Atlantic Geoscience
Journal of the Atlantic Geoscience Society

Geological Association of Canada - Newfoundland and Labrador Section Abstracts: 2024 Technical Meeting, March 20 and 21, 2024

Association géologique du Canada - Résumés de la section Terre-Neuve-et-Labrador : réunion technique 2024, 20 et 21 mars 2024

Volume 60, 2024

URI: https://id.erudit.org/iderudit/1111936ar
DOI: https://doi.org/10.4138/atlgeo.2024.006

See table of contents

Publisher(s)

Atlantic Geoscience Society

ISSN

2564-2987 (digital)

Explore this journal

Cite this document

(2024). Geological Association of Canada - Newfoundland and Labrador Section Abstracts: 2024 Technical Meeting, March 20 and 21, 2024. *Atlantic Geoscience*, *60*, 117–129. https://doi.org/10.4138/atlgeo.2024.006

Geological Association of Canada, Newfoundland and Labrador Section

ABSTRACTS

2024 Technical Meeting

St. John's, Newfoundland

The Geological Association of Canada Newfoundland and Labrador Section (GAC-NL) 2024 Annual Technical Meeting was hosted in-person at the Department of Earth Sciences, Memorial University, on March 20 and 21. However, oral presentations were also available to be viewed virtually.

This year the meeting kicked off on Tuesday morning with introductory remarks from the outgoing GAC-NL President, Zsuzsanna Magyarosi. The rest of the conference was taken up by presentations on a wide range of geoscience topics. In the following pages, we are pleased to publish the abstracts from the oral and poster presentations.

The best student presentations are recognized and receive the "Outstanding Student Presentation Award" which consists of $100 and a certificate. This year one student won the best graduate student poster presentation and two tied for best graduate student oral presentation. These winners are indicated by an asterisk after the title.

As always, this meeting was brought to participants by volunteer efforts and would not have been possible without the time and energy of the executive and other members of the section such as Zsuzsanna Magyarosi, Roderick Smith, James Conliffe, Jared Butler, Nic Lachance, Heidi George, Nic Capps, Shawn Duquet, Sarah Hashmi, Annie Parrell, and Gabriel Santos. GAC-NL is also indebted to the partners in this venture, particularly the Geological Survey of Newfoundland and Labrador, Geological Association of Canada, Department of Earth Sciences-Memorial University, Alexander Murray Geological Club, Newfound Gold Corp., Altius Minerals Corp., Latitude Uranium, Sokoman Minerals Corp., Titjaluk Logistics, Fishhawk Gold, and Churchill Resources. GAC-NL is equally pleased to see the abstracts published in Atlantic Geoscience. The student award winners for best poster and oral presentations are noted at the end of the appropriate abstract.

Although the abstracts are modified and edited as necessary for clarity and to conform to Atlantic Geoscience format and standards, the journal editors do not take responsibility for their content or quality.

THE EDITORS

ATLANTiC GEOSCiENCE 60, 117–129 (2024)
2564-2987|24|00117–00129 $2.95|0
doi: 10.4138/atlgeo.2024.006

A late Maiolingian Series (Middle Cambrian) *Dorypyge* pygidium from the Manuels River Formation (Harcourt Group), Red Bridge Road Quarry, Conception Bay South, Avalon Peninsula Newfoundland and Labrador, Canada

W. Douglas Boyce[1] and Benjamin W.T. Rideout[2]

1. The Rooms Provincial Museum, St. John's, Newfoundland and Labrador A1C 5P9, Canada
< wdbenator@gmail.com>
2. Independent co-author

A fragmentary pygidium of *Dorypyge Dames* 1883 has been recovered from a single piece of shale talus within the Manuels River Formation (Harcourt Group) at the Red Bridge Road (Kelligrews) Quarry, Conception Bay South. A correlation with the *Plutonides* (formerly *Hydrocephalus*) *hicksii* Biozone to the *Paradoxides davidis* Biozone of Avalonia is indicated, placing it within the late Maiolingian Series (Drumian Stage) of the Middle Cambrian. The genus *Dorypyge* is uncommon in Avalonia, whereas it is a common constituent of Middle Cambrian deposits in Gondwana.

Regional and property geology, Kingsway Gold project, Glenwood area, Gander, Newfoundland and Labrador, Canada

John Clarke

Labrador Gold Corp., Toronto, Onartio M5C 1P1, Canada
<ejohnclarke99@gmail.com>

Since acquiring the Kingsway project in 2020, Labrador Gold Corp. has discovered seven new significant gold occurrences. These orogenic gold prospects are hosted within fine- to coarse-grained Ordovician to Devonian? sedimentary sequences as well as Silurian gabbroic intrusions. Geological mapping of the property has demonstrated that Silurian sedimentary rocks are more widespread than previously recognized and extend east of the Appleton Fault.

Over 100 new fossil localities have also been discovered. Species identified include graptolites, bryozoa, crinoids, nuculites, bivalves and possible stromatolites/stromatoporoids. Trace fossils include possible *Rusophycos*, *Skolithos*, and *Paleophycus*. Very few of these occurrences have been positively classified to date. Detailed palaeontological and sedimentological studies are required to frame the regional geologic context of these newly discovered gold occurrences.

Granite-related critical mineral potential of the Gander and western Avalon zones, southern Newfoundland and Labrador, Canada

James Conliffe[1], Donnelly B. Archibald[2], Deepyaman Saha[2], Kiersty Malay[2,3], David Lowe[3], and Neil Rogers[4]

1. Mineral Deposits Section, Geological Survey of Newfoundland and Labrador, St. John's, Newfoundland and Labrador A1B 4J6, Canada
<jamesconliffe@gov.nl.ca>
2. Department of Earth and Environmental Sciences, St. Francis Xavier University, Antigonish, Nova Scotia B2G 2W5, Canada
3. Earth Sciences Department, Memorial University of Newfoundland, St. John's, Newfoundland and Labrador A1B 3X5, Canada
4. Geological Survey of Canada, Natural Resources Canada, Ottawa, Ontario K1A 0E8, Canada

The Gander and western part of the Avalon zones in southern Newfoundland are host to several known critical mineral deposits and prospects associated with granitic rocks. They include lithium–cesium–tantalum (LCT) pegmatites in the Burgeo area, where two zones of LCT pegmatites were first discovered in 2021 (Kraken pegmatite field and Hydra pegmatite). Other significant known deposits and prospects include vein-hosted W deposits (e.g., Grey River Deposit), porphyry Mo–Cu deposits (Moly Brook Deposit), Sn-greisen (Moulting Pond Prospect), and fluorite (St. Lawrence fluorite). In addition, the potential of these lithotectonic zones to host other deposits is highlighted by numerous smaller Li, W, Mo, Sn, Bi, and Be occurrences, as well as abundant peraluminous granites intruded into greenschist- to amphibolite-facies metasedimentary and metavolcanic rocks.

Despite the high prospectivity of this region, a number of fundamental geological questions and research avenues remain. They include the mineralogy, age, origin, tectonic setting, and economic potential of intrusive rocks in southern Newfoundland, the relative importance of crustal anatexis and crustal structures in the localization of mineralization, and regional correlations with similar deposits in peri-Gondwanan terranes across the Appalachian and Caledonian orogenies. Ongoing multidisciplinary research among government, academic, and industry partners aims to fill these knowledge gaps by combining field data with petrography, geochemistry, mineral chemistry, and geochronology. These results will improve our understanding of the tectonic history of southern Newfoundland, and the geological processes that resulted in formation of granite-related critical mineral deposits. In addition, mineralogy and mineral chemistry will be compared between mineralized bodies to help define advanced exploration vectors and aid in future mineral exploration.

