productive interaction between certain GSC scientists on the one-on-one level with counterparts in other groups.

Analysis of comment from other sectors of EMR, particularly that from resource-oriented divisions, has identified differences of philosophy, interests and experience. The quotations from a GSC scientist's internal report following a joint GSC-MPS excursion to mines in Eastern Canada (Section 5) clearly indicate that the productivity and effectiveness of personnel in both the GSC and MPS would be improved with a broader exposure to all geological and economical considerations that define a resource. The observation of the GSC scientist that "comprehensive discussions help in focussing on problems which geological research may help to solve, and hence is useful in indicating research topics that are of current interest to the mining industry" is testimony to the value of such a broader exposure in the development of objective research proposals.

Certain sectors within EMR communicate at the senior management level by interchange during regularly scheduled management meetings to which senior management representatives of other sectors are invited as observers. In the past, and probably for good reason, the GSC management has not taken full advantage of such an opportunity for exchange. Good communication between EMR sectors involved in geoscience and responsible for resources and other assessments which require input on basic geoscientific matters is, however, a desirable and almost essential requirement, and GSC management should take an active and leading role in promoting and effecting means of co-operative communication.

It is apparent that resource appraisal in EMR and the GSC research program, as well as the GSC research scientist, would benefit significantly through a temporary personnel exchange with the resource sectors. One MPS official, in proposing such an exchange, suggested two-year assignments, but, depending on the purpose and the personnel, it is believed that beneficial exchange can be achieved over shorter periods. The Committee recommends that the GSC management carefully evaluates the merits of this proposal.

Not only is the quoted observation of the GSC scientist in the previous paragraphs testimony to the value of broader exposure, but it is also a testimony to the value of integration of disciplines.

Integration is endorsed by many at the Survey and some programs included in the Integrated Multidisciplinary Pilot Project (IMPP) embrace this concept. However, the negligible involvement of the Central Laboratories and Technical Services Division in Survey programs at an early stage indicates that the benefits of integration are not always utilized to advantage at the divisional level. Since it is invariably true that co-operation and integration between divisions, when practised, lead to excellent one-on-one co-operation between scientists, and improved research and development, it follows that the practice of integration should be encouraged and indeed fostered throughout the Survey. Such leadership is the lot of the Division Director and the personnel at this management level should continually evaluate among themselves and with research scientists how fuller utilization of available Geological Survey expertise can stimulate effective interaction and improve output.

Integration between divisions can offset some of the criticism that is being directed at GSC scientists through comments appended to the Advisory Committee Questionnaire. An example of such criticism focuses on the inadequacy of Economic Geology sections included in several Memoirs and Bulletins describing the geology of certain regions.

The Committee has also noted that the very important Kitsault, Endako, Granisle and Bell copper ore deposits are not indicated on the recently published Skeena River (Map 1385A) and Parsnip River (Map 1424A) sheets on the 1:1 000 000 scale. One pertinent general observation by a respondent to the Questionnaire is that the "GSC does not seem to consider mineral deposits as part of geology".

Important research during the past three decades has established that metallic mineral and hydrocarbon deposits are an important and integral part of the geological environment in which they occur, and their proper documentation is essential. Any scientist who judges his experience with mineral deposits to be inadequate for proper description would benefit from an integration of effort with another scientist with relevant expertise. Similar integration between GSC geoscientists with expertise in surficial geology, geophysics, geochemistry, petrology, paleontology etc., would also improve the final product. In certain instances, an outside geoscientist may also be able to make a significant contribution.

There are examples of jointly authored publications among GSC productions resulting from integrated investigations in past years. Effective integration will lead to the completion of more coauthored Memoirs and Bulletins which will be considerably more valuable than individual publications produced independently by each of the authors and, at the same time, eliminate some of the shortcomings of previous GSC publications. Effective integration of this type of research and the monitoring of the content of publications is, again, under the control of Division Directors.

The Advisory Committee has observed that certain disciplines related to GSC fields of responsibility are under the jurisdiction of other sectors of the Federal Government. Specifically, groundwater and gravity studies are the responsibilities of the Department of the Environment and the Earth Physics Branch respectively. Such separations are unfortunate and may retard effective integration of research effort into the understanding of the Canadian landmass.

Communication with the Public

Interviews with Division Directors revealed that the GSC receives limited feedback from the public it is serving. Questionnaire responses have indicated that many Canadian geoscientists have a poor understanding of what the GSC is doing and how information on its output can be obtained.

Answers and comment to the questionnaire indicates that when communication between the GSC and its public is achieved, by whatever means, it is effective (Appendix "D", Question G-2). Section H reveals that less than 30 per cent of those responding are aware that the GSC welcomes scientific comment on its programs and output. Despite the GSC's demonstrated willingness to communicate, there is a surprising inertia on behalf of Canadian geoscientists at large to take advantage of this service (see Question H-2). The Committee senses that there is a disturbing lack of initiative on the part of both the GSC and its public underlying the present low level of interaction. Too many geoscientists, for example, are unaware of the availability of the Monthly Information Circular providing details of GSC publications released during the previous month. Others are unaware of the existence of GEOSCAN, GEOREF and data tape files. On the other hand, the GSC does not take advantage of many opportunities to generally inform Canadian geoscientists of its planned programs.

The problem is one of public relations. Should the GSC elect to prepare general information bulletins and, perhaps, an annual map showing location of field parties and other activities, it would find receptive editors at the Northern Miner, Oil Week, Geolog, PDA Recorder, CIM Reporter and other newspaper/newsletter publications.

Provincial geological survey agencies have established that annual open houses with papers, posters and demonstrations of the previous years' activities are very popular with geoscientists in industry, university and other government organizations. The Advisory Committee (and a large number of respondents to the Questionnaire) believes that carefully timed and planned GSC open houses will be well received and eagerly attended by a significant proportion of the geoscientific public. The successful initiatives of AGC, PGC and the Cordilleran Section have already been recorded and the Committee notes that the Ottawa based division of the GSC held a Current Activities Forum in January 1982.

Any open house involving the whole of the GSC would be a major and unmanageable occasion. It is recommended that open houses be planned by individual divisions at a minimum of two or three yearly intervals. Other programs could be developed around publicly attractive open house topics, such as "What is happening in the Arctic Islands?"; "What are some of the latest ideas on metallogenesis in the Cordillera?" or "What is AGC?". Such occasions would provide opportunities to display and distribute information booklets and available circulars, indices and descriptions of data files.

The suggestion of an annual subscription to information publications – the Monthly Information Circular, the GSC Yearly Index, the Cumulative Index and the Volume of Abstracts – plus the Current Research volumes, has considerable merit and the initiation of such a subscription will be well received by a majority of geoscientists, libraries and organizations.

An effective public relations program, which the Committee recommends, requires careful planning and fulltime supervision. The responsibility of such a program would naturally fall on the shoulders of the Director of the Geological Information Division, whose staff would have to be expanded to include a capable public relations administrator.

