

REVIEW 2017



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Cover: Laying out a Direct Current Resistivity (DCR) survey line atop glacially deposited sediments (minimum 15 m thick), in a study of susceptibility to coastal erosion near Parsons Pond, western Newfoundland (taken from a drone, looking approximately north-northwest). Aluminum electrodes, spaced at 5 m intervals along a 115 m profile, are driven into the ground to a depth of 20 cm in order to provide contact with the sediments underlying the vegetation. A yellow multicore cable (visible on the ground) connects the 24 electrodes to an electrical generator and recording console, located midway along the profile (not visible here). To the left can be seen Ground Penetrating Radar (GPR) equipment, mounted on a push cart. GPR profiles were surveyed concurrently with the DCR work, as well as along lines perpendicular to the DCR line, to measure local compositional differences in the upper few metres of sediments.

DEPARTMENT OF NATURAL RESOURCES

Mines Branch Review 2017

2017 Mineral Resources Review is the result of the outstanding partnership between the provincial chapter of the Canadian Institute of Mining, Metallurgy and Petroleum and our dedicated Mines Branch professionals. Together we are committed to sustaining and growing the Newfoundland and Labrador mining sector. We'd like to take this opportunity to highlight this year's work of the Mines Branch.

We are responsible for managing the province's mineral resources.

The Mines Branch is responsible for managing the province's mineral resources and for ensuring its contribution to the economic and social well-being of the province. Through the Mineral Development, Mineral Lands, and the Geological Survey teams, we are:

- increasing the body of knowledge on the province's mineral resources,
- mapping the geological framework of the province,
- encouraging exploration and development of resources,
- providing training and assistance for prospectors,
- assessing the economic potential and economic contribution to the province,
- developing mineral policy and providing advice to government on all mineral related matters,
- regulating the province's mineral and quarry material resources, and
- managing the core storage program.

An active field program provided many new initiatives.

The Geological Survey had an active field program this year with 13 field projects (three in Labrador, and 10 on the island). New initiatives included:

- bedrock geology mapping and mineral deposits research in the northern part of the Labrador Trough,
- multi-year project targeting volcanogenic massive sulphide mineralization in central Newfoundland,
- multi-year project studying industrial minerals province-wide, starting with west coast marble and fluorite on the Burin Peninsula,
- surficial geological mapping and till geochemistry of the Cormack–Silver Mountain map areas,
- geophysical (ground penetrating radar) study of the Daniel's Harbour landslide area,
- projects on carbonate-hosted zinc deposits in western Newfoundland,
- bedrock mapping in the Bay d'Espoir–St. Alban's map area,
- surficial mapping and till geochemistry in central Newfoundland,
- bedrock mapping on the Bonavista Peninsula,
- monitoring of coastal areas vulnerable to erosion, and
- the study of gold metallogeny in central Newfoundland.

Partnerships with the Geological Survey of Canada also continued to strengthen our geoscience knowledge in the province. As well,

efforts are being made to place available additional data on the Geoscience Atlas.

Commitment to prospecting and exploration continues.

- The Mineral Incentive Program continues to provide important financial support to junior exploration companies and prospectors. The program's budget was maintained at \$1.7 million for 2017-18.
- The annual prospector's training course occurred in Stephenville during May demonstrating our continuing commitment to prospector training.

Work is progressing to better serve industry.

- A review of the online mineral claim staking system MIRIAD is underway to assess modernization options.
- The Branch is committed to actively assessing options to improve the core storage program through potential partnerships with academia and industry.
- An internal review of the quarry legislation is underway with several administrative processes having been implemented to aid the processing of increasing volumes of permit applications.

The mining industry is showing promise for the future.

Mining projects continue to progress in the province. For example, IOC announced in February they will proceed with a \$79 million investment to develop the Wabush 3 project, construction of the St. Lawrence Project by Canada Fluorspar has been completed, and Rambler Metals are continuing with their Phase II plans for the Ming Mine project.

Gross value of mineral shipments for 2017 is forecast to be about \$3.7 billion, compared to \$2.9 billion for 2016 largely due to a projected increase in the value of iron ore shipments. As well, the 2017 forecasted mineral exploration expenditures of \$34.2 million compared to \$25.4 million in 2016 represents the first year over year spend increase since 2012.

We acknowledge the many exciting opportunities, and also recognize that low commodity pricing and uncertain markets weigh on our mining sector here as with the global community. Iron prices rebounded earlier in the year but have lately settled toward forecasted values. Copper and zinc prices have recovered slightly from last year's lows while nickel and uranium prices remain depressed.

The province remains an attractive prospect for future investment, with high mineral potential, large areas that are considered under-explored, a stable legislative and taxation framework, and a widely held appreciation for the importance of sustainable natural resource development. Mining will continue to be a major contributor to employment and economic development in the province.

Thank you for your contribution!

Mines Branch is undergoing transformation as a number of staff retired over the last year. Notable retirees include Charlie Gower and Joanne Janes who have contributed many years of dedicated and exemplary service to the Mines Branch, and indeed our province. Thank you for your dedication.

Perry Canning
Assistant Deputy Minister

GEOLOGICAL SURVEY

Three goals of the Departmental Strategic Plan are to enhance the knowledge-base of geoscience data, to identify opportunities for resource development, and to improve the promotion of these opportunities. The 2017-18 programs of the Geological Survey of Newfoundland and Labrador (GSNL) directly address these goals mainly through its field programs, publications, retention of qualified staff, and successful advancement of these activities. Budget 2017 provided GSNL \$5.0 million.

Almost \$1 million was allocated to field activities this year. In Labrador, there were three field projects. Two projects formed a multidisciplinary approach to enhancing our understanding of the bedrock geology and mineralizing potential of the northern part of the Labrador Trough. These are: 1) Bedrock geology mapping of the Hollinger Lake map sheet, 2) the Ni-Cu-PGE potential of Montagnais gabbro sills. A third project undertook reconnaissance bedrock mapping and regional Quaternary studies in the Hopedale block area, as part of a Geomapping for Energy and Minerals (GEM2) program managed at Natural Resources Canada.

On the Island, ten field projects were conducted; three more than in 2016. The following 4 are new projects: 1) A multi-year project targeting volcanogenic massive sulphide (VMS) mineralization in central Newfoundland; 2) A multi-year project studying industrial minerals province-wide, starting with west coast marble, and fluorite on the Burin Peninsula; 3) Surficial geological mapping and till geochemistry of the Cormack-Silver Mountain map areas, and 4) Geophysical (ground penetrating radar) study of the Daniel's Harbour landslide area. The remaining 6 are continuations of projects initiated in previous years. These are: 5) Mineral deposits focusing on carbonate-hosted zinc deposits in western Newfoundland; 6) Bedrock mapping in the Bay d'Espoir-St. Alban's map area; 7) Surficial mapping and till geochemistry in central Newfoundland; 8) 1:50 000-scale bedrock mapping on the Bonavista Peninsula; 9) Monitoring of coastal areas vulnerable to erosion; and 10) The study of gold met-allogeny in central Newfoundland.

Office-based research studies included data and map compilation for inclusion in the Geoscience Online database, including bedrock, surficial, mineral occurrence and geophysical data; a synthesis of the geology of eastern Labrador; a detailed summary of the geology of parts of northern Labrador; bedrock geology mapping of the Mesoproterozoic Seal Lake Group in Labrador; a regional synthesis of the bedrock geology of the Forteau and Hawke Bay groups in western Newfoundland; detailed systematic description of Cambrian trilobite fossils within the Forteau and Hawke Bay formations (Labrador Group); examination of the geological burial and exhumation history of the con-

tinental margin of this province, in collaboration with the Geological Survey of Denmark and Greenland; till geochemistry of parts of the central volcanic belt of Newfoundland; reprocessing of (private sector) geophysical data; and processing of data from UAV surveys as part of the Coastal Monitoring program. Laboratory geochemical analysis of lake-sediment and water, till and rock samples collected in 2016 continued on the Geological Surveys ICP-ES and ICP-MS analytical equipment. In addition, updates to the Mineral Occurrence Data System were ongoing, and processing of the Geological Survey's paleontology collection at The Rooms, Newfoundland Museum, continued.

The Geological Survey's geoscience program employed 13 summer field- and office-support students, all of whom are enrolled in Earth Science or Geography programs at Memorial University. As well as assisting the GSNL, this employment with the Survey provides future geoscientists with valuable opportunities to train with our experienced field and office staff.