Geophysical study of the historical landfill at Wishingwell Park, St. John's, Newfoundland and Labrador, Canada

Tshering Dendup, Colin G. Farquharson, and Alison Leitch

Department of Earth Sciences, Memorial University of Newfoundland, St. John's, Newfoundland and Labrador A1B 3X5, Canada <tdendup@mun.ca>

The City of St. John's, like many other populous and modern cities, suffers challenges in keeping up with increasing demands on disposal infrastructure and sustainable waste management. Stretches along most riverbanks and at the outskirts of the city continued to be illegal dump sites for many years after institution of a municipal council in 1902. The Wishingwell area was chosen as the city's first public landfill to resolve the issues. Due to complaints from the nearby community about the smell, it was officially abandoned in 1963 after burying accumulated wastes in trench(es). Later, the area was covered and converted to the present-day park. There is no traceable record of any remediation efforts and only one previous investigation using a seismic technique. The present research integrates four geophysical methods – magnetics, electromagnetics, ground penetrating radar (GPR), and geoelectrical – to study the area non-invasively. The surveys show highly conductive anomalies buried under the embanked cover. These responses are likely from buried metallic wastes, including vehicle wreckages, as seen in archival images.

Magnetic maps of the area depict distinct linear features roughly trending east-west, some of which can also be observed in inverted geoelectrical sections plotted transverse to the magnetic features. This observation supports conjecture from seismic data of wastes being buried in a long trench running roughly S85E, although the new work indicates the existence of more than one trench. GPR data depicts the contact between cover and undisturbed ground and scattering around the conductive features seen in geoelectrical sections. Thus, the study confirms the likely presence of metallic waste in the subsurface decades after their burial, and further highlights concerns about other non-biodegradable buried wastes in the area.

The Brass Buckle Trend—an unexplored, Au-rich, fault/shear structure in the Pacquet Harbour Group, Baie Verte Peninsula, Newfoundland and Labrador, Canada

Peter M. Dimmel

Krinor Resources Inc., St. John's, Newfoundland and Labrador A1B 2R2, Canada <pdimmell@outlook.com>

The Rambler South property, consisting of 17 claims, lies on the Baie Verte peninsula, 13 km southeast of the Baie Verte–Brompton Line, the western contact of the Dunnage Zone. A fault structure, termed the Brass Buckle Trend (BBT), extends through the property for approximately 4 km, through the basal portion of the Cape St. John Group (CSJ), crystal lithic tuffs; the Cape Brule Porphyry (CBP), quartz-feldspar porphyry; the Pacquet Harbour Group (PHG), primarily mafic volcanic/intrusive rocks; and is associated with intrusive units, quartz porphyry (QP) and quartz-feldspar porphyry (QFP) dikes.

Gold values are found from the 660 showing in the CSJ in the north, to the Skidder Pond showing in the QFP dike in the south. The high grade, Brass Buckle quartz/pyrite vein, 15–20 cm wide, along a QP/MV contact, gives consistent gold values in the 150 g/T range with tellurium (Te) values in the 100 to 200 ppm range.

The QFP dike, 15 m+ wide, possibly related to the CBP, follows the BBT structure and is offset by cross faults. It carries disseminated magnetite and variable minor pyrite. QP intrusions occur as linear bodies lying sub parallel to the BBT structure. They are variably altered, from incipient Si/Ser to entirely altered to Si/Ser and carry gold in quartz/pyrite and quartz/tourmaline/pyrite (QTP) veins. Strong potassic alteration, as chlorite/sericite, and silicification, is noted in the mafic units of the PHG (chlorite) and QP (Si/Ser).

Geochemistry, tills (up to 775 gold grains/74% pristine) and soils (up to 1741 ppb), give high grade gold values down ice (160 degrees) of the BBT. Geophysics (IP) shows a resistivity low along the BBT and a moderate chargeability anomaly extending from the BBT, which corresponds to a QP body that carries narrow (<5 cm) quartz/pyrite veins with gold values up to 15 g/T.

Enhancing mineral exploration with machine learning: applications and case studies

Michael W. Dunham and Shawn B. Hood

ALS Goldspot Discoveries, Montréal, QC H2Y 2P4, Canada <michael.dunham@alsglobal.com>

In mineral exploration, a pivotal component involves the collection of data to enhance our comprehension of geological structures and the potential for mineral deposits. Traditionally, the reconciliation of relationships, or patterns, believed to be indicative of mineralization has been achieved through manual interpretation of available geoscience data. While these conventional techniques retain their value and should remain in use, the adoption of machine learning (ML) technologies enables geo-scientists to derive greater value from their data by facilitating automated data integration.

Machine learning can be applied to geoscience data in variious ways, with three notable examples being super resolution, unsupervised learning, and prospectivity analysis. Super resolution, a deep learning approach, is trained to learn the statistical correlations between co-located low and high-resolution magnetic data. The advantages and limitations of this tool have been explored using public datasets from Western Australia. In unsupervised learning, clustering techniques are applied to geoscience data, segregating them into groups of similar characteristics. This result is exemplified in a case study from British Columbia, where clustering with topological properties has been utilized to refine geological understanding. Prospectivity analysis, a form of supervised machine learning, integrates geochemical data (e.g., assays from drill core, or outcrop samples) with other geoscientific information (e.g., geophysics, lithology, structures, remote sensing) to predict the likelihood of mineralization for specific deposit types, such as porphyry Cu. The efficacy of ML-based prospectivity analysis is demonstrated through a Brazilian case study, which successfully identified areas for future exploration. Periods of economic downturn in the mineral exploration sector offer prime opportunities to analyze existing data with ML, thereby optimizing future field campaigns and drilling programs in anticipation of improved financial conditions.

Crustal structure tn Trans-Hudson Orogen (northern Canada) through receiver function analysis*

Zahra Hossein Esfahani, J. Kim Welford, and Alison Malcolm

Department of Earth Sciences, Memorial University of Newfoundland, St. John's, Newfoundland and Labrador A1B 3X5, Canada
<zhosseinesfa@mun.ca>

The northern segment of the Canadian Shield comprises both Archean and Proterozoic geological structures, notably the Trans-Hudson Orogen (THO), which is the largest Paleoproterozoic orogenic belt globally. The primary aim of this study is to investigate the development of crustal structure in various regions of the THO utilizing the receiver function method applied to passive seismic data. The objective is to image discontinuities within the Earth's crust. This study utilizes receiver functions extracted from the incident P wavefield of teleseismic earthquakes with magnitudes exceeding 5.9. The research area is monitored by combining permanent and temporary seismic stations, with an average spacing of approximately 1200 km between them. The dataset encompasses a broad spectrum of epicentral distances ranging from 30 to 95 degrees.

Our results show Moho depths consistent with previous studies: average Moho depths of 37 km beneath the TULEG station in the western part of Greenland and 40.3 km beneath the CLRN station. Azimuthal differences in Moho depth around each station are also observed, particularly toward northwestern THO, and western part of Greenland. Results from the ongoing analysis of the azimuthal variations in the receiver function structures and approaches are presented.

