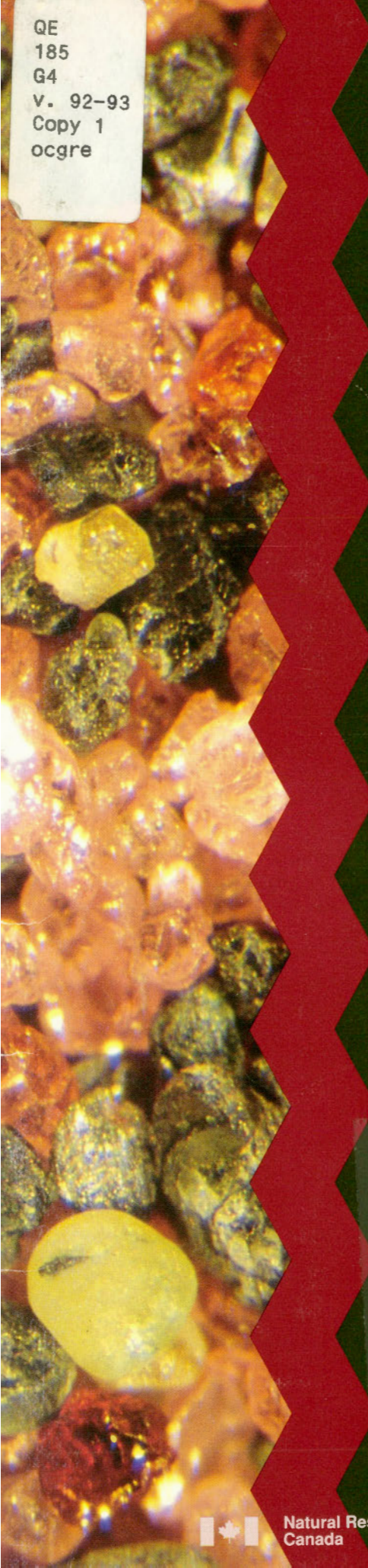


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Science *for* Today

Geological Survey of Canada

1992 - 1993

RESERVE/RÉSERVÉ

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POUR LA CONSULTATION SUR PLACE



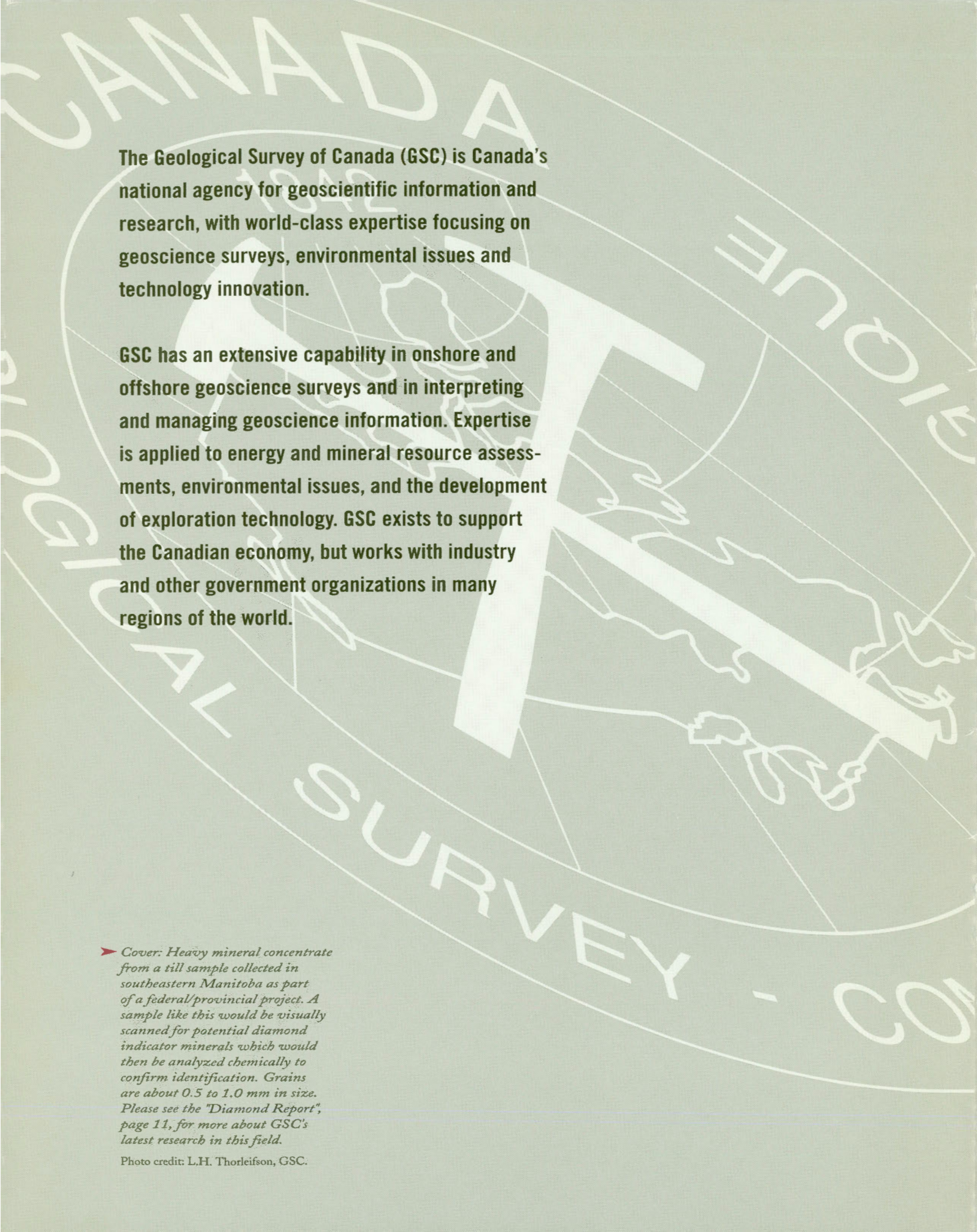
Natural Resources
Canada

Ressources naturelles
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The Geological Survey of Canada (GSC) is Canada's national agency for geoscientific information and research, with world-class expertise focusing on geoscience surveys, environmental issues and technology innovation.

GSC has an extensive capability in onshore and offshore geoscience surveys and in interpreting and managing geoscience information. Expertise is applied to energy and mineral resource assessments, environmental issues, and the development of exploration technology. GSC exists to support the Canadian economy, but works with industry and other government organizations in many regions of the world.

➤ *Cover: Heavy mineral concentrate from a till sample collected in southeastern Manitoba as part of a federal/provincial project. A sample like this would be visually scanned for potential diamond indicator minerals which would then be analyzed chemically to confirm identification. Grains are about 0.5 to 1.0 mm in size. Please see the "Diamond Report", page 11, for more about GSC's latest research in this field.*

Photo credit: L.H. Thorleifson, GSC.

*Geological Survey of Canada
1992 – 1993*

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GEOLOGICAL SURVEY OF CANADA
COMMISSION GEOLOGIQUE DU CANADA

MAR 22 1994

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SCIENCE FOR TODAY

*Message from the Assistant Deputy Minister
of the Geological Survey of Canada*

SCIENCE FOR TODAY

Helping Canada's resource industries succeed in today's highly competitive global markets is one of the most important services of the Geological Survey of Canada. We do so by providing world-class expertise, research and maps, technological innovation and the extensive knowledge infrastructure that Canadian companies require to achieve their goals.

To ensure that the Survey is truly the strong partner needed by industry and governments, we are committed to providing top quality science with a strong economic or environmental relevance to today's world. An excellent economic example is the NATMAP Shield Margin project that pulls together expertise from GSC, the Manitoba and Saskatchewan geological surveys, universities and industry in a program of focused cooperative research – over 180 exploration geologists gathered in Flin Flon recently to hear the new geological ideas for base metal exploration in northern Manitoba that resulted from this work.

Similarly, our new hydrogeology program is an initiative with direct environmental impact. The goal is to achieve a thorough enough understanding of groundwater in targeted areas to allow municipalities and others to make informed landuse decisions that will help protect these precious resources. Planning for this program is based on strong input from provincial agencies and from regional municipalities of such densely populated areas as Greater Metropolitan Toronto and the lower Fraser Valley in British Columbia. Results of this program will be the key to rational groundwater management for present and future inhabitants of these regions.

We are also dedicated to responding more quickly to the needs of our clients, particularly in the area of regional mapping. Computer-supported geological mapping has become the norm at the Survey – for example, in just the past three years, our regional mapping group has increased the use of computers in fieldwork from a limited pilot evaluation in 1990 to 85% of their field parties this year. By digitizing data in the field and developing a sophisticated computerized cartographic capability, we can deliver information much faster to clients who need it.

