



TARGETED GEOSCIENCE INITIATIVE

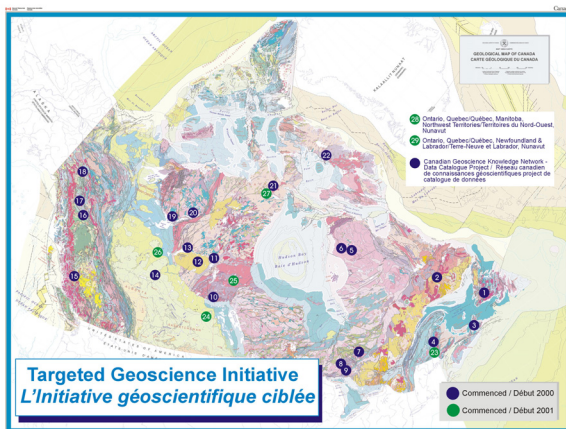
SEPTEMBER 2002

INTRODUCTION

The Government of Canada committed \$15 million in the 2000 federal budget to help stimulate new investment in mineral exploration by upgrading Canada's geoscience knowledge base. This funding allowed the Geological Survey of Canada (GSC) to implement the Targeted Geoscience Initiative (TGI) in partnership with provincial and territorial geological surveys, industry and academia. TGI's goal is to increase the level and cost-effectiveness of private sector exploration for mineral resources by upgrading and expanding the geoscience knowledge on which exploration depends.

Over the 3-year initiative, ending in 2003, the \$15 million TGI investment is expected to lever additional federal funding of \$8 million from GSC, plus \$19 million from provincial surveys and other external partners.

A total of 29 field projects were funded by TGI in targeted regions across Canada. In addition, TGI funds have helped support the On-line Data Catalogue project of the Canadian Geoscience Knowledge Network that will make this knowledge readily available to the users. This pamphlet summarizes the highlights of a representative cross-section of TGI projects compiled in the summer of 2002. More complete information on TGI, the projects, agencies, and personnel can be obtained from the TGI website: www.nrcan.gc.ca/gsc/tgi_e.html



Canadian Geoscience Knowledge Network (CGKN)

CGKN is an initiative of the National Geological Surveys Committee (NGSC) to provide an Internet portal to Canadian geoscience information, making Canada a global leader in providing rapid access to its knowledge assets. CGKN is creating comprehensive catalogues describing geoscience data, publications and maps that are available from Canadian government geoscience agencies and implementing a new Internet search engine. CGKN expands on the successful Canadian Geoscience Publications Directory by including information about geoscience data holdings. Through the web site, clients will be able to discover, view, evaluate and obtain

consistent and standardized geoscience data, maps and publications for regions and sources across Canada. As the main objective of TGI is to enhance the geoscience knowledge base on which companies depend for targeting and directing their exploration activities, it is crucial to the success of TGI that this new information be quickly and easily accessible to clients. Thus, TGI has contributed funding to assist in the **On-line Data Catalogue** project. The first Data Catalogue came on line in May 2002 and is accessible from the CGKN web site, www.CGKN.NET. Metadata collections for eight Canadian geoscience agencies, representing over 20 collections, are now searchable over the Internet, with many more collections from multiple agencies being added to the data catalogue over the next few months.

NEWFOUNDLAND and LABRADOR

The **Red Indian Line** project is located in an area of Central Newfoundland that is the focus of intense mineral exploration activity. While this activity cannot be directly attributed to the TGI project, the project is clearly contributing important new information in a region where it is in demand and where it will be put to immediate use by industry to find new mineral deposits. The release of this new knowledge in more than fifteen publications to date is acknowledged to have made a significant contribution to the scientific understanding of the area, and will provide a strong foundation for future work. As the exploration activity being experienced in central Newfoundland is one of the few bright spots in the local economy, it is being followed with considerable interest in the communities concerned and in the media, and the release of new maps and understanding derived from the 2002 field season is eagerly anticipated.