Questionnaire responses indicate that certain public libraries in Canada do not carry GSC publications. However, it should be noted that it is the responsibility of DSS to distribute approximately 125 copies of each GSC publication to public libraries across Canada. It is possible that some libraries not having Full Depository status, elect not to place these publications on their shelves. Such a practice means that an important source of reliable information on the Canadian landmass is not immediately available to some segments of the lay-public. In these times of public awareness of Canada's resources, it is important that easy access to reliable information of direct relevance to these resources be readily available to as many interested persons, groups, the press and other Canadians as possible. A study of such availability in public libraries should be part of a larger investigation of how basic geological information generated by the GSC on such diverse but topical and popular subjects as acid rain, geological hazards, coastlines and gold reaches the general public should be part of the public relations investigation.

Similarly, the feasibility of creating more outlets for the sale of GSC publications should be studied. The National Geological Surveys Committee, of which the GSC is a member, may be the proper forum to discuss outlets which would distribute certain federally and provincially derived geoscientific literature and also maintain indices and, possibly, supplies of topographic, air photograph and satellite photograph coverage of interest to the geoscientific public.

Further, in the spirit of the already established National Geological Surveys Committee, the GSC should explore the potential benefits of liaison with other established associations representing the mineral resource industries and geotechnical groups.

Accuracy, Reliability, Scientific Quality

Traditionally, the Geological Survey of Canada has established and maintained high standards of excellence in the quality of its output in the geosciences. It is apparent from the findings of the Committee that these high standards are being maintained, and the quality of work is widely and well respected.

The GSC product is a tested tool providing a level of quality desired by resource companies and other geoscientists. It is extremely important these standards be continued. An established reputation for quality promotes use, and resource identification and development is notably facilitated by the high quality of the basic geological and surficial map product.

Duration of Usefulness

Discussion in the body of this report on the degree of interest and use of disciplines as evidenced by the Questionnaire responses, noted that the popularity of a discipline for a variety of reasons, can vary markedly with time. It is relevant to observe that the duration of usefulness (and popularity) of a discipline and of data in a specific region can be affected directly or indirectly by advancements in our understanding and related successful application. For example, integration of disciplines in the definition of mineral deposit environments based primarily on the development of concepts of ore genesis has, and still is, influencing the importance, popularity and application of the various disciplines. Sedimentological studies have become much more a field of interest of mineral exploration geologists since it became apparent that they are of prime importance in the evaluation of the shale-hosted base metal environments and the polymictic conglomerate environments (Blind River) and their contained resources.

Geoscientists in general acknowledge that carefully and competently documented geological fact, whether in the form of a geological map, or other type of presentation, will remain a valuable and useful reference for an almost indefinite period of time. Many geological maps produced by GSC scientists (and also by geologists employed by provincial governments, universities and other private and public institutions) as many as 40 to 60 years ago are still important references even though ideas and concepts in many disciplines have changed markedly since their production. Mineral deposit geologists, for example, regularly use quality, vintage maps as a base reference for interpretation of mineral deposit environments despite the fact that the currently accepted understanding of the genesis of several types of mineral deposits contrasts with the ideas held when the maps were made.

Basic geoscientific data, competently recorded, are of lasting value and, as concepts and interpretations change, ongoing investigations refine and improve the data base effecting and stimulating improved understanding of geological environments.

This important appreciation of the nature of geoscientific progress is reflected in the response to the Questionnaire. In most disciplines and in all regions, respondents rate a significant proportion of the GSC output as having a duration of usefulness in excess of 20 years.

The Questionnaire results do, however, illustrate other prominent features which contrast with, but do nothing to undermine, the conclusions concerning the lasting value of many core geoscientific productions.

Opinions recorded in the Questionnaire responses on the duration of usefulness of GSC output in the various regions and in many of the disciplines are commonly, and perhaps typically, bimodal with the most prominent of the two modal peaks frequently identifying the longest time period – viz – "greater than 20 years". The second modal peak typically identifies the period "10 to 15 years" (Fig. 6.11).

This apparent conflict of opinion among the questionnaire respondents is difficult to explain. Some disciplines, notably "Metallogenic Studies and Types of Deposits", "Environmental and Engineering Geology" and "Geochemical Surveys and Technology" are bimodal but with one peak marking a period of usefulness of less than ten years. All three of these disciplines have advanced and changed rapidly in recent years and the opinion pattern is probably reflecting an appreciation of this advancing nature and anticipating further changes from ongoing progress. It is suggested similar anticipation of progress is responsible, to some degree, for the bimodal nature of opinion of the duration of usefulness of geoscientific data.

The most prominent exceptions to the bimodal nature of response are with Surveys and Appraisals of the various types of Canadian mineral resources. Opinion patterns for these disciplines are characteristically unimodal with prominent skewing towards the shorter time periods. Geoscientists are aware that the estimation of resources is subject to national and international political and economic factors which, from recent experience, can be alarmingly volatile. Resources, as a consequence, have to be continually assessed in the light of current events and, as such, Surveys and Appraisals of these resources are never complete.

Coverage

Canada is a large country bordering on three oceans. To expect Geological Survey of Canada scientists to be active in all regions investigating or utilizing all disciplines all the time would be unrealistic. Socio-political demands, as noted several times in this report, exert requirements which disrupt core programing. The political relationships with the provinces, as they relate to geoscience, are complex and often sensitive. High salaries offered by private enterprise for scientific expertise in resource evaluation and exploration have taken their toll on GSC staff and the continuity of its programs. Despite these factors, the questionnaire results indicate that Canadian geoscientists in general are complimentary of GSC coverage (see Fig. 6.10).

Nevertheless, there are changes that can be effected in the GSC which can improve coverage. For example, any discussion of coverage should relate to timeliness of production. Timeliness has been examined at length – and it is quite apparent that attention to timeliness will improve output. Also, integration between geoscientists and through Multidisciplinary Pilot Projects will expand productivity of individuals and disciplines, and lead to improvements in the coverage of surficial and mineral deposit geology and many other fields.

The first Advisory Committee report (Weir et al., 1979) drew attention to the need for closer federal-provincial co-operation in geoscientific activity advocating a division of labour and output between the federal and provincial geological surveys with a minimum duplication of effort. Potentially more productive would be a series of well planned co-operative programs bringing together complementary expertise and an integration that would be beyond the capability of any single province or the GSC alone. In expressing these same sentiments, the first Advisory Committee (Weir et al., 1979), stimulated the creation of the National Geological Surveys Committee (NGSC) whose members, from the provincial governments and the GSC, meet regularly to discuss individual and common concerns and possible means of co-operation at the scientific level. The questionnaire results and particularly the series of comments appended as Appendix "D" to this report should be reviewed very closely by the members of the NGSC and used as a guide in the formulation of co-operative programs designed to improve the coverage of Canadian geology, satisfy the needs of the geoscientific public and be favourably received by their political ministries. In this context, the Committee emphasizes that intellectual competition is an important facet of geoscience and, in part, the GSC's loss of influence and leadership recorded in certain questionnaire comments (Section 6) reflects elements of healthy progression. Quality geoscience research is being conducted in other estates and it is essential that the importance of a competitive spirit be recognized by Canada's geoscientific leaders and, whenever possible and practical, nurtured by enlightened and unselfish policies.

