Province of British Columbia
Ministry of Energy, Mines and Petroleum Resources
Hon. Jack Davis, Minister

The Future Mandate, Organizational Structure and Recommended Resource Distribution for the

BRITISH COLUMBIA GEOLOGICAL SURVEY BRANCH

Ministry of Energy, Mines and Petroleum Resources

PREPARED BY THE EXTERNAL REVIEW COMMITTEE:

Christopher R. Barnes, Chairman
David A. Barr
John M. Hamilton
W. David McRitchie
E.R. Ward Neale
H. Glen Rushton

For, and Approved By, the
CANADIAN GEOSCIENCE COUNCIL
March 1990

Information Circular 1990-8

Canadian Cataloguing in Publication Data

Canadian Geoscience Council. External Review Committee

The future mandate, organizational structure and recommended resource distribution for the British Columbia Geological Survey Branch, Ministry of Energy, Mines and Petroleum Resources

(Information circular, ISSN 0828-6094 ; 1990-8)

Chairman, Christopher R. Barnes.

Includes bibliographical references.
ISBN 0-7726-1139-4

1. British Columbia. Geological Survey Branch. I. Barnes, C.R. (Christopher Richard), 1940- . II. British Columbia. Ministry of Energy, Mines and Petroleum Resources. III. British Columbia. Geological Survey Branch. IV. Title. V. Series: Information circular (British Columbia. Ministry of Energy, Mines and Petroleum Resources) ; 1990-8.

JL432.Z3G46 1990 354.7110682'327 C90-092157-9

VICTORIA
BRITISH COLUMBIA
CANADA

August 1990

Canadian Geoscience Council
Conseil Géoscientifique Canadien

Department of Earth Sciences, University of Waterloo, Waterloo, Ontario N2L 3G1

THE FUTURE MANDATE, ORGANIZATIONAL STRUCTURE AND RECOMMENDED RESOURCE DISTRIBUTION FOR THE BRITISH COLUMBIA GEOLOGICAL SURVEY BRANCH

FOREWORD

The Canadian Geoscience Council is a forum of representatives of the thirteen major earth science societies, working co-operatively with industry, government, and the universities to encourage the development of the geosciences in the best interests of the nation and of the geoscience professions. The Council provides advice to the federal and provincial governments on science policy and its implementation with respect to the earth sciences.

Within this mandate, the Council has sponsored periodic reviews which assess the level and quality of activity in specific aspects of geoscience in this country. The Council has completed reviews of the British Columbia Geological Survey Branch (1982), the Alberta Geological Survey (1984), and the Ontario Geological Survey (1985). It is important to recognize these have been completely independent studies. When undertaking a review, the Council establishes an external Review Committee of eminent Canadian earth scientists and, in conjunction with the client agency, prepares the terms of reference for the study. The views expressed in the final report are not necessarily those of the Council or the client. However, such an audit is obviously an important contribution that is useful, not only to the client but also, when published, to similar agencies in Canada and elsewhere.

The six distinguished earth scientists who were persuaded to serve on the committee and to devote countless hours to the preparation of this report deserve our collective thanks and commendation. Under the chairmanship of Dr. Christopher Barnes, they worked hard to meet deadlines, since the effectiveness of such a study is, in large part, a function of its timeliness. The members of the committee were:

Dr. Christopher Barnes
Mr. David A. Barr
Mr. John M. Hamilton
Dr. W. David McRitchie
Dr. E.R. Ward Neale
Mr. H. Glen Rushton

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The high quality of Canada's provincial geological surveys is recognized worldwide. The role of these surveys is increasingly important to the nation. This role is not restricted to gathering the scientific data base that is essential in social planning and in ensuring sustainable economic development of our mineral and energy industries. New challenges relate to global change, natural hazards, and environmental concerns. There is also a need for greater public awareness and education in the fundamental relationship of earth science to people's health and safety and the quality of life on planet Earth.

Thus, the need for a strong, active, and growing geological survey has never been greater.

Appreciation must be given to the Hon. Jack Davis, Minister of Energy, Mines and Petroleum Resources, for requesting this study, and to his Assistant Deputy Minister, Dr. Bruce McRae, the Chief Geologist, Dr. Ron Smyth, and their staffs for their co-operation and frankness.

This study should stimulate consideration and debate that must lead to further improvement of an already widely respected geological survey group. I commend this report to your attention.

DONALD K. MUSTARD
President
Canadian Geoscience Council

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SUMMARY

This report was produced by an External Review Committee established by the Canadian Geoscience Council (CGC) to examine the operations of the B.C. Geological Survey Branch (GSB) at the request of the Ministry of Mines and Petroleum Resources. Specifically, the Committee was asked to:

(1) Review the current mandate of G.S.B. in terms of the Province's needs to 2000 AD;

(2) To analyze its organizational structure; and

(3) To report on the adequacy of staff and budget to meet demands of the next decade.

This report follows that of an earlier report of a review submitted in 1982 (Morris *et al.*, 1986) which resulted in many successful changes in G.S.B. operations through the 1980s. The present report is based mainly on extensive consultations with G.S.B. staff, industry groups, government and university people and also on a widely circulated questionnaire.

The activities of G.S.B. have expanded greatly in the past five years, initially through a Mineral Development Agreement (MDA) with Energy, Mines and Resources Canada, later by increases in A-Base budgets for the Branch. Expansion has been mainly in regional and mineral deposits mapping, geochemical surveys and industrial mineral studies. The clientele has welcomed these increased activities and enthusiastically agree that they have contributed to increased mineral exploration and have helped in the discovery of new mineral deposits. In addition, a backlog of publications has been cleared up and a diverse array of new products has appeared since 1986. Published reports are now released on time to a public that almost unanimously rate them from good to excellent. The government can be satisfied that its Geological Survey has translated increased financial resources efficiently and effectively into the generation of much needed geoscience data.

1) In keeping with its terms of reference, the first task of the committee was to identify the role of the G.S.B. and its working relationship with various client groups.

The mineral exploration industry has been the dominant external client of G.S.B. throughout its 95 year history and will undoubtedly remain so in the next decade and beyond. However, the role of G.S.B. will become increasingly diversified and complex during that decade because the government will require a much wider range of geoscience information and policy advice. The G.S.B. will find an accelerated demand on its services by ministries such as Environment, Forests, Parks, and Regional and Economic Development. Scientists and technicians will have to devote much more effort to communication with the public and some of this will be in collaboration with the Ministry of Tourism. A modest increase in activity also is expected with B.C. Hydro and the Ministry of Transportation.

There is a growing concern that the mineral exploration has failed in recent years to find economic mineral deposits as quickly as British Columbia's mineral reserves are being mined. The rate in decline in B.C.'s reserves is now marked and production fall-off is imminent. The industry needs fundamental stimulation and identification of new places to search. Experience has shown that 1:50 000 scale geological maps are one of the most effective survey products to achieve this. An expanded program of mapping would continue stimulating exploration activity and meet the envisaged mapping demands from a growing number of clients in the Province.

The $6.2 million annual cost of G.S.B. basic services represents a government investment of only 0.16% in the province's $3.2 billion mineral industry. This industry has contributed enormously to the provincial economy and has sustained many communities in coastal, interior and northern B.C. Near surface mineral deposits now have

almost all been discovered and to retain a 10 year reserve required for continuing productivity will require close collaboration with industry and other government agencies (*e.g.* the Geological Survey of Canada) in an intensified geoscience effort. It is, therefore, critical that support be provided to increase the pace of geological mapping, to develop G.I.S. and other databases, to improve map production techniques, to increase staff in district offices, and to double the small research grant program for universities.

To meet the demands of a more diversified mandate in the next decade, support also will be required to establish an Environmental Geology group, to recruit a geophysicist, to form a Public Information unit and to provide adequate technical and administrative staff.

2) As its second task, the Committee evaluated the organizational structure of G.S.B. and compared it with those of other provincial surveys. There have been no changes in organization during the recent years of rapid growth and branch management is well aware of current weaknesses whereby the managers of four prinicipal sections, together with several other individuals and groups report directly to the Chief Geologist.

Many recommendations are made for improved organization of which the most fundamental is the creation of two large sections which would cover Operations and Services. The two senior managers of these sections plus the managers of two smaller units would limit to four the number of individuals reporting directly to the Chief Geologist, thus freeing him for the continually increasing tasks of external representation. This new structure would reflect the responsibilities of the new mandate, facilitate reporting relationships and improve operational efficiency and staff morale.

3) The final task involved an examination of human and fiscal resources and, again, was accomplished partly by drawing comparisons with geological surveys in other provinces. The Committee concluded that the G.S.B. is under excessive strain trying to meet its present mandate while maintaining quality research and service and ensuring timely release of information. Also, the reduction of MDA support poses an immediate budgeting problem. After reviewing all aspects of G.S.B. activities and assessing needs through to 2000 A.D., the Committee proposes two options:

Option 1: recognizes current fiscal restraint and suggests that staff could remain at its present level of 97.5 FTEs (FTE = Full Time Equivalent Employee or Person Years) but that A-base budget must be increased from $6.2 million to $8.0 million (in 1989-90 dollars). It was clear to the Committee that the G.S.B. mandate in the next decade will involve many new responsibilities without any reduction in service to the present dominant clients: government and the mineral industry. In an era of free trade and increasing international competition, a healthy mineral industry is essential in terms of economic, social and regional development. But additional funds must be found for enhanced services in environment, resource assessment, data management, tourism and public information. The enhanced budget is still modest in comparison with other sectors such as forestry and agriculture.

Option 2: recommends a staff complement of 132 FTEs and an A-Base budget of 11.2 million (in 1989-90 dollars). It will enable the G.S.B. to respond to the responsibilities of its mandate in the next decade and provide British Columbia with a modern, efficient and responsive Geological Survey. Sound, long term fiscal planning demands this modest investment in the well-being of the Province and the Committee advises that Option 2 be implemented over a three-year period.

Through the 1980s the G.S.B. has evolved from a static, underfunded organization into a productive, innovative and respected institute of applied science. It could be far more productive and work to full intellectual capacity if provided with a modest increase in resources. Option 2 and the projected move into a single, well-designed facility would finally allow the G.S.B. to provide British Columbians with the necessary quality of timely services that are appropriate to start the third millennium.

MAJOR RECOMMENDATIONS

Recommendations appear in appropriate places throughout the text of the report and all are repeated in a final section. Brief summaries of some major recommendations follow:

BROADENING OF THE BRANCH MANDATE

- G.S.B. should increase its level of regional geological mapping to 10 sheets per year to meet anticipated demand from client groups.
- New mechanisms should be established immediately for joint planning with Geological Survey of Canada offices in Sidney, Vancouver, Calgary and Ottawa.
- G.S.B. should participate in joint projects with industry, the G.S.C. and selected university departments to expedite new exploration technology transfer.
- The main objective of the Coal Resources Unit should be fundamental geological investigations. Coal geologists are required in offices at Fernie and Prince George.
- The G.S.B. should **not** embark on a major program of exploration geophysics, however, it should recruit a geophysicist to handle interpretation, collation, vetting of reports and communication with external groups and individuals.
- A new Environmental Geology Unit is proposed to include present surficial geology studies and to be responsible for nearshore and geological hazards studies.
- A new Public Information Unit is proposed to coordinate promotion of geoscience to the public.

ORGANIZATIONAL STRUCTURE

- A new structure is recommended that would comprise two principal sections: Operations and Services. The director of each, together with the managers of Branch administration and of report and map production, would report directly to the Chief Geologist.
- A separate Geochemistry and Geophysics Unit should be established to act in an advisory and support capacity to both main sections and to report to the Director of Operations.
- G.S.B. should continue to have its program and program plans discussed by the (external) Technical Liaison Committee. Among its many advantages is the fact that this process helps offset the G.S.B.'s physical isolation from its clients for most of the year.

STAFF AND BUDGET RESOURCES

- Management must take immediate steps to redress the imbalance between professional and technical and support staff.
- Prompt consolidation of all components of the ministry into a single modern facility in Victoria is strongly endorsed. The library and information facilities must be accorded one of the top priorities in the relocation planning.
- After assessing all requirements and immediate needs and mindful of the financial stringency within the ministry, the Committee recommends that the G.S.B. 1990-91 A-Base budget be raised to $8 million (in 1989-90 dollars).
- The Committee recommends that the ministry seriously consider the full merits of investing additional resources in the G.S.B. to ensure the long-term health of the mineral exploration industry, for environmental protection, and for an enhanced tourism industry. An appropriate annual resource level for the G.S.B. is 132 FTEs and an A-Base budget of $11.2 million (in 1989-90 dollars).

CHAPTER I: INTRODUCTION

THE ROLE OF THE CANADIAN GEOSCIENCE COUNCIL IN EXTERNAL REVIEWS

The Canadian Geoscience Council (CGC) was established in 1973 to act as a national coordinating body for Canadian geoscience. Council includes representatives of 13 national geoscience societies, federal and provincial geological surveys, university geoscience departments, and other geoscience councils or agencies.

One of the prominent activities of the CGC has been to undertake external peer reviews at the request of certain agencies and to organize peer reviews of particular sectors, disciplines or special issues. Examples include reports on the B.C. Geological Survey Branch (Morris et al., 1986); the Alberta Geological Survey (Rutter et al., 1984); the Geological Survey of Canada (Lindseth et al, 1989); geology and geophysics at Canadian universities (Neale and Armstrong, 1981); and the disposal of high-level radioactive waste - the Canadian geoscience program (Barnes, 1979). Such reviews are prepared by a committee established by CGC through discussions with the agency involved; the final report is approved by CGC, submitted to the agency, and later published. The series of reviews has substantially improved the health of Canadian geoscience and aided communications between different sectors.

THE FIRST CGC REVIEW OF THE B.C. GEOLOGICAL SURVEY, 1981-82

The first review of a geological survey by CGC was undertaken in 1981-82 for the B.C. Geological Survey Branch at the invitation of the Deputy Minister, Ministry of Energy, Mines and Petroleum Resources. The committee consisted of H.C. Morris (Chairman), H.J. Greenwood, A.E. Soregaroli, G.D. Mossop, and E.R.W. Neale. In brief, their mandate was three-fold:

1) to review and report on the need for a Geological Survey Branch and to recommend the level and direction of effort;

2) to review and report on the present and desired relationship with the respective components of the mineral, academic, and government sectors; and

3) to review and report on the goals, objectives, organization, operations, management, and effectiveness of the Geological Survey Branch.

The report was submitted in 1982, but not published until 1986 (Morris et al., 1986).

The committee made many recommendations, including:

1) that expenditures of the Geological Survey Branch roughly double their present level;

2) that several sections of the Branch need reorganization;

3) that there be improvements in management, publication output, management training, and administrative support;

4) that the Branch assume more responsibility for activities such as geothermal energy, industrial and structural materials, surficial mapping, and land use, and that it broaden its mandate beyond the realm of mineral resources;

5) that communications with industry be improved;

6) that there be more effort to receive input for policy and planning purposes;

7) that public relations activities be expanded;

8) that representation outside of Victoria be increased through regional offices;

9) that data and results be promptly released;

10) that the program of support for university research should be maintained;

11) that the role of the Branch vis-a-vis the Geological Survey of Canada (GSC) should be considered as part of the overall policy review; and

12) that the Branch strive to improve the status and impact of its activities, given the significance and value of the minerals sector to the British Columbia economy.

The GSB has been successful in implementing most of these recommendations, as discussed in the Annual Report for the last three years. Several of these proposed changes are revisited by the Committee in this present report.

THE PRESENT CGC REVIEW OF THE B.C. GEOLOGICAL SURVEY, 1989-90

In May 1989, Dr. Bruce McRae, Assistant Deputy Minister, Mineral Resources Division, Ministry of Energy, Mines and Petroleum Resources, invited CGC to undertake a review of the Geological Survey Branch (hereafter referred to as GSB). He noted that the first review had been well received, with many of the recommendations having been implemented. The report had been valuable in charting new initiatives and directions for the GSB. Over the last five years, the GSB had grown in size, budget, and program mandate. It had also participated in the first phase of the federal-provincial Mineral Development Agreement (MDA) (1985-1990).

These recent developments have satisfied many of the recommendations in the 1982 CGC review, except for the level of financial support. However, there are increasing pressures on the provincial government involving issues of land use, environment, waste disposal, and oil spills, that demand other forms of geoscience information and advice. Dr. McRae considers the GSB to be at another watershed in its history of distinguished service to the Province, spanning 95 years. The challenge is to develop a geological survey to meet the provincial geoscience needs through the next decade. As such, the invitation to CGC to establish an external review committee suggested terms of reference significantly different from the first review in 1982. The focus of the new study was to be on mandate, organization, and resource allocation and distribution.

In September 1989, the CGC established the Committee membership and defined the precise terms of reference as follows:

1) to review the current mandate of the Geological Survey Branch (GSB) and to recommend changes, if any, that are deemed warranted in order to enable the Branch to better meet the Province's needs for geological information to 2000 AD. Specifically, to review whether the Branch's mandate should be broadened to include geophysics and/or offshore geology;

2) to review the organization of the Branch in the context of responsibility, reporting relationships, workload, and effectiveness, and to recommend any changes; and

3) to review and report on adequacy of staff and budget resources of the Branch and its various sections to effectively meet its mandate and serve the mining industry and its other major clients in the next decade, having regard to the longer term prospects for public expenditure.

The members of the Committee were:

Dr. Christopher R. Barnes (Chairman)
Centre for Earth and Ocean Research (CEOR)
University of Victoria

Mr. David A. Barr
Barrda Minerals Incorporated, Vancouver

Mr. John M. Hamilton
Cominco Limited, Vancouver

Dr. W. David McRitchie
Geological Services
Manitoba Department of Energy and Mines

Dr. E.R. Ward Neale
5108 Carney Road, N.W., Calgary

Mr. H. Glen Rushton
507 Willowbrook Drive, S.E., Calgary

COMMITTEE ACTIVITIES AND METHODOLOGY

The Committee completed its work during the period of October 1989 through March 1990. The full Committee met for two, two-day periods in Victoria during October and November to hear presentations, receive briefs, hold information discussions, and tour facilities with the staff of the GSB. Meetings were also held with the Deputy Minister, Mr. Douglas Horswill, and the Assistant Deputy Minister, Dr. Bruce McRae.

Considerable documentation was provided to the Committee by the GSB on the programs, organization, finances, and outputs. In addition, the Committee was provided with consultant reports, including the Review of Marketing Activity and a Proposed Marketing Plan for the Geological Survey Branch by the Gleneagles Group (1989), and a Strategic Plan, Industrial Minerals Subsection, by Hal McVey (1989).

On other occasions in November and December, subcommittee groups of the Committee met with senior staff of:

a) the Geological Survey of Canada (Cordilleran Division, Vancouver; Pacific Geoscience Division, Sidney; Institute of Sedimentary and Petroleum Geology, Calgary);

b) other groups in the B.C. Ministry of Energy, Mines and Petroleum Resources (Petroleum Resources Branch, Engineering and Inspection Branch);

c) other provincial ministries (Crown Lands, Environment, Forests, Parks, Regional and Economic Planning, Transportation and Highways, Tourism);

d) major and junior mineral exploration companies in Vancouver; and

e) the Coal Association of Canada and major coal companies with headquarters in Alberta.

The Committee met in full for three days in early February, during the Cordilleran Roundup. This enabled the following meetings with:

a) executive members of the B.C. and Yukon Chamber of Mines;

b) senior managers from B.C. and Ottawa of the Geological Survey of Canada;

c) senior staff of B.C. Hydro;

d) members of the Technical Liaison Committee to the GSB; and

e) members of the mineral exploration and prospecting community, the academic community, and with individuals from the federal and provincial geological surveys.

To ensure that all members of the provincial geoscience community could provide input to the deliberations of the Committee, a questionnaire was prepared (Appendix). This was distributed to all members of the B.C. Geological Survey, of the Sidney and Vancouver offices of the Geological Survey of Canada, of the B.C. and Yukon Chamber of Mines, of the Pacific and Cordilleran sections of the Geological Association of Canada, and of the

Coal Association of Canada. A total of over 2200 questionnaires were distributed through several geoscience organizations, although this naturally resulted in some individuals receiving duplicates. The 224 copies processed (11% return; probably 20% of all individuals) provided an additional source of opinions and allowed the discrimination of views expressed from industry, government, and other employment sectors. The questionnaire elicited extended, thoughtful comments from many individuals, which were a substantial help to the Committee. The results must naturally be interpreted with care and not assumed to reflect the views of the regrettably large silent majority.

Given the particular terms of reference, the volunteer nature of Committee members' work, and the desire for a timely report, the Committee considers that it was able to interact with all major agencies interested in the future work of the GSB, and that it provided opportunities for concerned individuals in the geoscience community to comment to, or meet with, the Committee. The Committee also considers that it received all necessary data pertinent to its terms of reference from the GSB. The views and recommendations presented in this report are, therefore, based on these meetings, data, questionnaire results, and, particularly, on the collegial wisdom, or otherwise, of the Committee members.

ACKNOWLEDGMENTS

The Committee was appreciative of the frank and open dialogue with the Assistant Deputy Minister, Dr. Bruce McRae; the Chief Geologist, Dr. Ron Smyth; and all the senior managers and staff of the GSB. This made our task an enlightening experience and allowed few skeletons to be left in the closet. We were also grateful to all the individuals who gave of their time to enter into vigorous discussion on the future direction, structure, and resources of the GSB.

The work of the Committee could not have been achieved on time, nor the members remain sane, without the support and tolerance of many who helped move small mountains of paper, manipulate questionnaire data, type innumerable drafts, and arrange meetings and travel schedules. Particular thanks are extended to Norma Chan and Michael Fournier, Geological Survey Branch; Terry Russell, CEOR, University of Victoria; and Steve and Linda Noakes, who processed the questionnaire.

CHAPTER II:
DEVELOPMENT OF THE B.C. GEOLOGICAL SURVEY BRANCH

HISTORY TO 1982

The Geological Survey Branch (GSB) has its roots in the B.C. Bureau of Mines, which was founded in 1895 in accordance with the "Bureau of Mines Act," 1895. The original mandate of the GSB was "the collection of all official information relative to the various mining projects of the Province." Its name was changed to Mineralogical Branch in 1937, to Geological Branch in 1973, and most recently, in 1985, to Geological Survey Branch. The Branch's reputation has been built on classical studies of known mining camps; mineral, coal, and industrial mineral deposit studies have been, and will remain, a Branch priority.

In considering the evolution of the GSB over an 95-year period, it is important to recognize the significant parallel and complementary contributions of the Geological Survey of Canada (GSC) in regional geological mapping of the Province and in a broad spectrum of geological and mineral deposit studies. For instance, the 1960 Report of the B.C. Minister of Mines devotes over one page to the contributions of the GSC; describes 18 mapping projects in progress in the Province; and reports on 27 publications relating to British Columbia, received by the Department in 1960. The preamble of the section of the report recognizing GSC activity contains the following excerpt:

"By an arrangement made at the time the Province of British Columbia entered Confederation, geological investigations and mapping in the Province are carried on by the Geological Survey of Canada. Several geological parties are in the field each year. Many excellent reports and maps covering areas of British Columbia have been issued by the Geological Survey of Canada, and they have made available a great amount of information that has been of much benefit to the mining and prospecting activities in British Columbia."

Evolution of GSB's Mandate

The GSB and its predecessor organizations provided a basically reactive response to the needs of the mineral industry. In the early years, most of the Provincial Mineralogists and later, Chief Geologists, had a strong mining background. It was not until the mid-1930s that a strong geologic focus developed which provided adequate support for the required emphasis on the search for and development of strategic minerals during World War II. Many of the Chiefs gained an appreciation of geology either directly or through their involvement in summer programs with the GSC. Commencing in 1943, all the succeeding Chiefs had strong geological backgrounds, which contributed to the changing mandate from a mining-oriented focus to one emphasizing exploration.

As the mineral industry expanded its exploration activities in the 1950s, culminating in over a decade of successful porphyry copper and molybdenum exploration in the Province, the GSB responded with supportive detailed mapping, mineral deposits and metallurgical studies through the latter part of the 1960s and into the 1970s. Coal prospects became an important part of the GSB's activities, commencing in 1975. During the late 1970s and throughout most of the 1980s, the industry focus turned back again to exploration for precious metals, particularly gold. As discoveries resulted, new camps emerged and old gold camps were re-evaluated and produced new mines, some from previous operations. The GSB assisted this activity with its detailed mapping programs and mineral deposits and metallurgic studies. It was not until the mid-1980s, as reviewed in the next section of this report, that the GSB mandate underwent a major modification with the impact of the MDA Program and the emergence of strong environmental and land-use issues.

Most of the important modifications to the GSB mandate commenced in the mid-1960s. As noted in a forthcoming paper by A. Sutherland Brown (The Geological Division (1966-1984): Through the Porphyry and

Coal Booms to Recession, Restraint and Renewed Gold Exploration in 1966), about 80% of the GSB's overall budget was directed to traditional geological field project operations, attendant salaries, and publication costs. In 1974, with a broadened mandate, this category was 45%, and by 1983 it had dropped to 28%. The increasingly diverse nature of the enlarged spectrum is reflected in the following brief summary of new directions, described in considerable detail by Sutherland Brown.

Publications

The last traditional Annual Report of the Ministry of Mines, in 1968, covered 513 pages. Beginning in 1969, Annual Reports contained only the statistics and analysis of industry, and information on the activities of the Ministry and its personnel. A new volume emerged called **Geology, Exploration and Mining in British Columbia (GEM)**, which contained geological reports, exploration activity, information from staff, exploration forms and assessment reports, and inspection and engineering reports. In 1974, **GEM** was split into three component parts, of which one, **Exploration in British Columbia**, has continued. From 1979 to 1984, the mineral section of the Annual Report continued as **Summary of Operations**. **Bulletins** continued relatively unchanged. A new publication, **Geological Fieldwork**, started in 1974, was designed to provide preliminary results of Branch work and has continued through to the present. Since 1977, it became the first of a new series of **Papers** published by the Ministry. Several other miscellaneous publications were also issued in this period.

Maps

A principal group of maps produced were compilations of the Province, mostly on a scale of 1:2 000 000. Preliminary Maps had been issued irregularly, but a numbered series was started in 1969 and about 60 were issued by 1983. They were normally black-line prints at field map scale with an appended short text which corresponded to the current Open File series. Aeromagnetic Maps were almost entirely the product of a federal/provincial program, but mostly managed, and entirely produced, by the GSC. Mineral Inventory Maps show the location of mineral, coal, and placer occurrences in the Province, and are meant to complement MINFILE. Mineral Deposit/Land Use Maps portray relative mineral potential and probability of mineral discovery, but these have not been updated since 1982.

Assessment Reports

During the mid-1980s, reports submitted by industry for assessment credits under the Mineral Act were made available on microfiche and photocopy, through a sales arrangement with a third party.

Regional Geochemical Survey Data

Commencing in 1976, in a jointly managed federal/provincial program, analytical data were made available on stream sediment and water surveys. Later, the program became mainly funded and managed by GSB. The data include, at a minimum, sample location maps and listings for 22 metals, as well as uranium and fluorine in water and pH. Data are available on floppy disks and hard copy.

Placer and Surficial Geology

The GSB had a program in placer and surficial geology from the 1940s through to the 1960s, but it was eliminated, due to other priorities, after the resignation of the Branch's specialists in these areas. The program was not reinstated until 1989.

Geophysical Program

The GSB was involved in aeromagnetic surveys on its own in the late 1950s and then in the more systematic 1:63 360 and 1:50 000 scale federal/provincial program managed by the GSC. The program was based on three-year term agreements, which were discontinued at the end of the 1971 agreement, and was not renewed until limited funding became available under MDA and surveys were flown in 1986 and 1987. Only very minor surface geophysical surveys were completed.

MINFILE

The Mineral Inventory started in the early 1960s with data on properties coded on cards and locations because of lack of access to a mainframe computer. A later proposed computer-based federal/provincial program was considered unmanageable and was aborted. A further attempt, initiated in 1969 under a dedicated geologist, led to success in 1973-75, through the Branch funding, with others, the development of the MinDep program at UBC, with a fairly complete Branch-derived manual inventory as a base for the computerized mineral inventory. The Branch took over MinDep in 1976 and renamed it MINFILE. Conversion of the program to a different mainframe system created problems. The system did not reach its current effectiveness until it moved to a PC operating system in 1988.

Coal Inventory

The coal inventory, CoalFile, was not initiated until the mid-1970s and differs from the mineral inventory in being a computer-based inventory from initiation and being an inventory of exploration data.

Coal Storage

In 1976, the Branch initiated a program of coal core recovery, storage, and curating at Charlie Lake near Fort St. John through a shared facility with the Petroleum and Natural Gas Division.

In 1985, the GSB's coal storage technician position was eliminated and, in 1988, the district office in Fort St. John was closed. Access to the coal core can be arranged through the Energy Division offices.

District Geologists

The need for closer contact with industry and prospectors in the regions had been recognized since the withdrawal of Resident Engineers. Ten District Geologists were initially authorized by the government in the early 1970s, but only four were hired before a change of government brought restraints. In 1978, District Geologists were established at Fernie and Fort St. John to meet the contact requirements of the coal industry. These were closed in 1988 due to declining demand for services resulting from a virtual elimination of coal exploration.

Prospector Training and Grants

The program of training and grants to prospectors and developers was initially established in 1943, first falling under the direction of the Resident Engineers and, later, the Mine Inspectors resident in the regions. In 1975, responsibility for the program reverted to the Branch and, mainly, to the District Geologists. Grants to bona fide prospectors have been available for many years through an annually approved base budget of about $100 000, with the amount awarded to eligible prospectors depending on the proposed program, the experience of the applicant, and the proposed location. The base budget has been increased at intervals on an irregular basis to its present level of $500 000, initially through the Accelerated Mineral Development Program in 1978 and 1979, but not again until the availability of funding through the FAME program in 1985.

1982 TO PRESENT: IMPACT OF NEW FINANCIAL RESOURCES

The first CGC review, described in Chapter I, helped to maintain programs and, indeed, the GSB itself during the 198385 restraint period. In 1983, the GSB responded to the recommendation to establish one or more committees to solicit input for planning and policy purposes by establishing the Technical Liaison Committee (TLC). It consists of representatives from industry, academia, and the GSC, as well as the Chief Geologist. It has established objectives for the Mineral Resources Division of the Ministry (MEMPR) as outlined below, and has been helpful in improving communications with industry and in obtaining additional resources. The TLC helped to focus the GSB's activities, which led to heightened dialogue between Ministry personnel and user groups, and the increased communication led to a growing awareness that financial resources available to the GSB were distinctly inadequate in the early part of the decade.

TABLE 1
OBJECTIVES OF THE MINERAL RESOURCES DIVISION OF THE GEOLOGICAL SURVEY BRANCH AS IDENTIFIED BY THE TECHNICAL LIAISON COMMITTEE, JUNE 1984

1. To aid and stimulate the growth of the mineral resource industry to the social and economic benefit of the people of B.C. This is accomplished by:
   - A. Collection and management of data, including:
     - i) Assessment data;
     - ii) Data from public and private sources; and
     - iii) Core storage facilities.
   - B. Preparation of geological maps, including:
     - i) Systematic (1:50 000±) coverage of:
       - (a)Mineral and potential mineral belts; and
       - (b)Other areas of geological importance.
     - ii) Detailed studies – (long-term) comprehensive studies of mineralized areas; and
     - iii) Mapping of active areas – (short-term) for database.
   - C. Regional geochemistry.
   - D. Regional geophysics.
   - E. Dissemination of information, such as:
     - i) By publications; and
     - ii) Through District Offices.
   - F. Recommendations re government applications for withdrawal of mineral lands, government and public use of lands, etc.
   - G. Coordinate and sponsor internal and external geological research.
2. To coordinate and recommend mapping carried out by the Geological Survey of Canada (GSC) in B.C.
3. To identify natural hazards.
4. To liaise with geological branches in other ministries and organizations (i.e. Transportation and Highways, Environment, Forests, B.C. Hydro).

In 1984, the present Chief Geologist, Dr. W. Ron Smyth, was appointed to succeed Dr. Atholl Sutherland Brown, who had stepped down earlier that year, after 33 years of distinguished service. Negotiations commenced to reach a Mineral Development Agreement (MDA) between Energy, Mines and Resources Canada and the B.C. Ministry of Energy, Mines and Petroleum Resources.

The MDA was signed in 1985, to take effect in 1986. It provided an additional $2 million per year for each of the succeeding five years, with funds provided equally by federal and provincial governments. This MDA is compared with others in the following table.

TABLE 2
FEDERAL-PROVINCIAL MINERAL DEVELOPMENT AGREEMENTS

Province or Territory	Value of Agreement ($ million) Total	Geoscience	Cost Share Fed:Prov	Program Delivery Fed:Prov
B.C.	10.0	7.1	50:50	4:95
Yukon	3.9	3.3	90:10	100:0
Saskatchewan	6.4	5.3	50:50	50:50
Manitoba	24.7	13.0	60:40	60:40
Ontario	30.0	18.3	50:50	37:63
Quebec	100.0	34.7	50:50	4:96
New Brunswick	22.3	12.4	67:33	64:36
Nova Scotia	26.9	14.5	60:40	60:40
P.E.I.	0.3	0.3	50:50	0:100
Newfoundland	22.0	16.4	50:50	55:45
TOTALS (Averages)	25.0	12.5	(54:46)	(32:68)

The B.C. MDA is less than half as large as the average for other areas, but the fraction allocated to geoscience, at 71%, is large compared to the 50% weighted average for all other areas. The cost-sharing formula for B.C. is similar to the average, but the provincial share of program delivery, at 96%, is almost half again as large as the weighted average. Accordingly, the B.C. MDA can be characterized as relatively small, with a (perhaps correspondingly) small component of federal program delivery.

