# Characterization of a nickel, cobalt, and platinum group metals occurrence in the Yellowknife greenstone belt.

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Newly discovered nickel (Ni), cobalt (Co), and platinum group metal (PGM) mineralization was found near the past-producing Mon gold mine, Yellowknife Greenstone Belt, Northwest Territories. The origin of the mineralization is unknown and the mafic host rocks may have been misclassified due to metamorphism and metasomatic overprinting. The research goal is to classify the critical mineral deposit type, clarify the host rock for the mineralization, and inform future mineral exploration efforts. The methodological approach includes determining the mineral paragenesis of hand samples representative of the host rock, alteration, and mineralization aided by false-colour elemental distribution maps produced by micro-X-ray fluorescence (μXRF). Polished sections will be studied using light and scanning electron microscopy to further identify minerals, paragenesis and mineral compositions. Preliminary results indicate that the least altered host rocks are metabasites, consisting of hornblende porphyroblasts surrounded by a weakly foliated groundmass of intermediate plagioclase (~$An_{23-51}$), titanium-rich biotite, chlorite(?), and minor amounts of muscovite. Two chemically distinct types of pervasive alteration overprint the metabasites: (i) Na alteration (albitite) of endmember albite with minor titania minerals and zircon, and (ii) Ca-Fe alteration of early endmember anorthite crosscut by foliated actinolite. Late potassic alteration locally rims minerals in both assemblages. Mineralization consists of Ni-Co-Fe±Cu in S-As-sulfosalts disseminated within albitite and Ca-Fe alteration. Discrete bands of late chlorite replace albitite, whereas late albite, anorthite and gypsum are restricted to monomineralic veins that crosscut replacement-style alterations. The preliminary paragenesis may indicate a Metasomatic Iron Cobalt deposit type and Metasomatic Iron Alkali Calcic system classification scheme.

**Poster/Presentation**

Poster

# A Geomorphological Analysis of Coastal Change in Port Joli, NS. Using Remote Sensing and GIS Methods

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For Nova Scotians, coastal and environmental change has become a topic of increasing concern in recent years. In a province where the majority of the population lives on or near the

coast, many residents have expressed a desire for the development of new coastal regulations and policies in response to changing environmental conditions and accelerated sea-level rise. This thesis investigates coastal change at three beaches in Port Joli, a site with a large recreational and residential use, in addition to a having a high cultural significance to the Mi'kmaq communities of Nova Scotia. Remote sensing methods such as historical air photos, drone photogrammetry and LiDAR, in conjunction with GIS methods were used to analyze the remote sensing data. This thesis aims to characterize the geomorphological features and processes of the site. The goal is to improve the understanding of how the system has changed over time thereby further informing future management efforts.

**Poster/Presentation**

Presentations

**University Affiliation Presentation**

Acadia

# Understanding the melt history of the Pokiok Batholith through melt inclusions in zircons

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The Pokiok Batholith, located in the Miramichi Terrane in New Brunswick, is a large igneous body composed of several distinct granitoid phases. In contrast to the mineralized Saint George Batholith (SGB) of similar age to the south-east, the Pokiok Batholith is relatively understudied due to its lack of intrusion-related critical metals such as Sn and W. The goal of this study is to reconstruct the magmatic history of the batholith and determine which factors might have led to its lack of mineralization. We conducted a petrographic study of the two dominant phases of the batholith, the Hartfield tonalite and the Hawkshaw granite, and examined melt inclusions and trace elements in zircon to track the evolution of melt through time. Laser ablation inductively-coupled plasma mass spectrometry (LA-ICP-MS) was used to analyse the trace elements in and to U-Pb age-date zircon. Major and minor element compositions of melt inclusions were determined by scanning electron microscopy-electron dispersive spectroscopy (SEM-EDS). Petrographic analysis reveals large proportion of K-feldspar in the Hartfield tonalite, requiring reclassification to a granodiorite. The Hawkshaw granite and Hartfield granodiorite yielded weighted mean ages of ~410 Ma and ~425 Ma, respectively. Based on chemical compositions of melt inclusions and zircon, preliminary results suggest melt evolution through protracted fractional crystallization, with titanite as a key fractionating phase influencing REE behavior. Further research is underway to determine the connection between the Hawkshaw granite and the Hartfield granodiorite, and to compare these results to the units of the SGB.