A significant percentage of the oil and gas constituency indicated coverage and timeliness to be poor to marginal with respect to subsurface studies in all but one of Canada's sedimentary basins. Resource studies and appraisals, particularly of energy resources, earn low coverage and timeliness ratings. There is a conspicuously low level of GSC activity in the Appalacnian regions and the Lowlands of Eastern Canada. In addition, the questionnaire responses indicate there has been a relatively poor coverage in Paleomagnetic Correlation, Mineral Commodity Studies, Environmental Geology Studies, and Engineering Sedimentological Studies in the Precambrian Shield, and a disappointing loss of stature over the past few years in Radiometric Dating. The Committee is aware that the GSC has responded to the conclusions and recommendations of the first Advisory Committee (Weir et al., 1979) with respect to Radiometric Dating and that excellent progress is being made in Paleomagnetic Correlation studies in co-operation with the Earth Physics Branch.

Most of the GSC activity in the western and northern sedimentary basins, areas where oil and gas exploration and production is most intense, is centred on the ISPG Division in Calgary. The boom conditions in the oil and gas industry in recent years have, to a large degree, eclipsed the GSC salary structure, with the subsequent loss of several of the Survey's personnel. This erosion of expertise is a very serious problem and, in this and all other situations, it is incumbent upon the GSC to maintain stimulating and challenging employment environments for productive scientists in situations where government salary levels are slow to adjust to competitive pressures.

By way of contrast, the observed lack of coverage of several mineral commodities by the Economic Geology Division is rooted in budget constraints. These in-house problems present major challenges to GSC management. Priority budget planning requires an up-to-date appreciation of the public need.

The recorded inadequacies in Paleomagnetic Correlation, Sedimentological Studies in the Precambrian, Radiometric Dating, and Environmental Geology and Engineering Studies were created by a combination of a lack of suitably trained personnel, constraining budgets and lack of leadership. To help eliminate these inadequacies a more aggressive attitude and internal stimulation is necessary to attract scientists, restore stature and confidence, and increase effectiveness and coverage. In those disciplines where budget restraints and excessive costs preclude a truly effective role for the GSC, opportunities should be selected that would allow the Survey to make productive contributions and meet its objectives without duplicating costly quality data and expertise available in other Canadian organizations. Such disciplines might include, for example, Precambrian mapping in certain regions of the Shield, subsurface studies in sections of the western sedimentary basins and sedimentological studies of the tar sands and heavy oil deposits of Alberta and Saskatchewan.

It is pertinent to repeat that Canadian geoscience looks to the Geological Survey of Canada for careful scientific evaluation of new disciplines. Technical capability in geophysics and geochemistry is rapidly expanding the applicability and capability of these disciplines. The utilization of satellite imagery is pregnant with possibilities for resource evaluation and geological mapping and the new discoveries along the East Pacific Rise and elsewhere promise profound insights into the understanding of mineral deposit genesis and the interrelationship of geological events. All these and more will lead to a better understanding of the Canadian landmass and its resources and the Geological Survey should continually research and evaluate these new fields as they emerge. It is a fundamental responsibility requiring primary attention and separate funding over and above the GSC's current pursuits.

Refereeing of Geological Survey of Canada Publications

With very few exceptions, the published output of the GSC is refereed in house. Division Directors claim that the quality of GSC publications is maintained by exposure of the research scientists to the peer population outside the Survey through frequent publication in refereed journals. The levels of scientific competency in the Geological Survey are very high, but insiders very often share the views of the authors and, generally, tend to be more lenient than anonymous outsiders when reviewing manuscripts. It follows that exposure of the GSC's formal manuscripts to outside reviewers would further maintain and possibly strengthen the quality of the GSC output. The engagement of outside reviewers for all formal manuscripts is not necessary but the Advisory Committee recommends that policy should require that important, innovative formal publications introducing new concepts and ideas be subject to external review.

Geological Survey of Canada Library

Several GSC Division Directors have expressed concern about the effects of inflation and budget constraints on the maintenance of the GSC libraries in Ottawa and other cities. These libraries maintain shelves of GSC publications, other Canadian and international publications, manuscripts of hitherto unpublished investigations by GSC and other scientists, university theses, computer files, and other geoscientific documents and translations. Altogether, these reference libraries are an extremely important repository of geoscientific information constituting the nation's most complete geological reference available for use by GSC scientists and the geoscientific public at large.

Limited funds in past years have led to the imposition of lower standards of storage and maintenance threatening the deterioration and loss of many valuable unpublished documents. Such an information loss would be an irreplaceable setback to geoscientific research in Canada and it is gratifying that there have been recent budget increases alleviating this situation. Nevertheless, it is very important that senior levels of government be impressed with the understanding that the Geological Survey Library is an invaluable national asset worthy of priority consideration.

Out-of-Print Publications

Many GSC publications have lasting value. Competent investigations and mapping projects completed in the early decades of the present century are still primary references for several types of applied geoscientific and resource studies. These and even more recent, popular publications are often out-of-print when enquiries about current availability are made.

GSC publications which have enjoyed popular demand since publication, for example D.F. Sangster's Paper 72-22, may be reprinted two or three times. However, many of the more vintage publications have long been sold and the original copy materials destroyed.

Recently, as a tribute to the late R.J.W. Dougals, the GSC reproduced as Memoir 402, Douglas' late 1940s study entitled "Callum Creek, Longford Creek and Gap Map Areas, Alberta" previously published as Memoir 255. The quality of this reproduction was excellent in all aspects except for the reproduction of the coloured map enclosed in the back pocket of the Memoir. The colours did not reproduce faithfully and there is a noticeable loss of clarity in areas of geological complexity. The reproduced map is useable, however, and as such the reproduction of the Memoir was successful.

It is conceivable that improvements in technology will allow an improvement in the quality of reproduction of coloured copy within a few years. The cost of the Memoir 255 reproduction, was a very reasonable $2700. It is evident that should sufficient demand exist, specific GSC publications can be profitably and satisfactorily reproduced. It is therefore suggested that the Geological Information Division explore the economics of such reproduction of out-of-print GSC publications and develop a procedure whereby the public may formally request that specific publications are reproduced. A similar feasibility study should evaluate the reproduction of early works in the microfiche format. Lack of colour reproduction and lower handling convenience of microfiche will make it a less popular alternative. However, availability in microfiche form may be justifiable for out-of-print publications in less demand.

Once defined, the procedure for requesting and ordering out-of-print publications can be included in the Current Research series of papers.