**Winner: GAC-NL Section Award for best graduate student poster presentation*

Zircon chemistry and Hf isotopes of felsic samples from volcanogenic massive sulfide (VMS) deposits of the Victoria Lake Supergroup, Newfoundland and Labrador, Canada

Alicia P. Escribano[1], Stephen J. Piercey[1], John G. Hinchey[2], and Nicole M. Rayner[3]

1. Department of Earth Sciences, Memorial University of Newfoundland, St. John's, Newfoundland and Labrador A1B 3X5, Canada
<adpescribano@mun.ca>
2. Mineral Deposits Section, Geological Survey of Newfoundland and Labrador, St. John's, Newfoundland and Labrador A1B 4J6, Canada
3. Geological Survey of Canada, Natural Resources Canada, Ottawa, Ontario K1A 0E8, Canada

Felsic volcanic and volcaniclastic rocks of the Cambrian–Ordovician Victoria Lake Supergroup in central Newfoundland, host volcanogenic massive sulfide (VMS) deposits with varying mineralization styles and base and precious metal content. Mineral and Hf isotope geochemistry of zircon from felsic samples from the replacement-style Cu-Zn-(Pb) Duck Pond/Boundary deposit, the barite-rich exhalative-style Zn-Pb-(Ag-Ag-Cu) Lemarchant, and low-tonnage Zn-Cu-Pb-(Ag-Au) Long Lake deposits are used to understand the composition and petrogenesis of host rocks to mineralization and the role of magmatism in the formation of VMS deposits. Zircon from all deposit samples have low Th/U (<1) and Th/Nb (<90) ratios. Only zircon from the Duck Pond/Boundary deposit has U/Yb ratios of >0.3, whereas zircon in the Duck Pond/Boundary and Lemarchant deposit samples has Dy/Yb ratios of <0.3. Zircon grains from the Duck Pond/Boundary and Lemarchant deposits have εHf(t) values and depleted-mantle model (T_{DM}) ages between +5.9 and +9.4 and 761 and 1064 Ma, respectively, whereas zircon grains from the Long Lake deposit sample has εHf(t) values and T_{DM} ages between +11.2 and +15.2 and 489 and 730 Ma, respectively. Mean log $fO2$ values in zircon from the Duck Pond/Boundary and Long Lake deposit samples are -14 to -14.9, whereas zircon from the Lemarchant deposit sample has more more oxidized values of -11. The εHf(t) values, TDM ages, and Dy/Yb ratios in zircon from the Duck Pond/Boundary and Lemarchant deposit samples suggest magmas were derived from juvenile sources but with minor crustal contributions from Neoproterozoic basement, and that amphibole was co-crystallizing with zircon. Higher εHf(t) values, Dy/Yb ratios, and younger T_{DM} ages in zircon suggest more juvenile components and less interaction with the basement for the Long Lake deposit. Ongoing research is focused on the interpretation of these data coupled with previous whole-rock lithogeochemical information.

Building the foundation for a 3-D offshore model of Newfoundland and Labrador, Canada

Kira J. Evans, J. Kim Welford, and Alison Malcolm

Department of Earth Sciences, Memorial University of Newfoundland, St. John's, Newfoundland and Labrador A1B 3X5, Canada <kjevans@mun.ca>

Offshore Newfoundland has a very rich geological history in terms of energy production. The Continuously Evolving Newfoundland Offshore Model (CENOM) will comprise all geophysical data sets available, including seismic, potential field, and well logs, reconstructed over geological time. The goal is to create an interactive, evolving visual of offshore Newfoundland. CENOM will be continuously updated and improved as more data are released. The work in this study has been focused on establishing the foundation for this project using various software packages such as QGIS, Petrel, GPlates, and Excel. To aid in future development of CENOM, "The Pantry" database was created in Excel, containing information from all of the well logs available on the Grand Banks and on the northeast Newfoundland shelf area. CENOM will involve synthesizing all existing models and databases and will continue to grow along with our knowledge of the area.

Deciphering metamorphic patterns through phase equilibria modeling and textural relationships: preliminary results of the Central Grenville Province, Quebec, Canada

Arlin Fonseca and Aphrodite D. Indares

Department of Earth Sciences, Memorial University of Newfoundland, St. John's, Newfoundland and Labrador A1B 3X5, Canada <abfonsecamar@mun.ca>

The Mesoproterozoic Grenville Province formed by continental collision between Laurentia and presumably Amazonia during the assembly of the supercontinent Rodinia at 1.09–0.98 Ga. Many of the exposed rocks record granulite-facies metamorphism but were exhumed from different crustal levels, yielding crucial insights into the thermal evolution of the Mesoproterozoic orogenic crust. A so-far little-investigated crustal segment in the southern part of the Central Grenville Province (Quebec) is characterized by exposure of 1.08 to 0.98 granitoid rocks and aluminous gneisses containing pressure-temperature (P-T) sensitive minerals. A meticulous examination of textures in the gneisses combined with phase equilibria modeling allows to constrain the P-T conditions of metamorphism and tectono-thermal setting of this segment during the Grenville orogeny.

Mineral assemblages of the aluminous gneisses are dominated by garnet, sillimanite, biotite, K-feldspar, plagioclase, and quartz, with locally cordierite or orthopyroxene. Petrographic textures, such as films or fingers of inferred former melt (now plagioclase) enclosing garnet, K-feldspar, sillimanite, or plagioclase, overgrowth (symplectite) between biotite and plagioclase, and composite inclusion in garnet consisting of biotite and sillimanite in a pool of plagioclase are evidence of melt production during metamorphism. Where present, cordierite is part of the peak mineral assemblage, suggesting low-P conditions. Additionally, phase equilibria modeling, specifically the pseudosection approach, is utilized to further constrain the P-T condition of metamorphism by depicting the stability field of the peak assemblage on the P-T field for specific rock composition and carefully comparing the calculated isopleths for mineral composition with the measured compositions. Maximum P-T conditions for aluminous gneisses in the southern Central Grenville Province were inferred in the range of 6.0–8.0 kbar and 820–860°C. The estimated pressure in this area is lower than the adjacent middle-P segment to the north, providing additional insights on the orogenic architecture.