The GSNL leads the minerals advancement efforts of the Mines Branch. The branch has always had a strong presence at the traditional conference venues (Mineral Resources Review in St. John's, Baie Verte Mining, Exploration Roundup in Vancouver, Xplor in Montreal, and the PDAC in Toronto), and again was part of the Canadian delegation at the China Mining Meeting in Beijing and associated meetings in other Chinese cities.

Staff Changes

There have been several staff changes in the Survey this year. Charlie Gower (Regional Geology) retired following a 38-year sterling career with the Survey, primarily focused on mapping the Grenville terrane of eastern Labrador. The Survey also lost Larry Nolan (Manager, Geoscience Data Management), and the position of Manager of the Geoscience Publications and Information Section as part of government/departmental restructuring. Shawn Duquet (Geoscience Data Management) has moved to Mineral Development Division, as has Robyn Constantine (Terrain Sciences) to the Mineral Lands Division.

Joining the Geological Survey are Jared Butler as Project Geologist in the Regional Geology Section, Zsuzsanna Magyarosi as Project Geologist in the Mineral Deposits Section, Sarah Hashmi as Project Geologist in the Terrain Sciences and Geoscience Data Management Section, and Jill March as Administrative Officer, Director's Office.

In an attempt to maintain the corporate knowledge and scientific expertise of our retiring geoscientists the Geological Survey had earlier implemented an Emeritus Program. This program is open to all retired geoscientists, and I am pleased to note that in addition to Andy Kerr (Mineral Deposits), Charlie Gower (Regional Geology) and David Liverman

(Terrain Sciences) have joined the Emeritus Geoscientist ranks.

Linkages and Partnerships

The GSNL benefits through linkages and partnerships with other branches of government (provincial, national and international), with academic institutions and non-governmental organizations, and with national and international geoscience organizations.

- The partnership between the Canadian Institute of Mining, Metallurgy and Petroleum (Newfoundland Branch) and the Mines Branch of the Department of Natural Resources results in the annual Mineral Resources Review conference.
- The Mines Branch is in partnership with the CIM Newfoundland Branch, Mining Industry NL, and PEGNL for the promotion of Mining Week.
- GSNL partners with the Geological Association of Canada (Newfoundland Branch) in actively supporting the annual student two-day Conference in the Spring, and Field Trip in the Fall.

The GSNL works closely with:

- The Department of Tourism, Culture, Industry and Innovation helping to develop the province's geotourism potential, including the 'Aspiring Geopark' proposal on the Bonavista Peninsula, and the 'Aspiring Cabox Geopark' in the Bay of Islands region, as well as continuing work on the province's paleontological and other initiatives such as the successful UNESCO World Heritage Status bid for Mistaken Point.
- The Department of Municipal Affairs and Environment on groundwater issues, partnering with them on a pilot program to analyze the chemistry of groundwater-sourced drinking water in private residences across the province.
- The Office of Climate Change on geoscience issues related to climate change, particularly coastal erosion.
- Fire and Emergency Services - NL and also to the departments of Transportation and Works, and Municipal Affairs and Environment, and municipal councils on potential geological hazards.
- The Department of Transportation and Works to provide guidance in the assessment of aggregate samples used in road construction and asphalt paving.
- The Geological Survey of Canada on multidisciplinary projects as part of the GEM2 and TGI5 initiatives.
- The Geological Survey of Denmark and Greenland on a project focusing on the geological burial and exhumation history of the continental margin of this province.
- The Ulster University, the Marine Institute of Ireland, Memorial University and the GSNL to

examine submarine morainal systems at fjord mouths on the province's south coast.

As well as servicing the exploration and prospecting community, mainly through Geoscience Publications and Information, GSNL partners with Mining Industry NL and the Earth Sciences Department at Memorial University on the Matty Mitchell Prospectors Resource Room. Staff also instruct at prospecting courses organized by the Mineral Development Division, Mines Branch. Several geologists have adjunct appointments in the Earth Sciences and Geography departments at Memorial University, and serve on supervisory committees for graduate students. We also provide direct and indirect support for research projects at Memorial University, and other academic institutions. The GSNL is a strong supporter of the geoscience community in the province, with several staff members holding significant positions in the national and local branches of the Geological Association of Canada, the Canadian Institute of Mining, Metallurgy and Petroleum, and the Atlantic Geoscience Society.

Organizational Structure

The GSNL is organized into three sections under the direction of **Martin Batterson**. The sections are Mineral Deposits (Senior Geologist, **John Hinchey**), Regional Geology (Senior Geologist, **Alana Hinchey**), Terrain Sciences and Geoscience Data Management (Senior Geologist, **Stephen Amor**); the Geochemistry Laboratory, part of the Terrain Sciences and Geoscience Data Management Section, is under the direction of **Chris Finch**. In addition, Geoscience Publications and Information, of the Department of Natural Resources, reports to the Director.

Director's Office

The Director's office is responsible for the administration of the GSNL, logistical support of office- and field-based programs, and liaison with other divisions in the Mines Branch. The Director represents the GSNL on the Committee of Provincial and Territorial Geologists and the National Geological Surveys Committee. With Government's commitment to long-term funding of geoscience, the GSNL is proceeding with its five-year plan for the period 2015–2020. The Survey is committed to consultations with our Industry partners, and has developed an online client survey. Once complete, we will consult with an Industry Advisory group to assist in analyzing the data, with the overall aim being to improve our service to the mineral exploration industry.

The Director's office is responsible for the financial operations of the GSNL. **Jill March** (Administrative Officer) is responsible for all requisitions, purchasing and payments, and assists the Director in budget monitoring. Logistical and communications support of field crews are handled by **Gerry Hickey** (Newfoundland) and **Wayne Tuttle** (Labrador). They are also responsible for maintaining all the

GSNL field equipment and vehicles. Field-safety training courses, including first aid, ATV, boat and helicopter safety, driver education, and chainsaw training are coordinated in-house. Gerry Hickey is our certified ATV safety instructor. Wayne Tuttle also carries out quarry inspections for central Labrador.

Safety in the field is a prime concern of the Geological Survey, and every effort is made to eliminate accidents through training and awareness initiatives. The Geological Survey was once again recognized for its safety record by the AMEBC – PDAC “Safe Day Everyday” Award in 2016.

Terrain Sciences and Geoscience Data Management Section

The mandate of the Terrain Sciences and Geoscience Data Management Section (**Steve Amor**, Senior Geologist) includes a range of geoscience, including till, lake-sediment and lake-water geochemical surveys, and their analyses; surficial geological and ice-flow mapping; geophysical surveys, compilations and interpretation; coastal-erosion studies and geological hazard mapping. As a result of a merger of two sections, the new section also organizes, manages and integrates geoscience information collected by the Geological Survey.

Multidisciplinary Study

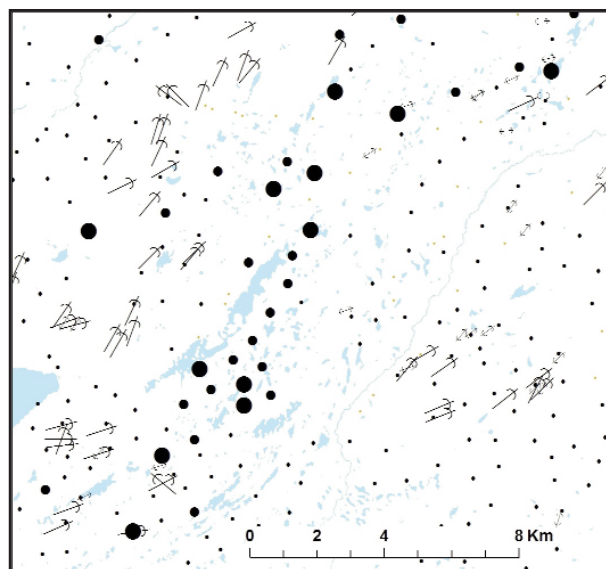
In collaboration with Memorial University and Natural Resources Canada, the section has undertaken multidisciplinary studies of coastal stability on the west coast of Newfoundland. Melanie Irvine, Gerry Kilfoil, Heather Campbell and Gillian Roberts conducted ground geophysical surveys (Ground-Penetrating Radar, Direct Current Resistivity and Induced Polarization) and drone-assisted photo work, along with preliminary stratigraphic mapping, of the Daniel’s Harbour and Parson’s Pond areas. This study aims to characterize the stratigraphic discontinuities in surficial sediments that may contribute to the susceptibility of the coastline to erosion.