**Poster/Presentation**

Poster

# On the discovery of age diagnostic Triassic footprints (Chirotherium) from Melvin Beach New Brunswick

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The Fundy Basin of Atlantic Canada represents an aulacogen that preserves a thick succession of continental clastic fluvial and lacustrine deposits on both the Nova Scotian and New Brunswick coastlines. The basin accommodated sediments between the latest Permian and the early Jurassic Periods. To date, the majority of paleontological research has been conducted in Nova Scotia, including skeletal remains of Canada's oldest dinosaurs (Prosauropods) and abundant late Triassic and Early Jurassic vertebrate ichnofossils, predominantly that of dinosaurs (i.e. *Otozoum, Grallator, Anomoepus*). Here, we present the first discoveries of vertebrate footprints, vertebrate and invertebrate burrows from the Echo Cove Formation at Melvins Beach New Brunswick, along the Fundy Trail Provincial Park. These traces represent the first evidence of vertebrate life (inferred from trace fossils) from the upper Triassic (Carnian stage), and the first known Mesozoic vertebrate burrows in New Brunswick. The vertebrate tracks are here tentatively assigned to the ichnogenus *Chirotherium* ichsp, that has been interpreted by others to be made by chirotherid archosaurs. Archosaurs dominated the early to middle Triassic Period alongside a variety of other terrestrial vertebrates that crossed the Permian-Triassic mass extinction event. Trace fossils can be used, where other conventional age-diagnostic information such as palynology or radiometric dates are absent. In addition to the systematic description of these new trace fossils, this study uses sedimentological and stratigraphic analyses of the Echo Cove Formation based on data collected from coastal outcrops to better understand its depositional setting that once supported the vertebrate and invertebrate activity described here.

**Poster/Presentation**

Presentations

**University Affiliation Presentation**

Dal

# Characterizing the crystallization and magmatic metal endowment of granitoids within the Saint George Batholith

## associated with the Mount Pleasant Complex, New Brunswick

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The Saint George Batholith (SGB) located in southwestern New Brunswick covers almost 2000 $km^2$, comprised of eight main intrusive units spanning over the Late Silurian to the Late Devonian. Economic polymetallic (Sn-In-Zn-W-Mo) deposits are located in the Mount Pleasant Granites within the Mount Pleasant Caldera Complex, situated above the SGB. Barren to sub-economic granites located within the SGB include the Mount Douglas Granite (MDG) that hosts well-known polymetallic mineral occurrences. This study aims to compare the magmatic characteristics of well-endowed granites to barren and sub-economic granites of the SGB, along with a comparison to the other sub-economic unit of the caldera complex, the McDougall Brook Granites (MBG). Crystallization ages for the MDG and the MBG from previous studies have all yielded essentially the same results, which has caused issues with interpreting their crystallization history. They are still unresolved in the sense that their age dates have overlapping age ranges with one another. To address these issues, this study will integrate aspects from petrography, whole rock and melt inclusion geochemistry, and the mineral chemistry of P-T, degassing and oxygen fugacity indicator minerals (i.e. apatite, titanite, zircon). The overall objective of this study is to resolve and characterize the factors that influenced the relative mineralization potential of granitoids. Higher resolution age dates for the MDG and the MBG will also be determined.

**Poster/Presentation**

Poster

## Kinematics and stratigraphy in the Chebogue Point shear zone, Yarmouth, NS

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The Chebogue Point shear zone is a major intra-terrane high-strain zone in the Meguma terrane in southern Nova Scotia. The shear zone juxtaposes Cambrian to Ordovician rocks of the metasedimentary Goldenville Group (Government Brook and Moshers Island formations) and Halifax Group (Cunard Formation) with Silurian and younger metavolcanic and metasedimentary rocks of the Rockville Notch Group (White Rock Formation). The rocks of the Rockville Notch Group as well as two suites of mafic sills and dykes occur only northwest of the shear zone. This shear zone is exposed in a coastal section at Chebogue Point west of Yarmouth. However, it is not known whether some of the Goldenville Group stratigraphy is

omitted in the shear zone. In particular, the Moshers Island Formation, a terrane-wide, high Mn-bearing marker unit, may not be present. A chemostratigraphic transect through the rocks affected by the shear zone will determine whether it is omitted, and U-Pb detrital zircon geochronology will attempt to determine which part of the Goldeville Group is present. Although the overall sense of motion in the shear zone is not well understood, some kinematic indicators such as boudinaged quartz veins, fold asymmetry, rotated clasts, and stretching lineations show a complex set of both dextral and sinistral horizontal strike-slip to moderately oblique movement. Preliminary data show there may be multiple episodes of motion represented in the shear zone and this coastal zone represents the lower metamorphic grade parts of the higher-grade amphibolite-facies, shear zone exposed farther to the north along strike.