Examining host-rock stratigraphy and mineralization styles of orogenic gold prospects along the Appleton Fault Zone, northeast-central Newfoundland and Labrador, Canada

Lillian N. Glodowski[1], Stefanie M. Brueckner[1], Ian W. Honsberger[2], and Hamish A.I. Sandeman[3]

1. Department of Earth Sciences, University of Manitoba. Winnipeg, Manitoba R3T 2N2, Canada <glodowsl@myumanitoba.ca>
2. Geological Survey of Canada, Natural Resources Canada, Ottawa, Ontario K1A 0E8, Canada
3. Mineral Deposits Section, Geological Survey of Newfoundland and Labrador, St. John's, Newfoundland and Labrador A1B 4J6, Canada

The Appleton Fault Zone (AFZ) in the Exploits Subzone, northeast-central Newfoundland, is a north-northeast to

south-southwest-trending deformation zone with considerable orogenic gold mineralization. Fifteen partial drill holes along the AFZ containing significant gold mineralization (e.g., >3 g/t Au) were selected from the Queensway (New Found Gold Corp.), Kingsway (Labrador Gold Corp.), and Bullseye and Titan (Exploits Discovery Corp.) projects. The selected holes were logged and sampled to better understand the setting and mineralization of orogenic gold systems in this area. The prominent mineralized lithologies in the chosen drill core include grey siltstone and shale with intervals of graphitic black shale and fine- to medium-grained sandstone, interpreted as parts of the Ordovician Davidsville Group. These epiclastic rocks in the drill holes contain disseminated, anhedral to euhedral pyrite and arsenopyrite (≤2 mm). Most of the sedimentary rocks are classified geochemically as shales based on whole rock lithogeochemical data obtained from non-mineralized samples. Medium-grained gabbroic intrusions containing disseminated sulfides including pyrite, arsenopyrite, and chalcopyrite also host gold mineralization along the AFZ. Trace element lithogeochemical data from non-mineralized gabbroic host-rocks indicate intermediate to mafic compositions of andesite to subalkaline basalt. The sedimentary and gabbroic host lithologies are cut by milky white to grey, coarse quartz ± carbonate veins up to 4 m wide. Low- to moderate-grade gold intervals (<3 g/t Au) are associated with disseminated sulfide mineralization (arsenopyrite and pyrite), commonly near quartz ± carbonate veins. Moderate- to high-grade gold intervals (>3 g/t Au) and disseminated gold flakes (≤1 mm) are found within quartz ± carbonate veins.

Overall, orogenic gold mineralization along the AFZ is hosted by epiclastic sedimentary rocks and gabbroic rocks in disseminated and vein-hosted styles. Subsequent research will include geochemical and microanalytical analyses of select mineralized samples to thoroughly characterize orogenic gold systems along the AFZ.

The geodynamic evolution of the Hopedale Block, Labdrador, Canada: new timing constraints on the assembly of the North Atlantic Craton

Alana M. Hinchey[1], Nicole M. Rayner[2], David Diekrup[1], Hamish A.I. Sandeman[1], and Daniella Mendoza Marin[1]

1. Regional Geology Section, Geological Survey of Newfoundland and Labrador, St. John's, Newfoundland and Labrador A1B 4J6, Canada <alanahinchey@gov.nl.ca>
2. Geological Survey of Canada, Natural Resources Canada, Ottawa, Ontario K1A 0E8, Canada

In Labrador, the North Atlantic Craton comprises the Saglek and Hopedale blocks. New SHRIMP U–Pb zircon geochronological data further refine the Archean tectonomagmatic evolution of the Hopedale Block. The oldest dated event is the formation of the protoliths of the Maggo gneiss at ca. 3262–3245 Ma. Between ca. 3141 and 3105 Ma, the area experienced a magmatic event that included at least three plutonic pulses and the deposition of the Hunt River Group. Based on cross-cutting relationships and new geochronological data a newly identified package of volcano-sedimentary rocks older than ca. 3124 Ma is identified and possibly another older than 3262 Ma. Between ca. 3032 and 2979 Ma, events included the intrusion of plutonic suites and the deposition of the Florence Lake Group. These rocks were collectively intruded by the ca. 2892–2832 Ma Kanairiktok Plutonic Suite. This was followed by a plutonic event at ca. 2720 to 2710 Ma and the youngest Archean event is the emplacement of the ca. 2578 to 2545 Ma Aucoin Plutonic Suite. The oldest evidence of metamorphism is cryptic at ca. 2961–2953 Ga, preserved as zircon overgrowths in two samples. Most of the metaplutonic suites in the block preserve evidence of widespread metamorphism at ca. 2846–2796 Ma and ca. 2732–2700 Ga (as zircon overgrowths and titanite growth). The ca. 2846–2796 Ma metamorphic events are geographically widespread and synchronous, in part, with the intrusion of the Kanairiktok Plutonic Suite. The Kanairiktok Plutonic Suite is hypothesized to represent a continental magmatic arc that formed during the initiation of plate tectonics in the region. Based on widespread occurrence in both blocks, the 2732–2700 Ma metamorphic event likely corresponds to the collision between the Saglek and Hopedale blocks. One outcrop preserves evidence of a ca. 2554–2542 Ma metamorphic event (as zircon overgrowths), and as this event is documented only locally it may be restricted to the western Hopedale Block. No evidence of the previously proposed Hopedalian metamorphic event is observed and little evidence for the Fiordian event.

Hummocky-like stratification and links to faulting on the passive Laurentian margin

Jorge Iturralde and David Lowe

Department of Earth Sciences, Memorial University of Newfoundland, St. John's, Newfoundland and Labrador A1B 3X7, Canada <eiturraldeto@mun.ca>

The Cambrian–Ordovician Cow Head Group of Western Newfoundland consists of allochthonous strata that provide a record of submarine carbonate sedimentation on the Laurentian margin. The most striking facies are catastrophic boulder limestone megaconglomerates (chaotic boulder conglomerate with large blocks up to >5 m) of the Upper Cambrian Downes Point and terminal Cambrian to Lower Ordovician

Stearing Island members of the Shallow Bay Formation. While most authors agree that seismicity was involved in the initiation of megaconglomerate transport, the cause of slope failure and sedimentation has also been linked to eustatic regression. To detail the potential effects of faulting on sedimentary processes and elucidate tectonic versus eustatic control, facies analyses were undertaken in the Late Cambrian and Early Ordovician sections of the Shallow Bay Formation. Most facies are consistent with submarine sedimentation below storm wave base, suggesting a slope setting. However, the discovery of hummocky cross-stratification (HCS) and oscillatory ripples occupying the Tc interval of Bouma sequences suggests a significant influence of waves and perhaps a much shallower sedimentary environment. Nevertheless, paleobathymtric constraints can be used to contextualize and understand these wave-formed features. For example, megaconglomerates are generally clast-supported with extrabasinal white algal boulders and blocks surrounded by intrabasinal lime mudstone to grainstone clasts, and lack cohesive matrix, indicating sedimentation as slumps with short transport distances. Paleoflow directions are dominantly toward the south and the coarsest clasts occur in the northern sections of the allochthon, suggesting the presence of a steep slope oriented 90° to the paleo-margin. Moreover, isotopic data suggest progressive basin confinement from the Late Cambrian onward. In this context, the genesis of HCS and oscillatory ripples are explained by the reflection of turbidity currents against fault scarps in a confined basin, resulting in the development of an internal shear boundary and propagation of oscillating currents to the bed during deceleration of turbidity flows.