Geophysical crew in action above cliff of surficial sediment, Daniel’s Harbour

Quaternary Geology and Geochemistry

Steve Amor and **Jennifer Organ** are releasing geochemical data from two surficial mapping and sampling surveys centred on Sheffield Lake and the Topsails. The Sheffield Lake study area includes a past-producer (the Gullbridge mine), but a number of encouraging anomalies, of various elements, have also been identified in areas with limited exploration history.



Geochemical dispersion train, central Newfoundland. Arrows represent ice-movement direction, as indicated by striations.

In June and July, **Heather Campbell**, **Dave Taylor** and **Robyn Constantine** were in south-central Newfoundland (Middle Ridge area), as part of the ongoing regional surficial mapping and sampling program. A helicopter was used to collect samples at 374 sites, at a density of one per 4 km²; an additional 30 sites were sampled along the Bay D’Espoir highway. Surficial mapping and sampling were carried out northwest of this survey, with 54 sites sampled along roadways in the Twillingate, New World Island, Boyd’s Cove and



Typical roadside till sample site, Middle Ridge area (NTS 02D/06).

Victoria Cove areas, at a nominal interval of one sample per linear km.

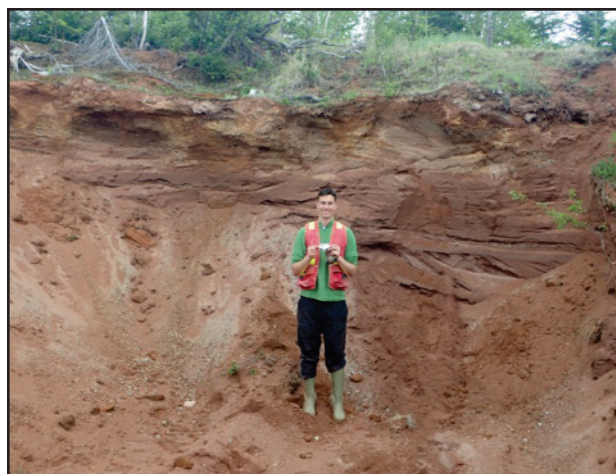
In August, Heather participated in reconnaissance work for the GEM2 integrative bedrock and surficial mapping and sampling program near the Hopedale–Saglek boundary in Labrador, along with Alana Hinchey (GSNL), David Corrigan (GSC) and Dianne Van Rooyen (Cape Breton University). This targeted research should upgrade geoscientific knowledge, and stimulate mineral exploration along the Hopedale–Saglek tectonostratigraphic corridor. The surficial component of the project will clarify ice-transport directions in drift-covered areas, and elucidate the sources of geochemical anomalies by examining glacial dispersal patterns and landforms.



Glacial landforms northwest of Hopedale, Labrador.

Sarah Hashmi, who joined the section this year, started a surficial mapping and till sampling program in the Cormack (NTS map area 12H/06) and Silver Mountain (NTS map area 12H/11) areas in western Newfoundland; a region prospective for Au, Cu, Ni, U and bitumen/oil shale. Fieldwork was conducted between June and August and 252 till samples were taken for geochemical analysis, and selective heavy-mineral separation. The main objective of the program, which is part of the ongoing regional surficial mapping and sampling program for the Island, is the characterization of regional geochemistry and the interpretation of local glacial history. Deliverables will include a Current Research report describing the work, two 1:50 000-scale surficial geology maps for the Cormack and Silver Mountain map areas, and an open-file report describing the surficial geochemistry.

David Taylor continues to coordinate the integration of digital data with the online Geoscience Atlas. The surficial geology map of the Sheffield Lake area is complete and available for viewing. To date, all old paper 1:50 000 scale surficial-geology maps have been digitized, including 36 000 landform structures, and placed in the Geoscience Database



Roadcut in medium-fine sands (mapped as an esker) in Cormack map area (NTS 12H/06).

to bring the total available maps to 111 for the Island and 38 for Labrador.

Geological Hazards and Climate Change

Melanie Irvine carried out fieldwork across Newfoundland as part of the ongoing landscape hazard and coastal-monitoring program. Almost 50 coastal cliff and beach sites were surveyed by drone, obtaining accurate topographic data and orthophotos. Analysis of the data will allow for the quantification of rates of cliff erosion and landscape modification in areas prone to slope movement, and generation of flood-risk maps from sea-level rise and storm-surge events. Three-dimensional models are being created, which aid in stratigraphic mapping of unconsolidated cliff faces and in visualizing landscape processes.

Along with Gillian Roberts, Melanie presented a paper entitled “Exploring the use of UAVs in coastal environments, mining and geotourism” at the “High Resolution Mapping Along the Coastal Zone” Workshop held in Lawrencetown, N.S. in February. Melanie continues to provide information,



Effects of recent coastal erosion at Shoal Point (NTS 11O/14).

and recommendations related to landscape hazards and the implications of climate change, to land-use planners, municipal leaders, NGOs and other stakeholders.

Laboratory Services

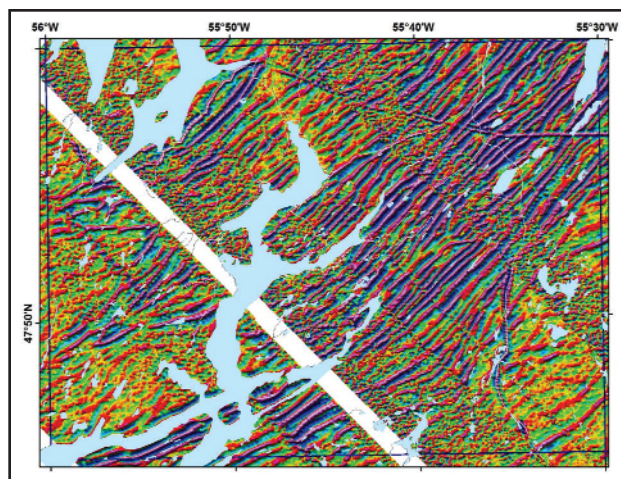
The Geochemical Laboratory is mandated with the task of fulfilling all analytical requirements of the Geological Survey. The laboratory is located in the Howley Building, Higgins Line, St. John's, and has four staff: the Laboratory Director (**Chris Finch**) and Mineral Laboratory Chemists **Jennifer Kelly**, **Rosauero Roldan** and **Lisa Walsh**. The lab carries out analyses for approximately 65 elements; over 200 000 determinations are done annually. Most of the analyses for trace and major elements are carried out using Inductively Coupled Plasma-Emission Spectrometry (ICP-ES) and Inductively Coupled Plasma-Mass Spectrometry (ICP-MS). Other selective methods for loss-on-ignition (LOI), FeO, Fluoride, Conductivity and pH are also used.

A detailed description of the currently applied sample-preparation and analytical methods is being prepared for release as an open file before the end of the year. This will reflect the many additions and improvements to the available methods since the last such document was prepared in 1998.

Geophysics

Gerry Kilfoil and **Robyn Constantine** (currently on secondment to the Mineral Development Division) continue to reprocess geophysical data from surveys flown by industry, to yield standardized, high-quality imagery and map products amenable to desktop mapping software. An index of airborne surveys, available through the online Geoscience Atlas, is maintained and updated as data become available.

Airborne VLF-EM data, acquired during the 2015 St. Albans survey, were purchased from the contractor, and are being released to complement existing gradient magnetic and radiometric data from that survey. In particular, these



Quadrature VLF response, St. Albans map area. The strongest anomalies are indicated by purple and blue lines.

results highlight the strong NE–SW linear fabric over the Baie d’Espoir Group (layered volcanic and metasedimentary rocks) which underlay the north-central part of the survey.

Geophysical guidance continues to be provided to prospectors and mineral exploration companies, as well as quality assurance for geophysical data submissions as part of mineral assessment.

Geoscience Data

As the size and number of geoscience datasets has grown, it is important that digital techniques are used to manage this information and apply it effectively to mineral exploration. Significant changes in digital information and communications technology over the past decade, are completely transforming the way in which geological surveys manage and disseminate geoscience knowledge. In response to these changes 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.

Loretta Crisby is responsible for the bedrock geology database for the province. The digital bedrock geology dataset for the island is complete and available for download from the Geoscience Atlas. Also, she is collaborating with **Alana Hinchey** on creating a geochronology database. This database will be added as a layer to the Geoscience Atlas in 2018.