8. LIST OF ABBREVIATIONS

AGC	Atlantic Geoscience Centre
AECB	Atomic Energy Control Board
AECL	Atomic Energy of Canada Limited
CANMET	Canada Centre for Mineral and Energy Technology
CIDA	Canadian International Development Agency
CIM	Canadian Institute of Mining and Metallurgy
CLTS	Central Laboratories and Technical Services
DIAND	Department of Indian Affairs and Northern Development
DREE	Department of Regional Economic Expansion
DSS	Supplies and Services, Canada
EGR	Economic Geology Report
EPS	Energy Policy Sector (of EMR)
GEOREF	Geological Reference; system conceived---
GEOSCAN	Geological Information Scan; system conceived---
GID	Geological Information Division
GSC	Geological Survey of Canada
EMR	Department of Energy, Mines and Resources
IMPP	Integrated Multidisciplinary Pilot Project
ISPG	Institute of Sedimentary and Petroleum Geology
MPS	Mineral Policy Sector (of EMR)
M:S	Manuscript (ref. to Table 3.3)
NEB	National Energy Board
NGSC	National Geological Surveys Committee
PDA	Prospectors and Developers Association
PGC	Pacific Geoscience Centre
R&D	Research and Development
RGG	Resource Geophysics and Geochemistry Division
TSD	Terrain Sciences Division

APPENDIX A

Repository Libraries of Geological Survey of Canada Published Output

FULL/UNIVERSELS

ALBERTA

University of Calgary,
Library,
Calgary, Alberta
T2N 1N4

Legislature Library,
Documents Section,
216 Legislature Bldgs.,
Edmonton, Alberta
T5K 2B6

Edmonton Public Library,
No. 7 Sir Wilfred Churchill Square,
Edmonton, Alberta
T5J 2V4

University of Alberta,
Government Documents,
Library,
Edmonton, Alberta
T6G 2J8

BRITISH COLUMBIA

Simon Fraser University,
Library,
Acquisition Division,
Serials,
Burnaby, B.C.
V5A 1S6

University of British Columbia,
Government Publications,
1956 Main Mall,
University Campus,
Vancouver, B.C.
V6T 1Y3

Vancouver Public Library,
750 Burrard Street,
Vancouver, B.C.
V6Z 1X5

Legislative Library,
Parliament Buildings,
Victoria, B.C.
V8V 1X4

University of Victoria,
Government Documents,
McPherson Library,
Serials Division,
P.O. Box 1800,
Victoria, B.C.
V8W 2Y3

MANITOBA

Legislative Library,
Province of Manitoba,
200 Vaughan Street, Main Floor
Winnipeg, Manitoba
R3C 0V8

University of Manitoba,
Elizabeth Dafoe Library,
Winnipeg, Manitoba
R3T 2N2

NEW BRUNSWICK

University of New Brunswick,
Library,
Government Documents,
P.O. Box 7500,
Fredericton, N.B.
E3B 5H5

Université de Moncton,
Bibliothèque Champlain,
Moncton, N.B.
E1A 3E9

Mount Allison University,
Ralph Pickard Bell Library,
Sackville, N.B.
E0A 3C0

NEWFOUNDLAND

Memorial University,
Government Documents Section,
Library,
St. John's, Newfoundland
A1B 3Y1

NORTHWEST TERRITORIES

Northwest Territories
Government Library,
Government of the N.W.T.
Yellowknife, N.W.T.
X0E 1H0

NOVA SCOTIA

Dalhousie University,
Killam Memorial Library,
Government Documents,
Studley Campus,
Halifax, N.S.
B3H 4H8

Acadia University,
Library,
Wolfville, N.S.
B0P 1X0

Note: To reduce the size of this report Appendices B and D are not included here but have been made available for consultation as GSC Open File 946.

ONTARIO

University of Guelph,
Library,
Guelph, Ontario
N1G 2W1

Hamilton Public Library,
Government Documents,
55 York Blvd.,
Hamilton, Ontario
L8R 3K1

McMaster University,
Government Documents,
Mills Memorial Library,
Hamilton, Ontario
L8S 4L6

Queen's University,
Douglas Library,
Mackintosh Corry Hall,
Government Documents,
Kingston, Ontario
K7L 3N6

University of Western Ontario,
Library,
Government Publications,
London, Ontario
N6A 3K7

Bibliothèque du Parlement,
Chambre des Communes,
Ottawa, Ontario
K1A 0A9

National Library,
Canadian Acquisitions Division,
Ottawa, Ontario
K1A 0N4

Metropolitan Toronto Central Library,
789 Yonge Street,
Toronto, Ontario
M4W 2G8

Legislative Library,
Government Publications,
Parliament Buildings,
Queen's Park,
Toronto, Ontario
M7A 1A2

University of Toronto,
Library,
Serials Department,
Toronto, Ontario
M5S 1A5

York University,
Government Documents,
Scott Library,
4700 Keele Street,
Downsview, Toronto, Ontario
M3J 2R6

Public Library,
216 S. Brodice Street,
Thunder Bay, Ontario
P7E 1C2

Lakehead University,
Chancellor Paterson Library,
Thunder Bay, Ontario
P7B 5E1

Windsor Public Library,
850 Ouellette Avenue,
Windsor, Ontario
N9A 4M9

University of Waterloo,
Data Porter Arts Library,
Government Publications,
Waterloo, Ontario
N2L 3G1

PRINCE EDWARD ISLAND

Planning Library,
P.O. Box 2000,
Charlottetown, P.E.I.
C1A 7N8

QUEBEC

Concordia University Libraries,
Acquisitions – Serials,
1455 De Maisonneuve Blvd. W.,
Montreal, Quebec
H3G 1M8

SASKATCHEWAN

Legislative Library,
234 Legislative Bldg.,
Regina, Saskatchewan
S4S 0B3

University of Saskatchewan,
Government Publications,
The Library,
Saskatoon, Saskatchewan
S7N 0W0

FULL BILINGUAL/UNIVERSELS BILINGUES

NEW BRUNSWICK

Government Publications Section,
Legislative Library,
766 King Street,
P.O. Box 6000,
Fredericton, N.B.
E3B 5H1

ONTARIO

University of Ottawa,
Morisset Library,
Government Publications,
65 Hastey,
Ottawa, Ontario
K1N 9A5

Laurentian University Public Library,
Documents,
Ramsey Lake Road,
Sudbury, Ontario
P3C 2C6

QUEBEC

Centrale des bibliothèques,
1685 est rue Fleury,
Montréal, Québec
H2C 1T1

Bibliothèque de la Ville de Montréal,
1210, rue Sherbrooke est,
Montréal, Québec
H2L 1L9

McGill University,
Library – Government Documents,
3459 McTavish Street,
Montreal, Quebec
H3A 1Y1