**Poster/Presentation**

Poster

# A blast-furnace from the past; using Renaissance smelting techniques to assess stable copper isotope fractionation in L'nu artifact provenance analysis

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Stable isotopes play significant roles in geoscience, from topics like geochemistry and ore deposit geology to hydrogeology and paleontology. It has only been recently that stable heavy isotope systems (Pb, Sn, Cu, Ag, Fe) have been applied to related fields like archaeometallurgy. These elements are important in determining provenance of metallic artefacts. Temperatures of the smelting conditions of sulfidic ores are hypothesized to induce fractionation of isotopes but given their high atomic mass their isotope ratios remain minimally affected. Given the lighter nature of Cu, fractionation may be more significant relative to the other elements. The objectives of this study are to elucidate the nature of the fractionation of Cu. This was done by assessing the variation of $\delta^{65}$Cu in natural chalcopyrite ores from important mining districts during the renaissance era such Sweden, Norway and Germany. This was compared to $\delta^{65}$Cu values in contact period North American L'nu copper artefacts from Nova Scotia and Renaissance era Swedish coinage. To fingerprint the extent of Cu isotope fractionation due to natural variations in ore systems, smelting experiments were derived to discern provenance. The experimental techniques were based on historical accounts of smelting techniques used in the 17$^{th}$ C copper production from the Great Copper Mountain at Falun, Sweden during its peak production period. Petrography and SEM analysis was performed to characterize chalcopyrite mineralization and on smelt products to assess metal purity. These future experiments will allow Cu fractionation to be quantified at each individual stage of the experimental process.

**Poster/Presentation**

Poster

# Petrogenesis of Neoproterozoic LREE-Enriched Pegmatites, Perch Falls, southwestern New Brunswick:  preliminary mineral-chemical and geochemical analysis

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At the Perch Falls Quarry in south-central New Brunswick, there are simple NYF-type granitic pegmatite dykes that locally have central quartz zones and magmatic epidote and locally allanite that generally trend NE to East with variable dips, which intrude the Neoproterozoic Perch Falls Granodiorite. These dykes seem to form the youngest Neoproterozoic magmatic event in the region: the Prince of Wales Granite, located ~ 600 m south. The pegmatites also have sulphide-bearing variable concentrations of radioactive elements (eTh = 3.6-75 ppm, eU= 0-6.8 ppm) determined by field-portable gamma-ray spectrometry.

Eight ~5+ kg samples of the pegmatitic dykes were collected, prepared as polished thin sections (PTS), and then analyzed by portable X-ray Fluorescence (pXRF) to assess feldspar composition and U-Th enrichment. These bulk samples were then analyzed lithogeochemically at ACTLabs through fusion ICP-ES and ICP-MS. Petrographic and micro-X-ray Fluorescence-Energy Dispersive Spectrometry mapping reveal magmatic phases including quartz, two feldspars, epidote, allanite, titanite, apatite, and local zircon. Geochemically, these leucogranitic pegmatites exhibit high silica and a fractionated I-type signature consistent with a post-collisional setting.

Field, petrographic, and geochemical evidence indicate that these pegmatitic dykes have experienced two stages of hydrothermal overprinting. During the first stage, Fe-S-rich magmatic-hydrothermal fluids infiltrated quartz-feldspar domains containing minor mafic minerals, forming Fe-rich vein-like structures, and promoting chloritization through reaction with mafic silicates. This generated magmatic-hydrothermal epidote, allanite, titanite, and apatite. Later, a Ca-rich hydrothermal pulse altered some early-formed chlorite back into secondary epidote and enhanced titanite precipitation along fractures.

**Poster/Presentation**

Poster

# Updates on an ichnofossil assemblage from the mid Pennsylvanian Minto Formation of central New Brunswick

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A prolific fossil locality situated along the southern shoreline of Grand Lake has continued to yield a diverse array of plant fossils, tetrapod and invertebrate footprints and invertebrate body fossils from the mid-Pennsylvanian aged Minto Formation of central New Brunswick. The tetrapod ichnofossils are represented by six ichnogenera that tentatively include: *Batrachichnus salamandriodes*, *Characichnos*., *Limnopus sp*., *Matthewichnus sp*., *Notalacerta* sp., cf. *Psuedobradypus sp*. Trackways provide ichnological evidence as a proxy for biodiversity of terrestrial amphibians (temnospondyls, microsaurs, stem tetrapods, anthracosaurs) and early amniotes (reptiles and/or synapsids). Tetrapod footprints are preserved alongside an equally diverse invertebrate ichnofaunal assemblage (7 ichnogenera). In the proximal floodplain grey shales, millimeter-scale surface traces (*Gordia sp*., *Helminthoidichnites sp*., *Helminthopsis sp*.) are found in association with small land snails (*Dendropupa sp*.). Small (2cm wide) examples of myriapod tracks (*Diplichnites cuthiensis*) are commonly preserved in the distal floodplain redbed shale facies alongside rare examples of scorpion tracks (*Stiaria sp*.). Rare xiphosuran trackways (*Kouphichnium sp*.) are interpreted as evidence of a distal open water connection, perhaps in back-barrier wetland environments as was previously interpreted from the petrography of Minto coal beds. Planolites traces are found associated with tetrapod tracks in sandstone lithofacies. Rare blattoid (cockroach: *Archimylacris sp*.) and Odonata (dragonfly-like: *Brunellopteron norradi* and cf. *Meganura sp.)* wings represent flying insect fauna in the Minto Formation. Cumulatively, these ichnofossils and invertebrate body fossils help to futher populate the limited biodiversity of the Minto Formation.