The web-based Geoscience Atlas (<http://gis.geosurv.gov.nl.ca/>), online delivery of geoscience information, online data standards and integration are coordinated by **Pauline Honarvar**. Due to changes in personnel over the past year, the Atlas has not been upgraded; this will be done in the coming year. The new information is available, in uncompiled .pdf form, as Open Files, through the Geofiles text-based search tool (<http://gis.geosurv.gov.nl.ca/minesen/geofiles/>) and the Map Index page (<http://www.nr.gov.nl.ca/nr/mines/geoscience/publications/indexes.html>).

The Geological Survey is maximizing the value of the work of our retired geologists by organizing an archive of material relating to their work. Presently, these items consist of field notebooks and thin sections. The field notebooks are being catalogued according to geologist's last name, and indexed with information such as the year, project area, NTS sheet, and field sample numbers. The thin sections are being indexed with UTM location and rock name, and will eventually be linked to petrographic descriptions, if available. Other archival items that will be compiled include rock suites, field photos, and field maps including traverse locations.

Gillian Roberts is investigating new ways of visualizing and presenting geospatial datasets; creating orthophotos and highly accurate digital elevation models from UAV surveys

and experimenting with different programs to present data in motion and 3-D while providing GIS support for various projects in the survey. Gillian continues her successful collaborations with Alana Hinchey (geotourism) and Melanie Irvine (coastal hazards); post-processing the datasets and integrating them seamlessly into digital products. Gillian is participating in the multi-year, multi-disciplinary coastal stability study on the west coast along with other members of the TSGDM section; operating the UAV's, processing UAV data and assisting with the geophysical surveys.

Mineral Deposits Section

The Mineral Deposits Section (**John Hinchey**, Senior Geologist) is responsible for the documentation of metallic and non-metallic mineralization, conducting related research, and developing assessments of regional mineral potential. The section also has input in resource issues related to aboriginal land claims, protected areas/land-use discussions, and in the promotion of the provinces' resources.

Mineral Occurrence Data System (MODS)

The MODS is a detailed database of mineral occurrences that incorporates public-domain information gathered from mineral exploration and Geological Survey reports. It is managed by **Greg Stapleton**, with the assistance of **Jan Smith**, and is continually updated. During 2017, updating of the database was undertaken on a province-wide basis with gold on the Burin Peninsula being a focus for insular Newfoundland, and base, precious, and industrial minerals being a focus for Labrador. The MODS is accessible through the Survey website and through the Geoscience Atlas. It is a real-time database; new or updated occurrences become available online within 24 hours after input.

Another project activity is land-use planning. Mineral inventory personnel review provincial government land-use applications and environmental assessments, with the aim of minimizing the impact of land development on the province's documented mineral resources and areas of high-mineral potential.

Base-metal Mineralization

James Conliffe started a new project investigating the base-metal metallogeny in the Labrador Trough, western Labrador. Fieldwork in 2017 focused on the Ni–Cu–PGE potential of Montagnais gabbro sills in western Labrador. A number of known occurrences and new showings in the Howse Lake and Moss Lake area were visited, and samples of mineralized gabbro were collected for whole-rock geochemistry and isotopic analysis. These samples form part of a B.Sc. (Hons.) project by Andrew Smith at Memorial University investigating the genesis of magmatic sulphide mineralization in western Labrador and adjacent Québec. Initial results from this project will be published in 2018 as a *Current Research* article.



Examination of drillcore from Schefferville.

James also remains involved in ongoing projects related to carbonate-hosted base-metal deposits in western Newfoundland. Fieldwork in 2017 was limited to a short visit to Altius Mineral Corporation's Sail Pond Property near Roddickton. Laboratory work continues to include whole-rock geochemistry, electron-microprobe and sulphur-isotope analyses of samples from known zinc occurrences on the Northern Peninsula, including the former Newfoundland Zinc mine at Daniel's Harbour, as well as the Round Pond, Twin Ponds, Salmon River and Eddies Cove prospects. A *Current Research* article on the genesis of the Round Pond, Twin Ponds and Salmon River prospects will be published in 2018, summarizing the results of a recently completed B.Sc. (Hons.) project by Robert King at Memorial University.

John Hinchey continued his research examining volcanogenic massive sulphide (VMS) deposits, and potential environments for VMS mineralization, in central Newfoundland. Ongoing office-based work includes petrographic, lithogeochemical, and geochronological studies on samples from the North Steady Pond Formation of the Baie d'Espoir Group, host to the Katie VMS occurrence, and the Cold Spring Pond formation, host to the Great Burnt Lake and South Pond deposits. The goal is to document the styles of VMS mineralization, to characterize the host rocks, and to add to the tectonostratigraphic understanding of the area. John is also involved with the Promotional Team and attends both international (China Mining) as well as National (Mineral Exploration Roundup, and PDAC) conferences to assist in promotion of the provinces mineral potential.

Greg Sparkes began a new multi-year study targeting volcanogenic massive sulphide (VMS) mineralization developed within the central portion of the Buchans–Roberts Arm Volcanic Belt. Base-metal mineralization was first dis-



Field mapping along the Gullbridge mineralized horizon.

covered in the area of Great Gull Lake in the early 1900s, leading to the discovery of the Gullbridge deposit, which produced ore from the late 1960s to the early 1970s. Intermittent mineral exploration has been conducted within this region since the 1950s, and recent detailed geological maps and airborne geophysical surveys have been released by the geological surveys of Newfoundland and Labrador and Canada, respectively. These data provide a comprehensive regional database which will be utilized for deposit-level studies, focusing on the nature and timing of the VMS mineralization.

Field work conducted in 2017 spanned the area from the Gullbridge deposit in the north to the Lake Bond deposit in the south. This work examined VMS-related occurrences within the region in addition to mapping the associated alteration zones. Limited work was also conducted on prospects displaying a spatial association between precious-metal enrichment and localized base-metal mineralization (e.g., Handcamp prospect). As part of this new project, representative samples from the various occurrences were col-



Examining exploration trenches exposing alteration associated with precious metal mineralization at the Handcamp prospect.

lected for geochemical and spectral analyses to better characterize the styles of alteration and related mineralization developed within the region. Initial findings from this project will be published in 2018 as a *Current Research* article.

Gold–Silver–Antimony Mineralization

Hamish Sandeman conducted a short field season on gold–silver–antimony mineralization in central Newfoundland in areas southwest of Glenwood towards the Beaver Brook Antimony Mine. This included further examination of regional outcrops and drillcore at the Beaver Brook Mine and also at the Yellow Fox and Clarkes Brook West showings. Hamish and his field assistant, Cody Spurrell, also spent a number of days investigating the coastal exposures of the Indian Islands Group, the Ten Mile Lake Formation, the Duder Group and the Dog Bay Line (as defined by Hank Williams and others in 1993). These examinations were undertaken to confirm the similarity and proposed correlation of the geological units exposed near Beaver Brook Mine with those rocks exposed at their type localities along the northeast coast of Newfoundland near Gander Bay. Laboratory work continues to include U–Pb and ^{40}Ar – ^{39}Ar geochronology, petrography, lithogeochemistry, image analysis using SEM/MLA (scanning electron microscopy) methods and electron microprobe analysis. A *Current Research* article on the Beaverbrook Antimony Mine will be published in 2018.



Field assistant Cody Spurrell using a hand lens.

Iron-ore Deposits

Research related to iron-ore deposits in western Labrador continued under the direction of **James Conliffe**. Fieldwork in 2017 included visits to a number of high-grade Direct Shipping Ore (DSO) deposits in western Labrador, including Tata Steel Minerals Canada's mines in the Kivivic area. Samples were collected for isotopic and lithogeochemical studies to investigate the genesis of these deposits and develop vectors toward mineralization. In addition, a new collaboration between academia and government was initiated, investigating the stratigraphy and



Tata Steel Minerals Canada's mine in the Kivivic area.

geochemistry of taconite deposits in the Labrador Trough. This research is coordinated by Prof. Michael Babechuk of Memorial University, and fieldwork in 2017 included detailed logging of drillcore and collection of samples for geochemical analysis.

