

The 73rd Annual Atlantic Universities Geoscience Conference



19th – 21st October 2023
Memorial University of Newfoundland,
St. John's, Newfoundland and Labrador

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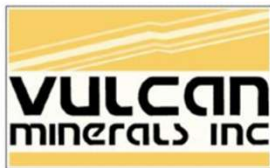
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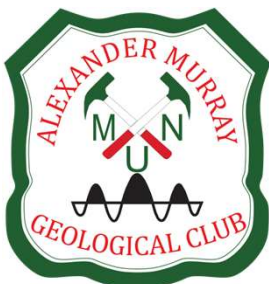


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Meet Our Team

Josh Young	Chairman
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Jake Broders	Vice-Chairman and Secretary
Sam Pike	Treasurer
Gemma Anderson	Social Events Coordinator
Kelsey Strickland	Social Media and Fundraising Coordinator
Ryan Pryor	Program Coordinator

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Gabriel Santos – Geological Survey of NL
Jennifer Cranshaw – ExxonMobil Canada
Deanne van Rooyen – Acadia University

Special Thanks

Leah Careen	James Conliffe	Pascal Prévost-Aubin
Michelle Miskell	Donnelly Archibald	John Jamieson
Penny Morrill	Deanne van Rooyen	Lois Whitehead
Alyson Park	Peter Price	Josh Barbour
Heidi George		

Letter from the Head of Earth Sciences, Memorial University



Faculty of Science

Department of Earth Sciences
Alexander Murray Building,
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St. John's, NL A1B 3X5
www.mun.ca

To: All participants;

Welcome to the 2023 Atlantic Universities Geoscience Conference (AUGC) at Memorial University. We are pleased to be hosting the AUGC this year, which is organized by the undergraduate students.

This is one of the oldest geological conferences in Canada and I congratulate the Alexander Murray Club and organizing committee for putting it together. It promises to provide a good mix of scientific presentations, guest speakers, fun activities and two field trips; one to see classic gold mineralization in an Avalonian arc setting, and the second to learn about some of the recent work and discoveries in the continually developing story of Ediacaran fauna in Avalonian sedimentary basins here.

This meeting will be a great opportunity to see new geology on 'The Rock', meet faculty and students from across Atlantic Canada, and perhaps trigger new opportunities for you.

Enjoy your visit to Newfoundland and I will see you at the meeting!

A handwritten signature in black ink, appearing to read "Greg Dunning". The signature is fluid and cursive, with a large loop at the end.

Greg Dunning
Head, Department of Earth Sciences

Letter from the AUGC Organizing Committee Chair:

Greetings from Newfoundland!

On behalf of the 2023 AUGC planning committee and the Alexander Murray Geological Club, I am delighted to welcome you all to the 73rd Atlantic Universities Geoscience Conference (AUGC). The AUGC is a long-standing tradition that dates back to 1950 and is one of the oldest geologic conferences in Canada. It is a unique opportunity for undergraduate students from Atlantic Canada to showcase their research, learn from experts, and network with peers and professionals in the field of geoscience.

This year, we have prepared an exciting program that includes a variety of activities, such as field trips, guest lectures, poster sessions, and oral presentations. You will get to explore some of the amazing geology of Newfoundland, such as the Cambrian stratigraphy of the Avalon Peninsula, the Ediacaran fossils from Upper Island Cove, and the Neoproterozoic epithermal alteration and gold mineralization of the eastern Avalon Zone.

We hope that you will enjoy your time at the conference and make the most of this valuable learning experience. We also encourage you to discover the culture and history of Newfoundland, which is rich in music, art, cuisine, and folklore. You will find that Newfoundlanders are very friendly and hospitable people who will make you feel at home.

We are very thankful to the AUGC planning committee, the Earth Science Department at Memorial University, Science Atlantic, and the AMGC for making this conference possible. I will hold onto the memories from this experience for the rest of my career, I hope your experience this year will leave you feeling the same. Your efforts and support are greatly appreciated. We also thank our sponsors, volunteers, faculty, and staff for their contribution and generosity.

We look forward to seeing you soon at the 73rd AUGC!