We are also working to make the Survey's expertise more accessible to potential partners, for example:

- Our Industrial Partners Program (IPP) completed a very successful first year. Sixteen companies partnered with GSC scientists to develop technology or to work on specific geoscientific problems of mutual interest. Based on the strong response and feedback to the program, we increased its funding threefold to \$1.5 million for its second year of operation. More about IPP can be found on page 7.
- We also opened a Business Development Office with a mandate to stimulate new markets for GSC products and expertise. An important function will be using GSC's international science contacts to find and develop commercial opportunities for Canadian resource and service industries. For example, GSC scientists working under a Canada-Russia exchange program have already identified several promising business opportunities in Russia that have excellent tie-ins with Canadian companies; these are being pursued.



R. Lowe

Computers are revolutionizing geological fieldwork, even in the most remote locations.

Finally, we have worked hard over the past year with our provincial and territorial government counterparts to develop new coordinating mechanisms that ensure we optimize resources and eliminate any possible overlap in our research programs. Cooperating for cost efficiency and maximum relevance of science will guide future joint planning.

In reading the rest of this report, my hope is that you will see a connection of mutual value and benefit that your organization could make with the Survey. To stimulate ideas, what follows is an overview of the many types of successful research partnerships we have with industry, other research organizations, other government agencies at all levels, and universities.

I encourage you to contact us to discuss how the Geological Survey of Canada may be able to meet your geoscience information needs.

Elkanah A. Babcock
*Assistant Deputy Minister
Geological Survey of Canada*

GEOSCIENCE SURVEYS

Successful Research Partnerships: Some Examples from 1992-93

GEOSCIENCE SURVEYS

Geoscience surveys, the backbone of our programs, are increasingly multidisciplinary — in scope and collaborative in nature. Some major goals are to expand the techniques and parameters of resource exploration and to find new environmental applications for existing data.

Bedrock mapping and exploration

Bedrock mapping, a basic component of GSC's research program, has a direct link to stimulating exploration activity or extending the life of existing mines. Exciting prospects identified during the year include:

- In Ontario's Manitouwadge greenstone belt, collaboration with industry is providing new information that could be useful in the search for new reserves, thus extending the economic basis of the Manitouwadge community. In collaboration with the Ontario Geological Survey, detailed mapping in the Swayze greenstone belt, which has strong economic potential, will provide the important framework necessary for further exploration.

- In New Brunswick, rocks with high mineral potential were recognized continuing into southwest Newfoundland, with implications for potential exploration targets.
- A joint mapping initiative with industry and Mineral Development Agreement support in the Gibson Lake area, NWT (an extension of the economically important Rankin-Ennadai greenstone belt), identified a metasedimentary belt with base metal potential.
- Collaborative mapping with the Newfoundland Department of Mines and Energy documented the previously unmapped northern Torngat Orogen of Labrador, and work in the Snowbird tectonic suture zone showed that the longest gravity anomaly in the Canadian Shield is a major Archean tectonic boundary transecting the Shield from northern Saskatchewan into central District of Keewatin.

Aeromagnetic Survey of Southern Alberta Completed

GSC and partners from the oil and mineral exploration industry completed a high resolution total field aeromagnetic survey of Southern Alberta. This three-year project was carried out under annual cost-sharing agreements that gave industry partners exclusive rights to the data for periods ranging from three to five years

before general release by the GSC. The first survey, in 1990-91, attracted eight industry partners (Amerada Hess Canada, Amoco Canada, Cameco Corp., Canadian Hunter, Esso Resources, Mobil Oil, Pan Canadian Petroleum and Petro-Canada); the second, 1991-92, involved five partners (Amoco Canada, Esso Resources, Mobil Oil, Pan Canadian Petroleum and Shell Canada); and in the final year, 1992-93, there were four (Amoco Canada, Esso Resources, Mobil Oil and Pan Canadian Petroleum). In total, industry contributed \$850,000 or 36% of the survey contract costs. The survey greatly accelerated the GSC's national program to map the magnetic field – 244,720 line km of new high quality data were added to the National Aeromagnetic Data Base, representing virtually complete coverage from the Alberta-Saskatchewan border (110°W) to the Okanagan Valley (119°W). The survey results also contributed to the search for diamondiferous kimberlite swarms, to LITHOPROBE investigations and to geological studies of the Precambrian basement and the relationship between basement structure and sediments in the oil- and gas-bearing Western Canada Sedimentary Basin.

Fraser Delta

The second phase of a marine program to study B.C.'s Fraser Delta was completed this year. The objective of this large-scale multi-disciplinary project, which pulls together expertise from GSC, B.C. Hydro, Terra Surveys and five universities, was to collect data needed for submarine slide risk analysis and mitigation for this densely populated and developed area. Data collected will enable assessments of the potential for liquefaction-induced sediment failure such as could result from an earthquake. The effects of storm waves on the seabed were also monitored off Sand Head's Lighthouse and confirmed the dynamic nature of the delta front – during the monitoring period, a submarine landslide cut back into the delta front to within about 30 m of the lighthouse. Information collected by current meters about the effects of tidal waves on the seafloor will have direct application to the maintenance of an electrical transmission cable corridor. Onshore in the Fraser Delta, a program of geological drilling and geophysical surface and borehole measurements is continuing to assess the susceptibility of thick surficial sediments for ground motion amplification and liquefaction from earthquake shaking.



Natural Resources Canada

URBAN GEOSCIENCE DATABASE FOR SOUTHERN B.C.

Consultation with engineers from the Greater Vancouver Regional District, B.C. Hydro, the municipalities of Richmond and Delta, the B.C. Department of Highways, local universities and three geotechnical consulting firms resulted in the decision to build on the urban geoscience database started by GSC in the early 1970s. Strong input from all potential users is ensuring that the database is relevant to the planning and development needs of today's complex urban settings. Following a pilot project covering part of the region, a new "user friendly" format was developed and released.



NATMAP Shield Margin project collaborators from GSC, the University of New Brunswick and the Manitoba Geological Survey on a field trip, Athapapuskow Lake, Manitoba, June 1992.

NATMAP AIDS MINERAL EXPLORATION

GSC's national mapping initiative, NATMAP, spearheaded successful collaborative studies this year that brought together experts from provincial and territorial governments, industry, LITHOPROBE and universities.

In the Northwest Territories, significant industry expansion and evaluation of high exploration potential areas such as Lac de Gras and High Lake were a direct result of the increased geological mapping coverage for the scientifically and economically important Slave Structural Province.

In northern Manitoba and Saskatchewan, the NATMAP Shield Margin project made major contributions to the national geoscience database with the timely release of compilations integrating bedrock mapping data, drill core, and magnetic, gravity, isotopic, metamorphic and rock property studies. New interpretations of the sub-Paleozoic geology in the form of three 1:250 000 compilation maps and the release of a CD-ROM version, generated much interest and have stimulated exploration activity.

Advising on Seafloor Telecommunications Cable Route

Under contract to Teleglobe Canada, a Canadian industry consortium, led by McElhanney Geosurveys Ltd., undertook a marine survey of the Scotian Shelf with GSC and the Canadian Hydrographic Service to determine a suitable route for the seafloor placement of Teleglobe's new fibre-optic cable between Nova Scotia and Europe. The project provided an excellent opportunity for the government partners to test out new marine equipment (SWATH bathymetric and side-scan sonar systems) and for the industry groups involved to learn the practical applications of these new technologies. The survey also enabled GSC scientists to add new information to our regional knowledge base.



GSC and the Quebec Department of Energy and Resources (MERQ) continued to carry out geological mapping in the central part of the Grenville geological province. Of particular note, the work identified highly metamorphosed volcanic sedimentary sequences in Quebec's St. Maurice area that led to an extension of the Mautoban Group, significantly increasing the known area of economic interest.

New NATMAP Project looks at Groundwater

Quaternary geology and environmental issues in the Prairies are the focus of a new project with the Manitoba Department of Energy and Mines and the Manitoba Water Resources Branch. Two field seasons of computer-based

mapping have been completed in two southern Manitoba areas which extend into adjacent Saskatchewan and Ontario. Supplementing the mapping are new drilling and subsurface data compilation which will address urgent requirements in the field of groundwater management. ■

INDUSTRIAL PARTNERS PROGRAM (IPP)

APPLYING OUR SKILLS TO YOUR PROBLEMS

Through this new program, the Geological Survey of Canada puts its scientific and technological excellence to work on the specific problems of Canadian industry partners.