This MDA nonetheless had a large, if somewhat transitory, impact on the Branch, whose ABase budget had been fairly constant at about $3 million per year for several years. Addition of the geoscience part of MDA funds started to relieve a long-standing problem of chronic underfunding. Then a Mining Industry Task Force appointed by the provincial government recommended, among other things, that B.C.'s geological database be enhanced and this, coupled with recommendations of the TLC, resulted in significantly increased ABase budgets for the Branch in each of 1987 and 1988. Budgets in the 1982 to present period are set out below.

TABLE 3
GEOLOGICAL SURVEY BRANCH BUDGET, 1982-89
($ millions)

Year	Budget ($ of the day) A-Base	MDA	Total	Budget (1982 $)* A-Base	MDA	Total
1982-83	2.8	0.0	2.8	2.8	0.0	2.8
1983-84	2.7	0.0	2.7	2.6	0.0	2.6
1984-85	3.0	0.0	3.0	2.8	0.0	2.8
1985-86	3.0	0.4	3.4	2.7	0.4	3.1
1986-87	3.0	1.8	4.8	2.6	1.6	4.2
1987-88	5.0	1.6	6.6	4.2	1.3	5.5
1988-89	6.7	1.4	8.1	5.5	1.1	6.6
1989-90	6.7	1.1	7.8	5.3	0.9	6.2

**Amounts adjusted to 1982 $'s using Gross Domestic Product Implicit Price Deflators (1981 = 100)*

Accordingly, the MDA has augmented the cumulative ABase budget of $24.4 million over the last five years by $6.2 million, or 25%. MDA funds for geoscience were spent most quickly in the early stages of its five-year life, when the ABase budget was small and projects, many of which are now in the "write-up" phase, were attracting field and logistics costs. MDA funds available to the Branch were directed mainly to regional and mineral-deposit mapping, regional geochemical surveys, and industrial minerals/construction materials (Table 20, p.87).

The impact made by these increased financial resources is large and impressive, leading directly to a commendable increase in contributions to geoscientific knowledge. A backlog of publications was cleared up by 1986 and an array of products that is noteworthy for its size and diversity has appeared in each year of the latter part of the period considered. Publications activity is abstracted below; details are available in Information Circular 1989-19 and in annual Provincial Geologists Journals, Volumes One to Six.

TABLE 4
GEOLOGICAL SURVEY BRANCH CONTRIBUTIONS, 1982-89

Contribution	1982	1983	1984	1985	1986	1987	1988	1989
Bulletins			1	2		1	1	
Papers	1	2	2	2	4	2	1	4
Preliminary Maps		3	5	1	6	4	3	1
Open File Maps/ Reports					7	22	22	28
Coloured Maps		3						
Regional Geochem. Surveys			2		2	4	3	3
Info. Circulars				1	7	2	6	28
Other Publications	1		10		7	3	4	26
Papers in Journals				2	?	7	11	7

The dearth of Bulletins occurs because few major projects were possible with the limited financial resources available early in the decade. Many major projects began in mid-1980s and about 10 Bulletins are in preparation, with roughly half of these due in 1990.

The questionnaire (Appendix) probed the matter of publications and computer databases such as MINFILE. More than 80% of respondents who expressed an opinion gave these products good or excellent marks for adequacy of editing standards and appropriateness of formats used, while 80% felt that the quality of new or improved geoscience knowledge is good or excellent; 73% also felt that appearance is timely. Further, these views were shared by respondents from both industry and the federal and provincial governments.

One of the Papers is the very popular "Geological Fieldwork," which has increased in size during the period by a factor of 2.3 to 630 pages in 1989. Clearly industry and government users of geoscience data are now receiving a greatly increased volume of publications, which the Branch has worked hard to deliver. **The government can take some considerable satisfaction from the fact that its Geological Survey Branch has parlayed additional financial resources into additional geoscience data efficiently and effectively.**

In considering whether this increased effort has had a significant impact, the Committee notes results from the questionnaire. Fully 93% of respondents who expressed an opinion feel GSB activities have contributed to increased exploration or mineral resource exploitation somewhat or significantly, and 74% acknowledged that they, or their organization, increased their effort because of GSB products. More than half of those who expressed an opinion scored the value of GSB products in their thinking and planning processes, and impact of use of these

products on their work as "good" or "excellent". Finally, 92% of those who expressed an opinion said GSB people and/or products have helped indirectly in discovery of new exploration targets; 66% said directly. Generally, these opinions were shared by users of all affiliations. This is a rather remarkable vote of confidence by the user community.

There is no doubt that GSB activities and products are having the hoped-for results in terms of increasing exploration activity. Some examples are:

1) A GSB geologist located the Cub porphyry molybdenum occurrence in July, 1989, during the MDA-funded 1:50 000 Bridge River mapping project. The owner of the claim had not located this showing, but examined it immediately and commenced a significant drill program that fall.

2) Two GSB geologists encountered the Crine galena-bearing auriferous vein in the Tagish Lake area, northwest B.C. during 1:50 000 mapping in 1988. The claim owner subsequently completed detailed geological work, which led to discovery of several poorly-exposed subsidiary veins, and a $0.5-million drill program in 1989.

3) A prospector who lives in the Gulf Islands received a FAME grant in 1988 to work near Kitsault Lake, 15 km east of Stewart. He brought attractive samples to a GSB geologist in a Regional Office, where representatives of a mining company saw them and were given the prospector's contact. The company concluded an agreement with the prospector and later intersected interesting mineralization on the prospector's claims, as well as at the exciting nearby Red Mountain gold occurrence during a large drill program in the area.

CURRENT COORDINATION AND LIAISON ACTIVITIES

GSB's efforts to coordinate its activities with other producers of, and liaise with other users of, geoscience data have evolved over the last eight years. Some significant improvements have been made, but room for improvement remains, especially in view of the evolving mandate and client base.

Coordination With Other Producers of Geoscience Data

Both the Director of the Cordilleran Division of the GSC and the Head of the University of British Columbia's Department of Geological Sciences sit on the Technical Liaison Committee (TLC). However, the TLC exists primarily to provide liaison with industry and is an inappropriate forum for coordinating production of geoscience data.

We note that, in its most recent brief to the Mines Ministers Conference (August 1989), the Committee of Provincial Geologists addressed federal-provincial cooperation in the earth sciences. It feels that cooperation is essential for effective development of a modern information base and recommended, among other things, that comprehensive procedures be developed for cooperative planning, implementation, and funding of geoscience programs.

As discussed further in Chapter III, it has been agreed recently to establish a coordination group consisting of four senior managers or scientists from each of the GSC and GSB. **[C/R1] Our committee unanimously endorses this initiative because it believes that a significant need remains for improvement in coordination. The Committee notes that people at the Director General and Director level have been appointed by the GSC and cautions that the group will be effective only if representatives chosen to represent each survey have significant and roughly equivalent decision-making authority.**

About 55% of those expressing an opinion on the questionnaire feel that the present level of integration or dovetailing of GSC and GSB activity is satisfactory; only 11% said it is highly satisfactory or not an issue, while 23% said it is unsatisfactory. An opportunity to comment was provided and elicited 51 responses. More than half

asked for better coordination or, at least, for a better definition of roles. In addition, comments about a less than ideal level of cooperation were a minor but recurring theme in comments made elsewhere in the questionnaire.

Coordination between the Branch and university departments arises because the Branch supports selected university research activity as limited resources permit, and because some thesis work helps the Branch achieve some of its goals. The Branch supported 20 projects at 15 institutions with $118 000 of A-Base budget last year, including two projects at UBC totalling $8000, plus eight additional projects funded at UBC with $60 000 of MDA funds. Student assistants employed for fieldwork are given valuable training and provide additional opportunities for communication. **[C/R2] It appears to this Committee that coordination of activity with universities, while adequate, is a matter that could be improved, depending, as it does, largely on continued one-to-one contact between working scientists at institutions and in the Branch. The Committee also suggests that the overall level of support is inadequate, especially as the MDA funding will cease.** This is discussed more fully in Chapter III.

Other ministries of the provincial government produce and use geoscience data. The Committee recognizes a present and a larger future need for better coordination and liaison. These important matters are also addressed in Chapter III.

Liaison With Other Users of Geoscience Data

The GSB has moved steadily and effectively to improve liaison with industry. The TLC was established in 1983 (Chapter I), followed by the Advisory Committees for Industrial Minerals in 1986 and Coal and Geochemistry in 1987. Each meets twice a year, generally in the spring to comment on proposed programs once the overall budget framework is known, and in the fall to review progress and recommend initiatives for consideration in the following year. A spin-off benefit of these groups is that their members become acquainted with Branch programs, priorities, aspirations, and constraints, and can, therefore, provide useful insights, opinions, and advice to Branch management and/or Ministry executives.

About half of those from industry and the provincial government who expressed an opinion on the questionnaire said that outside liaison in the program planning process is good or excellent, with only 13% judging it poor. However, a third of federal government people felt it is poor and none felt it is excellent.

A second initiative, primarily to increase liaison with industry, was the opening of a Vancouver office in 1985 and the increase of its staff to three in 1990. This has, however, only partly sated the demand by industry people, who are based largely in Vancouver, for easier access to Branch scientists. Most respondents to the questionnaire feel that availability of GSB staff for contact is good to excellent, but Question 23, which solicited comments, elicited a large number from people who feel Victoria is too remote. Question 36 asked for recommendations on specific changes in overall organizational structure and the most commonly raised items were "strengthen regional offices" and "increase presence in Vancouver".

Vancouver joins Smithers, Prince George, Nelson, Kamloops, and Victoria as a city with a district office. These offices were visited by close to 1500 people seeking geoscience data in 1989, with Vancouver accounting for roughly one-quarter of all visits. Geologists from industry make up almost half of all visitors and prospectors almost a third. Other government employees and members of the public each account for 10 to 15% of visitors helped by District Geologists. Nearly half of those expressing an opinion on the questionnaire judged these district offices useful or essential and, also, somewhat inadequate in number.

An analogy can be drawn between appropriate relative Branch staffing levels in the central and district offices and the way companies with large mineral exploration departments approach a similar question. Examples in industry show staffing of district offices ranges from minimal to substantial, with pros and cons attached to any option selected.

The Committee notes that the mineral industry contributes substantially to the provincial economy, that industry geoscientists are by far the largest client group of the GSB, that the Vancouver Office could be expanded to the likely benefit of both parties, and that the GSB's need to be better represented in the districts is likely to increase as land use and environmental questions assume more importance. The Committee wrestled with the relative staffing level question, including perhaps moving the Victoria District Geologist's Office up-Island. The Committee concluded that relative staffing levels and district office locations are best decided upon by GSB management in response to changing needs, but commend the continued attention of management to this matter as the mandate and client base evolves in the years ahead. Other specific proposals are made in Chapter V.

It is most regrettable that the laudatory array of Branch publications noted in Table 4 are not available for purchase at all Branch offices. This is a problem with which all Branch personnel are keenly familiar. No other item attracted more oprobrium from people who submitted questionnaires, and the most common comment to Question 17, which solicited general comments about publications is that they are hard to get. Recently, publications have become available at the B.C.-Yukon Chamber of Mines office in Vancouver, but this only partly addresses the problem. However, users clearly feel strongly that publications should be available for purchase at district offices.

The Committee notes that while privatization of sales of government publications may be a sound concept, the GSB produces highly technical reports, which will have maximum impact only if they are easily available to a relatively small, specialized and widely distributed audience of technical people. **[C/R3] Publications are the principal product of every geological survey, and the effectiveness of the GSB will continue to be critically undermined as long as publications remain unavailable at district offices. It is recommended that this issue be resolved between the GSB and Crown Publications.**

The need for liaison with other government users of geoscience data is growing rapidly as the economic, environmental and social consequences of selecting various land-use options become more sharply defined and stridently promulgated. The Ministry has responded, very recently, by moving the Land-use Subsection from this Branch to the Mineral Policy Branch. This and related matters are discussed more fully in Chapter III.

COMPARISON WITH OTHER PROVINCIAL GEOLOGICAL SURVEYS

Previous comparisons between provincial geological surveys have tended to look simply at the staffing levels and budgets that each agency has to work with, compare these with the total value of mineral production in the region and, on a percentage basis, conclude that a particular agency is either well served by its administration or under-funded, compared to other provincial surveys. A typical table of statistics, taken from the most recent Provincial Geologists Journal (in prep.), is included as an example (Table 5). Additional statistics are provided in Table 6 below, comparing the respective ages of the provincial surveys and their burgeoning responsibilities and capabilities over the years.

PROVINCIAL GEOSCIENCES EXPENDITURES
1988 – 1989

TABLE 5
PROVINCIAL GEOSCIENCES EXPENDITURES, 1988-89

PROVINCE/ TERRITORY	SURVEY EXPENDITURES $ X 10^6	% OF TOTAL	TOTAL 1988 VALUE OF PROVINCIAL MINERAL PRODUCTION[1] $ X 10^3	SURVEY EXPENDITURES AS % OF TOTAL VALUE OF PROVINCIAL MINERAL PRODUCTION	AREA OF PROVINCE/ TERRITORY KM^2 X 10^3	SURVEY $ SPENT/KM^2	POPULATION (1986) X 10^3	SURVEY $ SPENT/ CAPITA
NEWFOUNDLAND	4.7	5.6	888 476	.53	405	11.6	568	8.3
NOVA SCOTIA	5.8	7.0	253 243	2.29	55	105.5	873	6.6
PRINCE EDWARD ISLAND	-	-	2 825	-	6	-	127	-
NEW BRUNSWICK	2.8	3.4	797 158	.35	73	38.4	709	4.0
QUEBEC	20.7	24.8	2 718 152	.76	1 541	13.4	6 532	3.2
ONTARIO	21.3	25.7	7 069 265	.30	1 069	19.9	9 102	2.3
MANITOBA	3.3	4.0	1 597 389	.21	650	5.1	1 063	3.1
SASKATCHEWAN	3.7	4.5	1 624 043	.23	652	5.7	1 010	3.7
ALBERTA	9.6*	11.6	750 966	1.28	661	14.5	2 366	4.1
BRITISH COLUMBIA [2]	8.8**	10.6	2 306 477	.38	948	9.3	2 883	3.0
YUKON	1.0	1.2	466 530	.21	483	2.1	24	41.7
NORTHWEST TERRITORIES	1.3	1.6	768 157	.17	3 380	0.4	52	25.0
TOTALS	**83.0**	**100.0**	**19 242 681**	**-**	**9 923**	**-**	**25 309**	**-**

[1]Source : Canadian Mining Journal, March 1989

* Includes about $7M support for studies of oil and gas, coal and oil sands

** Includes $1.1M support for Energy Division's Geological Branch for oil and gas investigations

TABLE 6
PROVINCIAL GEOLOGICAL SURVEYS, RECORDS OF PROGRESS

Province	Date of Founding	First Mapping	Main Regional Thrusts	First "Total" Coverage
Newfoundland	1864	1930	1974	1967/72
Nova Scotia	1865	1950s	1974	1979
New Brunswick	1846	1933	1952/70	1979
Ontario	1891	1950s	1962/63	1972
Quebec	1929	1939	1970	1963
Manitoba	1930	1946	1970	1979
Saskatchewan	1920/30	1947/48	1970	1980
Alberta (presently unavailable)				
British Columbia	1895	1986	1986	

All dates refer to programming mounted by the provincial agencies (*i.e.* independent of contributions made by the GSC). First "total" coverage identifies the date on which a complete geological map covering the entire province was first published (*i.e.* no blank areas).

Obviously the size of an organization and its resources are significant in determining the workload and range of capabilities. However, there are numerous other factors to consider when making comparisons of this nature.

Constraints imposed by harsh climate, lack of infrastructure, and difficult terrain can dramatically increase the amount of time required to document an area. Geological complexity in itself makes nonsense of those statistics that compare person years and expenditures to unit area. Large tracts of Canada are blanketed by surficial deposits, precluding bedrock studies. The time taken to map a complex greenstone belt will vastly exceed that required for a homogeneous granitic batholith or undeformed sedimentary strata.

Comparison of current statistics may ignore the maturity and quality of the geoscience database. In some provinces, other agencies may be undertaking similar work, even though the mandates are not identical. In this respect, it is important to note that the unique geology and mineral potential of British Columbia is engaging the attention of a wide range of geoscientists working for the Geological Survey of Canada in Vancouver and Sidney, as well as for the universities of British Columbia, Simon Fraser, and Victoria, and Royal Roads Military College. In the 1988 Overview of Geological Survey of Canada Activities in British Columbia, staff having a direct involvement in the Province included 37 research geologists from the Vancouver and Sidney offices (total staff 75), four from the Calgary office, and 14 contributions from GSC staff based in Ottawa; university contributions included 10 from research workers in the Province, six from universities in Alberta, 15 from other parts of Canada, and five from the United States. Numerous other researchers support various aspects of the provincial GSB program in B.C. All of these individuals are helping to build the geological database in British Columbia and, in so doing, free the GSB to focus on its priorities.

In this respect, British Columbia compares favourably with other provinces, and the GSB is in a relatively advantageous position. The broad range of these other activities makes it all the more important that the overall program in B.C. be coordinated to avoid unnecessary duplication of effort and to maximize logistical arrangements and information collection wherever possible.

The maturity of the GSB, founded as the B.C. Bureau of Mines in 1895, compares favourably with the Ontario Survey (1891). It is about 30 years younger than the surveys in Atlantic Canada, yet 30 years older than other

surveys in Western Canada. The territorial agencies are truly in their infancy and cannot be compared with their southern counterparts in most respects.

As outlined earlier in this chapter, for the past 95 years, the GSB has focussed almost entirely on supporting the mineral industry and documenting mineral deposits. Throughout this period, the federal survey gave regional dimension to the provincial vignettes by undertaking systematic 1:250 000 geological mapping programs, supplemented by more detailed coverage in selected areas. It was not until 1986 that systematic geological mapping at a scale of 1:50 000 was initiated by the GSB.

Most other provinces had embarked on one-mile-to-the-inch mapping following the World War II, then expanded these to systematic regional mapping programs during the early 1970s, and completed first-pass coverage of important mineral belts by the end of that decade.

In this context, the GSB is considerably behind other provincial surveys in mapping its territory at a standard inventory scale. The current emphasis given to regional mapping is appropriate and timely, and should be sustained with full cooperation from the Geological Survey of Canada, wherever this is appropriate to their mandate. **[C/R4] It is likely that additional progress will be made through the proposed National Mapping Program, and the Committee recommends that the GSB continue discussions with the GSC to that end.**

By comparison, the GSB's efforts in conducting deposit studies, compiling mineral data, and generating computer-accessible data banks has placed it at the forefront of these fields of endeavour, and it is to be complimented for the high standards achieved and sustained. One shining example of the products developed is MINFILE. This computerized mineral inventory database has achieved international recognition in recent years.

All provincial surveys contain surficial geology components and, in some regions, these also contain elements targetted at aggregate resources. It is timely, therefore, that the GSB has reintroduced a surficial geology operational capability, particularly with the current upsurge in demand for information on the environment and geological hazards. B.C. appears to be the only provincial geological survey without a geophysicist on staff and, elsewhere in this report, the Committee recommends that one be appointed as a minimal start to correcting this problem.

Although most provincial surveys in Canada are experiencing an increased involvement in land-use issues, the GSB appears to have anticipated this demand ahead of its counterparts and is favourably situated, having designated these responsibilities to a specific land-use unit. Even so, presentations made to the Committee suggest that the demand for involvement is growing on a daily basis and the resources of this group appear stretched to the limit. Other provinces would be well-advised to maintain a constant watch on developments in B.C., as an indicator of future workloads that they might encounter.

Not all provinces contain coal resources and, accordingly, direct comparisons cannot be made across the country. There appears to be a need to reevaluate the mandate and role of the GSB Coal Resources Unit, to make maximum use of the contributions coming from other agencies (e.g. Geological Survey of Canada, Calgary), and to ensure that the provincial resources are targetted and organized effectively.

The Industrial Minerals Unit also has its counterparts in other parts of the country, and is actively engaged in assessing the diverse potential in the Province.

The Analytical, Cartographic, and Lapidary units are essential support components to any modern professional survey. However, a comparison of the existing professional staffs shows the GSB units to be woefully understaffed. To some extent, this is offset by the fact that most geologists are supported by senior assistants dedicated to each project. Nevertheless, the skills peculiar to a young geologist are rarely comparable to those possessed by a trained analytical technician or cartographer, and **[C/R5] it would seem reasonable that the GSB review its current**

complement of Senior Assistants with the intent of reassigning some of these FTEs to appropriately skilled technical and secretarial support staff.

One peculiar inadequacy arising from the existing spectrum of technical skills in the GSB is the inability to produce coloured geological maps. Numerous new approaches have been developed over the last decade for generating cost-effective products in this category, **and [C/R6] the GSB would be well advised to mount a survey of practices, current or under development elsewhere in the country, to determine whether it could produce coloured geological maps which are routinely generated by other provincial surveys.**

Six district offices are maintained by the GSB. There is some indication that the existing siting of personnel is not optimized to regional needs. In comparison to the other provincial surveys, GSB shows a better-than-average representation in the regions. **[C/R7] However, as with other provincial agencies, Head Office in Victoria does not seem to maintain adequate communication with these outposts, and increased efforts must be made to improve communication links, coordinate seasonal investigations, and increase the number of visits made to each of the districts by Head Office management and operational personnel.**

In communicating with its public, the GSB mirrors in all respects the efforts of the other provincial surveys. Liaison committees are maintained, with representation from various industry groups and from the GSC. Accountability is maintained through regional meetings and workshops, as well as through the annual Cordilleran Roundup in Vancouver.

Linkages with university groups also appear well established; however, as in most other provinces, the present level of activity is overly dependent on MDA funding.

Finally a note on facilities and location. The scattered distribution of the GSB into five separate locations in downtown Victoria is highly unsatisfactory, leading, as it does, to inefficient communication between the various components of the organization, and to a general feeling of fragmentation. **[C/R8] Top priority should be given to co-locating all Head Office components in a modern facility with adequate space to conduct operations. Precedents elsewhere in Canada indicate minimal disruption to operations if the laboratory and rock storage elements are housed separately, and this option should be left open for any future planning considerations.**

Most provincial surveys have traditionally maintained their head offices in the main centre of commerce, with representation in the regions provided by essentially reactive district offices. Although Ontario is in the process of relocating its survey to Sudbury, the preferred configuration still appears to be one in which the headquarters are kept close to the main concentration of industrial presence, and even the Sudbury move can be viewed as a variant to this theme. Another major requirement for all government organizations is that the operational divisions be co-located with the seat of government. This appears to have been the overriding consideration in B.C.'s case, and the establishment of a regional office in Vancouver was a reasonable, and possibly the only, option open for strengthening the linkages with clients on the mainland.

In conclusion [C/R9] the Committee considers that the GSB has a major task ahead in order to catch up with the level of geological mapping developed in other parts of Canada. This is addressed in Option II of resource distribution in Chapter V. In some other aspects, the organization compares favourably, if not advantageously, with its counterparts in the other provinces. The principal shortfalls are the need for improved facilities, a better balance between professional and technical personnel, internal reorganization of reporting lines to better facilitate program delivery, and improved communications between Head Office and the regions.

CURRENT SPECIAL ISSUES

The Committee encountered repeated concerns about several special issues which it feels deserve comment here under the categories of Space, Laboratory, Library Facilities, Morale and Personnel, and Publications. While they are not directly related to the three principal issues in the Committee's mandate, they are important matters that deserve the attentions of GSB management and for which some recommendations are offered.

Space

GSB staff are presently located in five different locations in Victoria. This is mostly a result of an unplanned forced moved by the rapid expansion in both staff numbers and in the numbers of new initiatives undertaken by the Branch over the past few years.

As would be expected when operating units are not located under one roof, problems of communication and liaison between units exist. Those units remote from the Chief Geologist's location have a perception of being ignored, even though such a perception may not be valid. On the other hand, some of the units feel that isolation from the more bureaucratic elements of "Head Office" is an advantage.

Much of the space presently occupied is overcrowded, with limited space available when all technical personnel are in Victoria. This problem is not unique to the Branch and is fairly typical of many government offices in Victoria. Privacy is, likewise, at a premium, particularly for certain individual Unit Heads who may, from time to time, have need of privacy for discussions with industry or other government personnel.

As noted elsewhere, there is no space currently available for a central geological library. Records storage is equally inadequate, with the MINFILE records stored on the floor above the laboratory, and the CoalFile records in a basement. Both of these areas lack space where members of the public can refer to the records with any convenience.

The Committee has been given to understand that a new building to house the entire Ministry of Energy, Mines and Petroleum Resources in Victoria is under consideration. Certainly communication within the Branch would be much improved, as would the Branch's day-to-day communications with other portions of the Ministry, if everyone were under the same roof. **[C/R10] If a new building is authorized, the Committee would recommend that proper space for a geological library, and secure storage and reference areas for the MINFILE and CoalFile records be incorporated in its design.**

Laboratory

In 1985, the Laboratory section of the GSB was the subject of a study and a report by an advisory committee chaired by Mr. P.D. Kluckner of Environment Canada. Commercial laboratories, industrial laboratories, and universities were also represented on this body. A copy of the report has been made available to this Committee.

The 1985 report sets out the responsibilities of the Laboratory as follows:

1. the provision of high quality analytical data at reasonable cost for GSB geologists.
2. analytical quality control and management of the Regional Geochemistry Survey program, with research into efficient use of data generated by this program. (This responsibility was added this fiscal year.)
3. certification of assayers in the Province.
4. provision of an advisory service to commercial and industrial laboratories serving the mining industry in the Province.
5. provision of chemical expertise to the Ministry.

6. playing an acting role in the provision and certification of standard reference materials to the mining industry.
7. development of new analytical methods applicable to analytical problems faced by the exploration and mining industry in the Province.
8. playing an active role in the development of alternate uses for coal resources in the Province.

The 1985 report made detailed recommendations, many of which appear to have been carried out in the intervening period. In particular, the provision of timely, accurate quantities of data; high-volume, batch-processing of samples; and better communication with end-users appear to have been achieved. However, the recommendations made with regard to funding for replacement of obsolete equipment and for ongoing enhancement of equipment have not been carried out. There is also little or no capacity for coal analyses. Such deficiencies threaten the longer-term place of the Laboratory in providing a centre for expertise in the Province.

The demands on the Laboratory have increased remarkably since the 1985 report was prepared and peaked in 1987-88. All measures of activity increased, as illustrated below.

Calendar Year	# of Samples	Total Analyses	Analyses/Samples
1985	1807	15,082	8.4
1986	2051	22,028	10.7
1987	3233	44,542	13.8
1988	3045	50,965	16.7
1989	2428	29,536	12.2

[C/R11] There appears to be little control over the analytical demands made by individual project geologists and analytical costs are not charged to individual projects, nor included in the project budgets. Some control of this would appear to be appropriate, and the Committee recommends that the GSB examine the feasibility of instituting such a system.

The Laboratory continues to advise and monitor the contracting of analytical services for the GSB, particularly with regard to the work in geochemical surveys. This appears to work in a very satisfactory manner.

The 1985 report also concluded that: "It is clear that contracting of the Branch's analytical requirements to commercial laboratories is not the solution. As a general policy, it would be fraught with problems, with no major offsetting benefits. The lab offers a centre of expertise, in both chemical analysis and non-analytical geochemistry, that could not be duplicated through contracting. Contracting does have a place in handling new or unusual requests and in processing the workload generated by the Regional Geochemical Survey. In such situations, the Laboratory must remain the centre of expertise, exercising control over the contracting process and evaluating the quality of the data." This Committee endorses this conclusion.

Library Facilities

Throughout the ages, a principal criterion of a scholarly institution's reputation has been the size and range of its library holdings and services. Geoscience research agencies are, of course, scholarly institutions, and so it is appropriate to quote a policy statement of the Calgary Division of the Geological Survey of Canada (GSC), the Institute of Sedimentary and Petroleum Geology (ISPG): "The library is to provide an environment which will encourage the pursuit of scholarly excellence in research and the professional and intellectual growth of ISPG scientists."

Scientists must keep up-to-date with their own and related fields, and the principal method of doing this is through the periodical journals. During the information explosion of the last few decades, new contributions to

science are being scattered through an increasingly wide range of journals, each of which must be scanned in person or electronically (through key words and phrases) in order to select those articles pertinent to an individual scientist's interests. When undertaking a new project and, again, when writing up a final report, a scientist must carry out a comprehensive literature search in order to benefit from the results of all previous studies on the various elements of the project. To facilitate this, scientists need immediate access to in-house holdings through their personal computers and, with the help of a competent library staff, electronic access to other library catalogues and to the many government and commercial databases across the country.

A research establishment requires a library staff capable of implementing its collection policy; cataloguing, coding, and indexing its information resources; circulating its periodicals; and assisting its scientists with their on-line searches. Additionally, as it is usually a publicly funded facility and, in most cases, has unique aspects to its collection, it owes a service to the public. For this reason, a research institute must have adequate staff to handle phone calls and visits from a public that consists chiefly of scientists and engineers who are much less versed in library procedures than are its own scientists; that is, from people who require considerable assistance.

The library of the Calgary ISPG was quoted above because it has a roughly similar mandate, serves the same number of in-house scientists and support staff, and has an equivalent outside clientele as the GSB Library. For many years, it has occupied 5500 square feet of well-lighted space, has additional storage room, and is presently staffed by two professional librarians and two highly qualified assistants. It has long been regarded by the community it serves as adequate, although there are constant pressures upon it to broaden and increase its services.

The Library that serves the GSB and other branches of the Ministry occupies an ill-suited and woefully inadequate 1200 square feet in a building far removed from its "in-house" clients. It has neither the space nor the facilities to accommodate the public who wish to peruse Ministry products such as assessment reports, CoalFile reports and MINFILE data. Its collections have been pruned and down-sized over the past several years. Only one person is presently on staff to service needs equal to those of the ISPG library mentioned above. This lack of staff requires that the Library be closed for half of each day, a particular hardship on outside users. Those whom we queried praised the Trojan efforts of the single staff member who attempted to provide for their needs, but felt that the Library fell far short of providing the information resources needed by the Ministry's very active applied science research units. Thus, there is no possibility of providing the bibliographic searches and other services so desperately required with present staff and facilities. The Library, always inadequate, has diminished even as the scientific staff and the outside clientele have greatly increased.

We understand that the Ministry has commissioned and obtained a conceptual design for an expanded library and that there are plans to incorporate such an information centre in the planned new building that will house the Ministry.

[C/R12] The Committee recommends that the space and staffing of the Calgary ISPG library be considered a bare minimum when attempting to satisfy the needs of the Ministry's scientists and their clientele. It further recommends that, of all the facilities and services to be located in the new building, the Library be accorded one of the top priorities.

Morale and Personnel

The GSB has almost doubled its complement over the past few years and has moved into several new spheres of activity. Its growth has been due to substantial injections of funds received at an unpredictable rate which thwarted careful planning and required some hasty decisions, most of them, fortunately, good ones.

This recent history of rapid change, naturally, has caused unrest and dissatisfaction among some elements of the staff. For example, changes in emphases concern some of the older scientists who fear that their sectors will be deprived. Also, the termination of the MDA and current talk of restructuring create a feeling of insecurity

among newer employees, many of whom are on contract. Despite this, there has been a vast improvement in morale since the GSB was last visited by an equivalent committee in 1980-81. Even those who complained the loudest were obviously proud of their work and convinced of its importance.

Management

The senior managers of the GSB are a sound mix of wise veterans and imaginative newcomers. The GSB has moved from a low to a modest level of activity in a very short time and, despite the disruptions and uncertainties this has involved, a productive and interactive spirit has been fostered. This has to imply that generally fair and open management procedures have prevailed.

That said, there were several criticisms of management which are discussed in the following section. One deserves comment here; namely, that the managers are widely perceived by the scientists to have adopted a confrontational rather than a team approach to decision-making. It is easy to understand how this approach could develop in a period of rapid expansion. But its weaknesses, such as the "squeaking wheel syndrome," are well-known, and the new era of stability, slower growth, and a more logical organizational structure (Table 18) demand a revamping of management style. The prognosis is good: the senior managers, individually and collectively, are aware of this deficiency in style and the need to change it.

[C/R13] The Committee recommends an annual weekend retreat for the Chief Geologist, Section, and Subsection Managers to devise a more consultative and less competitive approach to Branch management and a team approach to decision-making in the critical years ahead.

Communication

The overall initial impression of the GSB is of easy, informal relationships and open doors. Everyone seems to know the Chief Geologist and the managers on a first-name basis and, with only a very few exceptions, one-on-one relationships seem genuinely cordial through the ranks. However, there is a disaffection and suspicion within some of the units which suggests a lack of adequate formal communication and consultation.