Sincerely,

A handwritten signature in black ink, appearing to read 'Joshua Young', with a stylized flourish at the end.

Joshua Young

Chair of the AUGC 2023 Committee

Letter from the AUGC Organizing Committee Chair:

Dear AUGC 2023 attendees,

Welcome to Newfoundland for the 73rd annual Atlantic Universities Geoscience Conference! After a year of hard work, we're excited to finally kick off this event. A huge thanks goes out to members of The Alexander Murray Geological Club and our dedicated conference organizing committee for their tremendous effort in making this conference a reality.

Over the next three days, get ready to embark on some captivating field trips exploring the world-class Edicaran biota and gold-related mineralization on the Avalon. I hope everyone gets a chance to attend student presentations, view some posters, and learn a thing or two from other students. Most importantly, I hope you meet lots of new friends, make lasting connections, and have a great time during your short stay in Newfoundland.

I've only been around for nineteen years but within that time, making this conference happen has easily been the most intensive challenge I've taken on, and I think my classmates would agree. That being said, this has also been the most rewarding task and never could have happened without the incredible teamwork from our organizing committee and all of the skills each one of them brought to our planning meetings.

I'd like to make a special thanks to James Conliffe, Donnelly Archibald, Deanne van Rooyen, and everyone in the MUN Department of Earth Sciences' Office for their time and patience with me throughout the planning process, this conference would not have been possible without them. I would also like to thank the last sixty years of Murray Club executive teams for archiving decades' worth of AUGC material that helped to inspire this event.

The Alexander Murray Geological Club has been an integral part of my life over the last three years and I hope it adds to the enjoyment of these next three days for you.

Sincerely,

Maria O'Neill

Co-Chair, AUGC 2023

President, Alexander Murray Geological Club

Conference Schedule

Thursday, October 19th 2023

2:00pm – 6:00pm	Check-in at the Murray Club (Goodie bags provided here)
6:00pm-8:30pm	Pre-George Street Meet-Up at the Murray Club
8:30pm-11:00pm	George Street Scavenger Hunt

Friday, October 20th 2023

8:00am-8:30am	Arrive at Earth Science Building for check-in
8:45am-5:15pm	Field Trips will be taking place Field Trip 1: Duncan McIlroy and Hilary Corlett at Upper Island Cove Field Trip 2: Greg Sparkes at the Eastern Avalon High-Alumina Belt
6:30pm-11:30pm	CSEG Regional Challenge Bowl Trivia at the University Centre's Breezeway. Free pizza!!

