# **REVIEW 2008**



Natural Resources



www.nr.gov.nl.ca/mines&en/

# **INTRODUCTION**

The **Mines Branch** of the Department of Natural Resources is responsible for:

- managing the province's mineral resources in a manner that will ensure that their contribution to the economic and social well-being of the province is maximized, sustained and enhanced,
- increasing the body of knowledge on the province's mineral resources,
- encouraging the orderly exploration and development of these resources,
- assessing their economic potential and economic contribution to the province, and
- formulating mineral policy and providing advice to government on all mineral- related matters.

The branch operates under the departmental vision of Newfoundland and Labrador as a province that realizes the full benefit from the sustainable development of its natural resources.

The Mines Branch has three divisions: Geological Survey, Mineral Development, and Mineral Lands.

The Geological Survey of Newfoundland and Labrador is responsible for mapping the geological framework of the province; to interpret and explain its geological evolution; and to describe, interpret and explain the distribution, nature, quantity and origin of the province's mineral resources.

The **Mineral Lands Division** is responsible for legislation and regulations governing the administration of the province's mineral and quarry resources and their exploration and development.

The **Mineral Development Division** is responsible for administration of the mining industry in the province and the technical and economic analysis of mining operations. The division provides advice and assistance to all provincial and federal government agencies who are involved in the permitting of mining projects.

2008 is proving to be a record year for the mining industry in Newfoundland and Labrador. The gross value of mineral shipments is projected at \$5.4 billion and exploration expenditures at \$148 million. This has made the past year busy and challenging for the Mines Branch. New funding for geoscience mapping was identified in Budget 2008 that allowed an enhanced field program for the Geological Survey. Partnerships with the Geological Survey of Canada and the province's energy corporation will result in significant improvements in the geoscience knowledge base through major geophysical surveys.

The Mineral Incentive Program continues to provide important financial support to junior exploration companies and prospectors. The branch has a strong commitment to prospector training, and continues to support courses in Stephenville and Goose Bay, the latter with a significant First Nations' participation.

Commitment to sustainable mining practices was demonstrated through the \$10 million remediation of former mining sites on the Baie Verte Peninsula which is now well under way.

The on-line mineral rights system (MIRIAD) has worked near flawlessly since its introduction in February 2005. This has been the most intense period of claim staking since the Voisey's Bay discovery. A new project to allow on-line permitting and approval for mineral exploration is in development, and should be introduced in 2009.

2008 saw the opening of the fourth mine in four years with Anaconda's Pine Cove project, demonstrating again that the province offers not only highly prospective geology but also an excellent regulatory regime for mining.

Recruitment remains a priority for the Mines Branch and the divisions have been fortunate to have excellent new staff join this year.

2009 will bring new challenges and opportunities and the branch is ready to support the industry in meeting them.

Richard Wardle Assistant Deputy Minister



Gold pour at Pine Cove Mine.



Mines Branch Review (2008): Newfoundland and Labrador Department of Natural Resources

# GEOLOGICAL SURVEY

# Introduction

The Departmental Strategic Plan for 2008-2011 states that one of the department's goals is to enhance the knowledgebase of geoscience data to identify opportunities for resource development and to improve the promotion of these opportunities. The 2008-09 programs of the Geological Survey directly address these goals through an enhanced field program, recruitment of highly qualified staff, and expanded promotion activities.

Budget 2008 provided an additional \$1 million to the Survey's base budget this year. In total, \$1.5 million was devoted to field activities, \$800 000 of which was invested in the most extensive mapping effort in Labrador in over a decade. The Labrador program included two major bedrock-mapping projects (in the Makkovik and Seal Lake areas), a pilot study addressing base-metal potential in the Makkovik area, a study of uranium mineralization in the Central Mineral Belt, and the continuation of a 20-year mapping effort in southern Labrador. The five projects on the island included three mapping projects (in western Newfoundland, northeast Newfoundland and the Buchans area), a project to study gold mineralization in the Red Indian Lake area, and a project on the Avalon Peninsula to conduct geochemistry surveys.



Field work, Central Mineral Belt.

The expanded field program also allowed the Survey to employ 21 summer students, a marked increase from previous years. Most of these students are enrolled in earth science degrees at Memorial University. As well as assisting the Survey, this provides a valuable opportunity to train future scientists.

The Geological Survey also led promotional efforts in the Mines Branch this year, with, in addition to the traditional venues (Mineral Resources Review, Mineral Exploration Round-up, PDAC), the expansion into new territory, including for the first time, a presence at the important China Mining meeting.

#### Staff changes

The demographic profile of the Survey, coupled with the increased budget for field work, has made recruitment a high priority this year. This is challenging as there are many employment opportunities for qualified geoscientists in industry, but the Survey has been successful in attracting excellent new staff members. The Survey has appointed four geoscientists at the project-geologist level since the last Review of Activities. At the management level, **Dave Liverman** was confirmed as Director, and **Martin Batterson** was appointed Senior Geologist for the Geophysics, Geochemistry and Terrain Sciences Section. There are still a number of vacant positions (including two in regional mapping, and one in surficial mapping) that the Survey anticipates will be filled shortly.

#### Linkages and Partnerships

The Survey benefits through links and partnerships with other branches of government, both provincially and nationally, with academic institutions, non-governmental organizations and with national and international geoscience organizations. Within the provincial government, co-operation with Tourism, Culture and Recreation has led to projects developing geotourism potential as well as continuing work on the province's paleontological resources. The Survey has been working closely with Environment and Conservation on groundwater issues, and provides advice to the Emergency Measures Organization on geological hazards and disasters.



Sampling for till geochemistry south of Buchans.