Industrial Minerals – Marble

Zsuzsanna Magyarosi began a new multi-year project studying industrial minerals throughout the province. The first part of the field season was spent examining marbles in the Northern Peninsula and the Corner Brook areas. Marble is used as dimension and decorative stone, but high-purity marble has many other industrial uses similar to limestone (*e.g.*, acid neutralization, cement, insulation). The main focus of the field work in the Northern Peninsula was to complete a limited examination of the marbles and compare them to the marbles in the Corner Brook area that were recently discovered by Ian Knight (GSNL) during regional mapping, and are less known by the industry. The visited occurrences included the Bonus, Sawmill Road North and South, Skidder Trail and Powerline south of White Arm Pond; Coles Pond South and North, Penny's Pond, Marble Brook and East Brook in the Roddickton area; Burnt Head Pond and Englee on the north shore of Canada Bay and Canada Harbour on the south shore of Canada Bay.

The main focus of the field work in the Corner Brook area was a marble unit located approximately 1 km south of Pinchgut Lake. The marble unit is approximately 1.9 km long and 200 m wide and is composed of light-grey to white, fine- to medium-grained marble, locally containing less metamorphosed carbonate layers and blocks. Field work included detailed sampling to determine the extent and quality of the marble and examination of field relationships to determine what controls the location of good quality marble. In addition, a marble occurrence approximately 8 km south-southwest of the Pinchgut Lake marble was also examined. The surface exposure of this marble unit is less than 200 m along a forest road. The marble is light grey,

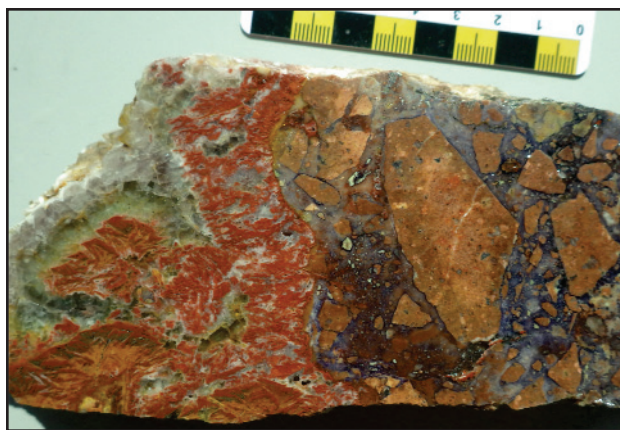
locally pink, and is interlayered with less metamorphosed carbonate layers and clasts. A small quarry along Lady Slipper Road, south of Corner Brook was also examined, containing white to light grey marble interlayered with less metamorphosed carbonate. Several occurrences were visited in the Massey Drive area of Corner Brook and along the Trans-Canada Highway.

Industrial Minerals – Fluorite

Field work in the second half of the field program concentrated on fluorite in the St. Lawrence area. Recently, Canada Fluorspar Inc. (CFI) completed significant exploration for new fluorite resources in the St. Lawrence area, which resulted in the discovery of the AGS deposit, scheduled to start full production in the fall. The focus of the field work was the AGS vein system, which is hosted in sediments and rhyolite sills, rather than the St. Lawrence granite that hosts most of the previously mined fluorite veins. The Church



White marble with stylonites from Pinchgut Lake.



Purple, green and white fluorite with rhyolite clasts and chaledonic silica (red).

Vein, Red Head Vein, Lord and Lady Gulch Mine, Little Salt Cove, Salt Cove Valley Vein and Chambers Cove Vein occurrences were also examined. The objective was to examine the several fluorite-forming events in the AGS vein system and the field relationships of the AGS vein with the sediments and rhyolite sills. Another objective was to compare the AGS vein with fluorite veins hosted in granite. Samples were collected for geochemistry, geochronology, petrography, electron microscope analysis and fluid inclusion studies. Initial findings from this project will be published in 2018 as a *Current Research* article. Field work was supported by the staff at CFI including Barry Sparkes (senior geologist), Melissa Lambert (project geologist) and Norman Wilson (consulting processing engineer and former mill manager). They provided safety orientation, access to their property, escort in active quarries and exploration data.

Regional Geology Section

The Regional Geology Section (**Alana Hinchey**, Senior Geologist) is responsible for bedrock mapping in the province. Two field projects were carried out in 2017. Jared Butler started a multi-year mapping project in the eastern Churchill Complex of western Labrador, and Anne Westhues continued her mapping project in the St. Albans area of Newfoundland. Andrea Mills, Bruce Ryan, Tim Van Nostrand, Ian Knight and Doug Boyce focused on data compilation, report writing, and office-based studies, and limited fieldwork to investigate specific geological relationships in their map areas. Monica Squires provides assistance to the project geologists.

Anne Westhues continued a 1:50 000-scale bedrock mapping project of the Baie d'Espoir area of the St. Alban's map area (NTS 01M/13), following a detailed airborne geophysical survey of the area. This region on the south coast of Newfoundland includes the boundary between two of Newfoundland's major tectonostratigraphic zones, the Dunnage Zone and the Gander Zone. Dominant rocks of

the Dunnage Zone in this area are variably deformed Ordovician clastic sediments and interbedded volcanic rocks of the Baie d'Espoir Group. The Gander Zone consists of the Little Passage paragneiss, intruded by the Silurian megacrystic Gaultois granite to diorite, and by biotite–muscovite granite of the Late Silurian to Devonian Northwest Brook Complex. Several mineralized quartz veins within the Baie d'Espoir Group contain visible arsenopyrite, stibnite, galena and/or chalcopyrite. Assays from the previous field season show that the area has potential for Au mineralization, and continues to be a focus of prospecting and exploration.

Tim van Nostrand continues compilation of three field seasons of 1:50 000-scale bedrock mapping of the northern Archean Ashuanipi Complex in western Labrador, including all or parts of NTS map sheets 23J/02, 03, 04, 05, 06, 07, 10, 11, 14 and 23O/03. The rocks consist of older, granulite-facies metasedimentary and tonalitic gneisses and subordinate gabbro to pyroxenite cumulate sills. These units predate extensive migmatitic diatexite, variably deformed granite, syenite and tonalite plutons and granite pegmatite. The region has the potential for hosting gold, base metal, platinum-group-elements and radioactive mineralization. Numerous gossan zones containing bornite \pm pyrrhotite \pm arsenopyrite \pm chalcopyrite mineralization, some with elevated Au, Ag, Cu, Pb, Ni, and Cr, occur within migmatitic gneiss, foliated granitoid rocks, diatexite and mafic to ultramafic intrusions. Some pegmatite intrusions and granite plutons have anomalous Th, U, REE and Mo contents. Limited exploratory work has been carried out on these rocks and the overall economic potential for the region remains largely untested.

Andrea Mills continues to map and compile 1:50 000-scale bedrock maps covering the Bonavista Peninsula (NTS map areas 2C/05, 06 and 11). This project complements previous



Geologist Anne Westhues enjoying the abundant outcrop in this tributary to Salmon River.



Summer student Nick Pochereva examines a sample for mineralogy and mineralization.

regional bedrock mapping on the peninsula and will generate an updated regional geological map. Studies focus on the lithogeochemistry and petrography of igneous and selected sedimentary rocks to better understand the changing tectonic regime through time. Petrographic and geochronological work on the glaciogenic dropstone diamictite of the Trinity facies (Musgravetown Group) has confirmed correlation of this unit with the Gaskiers Formation of the Conception Group on the Avalon Peninsula, and this has significant implications for reconstruction of the Avalon Terrane.

Ian Knight is studying the stratigraphic and regional variations of Early to Middle Cambrian Forteau and Hawke Bay formations, Labrador Group, that host several (some newly discovered), trilobite, brachiopod and small shelly faunas; these are being studied by paleontologists Doug Boyce (GSNL) and Christian Skovsted (Swedish Museum of Natural History). Results of this study have recently been published (October 2017). Ian is also studying Tournaisian terrestrial sedimentary rocks of the Fisher Hills succession of the Carboniferous Deer Lake Basin with Alana Hinchey.

Doug Boyce continued the detailed systematic description of late Early Cambrian (Dyeran) to Middle Cambrian (Delamaran) trilobites from mixed siliciclastic–carbonate facies within the Forteau and Hawke Bay formations (Labrador Group) of southern Labrador and western Newfoundland. This study has identified biostratigraphically significant species. Publications led by Drs. Ian Knight, Christian Skovsted and Uwe Balthasar includes a technical report and a scientific paper.