Volcaniclastic deep-water architecture and provenance of an arc-adjacent lobe fan system: the Mistaken Point Formation, St. John's area, Newfoundland and Labrador, Canada

Grace Khatrine and David Lowe

Department of Earth Sciences, Memorial University of Newfoundland, St. John's, Newfoundland and Labrador A1B 3X7, Canada <gkhatrine@mun.ca>

The Mistaken Point Formation (MPF) is a ~400 m thick late Neoproterozoic siliciclastic-volcaniclastic unit that crops out in the Avalon Zone of Newfoundland and is recognized as one of the worldâ€™s leading Ediacaran fossil-bearing deep-water successions. The MPF sits as the uppermost part of a thick succession of the volcaniclastic submarine fan strata of the Conception Group, deposited at or near the transition of a fore-arc or back-arc basin to proposedly a foreland basin. Thus, MPF strata can provide insight into whether the basin transformation affected key elements of the local sedimentary environment during sedimentation. Detailed stratigraphic, petrographic, and facies analyses were integrated, and support a submarine fan depositional system with four lobe facies associations that stack to form two lobe complexes: MPF1 and MPF2. Stratal stacking patterns suggests a "back stepping" lobe abandonment with overall upward reduction in sediment concentrations, flow energy, and syn-sedimentary volcanism. Facies analysis provides evidence of ponded turbidites and stratification with similarity to hummocky cross-stratification that record progressive basin confinement through time. Paleocurrent measurements demonstrate a slight variation in sediment routing diretions from S-SE to S-SW. Mineral and lithological ternary plots show an upward shift from a magmatic arc source to a dissected volcanic arc source. MPF1 detrital zircon ages define a polymodal peak at ca. 650 Ma consisting mostly of Ediacaran (66%), Cryogenian (13%), Mesoproterozoic (7%), and Paleoproterozoic (14%) ages, whereas the overlying MPF2 depicts a polymodal distribution with peaks at ca. 600 and 580 Ma consiting of 76% Ediacaran, 6.5% Cryogenian, and 16.5% Meso- and Paleoproterozoic ages. This study highlights the evolution of the MPF submarine fan system through its basin transformation, which is critical to improving paleogeographic reconstructions of submarine fans, and in better understanding the basin and tectonic evolution of Ediacaran strata on the northeastern Avalon Peninsula.

Geology of the Aurora vent field: first exploration of hydrothermal vents under ice in the Arctic Ocean*

Charles Lapointe[1], John W. Jamieson[1], Eoghan P. Reeves[2], Stefan Bünz[3], Eva Ramirez-Llodra[4], and Caroline Gini[1]

1. Department of Earth Sciences, Memorial University of Newfoundland, St. John's, Newfoundland and Labrador A1B 3X7, Canada <clapointe@mun.ca>
2. University of Bergen, 5020 Bergen, Norway
3. UiT The Arctic University of Norway, Hansine Hansens 9019 Tromsø, Norway
4. REV Ocean, Norway & Norwegian Institute for Water Research, Oksenøyveien 10, 1366 Lysaker, Norway

The Arctic Ocean's ultraslow-spreading Gakkel Ridge remains poorly explored due to its remoteness, sea-ice cover, and harsh conditions. Consequently, little is known of the hydrothermal activity on the ridge and of its place within the global mid-ocean ridge system. The Aurora vent field is the only such site to be located and explored on the Gakkel Ridge, and is hosted on an axial volcano at its southern terminus. In 2021, the first direct sampling of hydrothermal vents on the Gakkel Ridge took place during the HACON21 expedition on the Norwegian Icebreaker Kronprins Haakon. Using the remotely operated vehicle Au-

rora Borealis, 14 hydrothermal rock samples and 13 hours of high-resolution video footage were gathered as part of a multidisciplinary geological, geochemical, and biological survey and sampling of the vent field.

In this presentation, we provide a geological overview of this newly explored field, discuss results in the context of geological controls on hydrothermal systems along ultra-slow-spreading ridges, and describe some of the unique challenges of exploring the seafloor below perennial sea-ice. The site consists largely of inactive and collapsed hydrothermal sulfide edifices that extend over an area of 140 × 100 m on a sedimented pillow basalt substrate. Three high-temperature (>350°C) black smokers (the Enceladus, Ganymede, and Hans Tore vents) were discovered within a ~10 m diameter cluster in the northeastern region. Adjacent low-temperature diffuse venting is associated with Fe-oxide deposits. Results from compositional characterization (petrography, X-ray diffraction analysis, trace element geochemistry) of sulfide-rich samples indicate a dominance of the high-temperature-associated minerals chalcopyrite, anhydrite, and pyrrhotite. Lower-temperature minerals such as sphalerite, barite, and amorphous silica are notably absent. Relatively high Ni and Co concentrations in the sulfides suggest an interaction of hydrothermal fluids with ultramafic rocks at depth, as also evidenced by water column plume CH_4:Mn ratios.

**Winner: GAC-NL Section Award for best graduate student oral presentation*

The inception, evolution, and terrane-scale significance of a Late Ediacaran foreland basin in the eastern Avalon Zone of Newfoundland and Labrador, Canada

David Lowe, Santiago Serna Ortiz, Grace Khatrine, and Juvani Bryce

Department of Earth Sciences, Memorial University of Newfoundland, St. John's, Newfoundland and Labrador A1B 3X7, Canada <dlowe@mun.ca>

The Ediacaran to Cambrian (ca. 590–510 Ma) arc-platform transition in Avalonia is widely attributed to ridge-trench subduction based on constraints from Avalonian terranes in the Maritimes and the western part of the Avalon Zone in Newfoundland, where arc activity was followed by rifting. However, coeval successions from the eastern Avalon Zone contain evidence of post-arc compression, ascribed to the Avalonian orogeny, which has been used as evidence to support an alternative model of oblique terrane collision leading to arc shutdown. To attempt to resolve these conflicting tectonic regimes and understand the role of compression during the arc-platform transition, we summarize sedimentologic and provenance results from the upper Conception Group to the Signal Hill Group (ca. 565–550 Ma) on the eastern Avalon Peninsula of Newfoundland. The ca. 566–564 Ma Mistaken Point Formation records basin reorganization, with back-stepping, rerouting, and confinement of submarine fans, a change from volcaniclastic to siliciclastic sedimentation, and changes in provenance. The overlying St. John's Group (ca. 564–557 Ma) records a change in sediment routing with an increase in sedimentation rates, retreat of submarine fans, slumping, and deltaic progradation. The overlying Signal Hill Group (ca. 557–540 Ma) records deltaic to fluvial progradation, with evidence of forced regression, blind thrusting, and hinterland exhumation at ca. 556 Ma. The fluvial Flatrock Cove Formation (ca. 551–549 Ma) records growth strata development during fold limb rotation, followed by the emergence of a thrust with 3.5 km of vertical throw, and renewed hinterland exhumation. Commonly cited as a strike-slip basin, the ca. 565–550 Ma stratal record in the eastern Avalon Zone is more consistent with a foreland basin. It probably represents a retro-arc basin, formed either on a coherent West Avalonian terrane during the subduction of a spreading ridge, or on a subsidiary West Avalonian terrane prior to collision.