A long-standing relationship with the Geological Survey of Canada (GSC) has been highlighted by projects in the Buchans belt and on the Baie Verte Peninsula as part of the Targeted Geoscience Initiative, conducted by the GSC in close cooperation with the Survey. We are also collaborating with the GSC on uranium deposits research. The federal government announced the Geo-mapping for Energy and Minerals Initiative in its Budget 2008. The provincial Geological Survey is partnering with the GSC in a major co-operative three-year project in western Labrador; work commenced earlier this summer. This will complement similar work by the Québec Geological Survey on its side of the border.

As well as servicing the exploration and prospecting community through the Survey's Geoscience Publications and Information Section, the Survey partners with the Newfoundland and Labrador Chamber of Mineral Resources on the Matty Mitchell Prospectors Resource Room. The Survey provides experienced geoscientists to instruct at prospecting courses organized by the Mineral Development Division of the department. Several of our geologists have adjunct status in the departments of Earth Sciences and Geography at Memorial University and serve on supervisory committees for graduate students. The Survey is a strong supporter of the geoscience community in the province, with survey staff being very active in the Geological Association of Canada and the Canadian Institute of Mining and Metallurgy.

The UN General Assembly proclaimed 2008 as the International Year of Planet Earth (IYPE). The Survey's contribution to this initiative is a partnership with the Johnson Geocentre, sponsoring a series of public lectures to raise public awareness of the importance of the earth sciences in society.

Dave Liverman is the Director of the Geological Survey, which consists of the following Sections; Regional Geology (Senior Geologist Lawson Dickson), Mineral Deposits (Senior Geologist Andy Kerr), Geochemistry, Geophysics and Terrain Sciences (Senior Geologist Martin Batterson), Geoscience Data Management (Senior Geologist Larry Nolan) and Geoscience Publications and Information (Senior Geologist Sean O'Brien).

#### **Regional Geology**

The Regional Geology Section (Lawson Dickson, Senior Geologist) is responsible for all bedrock mapping in the province. Five field projects were carried out in 2008 – three in Newfoundland (Brian O'Brien, Ian Knight, Doug Boyce) and two in Labrador (Tim Van Nostrand, Alana Hinchey). Bruce Ryan and Charlie Gower focused on office-based research and data compilation and only limited field work. Lori Cook recently joined the section and provides assistance to the project geologists. Lawson Dickson supplies information to clients on dimension stone, aggregate petrology and industrial minerals.

#### Newfoundland Mapping Projects

Brian O'Brien mapped the Ordovician and Silurian rocks

in the Springdale and King's Point map areas (NTS 12H/08, 09), western Notre Dame Bay. Two important styles and ages of regional alteration were identified within the Ordovician Catchers Pond Group and adjacent Silurian rocks between the Green Bay and Lobster Cove faults.

Fracture-controlled potassic, propylitic and clay alteration occurs near structures where Siluro-Devonian and Carboniferous faults, displacing the Silurian Topsails Intrusive Suite and the Silurian Kings Point Complex, also offset earlier-formed thrust sheets in the Ordovician Catchers Pond Group. In places, these linear fractures host late-stage chalcopyrite mineralization. Lithofacies-controlled hydrothermal alteration is abundant in the Batters Brook lithotectonic sequence of the Ordovician Catchers Pond Group. This alteration is associated with the felsic pyroclastic strata that host the Ursa Minor, Goldfish, Rigel and Lochinvar massive sulphide horizons.



Jasper and hematite developed in bilateral alteration zones adjacent to quartz-pyrite-chalcopyrite veinlets in fractured gabbro containing secondary epidote, chlorite, carbonate and disseminated magnetite.

**Ian Knight** continued mapping the Cambro-Ordovician carbonate platform sequence, at 1: 50 000 scale, in the Lomond map area (NTS 12H/05) and carried out additional mapping in parts of the Pasadena map area (NTS 12H/04). This area is underlain by the Goose Arm thrust stack, a complex, polydeformed, tectonic assemblage that

lies in the footwall to the main elements of the Humber Arm Allochthon. The northwest-verging stack consists of several thrust slices, is deformed by east-verging D2 structures including folds, back thrusts and strongly developed, penetrative cleavage.

Near Goose Arm, copper mineralization is associated with ultramafic olistoliths in mélange. Copper is also present in the McKenzies formation, and the Humber Arm Allochthon hosts minor copper mineralization near Wigwam and Blue ponds. Locally, grey Goose Tickle Group slates have excellent dimension stone/roofing qualities.

**Doug Boyce** continued with paleontological support for Knight's project in the Corner Brook to Lomond map areas, western Newfoundland. Fifty-one previously undocumented fossil localities were sampled in the Cambrian– Ordovician sequences of western Newfoundland and southeastern Labrador. A spectacular block of Middle Cambrian Penguin Cove Formation containing more than 40 complete Kootenia trilobites, representing a mass-kill, was recovered from North Brook near Gallants. Macluritid snails and trilobites diagnostic of the Middle Ordovician Table Point Formation (Table Head Group) were found in the Bonne Bay Little Pond area.



Block of Penguin Cove Formation containing more than 40 complete Kootenia trilobites representing a Middle Cambrian mass-kill.

#### Labrador Mapping Projects

Alana Hinchey continued regional geological mapping of the Aillik domain of the Makkovik Province, south of Makkovik. The 2008 field season completes the 1:50 000scale, bedrock mapping of the Monkey Hill map area (NTS 13J/14), a region mostly composed of Paleoproterozoic volcano-sedimentary rocks of the Aillik Group and Paleoproterozoic intrusive suites. Mapping further defined the lithological variation and geographical extent of the Aillik Group that underlies most of the northern part of the Monkey Hill map area. The southern part of the map area mostly consists of weakly foliated, coarse-grained plutonic rocks; these likely represent an exhumed deeper crustal section, relative to the rocks in the north. The entire map area was affected by late brittle faulting.