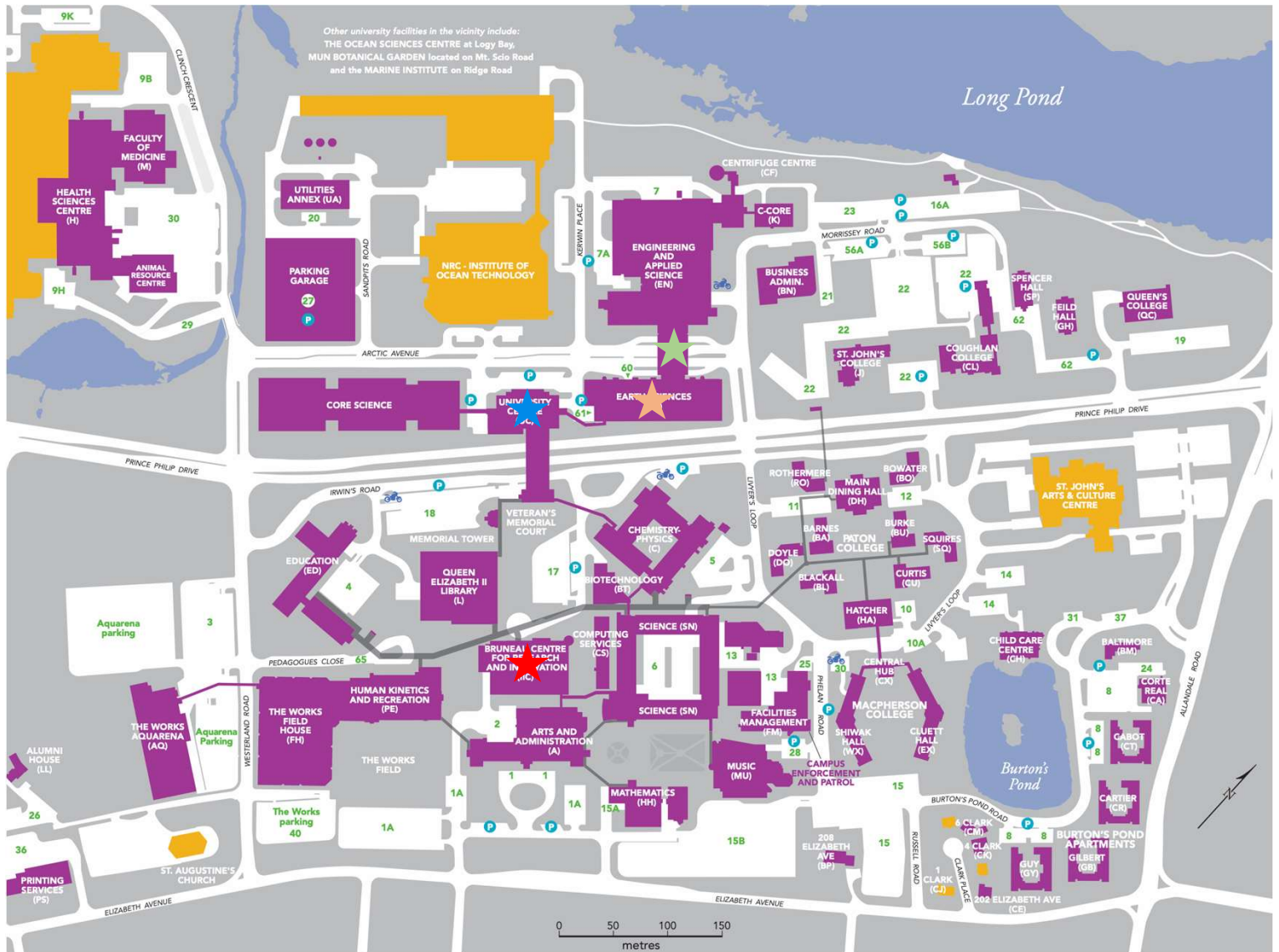
Saturday October 21st 2023

8:00am-8:45am	Check-in and poster set-up at MUNL's Bruneau Centre
9:00am-4:00pm	Oral presentations and poster sessions
6:30pm-11:45pm	Reception and award banquet at the Delta Hotels Conference Centre

Presentation Schedule

9:00am-9:20am	Oral Presentation – Beatrice Bromley
9:20am-9:40am	Oral Presentation – Tilda Hughes
9:40am-10:20am	Poster Viewing & Refreshments
10:20am-10:50am	Guest Speaker #1
10:50am-11:30am	Poster Viewing & Refreshments
11:30am-11:50am	Oral Presentation – Keaton Markham
11:50am-12:10pm	Oral Presentation – Lauren Kew
12:10pm-2:00pm	Lunch and Poster viewing
2:00pm-2:30pm	Guest Speaker #2
2:30pm-3:00pm	Poster Viewing & Refreshments
3:00pm-3:20pm	Oral Presentation – Gabriela Fuentes Waye
3:20pm-3:40pm	Oral Presentation – Abigail Kennedy

Map of the Memorial University Campus:



CAMPUS MAP

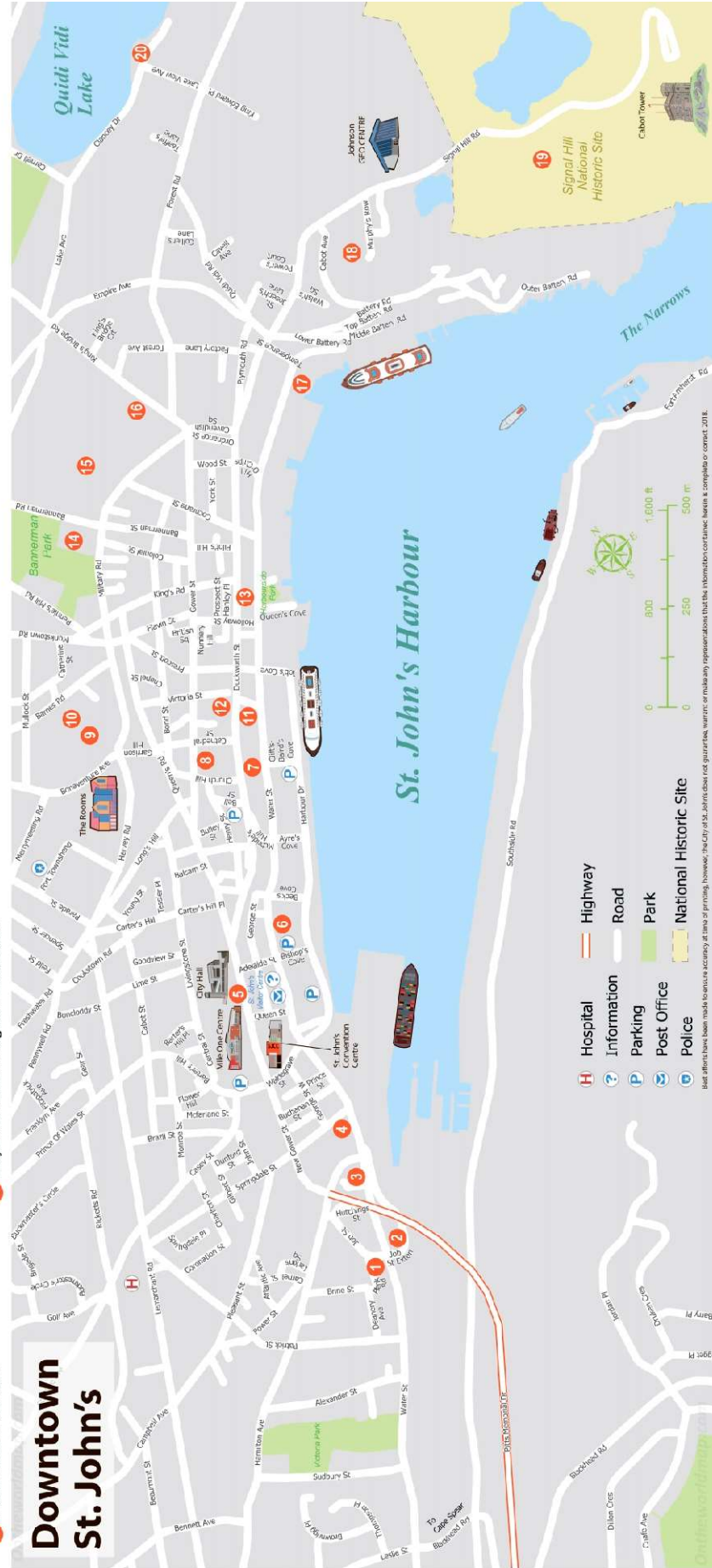
-  Parking – pay by use
-  Permit parking
-  Motorcycle parking
-  Pedestrian tunnel
-  University building
-  Other associated building

-  Bruneau Centre
-  University Centre
-  Earth Science Building
-  Alexander Murray Geological Club

Map of Downtown St. John's



- 1 Tommy Ricketts Memorial
- 2 Railway Coastal Museum
- 3 Apothecary Hall
- 4 Newman Wine Vaults
- 5 Mile Zero Marker
- 6 Murray Premises
- 7 Supreme Court
- 8 Anglican Cathedral
- 9 Basilica
- 10 Presentation Convent
- 11 Craft Council of NL
- 12 LSPU Hall
- 13 National War Memorial
- 14 Colonial Building
- 15 Government House
- 16 Commissariat House
- 17 Terry Fox Memorial
- 18 Memorial University Signal Hill Campus
- 19 Signal Hill Visitor Interpretation Centre
- 20 Royal St. John's Regatta Boathouse



Field Trips

Field Trip #1

(Nearly) 3D Ediacaran fossils from Upper Island Cove: Insights into the life and times of the earliest animal-like fossils.