QUEBEC

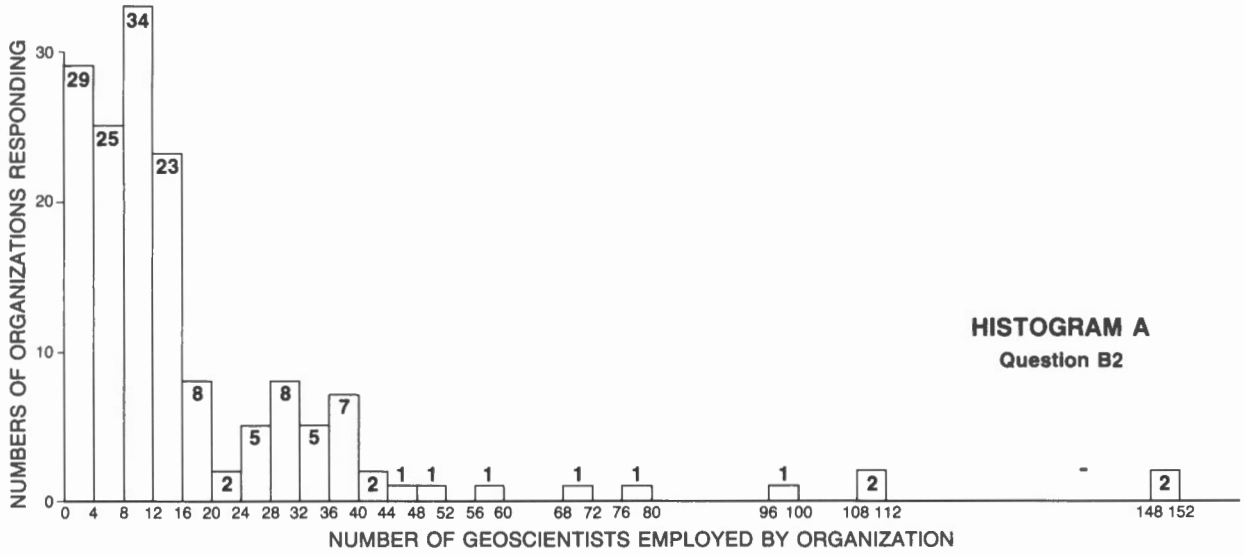
Bibliothèque des sciences humaines et sociales,
Publications officielles,
Université de Montréal,
C.P. 6202, Succursale 'A',
Montréal, Québec
H3C 3T2

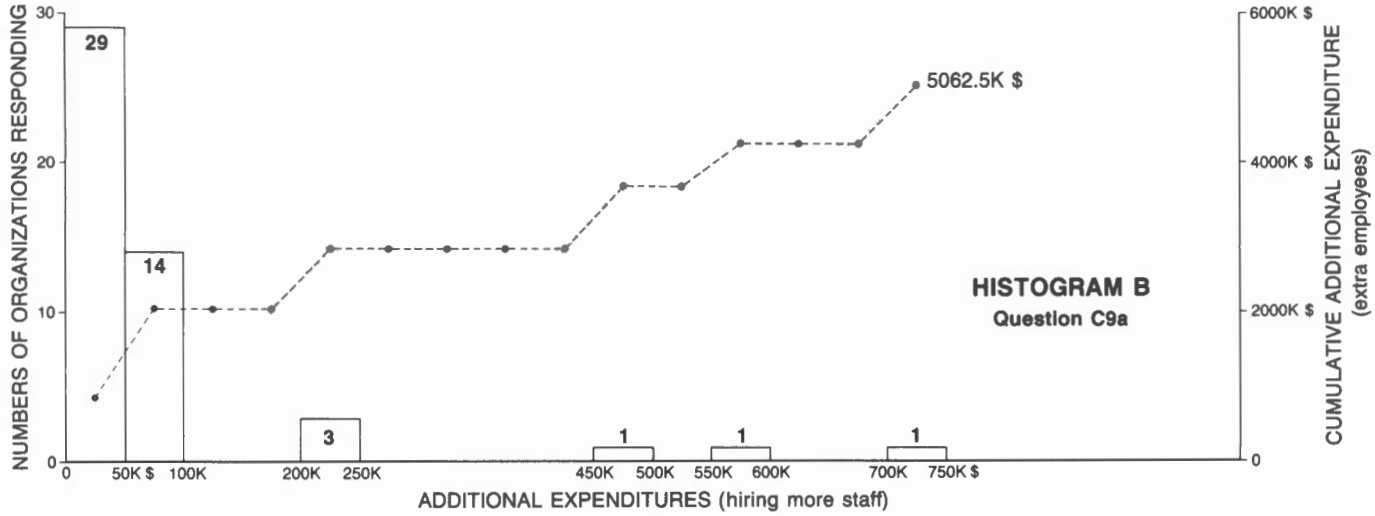
Université du Québec à Montréal,
Bibliothèque – Publications officielles,
1199 Bleury, C.P. 8889
Montréal, Québec
H3C 3P8

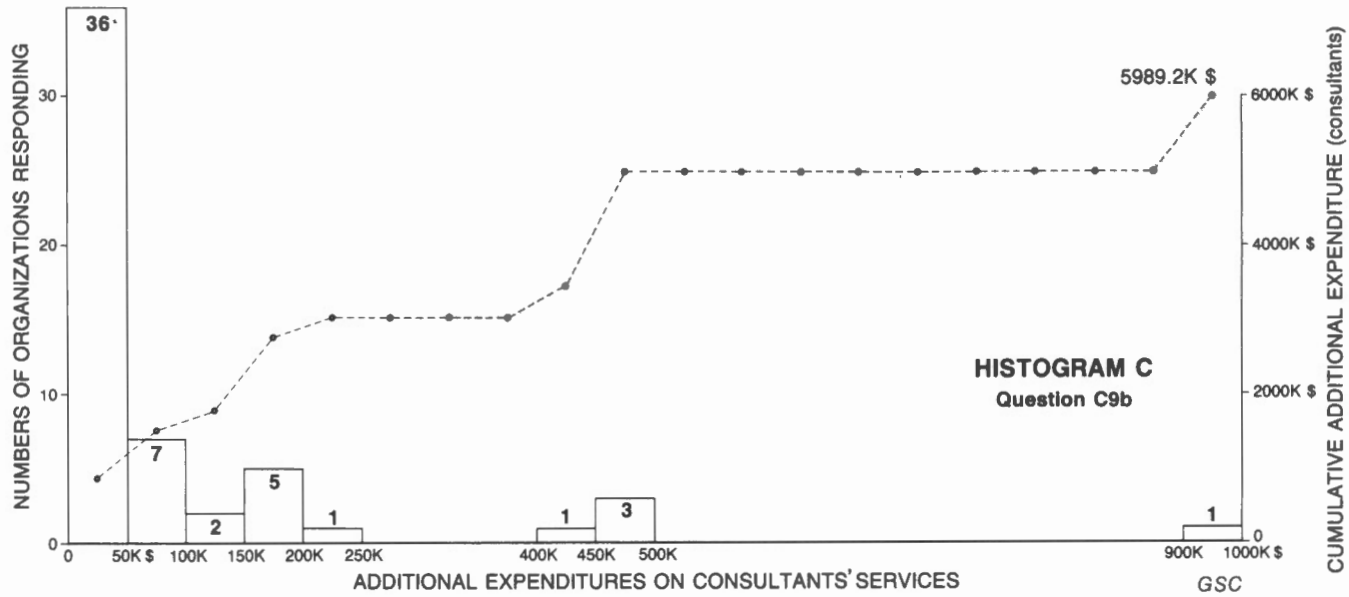
Université Laval,
Service des documents officiels,
Cité Universitaire,
Ste-Foy, Québec
G1K 7P4