Within the Monkey Hill and Makkovik map areas (NTS 13J/03), the Aillik Group hosts numerous uranium and molybdenum showings and also some copper, lead and pyrite showings. Several new anomalous radioactive and molybdenum-bearing occurrences were found within the Aillik Group in the Monkey Hill map area. **Crystal Laflamme** (Department of Earth Sciences, Memorial University of Newfoundland) who was part of the field party is working on a M.Sc. thesis based on this summer's field work.



Monkey Hill, Central Mineral Belt.

Tim Van Nostrand initiated a bedrock mapping project in the Seal Lake area. Field work consisted of 1:50 000 scale bedrock mapping of the southern parts of NTS map areas 13K/5 and 6. This project forms part of the Survey's contribution towards the Geo-mapping for Energy and Minerals joint project with the GSC and the Québec Geological Survey.



Gabbro sill, Seal Lake.

The stratified rocks in the area are part of the Middle Mesoproterozoic Seal Lake Group. These rocks are a primarily sub-greenschist, typically shallow-marine facies clastic sedimentary succession. These include red sandstones and siltstones (locally ripple and cross-laminated). The sedimentary rocks are inter-layered with fine-grained, basaltic flows and intruded by extensive coarse-grained gabbro sills and finer grained gabbro dykes.

The region is characterized by a dominant east-northeast trending regional S1 foliation associated with F1 folds, variably plunging minor folds and mineral lineations developed in the supracrustal rocks, and northeast trending faults. Kinematic features of these faults indicate a dominantly north-directed shear sense.

Copper mineralization in the area is hosted primarily by quartz–carbonate veins associated with fractures and shears proximal to mafic volcanic–slate contacts. Mineralization consists of native copper seams and "nuggets" up to 30 cm in diameter, as well as chalcocite–bornite–malachite aggregates. Other occurrences include slate-hosted native copper and chalcopyrite–bornite–malachite within gabbro sill and dyke margins.

**Charlie Gower** returned to Battle Harbour in southern Labrador and continued to develop a brochure on the geological features of Battle Island, designed for use by visitors to this now well-known tourist destination. Some time was spent carrying out detailed geological mapping of some of the adjacent islands. These adjacent islands show a similar sequence to that seen on Battle Island where metamorphosed supracrustal rocks are injected by mafic intrusions and pegmatite. Several new amazonite-bearing pegmatites were located.



Aerial view of Battle Island, southeast Labrador.

Also, he continued mapping rock exposures newly created as a result of construction of the highway from the southeast coast of Labrador to Goose Bay. These are not abundant, but serve to confirm and refine previous mapping in the Eastern Grenville Project, especially with respect to some of the late- to post-Grenvillian granites.

#### Mineral Deposits

The Mineral Deposits Section (Andy Kerr, Senior Geologist) is responsible for the documentation of metallic and non-metallic mineralization, conducting related research studies, and developing assessments of regional mineral potential.

#### Mineral Occurrence Data System (MODS)

MODS is an extensive relational database of mineral occurrences that incorporates public-domain information from mineral exploration reports and Survey research. MODS is managed by **Greg Stapleton**, and assisted by **Jan Smith**, **Dorothea Hanchar** and **Heather Rafuse**. The database is continually updated with new available public-domain records; during 2008, NTS map areas 1N, 2C, 2E, 12A, 12H and 13K were updated. Work on systematic updates of NTS map areas 2D (Newfoundland) and 13J (Labrador) continued. MODS is accessible through the Survey website and through the on-line Geoscience Atlas. The system was enhanced in September to become a real-time database, and new or updated occurrences will be immediately available to users of the atlas.

#### Uranium Mineralization

**Greg Sparkes** completed the second field season of a regional survey aimed at documentation and metallogenic analysis of uranium mineralization in the Central Mineral Belt (CMB) of Labrador. In 2008, field work focused on the western end of the CMB including investigation of mineralization in the Moran Lake and Anna Lake areas. Work was also conducted in the area around Makkovik, where it was coordinated with the systematic mapping project of Alana Hinchey (see Regional Geology Section).



High-grade uranium mineralization in altered felsic metavolcanic rock at the Michelin deposit, Labrador.

All of the known major uranium occurrences across the CMB have now been systematically examined, and the first integrated review of such mineralization in 25 years was

published in 2008. Preliminary geochronological results indicate that the small but high-grade Kitts deposit and the larger, low-grade Michelin deposit represent the products of two discrete mineralization events.

A collaborative project to directly date uranium mineralization has been initiated with the Geological Survey of Canada.

#### VMS Mineralization in Newfoundland

This project by **John Hinchey** focuses on the metallogeny of the Victoria Lake supergroup of central Newfoundland. The project was office based in 2008, where the emphasis was on preparing a manuscript on the recent results, including the documentation of bimodal-felsic, felsic-siliciclastic and hybrid VMS-epithermal systems within the Tulks Group and adjacent rocks. Field work in 2008 consisted of examining some new sulphide intersections from the southern part of the Tulks Group, and the sampling of footwall felsic tuff units at Daniel's Pond for potential geochronological studies.

#### Gold Mineralization in Newfoundland

A gold metallogenic studies program started in late summer 2008 led by **Hamish Sandeman** (hired August 2008). Work focused on deposit-scale studies of the important Golden Promise and Valentine Lake deposits, hosted within the area of the Victoria Lake supergroup. Field work on Golden Promise emphasized relationships between vein systems and at least two generations of mafic dykes, and on the origin and distribution of peculiar "spotty" alteration in the host rocks that may provide a vector towards mineralization.