Part 1) Here we will take a tour through the Cambrian stratigraphy of the Avalon Peninsula. Starting off our tour of the Cambrian, we will check out the microbial mats of the lower Cambrian Smith Point Formation and continue to Manuels River. Here we will see several species of trilobites from the Orders Redlichiida, Ptychopariida, and Agnostida. Together, these well-preserved trilobites are found in the green to grey shales of the Manuels River Formation (middle Cambrian, Miaolingian).

Part 2) The famous Upper Island Cove site only an hour drive from St. John's includes an abundant fauna of Ediacaran fossils including the fractal like rangeomorphs and iconic Ediacaran fossils like *Charnia* and *Charniodiscus*, come and join us to learn about recent advances in understanding these fossils and their preservation with Dr. Duncan McIlroy and the @MUNPaleobiology Crowd.

Field Trip #2

The Eastern Avalon High-Alumina Belt: examples of Neoproterozoic epithermal alteration and related gold mineralization, eastern Avalon Zone, Newfoundland

Well-preserved examples of late Neoproterozoic epithermal systems are a hallmark of Avalonian rocks in Newfoundland. The eastern Avalon Peninsula contains well-preserved examples of both low-sulphidation and high-sulphidation style epithermal systems, the latter of which is associated with extensive advanced argillic alteration. This excursion will place these contrasting epithermal systems in the geological framework now provided by high-resolution U-Pb geochronology and field mapping, completed over a 20-year period.

Our Guest Speakers

Dr. Steve Denyszyn – Memorial University of Newfoundland

Dr. Steve Denyszyn is a faculty member of the Department of Earth Sciences at MUN. After completing his PhD studies at the University of Toronto, he held a research position at the Berkeley Geochronology Center in California before moving to the University of Western Australia where he held a research and teaching position associated with the Centre for Exploration Targeting and arrived at MUN in 2022. His research focus is on the high-precision geochronology of igneous rocks, particularly those associated with Large Igneous Provinces, to answer questions about paleocontinental reconstructions, rates of transport in magmatic ore deposits, and connections between volcanic activity and mass extinctions. He has also applied this expertise in deep time to other diverse geological topics, such as the growth of continental crust, the suitability of geological repositories for nuclear waste, and hydrocarbon-hosting basin development.

Kendra Revoy – New Found Gold Corp.

Kendra Revoy is a recent graduate of Memorial University in the BSc. (Hons.) Earth Science program. She is now a Geoscience Communications Coordinator at New Found Gold Corp. and will speak about the company's Queensway Project.

Lawrence Winter – Altius Minerals

Ph. D., P. Geo.

VP Generative & Technical Lawrence joined Altius' executive team in 2006. Lawrence is a graduate of Memorial University (BSc Hons, Msc) and The University of British Columbia (PhD, a registered Professional Geoscientist (PEGNL) and a Fellow of the Society of Economic Geologists. Lawrence has worked in mineral exploration across Canada and internationally and is responsible for Altius' project generation efforts globally.

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Abstracts

Regional marine trends following cessation of CO₂ emissions: what will be the future of coral reefs?

Josie Mallett

*St. Francis Xavier University, 4130 University Avenue Antigonish, Nova Scotia,
Canada B2G 2W5*

In 2020, the Zero Emissions Commitment Model Intercomparison Project (ZECMIP) explored what will happen to global climate after net-zero carbon emissions are reached. The globally averaged value of the Zero Emissions Commitment (ZEC) was found to be approximately zero, but with strong regional variations. Moreover, ZECMIP projects that atmospheric CO₂ levels are to decrease, but that leaves unanswered questions about levels of CO₂ being sequestered in the ocean. The ocean is commonly referred to as a carbon sink, and dissolving the projected high levels of CO₂ into it will result in ocean acidification. The ZECMIP datasets are used here to examine marine trends such as ocean surface temperature and aragonite saturation state in the locations of modern major coral reefs. The aragonite saturation state implicitly considers ocean pH and will act as an indicator of healthy coral conditions. Given the current global trajectory, major coral reefs are expected to undergo mass bleaching events resulting in widespread coral mortality. After the turning point of coral mortality is surpassed, the question left to be answered is whether the oceans will be able to support coral ecosystems in the future. Through examining these regions with ZECMIP, it was found that while the data is largely inconclusive to date due to a lack of model availability, the ocean is very unlikely to return to a viable state to support coral ecosystems within 100 years after CO₂ emissions cease.