The **Grenville Transect** project (see also Quebec) has involved joint fieldwork by the Newfoundland and Labrador Geological Survey and the GSC over a period of three years. A highlight of the 2001 field season was the discovery of anomalous platinum, palladium and gold in a gossanous outcrop within a layered mafic intrusion. A timed release of this information resulted in immediate staking activity. General interest in the nickel potential within the mapped areas, along with the rest of Labrador, has increased significantly since the agreement in principle on the Voisey's Bay deposit, and publication of data and maps from the project is meeting this emerging demand.



NOVA SCOTIA

Bedrock and surficial **Geological Mapping for Mineral Development in South-central Cape Breton Island** has significantly upgraded the geoscience database, resolving stratigraphic and structural problems and uncovering significant deposits of clay suitable for a wide range of uses. The final digital geology maps and associated databases will be useful in

future industrial and metallic mineral exploration, for land use planning and to identify other potential clay deposits. Mineral deposit studies have improved knowledge of the setting of the major limestone/dolostone/marble deposits in the project area and produced an upgraded, comprehensive mineral deposits database that will be useful to explorationists. The TGI project has produced a strong and positive response from several sectors. A series of community presentations about the project led to inquiries about the potential for mineral development as part of a diversified economy. Local artisans, landowners and economic development officers have requested information on locating and developing more new clay deposits. New information on carbonate resources spawned increased exploration activity at both the industry and grassroots levels. This TGI project has also attracted the attention of the Nova Scotia Department of Economic Development and has led to a MOU with the Strait-Highlands Regional Development Authority to provide advice and assistance in promoting and developing the mineral resources of southern Cape Breton Island.

NEW BRUNSWICK

Under the TGI project **Metallogeny of Intrusion-Related Gold Systems in Southern New Brunswick**, efforts have focussed on regional and detailed mapping, drill core logging and modeling in the Poplar Mountain and Clarence Stream areas of southern N.B. to decipher stratigraphy and structure. The TGI project has helped sustain exploration, with more than 3000 claims staked. Over 130 diamond drill holes have intersected several, potentially economic ore zones. More than 2 million dollars has been spent on drilling and detailed geological, geochemical and geophysical surveys by the private sector. As work continues on these discoveries, prospecting aided by government sponsored regional geochemical and geophysical surveys is revealing additional occurrences that warrant exploration. The existence of potential



gold sources in and around intrusive suites elsewhere in the province similar to those in the Poplar Mountain and the Clarence Stream - Mount Pleasant area are known, but are essentially under explored. The work being conducted under the gold TGI project is an effective mechanism to

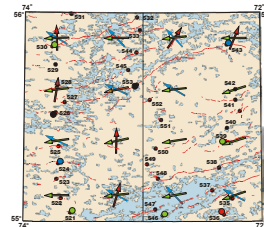
help maintain and enhance much needed exploration activities in the province. It is rapidly becoming apparent that a district-scale gold district is evolving in the region, with a very real possibility of a new mine. The TGI project has enjoyed tremendous support from the private sector through logistical and monetary support, and information transfer. The current activities are viewed very favourably in communities of the region where mining activities have formerly been an important part of the economy.

QUEBEC

The **Lac Vernon Airborne Geophysical Survey TGI** project was undertaken as a component of Projet Grand Nord to acquire high resolution magnetic data in an area spanning thirty, 1:50,000 scale map sheets in the Lac Vernon and Lac Anuc regions. The resulting maps support ground-based geological studies and delineate regional scale geological features, significantly improving the ability to identify targets for exploration for a variety of mineral commodities. Based on the release of the TGI project maps in 2001 and 2002, at least five companies have acquired properties and have begun to undertake exploration in

the respective areas. The expansion of exploration could have considerable impact on the economy of local communities.