Not surprisingly, the unit that feels most alienated is that farthest from headquarters, the District Geologists. Although praised by each of the managers as "the backbone of the Survey" and "the Branch's front-line troops," these scientists feel a real sense of isolation. They claim that they receive no firm guidelines from Victoria, that they are asked to set their own priorities and, when they do, they "catch flak." They have almost naive misperceptions of the power and influence of the Technical Liaison Committee and a deep resentment of the current emphasis on publications which, they feel, has undermined appreciation of their service roles. In short, the District Geologists believe that they are "regarded as data gatherers who are excluded from planning and decision-making."

The Mineral Deposits Unit, the original core of the GSB, also feels somewhat neglected and threatened. Its scientists feel that the recent emphasis on regional mapping has been at the expense of their growth and that the entry into land-use and environmental studies diffuses traditional concentration on mineral deposits. They suspect that recently increased grants to professors and graduate students are designed to shift mineral deposit studies to the universities.

There were also widespread complaints about the lack of adequate numbers of support staff and a tendency to assign the blame to management. But when unit members were asked, given an opportunity for a permanent position, who they would hire, each unit opted for a scientist rather than a support person. All of this suggests the need for increased, formal communications.

[C/R14] The Committee recommends regular (monthly or bi-weekly) meetings of each section to disseminate information, air viewpoints, and call for suggestions. District Geologists should be invited to such meetings, possibly on a rotation basis or when the matters under discussion would benefit from the input of one or more of them. Written summaries of such meetings should be circulated throughout the GSB.

[C/R15] The Committee recommends regular meetings (e.g. brown bag lunch) of all Section and Unit Heads to provide cross-fertilization between sections and to provide feedback to the individual scientists. Such meetings should be scheduled to accommodate District Geologists if one or more of them is in town on other business.

[C/R16] The Committee recommends frequent, regular visits to District Offices by the Chief Geologist, Section and Unit Heads on a rotation basis, partly decided on topicality of interests.

[C/R17] Finally, the Committee suggests that management explore the feasibility of an exchange system that would require District Geologists to exchange posts at intervals or, alternatively, bring them back to headquarters for "sabbatical years."

Personnel Issues

Deficiencies in personnel management seem to affect the scientists in minor but irritating ways. They are of major concern to support staff.

Some scientists complained mildly about salary ranges which they feel are lower than for equivalent classifications in other provinces. The Chief Geologist assured us that salaries matched those in other provincial surveys and our own enquiries generally bear this out; nonetheless, the matter deserves thorough investigation and circulation of information. Scientists also point out that there is no financial compensation for those who take on positions as subsection heads. As these posts tend to rotate at intervals, the Committee suggests management investigate the possibility of special stipends for the period in the post, similar to those that some universities allot to Deans and Department Heads during their tenure of office. Another complaint, first heard by a similar committee ten years ago, was the necessity of a Scientist being a Registered Professional Engineer in order to qualify for the normal working classification of Licensed Scientific Officer (LSO). Able Scientists who do not meet this anachronistic paper requirement are slotted into other classifications, such as Research Office (RO), which impose restrictions (e.g. mandatory overtime pay) that hinder fieldwork.

Probably more serious are support staff complaints, which again go back many years, that the Branch is not administratively well-supported by the Ministry. Shortcomings in computer services, accounting procedures, and personnel management were mentioned. These conspire to frustrate the scientists and to place heavy burdens on support staff, often outside of their job descriptions. Personnel management deficiencies are particularly aggravating. Some support staff claim to have been in their present classification for over 10 years, during which time their duties and responsibilities have increased greatly so that they bear little relation to original job descriptions. On-the-job training is apparently sparse, and the Branch is no longer state-of-the-art in computer-assisted office programs.

We understand that the Branch is about to employ a Consultant to investigate these and other problems of personnel support services. However, we feel that the anomalies reported to us should not have been allowed to grow and fester, but should have been the object of ongoing investigation and concern.

[C/R18] The Committee recommends that the appropriate division of the Ministry immediately look into problems such as those pointed out above and, in the long-term, ensure that counselling, job descriptions, training, and performance evaluations be provided on a continuing basis.

Publications

The CGC Committee that investigated GSB operations during 1980-81 encountered client complaints about almost every aspect of publication policy and practice. This Committee recommended that "The publication procedure must be drastically revised to provide for effective release... within a reasonable time frame."

Drastic revision has taken place in the past few years: a full-time Science Editor is in place, reports of fieldwork appear swiftly, the Information Circular series has blossomed, and the Poster Session at the Cordilleran Roundup is regarded as probably the best open house display of its kind in the country. This is all reflected in responses to our questionnaire (*see* Appendix): 17% of respondents consider timeliness of publication excellent, 50% consider it good; 17% consider scientific editing excellent, 61% consider it good. The runaway favourite is the Roundup Poster Session, which scored a phenomenal 50% excellent, 37% good, and no poor ratings. **This is a far cry from the widespread condemnation of 10 years ago.**

Regrettably, as publication productivity has improved, the method of distributing publications has been degraded. The former procedure of distribution by a Ministry Sales Unit was considered highly satisfactory. The present system, under privatization, is inappropriate for scientific publications and has evoked widespread criticism from the industrial user community (questions 15-17, Appendix).

Present Activities

Publication over the last few years has concentrated on rapid release of information. Much effort is devoted to getting preliminary results of fieldwork into the hands of clients as soon as possible (Table 4). Scientists devote most of the fall months to preparing reports for the massive, best-selling volume "*Geological Fieldwork*," which staff of the Scientific Review Unit successfully scramble to compile and release for sale at the Cordilleran Roundup in early February. Another major compilation, for July printing, is "*Exploratio in British Columbia* ," which includes overviews and descriptions of mining camps and properties by GSB scientists. In addition, more detailed preliminary maps and reports have been made speedily available in an informal mode through the Open File system. Also, Information Circulars have appeared in abundance, many of them, such as "Dimension Stones," designed to catch the attention of people (*e.g.* architects) peripheral to the mining industry.

Studies in depth are published in the Paper Series or as Bulletins. Bulletins are regarded as the last scholarly words on a subject for some years to come - they are expected to have a long shelf life. Only six Bulletins have been published in the last decade, four of them since 1985. It is notable, however, that five Bulletin manuscripts are in the Editor's hands and all will probably be in print in 1990. Another four are in advanced stages of author preparation. There is, indeed, an explosion in GSB publications (Table 4).

The multitude of manuscripts, when submitted by the scientists, are processed by a Scientific Review Unit that consists of a Scientific Editor, an outside contractual Editor, and two Assistants who handle desktop publishing and layout. Almost half of their year is devoted to producing "Geological Fieldwork" and "Exploration in B.C." on schedule. They are steadily losing ground as they attempt to cope with the demand for Information Circulars and the stepped up production of Paper and Bulletin manuscripts. The three Cartographers, even with the aid of recently acquired Autocad systems, are also unable to keep pace. Coloured maps, long regarded as basic end-products of major studies, have not been produced for some years. Scientists have had to prepare many of the figures to illustrate their texts. The situation will only worsen as GSB is called upon to meet demands from new spheres of interest such as the environment, natural hazards, parks, *etc.*

[C/R19] The Committee commends GSB for its aggressive publication policy of the past few years and strongly recommends immediate staff increases in the Scientific Review Unit to cope with present and anticipated future demands.

Publications Distribution

Publication of scientific results is the lifeblood of information exchange and technology transfer. As a senior GSB manager stated, "It should not be a business but a major service to industry that will be repaid many times over." Responses to our questionnaire (Appendix) show that map and report distribution is the single major failing of the GSB operation in the eyes of its users.

In 1988, the Ministry eliminated its Publication Sales Unit in favour of a private outlet. Distribution of reports was taken over by Crown Publications Inc. and distribution of maps by Maps B.C. Due to the 400% mark-up required by Crown, significant price increases resulted. Maps B.C. quickly alienated users by six-week delays on filling orders. Protests led to a recent change, whereby Crown Publications has taken over sales of both maps and reports from its Victoria headquarters. Also, the B.C. and Yukon Chamber of Mines has agreed to act as its Vancouver sales agent. The Chamber, however, has limited space and can only handle recent publications, not the back issues that so commonly come into strong demand. In addition, Crown has stated that it will use the existing network of government agents to increase sales throughout the Province.

However, the Committee feels constrained to point out that reasonably priced maps and reports are **not a subsidy** to industry and other clients, **but are a catalyst** to exploration, development, and conservation. This is why government distribution units, with their highly trained staffs, from one end of Canada to the other, have stood the test of time, and why the Committee has recommended that GSB publications be available from all District Offices.

CHAPTER III:
FORECAST EVOLUTION OF GSB MANDATE TO 2000 AD

INTRODUCTION

Over the last decade, a variety of international forces have resulted in increasingly competitive trade relationships, diversified economies with a trend towards information technologies and an increased service sector, and attempts to avoid passing on both fiscal and environmental deficits to future generations. The federal government has been transferring certain responsibilities and, consequently, fiscal obligations, to the provinces. Other reductions in federal services (e.g. scientific research and development) have pressured provincial governments to assume some of these activities.

Over the next decade, there are signs that British Columbia will receive a significant population increase, largely through immigration. Pressures on the main urban regions will intensify, as will environmental concerns. Efforts to develop a more industrialized and broader based economy will create further conflicts with those groups in society wishing to protect the Province's natural beauty or enhance tourism. Land-use issues, already central in the government's agenda, will intensify. The public will demand more government controls and protection to improve forest logging practices, to prevent precipitous mine closures, and to ensure sustainable development of renewable resources.

If these speculations or projections for the Province over the next decade are generally correct, they imply that the GSB must also diversify its activities to provide a wide range of geoscience information and advice to the government, industry, and the public. Governments are increasingly harried by single-issue interest groups. Limitations in the political process, media coverage, and industry responsibilities all result in problems in any public debate involving sophisticated technological information. For the development, promulgation, and acceptance of new government policies, provincial ministries will have to increase their direct communication with the public on scientific issues.

ROLE OF A PROVINCIAL GEOLOGICAL SURVEY IN THE 1990S

Current Status and Issues Facing the Provincial Geological Surveys, 1990-2000

The decade of the 1990s will present an impressive array of new challenges to provincial geological survey organizations. These will include a rapidly expanding mandate to address environmental, geological hazard, and land-use concerns; an elevated level of interagency cooperative program delivery; the need to upgrade archival databases for compatibility with electronic processing techniques; more rapid turn-around for map and report production; and more effective and widespread representation on intergovernmental and interagency industrial development committees. All of this will have to be accomplished, at the same time as maintaining the traditional mapping research, service, and inventory functions in the face of fiscal restraint, and with competition for funding being an accepted element of day-to-day management strategies. Additionally, major efforts must be made by the surveys to communicate more effectively with industrial clientele, the public, and decision-makers both in government and the private sector. This will ensure that the significance of their work, and that of the mineral sector, is appreciated by society.

Fortunately, the provincial surveys (through various provincial, interprovincial, federal/provincial, and interagency committees) are aware of these demands and have already made adjustments to take on some of these new responsibilities. The recent Mineral Development Agreements have played a key role in focussing outputs generated by the surveys, and in providing hands-on experience with parallel federal/provincial program delivery,

as well as joint management structures. With appropriate and continued support the provincial surveys and their federal counterparts will be able to extend and consolidate the framework for effective, cooperative (federal/provincial/industrial/university) program planning and delivery which has been established over the last five to 10 years.

During the 1990s, the ability of the individual provincial surveys to embark upon new initiatives and concerns confronting their administrations will vary considerably. It will, in large part, reflect a compromise between maintaining progress on the longer term, systematic documentation of the provincial endowments, and responding to the externally driven demands for information essential to environmental and land-use decision-making. How this balance is achieved will depend on the level of funding and staffing provided by the respective administrations over the next decade. Individual surveys must make maximum use of their resources and work closely with all related government agencies and with the private sector.

Demographic studies have shown that a major proportion of professional government geologists are at a relatively advanced age: 30% may retire by the turn of the century. Another 50% are in the age range 35-49, so there is every possibility that they will either be in management positions or unlikely to undertake lengthy field seasons. Ultimately, this could lead to cutbacks in the level of new data acquisition, unless concerted efforts are made to instill new blood into the organizations as soon as possible. Here too, difficulties are likely to be encountered if current trends in university enrolment in earth science undergraduate and graduate studies continue to show the alarming decline apparent since 1984.

On the positive side, the relative stability of the provincial surveys over the last 10-15 years and the maturity of their geologists reflect a unique depth of knowledge and insight into each region's geological attributes. The 1990s will, therefore, also present a window of opportunity for provincial survey managers to capture these perspectives by mounting appropriate synoptic and compilation initiatives.

Geological Mapping and Mineral Documentation

Recent reviews of Canada's base metal reserves indicate a progressive decline in zinc and copper (27% and 18%, respectively, since 1975). To rectify this situation, a major new exploration thrust must be initiated. For the federal and provincial surveys, this has been translated into programming that, with renewal of the MDAs, would see significant increases in the rate at which new geological maps are produced for the more prospective areas. In Manitoba, new multi-disciplinary GSC investigations (EXTECH), primarily using federal A-Base funding, and with help from the provincial survey, are being focused on mining camps to define the controls localizing mineralization. These studies will also entail an evaluation and enhancement of geophysical techniques that would facilitate exploration at depth.

A concern that the rate of geological mapping in Canada is inadequate to meet today's and tomorrow's needs prompted the GSC to propose a National Geological Mapping Program (NATMAP). All provinces have been invited to take part in honing the concept and mounting a coordinated approach to enhancing, standardizing, and modernizing the documentation of Canada's geological endowment.

The provincial surveys are also participating in aspects of the LITHOPROBE and Continental Drilling Program initiatives. These, too, compete for the time and efforts available to address other new issues.

Systematic documentation of mineral occurrences will continue throughout the next decade, together with mine-specific studies and metallogenic modelling. Some provinces are giving increased emphasis to industrial mineral investigations, diversifying the mineral base.

Environmental, Geological Hazard, and Land-use Issues

Many environmental issues contain an important component of geology. Although self-evident to most geologists, it appears to escape some environmentalists, who regard anything to do with geology as having a rapacious, developmental stigma.

The provincial surveys have been drawn into a more active role, largely through interdepartmental technical advisory committees, especially those linked to new hydro and other developments. Active conservation programs are in effect in several provinces, including geological sites with a unique or scientific interest (e.g. ANSI in Ontario). Some provinces lacking such a program are giving thought to developing equivalent practices, with attendant demands on time required to draft the appropriate legislation. In other provinces, strident efforts by environmental groups and naturalists have seriously encroached upon the amount of territory available to developers, prompting the government to initiate a "No alienation without evaluation" policy. This ultimately imposes the responsibility to undertake the required assessments on the provincial surveys.

Virtually all provinces have experienced the same outburst in demand for geological information and boardroom participation, as a counterpoint to the upsurge in environmental lobbies and land-use proposals threatening sterilization of mineral resources. Geological personnel more familiar with the field environment have had to learn new debating and negotiating skills in order to represent the minerals development position effectively. There is a growing awareness of the need to have equivalent-rank representation in the boardroom, as well as the need to maintain a "hot-line" between personnel handling the conflicts and decision-makers at Head Office. The increased workloads are compounded in several provinces by Native Land Claims, which require advice from the provincial surveys as custodians of the minerals database. These demands are increasingly encroaching on other aspects of the surveys' endeavours, so long as their principal responsibility is to maintain a maximum amount of land available for exploration and development. To meet this growth in demand, some provincial surveys have established land-use units.

Certain parts of Canada, particularly B.C., are prone to natural hazards such as earthquakes, landslides, avalanches, rockfalls, volcanism, and tsunamis, as well as floods and shoreline erosion. In these regions, discussions are well advanced and could result in significant provincial programming to classify geological hazards to guide future municipal and housing developments.

Cooperative Program Delivery

Cooperative working relationships between the provinces and the federal government have been in place, with minor breaks, since the early 1970s. The funding formulae and balance of program delivery have varied over the years. The Mineral Development Agreements (MDA) have proven to be a most effective mechanism for regional economic development, and substantial advantages have accrued through their implementation. The most recent round of agreements (1984-1990) involved many cases of parallel program delivery with the agencies in Energy, Mines and Resources Canada. The provinces benefited not only from the influx of federal dollars, but also from the infusion of discrete, yet complementary, federal expertise. Joint workplans were developed annually, with cooperation from industry through advisory and liaison committees. The programming was monitored by federal/provincial management committees, with emphasis being given to high visibility and rapid dissemination of outputs. MDA's in several provinces also included initiatives addressing both the development and exploration sectors of the mineral industry.

The private sector appeared well pleased with the approach developed by both levels of government, and have lobbied vigorously for renewal of the MDA's into a second five-year term. At the time of writing, new Agreements for the Maritime provinces are in an advanced stage of negotiation. Those for the west are less certain, although assurances were received from the federal minister (EMR), in November 1989, that a second round of Agreements

would take place once the federal government had established its other priorities for regional economic development in western Canada.

If the provincial surveys are to be successful in attempting some of the initiatives expected of them over the next decade, renewal of the MDA's will be essential in the short-term. There is a growing awareness that the provincial surveys have become unduly dependent on the continuity of federal supplements and, to redress this situation, several provinces have argued for adjustment of their A-Base levels to permit continuity of core programming, independent of federal/provincial agreements. The continuing constraints on budgets arising from deficit reduction policies by both levels of government have prompted some provinces to look at industry/government funding arrangements such as AMIRA in Australia. If such an approach were to be developed in Canada, the nature of work undertaken by the provincial surveys might see some modification.

Electronic Data Processing

All provincial surveys are in the throes of evaluating computer hardware and software packages that might enhance their ability to collect, store, process, and analyze the huge volumes of data that have been accumulated and archived over the last century. Most agencies have been deeply involved since the early 1970s; some have spent vast amounts of time and money evaluating various systems, others, with less resources, have waited on the sidelines, monitoring each new claim of progress, and occasionally stepping in to maintain a hands-on involvement.

The state of the art across Canada is highly variable. However, a growing number of efficient and inexpensive systems are now emerging, and most provincial surveys now resort to WP and DTP systems for developing their reports. The provincial leader in the field of report production appears to be Ontario, which has established the aim of developing an electronic, fast turn-around printing system to permit release of reports and colour maps within six months of manuscript completion. Should this prove possible, adoption of the approach by other provinces would remove one of industry's principal, long-standing complaints concerning publication delays.

All provinces are also heavily involved in evaluating various Geographical Information Systems (GIS), either independently, in cooperation with the GSC, or as part of a wider provincial GIS appraisal. Although several systems are in use, no province can claim to have a fully operational GIS, but significant rapid advances can be anticipated. Several, if not all, of the longer range plans for programming during the 1990s contain budgets with significant components dedicated to electronic data management.

Communication

Quoting from Simon (1982): "Geology and geologists have become more specialized, their language more complex and obscure to the general public, their erudition more focussed toward their scientific colleagues than on outsiders, and perhaps even their attitudes less focussed on general societal concerns than on their own narrow self-interests. This situation has led to a deplorable lack of transfer of information from the geologic community to the political decision makers....

"...geological scientists who talk only to other geological scientists have little impact on the society. It is only when such information is translated and transmitted to decision-makers that the science of geology serves the needs of society. Whether or not we wish to admit it, that translation is the responsibility of geologists; the public and private decision-makers are not equipped to do it."

Major advances were made by some provinces (in cooperation with the GSC) in advocating the importance of minerals to society, during the last spate of MDA's; related government programs deserve substantial support.

The Mining Association of Canada and the Prospectors and Developers Association of Canada (PDAC) are acutely aware of the stigma that is attached to their sector and, by association, the provincial surveys (who have long supported mineral development) are also looked upon as being less than impartial in matters concerning the

environment and alternative land-use designations. Nevertheless, with active representation in the boardroom and committee debates, provincial minerals officials should eventually be accepted as legitimate advocates of sustainable development.

The need to enhance the sector's image is being addressed independently by the mineral industry through its own public relations initiatives and an overhaul of its mining practices, as well as within the workplans awaiting an MDA II go-ahead. Communications will continue to play an important role in getting the message out to the public. Receiving feedback communication from the public will be facilitated by establishing a toll-free telephone number at GSB headquarters. This responsibility must also be addressed by communications with those decision-makers who hold the purse strings, in order that the provincial surveys can compete successfully with other departments for dwindling tax dollars.

In this respect, provincial survey managers must give greater ear and attention to the needs of the program evaluators and make a point of recording the statistical records of performance that will be used in defense of future budget requests.

Research

Significant advances have been made over the last decade in developing good cooperative working relationships with university researchers. This has proved immeasurably beneficial in enriching the database and later interpretations. Some provinces have dedicated portions of their A-Base budget to this type of contracted work; others have been able to establish separate funds devoted to university research; many provinces were able to allocate a portion of their MDA budgets to this end.

The parallel delivery workplans and joint federal/provincial management committee structure attendant with the MDA's place the federal and provincial survey personnel in an advantageous position to recommend new applied research topics to university specialists. The opportunity to undertake research complementing the work of the survey organizations creates a synergistic environment benefitting all parties.

In conclusion, the provincial surveys play a unique role in facilitating, coordinating and cultivating an enhanced awareness of the potential and value of each region's mineral endowment. In the past, this has been heavily weighted toward the extractive process and industrial applications. The next decade will be one in which the generalist skills of the survey geologist will be stretched to encompass the somewhat different perspectives required to facilitate responsible land-use management and sustainable development.

SUPPORT TO THE PROVINCIAL GOVERNMENT

Within the Ministry of Energy, Mines and Petroleum Resources

The GSB is the largest single branch within the Ministry, with 97.5 staff, being about 45% of the total Mineral Resources Division and a little larger than the entire Energy Division. It is the principal unit conducting scientific work and providing basic information for use and policy formulation by other units.

In order for the Ministry to prepare inspection and engineering reports, to adequately document titles to mining properties, and to develop mineral and land-use policy for regulations and legislation, a sound geoscience database is required. The provision of information and policy advice is generated by the various sections for mineral deposits, coal, industrial minerals, surficial geology, aggregate and placer minerals. Innovative methods of data storage and analysis have been developed (e.g. MINFILE). The GSB has been highly successful in providing timely new data for a federal-provincial agreement entered into by the Ministry (Mineral Development Agreement). The Ministry, through the work of the Geological Survey, provides publications and maps on the geology

of the Province for industry, university researchers, and the public, as well as for other provincial and federal government agencies.

Over the next decade, these basic contributions to the activities of the Ministry will continue at a level likely higher than at present. Mineral deposits will be sought in more remote and less well explored areas; coal-bed methane production will require new studies; shortage of aggregate in Greater Vancouver and Greater Victoria will demand more intensive mapping; new offshore regulations will likely result in new placer industries in coastal waters; urban growth and improved transportation corridors will require more detailed mapping, surficial geology work, and natural hazard reduction advice; the continuing threat of earthquakes, especially a megathrust earthquake (8.0-9.0 on the Richter Scale), will necessitate close collaboration with geoscientists in the Geological Survey of Canada and with Emergency Preparedness agencies. The threat of geological hazards in an increasingly populated world has led to the adoption of the United Nations Decade of Natural Hazard Reductions Program (UN/DNHRP). The physiographic and geological nature and the increasing development of British Columbia all result in the Province having a high susceptibility for many geologic hazards. Surprisingly, the GSB, and to a lesser extent the GSC, provide relatively few resources to the analysis of such hazards and to contributing such data to land-use investigations. The Ministry will be increasingly involved in interministry discussions on matters such as the environment, land use, and regional and economic development, for which updated or new geoscience information and advice will be required.

Predictions by both the mineral industry and the Department of Energy, Mines and Resources Canada indicate a sharp increase in demand for base metals by the middle of the next decade as the world inventory is reduced. The mineral industry also welcomed the Free Trade Agreement with the United States, anticipating expanded markets. The provision of a sound, detailed geoscience database is an important factor in retaining and attracting a viable mineral industry in the Province. Such indirect support is not considered as a countervailable subsidy. Therefore, over the next decade, the role and activities of the GSB to the Ministry are expected to increase and diversify.

Within Other Ministries

The Committee met with senior staff of seven other ministries and one crown corporation, in part to determine their future geoscience information needs.

The GSB is presently strongly interactive with the **Ministry of Crown Lands**. With the recognized need for integrated land-use studies and decisions, Crown Lands has been given new resources to develop a Geographic Information System (GIS) (e.g. the TRIM Program) for the Province. This is being produced at 1:20 000 scale and hence needs some modification to incorporate the 1:50 000 scale geological mapping data of the GSB. The developing National Geoscience Mapping Project (NATMAP) of the Geological Survey of Canada and all provincial surveys can be expected to produce some quantum advances in geoscience data handling, retrieval, and map production over the next decade. This work in B.C. will have to be well coordinated with that of Crown Lands and improvements made in both production of coloured geological maps and in the sale and distribution of publications and maps.

After decades of abusing the environment, governments and the public are now demanding new standards and aiming for future development in harmony with the environment. The **Ministry of Environment** is, and will continue to be, under intense pressure and will require more geoscience information, both from its own small geoscience staff and from the GSB. Great fears are expressed in the Province, for example, about oil spills from tankers (cf. Exxon Valdez disaster in Alaska), yet there is clearly a grossly inadequate understanding of the B.C. coastal zone by the few specialist geoscientists in both federal and provincial agencies.

The **Ministry of Forests** has likewise been under considerable public pressure to ensure that sound logging practices are implemented. Recent examples of mountain crest to beach clear-cut logging along Kyuquot Sound

on western Vancouver Island indicate a potential for serious soil erosion that is clearly counter to the basic premises of sustainable development. Soil scientists are part of the staff of the Ministry of Forests, but the Surficial Geology Unit of the GSB could assist and advise the Ministry of Forests in matters of soil erosion, soil and bedrock type, and hazard reduction (*e.g.* slope stability). This would require additional staff, but perhaps the Province would be better served with information and advice from a dispassionate agency unconnected with the exploitation of the forest resources.

Another agency with a considerable present involvement with the GSB is the **Ministry of Parks**. Approximately 6% of the provincial lands are reserved for parks and recreational activities. The Ministry of Parks is considering proposals to double this area of parks (exclusive of any future federal parks). For each new proposal, a mineral resource inventory must be secured to ensure that no major mineral deposit is denied exploitation by inclusion within the park boundaries. The Ministry contracts with the GSB to prepare an assessment report, which involves detailed mapping of the proposed park and adjacent lands. With a long inventory already of proposed new parks and recreational and wildlife reserves, the next decade will see a heavy demand on the GSB, assuming that the Ministry of Parks provides the necessary funds for this significant commitment of GSB staff.

As with most provinces in Canada, many smaller communities, especially in the north, owe their existence to mineral discoveries and mine development. Forestry and mining are key ingredients in the mandate of the **Ministry of Regional and Economic Development**. In particular, the Ministry is enthusiastic to see new industrial opportunities developed (*e.g.* industrial minerals, offshore placers). The District Geologists of the GSB play important roles in the interministry meetings in the provincial regions, although most seem to feel that they are under-represented and outranked at such meetings, placing their contributions at a disadvantage. As British Columbia is a relatively young and unexplored province anticipating an expanded population over the next decade, it seems evident that the work of the GSB will be in strong demand by this ministry.

The **Ministry of Transportation and Highways** recognizes a number of future geoscience problems in its domain, such as landslide and hazard reduction, and new sources of aggregate. The Ministry has some geotechnical staff and does not anticipate many new transportation corridors over the next decade. It is not clear whether this ministry is making full use of the talents of the GSB. In the development of tourism, particularly roadside tourist stops, the advice of the GSB should be sought in the development of new stops that explain the geology and scenery to the public.

Tourism is reputed to be the second largest industry in B.C.; the brochures proclaim the Province to be "supernatural." This exalted state derives from its geological and geomorphic history and features. Tourism increasingly depends on repeat visits; these occur by whetting the appetites of first-time visitors. There is an appalling lack of geologic/geomorphic interpretation of the scenery for visitors. In Canada, the location receiving the most visitors each year is the Ontario Science Centre. The entire province of B.C. is a beautiful science centre, but with little interpretation to the public and visitors. The **Ministry of Tourism** has no expertise in this area and would welcome assistance. The GSB (with contracts to the universities and in collaboration with the Royal British Columbia Museum) could help prepare roadside plaques, guidebooks, posters, tours for Ministry of Parks staff, etc. Such work would undoubtedly enhance tourist attractions and, hence, provincial revenues. This could be one of the most significant contributions by the GSB over the next decade. The staff would thereby also help in the education of school children and in the public awareness of science. Such work would bring a more rational acceptance of mineral exploitation through the dissemination of accurate and well-prepared information. A separate Public Relations Section in the Geological Survey could help coordinate such work with the Ministries of Parks, Highways and Transportation, Advanced Education and Job Training; the universities; the Royal British Columbia Museum; and the media.

Energy will continue to be a central societal issue over the next decade. Fears of global warming will place pressures on the use of fossil fuels. Hydroelectricity will be favoured as a clean energy source. Additional major dam projects will be planned, and geoscience information will be needed to secure existing dams against the threat

of a megathrust earthquake. **B.C. Hydro** has its own geotechnical staff, but does depend on the availability of geological maps when considering new dam sites and when making land-use decisions concerning transmission line routes.

In discussions with senior staff of other branches within the Ministry of Energy, Mines and Petroleum Resources, and also with seven other ministries and one crown corporation, the Committee perceived an increased demand for the services of the GSB. In no case did there appear to be a diminished need and, in Tourism, there are remarkable, untapped opportunities. Such increased demands on services demand new resources if the GSB is to explore the new opportunities successfully - the precise amounts are discussed in Chapter V.

[C/R20] It is recommended that, in order to provide an anticipated increased demand for services by several provincial ministries and to develop new productive opportunities, the staff and budget of the Geological Survey be increased immediately and progressively over the next decade.

[C/R21] It is specifically recommended that the Geological Survey develop a new program, in collaboration with other ministries, the universities, and the Royal British Columbia Museum, to interpret the geology and scenery of the Province in order to enhance the tourism industry and the public awareness of science and resource development.

SUPPORT TO THE MINERAL INDUSTRY

Metals

Metals contributed a value of $1726 million in 1988, with copper the most important, at $969 million. Since 1982, annual exploration expenditures in B.C. have more than tripled, to roughly $200 million annually. Various fees paid by the exploration industry to the Gold Commissioner's office for claim recording and like matters now aggregate between $4 and $5 million annually, not far short of the current GSB budget.

Two approaches were taken to assess the success of this exploration. First, metal reserves in B.C.'s operating mines were reviewed. They are tabulated in the 1982 to 1989 period in Table 7.

TABLE 7
QUANTITIES OF METALS CONTAINED IN PROVEN AND PROBABLE MINEABLE ORE IN OPERATING MINES IN B.C. AND DEPOSITS COMMITTED FOR PRODUCTION AS OF JANUARY 1, 1982-89 INCLUSIVE

Metal*	1982	1983	1984	1985	1986	1987	1988	1989
Copper	5287	7427	6617	6698	6438	5560	5177	5133
Lead	1752	1428	1930	1810	1451	1256	1180	1071
Zinc	2690	2156	3564	3408	2789	2516	2435	2270
Molybdenum	491	467	429	373	349	333	202	216
Silver	6747	6835	6112	7492	6792	5838	5621	6140
Gold	187	196	136	147	131	163	167	172

**Thousands of tonnes for base metals, tonnes for silver and gold.*

Notes:1) No allowance is made for losses in milling, smelting or refining.
2) Includes metal in mines where production has been suspended indefinitely, but not metal in placer deposits.
3)Source: A. Lemieux, Energy, Mines and Resources Canada as quoted in Canadian MiningJournal, 1982-87, and personal communication, 1990.

Reserves at operating mines commonly are reviewed each year in light of changing mining, milling, transport, and smelting technology and costs; production and discovery experience; and long-term forecasts of metal prices. Also, some new mines started production. Hence, there is some scatter in the data, but clearly the overall trend is down. Experience in B.C. mirrors that of Canada, suggesting an uninspiring level of exploration success.

The B.C. and Yukon Chamber of Mines publishes annually a "Summary of Potential Producers" and, as a second method of gauging exploration success, the lists in the 1982 and 1989 May/June issues of Mining Review were compared. This comparison considered only those B.C. deposits large enough to employ at least 100 people directly for at least 10 years (if the quoted amounts of mineralized material were all mined and milled).

For 1982, 25 deposits of significant tonnage are listed, while 29 show up in 1989. However, three of the "newcomers" were known in 1982, even though they were not listed: Hail/Harper Creek, Hushamu, and Anyox. Two shown in 1982 do not appear in 1989: Hudson Bay Mountain (omitted in error) and Valley Copper. Valley Copper is the only "potential producer" of significant size listed in 1982 which achieved production in the interim. One other deposit on the 1982 list, now called Mount Polley, is under detailed consideration for production. More than two dozen other large deposits discovered at various times prior to 1982 have not achieved production in the interim, so their prospects for becoming economically extractable are limited. The Committee notes that exploration typically results in many more sub-economic deposits than orebodies.

Over this seven-year period, five deposits of at least medium size have been added: Kerr, Mount Milligan, Windy Craggy, Trout Lake, and Capoose Lake. The Committee cannot forecast which will permit economic extraction, but is sure that all will not reach production by 2000 AD.

[C/R22] The conclusion is that, over the last decade, the exploration industry has failed to find economic metal deposits as quickly as British Columbia's metal reserves are being mined. At recent rates of production, the Province has enough reserves to last about 17 years for copper, 10 and 16 years for lead and zinc respectively, 18 years for molybdenum, 15 years for silver, and 14 years for gold (Table 7).