Costs are shared, and both the industry partners and the Survey contribute expertise. It's a win-win situation with both partners benefiting from the research.

Some examples from our IPP project list:

- ◆ Environmental impact of coal bed methane development
- ◆ Towards development of a 3-D seismic exploration technology
- ◆ A study of peat bogs as natural repositories for airborne metal pollutants
- ◆ A new real-time monitoring of sediment scour
- ◆ Stable isotope geochemistry and alteration at the Nugget Pond Gold Deposit, Baie Verte, Newfoundland
- ◆ Petroleum geochemistry of the Canadian Arctic
- ◆ Unmanned weather stations at remote sites

For further information, please contact:

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(613) 947-1189
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(613) 996-9670



MINERALS

The Geological Survey of Canada's geoscience research has made it a world leader in the development of new concepts and technology for Canada's mineral exploration industry. We provide baseline knowledge of the distribution and origin of Canada's mineral resources, mineralogical and chemical expertise and services, and assessments of domestic and foreign resource potential.

First Mineral Development Agreement for Alberta

Following extensive consultation, Alberta's first MDA (1992-95) began in time for a full slate of field programs in 1992. Lead agencies in the work are GSC and the Alberta Geological Survey: in 1992-93, three private sector MDA-funded projects also were undertaken with funding from the Alberta side of the MDA. GSC Alberta MDA studies include re-investigation of the exposed portion

of the Precambrian Shield of northeastern Alberta in the light of modern concepts of tectonic evolution and mineral deposit genesis; investigation of the mineral potential of the Crowsnest volcanics of southwestern Alberta; mineralogical and geochemical of the potential for diamond occurrences in Alberta, much of which is under lease for diamond exploration; orientation studies designed to assess potential gold and platinum metal occurrences in gravels; and studies of calcium and magnesium-rich brines for their economic potential. The first products of the GSC Alberta MDA research, including two 1:50 000 scale open file, full colour geological maps of northeastern Alberta (acquired and produced digitally), appeared in early 1993.

New Mineral Development Work in B.C.

The B.C. Geological Survey, mineral exploration industry and GSC developed and began work this year on a collaborative program of geoscience studies under the B.C. Mineral Development Agreement. Work includes regional projects in

the Quesnel Trough and Chilcotin Region to update outmoded geoscience databases for these areas. Another project will establish a GIS-based library of digital information at 1:1 000 000 and 1:250 000 scale for British Columbia. This is a strongly supported program with direct relevance to the needs of the exploration community.

Iskut Project

Another multidisciplinary project with active input from the B.C. mineral exploration industry also had a strong year. The project, which pulls together geologists from GSC, the B.C. Geological Survey and the University of British Columbia, includes regional geological mapping of the Iskut quadrangle, integrated with studies of the stratigraphy, the metallogeny, the biostratigraphy, and the geologic evolution of the region. ■



Natural Resources Canada

FUTURE EXPLORATION OF THE SUDBURY STRUCTURE

The investigative study of the mineral-rich Sudbury structure is an excellent example of integrated multidisciplinary studies, involving the GSC, LITHOPROBE, industry, universities and the Ontario Geological Survey. High resolution reflection seismic profiling, aided by physical rock property and borehole geophysical studies, electromagnetic profiling, modeling of potential field data and structural geology data, form the first detailed picture of the highly asymmetric deep geometry of the Sudbury Structure. Though the area has been mined for more than 100 years, the study provides the first geometrical constraints for future deep exploration of the Sudbury structure and is directly relevant to the long-term exploration of its vast mineral deposits. In particular, a major consequence of the newly defined zones is that some important ore-bearing horizons on the margin of the igneous complex may be repeated and explored at depth.

The GEOPHYSICAL DATA CENTRE

GSC's Geophysical Data Centre provides user access to the National Aeromagnetic and Gravity Databases and supplies digital data, data processing and plotting services.

The National Aeromagnetic Database contains more than 11,000,000 line kilometres of regional total field survey data and high resolution detailed surveys. The aeromagnetic data have been levelled to a common datum and levelled profile and gridded data are now available for eight provinces.

The National Gravity Database contains 650,000 gravity observations and 5,500 gravity control stations. Data are provided in a variety of formats in consultation with clients.

For more information, call:

(613) 995-5326

FAX (613) 992-2787

or write to:

Geophysical Data Centre
Geological Survey of Canada
1 Observatory Crescent
Ottawa, Ontario
K1A 0Y3



D. Ames, GSC



B. Turner, GSC

*Examining drill core,
Sullivan Mine core shed.*

Ruttan Mine, Manitoba.

BASE METALS INITIATIVE

In response to the significant decrease in the country's reserves of base metals over the past decade, GSC has initiated studies of major massive sulphide deposits in Canada to promote new ore discoveries. GSC scientists are working in close collaboration with company geologists to enhance the understanding of the Sullivan (Cominco Ltd.), Kidd Creek (Falconbridge Ltd.) and Brunswick No. 12 (Brunswick Mining and Smelting) deposits. Detailed mapping, mineralogical and chemical studies are providing new exploration guidelines and, at the same time, are giving new insights into ore-forming processes. In addition, GSC's first EXTECH project is nearing completion in the Snow Lake and Ruttan areas of Manitoba. This multidisciplinary project, undertaken jointly with the Manitoba Department of Mines and Energy and with exploration companies active in the area, has led to new geological interpretations as well as innovative approaches to geochemical and geophysical exploration and the application of expert systems.

the DIAMOND REPORT



G.A. Gauret, GSC Jr.

Soil sampling as part of the Prairie Indicator Mineral Study, southwestern Saskatchewan.

The Geological Survey of Canada, as part of its mandate to provide the fundamental knowledge infrastructure of Canada's geology, has over the years published information with direct application to Canada's diamond exploration industry. It has also provided on-demand expertise to exploration companies seeking diamonds. What follows is a summary of the latest diamond-related work at the Survey.

The Prairie Indicator Mineral Study Kimberlites contain significant quantities of indicator heavy minerals such as garnet that have been glacially dispersed and can now be found in tills and soils. Tracing the source of these indicator minerals can help in the search for diamonds. Towards this end, GSC recently completed a prairie-wide multidisciplinary till and soil survey of 850,000 km² of central North America in cooperation with the Alberta and Saskatchewan Research Councils, the Manitoba Department of Energy and Mines and the U.S. Geological Survey. The survey will help define target regions for kimberlite exploration and provide geochemical information relevant to health hazard and agricultural studies. Results of the survey have started to be released as GSC Open Files: Prairie Kimberlite Study "Soil and Till Geochemistry and Mineralogy, Low Density Orientation Survey Traverses, Winnipeg-Calgary-Edmonton-Winnipeg" (OF:2685) and "Till Matrix Geochemistry and Preliminary Indicator Mineral Data" (OF:2475).

New Mapping and Sampling Programs Target Diamonds

Increased interest in diamond exploration in the Canadian Shield has led to important collaborative and jointly funded mapping and sampling investigations of several key areas in the Northwest Territories, Saskatchewan, Alberta and Ontario.

For example, in the Lac de Gras – Aylmer Lakes areas of the Northwest Territories, detailed mapping investigates the relationship between bedrock, surficial deposits, geological structures and the spatial distribution of kimberlites, to aid in defining new areas of high kimberlite potential. Mapping in west-central Churchill Province (1991) near Dubawnt Lake, NWT, and subsequent publications released this year, led to a microdiamond find by industry in a lamproite breccia.

Claim-staking in Beardmore-Geraldton A surficial geological survey carried out under the Canada-Ontario Mineral Development Agreement (I) of the Beardmore-Geraldton area generated a series of joint GSC-Ontario Geological Survey reports related primarily to gold in till. From late 1987 on, the reports dealing with gold grain counts and other data have stimulated gold staking and exploration activity in the area. Now this information is influencing diamond exploration needs unanticipated even a few years ago – in 1993 a large area near Beardmore, Ontario, was staked strictly on the basis of kimberlite indicator mineral results of this survey. The latest report published from this survey is "Quaternary Geology and Drift Prospecting, Beardmore-Geraldton area, Ontario" by L.H. Thorleifson and F.J. Kristjansson, 146 pages with map (GSC Memoir 435). \$23 in Canada, \$29.90 outside Canada. See page 27 for ordering information. ♦

ENERGY

The energy supplies of a developed country are one of its most precious national resources and are absolutely vital to its future. The Geological Survey of Canada directs its energy-related research towards providing the knowledge infrastructure necessary for the long-term management of these resources and for exploration and development.