Université de Sherbrooke,
Bibliothèque Générale,
Cité Universitaire,
Publications gouvernementales,
2500 boul. Université,
Sherbrooke, Quebec
J1K 2R1

Bibliothèque de la Législative du Québec,
Hôtel du Gouvernement,
Québec, Québec
G1A 1A5


HISTOGRAM A
Question B2
NUMBERS OF ORGANIZATIONS RESPONDING
NUMBER OF GEOSCIENTISTS EMPLOYED BY ORGANIZATION
29
25
34
23
8
2
5
8
5
7
2
1
1
1
1
1
1
2
2
0 4 8 12 16 20 24 28 32 36 40 44 48 52 56 60 68 72 76 80 96 100 108 112 148 152


HISTOGRAM B
Question C9a
NUMBERS OF ORGANIZATIONS RESPONDING
CUMULATIVE ADDITIONAL EXPENDITURE (extra employees)
ADDITIONAL EXPENDITURES (hiring more staff)
5062.5K $
29
14
3
1
1
1
0 50K $ 100K 200K 250K 450K 500K 550K 600K 700K 750K $
6000K $
4000K $
2000K $


HISTOGRAM C
Question C9b
NUMBERS OF ORGANIZATIONS RESPONDING
CUMULATIVE ADDITIONAL EXPENDITURE (consultants)
ADDITIONAL EXPENDITURES ON CONSULTANTS' SERVICES
5989.2K $
36
7
2
5
1
1
3
1
0 50K $ 100K 150K 200K 250K 400K 450K 500K 900K 1000K $
6000K $
4000K $
2000K $

GSC

APPENDIX C

Questionnaire and Summary of Responses from 395 Returns

Σ 395 Responses

Corrected arithmetic responses (Last Run)

BSN 25 5/81

ADVISORY COMMITTEE TO
THE GEOLOGICAL SURVEY OF CANADA

SECTION B. WHAT ARE YOUR INTERESTS?

№ 656

As indicated in the covering letter, we are asking you to respond either on your own behalf or for your organization.

		Yes
B-1.	Do you represent yourself?	☐ 48.1%
	Or do you represent your organization?	☐ 51.9%
B-2.	If the latter, approximately how many geoscientists?	☐☐☐ 57.21% no answer Histogram A shows responses

B-3. What is your type of business or personal activity?

	Oil/Gas	Coal	Metals	Industrial Materials
Exploration	☐ 19.74%	☐ 7.59	☐ 46.83	☐ 9.62
Production	☐ 8.59	☐ 1.26	☐ 10.88	☐ 1.51
Terrain studies		☐	9.11	
Government agency		☐	12.65	
Education		☐	13.42	
Consulting or service agency		☐	24.80%	

Other (please specify) . . . . . .

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B-4. Geographic area of interest (check one or more):

Pacific offshore	☐	8.10%
Western Cordillera	☐	57.21
Western sedimentary basin	☐	42.27
Western Arctic offshore	☐	12.65
Arctic islands	☐	22.02
Precambrian Shield	☐	55.19
Eastern lowlands	☐	20.50
Appalachian region	☐	36.20
Atlantic and eastern offshore	☐	23.79%

Comments on Section B . . . . . .

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SECTION C. WHAT IS THE NATURE OF YOUR USE OF GEOLOGICAL SURVEY OF CANADA OUTPUT?

		Yes	No	Nil response
C-1.	Do you receive the Monthly Information Circular of the GSC?	☐ 64.81%	☐ 34.43	0.76
C-2.	Do you use GSC published or informal output?	☐ 90.37	☐ 9.63%	

If no, please return questionnaire completed to here.

If yes, do you consider yourself/organization

a major user	☐	11.39%
an important user	☐	23.03
a moderate user	☐	33.67
a minor user	☐	19.49
a rare user	☐	2.28%

C-3. Which type of documents do you use and how frequently?

Approximate degree of use

	Daily	Weekly	Monthly	Yearly	None	
a. Hard copy						
Memoirs	☐	☐ 6.07%	☐ 22.53	☐ 33.92	☐ 22.53	1.77
Bulletins	☐	☐ 5.06	☐ 22.28	☐ 36.71	☐ 22.02	1.26
Papers	☐	☐ 6.07	☐ 23.54	☐ 36.96	☐ 17.47	2.53
Current Research	☐	☐ 3.03	☐ 11.90	☐ 25.82	☐ 28.35	9.36
Economic Geology series	☐	☐ 3.60	☐ 11.39	☐ 30.38	☐ 25.06	9.11
b. Maps						
Bedrock	☐	☐ 12.40	☐ 29.11	☐ 24.80	☐ 15.69	3.29
Surficial	☐	☐ 3.03	☐ 8.86	☐ 22.28	☐ 28.86	14.94
Aeromagnetic	☐	☐ 4.55	☐ 12.40	☐ 23.03	☐ 25.31	14.43
Airborne radiometric	☐	☐ 1.01	☐ 4.05	☐ 12.40	☐ 25.82	30.12
Geochemical	☐	☐ 1.01	☐ 7.59	☐ 22.53	☐ 24.55	20.50
Offshore multi-parameter	☐	☐ 0.25	☐ 1.01	☐ 2.78	☐ 7.59	53.92
Regional compilations	☐	☐ 2.02	☐ 12.15	☐ 26.83	☐ 25.82	7.36
c. Open File						
Maps and reports	☐	☐ 4.81	☐ 11.14	☐ 25.82	☐ 32.91	11.65
Data tapes	☐	☐ 0.25	☐ 0.25	☐ 3.03	☐ 11.39	67.08
Microfiche	☐	☐ 0.25	☐ 1.51	☐ 7.59	☐ 14.43	55.94%

SECTION C (*Continued*)

C-4. What use do you make of GSC documents?

(Check as appropriate.)

	Source of Special Data	Source of Numbers	Source of Ideas	Basic Reference	Educational	Nil Use
a. Hard copy						
Memoirs	40·00%	11·90	27·59	66·33	13·92	2·28
Bulletins	37·97	11·40	28·86	62·53	12·91	1·77
Papers	41·01	13·47	33·16	57·97	13·92	3·29
Current Research	28·10	9·42	40·76	32·65	14·43	8·10
Economic Geology series	28·35	14·44	20·76	50·63	16·71	9·87
b. Maps						
Bedrock	41·26	4·55	21·26	60·50	0·63	3·54
Surficial	25·82	3·54	5·32	39·24	7·84	15·95
Geophysical	29·61	10·13	16·71	39·49	6·58	12·40
Geochemical	27·59	16·20	16·45	31·64	6·32	17·21
Regional synthesis	15·44	2·78	25·06	49·97	12·91	8·35%

C-5. a. Are you a user of other output?

No answer	Yes	No
11·90%	73·67	14·43%

b. If yes, which type and approximate frequency of use?

	Daily	Weekly	Monthly	Yearly	None
External publications	4·55%	9·36	21·77	15·95	4·81
Workshops, meetings, seminars	0·25	1·01	13·16	40·50	6·32
Written or verbal advice	1·26	7·59	30·12	29·61	4·81%

Comments on C-1 to C-5 . . . . . .