Usually about 10 years elapse between the initial encounter of an economic deposit of significant size and sustained employment by a new mining operation. The rate of decline in B.C.'s reserves is now marked, and production fall-off is imminent. The industry needs fundamental stimulation and identification of new places to search. Mining is one of B.C.'s few revenue generators which is not much constrained by the Province's geography.

The GSB's 1:50 000 mapping program fell well behind that of other provinces during the 1970s and early 1980s. There are 1050 map sheets at 1:50 000 scale in the Province. About 800 of these have enough rock exposures and high enough mineral potential to be important for mapping; only about 10% of these have been satisfactorily mapped to date. Experience in the metals exploration industry shows that mapping at a scale of 1:50 000 is the smallest that is directly useful, because only at that scale can a geologist break down formations into their all-important constituent lithologies.

The four legs on British Columbia's economic stool are forestry, agriculture/fishing, mining/petroleum, and tourism. Mining/petroleum shows signs of weakening between now and 2000 AD if exploration success does not improve. These four legs are compared in Table 8.

TABLE 8
GROSS SALES AND MINISTRY BUDGETS,
SELECTED ELEMENTS OF B.C.'S ECONOMY

Activity	Sales in 1988 (Billions $)	Ministry 1989/90 Budget (Millions $)	Budget as a % of Sales	1988 Provincial Revenues (Millions $)	Budget as a % of Revenues
Agriculture & Fisheries	2.0	104.5	5.22	N/A-	
Forestry	13.3	557.9	4.19	678	82.3
Tourism (& Prov. Secretary)	3.5	39.2	1.12	N/A-	
Energy, Mines & Petroleum Resources	3.8*	36.4	0.96	315	11.6

**Sales exclude electrical energy.*

It is against these facts that the Committee considered how the mandate of the GSB should evolve with regard to metals over the next 10 years.

There is reason for optimism. British Columbia, despite its mineral heritage, is the least geologically mapped province in Canada. Fortunately, available funds are being used to begin to address this problem. Only government agencies can provide the needed 1:50 000 mapping data because industry is constrained by competitors' claim holdings. The need for contemporary mapping data is still chronic. When asked to identify areas where more GSB effort is desired, 43% of questionnaire comments requested more geological mapping and studies of known mineralized areas; a further 18% requested more surficial, geochemical, and geophysical mapping. Provision of the needed data can be viewed as an excellent investment opportunity for government, which will pay dividends in the land-use, hazard abatement, and environmental areas, in addition to stimulating wealth creation.

The Committee is confident that British Columbians can look forward to employment opportunities and revenue streams from metal mining that will persist for substantially in excess of one or two decades, because its mineral endowment is most unlikely to have been seriously depleted. However, the "easily" discovered orebodies (including the Ingerbelle and Afton mines, both within a kilometre of major highways) and sub-economic deposits are now largely known.

Finding the rest of the Province's elusive orebodies will require the development and use of better technology and deeper drilling. Increased demand for, and application of, geophysical data to explore the third dimension is to be anticipated. These are expensive, but industry has the skills and will follow through in a geologically favourable, politically stable area such as B.C. if government agencies adequately chart the way and raise confidence levels about ultimate exploration success. The GSB has made commendable progress in embracing and developing new technology. Examples include rapid provision of MINFILE and other data that can be manipulated on small computers, and development of the moss mat geochemical technique.

The GSB's present efficiency and range of activities in support of the mineral industry are lauded. There is, however, a serious question about whether present levels of activity are adequate to facilitate success in the longer term.

[C/R23] The Committee is convinced that the current level of activity in support of the mineral industry is a barely acceptable minimum, and fears that present levels of activity will not be up to the task of facilitating

industry finding metal to replace mined reserves in this poorly mapped province and recommends that government take immedsteps to rectify this.

The most attractive areas for application of new resources from the point of view of facilitating the metal discovery process, are:

1. **enhancement of the scope of 1:50 000 geological mapping.**
2. **adaptation and development of Geographic Information System (GIS) techniques to geoscience information in close concert with federal government initiatives in this area, including provision of spectral data obtained from satellites or high altitude flights.**
3. **provision of more complete low-level airborne magnetic data, preferably in concert with federal agencies, and ground geophysical mapping in mining camps, to provide another important "layer" of data for inclusion in GIS-based products.**
4. **participation in joint research projects with industry, the GSC, and selected university departments to expedite new exploration technology transfer and to help overcome obstacles to pragmatic application of new technology in the future.**

Coal

The British Columbia Coal Industry

In 1988, the latest year for which data are available, coal accounted for approximately 3% of all provincial economic activity in the goods-producing sector. In terms of mineral commodities, coal ranked first in terms of value of production, with gross revenues of $1 622 billion, and net mine revenues of $1 022 billion after deduction of rail and port handling costs. Revenue to the British Columbia government, exclusive of employee income taxes, totalled over $77 million in 1988.

Direct employment in the coal industry totalled over 5300, while an additional 11,000 employees in supply, transportation, and service industries depended on coal mining for their livelihood.

Production of coal in the Province (Table 9) comes from seven major mines, five in the south-east and two in the north-east coalfields. There is also some minor production on Vancouver Island.

TABLE 9
PRODUCTION DATA FOR B.C. COAL

(thousands - metric tonnes)

Calendar Year	Metallurgical Coal	Thermal Coal	Total
1986	17 528	3230	20 758
1987	18 721	3406	22 127
1988	22 460	3062	25 523

Almost all of the metallurgical coal is exported, with less than 1% used in Canada in 1988. Over 70% of the thermal coal went to offshore markets; the remaining 30% was used in Ontario. British Columbia itself consumes only minimal amounts of coal. Unlike Alberta and Saskatchewan, there is no provincial consumption base for the Province's production and the industry is entirely dependent on the export markets for its existence.

The past several years have been extremely difficult ones for the provincial coal industry. Excess supply in the international markets which it serves coupled with the increased currency value of the Canadian versus the

U.S. dollar in which coal prices are set have contributed to low returns to the producers. The principal markets for coal have also shifted as steel producers in other countries have acquired market share at the expense of the Japanese mills. Improving general world economic conditions, coupled with the rising demand for steel, have slowly remedied the results of the 1982 recession, and capacity-utilization in the Province's coal industry has improved in recent years. However, the industry remains in a highly-competitive environment with producers in other countries, most of whom have cost advantages in the geological and geographic settings of their coals. It is only by achieving marked improvement in productivity that the British Columbia mines have managed to survive.

In 1988, capacity-utilization in British Columbia rose to almost 95% in metallurgical coal; thermal coal capacity-utilization fell to under 55%, a drop of almost 10% from the previous year. While thermal coal constitutes some 18% of total capacity, pressure on prices in the international arena left much of British Columbia's thermal coal unable to compete.

Most forecasters agree that growth in world trade in metallurgical coal will be slow over the next decade. Conversely, growth in thermal coal trade is forecast to be high. Whether the Province's industry can participate in this growth will involve the question of prices and their stability over the longer term. Current thermal coal production, for the greater part, is very much a by-product of metallurgical coal production. Only one of the present mines produces thermal coal as its principal product. New mines, solely devoted to thermal coal, are most likely to develop where the quality and price of the coal satisfy the criteria most commonly demanded in international trade.

Coal exploration and development have been at low levels over the past several years, reflecting the general difficulties within the industry and the markets as a whole. Some specialized situations in B.C., reflecting coal quality and/or location factors, such as coals on Vancouver Island and at Telkwa and Mount Klappan, have seen more activity than traditional mining areas in the south-east or the newer mining area in the north-east. In the latter areas, work has been confined either to further delineation of known reserves, particularly those portions with lower strip-ratios, or to the search for lower-cost reserves adjacent to existing operations.

Hence the best that can be expected over the next decade is that the province's coal industry will maintain its current volume in the metallurgical trade, that some growth in thermal coal by-product may occur, and that new mines, directed to the international thermal coal trade, may develop on Vancouver Island and at Telkwa. Shipments of thermal coal to Ontario may well remain at current levels, since their electrical generating growth will be based on nuclear stations. Some minor electrical generation based on waste coal from existing mines may also develop in south-east B.C.

The GSB Coal Unit

The Branch currently spends $484 000 on coal activities. These funds lie entirely within the base budget and no additions from MDA are provided in the 1989-90 fiscal year. In comparative terms, this represents 6.2% of the total Branch budget and is roughly equal to what is spent on geochemistry or publications. This is certainly not a reflection of the importance of coal to the provincial economy, nor does it reflect the large provincial investment in coal infrastructure for the north-east mines.

The current budget for the Coal Unit provides for six permanent FTEs, and current staffing consists of five professional personnel, a Secretary, and auxiliary personnel. The objectives of the Coal Unit, as set out in Information Circular 1989-24, are to:

Conduct regional and deposit scale studies so as to determine the distribution, configuration, mode of formation, and utilization potential of the Province's coal resources to improve the effectiveness for exploration and development.

- Develop and maintain an up-to-date inventory of the quality and quantity of the Province's coal resources.
- Maintain and curate CoalFile, a computer-based file of coal exploration data.
- Promote the development and utilization potential of the Province's coal resources.
- Provide advice to government on coal research and development.
- Participate in inter-provincial coal research projects.
- Maintain and curate a library of coal exploration assessment reports.

The action plan which addresses these objectives is also set out in the Circular and simply shows the staff assignments to the various portions of the foregoing. As well, there was an initiative to hire a Coal Project Geologist to address the forthcoming regional assessment of 'frontier' coal in north-east B.C. which was actioned in 1989.

Currently, interest in coal-bed methane is growing, particularly in the petroleum industry, and the Coal Unit is involved in work to encourage industry programs. This work may occupy an increasing portion of the available time and can only add to an already large workload. The current proposal for a joint GSC-GSB study of the Bowser Basin, including the coals therein, will stretch these limited resources even further. The Unit does not have any capacity to produce the detailed compilations of coal resources and reserves which appear annually in Alberta. Monitoring of these reserves would appear to be of great importance, given the serious potential socio-economic effects of even one mine closure.

The Unit's support to the coal industry is perceived as being minimal. The closure of the District Geologist's office in Fernie and its amalgamation with the Nelson office effectively closed off its only working contacts with the coal operations in the area. Three of the six major operators are based in Calgary, as is a good deal of the other active coal exploration conducted in the Province. The GSC's major work in coal is centred at the Institute of Sedimentary and Petroleum Geology (ISPG) in Calgary. The major centre for coal R & D in Western Canada is at Devon, Alberta, where the facility is jointly operated by CANMET (EMR), the Alberta Research Council, and the Coal Mining Research Company. Thus, the Unit experiences difficulties in maintaining frequent, working-level contacts with a good proportion of the coal community, much of which would involve out-of-province travel if the situation were to be improved.

The Ministry relies on the Coal Unit for advice on all aspects of coal R & D. Such advice should be confined to the Unit's areas of expertise (i.e. coal geology/geophysics and coal quality). The Ministry should obtain its advice on others aspects of coal R & D, (i.e. mining, processing, and utilization) elsewhere or the Province will continue to lag behind other jurisdictions in coal R & D.

The rationale presented to the Committee for the limited effort in coal is one of competing priorities, and the fact that the limits of the coal-bearing formations are known and that there is, therefore, no need for the GSB to do further work to encourage exploration for coal. This is not only short-sighted, but indicates a degree of complacency which may not be valid. For a better understanding of the Province's mineral resources, there must be studies of the sedimentation, structure, and geological history of the coal deposits, particularly since the Province contains a wide variety of coal deposits in diverse geological settings.

[C/R24] It is recommended that:

1. **the main objective of the Coal Resources Unit be fundamental geologic investigations, where regional studies are prepared exclusive of coal licence and lease boundaries.**
2. **the feasibility of publishing provincial coal resource estimates and coal reserve estimates for approved coal mining projects on a regular basis be examined.**
3. **coal research and development work conducted by the GSB, and advice thereon to the Ministry be confined to coal geology/geophysics and coal quality. In particular, research into**

areas of surface geophysics which may aid surface mapping programs should be encouraged.

4. **full-time professional staff be increased, if possible, to allow Coal Geologists to be based at offices in Fernie and Prince George.**

5. **cooperation with GSC (ISPG) scientists on computer modelling of coal deposits.**

Industrial Minerals and Structural Materials

Industrial minerals are defined by the U.S. Bureau of Mines staff as "rocks and minerals not produced as sources of metals but excluding mineral fuels." The Canadian Minerals Yearbook of Energy, Mines and Resources Canada, which contains a review of all principal minerals produced, recognizes three main categories, metals, non-metals, and fuels. For this review, it is appropriate to subdivide these into industrial minerals and structural materials. The GSB has, until recently, had both under the Industrial Minerals Unit and also partly under the Surficial Geology Unit. The structural materials category reflects products used principally by the construction and, to a lesser extent, the agricultural industries, where transportation costs from source to use area are particularly critical because of the relatively low sale value per ton of the product compared with many industrial minerals. Construction or structural materials are commonly grouped in a separate category for statistical reporting purposes (e.g. Canadian Mining Journal annual review of the Canadian mineral industry), with non-metals comprising the other sector. Detailed statistical information on production of all minerals in B.C. has been reported in Annual Reports of the B.C. Minister of Mines since prior to 1950.

Structural Materials

Canadian production of structural materials in 1988 was valued at $2 772 million, of which $298 million was produced in B.C., compared with other industrial minerals valued at $2 678 million, of which $135 million was produced in B.C. (Table 10). This compares with a total value of $37 080 million for Canadian mineral production in 1988, including $17 840 million for fuels and $13 790 million for metals.

As shown in Table 11, since prior to 1950, structural materials produced in B.C. have represented all the principal recognized products, including clay, cement, lime, sand and gravel, and stone. In B.C., large volumes of limestone are mined each year for cement and lime manufacture, for use by the pulp and paper industry, and for various construction purposes. An important part of production is exported. The Province also produces a variety of architectural stone products for exterior and interior finishes in office buildings.

The value of production has increased by nearly 3000%, from $10.2 million in 1950. In 1950, the principal value for British Columbia production was cement (30%), sand and gravel (37%), and lime (11%); compared with 1988 production values for cement (36%), sand and gravel (45%), and lime (12%). These data reflect considerable stability in the need for these products and only marginal differences over a 38-year period in their relative values, which aggregated 78% of the total value of structural materials in B.C. in 1950, compared with 92% in 1988.

To date, the GSB has devoted only a minor amount of its resources to the search for, or documentation of, sources of structural materials which are a basic requirement in the Province's economy and which have a widespread use by industry, provincial government and municipal agencies in residential, commercial, institutional, and engineering construction. Important sand and gravel studies by the GSB include Paper 1980-10 and Open File 1988-27. These studies provide a basic inventory of the aggregates resource of B.C., the former focusing on the Lower Mainland and the latter considering transportation corridors and populated areas in the rest of the Province (excluding Vancouver Island).

Studies on the geology of sand and gravel deposits in the Lower Mainland and in the southern Straits of Georgia were completed principally by the GSC and as thesis projects, commencing in the 1950s and continuing

through the 1980s. Included were publications of surficial geology maps on 1:50 000 scale. Considerable mapping of Vancouver Island and most of the coastline west and northwest of Howe Sound has been completed at 1:50 000 scale by the Resource Analysis Branch of the B.C. Ministry of Environment.

Canada is an important exporter of industrial minerals and some structural materials (Table 12), with significant contribution to exports by B.C.

Discussions between the Committee and pertinent government agencies, particularly the ministries of Transportation and Highways, Regional Development, and Forests, reveal little past need for liaison with the GSB concerning sources of sand and gravel for road construction, which has been provided either by their own personnel or private consultants. However, some concerns were expressed by the Ministry of Transportation and Highways regarding future sources of materials, particularly gravel currently being barged from Victoria sources to the Lower Mainland, with depletion of nearby Victoria sources envisaged in the near term.

Non-Metals

As shown in Table 11 under non-metals, other industrial minerals produced since 1960 in B.C. show the growth through the 1970s and 1980s of this sector, from a base of asbestos and gypsum production and the addition of important elemental sulphur production, which increased from a value of $504 000 in 1971 to a high of $51.9 million in 1986 and $38.7 million in 1988. This was supplemented by sulphur in natural gas and other sources, valued at $13.9 million in 1988. In 1960, the principal product of value in this sector was asbestos, at $9.5 million, with output valued at $90.8 million in 1985 and ranging from $39.6-$50.0 million in 1986-88, the recent drop in value attributed principally to environmental concerns. Although the sector includes production of barite, gemstones, gypsum, quartz, magnesite, marl, mica, peat, and perlite, the most important contributors to the current value of production are asbestos and sulphur, which collectively account for 77% of 1988 production valued at $134.8 million compared with 85% of 1984-87 averaged production value totalling $122.9 million.

Outlook

In terms of outlook, the relatively stable growth of the Structural Materials Sector largely parallels economic and population growth in the Province and can be predicted to continue at a sustained level for the next decade. Within this period, the GSB may be requested to assist principal users of this important sector in studies of potential sources, including off-shore areas, to provide, in particular, the sand and gravel requirements for construction purposes.

In its March 1989 annual review of the Canadian mineral industry, the Canadian Mining Journal noted that, for the first time since 1979, the outlook for the asbestos industry was good, with a 6% increase in 1988 production over 1987, all 1988 production sold and prices starting to firm. Barring any very negative regulatory developments, asbestos fibre production was expected to rise steadily over the next five years.

Canadian elemental sulphur production in 1988 increased 2%, to six million tonnes, from natural gas processing plants (90%), oil sands plants (7.5%), and oil refineries. Sulphur deliveries in Canada accounted for 10% of total shipments, while exports to the U.S. accounted for 13%. Canadian sulphur production accounted for 15% of world elemental sulphur production, with B.C. production representing about 8.4% of Canadian value. The sulphur market is currently in fair balance and is expected to remain so in both the short-term and long-term according to the Canadian Mining Journal.

TABLE 10

BRITISH COLUMBIA AND CANADIAN MINERAL PRODUCTION

NON-METALS AND STRUCTURAL MATERIALS, 1984-88**

British Columbia & Canadian Mineral Production
Non-Metals & Structural Materials - 1984-1988**

(ooo's/metric tonnes)

	1984		1985		1986		1987		1988(***)	
	B.C.	Canada	B.C.	Canada	B.C.	Canada	B.C.	Canada	B.C.	Canada
Non-Metals										
Asbestos (t)	92	837	93	744	78	662	95	665	100	705
Asbestos ($)	75,296	379,275	90,779	352,275	39,663	234,063	47,791	235,168	51,000	268,367
Barite (t)	x	64	x	70	x	40	x	41	x	54
Barite ($)	2,712	6,974	2,694	6,335	849	4,215	1,126	3,886	1,611	4,336
Gemstones (kg)	x	184	x	x	x	354	x	297	x	440
Gemstones ($)	1,041	1,118	1,041	1,151	1,089	1,287	1,876	1,953	1,561	2,098
Gypsum (t)	412	7,775	378	8,384	485	8,803	497	8,811	428	8,522
Gypsum ($)	4,076	61,562	4,340	80,321	4,896	83,072	5,304	87,908	4,970	87,674
Quartz (t)	x		x	2,180*	x	2,640	x	2,560	x	2,710
Quartz ($)	1,730	40,845	2,013	44,110	1,896	41,640	2,309	44,307	x	46,997
Sulphur, in smelter gas (t)	231	844	50	773	20	758	23	803	143	820
Sulphur, in smelter gas ($)	10,210	63,200	2,199	65,902	2,953	72,614	3,464	93,269	13,871	73,615
Sulphur, elemental (t)	277	8,353	246	8,250	295	6,966	293	6,888	326	5,915
Sulphur, elemental ($)	17,005	609,141	29,174	68,1655	51,889	857,584	44,626	650,762	38,737	460,800
Other*	3,588	1,204,354	3,775	1,202,988	14,647	1,227,406	15,614	1,363,187	23,088	1,734,193
Total Non-Metals	**115,658**	**2,366,469**	**136,015**	**2,434,737**	**117,882**	**2,522,181**	**122,110**	**2,480,440**	**134,838**	**2,678,080**
Structural Materials										
Clay products ($)	7,230	136,795	3,800	144,487	8,652	179,515	6,833	210,208	9,500	185,273
Cement (t)	939	9,240	990	9,772	1,071	10,611	1,247	12,205	1,512	12,611
Cement ($)	69,939	717,282	77,339	780,050	73,696	824,344	88,287	976,025	106,133	1,012,625
Lime (t)	97	2,249	108	2,010	123	2,243	115	2,271	171	2,535
Lime ($)	6,559	157,645	7,300	137,043	10,339	171,359	9,848	177,900	14,928	189,946
Sand/Gravel (t)	35,103	233,759	31,750	223,724	42,888	257,971	38,600	260,265	49,300	276,064
Sand/Gravel ($)	85,973	546,328	76,835	551,254	105,282	678,612	102,290	729,147	133,110	782,675
Stone (t)	6,739	81,754	6,100	77,930	4,403	97,602	4,085	105,675	4,913	112,422
Stone ($)	38,181	393,433	36,235	378,155	23,049	488,655	23,700	547,495	34,388	601,312
Total Structural Materials	**207,882**	**1,951,483**	**201,409**	**1,990,989**	**221,018**	**2,342,485**	**230,958**	**2,640,775**	**298,059**	**2,771,831**

* In B.C. includes magnesite, dolomite, brucite, marl, mica, peat, perlite
x Withheld due to confidentiality.
** Data derived from annual Canadian Mineral Review issues of Canadian Mining Journal.
*** Preliminary.

TABLE 11
BRITISH COLUMBIA MINERAL PRODUCTION (1)
NON-METALS AND STRUCTURAL MATERIALS, 1950, 1960, 1970, 1980

British Columbia Mineral Production(1)
Non-Metals & Structural Materials
1950, 1960, 1970, 1980

	1950	1960		1970		1980	
	Value ($)	Quantity(2)	Value	Quantity(2)	Value ($)	Quantity(2)	Value ($)
Non-Metals							
Asbestos	-	40,748	9,482,923	86,730	16,013,827	100,089	81,688,936
Barite	17,284	23,573	279,716	45,320	382,508	-	-
Diatomite	(3)	44	1,430	1,276	26,567	3,615	138,273
Fluxes (quartz, limestone)	268,411	83,370	294,559	31,626	106,533	43,986	93,135
Granules (quartz, limestone, granite)	104,590	19,063	257,067	22,349	526,491	31,393	1,694,947
Gypsum & Gypsite	620,108	107,900	337,200	270,266	736,635	751,067	5,387,949
Jade	-	50,300	10,325	262,602	250,256	449,156	1,580,241
Mica	5,641	122,000	3,186	-	-	-	-
Sulphur	1,421,806	264,697	3,095,541	336,420	3,957,542	359,413	21,712,359
Others	-		-		-	x	3,630,167
Total Non-Metals	**$2,437,840**		**$13,762,102**		**$22,020,359**		**$115,926,007**
Structural Materials							
Cement	3,088,296	x	6,432,752	601,983	13,485,549	1,351,320	90,881,086
Clay Products	1,081,498	x	2,073,708	x	4,714,368	x	10,387,121
Crushed Rock	990,257	1,148,305	1,075,373	2,692,282	3,018,242	3,129,762	9,945,044
Lime	1,133,776	565,945	1,602,019	1,867,586	3,169,665	7,019,167	32,436,456
Sand/Gravel	3,723,487	x	7,597,278	23,155,989	21,679,387	45,278,202	98,666,100
Stone	188,675	4,328	48,859	175	2,449	91	9,850
Total Structural Materials	**$10,205,989**		**$18,829,989**		**$46,069,660**		**$242,325,657**

(1) Statistics from Annual Reports, B.C. Minister of Mines
(2) Tons except for mica, jade (lbs.). In 1980 data are tonnes and kilograms, respectively.
(3) Included in mica production.
(4) Preliminary.
x Withheld due to confidentiality or inapplicability (others).

TABLE 12
CANADA, PHYSICAL VOLUME OF EXPORT TRADE FOR SELECTED COMMODITIES, 1980-86[1]

CANADA, PHYSICAL VOLUME OF EXPORT TRADE FOR SELECTED COMMODITIES, 1980-86 [1]

	Unit of weight	1980	1981	1982	1983	1984	1985	1986
Nonmetals:								
Potash	t	10 554 063	10 067 830	7 221 375	9 411 895	11 493 732	9 980 965	9 893 879
Sulphur, crude	t	6 850 142	7 309 215	6 111 447	5 670 281	7 326 852	7 818 425	6 257 074
gypsum	t	4 960 239	5 094 872	4 775 780	5 187 032	6 224 573	5 879 664	5 885 349
Salt & Brine	t	1 655 770	1 507 708	1 721 892	1 914 626	2 545 011	2 263 076	2 502 526
Limestone, crushed	t	2 214 489	1 758 298	1 517 498	1 390 795	1 216 674	1 195 939	1 350 351
Asbestos, crude & fibres	t	1 217 733	1 062 287	880 703	753 901	796 764	722 003	752 068
Crude refractory materials	t	803 893	629 770	40 838	241 131	579 487	534 579	728 659
Nepheline syenite	t	448 465	476 280	414 781	398 295	387 066	351 026	338 263
Sand & gravel	t	383 531	318 634	168 691	95 634	109 809	241 790	249 835

[1] Canada Minerals Yearbook 1987

Summary

As will be evident from the foregoing review, the current and historical value of industrial mineral production in B.C., apart from structural materials, has been dominated by the asbestos and sulphur industries, with the latter being by-product production related to the metals and fuel sectors.

In assisting in development of a strategic plan for the next decade for the Industrial Minerals Unit, the GSB retained Mineral Marketing Inc. (of Rough & Ready, California) to prepare a report, which was completed by Hal McVey in October 1989. Mr. McVey noted that most of his recommendations had "already been implemented in some manner so it is only a question of enhancing the thrust into more marketing, economics and processing to provide a more complete package to prospective developers." The report noted that there is a continuing demand for such industrial materials as graphite, titanium minerals, zircon, chromite, rare earths, and yttrium, which can bear higher transportation costs and which should be sought in some of the more remote areas of the Province. In order to fund the ongoing level of activity in the Unit (currently budgeted at $191 000) and provide for elements of marketing/economics and processing recommended, a minimum budget of $300 000 per year was recommended at current levels. Although several staffing options were considered, a Field Geologist, a Mineral Economist, and a Unit Manager were considered essential.

Other provincial survey branches either include provision for industrial mineral programs in their most recently published budget allocation for mineral deposit inventory and analysis or in specific geological survey budgets (e.g., Quaternary, and Aggregate in Ontario). Specific budget allocations are provided by Manitoba ($152 000), Quebec ($453 000), and New Brunswick ($134 000) for industrial mineral programs in their most recently published budget (1987-88, Provincial Geologists Journal).

Comparison of base budgets of operating groups in the GSB 1989-90 Plan, without support of indirectly affiliated units, shows the following relationship, to the total value of $3,409 million, for British Columbia's value of mineral production in 1988, excluding oil and gas (Table 13).

TABLE 13
COMPARISON OF VALUE OF B.C.'S MINERAL PRODUCTION WITH GSB BUDGET

Value of Mineral Production 1988		GSB Budget 1989-90		
	%			
Metals	55.0	Mineral Deposits	$ 922 000	54.3
Non-metals	4.0	Industrial Minerals	191 125	11.3
Coal	32.3	Coal	484 100	28.5
Structural Materials	8.7	Surficial Geology	100 000	5.9
Totals:	100.0		$1 697 000	100.0

Although the comparison may be questioned as to its applicability, it appears evident that the 1989-90 budget for the Industrial Minerals Unit is anomalously high on this comparative basis, and that increasing it to the $300 000 level proposed is not supportable without an overall increase to the GSB budget. Of particular concern is the unexpected involvement by GSB in future studies within the overall industrial mineral sector, which would be commensurate with the historic and current value of production from the asbestos and elemental sulphur industries, which collectively represent about 80% of the total non-metallic production in B.C., exclusive of structural materials.

[C/R25] The Committee recommends that:

1. **the present funding level for Industrial Minerals Unit is appropriate for industry needs, apart from an expanded commitment which is considered essential to support a significant growth anticipated in locating and developing aggregate sources required to meet requirements in the Lower Mainland and Greater Victoria area.**
2. **the Industrial Minerals Unit be included as a subunit of the Minerals Section in the proposed reorganization.**
3. **the Minerals Section also include an Aggregate Unit, requiring an additional Geologist, in the proposed re-organization.**
4. **future activities by the Industrial Minerals Unit be guided by economic constraints, with the proviso that commodities studied or being sought within the Province would be marketable.**
5. **all mapping done by the Regional Mapping Section involve close liaison with personnel in the Minerals Section with respect to recognition and definition of areas with potential for industrial minerals and structural materials as well as for metals.**

COLLABORATION WITH FEDERAL GOVERNMENT AGENCIES

The principal government agency with which GSB has had occasion to collaborate on support services within the Province is the Geological Survey of Canada (GSC). The GSC is represented in British Columbia by scientists and their support staff in the Vancouver Office and by the Pacific Geoscience Centre at Sidney, with 30 and 40 permanent personnel, respectively.

As noted in Chapter II, by an arrangement made at the time of Confederation, geological investigations and mapping in the Province have been carried out by GSC; in addition, activities in these areas are performed by GSB under its jurisdictional rights.

For more than a century, the GSC has provided geological mapping coverage at 1:250 000 scale, with some detailed coverage at 1:63 360 and 1:50 000 scale. The GSC has continued to provide this coverage as requested within severe budget limitations; however, with the MDA program, the emphasis has changed, with the GSB providing a much increased program of 1:50 000 scale mapping. In pre-1985 projects, most of the effective collaboration between GSC and GSB occurred between project supervisors at the field level. The structure of annual planning meetings by the two agencies has tended to run in parallel, without allowance for any modification prior to program initiation which could maximize cost effectiveness by shared resources.

Commencing in 1989, a concerted effort was made by both GSB and GSC to engage in an open spirit of cooperation and joint planning to achieve mutual objectives without duplication of effort. The emphasis is on long-term planning.

The Committee recommends that new mechanisms be established immediately to implement closer and more frequent liaison and joint planning with GSB and the GSC in Sidney, Vancouver, Calgary, and Ottawa. These initiatives should look well beyond the customary year-to-year workplans and briefing sessions and should aim to establish a clear definition of mandates for each of the organizations, as well as five and ten-year reviews of intended programming, geared to the needs of western Canada. Regular updates and revisions should be a routine component of the annual Estimates process for both organizations.

In preparation for a joint meeting of the GSC and GSB on November 30, 1989, in Vancouver, in a November 6, 1989, letter to Dr. Ken Babcock, Assistant Deputy Minister of GSC, Dr. Ron Smyth listed the following activities (Table 14) which the GSB felt that the GSC should undertake.

TABLE 14
RESEARCH ACTIVITIES CONSIDERED BY B.C. GEOLOGICAL SURVEY BRANCH TO BE GIVEN HIGH PRIORITY BY GEOLOGICAL SURVEY OF CANADA

Discipline	Area, Specialization	Priority
Geological Mapping	1:250 000 regional mapping	A
	1:1 million compilations in digital format	A
	Tectonic synthesis	A
	Basin Analysis	B
Geochemistry	Research and development sampling methods, etc.	A
	National regional geochemical survey	A
	Drift prospecting	B
Geophysics	Aeromagnetic surveys	A
	Gradiometer surveys	B
	Research in exploration methods in mountainous terrain	A
	seismic monitoring	A
Coal Deposits	1:50 000 regional mapping	A
	Regional scale coal quality and petrography studies	A
Remote Sensing	Image analysis/GIS development standards	A
Environmental Geology	Hazards/U-Th	A
Offshore Geology	Ridge/slope/platform/coastal	A

Also discussed in the letter was support for the GSC strengthening its presence in the Cordillera with Vancouver-based personnel who could provide expertise in areas where the GSB is lacking (e.g. exploration geophysics) and some concern for duplicating expertise (e.g. mineral deposits geologists).

At the November 30 meeting, the two agencies tentatively approved the following principles for cooperation:

1. The GSC and GSB have a continuing and complementary responsibility to develop a knowledge and understanding of B.C. geology.

2. GSC's program is national in scope and reconnaissance in scale, designed to establish the fundamental framework of the Canadian landmass, including the offshore, and appropriate for assessing the resources, geological hazards, and environmental concerns. In support of these broad objectives, and on occasion in support of some specific need of government, GSC also conducts a wide range of process studies and studies of specific structures, sites or phenomena, and these are undertaken at whatever scale is appropriate.

3. GSB is to provide a geoscientific database for the Province at an appropriate scale for resource management and environmental assessment and to encourage commercial development of provincial resources as appropriate.

4. The complementary nature of the work of the federal and provincial organizations requires cooperation between the organizations in program planning and implementation.

Plan for formal cooperation in program planning/implementation:

1. Formal cooperation should be based on joint development and implementation of annual and longer term plans for geoscience in the Province.

2. Annual and longer term planning should follow a similar process, with development of work plans at the working group level, followed by agency approval and geoscience committee endorsement.

3. This procedure requires establishment of a joint geoscience committee to establish guidelines, develop plans, and provide final endorsement of work plans. The committee will identify key contacts in each agency for each discipline/area to coordinate planning and implementation.