A regional survey of clinopyroxene compositions in upper mantle xenoliths of the West Eifel Volcanic Field, Germany

Beatrice Bromley, Cliff Shaw

University of New Brunswick, 2 Bailey Dr, Fredericton, New Brunswick, E3B 5A3

Lithospheric mantle xenoliths are common in the volcanic rocks of the West Eifel, Germany. The model for evolution of the sub-Eifel mantle is: 1) depletion by partial melting at ~ 3 Ga, 2) a Cretaceous metasomatic event, and finally 3) a Quaternary metasomatic event related to the erupted lavas. Major element compositions of clinopyroxene (cpx) in xenoliths from Gees are interpreted in two ways, in one interpretation the cpx formed during metasomatism by a carbonatite magma whereas the same results have also been linked to silicate magma metasomatism. We examine the trace element content of cpx to test these two hypotheses. Xenoliths range from harzburgite to wehrlite. Cpx in the wehrlites has lower xMg and higher CaO than that in the harzburgite / lherzolite xenoliths. There are three distinct groupings of trace element signatures. The wehrlites (Cpx-1) have strong enrichment in LREE, positive to negative Zr, Hf, and Ti anomalies. There are two groups of cpx in the lherzolites / harzburgites: both are LREE-enriched and have negative Zr and Hf and variable Ti anomalies. The two groups (Cpx-2 and -3) are distinguished based on their total REE content. Cpx-1, related to veins of clinopyroxene and phlogopite, is interpreted to result from interaction of peridotite and silica-undersaturated mafic magma. Cpx-2 is suggested to be related to carbonatite metasomatism and the origin of Cpx-3 is not yet clear. Future work will examine the textural relationship of the three cpx types to develop a relative time frame for enrichment events.

MeHg and THg concentrations of Hawaiian invertebrates and surface soils: potential volcanogenic influence

Hayley Newell, Nelson O'Driscoll, N. Kirk Hillier, Daniel Rubinoff

*Acadia University, 15 University Ave., Wolfville, NS B4P 2R6, University of
Hawai'i, 2500 Campus Rd., Honolulu, HI 96822*

Mercury (Hg) is a highly toxic element with organic forms (e.g., methyl mercury - MeHg) which can bioaccumulate and biomagnify in food webs. The island of Hawai'i has extensive volcanic activity which has been shown to release elemental and oxidized forms of mercury. Once this Hg is deposited it can be converted into MeHg which enters the base of the food web. Aquatic invertebrates have increasingly been used as biomonitors of MeHg in ecosystems, however there is much less data available on terrestrial invertebrates. This project used a combination of soil THg and invertebrate MeHg samples from 15 locations to examine mercury distribution on the island of Hawai'i. Surface mineral soils (A horizon) were dried, sieved to a silt/clay fraction and analyzed for THg and LOI using thermal pyrolysis AAS. Invertebrates were dried and analyzed for MeHg using ethylation GC-AFS (Brooks-Rand MERX). Soil samples were grouped based on their proximity to the most active volcano, Kilauea and the dominant wind direction. Invertebrates were identified to their taxonomic family, and MeHg data grouped by functional feeding group (i.e., herbivores, omnivores, or carnivores). The carnivore group was significantly higher in MeHg than both the omnivore and herbivore groups ($p < 0.05$). THg in soils was significantly higher in the Kilauea slope group. More sampling is required to better quantify the spatial distribution of THg in soils and factors affecting bioaccumulation in terrestrial invertebrates.