Hydrocarbon Charge Modelling

A multidisciplinary program to develop hydrocarbon charge models of the Jeanne d'Arc and Sable east coast basins continued to receive strong support from industry, with eight oil companies (Amoco, Chevron, Husky, Lasmco, Mobil, Norcen, Petro-Canada and Shell) and Dalhousie University (through NSERC) contributing a mix of funding, data and or equipment/expertise. The program's principal science objective is to quantify the complex dynamics that exist between physical, chemical and geological processes in controlling the distribution and

volume of hydrocarbons in Canada's east coast basins. The principal business objective is to translate these science activities into tools that, for the exploration and production professional, will provide a quantitative basis for ranking drilling prospects, will reduce finding and production costs, and will thus increase the region's competitiveness.

Deep Seismic Surveys in Alberta

During the summer of 1992 the first of three LITHOPROBE-sponsored deep seismic reflection surveys across Alberta was completed, with five industry participants (Gulf Canada, Norcen, PanCanadian, Renaissance Energy and Saskoil) contributing \$150,000. Some 512 km of seismic reflection data were collected over major basement and Phanerozoic targets in central Alberta. The quality of the reflection data for both shallow and deep targets is outstanding. Results of this first transect were presented in March 1993 at the third annual Alberta Basement Transect workshop at which 75% of the participants were from the petroleum and mining industries.

New Frontiers for Exploration in Western Canada

A new project under GSC's Industrial Partners Program to study the Lower Paleozoic strata in the subsurface of the Western Canada Sedimentary Basin attracted 13 oil companies, including major and medium-size exploration companies and service companies. Groundwork for the project (initial research, design) was completed in 1992-93 establishing the wellspring for the new consortium. A multidisciplinary analysis of existing cores and cuttings, assisted by re-examination of existing seismic records and the new LITHOPROBE Alberta Basement Transect, will result in the establishment of a new stratigraphic framework and a diagenetic and thermal history for these rocks. The results may open up a new frontier for hydrocarbon exploration in the Western Canada Sedimentary Basin.



Natural Resources Canada

Borehole Stability Problems

GSC worked with LASMO (Nova Scotia) Ltd. to resolve borehole stability problems encountered in their offshore production drilling program in the Panuke oil field. GSC's previous study of the in situ stress regime of the Scotian Shelf proved invaluable in diagnosing the probable causes of the borehole wall caving that was causing concern to LASMO production engineers. ■



Three dimensional view of a coal bed methane drilling target located over a high on the underlying Paleozoic unconformity surface, derived from a computer model based on 500 boreholes. The Medicine River Coal Zone in this part of central Alberta locally reaches 14 m in thickness. The 45 by 50 km area studied may contain in situ methane resources of up to 9 Tcf.

The GSC's coal program delivers information on the economic, technological and environmental characteristics of Canada's coal resources with the twin objectives of maximizing the competitiveness of Canada's coal mining sector in domestic and international markets, and minimizing the social and environmental impact of mining and coal utilization.

The program's success rests heavily on active industry participation: the coal mining sector contributes exploration and analytical information that would otherwise be very costly to obtain, and the coal utilization sector participates through fully cost-recovered and jointly funded projects. Provincial agencies with legislative control over coal resources also participate through cost-shared Mineral Development Agreements and direct contributions.

Activities include resource assessment using industry data and standardized computer-based technologies developed by GSC; characterization of coal utilization potential using petrographic and chemical methods; and the assessment of environmentally hazardous trace elements released by coal combustion.

All activities are reviewed annually by an Independent Review Committee comprising 15 representatives from industry, provincial regulatory and geoscience agencies, universities and the Coal Association of Canada. Products resulting from the program in 1992-93 include:

Computer models and resource assessments for southern Saskatchewan (funded by the Canada/Saskatchewan Mineral Development Agreement) Detailed economic and geological

assessments were provided to the Saskatchewan Department of Energy and Mines. This group must ensure that coal resources in provincial coalfields are adequate to serve existing thermal generating capacity (70% of Saskatchewan's electricity) and that future mining optimizes coal recovery in order to conserve these non-renewable resources.

Computer models for the Sydney and Pictou Coalfields and development of resource assessments for the Foord Seam, Nova Scotia (jointly funded with the N.S. Department of Natural Resources) These models were used to assess conventional underground mineable coal resources and to create drill target selection maps for coalbed methane exploration planned for 1994-95.

A national study of in situ trace element concentrations in potential coal feedstocks This study provides the basis for a co-funded project (including several major coal utilization companies) to examine the dispersion of potentially hazardous trace elements into the environment as a result of coal combustion.

The potential of coalbed methane to contribute to Canada's energy future This assessment was based on analyzing coals obtained from industry drilling programs for coalbed methane potential and provided industry with optimal drilling targets utilizing GSC's computer-modelling technologies on a cost-recovery basis. ●

WORKING

with the Geological Survey of Canada



- *Is there geoscientific research or expert advice that would help you meet your organization's objectives?*
- *Would you like to learn new ways of applying geoscience data to your field of interest?*
- *Are you interested in developing prototype exploration technologies?*

If your answer is YES to any of these questions, the Geological Survey of Canada would be interested in talking with you.

We want to match our world-class expertise in geoscience surveys, information management and dissemination, and technology development to your needs.

We can work directly with you or help match your needs to a wide range of suppliers in the Canadian geoscience service industry and research community. Our excellent links with industry, government and research groups around the world can plug you into the global scientific network.

Those wishing to work with the Survey or who would like an assessment of a project should contact:

Dr. David Harry
Business Development Office
Geological Survey of Canada
601 Booth Street
Ottawa, Ontario
Canada K1A 0E8

Telephone: (613) 947-1189

Fax: (613) 996-9670



ENVIRONMENT

Geoscience data and methods provide a fundamental baseline for global climate change studies and are vital to local issues of land stability, toxic waste disposal and polluted water and air. They form the basis for rational decisions on competing land uses.

Emergency Response for Volcanic Eruptions

Eruptions of Mount Spurr, near Anchorage, Alaska, in June, August and September 1992 provided an excellent opportunity to test the emergency response plan for volcanic eruptions developed by GSC, the Atmospheric Environment Service, Transport Canada, Emergency Preparedness Canada, RCMP, provincial emergency program, and the Yukon Emergency Measures Organization. Ash from volcanic eruptions can have a crippling effect on an airplane's engine with consequences ranging from the tragic in the event of a crash, to the costly – airplanes flying within 100 km of an ash cloud released by a volcano would require a jet engine overhaul costing about

\$1,000,000. All emergency response organizations involved in the exercise were kept informed as the volcano continued erupting, and warnings to airlines operating in the affected zone were continuously updated.

Tsunamis Provide Evidence for B.C. Earthquake

Field investigations on western Vancouver Island provided evidence for a tsunami triggered by a great earthquake on the Cascadia subduction zone about 300 years ago. The tsunami deposited a sheet of sand in tidal marshes at Tofino, Ucluelet, and Port Alberni. Older sand sheets record other tsunamis in the North Pacific Ocean, and a chronology of these tsunamis has been constructed through radiocarbon dating. Information on earthquake hazards allows governments to put in place appropriate emergency preparedness procedures and to revise building codes to minimize earthquake and tsunami damage. This GSC-led project brings together staff of Simon Fraser University, the B.C. Geological Survey, Coastal Geoscience Research Corporation, MacLeod Geotechnical, Klohn Leonoff and BRAQ-Stratigraphie.

Estimating Earthquake Hazard in Southwest B.C.

Also in support of understanding earthquake hazard in British Columbia, GSC working with the Geodetic Survey of Canada and the U.S. Geological Survey completed a multi-year GPS resurvey of the expanded crustal strain monitoring network across the Juan de Fuca Strait. This project was designed to resolve spatial and temporal variations in the deformation rates and provide estimates of the likelihood of a great earthquake occurring in southwest B.C. Complementing this work, was a seafloor study that tracked the present-day motion of the Juan de Fuca Plate and measured peak strain rates at the North American Plate margin. Both are key factors in estimates of seismic risk for southwest British Columbia.