**Poster/Presentation**

Presentations

**University Affiliation Presentation**

UNB

# On the discovery of a large Taenidium burrow from the Clifton-Stonehaven Formation in New Brunswick

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Trace fossils from the Clifton Formation have sparsely been reported in literature with only a cameo-appearance of an amphibian track and an invertebrate trackway being reported amidst a detailed description of the sequence stratigraphy of the formation and sedimentary lithofacies. We report the first systematic description of a large *Taenidium* burrow from the Clifton Formation, discovered near the township of Stonehaven. This fossil is notably larger relative to other Carboniferous-aged *Taenidium* burrows in the region; although it is comparable in sizes to other examples of *Taenidium* known elsewhere in the ichnological record. The burrow exhibits a meniscate backfill that is characteristic of the ichnogenus *Taenidium,* but differs with the presence of intraformational grey-colored mudstone intraclasts within the infilling sediment. The matrix sediment which infills the burrow is identical in lithology to the host sediment, making recognition of the burrow difficult. This heterogeneous infill has not been reported in association with *Taenidium* burrows before and does not adhere to known vertebrate taxonomy. The Clifton Formation was deposited under semi-arid conditions, and this paleoenvironment may have contributed to the unique preservation and infill characteristics observed in this burrow. We propose a new ichnospecies within *Taenidium*, expanding its ichnotaxonomic definition to include backfills incorporating lithologically similar intraclasts. This discovery not only adds to the ichnodiversity of the Clifton Formation but also offers new insight into trace maker behavior and sedimentary processes in semi arid Carboniferous environments of Atlantic Canada.

**Poster/Presentation**

Presentations

**University Affiliation Presentation**

UNB

# Depth effect on metamorphic decarbonation: insights from petrography and mass balance constraints in the Sierra Nevada continental arc

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Earth’s climate has alternated between greenhouse and icehouse periods throughout geologic history. In addition to existing carbon sources such as volcanic eruptions, recent studies proposed that metamorphic decarbonation may be another carbon source in the global carbon cycle, especially during the Cretaceous. The evidence for this proposal is the temporal coincidence between the longest continental arcs in Earth’s history and the widespread carbonate platforms. Arc magma reacting with pre-existing carbonate rocks releases $CO_2$ and leads to the formation of metacarbonate rocks (i.e., calc-silicate mineral assemblages). Most previous studies assumed the magma inevitably reacts with carbonate rocks regardless of

depth, whereas field-based studies only focused on decarbonation in shallow arcs (< 2 kbar). Therefore, I propose to investigate how depth affects decarbonation behavior. I will focus on metacarbonate rocks within the Sierra Nevada Batholith in California, USA, where arc magma intruded carbonate platforms at varying depths potentially causing metamorphism at a gradient of pressures. I hypothesize that the deeper arc experienced less decarbonation than its shallower counterpart, because heat and fluid required for decarbonation reactions to take place are likely not feasible at depths. I will test this hypothesis by comparing the magnitude of carbon loss from the calc-silicate rocks formed at shallow depths with that formed deeper. This project will provide new field-based constraints on the depth effect on the behavior of metamorphic decarbonation and add additional insights into how metamorphic decarbonation might contribute to the global carbon cycle.

**Poster/Presentation**

Presentations

**University Affiliation Presentation**

Acadia

# Resolving the impact of North Atlantic Ocean circulation structure on microbial diversity

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The destabilization of the Atlantic meridional overturning circulation (AMOC) is one of the most important environmental issues of our time due to its close correlation with extreme weather patterns. The effect of this changing current on the stratification of microbial communities in the North Atlantic is thus far poorly understood. Last summer, the One Ocean Expedition’s transatlantic cruise brought together scientists from around the world to measure ocean productivity markers and compare this to satellite data. From this cruise, our group collected a total of 26 surface water and water column filtrate samples from 10 stations along a transect between Iceland and Portugal with the aim of surveying cellular membrane lipids as a proxy for microbial diversity. Lipids were extracted from the filtrate using a modified Bligh-Dyer technique, then measured using ultra high-pressure liquid chromatography coupled to a quadrupole time-of-flight mass spectrometer. Each unique detected lipid class can be correlated to the presence of a specific microorganism type. Data has currently been collected for chlorophyll and its derivative pheophytin, indicators of primary productivity, and for some GDGT lipids indicative of heterotrophic archaea. By comparing the abundance of these lipid groups, we hope to create a snapshot of how microbial communities are stratified along various points in the transect. In the future, the lipidomic dataset created by this project will be compared to other geochemical and geophysical data (e.x: nitrate, ammonia, TOC concentration, remote sensing) to further resolve circulation conditions in the North Atlantic Ocean.