**Andy Kerr** with David Selby of the University of Durham (UK), continued efforts to directly date epigenetic gold mineralization in Newfoundland by Re-Os geochronology on pyrite and arsenopyrite.

# SEDEX VMS Potential in the Central Mineral Belt of Labrador

A pilot project was initiated in 2008, by **John Hinchey**, to assess the regional litho-geochemistry of argillitic sedimentary rocks in the Post Hill and Moran Lake groups (Central Mineral Belt, Labrador). The objective is to define prospective horizons requiring more detailed exploration. Both rock groups contain bedded sulphides in sedimentary rocks, and the latter hosts stratiform iron formations. Known copper and zinc showings were visited to upgrade descriptive information for MODS, and previously undescribed massive sulphide showings were documented from islands in Kaipokok Bay.

#### Optical/Infrared Spectroscopy

In 2008, the Survey purchased a portable spectrometer (Terraspec Plus) to aid in identifying alteration minerals and mapping alteration assemblages in mineralized systems. This technology is being applied to several problems on a trial basis, including characterization of unusual epithermal-style alteration associated with some VMS deposits (John Hinchey), enigmatic "spotty" alteration associated with vein-hosted gold in sedimentary rocks (Hamish Sandeman) and superimposed chloritic and potassic alteration at the Moly Brook deposit (Andy Kerr).

#### Other Projects

In 2008, Andy Kerr conducted some small-scale field projects, including an initial appraisal of the potential for potash in the Carboniferous Bay St. George basin, with the assistance of **Ian Knight** and **Gerry Kilfoil** and geochemical and geochronological studies on the Tenajon Resources Corp. large-scale bulk-tonnage molybdenum target near Grey River in southern Newfoundland (partly in conjunction with Edward Lynch and Martin Feely (Galway, Ireland), David Selby (Durham, UK) and Derek Wilton of Memorial University).



Molybdenite associated with quartz veins in granite, Moly Brook deposit.

# Geochemistry, Geophysics and Terrain Sciences

The Geochemistry, Geophysics and Terrain Sciences Section (Martin Batterson, Senior Geologist) provides a diverse but focused range of geological services, including aggregate-resource assessments, till and lake-sediment geochemical surveys, Quaternary geology and ice-flow mapping, geophysical compilations and interpretation, and environmental initiatives including geological hazard mapping and coastal monitoring.

#### Quaternary Mapping

In central Newfoundland, Jennifer Smith (hired Spring 2008) mapped the surficial geology of southeastern part of the Red Indian Lake basin; and sampled tills for geochemical analyses. Over 780 sites were visited by truck, ATV and helicopter, and 762 till samples were collected from the C- or BC- horizons of hand-dug pits. The surficial geology of

the south side of Red Indian Lake is dominated by thick deposits of locally derived diamicton that commonly form blankets and areas of hummocky terrain. There are few natural exposures in the area, and only one stratigraphic unit of diamicton was identified.

The ice-flow history of the area is complex. Age relationships indicate an initial flow towards the south-southeast (likely Topsails source), followed by an east-northeast flow in the eastern part of the field area and a west to southwest flow in the western part of the field area. These later flows indicate the presence of an ice divide between Bobby's Pond and Costigan Lake.

On the Avalon Peninsula, **Dave Taylor** continued work on the Eastern Newfoundland Till Geochemistry project. Till samples were collected along the southern shore of the Avalon Peninsula from St. Catherine's in St. Mary's Bay, along the southern shore highway to the community of Witless Bay. A total of 373 samples was collected in 2008, bringing the total number of samples to 2605 for the Avalon Peninsula.



Dave Taylor measuring ice-flow directions in eastern Newfoundland.

Ice-flow measurements (mostly striations, but including clast-provenance data) indicate the area was affected by two ice-flow directions, both of which are tentatively assigned to the late Wisconsinan. The glacial maximum ice flow shows a consistent radial ice-flow pattern from an ice centre in St. Mary's Bay, from where ice flowed westward across the Cape St. Mary's Peninsula, and east and southeast across the Trepassey Peninsula. Subsequently, the ice centre shifted eastward to the Trepassey Peninsula highlands from where ice flowed westward into St. Mary's Bay, south and east across the Trepassey Peninsula, and north towards Conception Bay.

#### Geochemical Studies

John McConnell continued to work on lake-sediment and water geochemical sampling, data analyses and data releases. In 2005, a detailed lake-sediment and water survey was conducted in eastern Labrador (NTS map areas 13J/11, 12, 13, 13K/9, 16, 13N/1 and 13O/4), and the results released in February, 2008. The area is underlain by the Archean Hopedale Block, the Paleoproterozoic Makkovik Province and the Grenville Province. Several occurrences of copper and uranium mineralization are known in the survey area. Sediment samples from 809 sites were analyzed for a standard suite of over 50 elements. Waters were analyzed for pH, conductivity and 25 elements including uranium, copper, nickel and zinc. Many of the known uranium and copper occurrences are reflected in the geochemical data that also suggests several additional prospecting targets for uranium, copper, gold and molybdenum.

#### Laboratory Services

The geochemical laboratory undertakes most analytical requirements of the Geological Survey. The laboratory currently consists of four staff; a Laboratory Director (Chris Finch), two Mineral Laboratory Chemists (Anne Marie Bourgeois and Chuck Riley) and a Mineral Laboratory Assistant (Kieran Miller). The laboratory carries out analyses for about 40 elements with an annual production of over 200 000 determinations. Most are carried out by Inductively-Coupled Plasma-Emission Spectrometry for trace and major elements. The laboratory maintains an archive of all samples that were submitted for analysis.