LCT pegmatites–concepts, exploration, and the Killick pegmatite field, southern Newfoundland and Labrador, Canada

Kiersty M Malay[1,2], Donnelly B. Archibald[2], and James Conliffe[3]

1. Department of Earth Sciences, Memorial University of Newfoundland, St. John's, Newfoundland and Labrador A1B 3X7, Canada <kmmalay98@gmail.com>
2. Department of Earth and Environmental Sciences, St. Francis Xavier University, Antigonish, Nova Scotia B2G 2W5, Canada
3. Mineral Deposits Section, Geological Survey of Newfoundland and Labrador, St. Johnâ€™s, Newfoundland and Labrador A1B 4J6, Canada

Canada's efforts to develop low-carbon technologies has increased the demand for critical minerals/elements. Critical elements such as Li, Cs, Rb, Nb, and Ta can be sourced from minerals in lithium-cesium-tantalum (LCT) pegmatites where they are concentrated in minerals such as spodumene, pollucite, columbite, and tantalite. Recently, lithium exploration has seen a resurgence with a focus on hard rock LCT pegmatite resources due to their high concentration of lithium. The deposit model for LCT pegmatite formation is complex but several important exploration methods are currently being used industry wide. Southern Newfoundland is a region displaying favourable geological conditions to host lithium pegmatites including metasedimentary

host rocks (Bay du Nord Group), a major crustal-scale shear zone (Bay d'Est shear zone), and voluminous, geochemically evolved, two-mica granitic plutonic rocks (Peter Snout and Rose Blanche plutons). LCT pegmatites were first discovered in southern Newfoundland in 2021 and form part of the Killick pegmatite field. Pre-liminary work shows that both the granitic plutons and LCT pegmatites are hosted in the Dolman Cove Formation, which consists of metavolcanic and metasedimentary rocks metamorphosed to upper greenschist to amphibolite facies. So far, a swarm of LCT pegmatite dykes has been discovered at the Killick pegmatite field over more then 10 km of strike length, including the Kraken pegmatites and the Hydra pegmatite. The Hydra dyke is unique compared to the rest of the Killick pegmatites because it is rich in pollucite ($Cs(Si_2Al)O_6 \cdot nH_2O$), as opposed to the predominantly spodumene ($LiAlSi_2O_6$)-bearing dykes that comprise the Kraken pegmatites. Hydra is the first high-grade Cs discovery in Atlantic Canada. Preliminary work shows that the Hydra dyke is 5–6 m wide and can be traced ~100 m at surface. The dyke trends NE-SW, is steeply dipping, and shows zonation in the exposed area. The modal percentage of minerals in these zones varies, but so far, we have identified quartz, albite, microcline, pollucite, spodumene, white micas, tourmaline, coltan, zircon, garnet, and apatite.

CO_2 mineralization potential of Newfoundland and Labrador, Canada

Timilehin A. Oguntuyaki, Zhanae A. Sutherland, Matt J. Gill, Ben T. Taylor, and Penny L. Morrill

Department of Earth Sciences, Memorial University of Newfoundland, St. John's, Newfoundland and Labrador A1B 3X7, Canada
<taoguntuyaki@mun.ca>

This study aimed to identify potential sites of CO_2 mineralization associated with serpentinized ultramafic rocks of Newfoundland and Labrador (NL), Canada, and estimate the CO_2 mineralization potential of the province. Mapping and metadata analysis were performed to identify ultramafic occurrences in NL and determine parameters such as the volume of ultramafic rocks and the percentage of serpentinization. These parameters were used to calculate the CO_2 mineral-ization potential of serpentinite. The majority of ultramafic rocks are located on the island of Newfoundland with few or none identified in Labrador. Additionally, some of the parameters needed for the calculation were not available for all Newfoundland's ultramafic units. Units where data are missing are generally minor and conservative values were used for them in the calculation. Using a previously published conversion factor of 0.0563 Gt of CO_2 sequestered per km^3 of serpentinite, a CO_2 mineralization potential estimate of 59 Gt of CO_2 was calculated for the province. This estimate is ~15 000 times greater than the amount of CO_2 emitted in 2020 by the province's major industries. Some units contribute more significantly to the estimate, given their large surface area and volume. For example, the Bay of Island Complex contributed at least 70% of the total CO_2 mineralization estimate of the province; such complexes present opportunities for further research to constrain the optimum conditions that enhance their CO_2 mineralization capacity.

Structural characterization and tectonic evolution of 1.3 Ga REE-bearing Fox Harbour Volcanic Belt, southeast Labrador, Canada*

Nicolas Prieto and Eric J Thiessen

Department of Earth Sciences, Memorial University of Newfoundland, St. John's, Newfoundland and Labrador A1B 3X7, Canada
<nprietomoren@mun.ca>

The eastern Grenville Province in southeastern Labrador preserves evidence of a complex geological history, marked by Paleoproterozoic to Mesoproterozoic subduction-accretion orogens separated by intermittent extensional periods between ca. 1.8 and 0.9 Ga. These stages are preserved across different shear-bounded terranes, which are underlain by Labradorian (1.7–1.6 Ga) basement rocks. The study zone near St. Lewis, Labrador, is situated within a high-strain corridor over 300 km long and 20 km wide that experienced pervasive high-temperature deformation around 1.6 Ga with minor focused deformation at 1.0 Ga during Grenvillian orogenesis. The recent discovery of the 1.3 Ga Fox Harbour bimodal volcanic belt (FHVB) included highly deformed peralkaline rhyolite hosting rare earth element (REE) mineralization and prompts a reassessment of the high-strain corridor's timing, magnitude, and continuity, with a focus on the potentially prominent role of Grenvillian deformation. This project aims to characterize structural patterns governing the geometry of the FHVB and associated shear zones, coupled with age constraints on deformation fabrics and related metamorphism.

We employed current geophysical data in conjunction with existing geological maps to identify distinct tectonic domains and bounding shear zones, integrating detailed field observations, structural data, and microstructural petrographic analyses. Furthermore, U–Pb chemical abrasion LA-ICPMS analysis on zircon provided insights into protolith, depositional, and deformation ages, whereas timing of tectonic fabric development across different high-strain zones was constrained using in-situ titanite U–Pb petrochronology. The findings challenge previous interpretations, revealing pervasive Grenville high-temperature deformation (1.0 Ga) and significant bounding shear zone activity around 1.0 Ga after peak metamorphism. This activity facilitated the exhumation of the FHVB domain, characterized by three shear-parallel tabular bodies that locally exhibit buckle-folding structures, intersected by late strike-slip lower-temperature shears. This work provides a modern understanding of the nature and structural modification within this polydeformed terrane in southeastern Labrador, testing existing models of Proterozoic tectonics in the region.

**Winner: GAC-NL Section Award for best graduate student oral presentation*

Understanding rare earth element mineralization in peralkaline rocks from southeastern Labrador, Canada: how can zircon help?

Nicole M. Rayner[1] and Zsuzsanna Magyarosi[2]

1. Geological Survey of Canada, Natural Resources Canada, Ottawa, Ontario K1A 0E8, Canada <rayner@nrcan-rncan.gc.ca>
2. Mineral Deposits Section, Geological Survey of Newfoundland and Labrador, St. John's, Newfoundland and Labrador A1B 4J6, Canada

The area of Port Hope Simpson in southeastern Labrador is home to the most advanced rare earth-element (REE) project in Atlantic Canada. The REE are found in the Fox Harbour Volcanic Belt (FHVB) in the Mealy Mountains terrane of the Grenville Province which consists of three, parallel, mineralized, belts of metamorphosed and mylonitized peralkaline and non-peralkaline volcanic rocks. REE mineralization also occurs in pegmatites and their parent intrusions south of the FHVB in the Pinware terrane.

Over the course of a multi-year, collaborative project between the Geological Survey of Newfoundland and Labrador and the Geological Survey of Canada, 16 samples of peralkaline volcanic rocks, pegmatites, parent intrusions, and host rocks have been dated by SHRIMP zircon U–Pb geochronology. Volcanic rocks at Deep Fox (eastern extent of FHVB) yield crystallization ages of ca. 1310 Ma and 1260 Ma, as do parent granites and pegmatites farther south along the coast in the Pinware terrane. These ages are not unexpected as REE-bearing Mesoproterozoic peralkaline complexes are well known in Labrador (e.g., Strange Lake, Flowers River, and Red Wine complexes). Zircon grains from all samples also record Grenvillian metamorphism (1070–980 Ma) and in many cases only limited data indicate Mesoproterozoic crystallization. Grenvillian zircons commonly exhibit unusual trace element zoning patterns and may contain inclusions of REE minerals, including fergusonite.