The recent surge of diamond exploration in northern Quebec has emphasized the need to reconstruct regional glacial dynamics and to identify associated dispersal patterns in glacial sediments, knowledge essential for cost-effective exploration. The **TGI Glacial Dynamics and Diamond Exploration** project in northern Quebec is determining the succession of ice-flow systems in this heavily glaciated region and the possible occurrence and distribution of kimberlite indicator minerals in the glacial sediments. This project has yielded a new target region (Saindon-Cambrien corridor) with a high potential for diamonds. Announcement in March 2002 of the discovery of indicator minerals in the area prompted staking of nearly 600 claims within days.



The **Doyon-Bousquet-Laronde District, Abitibi TGI** project is providing a better understanding of the nature, origin and distribution of gold-rich, volcanogenic massive sulphide (VMS) deposits in this mining camp, knowledge that will help design new exploration models for enhanced future exploration success. Studies have re-defined many aspects of the host volcanic rock sequences, from structural complexity controlling the location of the known deposits to associated geochemical characteristics that can point to new discoveries. It is now known, for example, that not all the VMS lenses are associated with aluminous alteration, contrary to all previous models; this new information is important for exploration strategies. The TGI project has targeted key questions that local exploration companies consider critical in understanding the genesis and distribution of the ore bodies. Moreover, the project has fostered development of an excellent synergy between Géologie Québec, GSC and industry participants. For the first time, mining companies are sharing their information and visiting each other's properties during the field trips and workshops organized by the project.

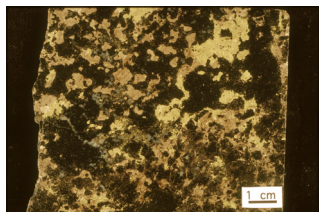
Eastern Quebec and Labrador are known for world-class nickel-copper, iron and titanium deposits and the respective provincial surveys have shown that geologic terranes in this area have all the ingredients for the discovery of more. The **Tectonic Framework and Evolution of the Eastern Grenville Province** project (see also Newfoundland and Labrador) will develop new maps, tools and models to enhance the current geological knowledge as the basis for new exploration guides. An important discovery has been the recognition of lithologic units within the metasedimentary basement rocks that represent a geological context similar to that hosting various base metal (copper, lead, zinc) deposits elsewhere in the world.

ONTARIO

The need for cost-effective diamond exploration methods, particularly methods that can be used in areas with a thick drift cover, is the impetus for the **Enhancement of Kimberlite Exploration Methods TGI** project in the Timiskaming Region where the known kimberlites are well documented and easily accessible. New or improved exploration methods developed as part of this research could enhance the effectiveness of diamond exploration, not only in the study area, but also in other parts of Ontario and northern Canada. Newly acquired ice flow and indicator mineral data for the region north of the Timiskaming-

Kirkland Lake kimberlite field, overlying the field and up to 80 km down ice, have identified new exploration targets. An early indication of the effectiveness of the new techniques is the discovery of a new kimberlite (Triple B) from which samples are currently undergoing analysis of the indicator minerals and diamond content. Response to the TGI project has been positive; exploration companies and prospectors have provided access to their properties, drill core and till samples, and have sought advice from the project's leaders.

To sustain or increase ore reserves at the Sudbury nickel camp, it is necessary to explore more effectively for those shallow deposits that have eluded detection, as well as for deeper deposits. The **Role of Structure and Host Rocks in the Evolution of Sudbury Ores** TGI project will increase knowledge of the ore-forming processes and the local volatile and structural history, leading to more effective exploration techniques. Chemical analyses have demonstrated that the four types of nickel - copper - platinum group element ores have distinctive trace element signatures, knowledge that provides a better understanding of their origins and emplacement history. Both major and junior mining and exploration companies operating in the basin have responded positively to the TGI project, providing geoscience information, access to drill cores and participating in field trips. This new knowledge will prove valuable in directing future exploration.