Sample preparation at Geological Survey's geochemistry lab.

#### Geophysical Surveys

Gerry Kilfoil provides geophysical support to mineral exploration and integrates geophysical data into the Survey website. Results of joint GSC-GSNL airborne surveys flown in the Gullbridge and Baie Verte areas as part of the 2007 Targeted Geoscience Initiative program have been incorporated into the airborne survey data inventory and made available on-line. The on-line airborne survey index was expanded to include several detailed airborne surveys that were flown by mineral exploration companies and which have now gained nonconfidential status. In response to renewed exploration for potash and hydrocarbon, gravity data



Aerial view of the recent landslide in Daniel's Harbour.

from all available sources covering areas in the Bay St. George Carboniferous Sub-basin were digitized, geo-registered, and compiled into a consistent database. This compilation, when completed, will be released as an open file. This sub-basin is a correlative of Carboniferous rocks in southern New Brunswick that host producing potash deposits and the recently discovered McCully natural gas field.

Tenders have been let for approximately 25 000-line km of 200 m spaced, fixed-wing aeromagnetic surveys that will be flown in an area extending from north of Stephenville to the southern boundary of Gros Morne National Park, western Newfoundland. The survey overlaps parts of several recent high-resolution airborne surveys flown by the mineral exploration industry. These data will be a significant improvement to the existing magnetic data available for this area.

#### Aggregate Resources

Aggregate resource work by **Jerry Ricketts** concentrated on converting 1:50 000 scale blueline aggregate maps to digital formats. The digital version will provide the same information that was shown on the blueline maps (outlining areas of aggregate potential and sample-site locations), but will also show grain-size data for sample site locations, petrographic numbers, exposure thickness where samples were collected, and the estimated deposit thickness. When completed, these digital maps will be made available on the Geological Survey website.

Work has continued on an aggregate-resource database of field notes collected by aggregate geologists since 1976. These notes consist of brief descriptions of the surficial material, bedrock geology or the geomorphology at sample sites or points of interest noted while conducting field work. These data will supplement the aggregate resources database that is currently available on the website.

#### Geological Hazards & Climate Change

Martin Batterson continued work on hazard mapping projects in the Humber Valley and northeast Avalon Peninsula in support of regional municipal planning. Increasing demands on land in these areas include proposed developments that are in areas at risk from current or future hazards. In particular, rising sea levels as a result of climate change need to be considered in municipal planning exercises. The continuation of a coastal monitoring program, in cooperation with the Geological Survey of Canada (Atlantic) supports this work. Research into past and present geological disasters also continued. Historical research into the 1959 avalanche at the Battery involved a summer student conducting interviews with residents involved in the event. The recent landslides at Daniel's Harbour also provided the opportunity to work with other government departments (Municipal Affairs, Environment and Conservation, and Transportation and Works) and consultants to determine the cause of the landslide and the potential for further landslides in this area.

# Geoscience Data Management

The Geoscience Data Management Section is responsible for the organization, management, and integration of geoscience data collected by the Geological Survey. As the size and number of geoscience datasets has burgeoned, it has become increasingly important that digital techniques are used to manage this information and apply it effectively to mineral exploration. In response to these trends and client needs, the section has focused on database management techniques and internet tools for the consistent and timely delivery of geoscience information to government scientists and industry clients. The section has five staff, headed by Senior Geologist Larry Nolan. Harj Missan manages on-line data standards and integration. Loretta Crisby-Whittle is responsible for the bedrock geology database for the province. The Geoscience Atlas and on-line delivery of geoscience information is managed by a database geologist; this position is currently vacant. Gillian Simms provides support to all the projects.

#### Bedrock Geology Database

2008 has seen many additions to the bedrock geology database, and significant work completed for the Avalon Peninsula as well as the incorporation of legacy legend data into the Geolegend database. There are now 40 geology maps of Labrador available in GIS format, and PDF versions of original printed geology maps are available for viewing on-line (75 in Newfoundland and 80 in Labrador).

#### Online Geoscience

The Geoscience Atlas has been updated and a number of new layers added this year. Highlighting the list are almost 19 000 historical ground and map staked claims with links to the Mineral Rights Inquiry Report and the Geofile record for any assessment reports filed. This layer is still under construction with polygons being edited or added on a regular basis. A new category was added for land-use information with layers for forestry access roads, Labrador Inuit Lands, Labrador Inuit Settlement Area, public water supplies, municipal boundaries and municipal planning areas. Geochemistry layers include an index for detailed surveys, and rock geochemistry. Improved documentation is provided for many layers with an emphasis on the bedrock geology help and legend files.

#### Other Projects

Ongoing work includes the standardization of field-data collections for surficial and bedrock geology using handheld computers with customized software and integrated GPS units. In addition, the format of legacy data published in the Geological Survey's open files is being modernized for inclusion in the Geoscience Online (Web) Service.

#### **Geoscience Publications and Information**

The Geoscience Publications and Information Section (Sean O'Brien, Senior Geologist) is organized around six principal lines of business. These focus on the communication of public- and private-sector geoscience and related mining-sector information to current stakeholders and future investors. Section goals are achieved via traditional and innovative means, in partnerships with other sections, divisions, departments, governments, and, in the case of the Matty Mitchell Prospectors Resource Room, the provincial mining industry association. The Section has 17 profession-al, technical and clerical staff.

The section also directs the development and implementation of branch-wide plans to promote opportunities for mineral exploration in the province. In doing so, it builds on other Survey efforts by helping market the wide array of information and data available to support exploration and mitigate risk. Additional responsibilities include the branch website, client databases, industry liaison and the provision of secretarial and cartographic support to the Survey.