Trace element abundances in zircon, both as spots and maps, were recently collected by LA-ICP-MS analysis to better constrain the timing of any mobilization of REE and begin to interrogate the role of Grenvillian metamorphism in the enrichment of REE in southeast Labrador. Presently there are more questions than answers, but this presentation is hoped to stimulate discussion of the zircon isotopic and trace element results to advance the understanding of the genesis of REE mineralization hosted in alkaline-peralkaline systems.

The Kraken lithium-cesium-tantalum (LCT) pegmatites in southern Newfoundland and Labrador, Canada

Deepyaman Saha[1], Donnelly B. Archibald[1], James Conliffe[2], and Kiersty Malay[1,3]

1. Department of Earth and Environmental Sciences, St. Francis Xavier University, Antigonish, Nova Scotia B2G 2W5, Canada <x2023fnq@stfx.ca>
2. Mineral Deposits Section, Geological Survey of Newfoundland and Labrador, St. John's, Newfoundland and Labrador A1B 4J6, Canada
3. Department of Earth Sciences, Memorial University of Newfoundland, St. John's, Newfoundland and Labrador A1B 3X7, Canada

Canada's efforts to develop low-carbon technologies has increased the demand for critical minerals/elements. For example, demand for lithium is driving global exploration for difficult-to-locate lithium pegmatites. Southern Newfoundland is a region displaying favourable geological conditions to host lithium pegmatites including metasedimentary host rocks (Bay du Nord Group), a major crustal-scale shear zone (Bay d'Est shear zone), and voluminous, geochemically evolved, two-mica granitic plutonic rocks (Peter Snout and Rose Blanche plutons). The present research is focussed on the Kraken pegmatites, a swarm of lithium-cesium-tantalum (LCT) pegmatites discovered in 2021 in southern Newfoundland. Preliminary fieldwork focussed on mapping and sampling multiple spodumene-bearing pegmatite dikes. Both the LCT pegmatite dykes and granitic plutons intruded the metasedimentary rocks. The mineralogy of the pegmatites is spodumene, quartz, K-feldspar, albite, muscovite, and garnet, with minor apatite, coltan, white beryl, and schorl tourmaline. Some of the spodumene dykes exhibit discernible internal zoning patterns, characterized by layered aplite in the footwall, a lower intermediate pegmatite zone, a core zone that contains the coarsest spodumene, and a hanging wall zone with abundant tourmaline. However, some of the exposed dykes are unzoned. This research aims to provide a better understanding of the age and mineralogy of the Kraken spodumene pegmatites and contribute to an enhanced understanding of processes that resulted in emplacement of spodumene pegmatites in southern Newfoundland and in broader Ganderia in the northern Appalachian orogen.

Petrochemistry, mineralogy and Nd isotopic data for Tithonian (ca. 148 Ma) alkaline lamprophyric intrusions, Notre Dame Bay, Newfoundland and Labrador, Canada

Hamish A.I. Sandeman[1], Alexander Peace[2], J. Kim Welford[3], Greg Dunning[3], and Alfredo Camacho[4]

1. Mineral Deposits Section, Geological Survey of Newfoundland and Labrador, St. John's, Newfoundland and Labrador A1B 4J6, Canada <hamishsandeman@gov.nl.ca>
2. School of Earth, Environment, and Society, McMaster University, Hamilton, Ontario L8S 4K1, Canada
3. Department of Earth Sciences, Memorial University of Newfoundland, St. John's, Newfoundland and Labrador A1B 3X7, Canada
4. Department of Earth Sciences, University of Manitoba. Winnipeg, Manitoba R3T 2N2, Canada

The magma-poor Newfoundland Atlantic margin formed following lithospheric extension that led to rifting by the Late Jurassic. Mesozoic-Cenozoic magmatism on- and offshore Newfoundland was contemporaneous with this rifting and breakup. In north central Newfoundland, the Budgell Harbour and Dildo Pond Stocks, two Late Mesozoic alkali monzogabbro intrusions, an associated lamprophyre dyke swarm and a peridotite sill form the Notre Dame Bay Magmatic Province. Geochronological constraints (one U–Pb TIMS and five $^{40}Ar/^{39}Ar$ laser step-heating plateau ages) demonstrate a short-lived (~4 Myr.) alkaline magmatic pulse on the Newfoundland margin at ca. 148 Ma (Tithonian), contemporaneous with rifting, and formation of offshore petroliferous basins. Geophysical investigations demonstrate the highly magnetic, dense, central coarse-grained monzogabbro stocks represent two coalescing, epizonal funnel-like bodies with upward-reaching apophases that likely fed the lamprophyric dykes. The stocks include coarsely modally layered phlogopite-enstatite-ilmenite-magnetite-kaersutite olivine gabbro or essexite. The radially disposed lamprophyre dykes are variably textured camptonites ranging from aphyric to ilmenite-magnetite-diopside ± olivine ± kaersutite ± phlogopite porphyritic and contain feldspathic- and/or carbonate-dominant ocelli. Silica-undersaturated alkaline mineral phases form small, late anhedral grains in the groundmass of the dykes between the carbonate-rich ocelli and the feldspathic groundmass, and as the paragenetically latest phases in the stocks. Collectively the intrusions represent an early phase of the Peri-Atlantic Alkaline Pulse and occur along the intersection of broadly northeast-trending, inherited, Appalachian lithospheric-scale faults and localized Moho depth variations along the northeast Newfoundland coast. These converging lithospheric structures and Moho variations likely focussed the ascent of low degree partial melts driven by distal, edge-driven upwelling associated with continued extension in the northwest Atlantic.

Updates to the geology of the Twillick Brook map area (NTS 2D/4), south-central Newfoundland and Labrador, Canada

Gabriel S. Santos

Regional Geology Section, Geological Survey of Newfoundland and Labrador, St. John's, Newfoundland and Labrador A1B 4J6, Canada <GabrielSantos@gov.nl.ca>

In 2023, a new 1:50 000-bedrock-mapping project commenced in the Twillick Brook map area (NTS 2D/4). The area is located in the Exploits Subzone in south-central Newfoundland, and includes metasedimentary and subordinate metavolcanic rocks of the Riches Island, St. Joseph's Cove, Salmon River Dam, and North Steady Pond formations of the Ordovician Bay d'Espoir Group. In addition, plutonic phases of the North Bay Granite Suite, Missing Island Granodiorite, Matthews Pond Granodiorite, Rocky Bottom Tonalite, Partridgeberry Hills Granite and Round Pond composite pluton occur in the area. Metamorphism in the metasedimentary rocks of the Bay d'Espoir Group in the Twillick Brook area does not exceed greenschist facies.