MANITOBA

Studies in the **Flin Flon TGI** project are resulting in development of a sophisticated geological context for the region that will aid mining and exploration companies to better understand the factors controlling volcanogenic massive sulphide (VMS) formation in this mining camp. A key goal of the project is to develop exploration criteria using mineralogical, geochemical and isotopic variations within attendant alteration haloes to identify the presence and nature of undiscovered, deep ore bodies. The Geological Survey of Canada (GSC), Manitoba Geological Survey (MGS),

Saskatchewan Geological Survey (SGS) and Laurentian University have collaborated on subprojects with local exploration geologists. Some important new findings stem from development of a new detailed stratigraphy for the Flin Flon "mine horizon" which, among other features, allows the "mine sequence" to be readily traced along strike and



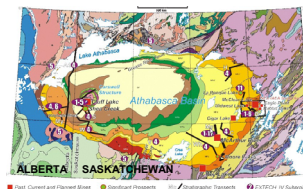
recognized well beyond the immediate mine complex. Collaboration among government agencies, university researchers and local mining companies has been exceptional. Provincial and federal government agencies have pooled resources, combined important geochemical data sets, shared archived samples, exchanged digital data, and mapped together in the field. The Flin Flon mining companies have supplied important samples, geochemical and drill hole data and confidential maps, as well as providing important and often vital logistical support. Mining companies are so supportive of the Flin Flon TGI project that they have suggested continued collaboration after the TGI is over.

The **Lynn Lake - Leaf Rapids TGI** project is providing insights into the regional tectonic setting of lode gold and VMS deposits in the region where the towns of Lynn Lake and Leaf Rapids are dealing with recent mine closures. The impact of the closures on the local economies emphasized the need for new geological and mineral deposit studies. The TGI project has two main thrusts. The first, led by GSC, is establishing the tectonostratigraphic framework across the region, information that will afford a high degree of confidence when tracing important rock units eastward from Reindeer Lake, Saskatchewan into Manitoba. The second component, led by MGS, is evaluating precious- and base-metal mineral potential of the area in support of exploration activity. This latter component continues the investigations under a five-year multidisciplinary initiative begun by the Province in 2000. Industry support for this project has been significant. Hudson Bay Mining and Smelting Co. Ltd. has shared data of all types for the Ruttan Mine with both GSC and MGS researchers. In Lynn Lake, Black Hawk Mining Inc. and Aur Resources Inc. have provided access to data and properties. The level of support by the mineral exploration industry highlights the important role of geological surveys in fostering exploration investment.

SASKATCHEWAN

The **Phelps Lake Area Integrated Mapping** project was undertaken to provide a coherent geological framework over a large, poorly understood, under explored region of northern Saskatchewan. This information will help define the area's mineral potential and contribute to decisions regarding establishment of Protected Areas in northern Saskatchewan. Bedrock and surficial geological mapping, incorporating data from the multiparameter (NATGAM) airborne geophysical survey, has significantly enhanced understanding of the geological framework of the northern part of map sheet 64M. For example, supracrustal rocks of the Ennadi and Hurwitz Groups, both of which have the potential to contain mineralization, are more extensive than previously recognized and favourable indications of a spectrum of mineral occurrence types have been revealed. A preliminary indication of the project's success is the acquisition by industry of new mineral dispositions on the basis of results from the 2001 field season, which focused on the northwest corner of map sheet 64M.

The **Athabasca Uranium Multidisciplinary Study** (see also Alberta) is building a modern, 4-dimensional, geoscience framework of the Athabasca Basin and its uranium deposits. A key component entails enhancing, developing and transferring technologies to industry that will facilitate exploration for deep deposits. TGI funding has allowed GSC's EXTECH IV project in the region to expand its original scope and range of studies.