4. All programs should go through the above procedures, with each agency retaining the right to proceed independently with projects which do not receive joint endorsement. Progress in such projects should be reported annually to the geoscience committee.

Cooperation at the project level:

1. Joint projects: provision should be considered whereby project leaders could contribute to projects delivered by the other agency (i.e. provincial leaders provide a provincial contribution to regional projects led by a GSC geoscientist).

2. Exchange visits: consideration should be given to exchange of project leaders between agencies or the assignment of a project leader from one survey to the other for an extended period of time. At a minimum, project leaders should be provided with the opportunity to present and discuss the results of their work with their colleagues in the other survey.

A Geoscience Planning Committee composed of four representatives from each agency, including two co-chairmen, was formed to examine and comment on all new projects to be undertaken in the Province by either agency.

The CGC Advisory Committee unanimously endorses this initiative because it believes that significant room exists for improvement in coordination. However, it recommends that the group should consist of senior and equivalent managers from each survey for maximum effectiveness.

With regard to GSB clientele's opinion of integration and/or dovetailing of GSB and GSC activity, respondents to the Committee's questionnaire considered this was highly satisfactory (9%), satisfactory (42%), unsatisfactory (17%), not an issue (9%). Of respondents, 23% had no opinion or no answer. (Question 34, Appendix).

The Committee's questionnaire addressed two specific areas in which broadening of the GSB's mandate is considered, which in part overlaps into areas of expertise of the GSC in the Province (i.e. geophysics and offshore geology) (Questions 6 and 7, Appendix). Respondents to the questionnaire considered involvement in geophysics by the GSB as excellent (23%), good (22%), fair (19%), poor (29%), with 7% providing no answer/opinion. With respect to involvement by the GSB in offshore geology, the respondents considered this would be excellent (8%), good (20%), fair (23%), and poor (43%), with 6% providing no opinion.

The Committee's recommendations on these issues are addressed in Chapters II and V.

[C/R26] The Committee recommends that:

1. **the Geoscience Planning Committee, composed of four representatives from each agency, consist of senior and equivalent management personnel from each survey for maximum effectiveness.**

2. **new mechanisms be established immediately to implement closer and more frequent liaison and joint planning with the GSC in Sidney, Vancouver, Calgary, and Ottawa. These initiatives should look well beyond the customary year-to-year workplans and briefing sessions and should aim to establish a clear definition of mandates for each of the organizations, as well as five and ten-year reviews of intended programming, geared to the needs of western Canada. Regular updates and revisions should be a routine component of the annual estimates process for both organizations.**

3. **the Geoscience Planning Committee should identify and initiate appropriate joint projects with joint publications (*e.g.* Bowser Basin) (*cf.* Peace River Arch Project in Alberta).**

COLLABORATION WITH UNIVERSITIES

Following a recommendation in the first CGC review (Morris et al., 1986), the GSB established a modest fund from which to award contracts for geoscience research projects undertaken at universities. In 1989-90, some 28 grants were awarded for a total value of about $180 000 (including $60 000 from MDA). Unlike the similar program of the Ontario Geological Survey, grants are only partly restricted to the provincial universities.

The program has been extremely successful in ensuring that research is undertaken that cannot be covered by the GSB staff. It has attracted many able university researchers (faculty and graduate students) to undertake projects in the Province who would otherwise focus their efforts elsewhere. Special analyses are commonly undertaken which are unavailable in provincial laboratories. Further, in nearly all cases the results are published in the scientific literature, enabling other scientists and industry to build on this knowledge. Many grantees present the results of their projects at the Cordilleran Roundup, along with the work of the GSB.

However, such grants are part of a wider competitive scene in university geoscience research. It must be noted that many provinces provide substantial support through similar programs (e.g. Ontario, Quebec) or through contracting out MDA funds (e.g. Newfoundland, Nova Scotia). Given the recent doubling of staff; given the expansion of provincial university geoscience expertise with the Centre for Earth and Ocean Research (CEOR) at the University of Victoria; given the pressing demands on the GSB staff over the next decade; and given the increased sophistication of geoscience research, it is proposed that the level of funding for university geoscience grants be doubled. The benefits to the Canadian economy of geoscience R & D were documented recently in a separate report commissioned by the CGC (Wojciechowski, 1989). The federal government has advocated the doubling of total Canadian R & D (to 2.5% GDP). If the Province is to remain competitive and is to attract cutting-edge research on its geoscience problems in support of the Ministry and industry, then additional resources are required. The existing funding level has remained relatively static for the past four years.

[C/R27] The Committee recommends that the funding for university geoscience research provided by the GSB be doubled over the next three years.

COMMUNICATION WITH THE PUBLIC

Studies in Canada show that we do not differ from the U.S.A., U.K., and other countries in our appallingly low rate of science literacy. Appreciation of science is probably less now than it was 30 years ago. A recent poll in Calgary showed that 65% of respondents could not name a Canadian scientist, living or dead – and Calgary boasts more engineers and scientists per capita than any other Canadian city.

Scientists have been traditionally reluctant to communicate with the public and have commonly belittled the efforts of those who do. However, this attitude is changing rapidly and many scientific societies are now urging their members to become involved in public lectures, popular accounts of their work, museum outreach programs, and elementary and secondary school activities. Two recent advisory reports to government, one by the Science Council of Canada and the other by the Canadian Geoscience Council, recommend that government scientists be encouraged to view their work in its social context and that lucid communication of science be a valid element in career advancement.

Quebec has, for many years, been the only province with a well-developed science leisure industry. However, a recent B.C. initiative has attracted national attention by bringing both working and retired scientists into a "Science in the Schools" program. This program attracted 186 volunteers to demonstrate scientific principles to 30,000 students in its first year of operation.

GSB Activities

The Branch has been moderately active in communicating science to the public, but the potential to do much more is present within its ranks. Activities of recent vintage include:

- About a dozen Branch scientists have been involved in a fairly minor way in the "Scientists in the Schools" program.
- District Geologists have participated for many years in school "career days" and in district forums involving the public.
- The Prospector Training Course is in one sense public communication, albeit to a rather specialized audience.
- Preparation of a coloured brochure outlining the work of the Survey in layman's language is almost complete - again, it is designed for an audience of potential clients.
- Some of the Information Circulars, especially those that are guides to source materials, are of interest to "rock hounds" and other members of the public.
- A popular booklet on "Minerals in B.C." is now out of print.

Earlier in this chapter, the Committee recommends that interpretation of the Province's spectacular scenery for the benefit of the travelling public should become a small but important part of the GSB mandate. Some possible additional activities are listed below:

- Participation in the government's "Science in the Schools" program should be increased and GSB's participating scientists and technicians should form a brown-bag lunch club to exchange experiences and thus improve classroom performances.
- Production of booklets suitable for school children and the general public on aspects of B.C.'s geology and its exploration activity.
- Production of a popular book and a simplified geological map on "Rocks and Minerals of B.C." Requests for information from the public pour into GSB and District Offices, suggesting a potential demand for a reasonably priced book of this nature.
- Building of closer connections with science writers, reporters and other media people in order to promote stories that illuminate the scientific method, using GSB research projects as examples.
- The new building planned to house GSB and other elements of the Ministry should be equipped with showcases and display areas designed to accommodate exhibits illustrating scientific principles and the work of the Ministry. These exhibits should be for the benefit of the visiting public and for school children, who would then be encouraged to visit the Ministry.

- There are dozens of other such projects. Not all scientists are suited to particular projects and some are unsuited to any close contact with the public - but those who have a flair for communication should be encouraged to use it.

[C/R28] The Committee recommends that the Ministry encourage GSB scientists and technicians to participate in public awareness of science projects and that it accords some recognition of this participation in career advancement.

CHAPTER IV: ORGANIZATIONAL STRUCTURE

The second term of reference given to the CGC Committee was "to review the organization of the British Columbia Geological Survey Branch in the context of responsibility, reporting relationships, workload and effectiveness, and to recommend any changes"to better equip the organization for the tasks ahead.

PRESENT STRUCTURE OF THE BRITISH COLUMBIA GEOLOGICAL SURVEY

The present organizational structure of the GSB is shown on Table 15. The GSB is one of four branches in the Mineral Resources Division of the Ministry of Energy, Mines and Petroleum Resources. Functions pertaining to petroleum resources are handled through two branches in the Energy Division. The other branches in the Mineral Resources Division deal with matters pertaining to inspection and engineering, titles, and mineral policy.

In a communique dated January 11, 1990, Assistant Deputy Minister Bruce McRae announced a reorganization in which the Mineral Policy Branch would be required to play a broader and lead role in proposing, developing, and/or coordinating Division activities in the areas of mineral, economic, social, and environmental initiatives. As part of the reorganization, the Land-use Unit of the GSB was transferred to the Mineral Policy Branch, joining units dealing with policy and program development, and economic and financial analysis. The Land-use Unit will be expected to continue its geological (GSB) work, but with a broader and stronger mandate for environment and land-use policy issues; the defunct divisional land-use committee will also be reactivated.

Currently the GSB is organized into four sections, each containing a number of distinct units informally headed by a Unit Leader. The four sections are Mineral Deposits and Regional Mapping, Geochemistry and Surficial Geology, Resource Data and Analysis, and District Geology and Coal Resources.

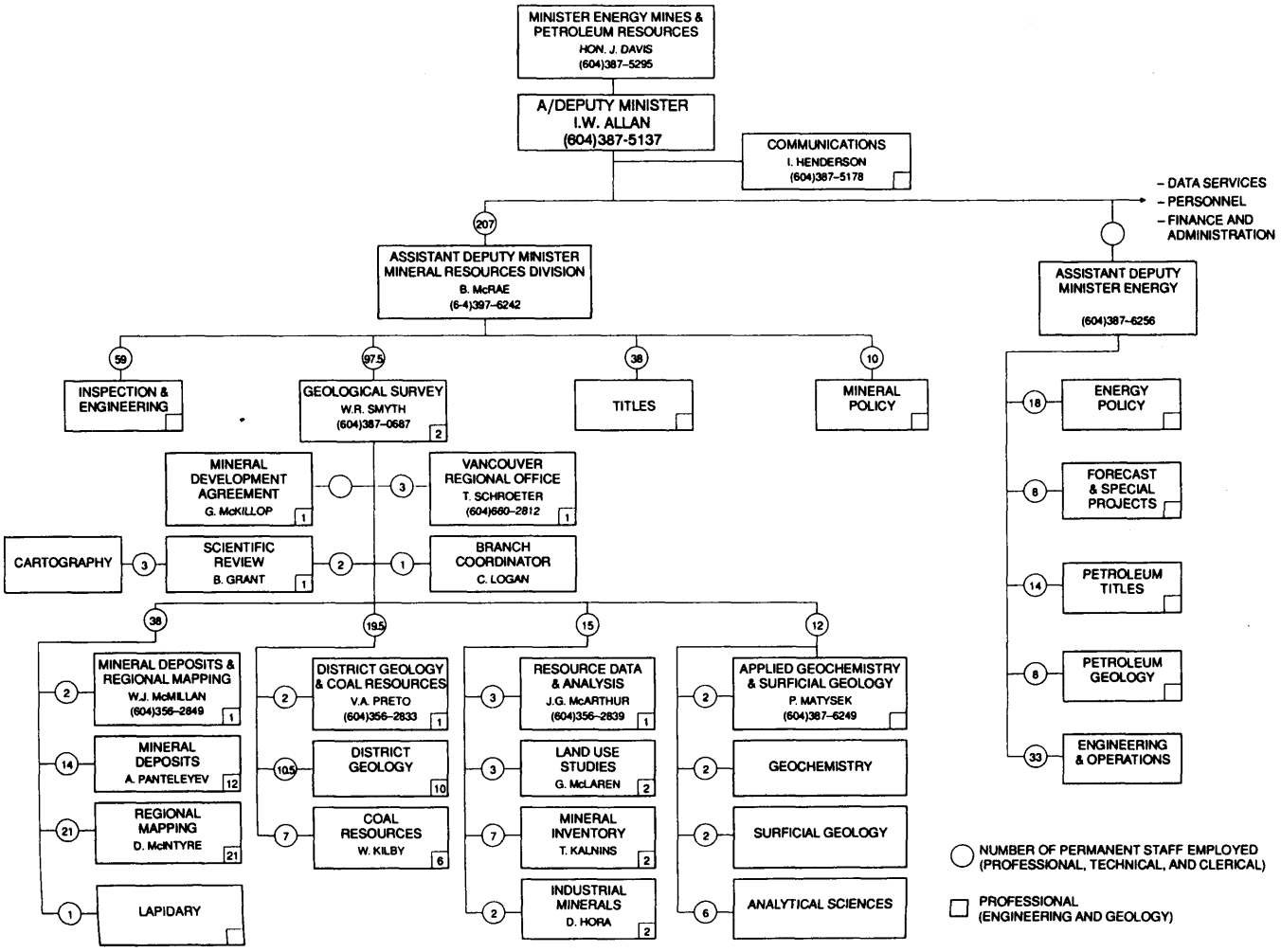
The present groupings of the Branch have evolved fairly rapidly with the expansion of the Branch's functions over the last few years. Not all groupings are logical and may be more the result of dividing responsibility and personnel equally among managers than grouping by functional relationships. In particular, the units which deal with the major mineral resources in the Province (*i.e.* mineral deposits, coal, and industrial minerals) each report to a different manager. Similarly, those units dealing with the dissemination or gathering of information from industry and the public report within different groupings.

In addition to the four managers with their diverse responsibilities, four other elements report directly to the Chief Geologist (Branch Coordinator/Financial Officer; Mineral Development Agreement Manager; Scientific Review/Cartography; and the Vancouver Regional Office). These numerous components must place considerable demands on the Chief Geologist's time and exceed the number of reporting elements normally recommended in conventional management structures.

THE ASSESSMENT PROCESS

A broad range of background material was provided to the Committee to facilitate the process of review. The Committee also considered the geological expertise in other ministries of the provincial government, namely groundwater activities of the Groundwater Section, Water Management Branch, Ministry of Environment, flood damage reduction, and some coastal erosion activities of the Special Projects Section of the same ministry. A Terrain Hazard Mapping function exists in the Department of Environment, but appears to be inactive. The Provincial Emergency Program has an established practice of commissioning consultant's reports to assess risks related to such geological hazards as landslides and attendant flood waves. Other geological positions with the Wildlife Branch (Parks) and the Ministry of Transportation and Highways, fulfill habitat-analysis and site-specific

TABLE 15
BRITISH COLUMBIA GEOSCIENCE ORGANIZATION CHART



engineering functions, respectively, which seem unrelated to the mandate of the GSB.

The Committee also considered the organizational structures adopted by other provincial surveys (latest volume (#7), Provincial Geologists Journal). The various components of the nine principal provincial surveys are summarized in Table 16, together with related functions in other branches of their ministry and/or in other ministries.

TABLE 16
OPERATIONAL CAPABILITIES OF THE PROVINCIAL GEOLOGICAL SURVEYS/GOVERNMENTS

Prov	#units rep.CG	#sub units	Wtr Res Hydgy.	Ld-use	Surficial Geology	Coal	Petr	Env	D/O	I.M.
BC	4	15	OM	R	I(as)	I	R	N	I	I
AB	4	-	OM	R	R	I/R	I/R	R	N	I
SK	4	-	OM	OM	OM	OM	I	OM	I	OM
MN	2x0 3xS	6	OM	R	I/s R/a	-	R	OM	I	I
ON	3x0 2xS	6x0 6xS	OM	R	I/s I/a	N	R	R	R	I
PQ	4x0 3xS	?	OM	R	I	R	R	R	I	I
NB	3x0 1xS	-	OM	R	I	R	R	N	I	R
NS	3x0	5x0 3xS	OM	R	I/s	R	R	N	I	R
NF	2x0 1xS	5x0 4xS	OM	N	I	R	R	N	I	I
PEI	1	-	OM	?	I	N	R	R	N	I

Abbreviations: **O** - operational, **S** - support, **OM** - other ministry, **I** - in branch, **R** - affiliated branch, **N** - no known function, **s** - surficial unit, **a** - aggregate unit, **D/O** - District Office, **I.M.** - Industrial Minerals, **Petr** - Petroleum, **Ld-use** - land use, **Env** - environment.

B.C., Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Newfoundland and Nova Scotia have geochemical components. Manitoba, Ontario, Quebec, New Brunswick and Newfoundland have geophysical components.

Briefs from Branch Personnel

The oral and written submissions made by GSB staff and management were compared to those of client groups gained through meetings and the questionnaire. Several detailed, alternative configurations for GSB organization, with rationales, were presented by individuals in the Survey.

Briefs forwarded to the Committee indicated that the recent growth had strained the resources of the Branch to the point where both morale and communication between different working groups had deteriorated. A trend towards creation of separate "units," each with its own manager, had further endangered the open, cooperative working relationships that were fostered by the previous informal liaison structures. Increased workloads were becoming increasingly burdensome, especially for managers and secretarial staff, both of whom expressed discontent regarding classification levels and the acute shortage of support staff (compared to professionals).

The current office accommodation is inadequate and not conducive to a positive working environment. The scattered distribution of the GSB in five separate locations in downtown Victoria is highly unsatisfactory, leading, as it does, to poor communication, alienation, and poor morale. Separation of the professional staff from the library, rock storage facilities, and analytical laboratory creates inconveniences.

Questionnaire Responses

Recommendations from the private sector regarding organizational effectiveness, not surprisingly, tended to be of a general nature. The overwhelming complaint was that the GSB was removed from the main centre of private-sector activity, and only a few of the respondents were willing to accept the compromise of strengthening representation through the Vancouver Office. Several respondents appreciated the broader sphere of influence that the GSB could have, and identified structural readjustments that might accommodate and address the rapid growth of environmental and land-use issues. As with most complex organizations, it appears that most outsiders (industry) have difficulty in understanding the respective roles and functions of the various subdivisions of the Branch. Critical comments, therefore, tended to focus more on outputs (or lack thereof), management styles (too much internal competition), and traditional stigmas associated with the public service (too many chiefs, overly bureaucratic, self-serving, *etc.*), rather than on the more complex assessment of organizational effectiveness. Of particular note, however, was the recurring theme that relationships and cooperation with the GSC in Vancouver must be strengthened, both in program planning and implementation.

Another principal complaint focused on the abysmal publication distribution and availability system that had resulted from privatization. Although a positive move to rectify this situation has been made through the December 1, 1989, consolidation of publication distribution through Crown Publications Inc. of Victoria, it is too early to say whether this solution will adequately address the needs of the industrial clientele. It is noted that only two distribution points are identified under the new system, and this still does not meet the District Geologists' need to provide one-stop servicing at each of the district offices.

Consultant studies

Over the last year, the Ministry commissioned the following consultant studies to examine various components of its operations, which were made available to the Committee.

- Review of Marketing Activity and a Proposed Marketing Plan for the Geological Survey Branch (Gleneagles Group, March 28, 1989).
- Strategic Plan, Industrial Minerals Subsection (Hal McVey, October 1989).

These were supplemented by earlier reports covering the activities of the Analytical Laboratory (March 1985) and the Coal Resources Unit (January 1987).

The following recommendations, stemming from the two most recent reports, are particularly relevant to considerations regarding the effective future reorganization of the GSB.

The Gleneagles Group recommended that the Mineral Resource Division explore ways to strengthen its efforts to promote the mineral potential of B.C. and present the Province as a good location for the exploration and mining industry "to do business." They recommended that the GSB expand availability of geological maps; have more intensive participation at important trade shows, scientific meetings and industry conferences; have improved information access in B.C., with increased communication with industry audiences outside of B.C.; develop potential cooperative promotional activity with the Ministry of Regional Development, the Ministry of International Business and Immigration, and the B.C. and Yukon Chamber of Mines; and have more communication with non-technical audiences such as the corporate/investment community, politicians, and the public.

The consultants also indicated that the GSB should monitor computerization closely, with particular attention to geological data banks and digital mapping.

It was recognized that personal interaction between Branch geologists and the exploration industry was an essential dimension of information exchange, and to facilitate this, improved access should be provided to

geologists outside of Victoria wherever possible.

The Committee concurs with all of these recommendations and urges the GSB to take immediate action to ensure their implementation.

The concluding statements of the Industrial Minerals Study indicate that most of these recommendations had been implemented already. Although the Subsection was noted as having a positive momentum, the consultants did note a dependence on MDA-related funding to sustain activities at a reasonable level.

THE ROAD AHEAD (ANTICIPATED NEEDS)

The following attempts to define the issues/needs that the GSB will have to address during the next decade, both in fulfilling its mandate as a Branch of the Ministry, and in remaining a productive and viable organization.

Provincial Needs/Priorities

Three priorities recently identified by the provincial government are environment, economy, and education.

Even with a change in administration, it is unlikely that the Province will drastically redirect its attention away from these three issues.

The GSB already plays a major role in fostering economic development through its support of the mineral sector. It has fulfilled a lesser role in education and an even more minor role in social and environmental matters, although recent organizational changes will enable it to address future land-use issues more effectively.

Ministry Perspectives

In its position paper (July 12, 1989) entitled "The Mineral Sector of British Columbia, A Longer Term View," the B.C. Ministry of Energy, Mines and Petroleum Resources identified a number of factors/issues likely to arise during the next ten-year period that will impact on the role the GSB will have to play.

The assessment of the mineral sector identified concerns regarding dwindling base metal reserves, a drop in the number of major companies active in the Province, a tendency to rely on juniors for grass roots exploration, and a general conclusion that the mineral industry would not see substantial growth during the next decade.

In the coal sector, no new developments were anticipated, with the exception of smaller thermal operations on Vancouver Island and in Smithers, a possible increase in sales of western coals to eastern markets, and some penetration of domestic energy markets.

Increased industrial mineral sales for import-replacement and export were deemed possible, as was the possibility of increased recovery of by-product minerals or "waste coal."

New potential for resource development in offshore areas and the Dominion Coal Block was predicted as an outcome of initiatives to resolve jurisdictional disputes with the federal government. Parallel negotiations with Native Indian bands were also anticipated to remove barriers to resource development on reserves and inhibitions to exploration in areas currently covered by Native Land Claims.

New regulations were predicted to increase "placer" activity, and a clear policy declaring "no alienation without evaluation," under the Mineral Tenure Act, was likely to impose on the GSB an upsurge in demand for mineral assessment mapping.

Branch Perspectives

Comments received from Branch Managers anticipated:

1. the need for the GSB to provide expert witnesses at public hearings reviewing proposals for new mine developments;
2. a need for increased sand, aggregates and industrial minerals to fuel an explosion in housing and construction in the Lower Mainland and Greater Victoria;
3. an increased demand for GSB support to junior mining companies engaged in grass-roots exploration;
4. increasing demands for involvement with land-use and environmental issues, including mineral resource assessments;
5. the need to embark upon GIS applications with appropriate allocation of resources;
6. improvements in communications with all potential clients, including a major effort to enhance the image of the mineral sector;
7. a much closer involvement with the GSC in planning and conducting cooperative/coordinated/integrated field programs and related research; and
8. an addition of FTEs and resources to mount exploration geophysical surveys.

Section/Unit Perspectives

Each of the sections/units interviewed by the Committee presented briefs outlining their perceptions of how the future might impact upon the work they were doing, together with organizational changes that might improve their service. In most respects, these submissions reflected similar views to those reported above from managers and senior personnel. Some points bear repeating because of the seriousness of the concerns expressed, and in some cases unique perspectives were offered.

Regional Mapping Unit

The principal concerns were increased workloads, strained communications, and the proliferation of subunits that might undermine effective cooperation between scientists. Of particular concern was the creation of a separate Geochemistry Section, which was considered to diminish the level of cooperation with mapping and mineral deposit geologists that had existed previously. The feeling was that units involved in geoscience field studies should be part of the same section and under the direction of a single manager or management team. This would facilitate greater integration of projects and would ensure that the overall goals of the Branch were met.

A specific appeal was made for greater integration between mappers, mineral deposit geologists, surficial geologists, and geochemists. Joint projects involving a multidisciplinary approach were favoured, as was consolidation of the Mapping and Mineral Deposit Programs. There was also general agreement that the amount of autonomy given to project leaders for the design and implementation of their projects represented a positive approach, encouraging teamwork and a high level of individual motivation.

In the matter of communications, it was thought that there should be more staff meetings where individuals could express opinions on important issues, especially where these might impact on the future of the GSB.

Mineral Deposits Unit

This unit, more than any other, appears to have difficulty accepting the diversification that has overtaken the GSB in recent years. Presentations made to the Committee reflected a deeply felt concern that the importance of Mineral Deposits work was being overshadowed by the emphasis given to some of the new initiatives. Nevertheless, the group felt that administrative amalgamation with the Regional Mapping Unit "would be

acceptable, providing that in cooperative ventures, mineral deposits interests were given priority and not subordinated to regional mapping priorities."

As with other operational components, it was felt that there was an acute shortage of clerical, administrative, drafting, and computer-support staff, a deficiency that was particularly aggravating near the end of each major project, especially when knowledgeable Senior Assistants left.

Concern was expressed about the current practice of having mineral deposit studies conducted by graduate students using applied geoscience research grants. It was felt that a preferred approach was to have such studies conducted by Branch staff. This would ensure an ongoing build-up of hands-on mineral deposit expertise, as opposed to arms-length data gathering by individuals whose first-hand insights did not become part of the Branch's assets.

Other problems included cramped offices, inadequate rock storage facilities, the need to upgrade the library, and difficulties encountered in getting timely approvals for out-of-province travel.

Industrial Minerals Unit

The current affiliation with the Resource Data and Analysis Section was thought to be highly inappropriate, and the principal recommendation by the Unit was for a transfer to the Mineral Deposits and Regional Mapping Section. The group was particularly concerned about the impermanence of its situation, lack of continuity in staffing, and a repeated need to shift offices.

The Unit noted that it was on the threshold of completing compilation studies and would soon be in a position to embark upon major field programs that would require an appropriate increase in technical support staff, primarily draftsmen and data entry and analysis personnel. The new initiatives could possibly encompass both sand and gravel, as well as peat. It was felt that renewal of the MDA was extremely important, if not essential, to the strategic plan for the Industrial Minerals Unit.

Coal Resources Unit

The Coal Resources Unit was formed in 1986, when individuals in three separate sections were finally brought together into a single, cohesive unit. The group has since been relocated twice and looks forward to the day when it can join the rest of the Branch in a single, appropriately designed facility.

The principal problems raised by the Coal Resources Unit related to inadequate facilities, both for working and for public viewing of CoalFile data; inequalities arising from differing classification schemes and professional affiliations; isolation from the coal industry and GSC in Calgary; and a lack of coal analysis facilities.

The Unit emphasized the links that it had with the petroleum industry, including a shared database and interest in structural and basin analysis. It was generally felt that there was enough geological work to do without getting into extensive coal R & D.

District Geology Unit

The GSB operates five District Offices, together with a Regional Office in Vancouver. All District Offices, except Victoria, share facilities with the respective Inspection and Engineering Branches. All have small libraries, assessment reports, MINFILE listings, property files, ore deposit suites, claim records, poster displays, and notice boards. The five District Offices have a total of 5.5 support staff, which includes three full-time Geologists, a half-time Secretary, and three part-time Assistants. The Vancouver Office contains a Senior Regional Geologist, a Secretary, and a Research Officer (Assistant Geologist).

Concerns voiced included: a lack of direction with clear priorization of tasks; inadequate staffing; a need for continuity of support; the need for standard (consistent) operating systems for all the District Offices; and a more appropriate location for the Southwest (Victoria) office, possibly in Nanaimo. It was also felt that there should be more frequent visits by Head Office personnel to the regions, more opportunities for dialogue with Victoria-based colleagues in related functions, and more conference calls.

It was felt that the role of the District Offices had changed noticeably in response to the many and growing needs of Ministry clients and that, in the future, the District Geologists would have to be more proactive, undertaking mineral deposit and related metallogenic studies. It was also realized that the District Geologists represented the front-line troops of the GSB and would, of necessity, have to play an increasing role in interpreting the more complex aspects of geological work to the clients, as well as representing the mineral sector in sundry land-use forums.

Almost without exception, it was recognized that the Vancouver Regional Office will play an increasingly key role in interfacing between the Ministry and its clients. Co-location with the GSC was deemed desirable by the majority of industry respondents, and current workloads seem to support the need for additional staff and facilities (including new microfiche readers), so that this office can function effectively in the heart of the business community.

Applied Geochemistry and Surficial Geology Unit

This relatively new Section contains three subunits with quite distinct mandates, one of which is the Analytical Sciences Laboratory, which comprised the Section on its own until 1989. The Geochemistry Unit envisages a reduction in output once the current MDA finishes. Withdrawal of the GSC from regional geochemical surveys has left something of a vacuum in B.C., where the program is only 50-60% completed.

The Surficial Geology Unit was established in 1989 and its mandate is still under development. The broad range of potential involvements as adjuncts to geochemical surveys, land-use issues, geologic hazard studies, and surficial deposit inventories, is virtually unlimited, and the group felt it would have to strongly target its efforts to avoid overdilution of effort. Their recommendations included: establish an interdisciplinary committee or task force to deal with geological hazards; develop a provincial Geologic Hazards Policy; develop and execute a placer gold exploration program in drift-covered areas of B.C.; design and test new methods for discovering industrial minerals in glaciated terrains; develop a long-term sand and gravel database for public consumption; and initiate a long-term ongoing surficial geology mapping program at a scale of 1:50 000.

The principal concern of the Analytical Sciences Laboratory relates to possible contracting out. Much of its equipment is old, the current facilities are run down, if not hazardous, and the current operation is labour-intensive and not computerized. The Laboratory services all of the Branch's needs, with the exception of geochemical analyses for the RGS program, rare earths, and selected coal analyses. Personnel felt isolated from the main organization and looked forward to improved communications in the future.

Scientific Review Unit

This Unit has recently embarked upon desk-top publishing to augment manuscript transformation into publishable reports. It has three computers, but only one printer. Recent acquisition of three Autocad units has speeded up production of maps and illustrations. However, the Unit is grossly understaffed in comparison to the number of manuscript originators, and this continues to impact upon the ability of the group to process manuscripts quickly. In some cases this has meant cutbacks in the quality of presentation (*e.g.* no coloured geological maps have been produced since 1983).

Privatization of government publications has severely limited the Branch's ability to communicate with its

clientele, and recent efforts to address this deficiency by opening a distribution office in Vancouver have only alleviated the problem superficially. Publications are the principal product of every geological survey, and the effectiveness of the organization will continue to be critically undermined so long as publications are not available for purchase at all GSB offices.

Resource Data and Analysis Unit

This Section contains both the Assessment Reports Subunit and MINFILE. The former provided statistics indicating a dramatic rise in the number of reports being reviewed, approved, and examined; and predicted potential overloads in the foreseeable future. Several options for changing current practices regarding the regulations pertaining to exploration data were presented. In future, government regulations may require assessment reports to contain floppy disks of analytical data and geophysical survey information. GSB should consider how to build this information into their database. The absence of a promotion matrix was considered detrimental, eroding both incentive and motivation.

The compilation, input, and editing of mineral information into MINFILE is lengthy and costly (VAX mainframe costs alone are $100 000/year). Nevertheless, the system is widely acknowledged as being of value to the mineral industry (170 users, with 520 clients on the mailing list) and a world leader in this category of information systems. Some industry responses indicated a need to upgrade the integrity and currency of information in the database, as well as the qualifications of some input staff, but these appeared to be in the minority, with a high degree of satisfaction being more customary.

Some overlap was evident between the inventory-related activities of the two units, but this may simply reflect the relatively recent and developmental nature of the computerized MINFILE approach, as opposed to the more traditional, longer established hard-copy filing systems.

Prospector Assistance

Prospector Assistance programs in B.C. date back to 1943. Although they have changed in format, the essential objective has always been to encourage individuals to search for deposits of potential economic interest. Recent evaluations of incentive programs in the Province concluded that the FAME Program was successful and that it should be continued. Funding levels are modest ($500 000 annually, with the ceiling on individual grants increased recently from $7500 to $10 000). However, the Program Manager and a few industry responses indicated a need to change some of the criteria used in making awards to individual prospectors. The policy of requiring grantees to complete their programs as proposed, regardless of the grant received, has proved difficult to implement, both for prospectors and for the administration.

To a large extent, the Program appears to operate independently of the other sections in the Branch, although some cooperation is provided by professionals in the operational units.

The program is based in Victoria and is delivered by one Geologist and a Secretary, both on contract, the latter devoting two-thirds time to the Prospectors Assistance Program, and one-third to District Geology.

Land-use Unit

The recent transfer of the Land-use Unit to the Mineral Policy Branch technically removes the need to consider this unit's position and role in the organization of the GSB. However, the critical function that the Unit will play on behalf of the Division in handling land-use issues is bound to impact upon the demands made on the GSB, and it is important, therefore, that perspectives tabled by the Unit be included in the current review.

Much of the group's work comes from externally driven needs and is therefore difficult, if not impossible, to

build into longer term program planning. The unit felt that most of the time it was "fighting fires," tended to be "outgunned" in boardroom conferences, suffered under a stigma-by-association with the mineral industry, and had a long way to go in establishing a reputation with other government agencies for impartiality. Furthermore, it was felt that much of the documentation used to back mineral development arguments was inadequate, mainly because it was untried or developed in isolation from the cases put forward by conservationists and other land-use protagonists.