**Poster/Presentation**

Presentations

**University Affiliation Presentation**

Dal

# U-Pb Geochronology and Petrography of Alkaline Intrusions from the Rehamna, Central, and Jebilet Massifs, Morocco

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Alkaline mafic magmatism is linked with intraplate volcanism and tectonic evolution of continents assembled by terrane accretion. In the Western Meseta terrane of Morocco, there are alkaline igneous rocks that require study to determine the conditions of their formation. Their tectonic setting is possibly arc-related or plume-derived, depending on the magma signatures. To associate such alkaline igneous rocks with a specific igneous process, the geochemistry and ages must be determined. This terrane represents the main orogenic zone linked to Africa's Variscan belt and is regarded as part of the precursor to the Gondwana supercontinent. The rocks of the Western Meseta massifs have uncertain ages, and the tectonic processes that led to their formation are vaguely understood. This study aims to constrain the ages and geochemistry of the Moroccan alkaline igneous rocks of the Western Meseta to understand the petrogenesis of the terrane. Preliminary geochemical analyses have been conducted on most samples; further analysis will help clarify whether an arc-related or plume-derived process caused their formation. Ages of the mafic to intermediate samples are unconstrained; employing techniques with greater precision will lead to a better understanding of the Moroccan samples. U-Pb geochronology, lithogeochemistry, and petrography will be used to collect data at Memorial University of Newfoundland. Thin sections for petrographic analysis are prepared, U-Pb geochronological analysis is performed using Isotope Dilution Thermal Ionization Mass Spectrometry (ID-TIMS), and lithogeochemistry work will involve Inductively Coupled Plasma Mass Spectrometry (ICP-MS).

**Poster/Presentation**

Poster

# Provenance of metasedimentary units in the Laurentian Long Range Inlier, west NL: Evidence of a shared history with the peri-Laurentian Dashwoods block

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The Long Range Inlier in western Newfoundland is a Laurentian massif primarily composed of metamorphic and intrusive crystalline rocks correlated with the Mesoproterozoic Grenville Province of eastern North America. Most of the current understanding of the inlier comes from mapping by the Geological Survey in the 1980s. Recent exploration in the inlier has led to the discovery of numerous gold occurrences, several of which are high grade over mining widths. Although demonstrating economic potential, locating a major deposit is impeded by a lack of detailed geological mapping and geoscientific research in the area. This study therefore aims to resolve the geological history in the southern LRI through mapping, detailed outcrop analysis, and detrital geochronology of metasedimentary units, traditionally grouped with Grenville basement. Field results indicate metasedimentary units sit nonconformably above basement and inferred (sedimentary) protoliths suggesting correlation with the Laurentian margin. These formed during Neoproterozoic rifting of Rodinia, with Cambrian through Ordovician opening and lifespan of the Iapetus Ocean. U-Pb ages of detrital zircons range from Cambrian to Paleoarchean, with age spectra showcasing peaks at 1.0, 1.8, and 2.8 Ga, typical of Laurentian derived units. However, zircon populations of 700-900 Ma and 2.0-2.2 Ga are atypical of Laurentia and often attributed to sourcing from exotic terranes. Interestingly, similar ages are observed in inherited zircons from the Dashwoods Block in west Newfoundland (an interpreted peri-Laurentian crustal fragment) suggesting a more complex (and previously unrecognized) early history in the inlier. These results have important implications in reconstructing Rodinia's rifting history.

**Poster/Presentation**

Poster

# An investigation of prograde, syn-tectonic garnet porphyroblasts from the Dalradian Highlands of Scotland

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Determining the timing of metamorphism is key to understanding the relationship between deformation, mineral growth, and crustal evolution during mountain building. This study investigates peak-metamorphic assemblages within the garnet zone of the Dalradian Supergroup in the West Highlands of Scotland. Samples were mapped and collected from Rubha Cladaich (Loch Leven Schist) and Cononish Glen (Ben Lui Schist), two areas that record distinct deformation histories. Garnet growth occurred syn-D2 at Rubha Cladaich and post-D1 to pre-D2 at Cononish Glen, providing an opportunity to examine how metamorphism and deformation were linked during different stages of the Caledonian Orogeny. Petrographic and microstructural analyses are being used to characterize garnet textures, inclusion trails, and

mineral assemblages in order to interpret pressure-temperature conditions and the timing of metamorphic events. Planned analytical work includes in-situ U-Pb dating of monazite, trace-element mapping of garnet (REE and Y zoning), and thermobarometric calculations to constrain metamorphic evolution. By comparing metamorphic features between these two Dalradian localities, this research aims to identify variations in metamorphic timing and intensity across the region. The results will help clarify how garnet growth relates to deformation phases and crustal thickening during the Caledonian Orogeny. Ultimately, this work contributes to a better understanding of the metamorphic history and tectonic development of the Scottish Highlands.