The \$7.5 million total resources by funding partners, Saskatchewan Industry and Resources, Canada (GSC, NSERC), Alberta Geological Survey, Cameco and COGEMA, substantially exceeds original TGI commitments so that 14 integrated sub-projects have been undertaken, including basement geology and structure, bitumens, borehole geophysics, clay mineralogy, geochronology, gravity, magnetotelluric, seismic, and Athabasca stratigraphy. The improved detailed and basin-wide stratigraphic and structural framework derived from these studies has enhanced consistency between industry exploration projects and allows for greater confidence in prospectivity models. This project will ensure that

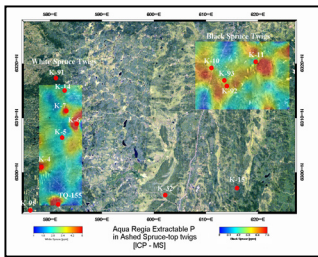
the Athabasca Basin remains the world's most attractive place to explore for and develop uranium deposits, thereby ensuring continued economic opportunities for Saskatchewan's northern communities.

The objective of the **Uranium City Area Integrated Mapping** project is to provide a regionally coherent geoscientific framework in the Uranium City area as a basis for current and future studies, leading to increased and effective exploration in this area of high potential for a variety of types of new mineral discoveries. Completion of an airborne multisensor (NATGAM) survey north of Lake Athabasca and 2,500 km² of 1:20,000 scale bedrock mapping, has led to a revised and improved definition and understanding of the geological framework in this region. Main lithologic sequences, for example, can now be correlated across major structures, permitting amalgamation of several previously distinct geological domains. This new knowledge has improved the focus for ongoing gold (Box Mine), Olympic Dam (copper, uranium, gold, silver), and base metal exploration, as one early measure of success.

The **Diamondiferous Kimberlites** project will facilitate and promote diamond exploration by providing an up-to-date synthesis of available geological data relevant to kimberlites and diamonds in central Saskatchewan. This is being accomplished through detailed stratigraphic, biostratigraphic, volcanologic and petrologic studies to establish a regional architectural framework for the diamondiferous kimberlites. Detailed geologic studies on selected kimberlite bodies, aided by geophysical techniques, will determine their internal structure, emplacement, post-emplacement histories, and controls on diamond grade. Knowledge has been gained on the depositional settings in which the kimberlites were emplaced and on the role these sedimentary processes played in reworking the eruptive kimberlite facies and influencing diamond grade. Five major kimberlite facies types can be distinguished and it has been shown that many of the 'individual' kimberlites consist of multiple 'stacked' kimberlites emplaced during up to six discrete eruptive episodes.

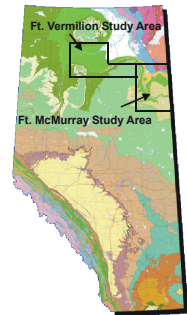
ALBERTA

Recent, intensive exploration for diamonds in northern Alberta has emphasized the need for geochemical methods to facilitate and enhance exploration for diamondiferous kimberlites in areas where there is little or no surface exposure of bedrock. In the first two years, orientation **TGI Geochemical Surveys** were carried out in selected parts of northern Alberta to identify appropriate sample media, sample preparation and analytical methods, followed by a regional geochemical survey. Analysis of kimberlite-indicator mineral dispersal patterns around a known kimberlite at the Buffalo Head Hills will add refinement to this exploration technique, and will complement the geochemical stream sediment data in three 1:50 000 scale map areas, also within the Buffalo Head Hills. The exploration industry has offered very positive feedback about the usefulness of the preliminary results, which have assisted and encouraged exploration activity for diamondiferous kimberlites in northern Alberta. Results from the geochemical stream sediment survey will also benefit stakeholders such as forestry, environment and groups interested in geochemical variations in the surficial environment.



Under the multi-faceted, **Athabasca Extech IV TGI** project (see also Saskatchewan), new geological maps that cross the Alberta and Saskatchewan portions of the Athabasca Basin have been made consistent across the provincial boundary through re-examination and interpretation of previously collected materials. As well, existing geological, geophysical and geochemical reports and relevant data are being compiled into a series of digital geographic information system (GIS) database-compilations that will be highly beneficial to ongoing uranium exploration in this area. Interpretation of Radarsat and Landsat imagery for northern Alberta is providing new information about the structural setting and possible surficial geological variations within the western part of the Athabasca Basin. Recent staking of most of the Alberta portion of the Basin by junior mineral exploration companies following release of preliminary results is ample testament to the value placed on the TGI project by industry.