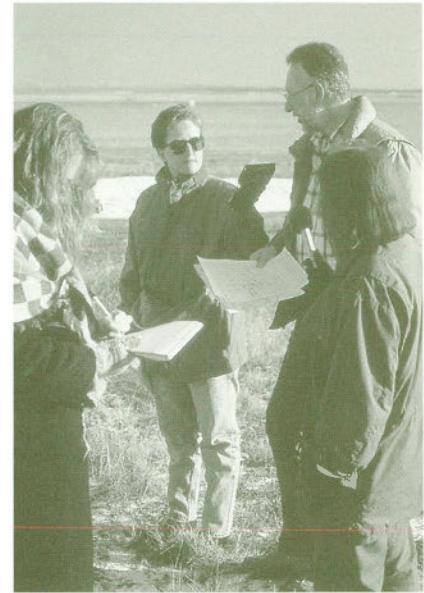
Groundwater Study to Lead to Better Clean-Up Methods

GSC is one of several partners involved in a new five-year project to evaluate the mobility, persistence and fate of creosote in groundwater. Results will be used to assess the effectiveness of various processes available to clean up contaminated industrial sites and aquifers. The

project, led by the University of Waterloo Centre for Groundwater Research, includes participants from the University of Alberta, Technical University of Denmark, Biotechnology Research Institute and GSC, and is supported by Domtar Inc., CH2MHill, Gartner Lee Ltd., Alberta Environment and Environment Canada Waste Water Technology Centre.

Defining Mercury Content in Ontario Lakes

Public concerns over the mercury content of fish in Ontario's lakes and possible sources of that pollution were addressed by a cooperative study by Ontario Hydro and GSC. Eighteen lakes, with a broad range of mercury concentrations in fish, were selected in the Huntsville, Ontario, area for a sediment core survey. Chemical analysis of the cores revealed that the upper 20 to 40 cm of sediment are enriched in mercury and other metals, a condition common to lakes all across Canada, and a phenomenon often cited as recent pollution. However, the distribution of mercury observed in the shallow sediments is a reflection of the metal content observed deeper in the core, suggesting

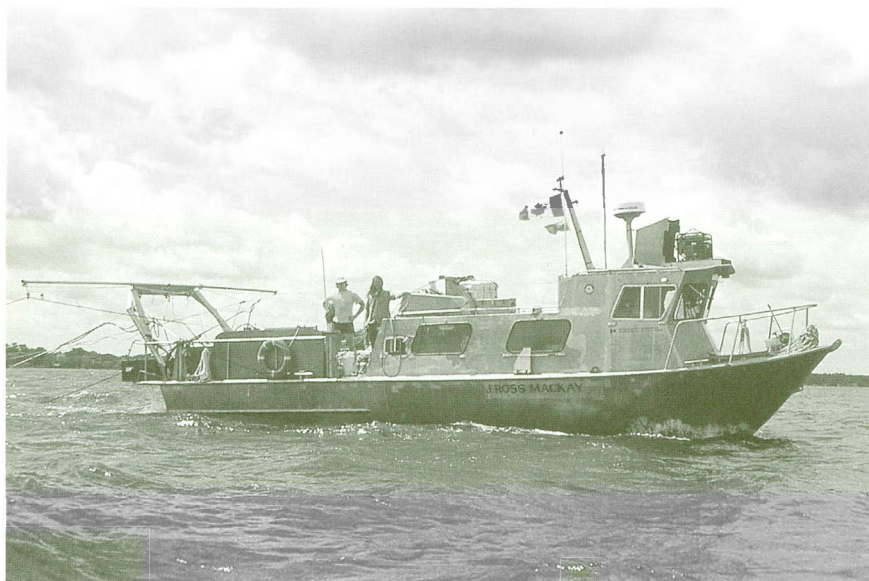


J. Carter, GSC

Journalists interview GSC scientist about Fort St. John earthquake.

UNDERSTANDING THE FORT ST. JOHN, B.C., EARTHQUAKES

GSC installed two seismograph stations near Charlie Lake and Cecil Lake in the Fort St. John area, the natural gas producing region of northeast British Columbia, where several Magnitude 4 earthquakes and associated aftershocks were strongly felt on January 9 and 30, 1993. This cooperative project between GSC and the B.C. Ministry of Energy, Mines and Petroleum Resources is a preliminary step towards understanding the earthquakes that have occurred almost every winter for the past decade in what was previously a seismically "quiet" region. GSC seismologists are testing the hypothesis that the earthquakes are induced by the hydrocarbon extraction process.



Assessing hazards to major structures resulting from ground movement along suspected faults is made easier by understanding neotectonic features in Paleozoic rocks and in the overlying unconsolidated sediments under water bodies. Towards that end, GSC conducted shallow geophysical surveys in southern Ontario's Kingston Basin, onshore and offshore Prince Edward County, and the Trent-Severn Waterway using our research vessel MV J. Ross Mackay. The resulting database will be important in furthering our understanding of possible recent faulting in the area.

that enrichment may in fact be a long-term, geologically controlled phenomenon and not the result of recent human activity.

Applications of Neotectonic Studies

GSC studies of neotectonics and postglacial faulting in central Canada responded to specific issues for groups such as Atomic Energy of Canada Ltd. (AECL) and Ontario Hydro. One project concluded that faulting in Ontario's Rouge River Valley, near the

Pickering nuclear power plant, is the result of glacial processes and has no seismic implications. As part of this study, Ontario Hydro is funding the operation of a GSC seismograph station north of Toronto, and information from this station will improve GSC's capability to respond to felt earthquakes in the densely populated Toronto-Niagara region. Ontario Hydro is also supporting the acquisition and interpretation of reflection data to map the crust beneath the Great Lakes; this will provide a greater understanding of the crustal structures at depth.

Another project is using earthquake rates from equivalent regions around the world to assess the likelihood of large (> Magnitude 6) earthquakes in the Canadian Shield. As knowledge of the rate of large earthquakes is fundamental to the design of facilities for the safe disposal underground of radioactive waste products, the results will shape AECL's environmental assessment of its engineering concepts.

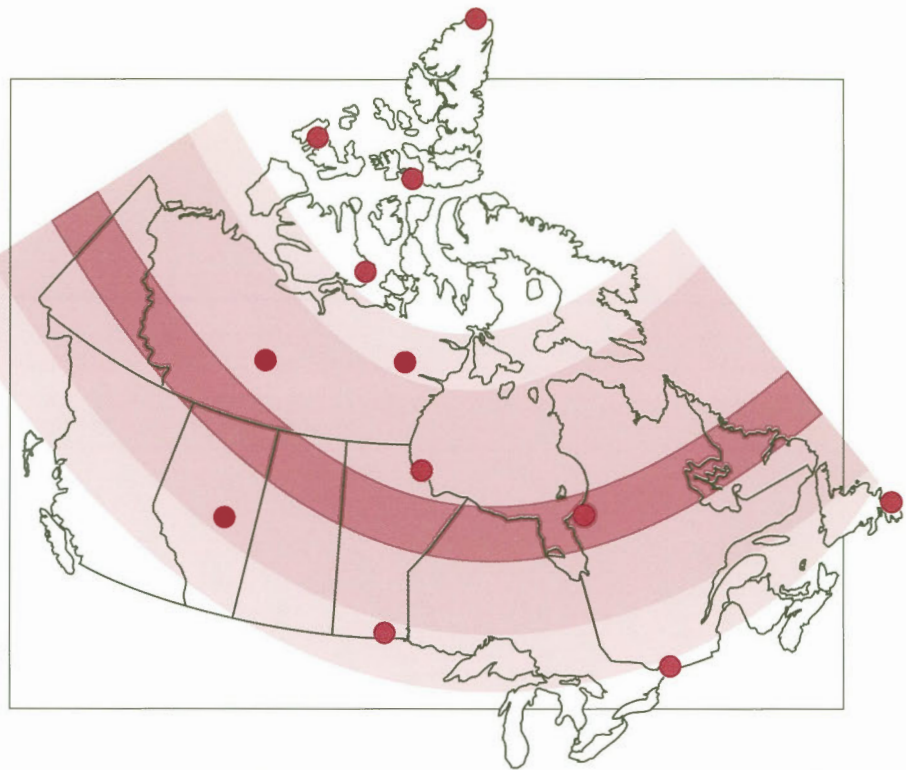
Great Whale Project

Regional geoscientific data and the analysis of geological processes are the basis for any environmental impact assessment. With this in mind, GSC launched a multidisciplinary pilot project in Quebec's subarctic Great Whale region, which is the proposed site of a hydroelectric mega-project. Hydro Quebec is participating in the project through the GSC's Industrial Partners Program. The work involves geochemical and mapping surveys of surficial materials as well as studies of geodynamic (terrain stability, permafrost, coastal dynamics) and geochemical (potentially toxic metals) processes in terrestrial and coastal environments, in an area representative

of that which could be affected by any development. The first phase of the project involved researchers from Laval University, INRS – Géoressources and GSC.