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SECTION C (*Continued*)

			Yes	No
C-6.	Do you, your staff, or company derive any direct economic benefit from use of any GSC documents?	Blank 13·92	☐ 40·76	☐ 45·31%
C-7.	Do you, your staff, or company derive any direct economic benefit from use of any GSC informal output?	16·20	☐ 31·64	☐ 52·15%
C-8.	Are there any components of present GSC output that you use that could not readily be replaced if not available?	23·79	☐ 59·23	☐ 16·96%

Please comment . . . . . .

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C-9. For components of GSC output that you use but that can be replaced from other sources or other means, what sorts of cost would be involved in replacing them per year?

		Yes			
a.	☐	20·5%	Hire more staff.	$ ☐☐☐☐☐☐	Histogram B shows responses
b.	☐	27·09%	Spend more on consultant services.	$ ☐☐☐☐☐☐	Histogram C shows responses

Comment . . . . . .

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SECTION D. COVERAGE, RELEVANCE, TIMELINESS, AND ACCURACY

This section attempts to gauge how well your needs are serviced by GSC formal output.

Please rate where applicable to you/your organization only. Comments are desired.

Use scale for columns a to c as follows:

5 = excellently; 4 = well; 3 = acceptably; 2 = marginally; 1 = poorly.

For column d,

5 = >20 years; 4 = 15 to 20 years; 3 = 10 to 15 years; 2 = 5 to 10 years; 1 = 0 to 5 years.

Note #s are % of total questionnaires returned (396)
not of responses to particular question

	a	b	c	d
	How well are your needs served in each topic by GSC formal output (documents)?	Timeliness of publication of GSC formal output to your needs	Accuracy, reliability, and scientific quality	Duration of usefulness of GSC formal output (in 5-year increments)
D-1. FOR REGIONS				
a. Pacific offshore	1 1·51 2 1·26 3 3·54 4 2·78 5 0·76	1 1·01 2 0·76 3 4·81 4 2·02 5 0·50	1 0·25 2 0·25 3 2·53 4 3·80 5 1·77	1 1·01 2 2·28 3 2·78 4 1·01 5 2·02
b. Western Cordillera	1 0·50 2 3·54 3 17·72 4 24·05 5 6·32	1 3·03 2 4·36 3 23·79 4 13·46 5 1·51	1 0·25 2 1·51 3 11·65 4 25·57 5 12·15	1 3·03 2 7·84 3 9·87 4 7·09 5 23·03
c. Western Canada sedimentary basin (south of 60°)	1 0·76 2 2·28 3 9·11 4 12·65 5 4·05	1 1·77 2 6·07 3 11·65 4 7·64 5 1·26	1 0·50 2 0·50 3 6·07 4 13·42 5 7·34	1 1·77 2 2·78 3 6·32 4 5·82 5 11·46
i. outcrop studies	1 4·30 2 5·06 3 8·61 4 6·07 5 1·51	1 4·05 2 6·58 3 9·11 4 4·81 5 1·01	1 1·26 2 1·01 3 6·58 4 11·65 5 3·54	1 3·80 2 6·32 3 4·55 4 3·80 5 6·32
ii. subsurface studies	1 0·25 2 1·51 3 7·84 4 8·35 5 3·29	1 1·01 2 2·53 3 10·13 4 6·07 5 1·26	1 0·25 2 0·50 3 4·55 4 10·63 5 5·06	1 0·50 2 3·03 3 7·84 4 3·54 5 7·59
d. Northwestern sedimentary basin (north of 60°)	1 1·26 2 1·26 3 4·30 4 2·53 5 0·60	1 1·77 2 2·28 3 6·83 4 4·30 5 1·51	1 1·26 2 2·54 3 7·09 4 3·03 5 0·76	1 1·26 2 1·01 3 6·58 4 11·65 5 3·54
i. outcrop studies	1 0·50 2 — 3 5·57 4 6·83 5 3·29	1 1·26 2 1·26 3 4·81 4 2·28 5 0·25	1 0·50 2 0·25 3 3·03 4 5·06 5 0·60	1 0·50 2 3·03 3 7·84 4 3·54 5 7·59
ii. subsurface studies	1 0·76 2 2·02 3 4·30 4 6·07 5 1·26	1 0·76 2 1·26 3 6·83 4 5·82 5 1·51	1 0·50 2 0·76 3 2·28 4 8·61 5 1·77	1 2·78 2 2·53 3 2·53 4 1·01 5 5·32
g. Precambrian Shield	1 1·01 2 5·06 3 16·20 4 16·22 5 4·30	1 1·01 2 2·02 3 4·30 4 6·32 5 0·50	1 1·26 2 1·26 3 4·81 4 2·28 5 0·25	1 0·25 2 1·26 3 8·35 4 22·78 5 11·39
h. St. Lawrence, Hudson Bay, and South Ontario lowlands	1 0·76 2 1·01 3 8·35 4 5·82 5 0·76	1 1·26 2 4·05 3 6·58 4 3·29 5 1·51	1 0·76 2 — 3 5·06 4 7·59 5 3·54	1 1·26 2 2·02 3 4·55 4 3·03 5 6·58
i. outcrop studies	1 2·02 2 3·80 3 12·15 4 9·62 5 1·77	1 1·01 2 2·53 3 5·82 4 7·59 5 1·26	1 1·77 2 4·30 3 4·55 4 1·77 5 1·77	1 0·76 2 0·25 3 3·54 4 6·83 5 2·78
ii. subsurface studies	1 0·50 2 2·02 3 8·10 4 4·05 5 1·01	1 3·29 2 6·58 3 12·15 4 6·07 5 0·76	1 0·76 2 0·76 3 7·34 4 13·42 5 6·32	1 1·77 2 5·32 3 6·83 4 6·55 5 11·65
j. Appalachian region			1 0·76 2 2·28 3 7·09 4 5·06 5 0·50	1 0·25 2 0·25 3 3·80 4 7·09 5 3·80
Atlantic and eastern Arctic offshore				1 3·29 2 3·03 3 3·80 4 4·55 5 5·69
D-2. FOR DISCIPLINES				
a. Environmental and engineering geology	1 2·53 2 4·30 3 9·11 4 4·55 5 1·01	1 2·53 2 4·05 3 8·86 4 4·30 5 0·50	1 0·76 2 1·26 3 5·32 4 9·13 5 2·53	1 0·25 2 1·01 3 8·35 4 22·78 5 15·19
b. Geophysical surveys and technology	1 0·50 2 7·34 3 15·69 4 15·44 5 5·32	1 1·26 2 9·11 3 15·95 4 12·15 5 4·30	1 0·50 2 2·02 3 11·65 4 22·02 5 7·59	1 8·61 2 9·87 3 8·61 4 4·30 5 11·65
c. Geochemical surveys and technology	1 1·77 2 7·09 3 19·49 4 13·16 5 3·29	1 1·77 2 8·86 3 18·98 4 11·40 5 2·03	1 1·02 2 12·15 3 20·00 4 10·63 5 2·02	1 0·50 2 1·26 3 12·40 4 23·79 5 8·86
d. Metallogenic studies and types of deposits	1 1·77 2 7·84 3 15·69 4 20·00 5 4·55			1 6·07 2 13·47 3 8·86 4 6·07 5 12·65