The multi-faceted studies under the **Potential for Carbonate-hosted MVT Pb-Zn Deposits in Alberta and NWT** project (see also NWT) are intended to evaluate prospects for a new lead-zinc deposit of the important Pine Point type in the Devonian carbonate strata. Field and drill core examinations and related studies are searching for features and conditions that might be indicative of MVT Pb-Zn deposits. This TGI project only began in 2001 and, while preliminary results from the first year's studies have not as yet substantially increased exploration in Alberta, there has been definite interest by exploration companies in the results presented at several forums attended by industry in the winter of 2001-02.



BRITISH COLUMBIA

To help attract and target mineral exploration, **National Geochemical Reconnaissance (NGR) Surveys** were undertaken through the Targeted Geoscience Initiative over 12,500 km² in the Dease Lake area of northern B.C., an area identified by the province as having considerable mineral potential. Reconnaissance-scale, drainage sediment and water surveys have a history of success in B.C. and are widely recognized as one of the most important exploration tools in the Cordillera. The immediate release of a multi-element map from this survey and addition of the new geochemical information on more than 1000 samples and sites to the geochemical database available to the mineral exploration industry, are proving effective in the renewed search for new deposits and reserves, particularly for copper, molybdenum and gold, base metals and platinum group elements.

The objective of the **Volcanic Massive Sulphide (VMS) Potential of East Bella Coola TGI** project is to enhance the geoscience knowledge of this under explored area with a high potential for base metals through 1:50,000 scale bedrock mapping, other detailed studies and NGR surveys. Expectation that new information on Jurassic and Cretaceous age volcanic stratigraphy would stimulate new mineral exploration has been borne out by industry's interest, and new staking generated by the release of geochemical survey data. The project has also generated, and benefited from strong community interest. Consultations with local prospectors have helped direct both the mapping activities and their own prospecting. A member of the Bella Coola Valley's Nuxalk First Nation has been an integral

part of the project team and First Nations groups have assisted in project logistics and afforded leads on prospective fossil sites.

The **Atlin, B.C. Integrated Geoscience Mapping TGI** project integrates new aeromagnetic surveys, bedrock mapping, structural and stratigraphic studies, geochronology and geochemistry to target prospective environments for mineral deposits. The aeromagnetic data from the first year of the project identified mineral prospective anomalies that helped focus the subsequent mapping and related studies along the boundary between two major structural units. Ultramafic rocks associated with placer gold in the Cache Creek Terrane are now recognized to be more extensive. New structural and geochemical understandings in the Nankina Transect region are testament to its VMS potential. These, and other new findings have made the Atlin map area one of the most active map areas in B.C., according to the provincial Mineral Tenure database, with a total of 10,635 ha of new mineral claims and 2,825 ha of new placer claims being staked since project inception. The project has also generated considerable community interest with the result that aboriginal place names are now being added to the geoscience maps.

YUKON

The Yukon TGI funding has enhanced the existing **Ancient Pacific Margin NATMAP** project. Ongoing NATMAP work by the GSC and Yukon Geology Program had resulted in the development of expertise and knowledge in widespread areas



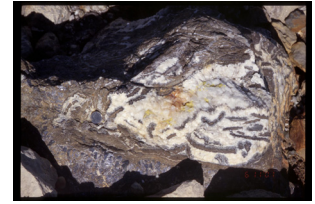
underlain by the Yukon Tanana Terrane (YTT). TGI funding has capitalized on that expertise to map extensive parts of the Finlayson and Glenlyon map areas at 1:100,000 scale, to augment mapping of the very poorly exposed Stewart River area

with a multispectral geophysical survey, and to undertake regional till geochemical surveys. Advances have been realized in understanding the YTT internal stratigraphy, complex geologic history, and relationships to bounding terranes. Several areas of high potential for VMS deposits have been identified: one new VMS prospect, one "kill zone", and two indicators of VMS deposition (iron formation and manganiferous chert) were discovered. The till geochemical survey resulted in the discovery of an epithermal gold prospect, which is now being explored, and several other promising anomalies. In the Stewart River area, a local prospector used the regional aeromagnetic survey results to outline the extension of a known iron oxide copper gold deposit. The deposit is now optioned and under active exploration. The TGI project team developed a streamlined and efficient process for data management and map production in the field. As a result, geology maps were released within months, a feature that generated an enthusiastic response from government leaders, individual exploration companies and the Technical Liaison Committee to the Yukon Geology Program.