Alana Hinchey started a collaborative targeted research project in Labrador as part of the joint GSC–GSNL–Nunatsiavut effort in upgrading geoscientific knowledge

and stimulating mineral exploration. This project is supported by the Geomapping for Energy and Minerals (GEM) program at Natural Resources Canada. Its principal aim is to assist in completing full coverage of regional-scale geological maps across Canada's north, and to enhance knowledge in regions that will build towards gaining a better understanding the geological evolution of key parts of the Canadian Shield. This project will target specific areas of the Nain Province that will improve knowledge of the Saglek and Hopedale crustal blocks, their mutual boundary, and potential correlations with SW Greenland. Field work will be a full season in the summer 2018, building on a reconnaissance survey carried out in summer 2017. Other collaborative projects include working the Department of Tourism, Culture, Industry and Innovation and local partners on a variety of geotourism projects, including the Aspiring Discovery Geopark on the Bonavista Peninsula and the Aspiring Cabox Geopark in the Bay of Islands region. She is also involved with several geoheritage projects. She continues to publish on her research in the Makkovik Province. She recently released the app “Bonavista! Geological Tour Through Time” exploring the half a billion year old history of the Bonavista Peninsula. This project was a collaboration with Gillian Roberts, Robyn Constantine and Sandra Murphy.



Drone capturing video for the new app “Bonavista! A Geological Tour Through Time”.

Bruce Ryan continues compiling maps and a report covering his and Don James’ (Nova Scotia Geological Survey) work in the Nain area, as well as revising some previously published geological maps; through consultations with Nunatsiavut government personnel, adding Inuktitut nomenclature for geographic features to all maps, as appropriate. He has continued to provide geological guidance to Labrador prospectors in specific pursuits, to several Labrador archaeologists with respect to prehistoric stone artifacts, and to several international academic researchers concerning aspects of the Nain anorthosites.



Jared Butler entering field data into a handheld device.

Jared Butler, who joined the section this year, completed the first year of a multi-year, 1:50 000-scale bedrock mapping project in the Labrador Trough (Hollinger Lake map area, NTS 23J/16), near Schefferville, QC. The region is within the foreland of the New Québec orogen, the Paleoproterozoic tectonic boundary formed between the Archean Superior and Churchill provinces. The study area is primarily underlain by Paleoproterozoic sedimentary/volcanic rocks of the Kaniapiskau Supergroup, including shale/siltstone, quartzite, dolomite, basalt, and iron formation, intruded by numerous fine- to medium-grained gabbro sills. These units were all affected by Trans-Hudsonian collision, which produced regional-scale southeast trending folds, and later thrust faults inferred from the pattern of magnetic lineaments. Mineralization includes disseminated sulphides within the gabbro sills as well as pyrite, chalcopyrite, and locally malachite in quartz veins that intrude the gabbro. Numerous gossan zones are also found in thin sedimentary xenoliths within the gabbro intrusions.



Field assistant, Benjamin MacDougall, sampling a mineralized vein.

Monica Squires provides vital support to the Regional Geology Section, including integration of digital data for project geologists and preparation of display and print materials for Mineral Resources Review. She is also responsible for the management and maintenance of collections at the Geological Survey's permanent rock-storage facility.

Retirement

2017 saw the retirement of project geologist Charlie Gower, who joined the Survey in 1979 and contributed greatly to our understanding of the Grenville orogeny of eastern Labrador. Charlie's most recent work was the completion of his synthesis of the geology of eastern Labrador. This report, in conjunction with already published 1:100 000-scale geological maps, addresses the regional geology of the eastern parts of the Makkovik and Grenville provinces. This is an impressive documentation of a career's worth of research into 3 volumes of text, an accompanying digital database and digital geological maps. The report is expected to be published in the Fall of 2018.

Geoscience Publications and Information

Publications and Cartographic Services

Publications and cartography includes editorial (**Chris Pereira** and **Des Walsh**), cartographic/GIS (**Kim Morgan**, **Terry Sears** and **Neil Stapleton**), and desktop publishing and design (**Joanne Rooney**). They are responsible for report and map preparation and production for the GSNL, and provide cartographic, basic geoscience graphic artwork and desktop publishing services to other divisions and branches of the department, as needed.

In the past year, the section published in excess of 15 maps, final project reports, open file releases, project Summaries 2017 report, and other documents including the annual Current Research volume. Staff provided geoscience graphic and related cartographic support for trade magazines, a wide variety of branch presentations, for promotions and investment initiatives at mining trade shows, conferences and symposia, and for the outreach projects. Updates of the Mines Branch area of the website and the web-based release (timed and otherwise) of all GSNL publications are also handled by this group.

Promotion, Geoscience Marketing and Investment Attraction

Carolina Valverde Cardenas and **Phil Saunders** have overall responsibility, within the Mines Branch, for a wide array of promotion and investment-attraction initiatives designed to encourage growth in the mining and mineral-exploration sectors. They provide technical information on current exploration activity, geological context of exploration trends, opportunities for new project generation, and information on Mines Branch programs to support the industry. Their mineral promotion initiatives in emerging markets also



Round-up, 2017

include information on Canadian business culture and best practices within the mining and exploration sectors.

As Promotions Geologist, **Carolina Valverde Cardenas** is fully dedicated to the development and delivery of an annual Mineral Promotions Program. In addition, Carolina maintains and manages technical databases and the promotions webpage, and develops the wide range of technical materials (some also in French and Mandarin) which are key to the promotions work.

In 2017, the Mines Branch delivered promotional initiatives at Mineral Exploration Roundup, PDAC and Xplor, as well as the local Mineral Resources Review. They continued to use and improve the new Newfoundland and Labrador Pavilion, introduced in 2014, at PDAC and Roundup. At both venues, they collaborated with Mining Industry NL and the Matty Mitchell Prospectors Resource Room, and



China Mining Congress and Expo, Tianjin, China

assisted Newfoundland and Labrador prospectors and junior company representatives in attendance. They were joined by Minister Coady at PDAC and the related Canada–China mineral forum in Toronto.

Carolina Valverde Cardenas, Phil Saunders and John Hinchey joined several Canadian jurisdictions and Natural Resources Canada (NRCan) in the Canada Pavilion in 2017 at the China Mining Congress & Expo in Tianjin. The Pavilion enhanced Canada's presence at the event, while still showcasing the individual participating provinces and territories. They also attended the Canada–China Mineral Investment Forums in Beijing and Toronto.



Beijing, 2017

Web-based promotional initiatives continued to target both traditional and emerging markets. The 'Explore Newfoundland and Labrador' and the 'Asian Investment Initiatives' areas of the website (available in both English and Mandarin) were maintained and updated to encourage and facilitate industry participation in this area.

Industry Information and Client Services (Mineral Exploration Consultant)

The Mineral Exploration Consultant's office (**Phil Saunders, Crispin Pike and Stephanie Neary**) represents the initial point of contact for most clients of the GSNL, and for the Mines Branch. It provides information and consultation services to a broad client base including companies, prospectors, industry associations, other government departments and agencies (both federal and provincial) and the general public. The office has a close working partnership with the Matty Mitchell Prospectors Resource Room (*see below*) and with Geofiles staff. It collectively handles a large volume of requests for information, help and advice made through office visits, phone calls and emails.

As Mineral Exploration Consultant, Phil Saunders provides independent advice and information to clients relating to mineral exploration. He maintains a key role as industry liaison,



Gold workshop participants, 2017, central Newfoundland.

tracks exploration trends and activities in support of promotional activities, and provides strategic advice to clients.

The Exploration Services Geologist (**Crispin Pike**) brings considerable industry experience to the position, especially in the fields of geophysics and nickel exploration. He provides information and advice to prospectors and new companies that are exploring in the province, and also helps prospectors to compile and display their pre-existing data on compilation maps.

The Consultant's office launched a new Prospector's Workshop initiative in 2017, sponsored in part by the Newfoundland Branch of the Canadian Institution of Mining, Metallurgy and Petroleum. Two, 2-day training events were held: "Introduction to Digital Maps using QGIS" and "Exploration for Gold in Central Newfoundland". Course content was designed and delivered by Heather Campbell of the Geological Survey's Terrain Sciences and Geoscience Data Management Section. Both events were well attended, and were considered very successful, not only for attendees but for the Survey and its industry partner. Future courses are planned.



Training workshop "Introduction to Digital Maps using QGIS".

Geoscience Documents Collections and Databases

The Geofiles and Library collections, with related metadata, are maintained by staff of Geoscience Publications and Information (**Cindy Saunders, Paula Bowdridge and Desiree King**).

The Geofiles collection is a growing, digital and hard copy collection of private- and public-sector mineral exploration and geotechnical/geoscientific documents (currently 24 100 + items) relating to the province. Many of these documents are exclusive to this collection.