D-2. FOR DISCIPLINES — *Continued*

	a	b	c	d
	How well are your needs served in each topic by GSC formal output (documents)?	Timeliness of publication of GSC formal output to your needs	Accuracy, reliability, and scientific quality	Duration of usefulness of GSC formal output (in 5-year increments)
e. Metal mineral resources, surveys, and appraisals				
f. Non-metallic mineral resources, surveys, and appraisals				
g. Energy resources, surveys, and appraisals				
i. oil and gas				
ii. coal and peat				
iii. uranium				
h. Radiometric dating				
i. Quaternary geochronology				
j. Paleomagnetic correlation				
k. Paleontological standards and correlation				
l. Properties of geological materials				
m. Petrological studies				
n. Sedimentological studies				
o. Structure and tectonics				
p. Mapping				
i. detailed, e.g., 1:50 000				
ii. reconnaissance, e.g., 1:250 000				
iii. regional synthesis, e.g., 1:1 000 000				

Comment on Section D on specific topics or missing disciplines. Please comment on any marginal or poor scores.

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SECTION E. FORMAT OF PUBLICATIONS

E-1. Is the format of the following publications appropriate for your use?

	Too elaborate	Good	Acceptable	Poor	Not acceptable
a. Hard copy					
Memoirs	3·29%	70·63	11·39	—	—
Bulletins	1·01	71·14	12·15	0·25	—
Papers	0·25	65·82	16·20	0·50	0·25
Current Research	1·51	50·88	16·20	2·28	0·25
Economic Geology series	0·50	53·41	12·65	0·76	0·25%

Comment on any item . . . . . .

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b. Maps					
Bedrock geology					
1:250 000	0·25%	60·25	14·94	1·51	—
1:50 000	0·25	61·52	11·14	0·50	0·25
compilations					
1:1 000 000	0·50	51·14	15·44	1·01	0·25
Surficial geology	—	40·50	12·65	1·01	—
Aeromagnetic					
1:50 000	—	44·30	12·40	0·25	0·25
1:250 000	0·25	44·52	13·67	1·26	—
Airborne radiometric	—	23·63	14·17	1·51	0·25
Geochemistry					
1:250 000	0·50	30·38	15·44	3·03	0·25
Offshore multi-parameter	—	9·34	6·05	0·50	0·25%

Comment on any item . . . . . .

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	Yes	No	Nil Response
E-2. Do you/your organization have facilities for reading microfiche?	53·92%	31·90%	14·17%

SECTION E *(Continued)*

E-3. If yes, how often is the microfiche used?

commonly	☐	23.54%
rarely	☐	26.58%
never	☐	9.87%
nil response		40.00%

E-4. Do you feel publishing large quantities of supporting or tabular data only by microfiche is acceptable?

Yes	No	Nil response
☐	☐	
51.39%	27.09%	21.51%

Comment re microfiche . . . . . .

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E-5. Do you/your organization have facilities for direct use of computer tapes of GSC data?

		Nil response
29.36% ☐	53.41 ☐	17.21

E-6. Do you/your organization use GSC tapes of:

geochemical data	8.35 ☐	66.33 ☐	25.31
geophysical data	6.83 ☐	65.31 ☐	27.84
GEOSCAN data	5.82 ☐	66.33 ☐	27.84%

Other (please specify) . . . . . .

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Comment re computer tapes . . . . . .

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SECTION F. ACCESS

F-1. What are the main sources of GSC documents you use?

	Most important source	Next most important
Public library	1·26 ☐	3·03 ☐
University library	16·20 ☐	21·77 ☐
Government library	18·73 ☐	28·35 ☐
Company library	45·31 ☐	7·59 ☐
Individual library	9·36 ☐	18·98 ☐

Comment. . . . . .

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F-2. Do you find access to GSC information adequate?

Yes	No	Nil response
☐	☐	
73·92%	11·14%	14·94%

F-3. Which of the following do you use and find effective?

	a Do you use?		b Is it effective?	
	Yes	No	Yes	No
GSC Monthly Information Circular	62·27 ☐	18·73 ☐	56·71 ☐	1·77 ☐
GSC Yearly Index (Paper 73-3, etc.)	53·92 ☐	18·73 ☐	48·35 ☐	4·55 ☐
GSC Cumulative Index volumes	46·83 ☐	22·78 ☐	40·76 ☐	4·05 ☐
GEOSCAN	12·15 ☐	44·33 ☐	9·42 ☐	4·05 ☐
GEOREF	18·48 ☐	42·78 ☐	16·96 ☐	3·54 ☐
Information services at GSC offices	37·72 ☐	26·35 ☐	33·42 ☐	4·05 ☐

Comment . . . . . .

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F-4. Do you get and use the yearly GSC volume of Abstracts of papers in scientific journals by GSC authors (Paper 78-4, etc.) that give data on GSC output published externally?

Yes	No	Nil response
☐	☐	
38·98%	45·31%	15·69%

SECTION G. INFORMAL OUTPUT

G-1. How often do you communicate with GSC personnel?

frequently	☐	16·96
moderately	☐	40·76
rarely	☐	28·61
never	☐	3·29

G-2. Where do you communicate? And is it effective?

	a		b			
				Yes	No	
In the field	☐	36·96	36·96	☐	☐	1·26
In GSC offices	☐	59·23	58·48	☐	☐	0·76
At workshops, conferences	☐	55·44	51·39	☐	☐	2·28
By telephone	☐	64·30	61·52	☐	☐	1·01
By mail	☐	38·23	35·19	☐	☐	3·03

	Yes	No	No opinion	N.I response
G-3. Do you feel GSC personnel participate sufficiently in workshops and conferences?	☐ 49·37%	☐ 10·88%	☐ 26·07%	13·67%
			39·74%	
G-4. Much current output by GSC is published in outside publications such as scientific journals. Do you feel this is an effective way of communication?	☐ 72·15%	☐ 12·65%	N.I response 15·19%	

Comment on G-1 to G-4 . . . . . .

SECTION H. CURRENT RESEARCH AND NEW DIRECTIONS

H-1. *Current Research* is published by GSC three times yearly to present summary of research as rapidly as possible (Papers 79-1A, 79-1B, 79-1C, etc.). Are you aware *Current Research* welcomes scientific comments of all GSC output?

Yes	No	Nil response
☐	☐	
28.10%	56.96%	14.94%

H-2. To date only limited comment has been received for *Current Research*. Do you judge this to be due to:

(a) inertia	☐	39.49%
(b) confidentiality of possible germane information	☐	12.40%
(c) little controversial material occurs in GSC output	☐	11.14%
(d) prefer direct approach to authors	☐	29.61%
(e) not likely to be productive	☐	9.87%

H-3. What innovation would you like to see in GSC output in any aspect?

Comments . . . . . .