NORTHWEST TERRITORIES

Northwest Territories is in partnership with Alberta and GSC in the **Potential for Carbonate-hosted MVT Pb-Zn Deposits in Alberta and N.W.T.** project (see also Alberta). The abandoned open-pits of the Pine Point lead-zinc mine, located near Hay River on the south shore of Great Slave Lake, and a wealth of rock core collected during years of mineral exploration, provide

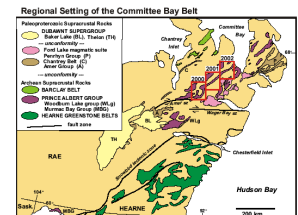
much of the fundamental data for the project. Work is still underway, with fieldwork continuing during the summer of 2002, so that final outcomes have yet to be realized. Nonetheless, positive benefits have already accrued. A CD ROM, containing the geochemical analysis, core descriptions, and interpreted cross-sections of 900 drill holes will be released early in the fall of 2002. Prospectors and junior mining companies, including those who hold land-rights in the area, have been in regular contact with project geologists and are keen for the new insights and improved access to data that will come with the CD's release. As well, regional analysis of basement faulting has caught the interest of the petroleum companies who have long suspected a linkage between such faulting and development of reservoirs in overlying strata.



A tangible benefit of the project has been the new level of collaboration with Alberta. Cross-border GIS and remote sensing compilations have brought workers together to solve a common problem. Similar collaborative efforts among surface and subsurface geologists in the two jurisdictions have also been established. One unanticipated, but potentially important outcome, is an improvement in the attitude of native communities towards mining.

NUNAVUT

The objective of the **Integrated Geoscience Mapping and Geophysics of the Committee Bay Greenstone Belt TGI** project is to provide bedrock and surficial geology maps and state-of-the-art aeromagnetic coverage in this poorly known region of central Nunavut, and to establish the structural and stratigraphic underpinnings of the potentially rich metal endowment of the greenstone terrane. The new aeromagnetic survey data have had considerable impact on interpretation of bedrock geology and structure, tracing greenstones beneath surficial cover and targeting drift prospecting over greenstones and anomalies possibly due to kimberlites. The several new geoscience products available to the mineral exploration community have begun to generate interest: one company commenced exploration for gold in the Committee Bay area in the summer of 2002.



Knowledge of precise isotopic ages of mineral deposits and the rock units with which they are associated can be used in the search for similar type deposits in related geological structures possibly hundreds of kilometres distant. New U-Pb ages from the **Geochronology of the Quebec/Baffin Segment of the Trans-Hudson Orogen TGI** project, combined with a major bedrock mapping project in central Baffin Island by GSC and the Canada-Nunavut Geoscience Office, have stimulated great interest from several mineral exploration companies who advanced an estimated \$250,000 in 2001 for exploration permits in this area.

This summary of the Targeted Geoscience Initiative was prepared under the auspices of the National Geological Surveys Committee and compiled from information contributed by:

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- Geological Survey of Newfoundland and Labrador
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- New Brunswick Dept. of Natural Resources and Energy
- Ontario Geological Survey
- Manitoba Geological Survey
- Saskatchewan Dept. of Energy and Mines
- Alberta Geological Survey
- British Columbia Geological Survey
- Yukon Geology Program
- C.S. Lord Northern Geoscience Centre (NWT)
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See www.nrcan.gc.ca/gsc/tgi_e.html