The Geofiles collection includes over 11 500 non-confidential mineral exploration assessment reports. 99% of these are now available online in .pdf format. The Mines Branch is now receiving and archiving most assessment files in digital-only format. The Geofiles collection also includes Geological Survey (and predecessor organizations) publications dating from 1873 to the present. Metadata for these 5100+ documents (including articles in volumes such as Current Research) are searchable online. Fifty percent of these documents are also available online as .pdfs.

The Geofiles database also contains records for, and links to, documents that we do not physically hold in our collection. These are mainly Geological Survey of Canada publications, and Memorial University of Newfoundland M.Sc. and Ph.D. theses that are related to Newfoundland and Labrador. In total there are over 26 800 records online. These records are searchable at (<http://gis.geosurv.gov.nl.ca/minesen/geofiles/>).

Many of our documents, especially assessment files, were originally posted online in pieces (*e.g.*, a report with linked large maps or appendices). During the past year we have started to consolidate all parts of a Geofile into a single large file. This is because most modern web browsers now come with built-in pdf viewers that do not allow for viewing internally linked maps and appendices. This project is ongoing. A summer student participated in this project and also continued to scan maps and documents that are not yet online.

Government web-use statistics indicate that between October 2016 and September 2017, about 247 000 pdfs were downloaded (displayed) and there were 50 900 Geofiles metadata queries. Geofiles staff provide customized searches of the Geofiles, Library, Pfiles and various in-house databases, and also assist clients (in-house and by phone) doing their own online searching.

Matty Mitchell Prospectors Resource Room

The Matty Mitchell Prospectors Resource Room is a private-public partnership with funding and in-kind support provided by the Mines Branch and Mining Industry NL. The project is overseen by a joint government-industry commit-

tee chaired by the Director of the Geological Survey, Martin Batterson. Resource Room Geologist, **Pat O'Neill**, is responsible for the daily operation of the project.

Some positive movements in the mining industry in 2017 were reflected in an increased number of properties optioned or sold by prospectors in Newfoundland and Labrador. Prospectors from all parts of the province continued to avail of the support and mentoring services offered by the Resource Room during 2017. Varying levels of technical support were provided that helped in the discovery, promotion and advancement of their mineral properties.

The Resource Room played a major role in assisting prospectors at Mineral Resources Review (St. John's), Mineral Exploration Roundup (Vancouver) and PDAC (Toronto). Informative property posters were compiled to help prospectors promote their properties at these events. A booklet, maps and flash drives containing information on "Properties Available for Option in Newfoundland and Labrador" were updated several times during the year and pdf versions of these properties are available on the Matty Mitchell website. The Resource Room website is continuously updated throughout the year, and articles are added to the new "Educational Tools for Prospectors" section launched in the previous year.

In 2017, the Resource Room geologist attended the fifth Annual General Meeting of the Newfoundland and Labrador Prospectors Association (NLPA) in Mt. Pearl with a display of promotional material, literature and rock samples and a presentation about the services offered by the Resource Room.

The Resource Room continues in its collaboration with the Mineral Incentive Program, whereby prospectors without grants can avail of seed funding to have promising mineralized samples assayed. This service includes rock and mineral identification, and informal discussions about the geology and mineral potential of the particular area of interest. As in previous years, this arrangement has resulted in new mineral discoveries and subsequent claim staking.

MINERAL DEVELOPMENT DIVISION

The Mineral Development Division administers the *Mining Act* and is responsible for: the approval of plans for the development, operation and closure of mines; the development of mineral policy; monitoring and economic analysis of the mining industry; the management of financial incentive programs for exploration; and, the management of orphaned and abandoned mines. This is the key Division for liaison with other federal and provincial government departments on mining matters. **Alex Smith** is the Director.

Operations

The Division is responsible for administering the *Mining Act*, ensuring that mineral resources are responsibly developed, and that end-of-life operations are properly closed and monitored. Also, the Division is responsible for rehabilitating orphaned and abandoned mines to ensure they do not present safety hazards.



Grebes Nest Pit with mill in background (credit, Canada Fluorspar (NL) Inc., 2017).



Canada Fluorspar's mill area (credit, Canada Fluorspar (NL) Inc., 2017).

The Division encourages the development of the province's mineral resources by providing training and financial assistance to prospectors and financial assistance to junior exploration companies under the Mineral Incentive Program. It monitors provincial, national and world-wide trends in the industry and provides advice to provincial and federal government agencies that provide support or assistance to mining projects.

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



Open pit operations (credit, IOC, 2017).

Engineering Analysis

The Engineering Analysis Section is responsible for the administration of the *Mining Act* and, the review and development of guidelines and policies related to the administration of the *Mining Act*. Mine operators must have their Development Plan approved and their Rehabilitation and Closure Plan accepted by the Minister prior to the start of mining, as required under the *Mining Act*. New plans are to be submitted every five years, or when there is a significant change to the mining operation. Financial assurance sufficient to cover full-site rehabilitation is required from operators and is administered by the section. The *Mining Act* also requires mine operators to submit an annual report on the past year's operations, and an operational plan for the coming year. Through review of these annual submissions and inspections of mine sites, the section ensures that operators are developing projects in accordance with approved development plans and, at the end-of-mine life, that sites are properly rehabilitated in accordance with the accepted Rehabilitation and Closure Plan.

The section also manages the orphaned and abandoned mines in the province and regularly monitors conditions at these sites. The orphaned and abandoned mines represent a significant contingent liability for the province. Some of these sites are a public safety risk and several sites have environmental liabilities estimated in the tens of millions of dollars.

Budget 2016 approved a four-year, \$2.4 million, dam-safety program to repair tailings dams at six of the orphaned and abandoned mines. These repairs are needed to meet *Water Resources Act* requirements and Canadian Dam Association, Dam Safety Guidelines. This year the former Consolidated Rambler mine tailings dams will be repaired at a cost of over \$500 000. The overall goal of the program is to have a long term, sustainable dam safety and maintenance program for all six mine sites.

The section is working to improve the way it conducts business, particularly through three ongoing initiatives: i) a review

and revision of the *Mining Act* Guidelines; ii) the establishment of a process by which mining companies create a financial assurance trust fund to cover the post mine closure cost of long-term monitoring and maintenance of tailings dams; and, iii) the formation of a risk registry for dams at orphaned and abandoned mines.

The section staff members serve on interdepartmental and provincial/federal/territorial committees and working groups. They work closely with mine operators on *Mining Act* regulatory compliance requirements and stay current on the status of mine operations. Staff also work closely with other departments and consultants to address safety concerns and improve environmental conditions at the orphaned and abandoned mine sites.

The section has seven staff positions including the Manager, four Mineral Development Engineers, a Geologist, and a Financial Officer.

Mineral Industry Analysis

The Mineral Industry Analysis Section maintains an ongoing program of research and statistical tracking of provincial and global mineral industries to provide data that directs policy and program development. Global market trends, events, supply/demand, etc. are analyzed for their impact on existing, developing and potential mineral projects within Newfoundland and Labrador.



Underground mine operations (credit, Rambler Metals and Mining Canada Ltd., 2017).



Voisey's Bay mine site (credit, Vale Newfoundland and Labrador Ltd., 2017).

The section compiles a semi-annual forecast of mineral shipments and employment levels *via* a direct survey of individual mining operators within the province. Forecasted data and property updates are provided to the Department of Finance as part of the provincial budgetary process. Mineral Industry Analysis works with Finance to provide information and analysis on mining related issues and projects to identify provincial impacts. Maintenance and publication of the mineral statistics database of shipments and employment is a responsibility of the section. Acquired statistics are reviewed, analyzed and compared to mineral industry census data obtained from Natural Resources Canada, security/exchange filings and *Mining Act* filings. Through an ongoing process of communication, data gaps and discrepancies are resolved to maximize statistical integrity.

The section provides data and analysis to departmental executive and contributes toward the development of mineral policy and regulations. It prepares regular reports such as a



Prospector training course.

daily commodity price list and issue specific briefing notes, as well as, maintains an ongoing process of analysis to identify trends in the industry and respond to emerging issues and challenges. This work is completed for projects operating provincially, as well as, those operating globally that potentially impact the provincial mining industry. The Section evaluates issues and trends to determine if a policy action is required. If a policy action is required, the Section will complete necessary policy development steps either as the lead or in cooperation with another Section.

Section staff participate on industry committees and inter-governmental and federal/provincial/territorial working groups to both collect and disseminate industry information. The section provides executive support for conferences and national meetings such as the annual Energy and Mines Ministers' Conference where ministers discuss shared priorities for collaborative action to advance energy and mining development across the country.