#### Industry Information and Client Services

Exploration consultation and information services are provided to a wide client-base via 'over-the-counter' assistance and community-based outreach, and in partnership with the Matty Mitchell Prospectors Resource Room (see below). The Industry Information and Client Services group (**Norm Mercer, Randy Meehan, Stephanie Neary**) represents the initial point of contact for most of the Geological Survey's clients. More than 1500 information requests from the private-sector have been processed thus far in 2008; a further 300 requests from government sources have been addressed. In 2008, more than 125 separate exploration companies availed of this group's services; an additional 50 companies, yet to acquire mineral rights in the province, contacted this office for information.

Throughout 2008, the Industry Information and Client Services group has provided key logistical, promotional and organizational support for the annual Mineral Resources Review, liaised with the Matty Mitchell Prospectors Resource Room on a daily basis and provided logistical support for implementation of the Mines Branch Promotion Plan.

#### *Promotion, Geoscience Marketing and Investment Attraction*

The section is responsible for the implementation of the branch's Promotion, Geoscience Marketing and Investment Attraction project, the ultimate goal of which is to further encourage growth in the mining sector by capturing external investment. The development of an annual Promotion Plan is the responsibility of a branch-wide committee chaired by **Sean O'Brien**. Highlights for 2008 include increasing exposure to Asian markets through participation in China Mining 08, expanding our presence at PDAC08 by developing a new Atlantic Canada Pavilion, and increasing promotion of exploration through information articles submitted to trade journals.

The section coordinated trade show booths and exhibits at Mineral Exploration Roundup and Québec Exploration. Promotional information packages were developed in partnership with the federal Department of Foreign Affairs and International Trade and the provincial Department of Business. Work continued throughout 2008 on a major goal of the branch promotions plan, namely, reorganizing and expanding the annual Mineral Resources Review conference while further integrating its public- and private-sector components.



Clients visiting DNR Mines Branch booth at China Mining.

#### Publications and Cartographic Services

The Publications and Cartographic Services group includes editorial (Chris Pereira, Des Walsh), cartographic (Dave Leonard, Tony Paltanavage, Terry Sears, Neil Stapleton), and desktop publishing and design staff (Beverly Strickland, Joanne Rooney, Deborah Downey). They are responsible for report and map preparation for the Geological Survey, and provide cartographic, graphic design and desktop publishing services to other branches of the department, on an opportunity basis. The section published in excess of 75 geological survey maps, open files and publications in the period 2007-2008, including the flagship Current Research volume. Cartographers provided graphic design and related cartographic support for mining trade shows and conferences in Beijing, Vancouver, Toronto, Québec City, Goose Bay, Baie Verte and St. John's, in support of the branch's 2008 Promotion Plan.

#### Geofiles: Geoscience Documents and Collections

Geofiles staff (Catherine Patey, Cindy Saunders, Paula Bowdridge) manage the branch's technical document collections and related metadata, including more than 9000 mineral exploration assessment reports that are currently being made available via the internet. The final phase of the project to complete scanning of these assessment reports for access of full text on-line was launched in late summer 2008. The goal is to have all historical assessment reports scanned by the end of the fiscal year. More than 200 new confidential assessment reports filed this year have been indexed with descriptions added to the website. Geofiles staff provided more than 200 customized searches of various in-house databases, including exploration and mining company archives, for clients during 2008.

#### Matty Mitchell Prospectors Resource Room

This partnership project between the Geological Survey and the Newfoundland and Labrador Chamber of Mineral Resources continued to supply mentoring, technical support and promotional assistance to a large group of prospectors



First Nations prospectors with the Matty Mitchell Room Geologist Pat O'Neill.

across the province, including an increasing number of First Nations prospectors from Labrador. The Resource Room project is managed by a joint government–industry committee chaired by **Sean O'Brien.** 

Day-to-day operation of the project is the responsibility of Resource Room geologist **Pat O'Neill.** In 2008, the project expanded its role in training courses in Stephenville and Goose Bay and delivered prospector workshops in rural parts of the province. A new series of training modules for prospectors, rockhounds and the general public was also developed.

The Resource Room developed paper and digital property posters for prospectors. The Properties for Option booklets were again developed in 2008 and the Resource Room played a major role in assisting prospectors at Mineral Exploration Roundup, PDAC08 and Mineral Resources Review.

#### Outreach

A formal initiative to provide geoscience and mining industry information tailored to the general public clients was developed in 2008 with the creation of the new position Outreach Geologist (**Amanda McCallum**). Another new development is the Bonavista Peninsula geotourism project, which is being advanced by the Department of Tourism, in partnership with the Geological Survey and community groups on the Bonavista Peninsula.

The section, in partnership with the Mineral Lands Division, developed a variety of industry information packages, posters and oral presentations on the mineral exploration sector, to better inform the public about mineral resource issues and developments. These were presented to community councils and economic zone boards in eastern and western Newfoundland and displayed at the annual Baie Verte Mining Conference and Expo Labrador. The section continued its usual participation in career fairs and government's public service initiatives.

# MINERAL LANDS

# Introduction

The Director of the Mineral Lands Division is **Ken Andrews.** The division is responsible for a number of essential regulatory programs and information services that contribute to sustainable development of the province's mineral resources. These include administration and management of quarry materials, administration of mineral land-tenure, permitting for mineral exploration, retrieval and storage of core from exploration drilling, and representing the branch on land-use issues. The division has extensive contact with most other departments and levels of government through referrals for various permits and approvals, and as the point of contact for the Mines Branch for the Interdepartmental Land Use Committee.