Satellite Monitoring of Acid Mine Drainage

One of the problems associated with mining and milling base metal deposits is the production of waste material in the form of large amounts of fine, sandy tailings. As sulphide minerals in the tailings oxidize, water percolating through them becomes acidified, a process which can have harmful effects on the surrounding environment. In an effort to identify and evaluate problems linked to acid mine drainage, Noranda Ltd. recently purchased Landsat Thematic Mapper (TM) data from Radarsat International for the area around its Rouyn-Noranda operations. The data, which were processed by scientists from GSC and the Canada Centre for Remote Sensing, will be used by Noranda to monitor and evaluate the environmental effects of acid mine drainage. ■



Geomagnetic hazard in Canada is determined from GSC magnetic observatories (solid circles); heaviest shading represents zone of greatest likelihood (0.4%) of problematic conditions for electric power utilities and pipeline operations.

GEOMAGNETIC FORECASTING SYSTEM

The Canadian Electrical Association and GSC started up a jointly funded, multi-year partnership in 1992 to study the geomagnetic hazard to electrical power transmission systems. Additional partners quickly joined in, including Nova Scotia Power, Hydro-Québec, Ontario Hydro, Manitoba Hydro, Alberta Power, B.C. Hydro and the University of Manitoba.

In Phase I of the study, completed September 1992, the probabilities of occurrence of geomagnetic conditions likely to cause power system problems were determined, largely from the extensive GSC geomagnetic observatory database. In Phase II, now underway, the magnetic field characteristics and the conductivity structure of the earth across Canada are being assessed. Electric fields to be expected during geomagnetic disturbances will also be calculated.

The results of the study will help power companies avoid operational problems or equipment damage due to magnetic storms, with the potential for substantial cost savings. The improved understanding of relationships between geomagnetic phenomena and power transmission problems will also enable GSC to better serve related segments of this industry, and may lead to improved services for all clients subscribing to the GSC's magnetic forecasting program.

For more information or to subscribe, please contact: Richard Coles, Geological Survey of Canada, 2617 Anderson Road, Ottawa, Ontario KOA 1K0
Telephone: (613) 837-4561

INNOVATION

Since its founding in 1842, the Geological Survey has been recognized for its innovation in creating new methods and technology or adapting existing technology to the geoscientific problem at hand. Technology transfer to industry for commercial development has met with great success.

New Ice Coring Drill

Ice cores provide high resolution information about climate change and atmospheric pollution, but an appropriate drill is necessary to collect core in extreme environments. This year GSC developed a new drill, based on a Danish model, which is capable of retrieving core to depths of 400 m. During field trials in the spring of 1993, the new drill successfully collected two complete surface-to-bedrock cores from the Agassiz Ice Cap. A Canadian company, Icefield Instruments, is assessing the market potential of this drill.

Commercial Development of Borehole Logging Technology

The ability to detect mineral deposits around a borehole has traditionally been limited to geophysical methods that measure the conductivity, magnetism or radioactivity of the mineralization. Spectral gamma-gamma (SGG), a new logging technique developed by GSC, can be used to infer the metal content of rocks based on their density. Published results of GSC research in this new area attracted the interest of IFG Corporation which, with Gunter Nuclear Engineering, is commercially developing the downhole probe and uphole modules for a commercial version of the SGG system. Of the two prototypes under construction, one will be used by IFG and Gunter for marketing purposes and GSC will receive the other for continuing research.

Improved Airborne Gravity Survey System

Sander Geophysics Ltd. of Kanata, Ontario is working with GSC, the National Research Council's Institute for Aerospace Research, the universities of Calgary and Carleton and partners in the oil and mineral exploration industry to develop a better and more cost-effective airborne gravity survey system. Although improvements in Global Positioning Systems (GPS) and the development of a state-of-the-art inertially stabilized gravity sensor are seen as the major tasks in achieving this objective, several partners bring excellent track records in airborne gravimetry and/or kinematic GPS to bear on the problem. Development over the next few years of an improved airborne gravity system, combined with magnetic/EM/radiometric configurations, will give Canadian industry a competitive edge in North American and overseas markets where the demand for such a system is high.



M. Douma, GSC

Field testing the new system.

UNIQUE RUSSIAN GEOPHYSICAL TECHNOLOGY UNDER DEVELOPMENT

In cooperation with the All Russian Institute of Hydrogeology and Engineering Geology and Androtex Ltd. of Toronto, GSC is participating in the commercial development of a land-based geophysical prospecting method and instrumentation for resistivity profiling and sounding. Unlike conventional resistivity measurement systems, this one does not require galvanic coupling to the ground, hence the system can be used in a wider range of applications in engineering and groundwater problems. Development of this system will lead to a second, more advanced generation that will provide a unique geophysical tool and technology to Canadian industry. This will enhance their competitiveness in the international markets in the field of geotechnical investigations of permafrost and arid regions.

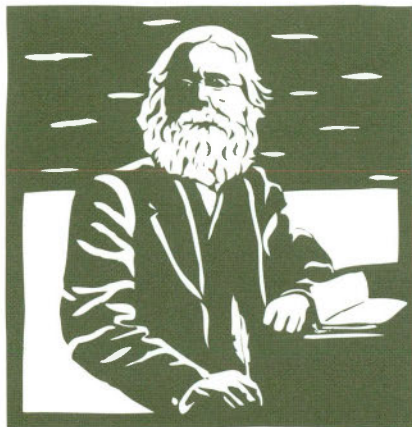


Preserving Canada's geoscience heritage

Rare books, manuscripts, photographs and maps in the collection of the Geological Survey of Canada are in urgent need of conservation if they are to be available for future researchers. The Logan Legacy Fund was set up in 1992 by the Canadian Geological Foundation to preserve these irreplaceable holdings of Canada's historic geological materials.

A tax deductible donation may be sent to:

*Canadian Geological Foundation
(Attn: Dr. H.C. Morris)
Imperial Metals Corporation
Suite 800, 601 West Hastings Street
Vancouver, B. C. V6B 5A6*



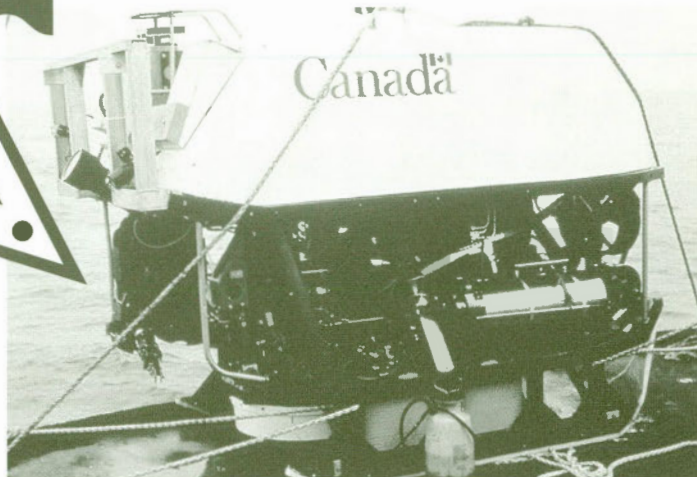
SIR WILLIAM LOGAN, GSC'S FOUNDER AND FIRST DIRECTOR FROM 1842 - 1869. HIS BOOKS AND MANUSCRIPTS ARE AN IMPORTANT PART OF THE COLLECTION.

Faster, More Accurate Analysis of Geological Materials

The analysis of solid geological materials by plasma normally requires that samples be pulverized and dissolved in a variety of solutions before injection into the plasma. This process is time- and labour-intensive, and does not always produce a chemically uniform solution owing to difficulties in dissolving some elements. Scientists from GSC and the National Research Council developed a device that overcomes these problems by permitting the direct injection of a powdered material into an analytical plasma. The device, which has been granted patent protection, has considerable market potential and will be produced commercially under licence by Protact Ltd.

New Methods Permit Ultra-Trace Level Analysis

The accurate analysis of very small samples of geologic materials for trace elements at the part per trillion and lower (10^{-15} gram level) is a difficult process using traditional dissolution methods. GSC scientists, working in cooperation with the Perkin-Elmer Corporation, are developing new techniques which vaporize small samples using a laser (Laser Ablation) or in a small graphite capsule which is electrically heated to over 3,000°C (electrothermal vaporization). The sample vapour is then pumped directly into the plasma of an Inductively Coupled Plasma Mass Spectrometer (ICP-MS) for analysis, thus avoiding dilution or contamination. Perkin-Elmer is a leading supplier in the multi-million dollar global ICP market and, as all of its spectrometers are manufactured in Canada, this level of cooperation with GSC will directly benefit the sale of Canadian instruments and expertise. ■



I. Jonasson, GSC

Remotely Operated Vehicle.