On the positive side, the establishment of a "No alienation without evaluation" policy under the Mineral Tenure Act was deemed to be a most progressive development, as was the transfer of the Unit to Mineral Policy, close to the seat of decision-making. Nevertheless, close coordination will have to be maintained between the boardroom representation and policy-making sector and the program delivery components of the GSB. The Land-use Unit has neither the time nor the resources to undertake comprehensive minerals assessments in areas slated for alternative uses, and some consideration will have to be given for routinely including these programs within the workplans and schedule of the GSB (which, after all, possesses the appropriately qualified professionals).

STRUCTURES IN OTHER PROVINCIAL GEOLOGICAL SURVEY ORGANIZATIONS

Table 17 summarizes the various categories of expenditure in each of the provincial survey organizations. Although all provinces maintain geological survey organizations, these vary considerably in size and range of activity. The scope and scale of each survey's operations is determined both by the population/tax base that the government can draw upon, and the peculiarities of the terrain and resource potential within the provincial boundaries. Some geological surveys possess large, hardrock, Precambrian contingents, others show a bias toward Phanerozoic subsurface investigations; some maintain a balance of the two, others are large enough to include major components of geochemical and geophysical specialization as well.

Relationships with industry are restricted almost entirely to providing support, advice, and information to the exploration sector. However, there is a growing awareness among some technologists that significant contributions can also be made by geologists/applied mineralogists in mineral processing and mill beneficiation.

Typically, petroleum and water resources are excluded from the sphere of concerns addressed by geological surveys and affiliated instead with the departments responsible for energy and environment, respectively. Some provinces maintain a separate Water Resources Branch within a Department of Environment or Natural Resources. Suitable linkages are maintained between the departments, either on a one-on-one basis between professionals or through standing or task-oriented technical advisory committees.

Several provinces support research councils or institutes whose activities augment those of the surveys. Many provinces maintain regional or resident geologist offices, which may be an integral component of the survey itself (B.C., Saskatchewan, Manitoba, Quebec, New Brunswick, and Nova Scotia) or part of a separate regional organization.

The limited mandate of the provincial geological surveys contrasts with the more all-enveloping sphere of responsibilities of their counterparts (state surveys) in the U.S. and, indeed, in many other parts of the world. This point was commented upon in the 1982 CGC Review but, for reasons unknown, no follow-up action seems to have been taken.

Table 16 indicates that, despite the regional variations in technical specialization and size, most geological surveys restrict the number of managers reporting to the Chief Geologist (or Director) to seven or less, three or four being the norm. Each manager is responsible for a one or two-tiered organization, the ratio of operational/support units ranging from 4/1, to 1.5/1. The larger surveys contain numerous subunits, generally with balanced representation by operational and support specialists. Most surveys are self-contained, with drafting and analytical units backing up the professional staff. In some larger organizations these functions have been periodically

TABLE 17
PROVINCIAL GEOSCIENCES EXPENDITURES, 1988-89

PROVINCE/ TERRITORY	SURVEY EXPENDITURES $ X 10^6	% OF TOTAL	TOTAL 1988 VALUE OF PROVINCIAL MINERAL PRODUCTION[1] $ X 10^3	SURVEY EXPENDITURES AS % OF TOTAL VALUE OF PROVINCIAL MINERAL PRODUCTION	AREA OF PROVINCE/ TERRITORY KM^2 X 10^3	SURVEY $ SPENT/KM^2	POPULATION (1986) X 10^3	SURVEY $ SPENT/ CAPITA
NEWFOUNDLAND	4.7	5.6	888 476	.53	405	11.6	568	8.3
NOVA SCOTIA	5.8	7.0	253 243	2.29	55	105.5	873	6.6
PRINCE EDWARD ISLAND	-	-	2 825	-	6	-	127	-
NEW BRUNSWICK	2.8	3.4	797 158	.35	73	38.4	709	4.0
QUEBEC	20.7	24.8	2 718 152	.76	1 541	13.4	6 532	3.2
ONTARIO	21.3	25.7	7 069 265	.30	1 069	19.9	9 102	2.3
MANITOBA	3.3	4.0	1 597 389	.21	650	5.1	1 063	3.1
SASKATCHEWAN	3.7	4.5	1 624 043	.23	652	5.7	1 010	3.7
ALBERTA	9.6	11.6	750 966	1.28	661	14.5	2 366	4.1
BRITISH COLUMBIA [2]	8.8	10.6	2 306 477	.38	948	9.3	2 883	3.0
YUKON	1.0	1.2	466 530	.21	483	2.1	24	41.7
NORTHWEST TERRITORIES	1.3	1.6	768 157	.17	3 380	0.4	52	25.0
TOTALS	**83.0**	**100.0**	**19 242 681**	-	**9 923**	-	**25 309**	-

[1]Source : Canadian Mining Journal, March 1989

[2] Note: British Columbia expenditures of 8.8 million includes $414 000 by Petroleum Geology Branch and $500 000 by the Prospecting Assistance Program.

centralized (even to other departments), but usually with extremely negative results and cutbacks to production levels. Some organizations maintain a well staffed rock preparation and warehousing capability, with dual-function technicians also mounting a seasonal scout-drilling program.

In addition to their management functions, Section Heads are expected to sit on various interdepartmental, intergovernmental, interagency, and government/industry liaison committees. This interagency synergism reached an all time high in many provinces during the recent spate of MDA's and was reflected in a significant increase in the level and quality of geoscientific outputs.

The comparison with other provincial surveys shows, therefore, that the GSB possesses, in most respects, the same basic structures that have proven to be effective in other organizations with similar mandates. The principal imbalances appear to arise from an over-proliferation and inappropriate grouping of subunits, as well as from an attendant breakdown in the functionality of reporting relationships. These inadequacies are addressed in the following section, which presents an alternative structure for the GSB, proposed by the Committee.

RECOMMENDATIONS FOR THE FUTURE ORGANIZATION OF THE GSB

To be effective, an organization must possess a mutually supportive, hierarchical network of skills and capabilities that will permit it to attain its goals and address the issues/needs that fall within its mandate. The grouping of functions should maximize the use of resources, vertically and horizontally within the structure, and communication linkages must be maintained between all related functions, whether these be internal (within the ministry), or external (other government agencies, universities, and clients in the private sector).

From the foregoing, it is readily apparent that the current organization of the GSB is not well suited to undertake the tasks envisioned over the next decade.

It is the Committee's view that some reorganization of the reporting and grouping of functions is both appropriate and timely. The primary objectives of such a reorganization should be:

1. to reduce demands on the Chief Geologist, allowing more time for him to focus on policy and general management.
2. to achieve better communication and integration among and between branch functions, with corresponding benefits in efficiency, cost-effective use of resources, and enhanced program delivery.

The first step taken by the Committee in proposing an effective new structure for the GSB was to address those activities that lay beyond the mandate deemed appropriate for the Survey during the next 10 years.

[C/R29] The Committee recommends that the GSB not embark upon a major program of exploration geophysics, because this lies principally within the domain of the private sector and the provincial government would be unlikely to bear the attendant high costs in the lean years ahead. However, the Committee does recommend the recruitment of a geophysicist, as discussed in Chapter V.

[C/R30] The Committee recommends that the Ministry encourage completion of appropriate and modern airborne magnetic surveys (drape flying) in the Province by the federal government.

[C/R31] In the matter of offshore programming, the Committee recognizes a long-standing involvement in such activities by the GSC and again feels that the high costs of mounting such programs would be beyond the levels favoured by the provincial government. The Committee, nevertheless, recognizes the importance of maintaining a provincial presence and participation in areas that do, or might eventually, fall under provincial jurisdiction, especially in the nearshore, and recommends that the GSB join with the GSC in planning joint projects that would service future provincial needs.

Secondly, the Committee looked at those operations that could be conducted in cooperation with geologists in other agencies.

The Committee recommended earlier (C/R1, 26) that the GSB continue to explore new mechanisms for enhancing closer and more frequent liaison and joint planning with the GSC in Sidney, Vancouver, Calgary, and Ottawa. These initiatives should look well beyond the customary year-to-year workplans and briefing sessions and should aim to establish a clear definition of mandates for each of the organizations, as well as five and ten-year reviews of intended programming, geared to the needs of western Canada. Regular updates and revisions would be a routine component of the annual estimates process for both organizations.

[C/R32] GSB should continue the current practice of having its programs and program planning vetted through the Technical Liaison Committee. Not only does this process facilitate the timeliness and appropriateness of program delivery, but it also offsets to some degree the acute disadvantage of being isolated from the principal customer for most of the year. The Victoria location, close to the seat of government, may well prove to be advantageous in future years, given the ever-increasing need for interdepartmental exchanges regarding land-use management and environmental issues.

[C/R33] The Committee strongly recommends prompt consolidation of all components of the B.C. Ministry of Energy, Mines and Petroleum Resources into a single modern facility in Victoria. The possibility of relocating the Analytical Sciences Laboratory to an alternative site (because of zoning restrictions) should be considered as a less desirable, yet nonetheless feasible and entirely workableoption, providing it is given appropriate and modern facilities.

[C/R34] The recent transfer of the Land-use Unit to the Mineral Policy Branch is considered to be well directed and should permit this component of the Division to perform more effectively. In a like manner, the Committee also endorses the recent reactivation of the Division's Land-use Committee and expects recommendations from this group to place an increasing demand on the professional resources and insight resident in the GSB.

[C/R35] The Committee feels that there is no need for the GSB to expand its staff to include a Paleontological Specialist, since such skills are available in the GSC and universities and can be requested/contracted on an as-needed basis.

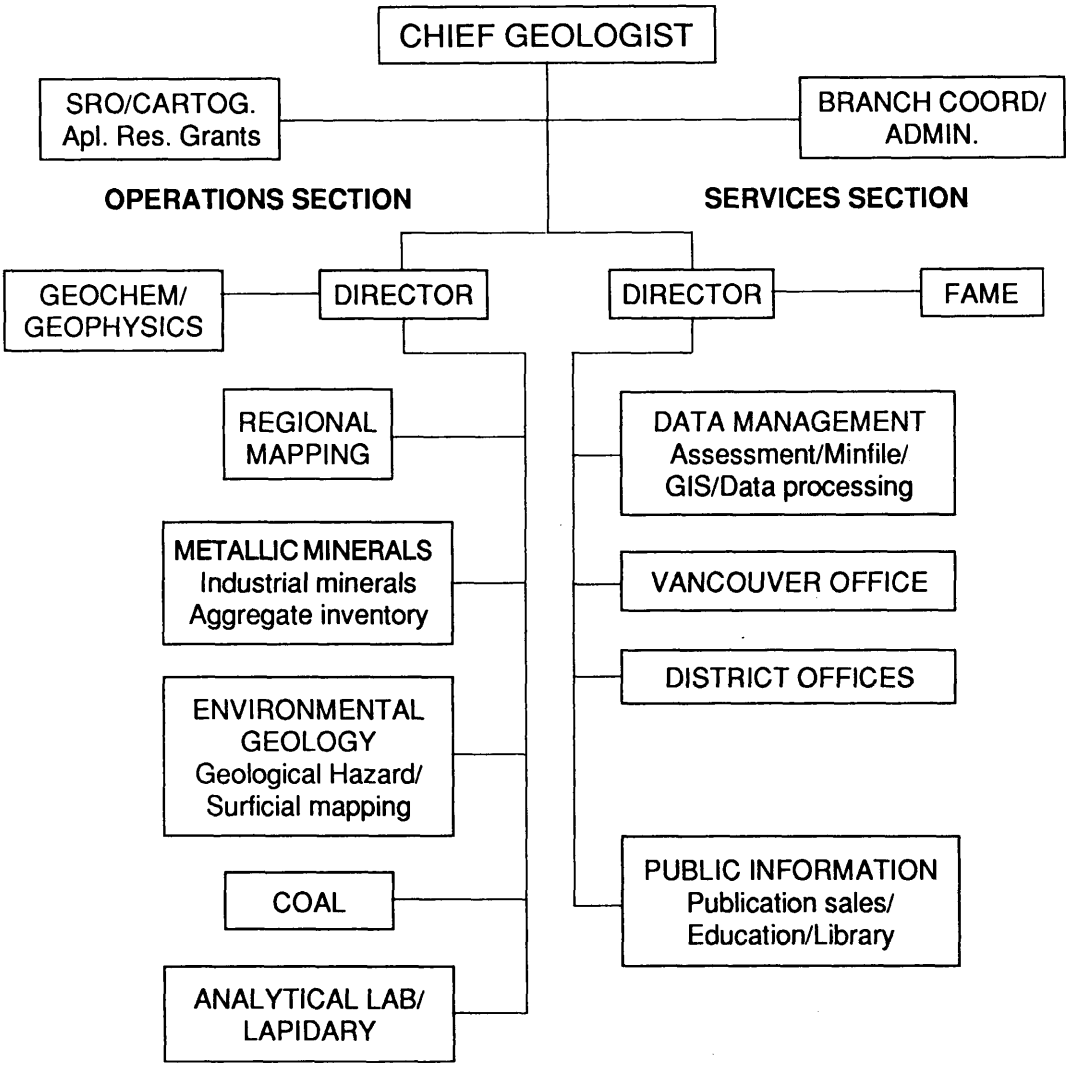
Thirdly, the Committee looked at the internal organization of the GSB.

The most marked deficiency in the current GSB is the extreme imbalance in staffing, heavy emphasis being given to professionals with a resultant overload on a disproportionately small technical support group. Although this was widely recognized as an acute problem, few, if any of the individuals interviewed, were prepared to substitute technical support personnel for professionals, even if provided with additional positions. Nevertheless, the Committee recognizes this as one of the most glaring deficiencies requiring attention.

[C/R36] The Committee recommends that management take immediate steps to redress the imbalance between professional and technical staff, particularly in the Scientific Review Unit, but not to the exclusion of additional secretarial support. It is recognized that considerable benefits accrue from having Senior Assistants assigned to projects on almost a one-on-one basis, but this is regarded as an ideal situation and should not be accepted as a substitute for technically proficient support personnel with skills and capabilities rarely possessed by graduate students specializing in geology.

The Committee regards the current organization of four sections, plus additional support elements (units), to be needlessly complex and, in large part, the cause of negative comment from, and poor relations and communications between, Branch personnel. **[C/R37] The Committee recommends an alternative organizational structure (Table 18) comprising two principal sections, one encompassing Operations, the other Services.**

TABLE 18
RECOMMENDED ORGANIZATIONAL STRUCTURE FOR THE GEOLOGICAL SURVEY BRANCH



Units responsible for Branch coordination/ administration and report and map production (SRO/Cartography) would also report directly to the Chief Geologist.

Both sections would report through Directors, whose main responsibility would be the coordination of programs mounted by their respective units. Although many of these units would be unchanged from those currently in existence, the Committee recognized a need to realign some reporting relationships, as well as incorporate several new components to address those issues anticipated to grow rapidly in importance over the next decade.

[C/R38] On the operational side, the Committee recommends the retention of the existing units responsible for Regional Mapping and Mineral Deposit work, the latter being expanded to include industrial mineral activities and aggregate investigations. Regional Mapping is retained as a discrete entity, in recognition of the important and demanding role that this group must fulfill in making up the deficit of map coverage.

[C/R39] The Committee recommends establishment of a new Environmental Geology Unit. In addition to mapping the Province's surficial deposits (including those in the nearshore regions), the unit would give principal emphasis to mounting an inventory and conducting site-specific evaluations of geological hazards in B.C. It is recommended that the Ministry of Energy, Mines and Petroleum Resources approach the Ministry of Environment once again with the request that geological personnel in that Ministry be transferred to the GSB in order to consolidate provincial initiatives and expertise in this area of critical concern.

[C/R40] In the matter of geological hazards, the Committee is concerned about the distribution and ad hoc manner in which studies have been conducted to date, and recommends that the Province develop a formal policy regarding the documentation, regulation, and future disposition of all affected areas. It is recommended that a multidisciplinary committee or task force be struck forthwith and given a mandate to develop a long-term program to identify and upgrade the documentation of all hazard-prone areas, and to develop guidelines restricting future development and outlining mitigative measures to be applied under the Province's Emergency Program. The GSC would continue, and possibly expand, its current longer term studies on mass movements, earthquake prediction, and volcanic eruptions. GSB contributions would be coordinated through the proposed Environmental Geology Unit.

[C/R41] The Coal Unit would comprise the fourth operational group; however, CoalFile would be moved to the Data Management Unit, along with MINFILE, assessment records and the new GIS and data-processing components.

[C/R42] Since most of the work conducted by the Analytical Laboratory and Lapidarist is done in support of the operational components of the Branch, these functions have been identified as a separate unit, reporting directly to a Director who would deploy their efforts as needed.

The Committee recognizes the significant gains that have been made in the past through geochemical surveys in the Province and fully supports continuation of such initiatives in the future. Furthermore, the Committee received strong support from industry for inclusion of some geophysical expertise in the GSB, to assist review of assessment work, support branch mapping programs, recommend new areas for regional airborne magnetic, gravity and electromagnetic surveys, collate and interpret existing geophysical data, and provide recommendations on techniques to be used in the ongoing documentation and exploration of the Province. Geophysics will also be a necessary component in new environmental geology work. As with geochemistry and paleontology, there is an opportunity to secure geophysical data through external contracts (mainly to industry), but it is essential that adequate financial resources be identified in the planning process and that managers ensure that GSB staff make full use of such data.

[C/R43] The Committee recommends establishment of a separate Geochemistry and Geophysics Unit to act in an advisory and support capacity to the Branch's two main sections. The Unit's mandate would encompass both exploration and environmentally related studies, and a major function would be to assist coordination and targetting of future geochemical and geophysical surveys mounted in the Province by the GSC.

[C/R44] The Services Section would contain four units, in addition to the FAME program. The existing Mineral Inventory Unit would include all aspects of resource data collection and management (assessment reports, MINFILE, microfiche, mineral inventory, CoalFile) and would be given an expanded responsibility for the longer term phasing-in of new data-processing techniques and Geographic Information Systems.

[C/R45] The Committee recognizes District Geologists as the organization's outreach program. Accordingly, several changes are recommended to strengthen and consolidate this sector of the Branch. In the proposed organization chart (Table 18), the importance of the Vancouver Office is recognized through designation as a discrete unit. The key role that the Vancouver Office plays in interfacing with the main body of industry clients was stressed repeatedly during the review process, and it is incumbent upon the Ministry to give further thought to ways of expanding and enhancing the current level of services provided through the Office.

[C/R46] The Committee recommends that the Southwest Office be moved from Victoria to Nanaimo to give this component a clearer identity and more immediate involvement with clients on the Island. The Committee also recommends re-establishment of the Fernie Office and addition of support personnel to both the Smithers and Kamloops offices. One of the major complaints made to the Committee was the apparent absence of guidelines establishing goals, standards, and operational procedures for the Regional Offices. It is, therefore, recommended that the District and Vancouver offices collaborate to develop a Manual of Procedures, to be submitted to the Chief Geologist for endorsement. Following recommendations from industry, each of the District Offices should also plan to establish nearby core facilities, following development of a coordinated plan to provide assessment credits for delivery by industry of representative cores, but these facilities should be utilitarian structures, functional but inexpensive. Furthermore, it is recommended that the District Geologists generate a yearly summary of activities in their respective regions, to be released in a single volume similar to that published in Ontario and Quebec.

[C/R47] It is also proposed that management and operational personnel based in Victoria increase the frequency of visits to the District Offices, both to maintain personal contact with individuals in the regions, and to coordinate proactive outputs of the District Geologists with those of the Regional Mapping and Minerals units.

[C/R48] On numerous occasions during the review, the acute shortfall in communicational "outreach" activities was brought to the Committee's attention. Accordingly, the Committee recommends that the Branch establish a Public Information Unit, whose responsibility would be to foster a greater awareness of the importance of the mineral sector and the Ministry's programs to society at large. Education programs for the public and the schools should be developed in cooperation with the ministries of Education and Tourism, and wider dissemination of publications should be encouraged as a supplement to the recent initiatives through Crown Publications. Finally, the importance of having a well stocked and adequately staffed technical library should be addressed, by having this function incorporated as a key component of the Public Information Unit.

[C/R49] The Committee recognizes an acute deficiency in personnel support services and recommends that the Ministry's senior management take immediate steps to see that proper counselling and direction is provided on an ongoing basis for the development of such staple managerial tools as job descriptions, regular performance evaluations, career pathing, and on-the-job training. Serious concerns were raised by several groups regarding perceived inequalities and inappropriate use of classifications for support staff within the organization, and the Committee also requests that these be investigated. Finally, difficulties were reported from some staff who appear to be caught up in jurisdictional disputes between the union and professional engineering organizations.

This should also be attended to, in the best interest of getting the job done with a minimum of unnecessary handicaps.

CHAPTER V: DISTRIBUTION OF RESOURCES

PRESENT DISTRIBUTION OF FISCAL AND HUMAN RESOURCES

This part of the review is based on data set out in Information Circular (IC) 1989-24, "Geological Survey Branch, 1989-90 Plan."

Fiscal Resources

The budgets and sources of funds for the various operational groups within the Branch are set out in Table 19, which has been copied from IC 1989-24.

TABLE 19
GEOLOGICAL SURVEY BRANCH BUDGETS, 1989-90 (IN $)

Operational Group	Base	MDA	FAME	Total
Chief Geologist	386 614			386 614
Scientific Review	404 000	69 000		473 000
Vancouver Geologist	135 700			135 700
Regional Mapping	1 170 335	418 000		1 588 335
Mineral Deposits	922 000	185 000		1 107 000
Geochemistry	510 000			510 000
Surficial Geology	100 000			100 000
RGS		185 000		185 000
District Geology	691 700	10 000		701 700
Coal Resources	484 100			484 100
Industrial Minerals	191 125	95 000		286 125
Land Use	191 788			191 788
Assess.Reports/RDA Mgmt	338 666			338 666
MINFILE	351 420			351 420
Lab	347 402			347 402
Overhead/Support		105 000		105 000
			500 000	500 000
$	**6 224 850**	**1 067 000**	**500 000**	**7 791 850**

Note: In Table 3 certain employee benefit costs were included in the 1989-90 A-Base budget to conform with presentations of earlier years.

For the 1989-90 fiscal year, the base budget of the Branch is some $6.225 million. The decrease of $400 000 from the previous year's budget is mainly due to the transfer of certain employee benefit costs to the budget of the Assistant Deputy Minister. In addition to the base budget amount, additional sums of $1.067 million from the Mineral Development Agreement (MDA), and $500 000 from the Prospector Assistance and Training Component of FAME are also available to the Branch.

Table 20 casts these data as percentages of the total Branch budgets. These percentages illustrate that the historical role of the Branch in supporting and studying the metals portion of the mineral industry continues.

TABLE 20
GEOLOGICAL SURVEY BRANCH BUDGETS, 1989-90
(% of total)

Operational Group	Base	MDA	FAME	TOTAL
Chief Geologist	6.2	-	-	5.0
Scientific Review	6.5	6.5	-	6.1
Vancouver Geologist	2.2	-	-	1.7
Regional Mapping	18.8	39.2	-	20.4
Mineral Deposits	14.8	17.3	-	14.2
Geochemistry	8.2	-	-	6.5
Surficial Geology	1.6	-	-	1.3
RGS	-	17.3	-	2.4
District Geology	11.2	0.9	-	9.0
Coal Resources	7.8	-	-	6.2
Industrial Minerals	3.1	8.9	-	3.7
Land Use	3.1	-	-	2.5
Assess Reports/RDA Mgmt.	5.4	-	-	4.3
MinFile	5.6	-	-	4.5
Laboratory	5.6	-	-	4.5
Overhead/Support	-	9.8	-	1.3
FAME	-	-	100.0	6.4
TOTALS (may not add to 100% due to rounding)	100.1	99.9	100.0	100.0

Human Resources

The 1989-90 authorization for staffing within the Branch is 97.5 Full-Time Equivalents (FTEs). This is an increase of 46 FTEs over the prior fiscal year. This increase was introduced to allow regular employment of staff who were on contract from prior years. The increase represents 24 full-time positions plus additional, shorter-term senior and junior Assistants. The MDA provides the equivalent of 17 FTEs over and above the base budget staffing.

As set out in IC 1989-24, the available FTEs are distributed as follows:

A-Base Budget:	Mineral Deposits	16.0
	Regional Mapping	18.0
	Mineral Inventory	8.0
	Land Use	3.0
	Industrial Minerals	2.0
	District Geology	7.5
	Coal	6.0
	Surficial Geology	2.5
	Applied Geochemistry	4.5
	Laboratory	7.0
	Vancouver Office	3.0
	S.R.O.	5.0

Other available FTEs within this portion of the budget are used to supply contract Geologists and contract/auxiliary support personnel in Mineral Inventory, plus Field Assistants in Land-use. Summer Assistants in Regional Mapping are included in the assigned FTEs.

MINERAL DEVELOPMENT AGREEMENT:

Mineral Deposits:	Contract geologists	2.0
	Summer assistants	2.0
Regional Mapping:	Contract years (includes summer assistants)	4.5

PROSPECTORS ASSISTANCE AND TRAINING:

These funds support two contract personnel (1.7 FTEs).

PRESENT DEFICIENCIES AND PROBLEMS

The base budget of the Branch has more than doubled since 1986 (Table 3). This increase in funding was partly in response to implementation of many of the recommendations made in the earlier study by CGC and by the Mining Industry Task Force. The staffing level remained more or less constant until the current 1989-90 year, when it increased from slightly over 50 FTEs to its present level of 97.5.

The foregoing would indicate that many of the previous deficiencies have been remedied. Indeed, the government is to be commended for the increases in Branch funding when faced with the need to constrain expenditures. However, deficiencies and problems remain.

Funding

Of immediate concern is the expiry of the current MDA at the end of the 1989-90 fiscal year and the likelihood that such funds will not be available to the Branch in the 1990-91 fiscal year. Since the bulk of these funds have been used to support the Regional Mapping and Mineral Deposits fieldwork, curtailment of the support portion of these programs is likely. Even with this support, and with prioritization of the map-areas, completion of the Regional Mapping program will take many years. Funding cuts will simply extend the completion time even further, and will impede proper planning and implementation of this important program. Long-term commitment of adequate funds for this program is necessary.

A necessity in maintaining contact with other members of the geological community, in dissemination of geological informatin to clients, and in publicizing the work of the Branch, is the ability to travel beyond the confines of the Province to conferences and meetings. Such trips are not a perquisite, but are essential to the full use and development of the skills of the Branch staff. Funds are made available within the budget for such travel, and such funding should be continued, or perhaps expanded to some extent.

Lack of capital funds over the past several years has prevented both the enhancement of equipment in the Branch laboratory and the replacement of obsolete items. These deficiencies detract from the overall capacity of this unit to stay in the forefront of technology and analytical data utilization.

Staffing

A consistent theme in all of the Committee's discussions with the staff of the Branch was the lack of secretarial support. While this lack was pointed out again and again, these same sections have elected to use the increased FTEs for 1989-90 almost exclusively to hire additional professional staff. Whether these decisions were driven by the fact that many of the additional professionals had already been working on contract and that there was, therefore, a need to retain such expertise, was not entirely clear. Notwithstanding, the Committee is of the opinion that adequate support is minimal, or non-existent in some cases. Such deficiencies appear to lead to many instances of professional staff using their time in drafting or word-processing tasks that would be better performed by support personnel. This ratio of support staff should be adjusted as opportunities permit.

The Committee has particular concerns about the lack of support or auxiliary staff in the District Geologists' offices. Many of these staff share support with the Inspection and Engineering Branch personnel at the various locations. While such arrangements may have served adequately in the past, the increasing demands on the District Geologists, in terms of land-use and regional issues, plus their continuing work in serving the public and conducting their own studies, indicate that good support is essential.

While MINFILE and CoalFile provide excellent examples of the use of modern technology to compile and distribute information, staffing in these areas is barely able to handle the workloads, and updates remain in arrears on a continuing basis.

Current staffing does not allow the Branch to maintain a central geological library. In the opinion of the Committee, such a library is an absolutely essential element of any provincial geological survey.

FUTURE RESOURCE NEEDS TO MEET PROPOSED MANDATE

Status at the Start of the 1990s

As noted in various portions of this review document, particularly in Chapter II, the evolution of the GSB has been particularly dynamic throughout recent decades, responding effectively to ever-changing client needs.

For almost a century, the GSB's main role has been the support of economic development of the Province's mineral resources - a continuing requirement for sustained growth and vitally important on both a provincial and national scale. Only in the last decade have environmental and land-use issues been recognized as major priorities to the extent that they threaten to subordinate or totally negate allowable development of the Province's mineral and other resources. Optimum use of all our resources on a timely basis, within the constraints of wise and efficient land management controls, remains a continuing objective in order to ensure all British Columbians benefit - present and future. The GSB is already preparing to meet this emerging major change in its mandate, which intertwines environment, economy, and education.

The results of this review show that the GSB has been largely successful in recognizing and meeting the need for changes in organization and future resource requirements. Based on 1988-1989 survey expenditures, the GSB compares favourably with other provincial survey branches in the following basic areas, except as % of total value of mineral production, being less than that of Alberta, Quebec, Nova Scotia, and Newfoundland (Table 21).

TABLE 21
COMPARISON OF PROVINCIAL GEOLOGICAL SURVEY EXPENDITURES, 1988-89

Area	GSB	Average Other Survey Branches
Survey Expenditures		
As % of total value of mineral production	0.38	0.44
As $ spent/km2	9.30	8.30
As $ spent/capita	3.0	3.30
As $ oper. expenditures/F-T employee1	74 222	36 720
Av. salary/F-T (permanent) employee1	37 352	39 667
Av. salary/F-T (permanent) employee2	37 352	36 530

1 Excludes Quebec and Nova Scotia - data not presented in applicable form for comparative purposes.

2 Excludes Alberta, in addition to Quebec and Nova Scotia, to reflect impact of higher salaries paid in the petroleum and natural gas sector.

The extreme range represented in the above data largely reflect regional variants related to small populations in large areas and higher operating costs in remote terrains. B.C.'s position reflects abnormally low survey

expenditures as a percent of the total value of mineral production and its population compared to other provinces.

Dollars of operating expenditure per full-time employee partly reflect work-loads, but may be affected strongly by regional variants, particularly high-cost support work (*e.g.* helicopters). As might be expected, the highest ratio applies to the Yukon ($142 771), with British Columbia ($74 222) significantly ahead of the Northwest Territories ($51 321) and Ontario ($49 857). Other provinces have extremely low ratios by comparison, ranging from $14 000 to $23 000.

Average salary levels per full-time, professional employee are affected by similar regional considerations. B.C.'s average salary, at $37 352, is the fourth lowest of the provinces surveyed, as is shown in the following summary from data provided in the Provincial Geologist Journal 1989, Volume 7, covering 198889 salaries for full-time (permanent) employees (Table 22).

TABLE 22
AVERAGE SALARIES FOR PROFESSIONALS IN PROVINCIAL GEOLOGICAL SURVEYS, 1988-89

Province[1]	Average Salary
British Columbia	$37 352
Yukon	54 143
Northwest Territories	57 358
Alberta	48 956
Saskatchewan	43 514
Manitoba	41 109
Ontario	35 843
New Brunswick	36 107
Newfoundland	28 749

[1]Specific salary data not provided by Quebec, Nova Scotia, or Prince Edward Island.

Mineral Resource Outlook - 1990s

In the post-World War II era, B.C. has benefited by several mineral-oriented exploration and development thrusts (copper, lead-zinc, asbestos, uranium, coal, gold-silver flow-through funding), which have served as well to establish a reasonable basis on which to project the Province's potential for further discoveries. Although its mineral resource base is well recognized and its political stability will remain a favourable factor in attracting further exploration and development of its mineral resources, no new thrusts which would significantly increase exploration and development activity are currently envisaged except MDA Phase II.

A 1988 study by D.A. Cranstone and A. Lemieux, entitled "Base Metals: Today's Exploration Challenge," notes that, since 1975, Canada's lead and zinc reserves have fallen about 27% and copper about 18%, whereas gold reserves have increased by over 400%. They forecast a comparatively small increment to the base metal supply, derived from presently undeveloped and hence marginal deposits, and a significant shortfall between the late 1980s and 2005. A separate study by B.W. Mackenzie and L. Bilodeau in 1989, entitled "Trends in Exploration Performance: The Search for Base Metals and Gold in Canada," showed the alarming increase in the cost per "discovery" in the 40-year period following World War II which, after allowing for inflation, increased by over 1500% for base metals and 200% for gold, the latter in the most recent four-year period they examined.

In B.C. the outlook for base metal production in the next decade is not bright, with seven copper mines scheduled to close by 2000 AD, resulting in a net decrease of 45% in copper production. Similarly, the recently announced indefinite closure of the Sullivan Mine interrupts most of the lead and 55% of the zinc currently

produced in the Province. A significant effort will be required to approach the current level of base metal production in the Province from new developments and discoveries by the end of the decade.

In 1988, coal accounted for 40% of the Province's mining revenues and ranked first among mineral commodities in terms of production of over $1.6 billion. Almost all metallurgical coal produced in the Province is exported, with less than 1% used in Canada in 1988. Most forecasters believe that growth in metallurgical coal in the next decade will be low, whereas growth in thermal coal is forecast to be high. Current thermal coal production in the Province is largely a by-product of metallurgical coal production.