The area has a complex deformation history. The earliest deformation event (D_1) resulted in the transposition of beds and the formation of a northeast-striking cleavage, parallel to the axial planes of isoclinal folds in the Bay d'Espoir Group. A second event (D_2) formed a new generation of isoclinal folds associated with a cleavage at shallow angles to D1 transposed beds. A third deformation event (D_3) resulted in the formation of folds ranging from open to close with an axial plane striking northwest. A possible fourth event (D_4) is associated with the formation of the east-west cleavage that dominates the northern part of the map area. A previously unidentified NE-striking linear feature between the St. Joseph's Cove Formation and Salmon River Dam Formation of the Bay d'Espoir Group is discernible in the aeromagnetic data. The implications of this structure to the Bay d'Espoir Group are as yet unclear.

Exploring the potential for ultra-trace aqueous geochemistry to detect small-footprint Li-Cs-Ta pegmatite mineralization in southern Newfoundland and Labrador, Canada

Shramana Sarkar[1], Michael G. Babechuk[1], James Conliffe[2], and Duc Huy Dang[3]

1. Department of Earth Sciences, Memorial University of Newfoundland, St. John's, Newfoundland and Labrador A1B 3X7, Canada <shramanas@mun.ca>
2. Mineral Deposits Section, Geological Survey of Newfoundland and Labrador, St. John's,

Newfoundland and Labrador A1B 4J6, Canada
3. Environmental Geoscience, Trent University, Peterborough, Ontario K9L 0G2, Canada

With global critical mineral demand increasing and surpassing current availability, it is imperative to devise new methods of mineral deposit exploration. Lithium-cesium-tantalum (LCT) pegmatite deposits are an important source of lithium and other critical minerals, but the small footprint of mineralization and associated alteration halos hamper exploration. With geophysical properties generally yielding insufficient contrast among granite, pegmatite, and pegmatite host rocks, existing exploration strategies rely primarily on whole-rock and mineral chemistry derived from solid reservoirs (rocks, till, soil, sediment), which are efficient only within proximity to mineralization. However, the element suites co-enriched in pegmatites and/or in adjacent rocks during metasomatism include several elements (i.e., Li, Be, Cs, Rb, K, W) that are soluble in natural waters and thus, amenable to release to the hydrosphere during weathering. This process renders aqueous geochemical methods potentially advantageous for exploration in areas with favourable hydrology. Despite bearing some practical and analytical challenges, aqueous geochemical exploration strategies for LCT mineralization are considerably untested.

This project aims to test the presence and potential downstream environmental dispersion of dissolved-load element budgets linked to known LCT pegmatite mineralization. Stream waters have been targeted in an LCT pegmatite-prospective area of southern Newfoundland between La Poile and Grey River to test drainage basins with known Li-rich and Cs-rich pegmatites, as well as drainage basins with no currently identified upstream mineralization. The isolation of (potential) mineralization signatures from background environmental signatures, without sample contamination during handling, is anticipated to be analytically challenging and requires clean sampling and laboratory procedures. This work will compare inductively coupled plasma mass spectrometry (ICP-MS) data from an academic research laboratory to those from a high-quality hydrogeochemical package at a commercial laboratory to define the practical viability of the exploration strategy. Progress-to-date in terms of sampling strategies and preliminary data is presented.

Gaseous biosignatures in ultra-basic serpentinite-hosted groundwater springs

Mary J. Whelan, Penny L. Morrill, and Matthew J. Gill

Department of Earth Sciences, Memorial University of Newfoundland, St. John's, Newfoundland and Labrador A1B 3X7, Canada
<mjw245@mun.ca>

Serpentinization is a hydration reaction that occurs when ultramafic bedrock incorporates water into the crystal structures of the constituent minerals (e.g., magnesite, brucite, pyroxenes). The minerals leach elements into the water, making it ultra-basic (pH >10) and reducing (<-100 mV), with an enrichment of methane (CH_4) gas. Studies have shown that specialized microbes inhabit these systems, using the available chemical energy for metabolism. The fluid discharges on land at groundwater springs, which can be sampled and studied as a proxy for subsurface processes. In this study three sites of terrestrial serpentinization were studied through their groundwater springs: The Tablelands (NL, CAN), The Cedars (CA, USA), and Aqua de Ney (CA, USA). The CH_4 found in the groundwater springs at these sites has been determined to originate from each of the known CH_4 sources on Earth: through breakdown of organic matter, from methanogenic Archaea, and from secondary serpentinization reactions, respectively. This study set out to characterize the field sites, quantify the flux of CH_4, and link the source of CH_4 to molecular and isotopic biosignatures found.

Aqua de Ney samples were associated with abiogenically derived CH_4, which had the highest flux from the spring surface (13.3 mol.m^{-2}.min^{-1}), whereas the other sites did not contain CH_4 in a high enough concentration to be detected by the flux experiments. Dissolved gas analysis from the microbially-derived CH_4 site (i.e., The Cedars) had a concentration of 5497 μmol/L, whereas the field site with non-microbially derived CH_4 (i.e., Tablelands) contained 4931 μmol/L CH_4.

Since sites of serpentinization have been found on other celestial bodies and support microbial life on Earth, these data may be used for characterization of extra-terrestrial sites of serpentinization found on future exploration missions and may play a role in the search for microbial life away from Earth.

Hot syn-orogenic granites of the Central Grenville Province: characteristics and tectonic settings

Cheuk-Yin Yip, Aphrodite D. Indares, and Gregory R. Dunning

Department of Earth Sciences, Memorial University of Newfoundland, St. John's, Newfoundland and Labrador A1B 3X7, Canada
<cyyip@mun.ca>

Conventional models of collisional orogens predict S-type granitoid emplacement during the orogenic climax, whereas A-type granitoids can be formed by late-orogenic extension. Yet, syn-orogenic S-granites are scarce in the Grenville Orogen, compatible with the development of the orogen on a previous active margin and reflecting the limited introduction of fertile sedimentary rocks into deeper crustal levels. On the contrary, the hinterland of the

Grenville Province displays A-type granitoid bodies that were sporadically emplaced throughout the 100 Myr duration of the orogeny. These rocks are particularly abundant in the Central Grenville Province as kilometre-scale plutonic bodies in the middle-P and low-P belts and tens of kilometre-scale batholiths spatially associated with 1.1 Ga anorthosites in the low-P belt.

Here, we document key characteristics of syn-orogenic granitoid rocks exposed along the Manicouagan–Escoumins Transect in the middle-P and low-P belts of the orogenic hinterland. These granitoid rocks were emplaced intermittently between 1090 Ma and 1015 Ma with no apparent spatiotemporal trend. In thin sections, perthite is common, whereas some contain magmatic pyroxene and display rapakivi texture. Based on geochemical classifications, the rocks are ferroan, metaluminous to weakly peraluminous, alkali-calcic to alkalic monzodiorite, monzonite, and granite. A detailed investigation of four plutons reveals crystallisation P–T conditions at ca. 5.3–6.7 kbar and ~800–1000° C, based on amphibole and feldspar chemistry. The presence of zircon inherited cores of Laurentian affinity, and bulk Nd and in-situ zircon Hf isotopic signatures suggest that the granitoid magmatism originated by mixing and/or assimilation of mantle and crustal sources.

The proximity of the largest granitoid bodies to older anorthosites in the low-P belt is consistent with the reactivation of long-lived lithospheric discontinuities. Overall, the granitoid magmatism indicates a mantle-derived elevated thermal input throughout the Grenvillian orogeny. How this can be accounted for in the continental collision model for the Grenville Orogen remains to be discovered.