The study of marine geoscience poses tremendous logistical challenges, requiring technological innovation on a grand scale. The work of the Geological Survey of Canada in developing the specialized tools and equipment needed to study our lakes, coastal zones and deep oceans has helped make Canada a world leader in marine geoscience. Some recent examples include:

Deep Sea Exploration by Remotely Operated Vehicle

Exploration of hydrothermally active regions of the seafloor using manned submersibles, such as the *DSRV Alvin*, is extremely expensive and potentially dangerous. To overcome these difficulties, GSC scientists in cooperation with colleagues from the Department of Fisheries and Oceans, have successfully developed and tested an unmanned Remotely Operated Vehicle (ROV) at depths up to four km. As the cost and lead time involved in operating manned submersibles continues to escalate, the U.S. National Oceanographic and Atmospheric Administration (NOAA), has started to look for a quick response system for the monitoring of volcanic activity on the seafloor of the eastern Pacific Ocean, and it would appear that the Canadian ROV may provide them with the best option available. Over the last year, NOAA scientists, using their research ship, *Discoverer*, participated in two test cruises of the Canadian ROV and contributed funding to the development of a new navigation system for the vehicle. Further testing on a German-sponsored cruise is planned for 1994. In addition, a business plan for the ROV is being prepared to enable private sector use.

Seafloor Sediment Monitor RALPH, an innovative marine monitoring technology, resulted when long term sediment transport research carried out by GSC in the Scotian Shelf and Grand Banks was applied to specific problems posed by industry. LASMO needed information on how the seafloor moves under various sea conditions, essential for offshore structures site planning and maintenance. To conduct this

research, under severe Atlantic conditions, required a new type of monitoring system – one sturdy enough to be deployed for periods of one day to three months. RALPH monitors waves, tides, currents and suspended sediment, does time-lapse bottom photography and is effective from surf zone to shelf edge. RALPH passed extensive field trials with flying colours and is now available for other marine research applications including coastal erosion monitoring, sediment stability assessment, pipeline/cable route surveys and sediment model calibration.

Multi-beam Survey System GSC and the Canadian Hydrographic Service completed successful field trials of a prototype survey system. A cruise on the Canadian research ship, *Matthew*, allowed the first operational use of the EM100 multi-beam survey system. With line spacing of 100 metres, the 36 simultaneous sounding profiles provide 100% coverage of the seafloor. The close line spacing and accurate navigation using the differential GPS system, provided an excellent opportunity for GSC to collect gravity and magnetic observations at an unprecedented density. The new system, with its updated methodology and data processing procedures, will enable the production of more accurate and more detailed magnetic maps; these are used for geological mapping at a scale of 1:25 000 or larger to project known land geology to nearshore areas, to assess the environmental impact of climate change, and to detect anthropogenic effects (e.g. ship wrecks, undersea cables). ▲



P. Morrow

All throughout 1992 and all across Canada, the Canadian geoscience community helped the Survey celebrate its 150th anniversary. The event went global when geoscientists from around the world gathered in Ottawa in April 1992 for the International Conference of Geological Surveys, held in recognition of the leading role the Survey plays on the world stage. A Royal Canadian Geographical Society expedition took the GSC flag to the top of Canada's highest mountain, Mount Logan, which is named in honour of GSC's founder.

INFORMATION

The Geological Survey of Canada has extensive geoscientific databases and is — a major scientific publisher.

Internationally respected research, combined with advanced in-house cartographic capability and digital systems, has made the GSC a world leader in geoscientific information. We share this information through direct sales, data exchanges, training courses and workshops.

Digitizing Field Geology

The last few years have seen the rapid growth of the utilization of computerized systems in field geology. Fieldlog, developed by the Ontario Geological Survey and GSC, is a relational database which when interfaced with AutoCad becomes a valuable mapping and exploration tool. This package is receiving widespread use in computer-aided mapping projects and databases and has been employed successfully in many diverse scenarios:

e.g. as a geological mapping tool by the GSC, provincial surveys and the Korean Geological Survey; in exploration activities by various Canadian mining companies; and as a teaching tool in field school and in graduate programs in at least six Canadian universities. The use of such technology, when integrated with GIS, facilitates the timely release of geoscience data, provides easy access to information and makes large-scale, multi-disciplinary programs such as NATMAP feasible.

New Digital Geophysical Library in Halifax

Husky Oil and Petro-Canada made an unprecedented gift to GSC of a geophysical/geological digital database that covers most of the frontier regions of Canada. Digital data on this scale have never before been available outside industry and under the terms of the transfer agreement, geoscience researchers, both in Canada and world-wide, now have access to it. GSC scientists are convinced that many new ideas and concepts about basins will result from future collaboration in the analysis of the data. The enormous volume of data (it requires over 65,000 magnetic tapes) has required an upgrade of its new home, the National Archive's Halifax Record

Centre tape library, with federal funding provided by the departments of Energy, Mines and Resources, and Communications.

New Quaternary Stratigraphic Database of Timmins

Under the Canada-Ontario Subsidiary Agreement on Northern Ontario Development – Mineral Program (1991-1995), a database of overburden drill hole records for the Timmins area is being compiled. Exploration companies earned the right to participate in the project by donating drill hole records and information from past drilling projects; participating companies (Falconbridge Ltd., Rio Algom Exploration Ltd., Falconbridge Gold Corporation, Royal Oak Mines Inc., Abitibi-Price Ltd., and, Cominco Ltd.) donated over 7,000 overburden and diamond drill hole records. This project will result in the compilation of a wealth of geological information, much of which would never have been released to the public. The results will support future exploration efforts in the Timmins area by providing baseline information for planning and interpreting the results from drift prospecting programs, for interpreting geophysical data, and for environmental assessments. ■



A CGIC staff member demonstrates one of the many CD-ROMs available to the user.

CANADIAN GEOSCIENCE INFORMATION CENTRE

Designed to provide the geoscience community with a single contact point for their information needs, GSC's new Canadian Geoscience Information Centre (CGIC) integrates the delivery of traditional library-based services with newer technology-driven information products and services. While supporting the core Library and GEOSCAN programs, the new unit provides greater emphasis on special collections, database and product development and the technical enquiries service. This service-oriented information unit, which provides a complete range of geoscience information from one source, is designed to better meet client needs in the 1990s.



Geology of the Cordilleran Orogen in Canada

edited by H. Gabrielse and C.J. Yorath

The fourth of nine volumes to be published in the "Geology of Canada" series, this comprehensive book has 495 figures. An accompanying folio includes new tectonic assemblage, metamorphic, terrane, and physiographic maps, figures showing the distribution of granitic suites and metallogenic associations, correlation charts and regional structural cross-sections. 844p. plus folio. \$70 in Canada, \$91 outside Canada.

Devonian Gas Resources of the Western Canada Sedimentary Basin

by G.E. Reinson et al.

The Western Canada Basin is the source of most of the natural gas produced in Canada and the Devonian succession accounts for 27% (55 trillion cubic feet) of proven reserves. This latest report in the GSC series of hydrocarbon resource estimation studies provides a geological play analysis of the 25 established mature plays and outlines a number of conceptual plays. It also provides an analysis that suggests what volumes of undiscovered gas may be economic at various price levels and evaluates the importance of exploration success rates and distance of new pools from gathering systems. 157p. (GSC Bulletin 452). \$24.75 in Canada, \$32.20 outside Canada.

Shear-sense Indicators: A Review

by S. Hanmer and C. Passchier

A critical evaluation of the kinematic significance of natural geological deformation structures commonly used as shear-sense indicators, this report is an excellent educational and reference tool for geologists. It examines the basic concepts of tectonic flow and the influence of material properties on the nature of flow at the local scale. 72p. with a set of twelve 35-mm colour slides. (GSC Paper 90-17). \$8.50 in Canada, \$11.05 outside Canada.

Principal Mineral Areas of Canada, 43rd edition

A comprehensive reference to mineral production in Canada and an excellent educational resource tool, this popular map is revised and reprinted annually. Scale 1:7 603 200 (Map 900A). One copy is provided free of charge, upon request, to each Canadian resident. Additional copies are \$7.50 each plus GST and PST (where applicable), \$9.75 outside Canada.

Ground Penetrating Radar

compiled by J.A. Pilon

An excellent introduction to the ground penetrating technique, this compilation of 26 papers presented at the Ground Penetrating Radar Workshop (Ottawa, May 1988) provides an overview of the state-of-the-art in this field. It covers ground penetrating radar design, application and interpretation. 241p. (GSC Paper 90-04). \$19.95 in Canada, \$25.95 outside Canada.