In the non-metals sector, no major growth is anticipated, other than in the important structural materials sector, with accessible aggregate sources becoming increasingly important to support growth anticipated in the economic development of the Lower Mainland and Greater Victoria. As noted in Chapter III, a major part of the value of the industrial mineral sector in the Province in the past 30 years, exclusive of structural materials, has been derived from asbestos production and from sulphur as a by-product of the oil and gas industry. Replacement of this dominant source from other industrial minerals is not foreseen in the next decade .

Tourism, Environment, and Land Issues - 1990s

National and international concerns about the environment and land issues will continue to grow and are expected to impact heavily on government priorities. The Province has outstanding scenic grandeur. Similar scenery was promoted at a much earlier stage by Alaska, despite its more inaccessible, costlier and less hospitable climatic environments. These developing issues will challenge the resource sector in its attempts to resist accelerating land withdrawals. A much greater effort will be required by industry to convince the public of the benefits of multi-resource use. The GSB, in its more impartial capacity, can, and should, exert a strong role in promoting resources to the public.

Adequacy of Staff and Budget Resources

Impressions, concerns, and proposed mandate modifications from the GSB perspective have been discussed and summarized in various parts of this review. In addition, the Committee's questionnaire addressed this topic in questions 37 through 42 (Appendix I).

With the exception of the federal government group, who believed that the current GSB budget of $6.2 million was about right, the majority opinion of all other client groups responding to the questionnaire was that it was too small and should be increased (i.e. 29% of those with an opinion considered the budget level about right, 5% too large, 30% too small, and 19% believed that it should be increased significantly). With respect to adequacy of staffing levels, the majority opinion of all clients was that they were inadequate (i.e. 37% of those with an answer or an opinion thought levels were about right, 8% more than needed, and 39% inadequate). A similar response was provided for the adequacy of office equipment.

As expected, a considerable variety of changes to the balance of resources were suggested, if the mandate were to change. Of the 92 respondents who commented on the question (41%), 126 comments could be reassessed as follows:

- Increased field activities, database studies - 37%
- Increased district office/staff/Vancouver office/staff - 18%
- Increased staff/budget - 10%
- Increased equipment, support facilities - 10%
- Increased mineral study focus - 10%
- Other - 15%

In its earlier review, the CGC Advisory Committee recommended the need for a significant increase to the GSB budget which, at that time, had an A-Base of $2.8 million. As discussed in the Chapter II, the A-Base portion of the budget, adjusted for inflation, did not increase above this level until 1987, and only in the last four years, with the significant increase to the A-Base budget, augmented by the average annual increase of 25% provided by MDA, has the Branch been capable of approaching the output demanded by its burgeoning client base. The additional growth requirements which are recommended to sustain this demand are summarized by staff and activity groups in the following section.

In reviewing the projected future needs in fiscal and human resources to meet the GSB's mandate, the Committee proposes two Options for consideration (p.67-68). Prior to these final proposals, the following specific recommendations are advanced.

Directors

Two Directors of the Operations and Services sections of GSB are recommended, to provide supervision of the nine units and two subunits in the proposed reorganization. This would provide for reduction in the number of managers reporting to the Chief Geologist, allowing more time for him to focus on policy and general management and for other efficiencies as noted.

Unit Heads and Project Leaders

The proposed reorganization provides for 11 units reporting to two Directors. Unit heads should be at managements or LSO 5 levels.

Larger units *(e.g.* Regional Mapping, Minerals Investigation) may require Managers. In the current organization, some Unit heads rotate their positions on an informal basis and derive no additional remuneration for this added responsibility.

[C/R50] In addition to recommending additional FTEs, the Committee proposes that appointment of Unit Heads be on a renewable term basis, subject to periodic review. Unit heads and project leaders should be compensated at an appropriate level in recognition of their additional responsibilities.,

Regional Mapping

As discussed in Chapter IV, Surficial Geology should be integrated within a new Environmental Geology Unit. A close liaison should be developed between this unit and the Minerals and Regional Mapping units, with provision for interchange of functions to provide growth opportunities for personnel and to increase overall efficiency. Important future studies, anticipated in the next decade in aggregate source definition, will require both mapping and economic-related assessments.

With the anticipation of improved definitions and efficiencies concerning the respective roles of GSC and GSB personnel in mapping and other geoscience-related activities in the Province, GSB should regard the completion of 1:50 000 scale mapping as a main priority.

The Province contains about 1050 map sheets at 1:50 000 scale, of which, in 1986, prior to the Regional Mapping Program, 117 were rated priority one, 265 priority two, and 378 priority three. About 55 of the map sheets had previous 1:50 000 scale geologic coverage. Since 1986, a total of 31 additional sheets have been completed, leaving 86 priority one sheets to be mapped.

The average cost per map sheet in the 1986-1989 period has been $150 000, ranging between $130 000 and $180 000. About 65% of expenditures are wages, the balance are operational costs.

The adopted level of this activity on an annual basis is subject to funding levels and recognition of the much higher cost per sheet for completion of mapping in remote versus accessible areas. Present resources provide for an average production level of five map sheets per year, with 18.3 FTEs, a mapping budget of $1.3 million, and eight projects in progress, of which three are in the write-up stage (i.e. no field mapping required). At the current production level, 17 years will be required to complete the map sheets presently identified as top priority.

Another mapping priority which could affect 1:50 000 scale mapping schedules is the Open File map series, which provides geological guidance in active exploration areas, largely to industry, and to the Land-use Unit now reporting to the Mineral Policy Branch. The Regional Mapping Unit should be sufficiently flexible to meet such requirements on a priority basis.

[C/R51] The present level of regional geological mapping is not considered adequate to meet the envisaged mapping demands from many client groups in the Province and to continue stimulating exploration activity. A more acceptable level of activity would be ten map sheets per year, requiring an additional nine FTE positions and an increase in budget of at least $1 million.

Minerals

As proposed in Chapter IV, the Minerals Unit would include the historic Mineral Deposits group and an Aggregates Subunit, with a total of four additional staff recommended.

As with the Regional Mapping Unit, the annual level of activity is difficult to predict and regulate. Both units, as with other operational components, appear to be adversely affected by their perception of having to perform functions of a clerical, administrative, drafting, and computer-support nature, which reduce their efficiency. This deficiency should be rectified and will add to the recommended level of support staff, if implemented.

Environmental Geology

A new unit is proposed, to include the present Surficial Geology Unit and personnel responsible for geological hazards and nearshore studies. Four additional personnel are considered necessary, of which two should be transferred from the Ministry of Environment.

Coal

As noted in Chapter III, coal currently represents the most important of the Province's mineral sections in terms of value of annual production. Two former offices providing District Geologist representation (Fernie and Fort St. John) no longer exist, and the only location with coal expertise within the Branch is in Victoria, which is visited frequently by industry representatives wishing to study reference files. Current unit facilities are considered inadequate and will only be rectified when replaced by a single cohesive unit, which should include a Technician to supervise public viewing of coal files, rather than the professional currently employed in this activity in addition to other principal duties.

Any significant expansion of the unit is clouded by: (1) the poor outlook for the coal industry in the next decade; (2) the Unit opinion that coal basins within the Province are well defined and limits of coal, other than local, are established; (3) the Unit opinion that there is enough geological work to do without considering the added function of extensive coal R & D; and (4) the possible new opportunities of coal-bed methane generation.

[C/R52] Notwithstanding the current outlook, the Committee recommends the addition of a Coal Geologist at both Fernie and Prince George and, in addition, a Technician at Victoria to supervise reference file studies.

Analytical Sciences Laboratory

[C/R53] The Committee has considered the various options available to the GSB with respect to its current laboratory and its future needs and has the following recommendations:

1. **The facility should be maintained with updated equipment to replace obsolete instrumentation, as required in a new facility.**
2. **Assuming that zoning restrictions will probably preclude inclusion of a new laboratory in a proposed new headquarters for the GSB in the downtown portion of Victoria, every effort should be made to provide good two-way data transmission.**
3. **The new laboratory should include provision for storage of geological rock specimens, in addition to space in the main office building for rock specimens essential for study during preparation of current reports.**
4. **To provide for analytical and scheduling control, geologists should budget for their requirements on an annual basis.**
5. **An X-ray diffraction unit is considered an essential requirement.**

Geochemistry and Geophysics

[C/R54] The Committee recommends the creation of a Geochemistry and Geophysics Unit, reporting to the Director of Operations. The Geochemistry sector of the Unit would include the Regional Geochemical Survey in the present organization at its current operating level. The Unit would also include a geophysicist to be recruited, who would provide the Branch with much-needed geophysics expertise in the following areas:

1. **interpretation of available geophysical maps and data to augment the geological database in areas of extensive drift cover.**
2. **collation of available industry geophysical data.**
3. **vetting geophysical reports submitted for assessment work purposes.**
4. **interfacing with universities and the mineral industry in geophysical research.**

Resource Data, MINFILE, and GIS Data Processing

One of the principal functions of the Resource Data group is the review and processing of about 1200 assessment reports annually in compliance with the Mineral Tenure Act Regulations, to provide for mineral claims to be maintained in good standing. The principal problem is the envisaged increase by the GSB in this activity in the foreseeable future, based on the dramatic rise in the number of reports reviewed in recent years. The Committee believes that this rise has peaked with the change in flow-through funding provisions, and that the level of activity will be lower in the foreseeable future and probably sustained at a more constant level. Furthermore, the Committee supports the need to change current regulations concerning the treatment of exploration data, with a view to optimizing use of the contained data in assessment reports and transporting it to the MINFILE system.

The closely affiliated MINFILE/GIS group, with its excellent and highly regarded output, has been subject to similar overload stresses and the same comments apply. It is in this area that much new effort is needed to develop appropriate GIS and other data management systems to ensure successful participation in the National Mapping Program.

[C/R55] The Committee recommends the addition of two FTEs to the Resource Data Unit with provision for more up-to-date hardware.

District and Vancouver Offices

The Committee recognizes the important role of District Geologists currently providing regional Branch representation at Victoria, Smithers, Prince George, Kamloops, and Nelson in facilities shared with respective

Inspection and Engineering branches. A similar but higher profile function is provided in Vancouver, with more staff required to interface between the Ministry and its many clients, principally industry representatives.

The Committee's questionnaire examined the usefulness of the Vancouver and District Offices (Question 41, Appendix). The reordered response was as follows (Table 23).

TABLE 23
SUMMARY OF RESPONSES TO QUESTION 41 OF QUESTIONNAIRE (Appendix)
CONCERNING DISTRICT OFFICES (given as percentages)

District	No Answer	Essential	Useful	Rarely Used	Not Used
Vancouver	8	44	25	10	12
Victoria	12	26	27	20	15
Smithers	14	22	24	17	23
Kamloops	17	15	19	21	28
Prince George	17	11	16	22	34
Nelson	17	10	16	25	31

In considering these responses, it is important to note that probably most of the respondents are based near one of these district offices.

[C/R56] The Committee supports an expanded role by the Branch at the District Offices as described under organizational changes. Among specific recommendations affecting resources are:

1. **The relatively autonomous position of the District Geologists should be recognized in their selection and rank as the image they project will reflect strongly on the Branch. They must be knowledgeable and well informed on most aspects of the Branch's facilities, activities, products and capabilities. Their compensation level should reflect this responsibility.**
2. **The Vancouver Office is a special situation. Much as industry would wish to see the GSB moved to Vancouver, this is considered impractical by the Committee, mostly from a financial perspective, but also partly because of the growing liaison which is being required with government as a GSB client. As an alternative, the Committee strongly recommends expansion of the Vancouver Office and its facilities to provide adequate service to the public. The current staff of three should be increased by two FTEs.**

   With the pending move of the Vancouver Office from its current location at Robson Square, the Committee recommends that consideration be given to a shared facility with the Geological Survey of Canada in the downtown core of Vancouver.
3. **The current activity at the Smithers and Kamloops offices justifies the addition of an Assistant District Geologist, in addition to a full-time Secretary at each location.**
4. **Consideration should be given to moving the Southwest (Victoria) Office to Nanaimo as recommended by the current District Geologist, in order to provide a more central location for an office representing Vancouver Island.**

The Committee's questionnaire asked whether GSB-maintained core shacks were appropriate for B.C. Although no central repository was discussed, locations near District Offices are considered most convenient, rather than one central repository in Vancouver or Victoria. Responses are summarized in Question 8 (Appendix). As indicated by the following summary, opinions tended to be polarized, reflecting the strong feelings on this issue by the majority of respondents. In addition, 25% of the government-affiliated group expressed no opinion to the question, compared to 5% by the industry group.

TABLE 24
SUMMARY OF RESPONSE TO QUESTION 8 OF QUESTIONNAIRE
(Appendix) (given as percentages)

	# of Responses	% No Answer	Excellent	Good	Fair	Poor	No Opinion
Industry	151	6	17	16	17	39	5
Government	53	4	17	13	17	25	25
Other	6	6	17	16	17	35	10

[C/R57] Based on questionnaire returns, the response for GSB-controlled core storage facilities is not considered sufficiently supportive to provide for this as a new activity. As an alternative, the Committee proposes that the Ministry (MEMPR) consider providing assessment credits to property owners for delivering representative suites of property drill-cores to the District Offices under a coordinated plan to be developed with industry input.

Outreach

[C/R58] The Committee recommends formation of a new unit required to coordinate promotion of geoscience to the public sector. This Public Information Unit would include responsibility for publication sales, education, library, and tourism subunits. Additional staff requirements envisaged are a Senior Information Officer, an Assistant, and a full-time Secretary.

FAME

[C/R59] Under the proposed re-organization, the FAME Program of prospector assistance should be maintained at the current annual funding level of $500 000, with provision for annual increases to offset inflation, as with the A-Base budget, and with individual grants to be increased on the same basis, but with an initial increase from $7500 to $10 000. The FAME Program should continue under contract, based in Victoria, with important input by District Geologists, and reporting to the Senior Manager, Regional and District Offices.

Scientific Review, Cartography

The output of GSB is reflected by its end product, publications and maps. This has suffered, with that of other government agencies, by privatization of publication and sales, restricted to Victoria and recognized by all GSB clients as untimely and inconvenient. Until this situation is rectified, no significant improvements in this area can be recommended.

The current practice of having professional staff spend a considerable portion of their time in functions which can be performed more efficiently, and with higher quality and at less overall cost, by highly qualified technical personnel is a serious impediment which should be rectified.

[C/R 60] The current staff in this Unit (Scientific Review/Cartography) are incapable, with the current staff and resources, of providing the required output and the Committee recommends addition of three Cartographers and one Editor.

Branch Coordination, Administration

[C/R61] With the maximum reorganization and budget level recommended by the Committee, provision should be made for the addition of two support secretarial FTEs.

Level And Distribution Of Future Resources

In the preceding sections of this report, the Committee has made many recommendations for changes to the GSB resources (increases, status quo, decreases). The internal reallocations to effect some of these changes must be left to GSB management.

The Committee recalls the initial directive of the Assistant Deputy Minister that, because of this period of restraint, recommendations for a significant increase in resource levels are likely to be disregarded. The ADM further noted, however, that an improved economy may allow readjustments some time in the future.

The first CGC review in 1981-82 recommended a significant increase in funding. The Mining Task Force, a few years later, analyzed the situation and recommended that the annual budget be about $10 million. In 1989-90, the A-Base budget had only achieved a level of $6.2 million. The reduction of MDA funds is of particular concern for the 199091 fiscal year and beyond.

[C/R62] After assessing all the pressing requirements and immediate needs, yet being reminded of the cautionary comments of the Assistant Deputy Minister, the Committee recommends that the GSB 1990-91 A-Base budget be raised to $8 million (in 1989-90 dollars).

It would, however, be irresponsible for the Committee not to express its more fundamental conclusion regarding future resources. It is perfectly evident that the GSB is feeling intense pressures for more activities, data, interpretation, and advice on environmental matters in the broadest sense. It is simply impossible for the GSB to deflect resources from its core missions *(e.g.* support to the mineral industry). In fact, our studies clearly reveal that the future health of the mineral industry in the Province requires an increased assistance through more geological mapping and related studies. The level of provincial support has been disproprotionally low compared to that given to other ministries for their industrial support programs (*e.g.* forestry). The days of finding the obvious orebodies are past; the future requires an increased initial investment upstream if the Province is to enjoy the resultant downstream revenues from mineral development. The report provides other examples (*e.g.* aggregate shortage, tourism opportunities) where investment in a strong GSB will pay future dividends, but where inaction will be detrimental to the provincial economy and to the public good.

The Committee, therefore, urges the consideration and adoption through phased budget increases, of Option II in the level and distribution of future resources to the GSB. We have examined the needs, future pressures, and opportunic metal deposits as quickly as British Columbia's metal reserves are being mined. At recent rates of production, the Province has enough reserves to last about 17 years for copper, 10 and 16 years for lead and zinc respectively,

TABLE 25
RECOMMENDED ADDITIONAL RESOURCES TO GEOLOGICAL SURVEY BRANCH UNDER OPTION II

Unit	New Resources	FTE	$K
SRO/Cartography	1 Editor, 3 Cartographers	3	200
Branch Coordination/ Administration	2 Secretaries	2	60
Geochemistry/Geophysics	1 Geophysicist	1	150
Regional Mapping	9 Mappers	9	2200
Mineral	1 Mineral Deposits Geologist;1 Aggregates	2	1300
Environmental Geology	2 new;(+2 from Ministry of Environment)	2	120
Coal	2 District Officers; 1 Coalbed Methane	3	160
Analytical Lab/Lapidary	Capital for new equipment (3 allocations @ $200K over 10 years)	-	~60/yr
FAME	None required	-	-
Data Management	3 for GIS/CoalFile/ MINFILE ($150K/yr for both operations & capital)	3	300
Vancouver Office	Enlarge staff & facilities	2	150
District Offices	1 at Smithers; 1 at Kamloops, with 1 secretary at each	4	120
Public Information	1 Info. Off.; 1 Tourism; 1 Secretary	3	200
	TOTAL ADDITIONAL RESOURCES	**32**	**5020**

[C/R63] The Committee recommends that the Ministry seriously consider the full merits of investing additional resources in the GSB to ensure the long-term health of the mineral exploration industry, for environmental protection, and for an enhanced tourism industry. The Committee considers that an appropriate annual resource level for the GSB is 132 FTEs and an A-Base budget of $11.2 million (in 1989-90 dollars).

It is preferrable that this increase be phased in over a three-year period and implemented with the consolidation of the GSB into a single building. Planning for this larger group should be immediately incorporated into the building requirements.

APPENDIX I
The questionnaire

Introduction

The Committee drafted a questionnaire in October and, after incorporating useful suggestions from GSB management, circulated it in late November as outlined below:

Distribution Agent	# of Copies Available for Distribution	# of Completed Questionnaires Returned
Coal Association of Canada	25	11
Mining Exploration Group	95	7
B.C.-Yukon Chamber of Mines	700	43
Geological Survey of Canada	90	19
S.E.B.C. Chamber of Mines	150	11
Smithers Exploration Group	57	17
B.C. Government (outside GSB)	30	5
B.C. Geological Survey Branch	100	18
Pacific Section, GAC	130	14
Cordilleran Section, GAC	700	65
Technical Liaison Committee	8	2
Kamloops Exploration Group	30	12
Totals	**2115**	**224**

(GAC = Geological Association of Canada)

The Committee is aware that not all copies available for distribution were distributed by each agency and that some people received two or more copies from various agencies. For instance, about 25% of the responses received from government employees were on copies distributed through channels other than government. The Committee estimates that about 20% of those receiving copies filled out and submitted one.

Respondents could identify themselves on an optional basis, and 70% opted to do so; identities of these respondents were held confidential by the Committee. Respondents' affiliations are tabulated below.

Nature of Employer	# of Respondents	% of Respondents
Large company	51	23
Small producer	14	6
Exploration company	41	18
Consultant	45	20
Industry Subtotal	**151**	**67**
Provincial government	31	14
Federal government	22	10
Government Subtotal	**53**	**24**
Academia	4	2
Other	6	3
Total	**224**	**100**

The questionnaire consisted of one page of background information about the GSB and 4.5 pages of questions. It has been reproduced at the end of this appendix. Fourteen questions asked for comments; responses to these were processed manually. Responses to all other questions were entered onto a disk for processing. Detailed results and tabulations for both kinds of questions were provided to the President,CGC, and the Chief Geologist, GSB. Highlights of responses are noted below. Reference should be made to the questionnaire itself for details about questions.

Responses to computer processable questions are shown as percentages of total responses from industry (151), government (53), and total respondents (224). For comment questions, only frequently made comments are noted. However, many respondents took time to prepare thoughtful suggestions and all comments were transcribed and forwarded (identifying affiliation but not individual) to CGC and GSB.

Overview of Responses (% of total)

?#	Group	No Answer	Excellent	Good	Fair	Poor	No Opinion
1	Industry	2	4	33	32	10	19
	Government	2	6	30	25	19	19
	Total	2	4	33	30	11	19
2	Industry	1	3	64	23	5	5
	Government	0	0	49	30	4	17
	Total	0	3	61	25	4	7
3	Industry	1	9	38	37	11	5
	Government	0	6	25	51	11	8
	Total	0	8	34	42	10	5

?#	Group	No Answer	Agree	Emphasis Adequate	Disagree	No Opinion
4	Industry	1	34	36	27	2
	Government	2	28	32	28	9
	Total	1	34	34	26	4

5 66% of returned questionnaires had a comment (compared to an average 32% response rate for all 14 "comment" questions). Most commonly cited items (with % of all 147 comments that mentioned it shown in brackets) were mapping (34), mineral deposit studies in new areas (18), mineral deposit studies in established camps (16), surficial and/or natural hazards and/or environmental geology (12), land-use studies and/or mineral resource assessments (12), database and/or libraries and/or GIS and/or assessment reports (10), geochemistry (8), and geophysics (8).

?#	Group	No Answer	Excellent	Good	Fair	Poor	No Opinion
6	Industry	2	28	18	18	32	3
	Government	2	9	34	17	25	13
	Total	2	23	22	19	29	5
7	Industry	1	5	18	23	48	6
	Government	0	15	23	15	42	6
	Total	0	8	20	23	43	6
8	Industry	6	17	16	17	39	5
	Government	4	17	13	17	25	25
	Total	6	17	16	17	35	10

9 31% of questionnaires contained a comment. Most commonly suggested new activities were land-use and/or environmental studies and/or mining impact studies (19), public awareness/talks in schools/geoscience information for tourists, etc. (16), and core storage (13).

10 Only 14% of questionnaires had a comment, the most common of which were "don't cut anything back" (19) and mineral deposit studies (19). Other items suggested were mapping (16) and regional geochemical surveys (9).

11 33% of questionnaires had a comment about activities, mandate, or client needs. 22% of these said "generally a well-directed program." Other items mentioned most frequently were: develop more exploration models (9), improve District Geologists Offices/field meetings (9), improve mapping (9), improve availability of publications (7), and concentrate on very applied research (7).

?#	Group	No Answer	Excellent	Good	Fair	Poor	No Opinion
12	Industry	0	17	52	18	6	7
	Government	2	19	45	21	2	11
	Total	1	17	50	19	5	8
13	Industry	1	18	62	9	2	9
	Government	2	15	57	9	0	17
	Total	1	17	61	10	1	10
14	Industry	3	13	62	11	1	9
	Government	6	9	62	9	0	13
	Total	4	13	61	12	1	9
15	*(at meetings)*						
	Industry	4	25	46	10	4	12
	Government	6	13	36	11	6	28
	Total	4	22	43	11	5	15
15	*(at D.G. Offices)*						
	Industry	5	17	39	15	9	15
	Government	4	9	25	13	9	40
	Total	5	16	36	14	10	20
15	*(day-to-day)*						
	Industry	5	11	36	19	14	16
	Government	4	4	19	21	21	32
	Total	4	9	31	21	17	19
16	Industry	5	20	45	19	3	9
	Government	17	23	26	9	4	21
	Total	8	22	39	17	4	11

17 42% of questionnaires included a general comment about publications. 33% of these noted that publications were hard to get, and there were some vitriolic comments; 31% were generally laudatory comments.

?#	Group	No Answer	Excellent	Good	Fair	Poor	No Opinion
18	Industry	0	48	36	4	0	11
	Government	0	55	38	0	0	8
	Total	0	50	37	4	0	10
19	Industry	1	12	54	15	3	14
	Government	0	2	17	32	11	38
	Total	1	9	44	19	5	21

?#	Group	No Answer	Excellent	Good	Fair	Poor	No Opinion
20	Industry	2	27	36	10	1	24
	Government	0	15	30	6	2	47
	Total	1	23	36	9	1	29
21	Industry	3	24	28	5	2	38
	Government	2	23	19	8	0	49
	Total	2	22	28	6	1	41
22	Industry	1	19	55	15	2	8
	Government	4	8	64	11	4	9
	Total	2	17	56	14	3	8

23 33% of questionnaires had a comment about contacting GSB people. 45% of these were of a generally to highly laudatory nature, while another 40% noted that Victoria is too remote or that District Geologist's offices are not staffed at sufficient levels.

?#	Group	No Answer	Excellent	Good	Fair	Poor	No Opinion
24	Industry	1	9	51	28	4	7
	Government	2	19	53	9	2	15
	Total	1	11	52	24	3	8
25	Industry	1	13	62	18	1	6
	Government	2	19	49	13	2	15
	Total	2	14	58	17	1	8
26	Industry	2	7	48	30	7	7
	Government	4	8	38	36	4	11
	Total	3	7	44	32	7	7
27	Industry	3	13	38	28	8	9
	Government	9	8	40	13	6	25
	Total	4	13	39	24	7	13
28	Industry	3	7	36	31	10	14
	Government	13	6	32	11	6	32
	Total	6	7	35	26	8	19

?#	Group	No Answer	Signif.	Somewhat	Not At All	No Opinion
29	Industry	7	11	49	22	14
	Government	13	9	15	11	51
	Total	7	13	27	17	25

		Directly			**Indirectly**			
?#	Group	No Answer	Yes	No	No Answer	Yes	No	No Opinion
30	Industry	38	36	26	19	59	6	17
	Government	57	40	4	19	38	2	42
	Total	42	38	20	20	54	5	21

?#	Group	No Answer	Signif.	Somewhat	Not At All	No Opinion
31	Industry	1	26	55	9	9
	Government	8	28	32	0	32
	Total	4	28	49	6	14

32 36% of questionnaires contained a response. 56% were generally laudatory in nature, while 7% were generally disparaging. 9% cited RGS and 7% cited MinFile as being particularly useful.

33 Only 13% of questionnaires included a comment and, as only 8% scored administration as "unsatisfactory" (see below), some who scored it higher nonetheless commented, and some of those were laudatory comments. No clear patterns emerged from the 29 comments received.

Group	No Answer	Highly Satisf.	Satisf.	Unsatisf.	No Opinion
Industry	3	12	54	9	22
Government	2	11	57	8	23
Total	2	12	56	8	22

34 23% of questionnaires included a comment; 35% of these said there should be better GSB/GSC coordination. 16% said clearly defined separate roles should be established and 8% said cutbacks at GSC are hurting them, or their clients, or both.

Group	No Answer	Highly Satisf.	Satisf.	UnSatisf.	Not an Issue	Opinion
Industry	5	9	39	18	11	19
Government	8	6	42	23	8	15
Total	6	8	42	17	9	17

35 Only 9% of questionnaires had a comment, the smallest response of all "comment" questions. Three of the 21 comments said District Geologists Offices should be emphasize more and three others noted that the MDA has led to some instability because of large variations in financial resource.

Group	No Answer	Highly Satisf.	Satisf.	Unsatisf.	No Opinion
Industry	2	7	63	7	22
Government	4	6	58	19	13
Total	3	7	62	9	19

36 34% of questionnaires included a comment about changes to the organizational structure; 41% of these asked for stronger District Offices, including Vancouver. 10% recommended a strengthened capacity to contribute forcefully to land-use decisions, and 10% more requested better compilations and/or dissemination of available data.

#?	Group	No Answer	Much Larger	Too Large	About Right	Too Small	Increase Signif.	No Opin.
37	Industry	0	1	4	32	34	17	12
	Government	0	2	8	23	23	19	17
	Total	0	1	4	29	30	19	13

#?	Group	No Answer	Needed	More than Right	About Inadequate	No Opinion
38	Industry	3	11	38	35	13
	Government	6	4	38	45	8
	Total	4	8	37	39	11

#?	Group	No Answer	Somewhat in Excess of Needs	About Right	Somewhat Inadequate	No Opinion
39	Industry	1	6	38	28	27
	Government	4	0	19	53	25
	Total	3	4	32	36	25

40 41% of questionnaires contained a comment. 17% said more mapping, 8% each said more geophysical work, more District Offices, larger Vancouver staff or better-equipped offices, and 7% each said strengthen District Office staff, improve the data base, or increase the emphasis on coal.

#?	District Office	No Answer	Essential	Useful	Rarely Used	Not Used
41	Kamloops	17	15	19	21	28
	Nelson	17	10	16	25	31
	Prince George	17	11	16	22	34
	Smithers	14	22	24	17	23
	Vancouver	8	44	25	10	12
	Victoria	12	26	27	20	15

(The Committee guesses that some respondents confused the Victoria District Office with the GSB Headquarters Office.)

42 25% of questionnaires included a general comment about resources available to the GSB. 14% of these said resources are currently adequate, 13% said improve publications availability in Vancouver or the District Office, and 11% asked for more staff in the Vancouver or District Offices, with numerous other items attracting a comment or two.

43 See opening remarks.

44 See opening remarks.

#?	Group	No Answer	Geol	Geochem	Geophy	Geol & Geochem	Geol & Geophy	All Three
45	Industry	8	62	2	3	17	3	5
	Government	18	62	4	0	4	2	0
	Total	14	62	2	2	14	2	4

#?	Group	No Answer	Industrial Minerals	Coal	Other
	Industry	76	7	7	9
	Government	72	6	2	21
	Total	74	7	5	13

46 42% of questionnaires contained a "final thought." 22% of these said the GSB is doing good work and/or provides useful, timely data, 13% suggested updating and/or concentrating on database activities, 9% said Victoria is an inappropriate location for the GSB compared with Vancouver, and 6% of comments were directed to each of better communication and better coordination with the GSC.

The Committee thanks all of those who took the time to fill out and return the questionnaire. A total of 992 comments were received in addition to the "computer processable" responses, and many of these comments were thoughtful. Some took the time to submit separate sheets with typed comments. The Committee valued the response to this questionnaire and referred to it often during the preparation of the main body of the report.

QUESTIONNAIRE

REVIEW COMMITTEE FOR THE B.C. GEOLOGICAL SURVEY BRANCH (GSB)

I. INTRODUCTION

The Canadian Geoscience Council has formed a committee to review the GSB, in response to a request from Mr. Bruce McRae, Assistant Deputy Minister. The last review, done in the early 1980's, was useful in planning and managing the GSB in the ensuing decade. Your comments will provide a broader opinion base than that reflected by the committee.

The terms of reference for this study were proposed mainly by GSB Management and briefly are:

1. To review the current mandate and to recommend any warranted changes so the GSB can better meet B.C.'s needs for geoscience information in the next decade. Specifically, to review whether the GSB's mandate should be broadened to include geophysics and/or offshore geology.

2. To review the organization of the GSB, and to recommend any warranted changes.

3. To report on adequacy of staff and budget, having regard for the longer term prospects for public expenditures.

II. BUDGET, 1989-90

	A-Base Budget (includes salaries)		
(a) Field Activities	$1,000's	%	No. of Permanent Positions
Regional Mapping	1,170	18.8	10
Mineral Deposits	922	14.8	9
District Geol. (incl. Vanc.)	828	13.3	10.5
Geochemistry	510	8.2	4
Coal Resources	484	7.8	6
Industrial Minerals	191	3.1	2
Land Use (Evaluations)	192	3.1	3
Surficial Geology	100	1.6	3
Subtotals	4,397	70.7	44.5
(b) Office/Lab/Support Activities			
Review, Editing, Drafting	404	6.5	6
Management/Univ. Research Grants	387	6.2	4
MINFILE	351	5.6	4
Lab	347	5.6	6
Assmt. Rpts/Resource Data Anal.	339	5.4	5
Subtotal	1,828	29.3	25
TOTAL	6,225	100.0	69.5

NOTES: (1) The Canada-B.C. Mineral Development Agreement (MDA), signed in late 1984, provided an additional $5 million from each of the Provincial and Federal governments, over a 5-year period ending in March 1990. About $6.7 of the total $10 million was for geoscience. In 1989-90 (the last year of the agreement) an additional $893,000 was spent in MDA-related field activities by the GSB. The outlook for renewal of the MDA is uncertain and is not expected until 1991-92 at the earliest.

(2) The surficial geology program was started during 1989-90.

(c) Related Activity

FAME grants to prospectors are administered by the GSB at a cost of $500 thousand in 1989-90. Field advice and training are provided. The program is funded annually and is expected to be renewed in 1990-91.

III. THE QUESTIONNAIRE (Quickly note the first responses that come to mind. Use an extra page(s) as required, with reference to appropriate section).

A. MANDATE OF GSB

During the next decade, it is expected that provincial governments may need more diversified geoscience information and advice (eg. on environment, land use, offshore minerals, terrain hazards, groundwater, tourism). During its earlier history, the principal clients of the GSB have been the Ministry and the mineral exploration industry. How should the mandate and activities of the GSB change over the next decade?