The section liaises with the public providing information on existing mining operations in the province. Semi-annual "Mining in Newfoundland and Labrador" and annual "Minfo" publications are produced and distributed at conferences and *via* an email distribution list. These documents are also published on the department's website along with other industry information maintained by the Section.

The section has five staff positions including the Manager, three Mineral Industry Analysts and a Clerk Typist.

Mineral Incentive Program

The 2017-18 operating budget for the Mineral Incentive Program (MIP) remains unchanged at \$1.7 million. The table below summarizes program spending from 2015-16 to the present.

The number of prospecting grant applications this year is on par with 2016-17 and total expenditures by the prospecting community are expected to be marginally higher than last

Program	2015-16	2016-17	2017-18 (projected)
Prospector Assistance			
Grants approved	69	52	53
Amount	\$251 824	\$241 410	\$301 324
Junior Exploration			
Number of grants	13	22	39
Amount	\$959 594	\$1 389 979	\$1 300 000
Prospector Training			
Course Number	0	1	1
Number of attendees		12	14

year. The Mineral Incentive Program continues to support prospector promotion through its annual \$40 000 operational grant to the Matty Mitchell Prospector Resource Room, and grants to Mining Industry NL to fund prospectors who are selected to travel to national conferences.

The annual two-week prospector training course was offered in Stephenville from May 29 through June 9, 2017. As in previous years, the course was well received, and successfully completed by 14 students who can now register for Genuine Prospector Designation with the Department of Natural Resources' Mineral Lands Division.

The Junior Exploration Assistance Program received thirty-nine letters of intent by the June deadline and it is anticipated that the program will be fully subscribed for 2017-18.

Field visits to prospector and junior exploration company work sites will be the focus until December. Review of technical reports from grant recipients and arrangement of final grant payments will take MIP staff through the end of the fiscal year.

The Mineral Incentive Program has three staff positions including a Manager, Geologist, and Clerk Typist.

Staffing

Grant Taylor was hired as a Mineral Industry Analyst in December 2016 and **Sarah Bassler** was hired as a Mineral Development Engineer (Environment) in February 2017. **Dale O'Reilly** was temporarily assigned as Manager, Mineral Incentive program at the end of August 2017 and **Robyn Constantine** joined the Division under temporary assignment as a Geologist II with the Mineral Incentive Program at the end of August 2017.

The Division has one vacant Mineral Industry Analyst position. This position will be advertised in the near future.

MINERAL LANDS DIVISION

The Mineral Lands Division is responsible for the regulatory functions and information services that facilitate the orderly discovery and development of the province's mineral resources. These include administration and management of mineral rights and quarry rights, permitting of exploration for minerals and quarry materials, retrieval and storage of core from exploration drill sites, and monitoring the types and amount of exploration activity in the province. The division has extensive contact with other departments and levels of government through its involvement in various review processes and application referrals, and represents the Mines Branch on the Interdepartmental Land Use Committee. The Director of the Mineral Lands Division is **Kevin Sheppard**.

Staff Changes

There are currently two vacancies in the division. After three years as a Core-storage Geologist stationed in the Pasadena office, **Chris Moran** left government to pursue other interests. **Joanne Janes**, Clerk IV in the Quarry Materials Section, retired on July 31 after 37 years of service. **Anne-Marie Woolridge** is currently carrying out the Clerk IV duties on an acting basis. The process to fill the vacant positions is currently underway. **Shawn Duquet** has been fulfilling the duties of the Assessment Report Geologist since April 3, 2017 due to **Trina Adams** being on leave. Trina will return to the Division on January 29, 2018.

Mineral Rights

The Mineral Rights Section (**Justin Lake**, **Laurie Hennessey**, **Stephen Hinchey**, **Shawn Duquet**, **Trina Adams** (on leave), **Charles Newhook** and **Brenda Lynch**) administers all aspects of the acquisition, maintenance and regulation of mineral rights in the province, mainly under the *Mineral Act* and *Mineral Regulations*. Many of these functions are performed through the Mineral Rights Administration System (MIRIAD). MIRIAD provides real-time, online, map-based claim staking, and integrates mineral rights information with the province's geographic information and financial management systems.

Mineral rights are further managed through several hard-copy registries that record transfers, confidential agreements, mineral licenses issued, and mining and surface leases, that together comprise over fifty volumes of documents. These documents are used extensively by the legal community and the exploration and mining industry generally. Work continues on a project to digitize all of these records and make them available to the general public via a web-based application.

The section monitors exploration activity and expenditures in the province. Expenditures are surveyed semi-annually by Natural Resources Canada and the survey results shared



South Tally Pond.



AGS Property.

with the province. The results are analyzed internally and aggregate results are reported to various branches of government and cited in publications.

The section is also responsible for the review of municipal plans and various land-use proposals to ensure that these do not have a negative impact on the mineral and aggregate resource industries of the province. The development of the Environmental Guidelines for Mineral Exploration document continued in 2017. Implementation of this document is anticipated prior to the end of 2018.

Exploration Approvals

All exploration work requires an ‘exploration approval’. This involves a referral process whereby relevant government and non-government agencies are notified of work intent and scope, and are given the opportunity to provide feedback.

Heather Rafuse administers the exploration approvals process and there have been 312 applications processed, so far, in 2017, compared to a total of 311 by year-end in 2016. Exploration-site inspections are conducted on a full-time basis, and companies are advised to be diligent in following



Trenching, Hammerdown.

all regulations and conditions governing their exploration approvals. Exploration Site Inspector **Matthew Snow** completed on-site inspection of 37 exploration project sites by mid-October, 2017, and inspections continuing later into the fall.

Quarry Materials Section

The Quarry Materials Section (**Gerald Kennedy, Ges Nunn, Andrea Devereaux, Kirby Way, William Oldford** and **Anne Marie Woolridge**) is responsible for the administration and enforcement of the *Quarry Materials Act* and associated regulations in support of various provincial, municipal, and local infrastructure projects across the province. A quarry inspector is stationed in Pasadena, Grand Falls-Windsor and St. John's, with each inspector having their own geographic area of responsibility to conduct compliance inspections, respond to complaints, and attend stakeholder meetings. Other staff provide in-office administrative support for quarry tenure, such as carrying out referrals for quarry permits, quarry leases, quarry materials exploration licence applications, and issuing approvals. Office staff are also responsible for addressing public and stakeholder concerns.

Earlier plans for the development of a new Quarry Management System (QMS) are on hold. However, the division has implemented several changes to the quarry materials program to lessen administrative workload and streamline permitting processes. An option to pay for quarry-related transaction is now available *via* the provincial government website. To date, there have been no issues with this option and reaction from industry has been positive. The *Quarry Materials Act* and *Quarry Materials Regulations* are under review and revisions to standard terms and conditions associated with quarry permits and leases have been completed. An ongoing project is the generation of polygonal shape file of quarry land tenure for upload to the Geoscience Atlas. This will allow stakeholders to view accurate boundaries of quarry sites located throughout the province.



Trenching, Sail Pond.

Core-Storage Program

The core-storage program (**Glen Penney**) is responsible for six core-storage facilities located in Pasadena, Baie Verte, Buchans, Springdale, St. John's and Goose Bay. Seasonally, the program is supported by four summer students, normally from the geology program at Memorial University. The core-storage areas house more than one million metres of drillcore samples from nearly ten thousand drillholes collected from various exploration projects located within the province. Samples are available for inspection and are used extensively by the mineral exploration industry. Sampling of core is permitted where sufficient core is available to allow removal of some material and with the conditions that all unused material is returned to the core library along with copies of analytical results. The core-storage database is available online via the GeoScience Atlas.



Geologists inspect drillcore samples at the core-storage facility in St. John's

The core-storage facilities, particularly Buchans, have been very active over the last few years. Access to the core-storage areas was limited this year due to required structural engineering inspections of all core-storage racks as part of the on-going departmental occupational health and safety review of the core-storage program. While the number of requests to visit the facilities was on par with previous years, many visits had to be postponed.

The core rack inspections have been completed. The majority of the drillcore stored on racking indoors is once again accessible for inspection. Persons interested in accessing the core-storage areas are asked to contact the core-storage geologist prior to planning a visit, to ensure the drillcore of interest is available.



A student prepares drillcore samples for inspection at the core-storage facility in Buchans

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2017 PROJECTS

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