#### Staff

In January 2008, **Ges Nunn** moved into the Resource Assessment Project Geologist position with the Quarry Materials Section. **Phil Saunders** was the successful candidate in the competition to fill the Exploration Monitoring Project Geologist position, and took up those duties in April of this year. Recruiting an experienced and suitably qualified person to replace Phil in reviewing assessment reports was a challenge; however, we were most fortunate to hire **Andrea Mills** for this position in early September.

Support staff are critical to the productivity and function of any organization. **Bernie Brazil** joined the Division in January of this year and is performing a variety of duties. **Charles Newhook** joined in February as a Geological Technician and is responsible for scanning documents for the Registry Project. **Anne Marie Woolridge** started mid-September as a Clerk/Stenographer providing secretarial and administrative support for the Division. Anne Marie replaced **Sylvia Newhook** who retired in June.

# **Mineral Rights**

The Northern Miner states "There can be no healthy mining industry without a secure and fair system of land tenure". The Mineral Act and Regulations, in addition to being clear and transparent, are extremely efficient and cost effective for both government and industry in the administration of mineral land tenure. The Mineral Rights Section is responsible for maintaining the Transfer and Agreements Registries. This year marks the 25<sup>th</sup> anniversary of the introduction of map staking in Labrador in August 2, 1983. Map staking is the superior method for free-entry acquisition of mineral rights.

The Mineral Rights Section (Jim Hinchey, Phil Saunders, Andrea Mills, Laurie Hennessey, and Charles Newhook) manages all aspects of the acquisition and the maintenance of mineral rights in the province. The acquisi-

tion and the maintenance of mineral rights are managed through the Mineral Rights Administration System (MIRI-AD). MIRIAD uses the internet and provides map-base claim staking (24-7) with fees paid by credit card only. It integrates mineral rights information with the province's geographic information System (GIS) and financial management system. Mineral rights are also managed through the maintenance of several key hard copy registries, including a registry of transfers, registry of confidential agreements and a registry of mining and surface leases. This represents about 50 volumes of documents. These registries are used extensively by the legal community as well as the mineral exploration clientele. To make these registries more accessible, a new project to scan this material commenced earlier this year. Upon completion, the information will be made available on the department's website.

The Mineral Rights Section also monitors exploration activity and related expenditures in the province. Expenditures are surveyed annually in cooperation with Natural Resources Canada. The results are analyzed internally, and reported to various branches of government, and externally, as required.

# **Quarry Materials**

Quarry materials literally form the foundation for all other developments in the province. The administration and management of quarry materials is becoming ever more challenging as a result of increasing land-use conflicts, and environmental and social concerns.

The Quarry Materials Section (Fred Kirby, Ges Nunn, Gerald Kennedy, Joanne Janes, Kirby Way and William Olford) is responsible for administration and enforcement of the Quarry Materials Act and associated regulations. The section is also responsible for the review of all Municipal Plans to ensure these do not have a negative impact on the mineral and aggregate resources of the province. The division operates from offices in St. John's, Grand Falls-Windsor and Pasadena.

There are currently 1339 quarry permits and 70 quarry leases issued in the province. Total production for the province in 2007 was 3 335 413 m<sup>3</sup>. To date quarry inspectors have completed 1800 inspections. Although increased inspection activity has led to better compliance with the Quarry Materials Act, serious violations are still occurring. To date, this year, inspection activities have led to one conviction for illegal quarrying, one case before the courts, and three other cases pending.

# Core-Storage Program

The Core-Storage Program in Newfoundland and Labrador, according to exploration personnel that have worked in other jurisdictions, is one of the best programs of its kind to be found anywhere in the world. It is managed by **Alvin** 



Drill core library at Buchans.

Harris who, with the assistance of Stewart Cochrane, operates six core-storage libraries located throughout the province. These libraries house more than 1.1 million metres of drill-core samples from 8579 drill holes collected from various exploration projects located from the Avalon Peninsula, to Okak Bay in northern Labrador. These samples are available for inspection by all interested parties and are used extensively by the mineral exploration industry. Sampling of the core sample collection is permitted where there is sufficient core available to allow removal of some material and with the proviso that all unused material is to be returned to the core library along with a copy of analytical results obtained from the core samples. Drill core acquisition continues with approximately 37 500 metres of core samples from 178 separate drill holes added this year. The core-storage database is available on-line via the Resource Atlas under the Mineral Lands tab.



Stewart Cochrane collecting core in Labrador.

#### **Exploration Approvals**

Heather Hickman and Bernadine Lawlor are responsible for processing exploration approvals. The demand dropped slightly in 2008 with 233 requests to date, compared to 268 in 2007. Heather and Bernadine have gained much experience in the past year in screening applications for exploration approval, consulting with other departments on exploration programs, and working with their counterparts with the Nunatsiavut Government in administering the new Standards for Mineral Exploration in Labrador Inuit Land.



Exploration inspection in Labrador.

It is becoming increasingly important for mineral exploration to be more carefully executed and have a lighter "footprint". A Mineral Exploration Approval Management System (MEAMS) is being developed that will allow shorter screening periods and quicker turnaround time for all permits and approvals for mineral exploration. As well, MEAMS will be the single on-line portal for filing application for all permits required for any exploration program. It will also enhance the monitoring and inspection of exploration sites and consist of two components, namely, an online application for mineral exploration approval and an inhouse database. Both components will incorporate GIS technology.

# MINERAL DEVELOPMENT

### Introduction

The Director of the Mineral Development Division is **John Davis**. The division is responsible for the technical and economic analysis of the mining industry in the province, as well as the monitoring and analysis of all phases of individual mining and quarrying operations. This is the key division for liaison with other government departments on mining matters.