(a) Activities of the GSB

	Excel.	Good	Fair	Poor	No Opinion
1. Outside liaison in the program planning process is	___	___	___	___	___
2. Overall, the present program balance is	___	___	___	___	___
3. Overall, the geoscience data base of B.C. is	___	___	___	___	___

	Emphasis Agree	Adequate	Disagree	No Opinion
4. The GSB should put more emphasis on surveying little known areas, versus active exploration areas.	___	___	___	___

5. I would like to see more effort in the following activities: _____

_____

_____

_____

I would like to see the following new activities (as described in 6-9):

6. Geophysics: The GSB is one of the few provincial surveys in Canada without a program in exploration geophysics. Currently geophysical surveys are delivered by the GSC - these are national in scope, reconnaissance in scale, and generally are not designed to target exploration sites. Provincial surveys, on the other hand, are generally targeted at detecting and tracing conductive strata, as an aid to exploration and mapping, and include gravity, electromagnetic, VLF and airborne EM surveys.

	Excel.	Good	Fair	Poor	No Opinion
I consider involvement by the GSB in geophysics would be	___	___	___	___	___

7. Offshore Geology: The coastal zone of B.C. contains placer and sand and gravel resources that may be economic in the near term. Currently marine geological surveying of offshore B.C. is conducted by GSC. Their offshore surveys include seismic, sidescan sonar, coring, and grab sampling, and by their nature, are very expensive to conduct. The Province owns the mineral resources in the Strait of Georgia, however no decision has been made to permit offshore mineral resource development.

	Excel.	Good	Fair	Poor	No Opinion
I consider involvement by the GSB in offshore geology would be	___	___	___	___	___

8. Core Storage Facilities ("core shacks")

Some provinces/territories have core shacks. While laudable in principle, they attract quite minor visitation and are expensive to maintain. Yet much valuable core stored on properties is lost each year. Remembering that funding to erect and maintain core shacks could mean significant cutbacks elsewhere in the GSB, please consider the pros and cons of government core storage, eg. Do you think entire submitted holes, or representative samples should be stored? Should GSB people be allowed to participate in a selection. Should core submission be voluntary? How long should core be confidential? Who should pay transport costs? Should recording and like fees be raised enough to cover all GSB's core shack costs or should other GSB activities be cut?

	Excel.	Good	Fair	Poor	No Opinion
Are GSB-maintained core shacks appropriate for B.C.?	____	____	____	____	____

9. Other New Activities: _____

10. I think the following activities could be cut back (state reasons): _____

11. General comments about activities, mandate or client needs: _____

(b) Publications and Computer Databases

	Excel.	Good	Fair	Poor	No Opinion
12. Timeliness of appearance of results	____	____	____	____	____
13. Adequacy of scientific/editing standards	____	____	____	____	____
14. Appropriateness of formats used	____	____	____	____	____
15. Availability - at meetings as in (c) below	____	____	____	____	____
- at Dist. Geol. offices	____	____	____	____	____
- from day to day	____	____	____	____	____
16. Cost ("excel." equals "bargain")	____	____	____	____	____

17. General comments about publications: _____

(c) Contact with GSB People

	Excel.	Good	Fair	Poor	No Opinion
18. Talks/Posters at Cordilleran Roundup	____	____	____	____	____
19. National Meetings (eg. GAC, CIM, PDA)	____	____	____	____	____
20. Regional Meetings (eg. Kamloops, Nelson, Spokane)	____	____	____	____	____
21. Field Meetings (eg. Bronson Creek, Atlin)	____	____	____	____	____

	Excel.	Good	Fair	Poor	No Opinion
22. Overall availability for contact	____	____	____	____	____

23. General comments about contacting GSB people: _____

(d) Impact of the GSB

	Excel.	Good	Fair	Poor	No Opinion
24. Quantity of new or improved geoscience knowledge	____	____	____	____	____
25. Quality of new or improved geoscience knowledge	____	____	____	____	____
26. Accessibility of new or improved geoscience knowledge	____	____	____	____	____
27. Value of above in my thinking and planning processes	____	____	____	____	____
28. Impact of above on the results of my work	____	____	____	____	____

29. GSB people and/or products (including assessment work reports, MINFILE, etc.) have caused us to increase our effort significantly _____; somewhat ____; not at all ____; no opinion ____.

30. GSB people and/or products in my opinion have helped in the discovery of new targets for exploration directly: yes _____, no _____; and/or indirectly: yes ____, no ____; no opinion ____.

31. In general, GSB activities have contributed to increased exploration or mineral resource exploitation significantly_____; somewhat_____; not at all ____; no opinion ____.

32. General comments about impact of the GSB, including any pertinent examples: _____

B. ORGANIZATION OF THE GSB

The current organization of the GSB is structured to deliver programs, information and advice to its principal clients. Is the current organization and administration effective? If the mandate is to be modified, how should the organizational structure be changed to improve effectiveness?

33. Overall, administration of the GSB seems highly satisfactory _____; satisfactory ____; unsatisfactory ____; no opinion ____.

If unsatisfactory, give examples: _____

34. From my viewpoint, integration and/or dovetailing of GSB and Geol. Surv. of Canada activity is highly satisfactory _____; satisfactory _____; unsatisfactory ____; not an issue ____; no opinion ____.

If unsatisfactory, give examples: _____

35. Overall, the current organizational structure seems highly satisfactory _____; satisfactory _____; unsatisfactory _____; no opinion ____.

If unsatisfactory, give examples: _____

36. If the mandate were to change, what specific changes to the organizational structure would you recommend: _____

C. ADEQUACY OF STAFF AND BUDGET RESOURCES

Are the present resources appropriate to deliver the program and services given the present mandate and fiscal climate? If the mandate were to be changed, how should this be reflected in the balance of resources?

37. In my opinion the present total budget allowance for the GSB of about $6.2 million, given the present and future needs of B.C. for geoscience information and given the finite nature of government resources in general, is much larger than necessary _____; too large _____; about right ____; too small ____; should be increased significantly ____; no opinion ____.

38. At present there are 69.5 permanent positions and an allowance for 27.5 person years of seasonal employment in the GSB. These staffing levels in my opinion are more than needed ____; about right ____; inadequate ____; no opinion ____.

39. As far as I know, the offices in Victoria, Vancouver and the Regions, and the office equipment are somewhat in excess of needs _____; about right ____; somewhat inadequate ____; no opinion ____.

40. If the mandate were to change, what specific changes to the balance of resources would you recommend: _____

41. Specifically, how useful to you are the Vancouver and Regional offices:

	Essential	Useful	Rarely Used	Not Used
Kamloops				
Nelson				
Prince George				
Smithers				
Vancouver				
Victoria				

42. General comments about resources: _____

ABOUT YOU

43. Name (optional): _____ Telephone (optional): _____

44. Affiliation: Large Company _____; Small Producer _____; Exploration Company _____; Consultant _____; Prov. Gov't. _____; Fed. Gov't. _____; Academia ____; Prospector ____; Other (specify) _____

45. Specialty(ies): Geology _____; Geochemistry _____; Geophysics _____; Coal ____; Industrial Minerals ____; Other (specify) _____

IN CONCLUSION

46. Any final thoughts: _____

(for processing use: 1, 2, 3, 4, 5, 6, 7, 8, 9)

Please deliver this questionnaire by December 22, 1989 to:

Mr. Dave A. Barr
Barrda Minerals Inc.
315-409 Granville Street
Vancouver, B.C.
V6C 1T2
Phone No. (604) 684-3443

or, if you prefer, to anybody else on the committee, who are:

Chairman:
Dr. Chris R. Barnes
Centre for Earth and Ocean Research
University of Victoria
P.O. Box 1700
Victoria, B.C.
V8W 2Y2
Phone No. (604) 721-8847

Dr. W. Dave McRitchie
Geological Services
Energy and Mines
535-330 Graham Avenue
Winnipeg, Manitoba
R3C 4E2
Phone No. (204) 945-6559

Mr. John M. Hamilton
Cominco Ltd.
700-409 Granville Street
Vancouver, B.C.
V6C 1T2
Phone No. (604) 682-0611

Dr. E.R. Ward Neale
5108 Carney Road, N.W.
Calgary, Alberta
T2L 1G2
Phone No. (403) 289-3583

Mr. H. Glen Rushton
507 Willowbrook Drive, S.E.
Calgary, Alberta
T2J 1N6
Phone No. (403) 271-2558

APPENDIX II
CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations of the Committee are highlighted (numbered [C/R 1-63] and printed in boldface) through the report. The full list is provided below.

CHAPTER II:THE DEVELOPMENT OF THE B.C. GEOLOGICAL SURVEY BRANCH

CURRENT COORDINATION AND LIAISON ACTIVITIES

Coordination With Other Producers of Geoscience Data

C/R-1 As discussed further in Chapter III, it has been agreed recently to establish a coordination group consisting of four senior managers or scientists from each of the GSC and GSB. **Our committee unanimously endorses this initiative because it believes that a significant need remains for improvement in coordination. The Committee notes that people at the Director General and Director level have been appointed by the GSC and cautions that the group will be effective only if representatives chosen to represent each survey have significant and roughly equivalent decision-making authority.**

C/R-2 **It appears to this Committee that coordination of activity with universities, while adequate, is a matter that could be improved, depending, as it does, largely on continued one-to-one contact between working scientists at institutions and in the Branch. The Committee also suggests that the overall level of support is inadequate, especially as the MDA funding will cease. This is discussed more fully in Chapter III.**

Liaison With Other Users of Geoscience Data

C/R-3 **Publications are the principal product of every geological survey, and the effectiveness of the GSB will continue to be critically undermined as long as publications remain unavailable at district offices. It is recommended that this issue be resolved between the GSB and Crown Publications.**

COMPARISON WITH OTHER PROVINCIAL GEOLOGICAL SURVEYS

C/R-4 The current emphasis given to regional mapping is appropriate and timely, and should be sustained with full cooperation from the Geological Survey of Canada, wherever this is appropriate to their mandate. **It is likely that additional progress will be made through the proposed National Mapping Program, and the Committee recommends that the GSB continue discussions with the GSC to that end.**

C/R-5 The Analytical, Cartographic, and Lapidary units are essential support components to any modern professional Survey. However, a comparison of the existing professional staffs shows the GSB units to be woefully understaffed. To some extent, this is offset by the fact that most geologists are supported by senior assistants dedicated to each project. Nevertheless, the skills peculiar to a young geologist are rarely comparable to those possessed by a trained analytical technician or cartographer, **and it would seem reasonable that the GSB review its current complement of Senior Assistants with the intent of reassigning some of these FTEs to appropriately skilled technical and secretarial support staff.**

C/R-6 One peculiar inadequacy arising from the existing spectrum of technical skills in the GSB is the inability to produce coloured geological maps. Numerous new approaches have been developed over the last decade for generating cost-effective products in this category, **and the GSB would be well advised to**

mount a survey of practices, current or under development elsewhere in the country, to determine whether it could produce coloured geological maps which are routinely generated by other provincial surveys.

C/R-7 Six district offices are maintained by the GSB. There is some indication that the existing siting of personnel is not optimized to regional needs. In comparison to the other provincial surveys, GSB shows a better-than-average representation in the regions. **However, as with other provincial agencies, Head Office in Victoria does not seem to maintain adequate communication with these outposts, and increased efforts must be made to improve communication links, coordinate seasonal investigations, and increase the number of visits made to each of the districts by Head Office management and operational personnel.**

C/R-8 Finally a note on facilities and location. The scattered distribution of the GSB into five separate locations in downtown Victoria is highly unsatisfactory, leading, as it does, to inefficient communications between the various components of the organization, and to a general feeling of fragmentation. **Top priority should be given to co-locating all Head Office components in a modern facility with adequate space to conduct operations. Precedents elsewhere in Canada indicate minimal disruption to operations if the laboratory and rock storage elements are housed separately, and this option should be left open for any future planning considerations.**

C/R-9 **In conclusion, the Committee considers that the GSB has a major task ahead in order to catch up with the level of geological mapping developed in other parts of Canada. This is addressed in Option II of resource distribution in Chapter V. In some other aspects, the organization compares favourably, if not advantageously, with its counterparts in the other provinces. The principal shortfalls are the need for improved facilities, a better balance between professional and technical personnel, internal reorganization of reporting lines to better facilitate program delivery, and improved communications between Head Office and the regions.**

CURRENT SPECIAL ISSUES

Space

C/R-10 **The Committee has been given to understand that a new building to house the entire Ministry of Energy, Mines and Petroleum Resources in Victoria is under consideration. Certainly communication within the Branch would be much improved, as would the Branch's day-to-day communications with other portions of the Ministry, if everyone were under the same roof. If a new building is authorized, the Committee would recommend that proper space for a geological library, and secure storage and reference areas for the MinFile and CoalFile records be incorporated in its design.**

Laboratory

C/R-11 **There appears to be little control over the analytical demands made by individual project geologists and analytical costs are not charged to individual projects, nor included in the project budgets. Some control of this would appear to be appropriate, and the Committee recommends that the GSB examine the feasibility of instituting such a system.**

Library Facilities

C/R-12 **The Committee recommends that the space and staffing of the Calgary ISPG library be considered a bare minimum when attempting to satisfy the needs of the Ministry's scientists and their clientele. It further recommends that, of all the facilities and services to be located in the new building, the Library be accorded one of the top priorities.**

Morale and Personnel

Management

C/R-13 The Committee recommends an annual weekend retreat for the Chief Geologist, Section, and Subsection Managers to devise a more consultative and less competitive approach to Branch management and a team approach to decision-making in the critical years ahead.

Communication

C/R-14 The Committee recommends regular (monthly or bi-weekly) meetings of each section to disseminate information, air viewpoints, and call for suggestions. District Geologists should be invited to such meetings, possibly on a rotation basis or when the matters under discussion would benefit from the input of one or more of them. Written summaries of such meetings should be circulated throughout the GSB.

C/R-15 The Committee recommends regular meetings (e.g. brown bag lunch) of all Section and Unit Heads to provide cross-fertilization between sections and to provide feedback to the individual scientists. Such meetings should be scheduled to accommodate District Geologists if one or more of them is in town on other business.

C/R-16 The Committee recommends frequent, regular visits to District Offices by the Chief Geologist, Section and Unit Heads on a rotation basis, partly decided on topicality of interests.

C/R-17 Finally, the Committee suggests that management explore the feasibility of an exchange system that would require District Geologists to exchange posts at intervals or, alternatively, bring them back to headquarters for "sabbatical years."

Personnel Issues

C/R-18 The Committee recommends that the appropriate division of the Ministry immediately look into problems such as those pointed out above and, in the long-term, ensure that counselling, job descriptions, training, and performance evaluations be provided on a continuing basis.

Publications

Present Activities

C/R-19 The Committee commends GSB for its aggressive publication policy of the past few years and strongly recommends immediate staff increases in the Scientific Review Unit to cope with present and anticipated future demands.

CHAPTER III:FORECAST EVOLUTION OF GSB MANDATE TO 2000 AD

SUPPORT TO THE PROVINCIAL GOVERNMENT

Within Other Ministries

C/R-20 It is recommended that in order to provide an anticipated increased demand for services by several provincial ministries and to develop new productive opportunities, the staff and budget of the Geological Survey be increased immediately and progressively over the next decade.

C/R-21 It is specifically recommended that the Geological Survey develop a new program, in collaboration with other ministries, the universities, and the Royal British Columbia Museum, to interpret the geology and scenery of the Province in order to enhance the tourism industry and the public awareness of science and resource development.

SUPPORT TO THE MINERAL INDUSTRY

Metals

C/R-22 The conclusion is that, over the last decade, the exploration industry has failed to find economic metal deposits as quickly as British Columbia's metal reserves are being mined. At recent rates of production, the Province has enough reserves to last about 17 years for copper, 10 and 16 years for lead and zinc respectively, 18 years for molybdenum, 15 years for silver, and 14 years for gold (Table 7).

C/R-23 The Committee believes that the most attractive areas for application of new resources as they become available, from the point of view of facilitating the metal discovery process, are:

1. **enhancement of the scope of 1:50 000 geological mapping.**
2. **adaptation and development of Geographic Information System (GIS) techniques to geoscience information in close concert with federal government initiatives in this area, including provision of spectral data obtained from satellites or high altitude flights.**
3. **provision of more complete low-level airborne magnetic data, preferably in concert with federal agencies, and ground geophysical mapping in mining camps, to provide another important "layer" of data for inclusion in GIS-based products.**
4. **participation in joint research projects with industry, the GSC, and selected university departments to expedite new exploration technology transfer and to help overcome obstacles to pragmatic application of new technology in the future.**

Coal

C/R-24 It is recommended that:

1. **the main objective of the Coal Resources Unit be fundamental geologic investigations, where regional studies are prepared exclusive of coal licence and lease boundaries.**
2. **the feasibility of publishing provincial coal resource estimates and coal reserve estimates for approved coal mining projects on a regular basis be examined.**
3. **coal research and development work conducted by the GSB, and advice thereon to the Ministry be confined to coal geology/geophysics and coal quality. In particular, research into areas of surface geophysics which may aid surface mapping programs should be encouraged.**
4. **full-time professional staff be increased, if possible, to allow Coal Geologists to be based at offices in Fernie and Prince George.**

5. **cooperation with GSC (ISPG) scientists on computer modelling of coal deposits.**

Industrial Minerals

C/R-25 The Committee recommends that:

1. **the present funding level for the Industrial Minerals Unit is appropriate for industry needs, apart from an expanded commitment which is considered essential to support a significant growth anticipated in locating and developing aggregate sources required to meet requirements in the Lower Mainland and Greater Victoria area.**
2. **the Industrial Minerals Unit be included as a subunit of the Minerals Section in the proposed reorganization.**
3. **the Minerals Section also include an Aggregate Unit, requiring an additional Geologist, in the proposed re-organization.**
4. **future activities by the Industrial Minerals Unit be guided by economic constraints, with the proviso that commodities studied or being sought within the Province would be marketable.**
5. **all mapping done by the Regional Mapping Section involve close liaison with personnel in the Minerals Section with respect to recognition and definition of areas with potential for industrial minerals and structural materials, as well as for metals.**

COLLABORATION WITH FEDERAL GOVERNMENT AGENCIES

C/R-26 The Committee recommends that:

1. **the Geoscience Planning Committee, composed of four representatives from each agency, consist of senior and equivalent management personnel from each survey for maximum effectiveness.**
2. **new mechanisms be established immediately to implement closer and more frequent liaison and joint planning with the GSC in Sidney, Vancouver, Calgary, and Ottawa. These initiatives should look well beyond the customary year-to-year workplans and briefing sessions and should aim to establish a clear definition of mandates for each of the organizations, as well as five and ten-year reviews of intended programming, geared to the needs of western Canada. Regular updates and revisions should be a routine component of the annual estimates process for both organizations.**
3. **the Geoscience Planning Committee should identify and initiate appropriate joint projects with joint publications *(e.g.* Bowser Basin - *cf.* Peace River Arch Project in Alberta).**

COLLABORATION WITH UNIVERSITIES

C/R-27 The Committee recommends that the funding for university geoscience research provided by the GSB be doubled over the next three years.

COMMUNICATION WITH THE PUBLIC

GSB Activities

C/R-28 The Committee recommends that the Ministry encourage GSB scientists and technicians to participate in public awareness of science projects and that it accords some recognition of this participation in career advancement.

CHAPTER IV: ORGANIZATIONAL STRUCTURE

The first step taken by the Committee in proposing an effective new structure for the GSB was to address those activities that lay beyond the mandate deemed appropriate for the Survey during the next 10 years.

C/R-29 The Committee recommends that the GSB not embark upon a major program of exploration geophysics, because this lies principally within the domain of the private sector and the provincial government would be unlikely to bear the attendant high costs in the lean years ahead. However, the Committee does recommend the recruitment of a Geophysicist, as discussed in Chapter V.

C/R-30 The Committee recommends that the Ministry encourage completion of appropriate and modern airborne magnetic surveys (drape flying) in the Province by the federal government.

C/R-31 In the matter of offshore programming, the Committee recognizes a long-standing involvement in such activities by the GSC and again feels that the high costs of mounting such programs would be beyond the levels favoured by the provincial government. The Committee, nevertheless, recognizes the importance of maintaining a provincial presence and participation in areas that do, or might eventually, fall under provincial jurisdiction, especially in the nearshore, and recommends that the GSB join with the GSC in planning joint projects that would service future provincial needs.

C/R-32 GSB should continue the current practice of having its programs and program planning vetted through the Technical Liaison Committee. Not only does this process facilitate the timeliness and appropriateness of program delivery, but it also offsets to some degree the acute disadvantage of being isolated from the principal customer for most of the year. The Victoria location, close to the seat of government, may well prove to be advantageous in future years, given the ever-increasing need for interdepartmental exchanges regarding land-use management and environmental issues.

Secondly, the Committee looked at those operations that could be conducted in cooperation with geologists in other agencies.

C/R-33 The Committee strongly recommends prompt consolidation of all components of the B.C. Ministry of Energy, Mines and Petroleum Resources into a single modern facility in Victoria. The possibility of relocating the Analytical Sciences Laboratory to an alternative site (because of zoning restrictions) should be considered as a less desirable, yet nonetheless feasible and entirely workable option, providing it is given appropriate and modern facilities.

C/R-34 The recent transfer of the Land-use Unit to the Mineral Policy Branch is considered to be well directed and should permit this component of the Division to perform more effectively. In a like manner, the Committee also endorses the recent reactivation of the Division's Land-use Committee and expects recommendations from this group to place an increasing demand on the professional resources and insight resident in the GSB.

C/R-35 The Committee feels that there is no need for the GSB to expand its staff to include a Paleontological Specialist, since such skills are available in the GSC and universities and can be requested/contracted on an as-needed basis.

Thirdly, the Committee looked at the internal organization of the GSB and proposes the following.

C/R-36 The Committee recommends that management take immediate steps to redress the imbalance between professional and technical staff, particularly in the Scientific Review Unit, but not to the exclusion of additional secretarial support. It is recognized that considerable benefits accrue from having Senior Assistants assigned to projects on almost a one-on-one basis, but this is regarded as an ideal situation and should not be accepted as a substitute for technically proficient support personnel with skills and capabilities rarely possessed by graduate students specializing in geology.

C/R-37 The Committee recommends an alternative organizational structure (Table 18, p.83) comprising two principal sections, one encompassing Operations, the other Services. Units responsible for Branch coordination/administration and report and map production (SRO/Cartography) would also report directly to the Chief Geologist.

C/R-38 **On the operational side, the Committee recommends the retention of the existing units responsible for Regional Mapping and Mineral Deposit work, the latter being expanded to include industrial mineral activities and aggregate investigations. Regional Mapping is retained as a discrete entity, in recognition of the important and demanding role that this group must fulfill in making up the deficit of map coverage.**

C/R-39 **The Committee recommends establishment of a new Environmental Geology Unit. In addition to mapping the Province's surficial deposits (including those in the nearshore regions), the unit would give principal emphasis to mounting an inventory and conducting site-specific evaluations of geological hazards in B.C. It is recommended that the Ministry of Energy, Mines and Petroleum Resources approach the Ministry of Environment once again with the request that geological personnel in that Ministry be transferred to the GSB in order to consolidate provincial initiatives and expertise in this area of critical concern.**

C/R-40 **In the matter of geological hazards, the Committee is concerned about the distribution of and ad hoc manner in which studies have been conducted to date, and recommends that the Province develop a formal policy regarding the documentation, regulation, and future disposition of all affected areas. It is recommended that a multidisciplinary committee or task force be struck forthwith and given a mandate to develop a long-term program to identify and upgrade the documentation of all hazard-prone areas, and to develop guidelines restricting future development and outlining mitigative measures to be applied under the Province's Emergency Program. The GSC would continue, and possibly expand, its current longer term studies on mass movements, earthquake prediction, and volcanic eruptions. GSB contributions would be coordinated through the proposed Environmental Geology Unit.**

C/R-41 **The Coal Unit would comprise the fourth operational group; however, CoalFile would be moved to the Data Management Unit, along with MINFILE, assessment records, and the new GIS and data-processing components.**

C/R-42 **Since most of the work conducted by the Analytical Laboratory and Lapidarist is done in support of the operational components of the Branch, these functions have been identified as a separate unit, reporting directly to a Director who would deploy their efforts as needed.**

C/R-43 **The Committee recommends establishment of a separate Geochemistry and Geophysics Unit to act in an advisory and support capacity to the Branch's two main sections. The Unit's mandate would encompass both exploration and environmentally related studies, and a major function would be to assist coordination and targetting of future geochemical and geophysical surveys mounted in the Province by the GSC.**

C/R-44 **The Services Section would contain four units, in addition to the FAME program. The existing Mineral Inventory Unit would include all aspects of resource data collection and management (assessment reports, MINFILE, microfiche, mineral inventory, CoalFile) and would be given an expanded responsibility for the longer term phasing-in of new data-processing techniques and Geographic Information Systems.**

C/R-45 **The Committee recognizes District Geologists as the organization's outreach program. Accordingly, several changes are recommended to strengthen and consolidate this sector of the Branch. In the proposed organization chart (Table 18, p.83), the importance of the Vancouver Office is recognized through designation as a discrete unit. The key role that the Vancouver Office plays in interfacing with the main body of industry clients was stressed repeatedly during the review process, and it is incumbent upon the Ministry to give further thought to ways of expanding and enhancing the current level of services provided through the Office.**

C/R-46 **The Committee recommends that the Southwest Office be moved from Victoria to Nanaimo to give this component a clearer identity and more immediate involvement with clients on the Island. The Committee also recommends re-establishment of the Fernie Office and addition of support personnel to both the Smithers and Kamloops offices. One of the major complaints made to the Committee was the apparent absence of guidelines establishing goals, standards, and operational procedures for the Regional Offices. It is, therefore, recommended that the District and Vancouver**

offices collaborate to develop a Manual of Procedures, to be submitted to the Chief Geologist for endorsement. Following recommendations from industry, each of the District Offices should also plan to establish nearby core facilities following development of a coordinated plan to provide assessment credits for delivery by industry of representative cores, but these facilities should be utilitarian structures, functional but inexpensive. Furthermore, it is recommended that the District Geologists generate a yearly summary of activities in their respective regions, to be released in a single volume similar to that published in Ontario and Quebec.

C/R-47 **It is also proposed that management and operational personnel based in Victoria increase the frequency of visits to the District Offices, both to maintain personal contact with individuals in the regions, and to coordinate proactive outputs of the District Geologists with those of the Regional Mapping and Minerals units.**

C/R-48 **On numerous occasions during the review, the acute shortfall in communicational "outreach" activities was brought to the Committee's attention. Accordingly, the Committee recommends that the Branch establish a Public Information Unit, whose responsibility would be to foster a greater awareness of the importance of the mineral sector and the Ministry's programs to society at large. Education programs for the public and the schools should be developed in cooperation with the ministries of Education and Tourism, and wider dissemination of publications should be encouraged as a supplement to the recent initiatives through Crown Publications. Finally, the importance of having a well stocked and adequately staffed technical library should be addressed, by having this function incorporated as a key component of the Public Information Unit.**

C/R-49 **The Committee recognizes an acute deficiency in personnel support services and recommends that the Ministry's senior management take immediate steps to see that proper counselling and direction is provided on an ongoing basis for the development of such staple managerial tools as job descriptions, regular performance evaluations, career pathing, and on-the-job training. Serious concerns were raised by several groups regarding perceived inequalities and inappropriate use of classifications for support staff within the organization, and the Committee also requests that these be investigated. Finally, difficulties were reported from some staff who appear to be caught up in jurisdictional disputes between the union and professional engineering organizations. This should also be attended to, in the best interest of getting the job done with a minimum of unnecessary handicaps.**

CHAPTER V: DISTRIBUTION OF RESOURCES

FUTURE RESOURCE NEEDS TO MEET PROPOSED MANDATE

Unit Heads and Project Leaders

C/R-50 In addition to recommending additional FTEs, the Committee proposes that appointment of Unit Heads be on a renewable term basis, subject to periodic preview. Unit Heads and project leaders should be compensated at an appropriate level in recognition of their additional responsibilities.

Regional Mapping

C/R-51 The present level of regional geological mapping is not considered adequate to meet the envisaged mapping demands from many client groups in the Province and to continue stimulating exploration activity. A more acceptable level of activity would be ten map sheets per year, requiring an additional nine FTE positions and an increase in budget of at least $1 million.

Coal

C/R-52 Notwithstanding the current outlook, the Committee recommends the addition of a Coal Geologist at both Fernie and Prince George and, in addition, a Technician at Victoria to supervise reference file studies.

Analytical Sciences Laboratory

C/R-53 The Committee has considered the various options available to the GSB with respect to its current laboratory and its future needs and has the following recommendations:

1. **The facility should be maintained with updated equipment to replace obsolete instrumentation, as required in a new facility.**
2. **Assuming that zoning restrictions will probably preclude inclusion of a new laboratory in a proposed new headquarters for the GSB in the downtown portion of Victoria, every effort should be made to provide good two-way data transmission.**
3. **The new laboratory should include provision for storage of geological rock specimens, in addition to space in the main office building for rock specimens essential for study during preparation of current reports.**
4. **To provide for analytical and scheduling control, geologists should budget for their requirements on an annual basis.**
5. **An X-ray diffraction unit is considered an essential requirement.**

Geochemistry and Geophysics

C/R-54 The Committee recommends the creation of a Geochemistry and Geophysics Unit, reporting to the Director of Operations. The Geochemistry sector of the Unit would include the Regional Geochemical Survey in the present organization at its current operating level. The Unit would also include a geophysicist to be recruited, who would provide the Branch with much-needed geophysics expertise in the following areas:

1. **interpretation of available geophysical maps and data to augment the geological database in areas of extensive drift cover.**
2. **collation of available industry geophysical data.**
3. **vetting geophysical reports submitted for assessment work purposes.**

4. interfacing with universities and the mineral industry in geophysical research.

Resource Data, MINFILE, and GIS Data Processing

C/R-55 The Committee recommends the addition of two FTEs to the Resource Data Unit with provision for more up-to-date hardware.

District and Vancouver Offices

C/R-56 The Committee supports an expanded role by the Branch at the District Offices as described under organizational changes. Among specific recommendations affecting resources are:

1. **The relatively autonomous position of the District geologists should be recognized in their selection and rank as the image they project will reflect strongly on the Branch. They must be knowledgeable and well informed on most aspects of the Branch's facilities, activities, products and capabilities. Their compensation level should reflect this responsibility.**
2. **The Vancouver Office is a special situation. Much as industry would wish to see the GSB moved to Vancouver, this is considered impractical by the Committee, mostly from a financial perspective, but also partly because of the growing liaison which is being required with government as a GSB client. As an alternative, the Committee strongly recommends expansion of the Vancouver Office and its facilities to provide adequate service to the public. The current staff of three should be increased by two FTEs.**

   With the pending move of the Vancouver Office from its current location at Robson Square, the Committee recommends that consideration be given to a shared facility with the Geological Survey of Canada in the downtown core of Vancouver.
3. **The current activity at the Smithers and Kamloops offices justifies the addition of an Assistant District Geologist, in addition to a full-time Secretary at each location.**
4. **Consideration should be given to moving the Southwest (Victoria) Office to Nanaimo as recommended by the current District Geologist, in order to provide a more central location for an office representing Vancouver Island.**

C/R-57 Based on questionnaire returns, the response for GSB-controlled core storage facilities is not considered sufficiently supportive to provide for this as a new activity. As an alternative, the Committee proposes that the Ministry (MEMPR) consider providing assessment credits to property owners for delivering representative suites of property drill-cores to the District Offices under a coordinated plan to be developed with industry input.

Outreach

C/R-58 The Committee recommends formation of a new unit required to coordinate promotion of geoscience to the public sector. This Public Information Unit would include responsibility for publication sales, education, library, and tourism subunits. Additional staff requirements envisaged are a Senior Information Officer, an Assistant, and a full-time Secretary.

FAME

C/R-59 Under the proposed re-organization, the FAME Program of prospector assistance should be maintained at the current annual funding level of $500 000, with provision for annual increases to offset inflation, as with the A-Base budget, and with individual grants to be increased on the same basis, but with an initial increase from $7 500 to $10 000. The FAME Program should continue under contract, based in Victoria, with important input by District Geologists, and reporting to the Senior Manager, Regional and District Offices.

Scientific Review, Cartography

C/R-60 The current staff in this Unit (Scientific Review/Cartography) are incapable, with the current staff and resources, of providing the required output and the Committee recommends addition of three Cartographers and one Editor.

Branch Coordination, Administration

C/R-61 With the maximum reorganization and budget level recommended by the Committee, provision should be made for the addition of two support secretarial FTEs.

LEVEL AND DISTRIBUTION OF FUTURE RESOURCES

C/R-62 After assessing all the pressing requirements and immediate needs, yet being reminded of the cautionary comments of the Assistant Deputy Minister, the Committee recommends that the GSB 1990-91 A-Base budget be raised to $8 million (in 1989-90 dollars).

C/R-63 The Committee recommends that the Ministry seriously consider the full merits of investing additional resources in the GSB to ensure the long-term health of the mineral exploration industry, for environmental protection, and for an enhanced tourism industry. The Committee considers that an appropriate annual resource level for the GSB is 132 FTEs and an A-Base budget of $11.2 million (in 1989-90 dollars).

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