**Poster/Presentation**

Poster

# Observations and models bearing on the origin of high fractionated granites of the South Mountain Batholith (NS) and their critical metal enrichment.

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Granites can serve as important hosts for high concentrations of critical metals, including Li, Ta, REE, with a common association between the most fractionated compositions and metal enrichment. The exact relation between granite magma evolution and metal enrichment is unclear, however, and the role of purely magmatic vs magmatic hydrothermal processes is debated. Within the South Mountain Batholith of Nova Scotia, there are several plutons containing highly fractionated compositions, represented as pegmatite and aplite segregations and dikes, that bear an intrusive relationship to less evolved host-rocks. This study seeks to understand the relation between these rock-types and associated differences in critical metal concentrations through chemical analysis and geochemical modelling. Samples including host rock and pegmatite/aplite were collected from the Halifax (HP) and New Ross (NRP) plutons, from surface outcrop (HP) and drillcore (NRP). Host rocks comprised mostly medium to coarse-grained granodiorite and monzogranite exhibiting both seriate and porphyritic textures. Pegmatites occur as centimeter-to-meter-scale dikes and segregations and are comprised of cm+-sized crystals of quartz-K-spar-plagioclase-muscovite. Fine-grained aplites containing quartz-K-spar-plagioclase-muscovite occur as sub-meter-width near-vertical dikes (HP), and cm-scale aureoles of hematite alteration. A total of 35 samples were collected, with a subset of 27 prepared for geochemical analysis. Samples were prepared by cutting into smaller fragments (<3in, <10kg) and careful removal of weathered exteriors. These were sent to a commercial laboratory for major and trace element analysis. Modeling is in progress using the MELTS thermodynamic algorithm for comparison to the HP and NRP host-rock and pegmatite/aplite compositions to assess crystallization processes.

**Poster/Presentation**

Presentations

**University Affiliation Presentation**

Dal

# The physiochemical drivers of carbonate precipitation, transformations and morphology at serpentinite-hosted springs.

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[1]Memorial University of Newfoundland

In order to meet global $CO_2$ reduction targets, the Intergovernmental Panel on Climate Change states other $CO_2$ mitigation methods are required. One method is carbon sequestration. This conservation method relies on the research and understanding of how carbonate precipitates, and the stability of carbonate phases for long term storage and sequestration. This study examines the correlations between carbonate precipitate chemistry and the corresponding aqueous geochemistry from three different serpentinite-hosted springs. The Cedars, California, Blow Me Down Massif (BMD), and The Tablelands, Newfoundland. Previously, water data has been reported for The Cedars, and solid carbonate samples were collected for future analysis. In August 2025, I conducted field work at BMD, resulting in data collection from one spring with 7 stations. We collected solids, precipitates, and water samples from the spring and tested the water's pH, Conductivity, Eh, and Total Dissolved Solids. To study this, various methods determining the mineralogy and chemistry of each site will be conducted. For the solid samples, I will use the scanning electron microscope, stable isotopes ($\delta^{13}C$ and $\delta^{18}O$), Fourier Transform Infrared Spectroscopy, and Inductively Coupled Plasma Mass Spectrometry. To analyze water samples, dissolved elements, $\delta D$ and $\delta^{18}O$ of $H_2O$, alkalinity, Total Inorganic Carbon concentrations and $\delta^{13}C$ will be completed. Preliminary results show a fairly consistent pH of 9.28-9.92, and varying alkalinity results for BMD samples. Ongoing analysis in comparison with upcoming results of solid carbonates will be conducted to determine the relationships of aqueous geochemistry and carbonate morphology and mineralogy at each location.

**Poster/Presentation**

Poster

# Characterizing the geomorphology and dynamics of potential rock glaciers in parc national de la Gaspésie using LiDAR and thermal imaging

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Three potential rock glaciers were visited in Parc National de la Gaspésie in summer of 2025, with the goal of contributing to the understanding of permafrost and periglacial processes in Eastern Canada. The presence of rock glaciers, along side their structures and activity, in eastern Canada has been fairly under documented and under characterized in recent decades. With the recent rise of global temperatures it is more important than ever to study these features and document their climate sensitivity. Remote sensing surveys were conducted with a small remotely piloted aircraft to collect photogrammetry, LiDAR, and thermal infrared data to produce high-resolution terrain models and multispectral orthophotos. These data were used in the following ways: high resolution imaging (orthophotos), mapping surface temperature anomalies (thermal imaging), identifying and mapping geomorphic facies (LiDAR), and examining internal reflectors, such as ice-rich zones (GPR). The analysis conducted thus far includes mapping of geomorphological features based on orthophotos and LiDAR data and inferring chronostratigraphy. Additionally, early stages of cross-referencing LiDAR data to thermal imaging in the analysis of these rock glaciers in order to look for cold anomalies, implying near surface ground ice.