Petroleum Resources of the Jeanne d'Arc Basin and Environs, Grand Banks, Newfoundland

The Jeanne d'Arc Basin, which extends across part of Newfoundland's continental shelf, contains potentially economic quantities of oil and gas. This report defines 15 hydrocarbon exploration plays by area and type of trap and by the lithostratigraphic horizon providing the reservoir facies. It also uses seismic and well data for each play for statistical estimations of the total and remaining hydrocarbon potential of the Jeanne d'Arc Basin and environs. 48p. (GSC Paper 92-8). \$15.30 in Canada, \$19.90 outside Canada.

Glacial History, Drift Composition, and Mineral Exploration, Central Labrador

by R.A. Klassen and F.J. Thompson

This report describes a study of ice flow history and drift composition carried out under the Canada-Newfoundland Cooperation Agreement on Mineral Development to establish a geological framework for drift prospecting and to develop exploration methods suited to the region. It focuses on the areas of greatest mineral potential within the Central Mineral Belt and Labrador Trough. It also has applications for environmental concerns which require knowledge of the composition and properties of surficial deposits. 76p. (GSC Bulletin 435). \$14.50 in Canada, \$18.85 outside Canada.

Field Guide to the Churchill Region, Manitoba

by L.A. Dredge

The development of a new national park has sparked tourist interest in the Churchill region. Through descriptions of specific features along several excursion routes in tundra and peatland environments, this guide gives naturalists and other visitors the interpretative information necessary to understand the natural landscape in this region. It also describes archeological sites on the west side of the Churchill estuary and construction problems associated with permafrost environments. 52p. (GSC Misc. Report 53E). \$9.50 in Canada, \$12.35 outside Canada.

Catalogue of Type Invertebrate Fossils of the Geological Survey of Canada, Volume VIII

by T.E. Bolton

Type specimens are the standards by which species are defined. The GSC's collection is the main repository for type fossil specimens in Canada, and as such serves the Canadian and international scientific community. The catalogue provides locality and reference data for type specimens added to the collection between 1981 and 1990. 424p. \$24.95 in Canada, \$32.45 outside Canada.

The Late Cenozoic Mount Edziza Volcanic Complex, British Columbia

by J.G. Souther

The Mount Edziza Volcanic Complex, the product of five cycles of magmatic activity, lies about 100 km inland from the continental margin in north-central British Columbia. It ranges in age from at least 7.5 million years to less than 2,000 years ago. During this long period of intermittent volcanic activity, the ebb and flow of local and regional glaciations resulted in a complex assemblage of subaerial and subglacial volcanic landforms. 320p. (GSC Memoir 420). \$35 in Canada, \$45.50 outside Canada.

Radiogenic Age and Isotopic Studies: Report 6

This collection of geochronological and other radiogenic isotope data produced by GSC's Geochronology Laboratory is released annually to the geological community. The report presents and interprets the data, relating them to field settings. 247p. (GSC Paper 92-2). \$14.50 in Canada, \$18.85 outside Canada.

Rocks and Minerals for the Collector: the Alaska Highway; Dawson Creek, British Columbia to Yukon/Alaska border

by A.P. Sabina

This valuable field guide describes mineral, rock and fossil occurrences along the Alaska Highway from Dawson Creek to the Yukon-Alaska border and roads branching from the Alaska Highway (including the Klondike, Canol, Cassiar-Dease Lake, Atlin and Sixtymile roads, and the Campbell Highway). 129p. (GSC Misc. Report 50E). \$16.50 in Canada, \$21.45 outside Canada.



Ordering information: Publications may be ordered from the GSC Bookstore in Ottawa (address below) or from our regional offices in Ste-Foy, Calgary and Vancouver (see page 30 for addresses). Prepayment is required by cheque or money order made out to the Receiver General of Canada. VISA and Mastercard are accepted.

* All prices listed are in Canadian dollars.

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ARCTIC LOGISTICS

The Polar Continental Shelf Project

ARCTIC LOGISTICS

Polar Continental Shelf Project, established in 1958, provides comprehensive logistics support to scientific research teams working in the Canadian Arctic. Each year, it provides about 250 research groups from about 40 different agencies with accommodation, communications and stevedoring services, field equipment and cost-effective fixed- and rotary-wing aircraft.

Support for projects is generally based on cost-sharing, with Polar Shelf providing some services at no cost to users. Non-Canadian projects are supported solely on a cost-recovery basis.

How to Apply

Polar Shelf distributes applications to potential clients each September with completed applications due in late October. Non-government and non-Canadian applications are reviewed by a Scientific Screening Committee in December. All applicants are subsequently notified by mid-February of the level and terms of support to be provided by PCSP in the coming field season.

If you wish to be added to Polar Shelf's mailing list, please send your name and address to:

Director
Polar Continental
Shelf Project
344 Wellington, Room 5146
Ottawa, Ontario
Canada K1A 0E4
FAX: (613) 990-1508 ■

PCSP CLIENT GROUPS IN 1992-93

Canadian federal government research scientists from:

- Department of Communications
- Energy, Mines & Resources Canada
- Environment Canada
- Fisheries & Oceans
- Indian & Northern Affairs
- Canadian Museum of Civilization
- Canadian Museum of Nature
- National Research Council

Provincial/territorial research scientists from:

- Alberta
- Newfoundland
- Northwest Territories
- Yukon Territory
- University researchers from across Canada
- Foreign university researchers – United States, Japan
- Independent researchers



J. Medendorp, CHS

Canadian Hydrographic Service launches surveying Pelly Bay.

Scientists supported by Polar Shelf work in partnership with northern communities and community leaders toward enhancing sustainable economic development of the Canadian Arctic.

In the spring of 1992, the Canadian Hydrographic Service (CHS), with substantial logistics support from Polar Shelf, successfully conducted a survey to find a safe shipping route for resupply vessels into the Hamlet of Pelly Bay in the Northwest Territories. As a result, in 1993 the first annual sealift into Pelly Bay saved the territorial government one million dollars in air cargo costs. Polar Shelf is currently supporting CHS' three-year survey of the Coronation Gulf to identify shipping routes in support of the mining industry and Government of the Northwest Territories.

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Fax: (604) 363-6739

Organization Chart

GEOLOGICAL SURVEY OF CANADA

ASSISTANT DEPUTY MINISTER

OFFICE OF THE CHIEF SCIENTIST

GEOPHYSICS, SEDIMENTARY AND MARINE GEOSCIENCE BRANCH

Atlantic Geoscience Centre

Geophysics Division

Institute of Sedimentary and Petroleum Geology

Pacific Geoscience Centre

MINERALS AND CONTINENTAL GEOSCIENCE BRANCH

Continental Geoscience Division

Cordilleran Division

Mineral Resources Division

Québec Geoscience Centre

Terrain Sciences Division

GEOSCIENCE INFORMATION AND COMMUNICATIONS DIVISION

COORDINATION AND PLANNING DIVISION

Administrative Services

Sector Finance Advisor

Sector Personnel Advisor

POLAR CONTINENTAL SHELF PROJECT

FINANCIAL STATEMENT

*Geological Survey of Canada
1992-93 Expenditures (in thousands of dollars)*

	<i>Total</i>	<i>Personnel</i>	<i>Operating</i>	<i>Capital</i>	<i>Grants and Contributions</i>
Assistant Deputy Minister	4 043	417	127	5	3 485
Chief Scientist's Office	463	301	162	—	—
Polar Continental Shelf Project	6 618	1 192	5 104	322	—
Geoscience Information and Communications Division	7 649	4 448	2 194	1 007	—
Coordination and Planning Division	3 355	1 574	1 385	395	—
Geophysics, Sedimentary and Marine Geoscience Branch					
Director General	195	134	58	3	—
Institute of Sedimentary and Petroleum Geology	15 429	8 795	5 658	976	—
Atlantic Geoscience Centre	12 799	6 923	4 526	1 350	—
Geophysics Division	11 656	6 240	3 965	1 451	—
Pacific Geoscience Centre	5 267	2 519	1 564	1 184	—
Total	45 347	24 612	15 772	4 963	—
Minerals and Continental Geoscience Branch					
Director General	656	564	74	18	—
Québec Geoscience Centre	3 036	1 533	1 288	215	—
Cordilleran Division	3 972	2 387	1 329	255	—
Terrain Sciences Division	8 761	5 129	3 116	517	—
Continental Geoscience Division	10 041	5 764	3 272	1 004	—
Mineral Resources Division	15 280	8 770	5 260	1 250	—
Total	41 745	24 146	14 339	3 260	—
Sector Total	109 211	56 690	39 083	9 953	3 485

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