#### Staff

The recent upswing in mineral commodity revenue over the past two fiscal years has had a major impact on work load and workforce performance in the division. Mineral Development lost the services of an experienced mining engineer and also a project geologist. To compensate for the engineering vacancy, in December 2007, Darren Pittman was hired as an Engineer I, and has been receiving on-thejob training in reclamation work and quarry development approvals. A vacant analyst position in Labrador West was temporarily filled by hiring a retired former employee (Ed Montague) until the permanent employee returns in December. We are in the final stages of filling a supervisory position from within, and actively recruiting two mining engineers and a geologist. The division has emphasized more awareness of occupational health and safety requirements, especially for field personnel, and has participated in off-season training courses, such as First Aid, and CPR, ATV operation, asbestos awareness, radiation safety and WHMIS.

#### Lines of Business

The division encourages the development of the province's mineral resources by providing training and financial assistance to prospectors and junior exploration companies under the Mineral Incentive Program. It also provides advice to all provincial and federal government agencies that provide support or assistance to mining projects. The division is responsible for administering the Mining Act and, through this, for ensuring that mineral resources are responsibly developed and that end-of-life operations are properly closed down. The division is also responsible for rehabilitating certain old orphaned and abandoned mines to ensure they do not present safety hazards.

Staff liaise with industry by attending technical conferences and trade shows and addressing regional strategic planning sessions on mineral resource development requirements on an invitational basis.

The division's activities are organized into three units by work functions: Engineering Analysis, Mineral Industry Analysis, and the Mineral Incentive Program.

# **Engineering Analysis**

This section is responsible for administration of the Mining Act and compliance of current mine operations with the Act by site visits throughout the year. To date, most site inspections have been completed (Alex Smith, Ned Vukomanovic, and John Davis) with the exception of Vale Inco's mine operation and the Port au Port area of the island. The section provides technical monitoring of work proposals by operators, such as proposed changes to milling operations (economic feasibility; impact on the environment; financial assurance implications; and influence on life of mine). Staff performed technical evaluations and reviewed proposal requirements for development plans, rehabilitation and closure plans and financial assurance needs to aid in work planning, as well as permitting and development of former operating properties (Nugget Pond, Rambler Metals and the Schefferville iron ore deposits).

This section is also responsible for ongoing rehabilitation work on orphaned and abandoned mine sites (**Ned Vukomanovic, Darren Pittman** and co-op student **Josh Hurley**), and works with the Department of Environment and Conservation on contaminated mine sites (chemical and toxic material spills; acid rock drainage–water treatment; and hazardous airborne particulate matter/asbestos). A threeyear work project rehabilitating the former Collier's Point barite mine at a cost of over \$200 000 was completed this year. Work valued at over \$40 000 was completed at the former Whalesback mine site to remove standing concrete foundations and dispose of acid generating concentrates. Work continues on locating, assessing, ranking and costing the remediation work for nearly 90 other mine sites.

Government's concern about the problem of abandoned mines in the province is demonstrated by a \$10.1 million three-year partial remediation of the former Baie Verte asbestos mine and the Consolidated Rambler copper mines, supervised by **Alex Smith**. To date, Phase I Environmental Site Assessments (ESAs) were completed in 2004/05, Phase II ESAs in 2006/07, and Phase III ESAs in 2007/08. Jacques Whitford Limited is managing the project. The immediate work plan is to eliminate public safety and health hazards by removal of underground storage tanks, to demolish the remaining buildings and infrastructure, to isolate fall hazards by fencing areas, and to cap shafts and openings to sub-surface work areas.

The project is halfway through the 3-year work period and has spent \$2.2–\$2.5 million. Water quality monitoring at Consolidated Rambler has started, and the air quality survey at Baie Verte Mines and the town of Baie Verte should be operational in October, 2008. The goal for the 3-year work period is to eliminate the public health and safety hazards and gather sufficient information to support evaluation of



Colliers Point site prior to and following rehabilitation.

the long-term remediation methods and costs. Currently delays are being experienced with demolition efforts at the Baie Verte Mine site, which is causing further delays with related on-going work. Regular updates to the Baie Verte town council are planned.

# **Mineral Industry Analysis**

This section (Tony Burgess, Brad Way, Keith Bradbury, Gord Button, Ed Montague, Lew Higdon and Brenda Kelly) is responsible for economic and business research, Mines Branch statistical and analytical functions, and the development and co-ordination of policy and program matters related to the mining industry. This section publishes "Mining in Newfoundland and Labrador" three times a year and the brochure "MINFO". Direct liaison with the mining industry in Labrador West is maintained by the presence of an analyst in Wabush. A mineral statistics database includes value of mineral shipments, employment, and exploration expenditures. The value of minerals shipped for 2008 is now estimated at \$5.4 billion versus the previous estimate for 2008 of \$3.9 billion.

# Mineral Incentive Program

The overall budget for the Mineral Incentive Program has remained the same for the past two fiscal years (Years 08 and 09) at \$2.528 million. The program is under the administration of **Len Mandville** and **Justin Lake**.

Under the Prospectors Assistance plan in 2008-09, 54 prospectors were approved for funding for a total of \$192 000, while under Natural Stone Assessment, two applications for funding were approved for \$100 000. Under the Junior Exploration Assistance plan, the Minister approved 21 projects for a total of \$2 100 000. Due to the low demand for support during the past two years, unexpended funds from the Prospector Assistance and Natural Stone Assessment categories have been directed to the Junior Exploration Assistance category.

This is the third consecutive year that the two-week prospector training course has been conducted in both Stephenville and Happy Valley-Goose Bay. It is anticipated that prospector work-site field visits will be the focus for the autumn, while final proposals for program assistance will be evaluated.



Prospectors training course at Stephenville.



# 2008 FIELD PROJECTS NEWFOUNDLAND & LABRADOR