**Poster/Presentation**

Poster

# Nickel for your thoughts: Decoding mineral textures and assemblages of the Geminid Deposit

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Located in northern Ontario 140km southeast of Timmins, the Kerr-Addison Mine was one of Canadas highest producing gold mines - producing over 11M oz of gold between 1938 and 1996. The deposit is located east of the Larder Lake-Cadillac Break within the Archean Abitibi Greenstone Belt, a region characterized by numerous ore deposits. Kerr-Addison was acquired by Gold Candle Ltd in 2015. Exploration drilling has been on-going since 2017, and in 2023, unexpected nickel mineralization was discovered and was named the Geminid Deposit. Since its discovery, the deposit has become a continued focus of exploration. The Ni-mineralization occurs within ultramafic and clastic facies of the Larder Lake Group and is dominated by millerite, a pure Ni sulphide mineral. This research will provide an initial characterization of the deposit, addressing limited prior research on the Ni-mineralization. The study will focus on magmatic and secondary sulphide mineral textures and phases, investigating their relationship to Ni distribution. This will be completed using: (1) Detailed petrographic analysis of the magmatic and secondary minerals present, (2) X-ray mapping to determine phase distributions, (3) Analysis of major and minor elements, including Ni, Co, Cu, etc, using EMPA, and (4) LA-

ICP-MS analysis to both map the distribution of minor and trace-elements and determine the maximum and minimum trace-elements contents. This will allow the determination of a mass-balance for Ni and other related elements. The results will be used to propose a model for the genesis of this Ni-deposit, providing a basis for future investigation.

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# Using coticules and porphyroblasts to characterize deformational and metamorphic events in the eastern Meguma terrane, Nova Scotia, Canada

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Clastic rocks of the Cambrian to Ordovician Goldenville and Halifax groups exposed in the eastern Meguma terrane were intruded by Devonian granitoid plutons. In the Tor Bay area, the uppermost Goldenville Group is represented by the metasandstone-rich Taylors Head Formation and the overlying Mn-rich metasiltstone of the Beaverbank Formation. The overlying lower Halifax Group is represented by sulphide-bearing slate of Cunard Formation and newly recognized, laterally equivalent, sulphide-poor metasiltstone of the Cole Harbour Formation. In the study area the Beaverbank and Cole Harbour formations were metamorphosed at greenschist- to lower amphibolite-facies conditions and have a strong near-vertical, E-W striking, composite foliation axial planar to regional folds. In the Beaverbank Formation, the metamorphic assemblage is Crd + Gt + Ms + Qtz + Ilm ± Chl with extensive garnet coticule layers which display boudinage, rotation, flattening, and tension gashes. Cordierite porphyroblasts overgrow the dominant foliation but also have syn-kinematic strain shadows. Based on the continuity of layers, the preservation of trace fossils, and the 3-dimensional deformation of the coticule layers, the primary component of deformation is interpreted to be flattening, with simple shear as a secondary component. In the Cole Harbour Formation, the metamorphic assemblage is And + Ms + Qtz + Ilm ± Bt ± Chl. Andalusite overgrows the dominant foliation, but also shows boudinage, rotation, and many porphyroblasts have syn-kinematic strain shadows. The relative timing of porphyroblast growth relative to deformation suggests at least two episodes of deformation, both with pre- (regional?) and syn- (contact?) kinematic metamorphism for each.

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# Chlorite compositions, prograde metamorphism, and gold-related trace elements

Lauren DiPietro[1], Dr. Richard Cox[1]

[1]Dalhousie

This project will focus on volatile-metalloid (VM) element (S, Se, Te, Sb, Bi, Hg, As, etc) behavior during progressive metamorphism of pelitic rocks from the West Highlands of Scotalnd. The metamorphism is represented by chlorite-mica schists to garnet-muscovite schists, with at least two stages of deformation and variable retrograde reactions present. VM-elements are commonly related to orogenic gold mobilization, and the compositions of sheet silicates have been used as indicators of gold deposition. In polymetamorphic terranes, different deformation events may be responsible for the reactions releasing volatile and metalloid elements. Microstructures preserved by sheet silicates are widely used to examine P-T conditions and deformation. This project will investigate P-T conditions and trace-element variations during multistage deformation in samples from the West Highlands which were mapped and collected in May of this year. These include samples from near the gold mine at Cononish Glen, where previous studies link high-Te with high gold concentrations. The research will involve, (i) SEM analysis of chlorite-schists and chlorite-altered retrograde garnets with identification of chlorite growth zoning during varying metamorphic conditions (ii) X-ray mapping and analyses of major elements in the sheet silicates to produce P-T-d maps, and in the future, (iii) trace-element analysis using LA-ICP-MS to determine which deformation event(s) released volatile, gold-related elements, (iv) grades of metamorphism that release the majority of volatile elements.

**Poster/Presentation**

Poster

# Exploring the influence of rock geochemistry on biofilm composition in a lithium pegmatite system using metabarcoding

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[1]St. Francis Xavier University

Microbes inhabit almost every environment on Earth and their community compositions are highly dependent on abiotic environmental gradients. These abiotic environments include different rock types that can have very different chemical compositions. The objective of this research is to investigate the influence of rock geochemistry on distributions in microbial communities, with a focus on lithium, a critical mineral that is important for decarbonization. Microbial biodiversity is being investigated using metabarcoding of rock surface biofilms on outcrops in the Hayman Hill area located near St. Stephen, New Brunswick. The study area is located in the St. Croix terrane of Ganderia and the local geology consists of igneous intrusions, including mainly diorite, granodiorite and biotite-muscovite granite, and spodumene pegmatite dykes that intruded metasedimentary rocks. Small (< 2cm diameter and < 0.5cm thick) rock chips were collected from different rock types for 3-domain metabarcoding, a process that generates a total community fingerprint of eukaryotic and prokaryotic rRNA barcodes that can identify organisms down to the species level and determine their relative abundances. Absolute abundances per unit of exposed surface area will be determined by normalizing to 3 internal standards. Preliminary results show a diverse biofilm community of prokaryotic and eukaryotic microbes and success of a novel DNA extraction method from rock chips. Future work will compare the rock surface metabarcodes to whole-rock geochemical data from the same samples. Taken together, this study aims to uncover the relationships between rock type, geochemistry, and microbial community composition on rock surfaces.

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# Petrography and geochemistry of subaerial felsic volcanics in La Poile Group, Newfoundland

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The Silurian La Poile Group is a volcano-sedimentary unit that crops out in two sub-basins (La-Poile and Rocky Ridge basins) in southern Newfoundland. Interlayered subaerial, mainly felsic volcanic rocks and fluvial sedimentary rocks are the most common rocks in these basins. The age of the La Poile Group is well constrained to ca. 428-420 Ma, however, the provenance of the sedimentary rocks and the petrogenesis of the volcanic rocks is poorly understood. The objective of this research is to determine the petrogenesis of the predominantly volcanic La Poile sub-basin using geochemistry and petrography. The La Poile basin is bound to the north by the Bay d'Est Fault Zone and the Cinq Cerf Fault Zone to the south. The volcanic rocks are mainly porphyritic rhyolite with phenocrysts of quartz, alkali-feldspar and biotite, and felsic tuff. Geochemical data from 17 samples shows SiO2 concentrations between 67.5 and 78.4 wt%,

low Fe2O3T between 1.0 and 4.5 wt%, and mildly peraluminous compositions with a calc-alkalic to alkalic-calcic signature. Rare-earth element (REE) data show steep negative light REE slopes, shallow negative to slightly positive heavy REE slopes, and negative Eu anomalies. Preliminary interpretations of trace element data indicate volcanic arc signatures. Future work will include a more in-depth investigation of the geochemical data with the goal of placing the petrogenesis of the La Poile basin volcanic rocks in the geological context of Ganderia.

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# Concentrations of REEs in coal seams in Nova Scotia

Jack Stinchcombe[1], Celeste Cunningham[2]

[1]Presenter, [2]Supervisor

New research has demonstrated that coal seams and surrounding strata contain elevated concentrations of rare earth elements (REEs). REEs are utilized in every aspect of our modern world, essential for production of MRI machines, military technologies, and electric motors, ranging from toy drones to electric semi-trucks. China currently dominates the market with 68% of global production and 86.8% of global supply, meaning Canada needs to act now in order to compete. The objective of this project is to determine whether REEs are present in high concentrations in Nova Scotia and if they can be extracted from coal seams and adjacent stratigraphic layers. Samples of coal and surrounding units of sandstones, mudstones, and soil from Sydney and New Glasgow NS were collected and analyzed using a portable x-ray fluorescence analyzer (pXRF). Stratigraphic logs and outcrop descriptions were taken at each study site. The resulting lithological and geochemical data will be analyzed to investigate whether the coal is economically viable to process for REEs. Results will be interpreted to determine which lithologies are the most enriched in REEs across study locations (Sydney, New Glasgow) to predict where REEs could be found elsewhere in Nova Scotia and Canada. If high concentrations are found in surrounding strata, coal mining waste and tailings could potentially be repurposed for REE extraction. Geochemical results confirming REE enrichment in Nova Scotia may allow Canada to start competing with China’s monopolized REE production, while also removing years of anthropogenic impacts that dispersed elements detrimental to the landscape.

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