A study of ankle breakers: Measuring sinkholes at Irishmans Road Recreation Site, Nova Scotia

Tilda Hughes, Mo Snyder, Keith Cusson

Acadia University, 15 University Ave., Wolfville, NS B4P 2R6

Irishmans Road Recreation Site, in Hants County, Nova Scotia, is a publicly accessible park with hundreds of naturally occurring sinkholes. These karstic geomorphological features form as a result of deformation, dissolution, and erosion of Carboniferous evaporite-bearing rocks that exist near the surface. Despite their acknowledged risk factor by the local municipality, no systematic sinkhole mapping has been done in this area. LiDAR (Light Detection and Ranging) data at two different resolutions complement the field-acquired data to map these sinkholes: (1) provincial 1 m resolution collected between 2018 and 2020, and (2) private 25 cm resolution collected in 2022. An in-house automated sinkhole delineation program, COLDS, located over 2000 sinkholes within the Irishmans Road property. However, field data acquired in 2023 suggest inaccuracies in COLDS' results. In areas of lower concentration, COLDS accurately located and defined the shape of large sinkholes. In areas of higher concentration, COLDS struggled to delineate small sinkholes, resulting in sinkholes being combined or missed. For example, in a 1200m² area in the northern area, 101 sinkholes were located, measured, and mapped, compared to the 57 sinkholes identified using COLDS. Precise mapping of these sinkholes is important because despite being aware of these sinkholes as a possible threat and health risk within the park and wider area, the county continues to allow unrestricted access to Irishmans Road Recreation Site. The sinkholes can be deep and the lack of clear communication of risks may result in bodily harm to site visitors.

Petrology, mineralization potential, and tectonic setting of late Devonian plutons in the central Cape Breton Highlands, Nova Scotia

Jack Carnochan, Sandra M. Barr

Acadia University, 15 University Ave., Wolfville, NS B4P 2R6

The West Branch North River (WBNR), Bothan Brook (BB), Centre Road (CR), and Peter Brook (PB), plutons are in the Aspy terrane of central Cape Breton Island, part of the Ganderia in northern Appalachian orogen. The plutons are elongate parallel to regional trends but are undeformed and appear to have been emplaced after Acadian deformation in the area. U-Pb zircon dating has confirmed previously assumed late Devonian ages of ca. 370-360 Ma. No petrological studies have been done on these plutons since the 1980's, and their mineralization potential and tectonic setting are unknown. Preliminary petrographic examination of cut slabs and thin sections about 40 samples collected as a part of regional mapping projects shows that included these plutons show a wider range in rock types from monzodiorite to synogranite. Samples from WBNR, BB, and PB plutons consist mostly of medium-to coarse-grained equigranular biotite monzogranite, whereas the CR pluton varies from hornblende-biotite monzodiorite to quartz monzonite. Chemical analyses of 33 samples show a range in SiO₂ content from about 53% to 77%, with lowest contents in samples from the CR pluton and the highest in the BB pluton. Most samples have high K₂O contents suggesting that they are shoshonitic affinity. Trace element compositions indicate that they formed in a subduction-related environment, perhaps from magmas generated in a post-collisional slab-failure tectonic setting. Although no mineralization has been observed, the highly evolved compositions in the BB pluton suggest some potential for Li or other critical elements.

Shooting science into rocks: hyperspectral imaging of historic core from the Walton barite mine, Nova Scotia

Keaton Markham, Mo Snyder, Masoud Aali

*Acadia University, 15 University Ave., Wolfville, NS B4P 2R6, Scient Analytics,
1345 Norma Eddy Ln, Halifax, Nova Scotia, B3J 1B6*

The historic Walton mine was operational from 1941 to 1978 and saw extensive mineral exploration and production of valuable commodities such as barite, copper, zinc, lead, and silver. This mine is located within the Windsor-Kennetcook subbasin of the Maritimes Basin, a vast, structurally and stratigraphically complex sedimentary basin extending from the Gulf of Maine to the Grand Banks of Newfoundland.

The Walton deposit is hosted in the Visean Windsor Group and is characterized by a barite orebody with a mineralized sulphide halo. Drill core from this deposit was logged manually by geologists from the provincial government and private companies. Visual analysis of core is a complex, time-consuming process that can be subjective and prone to error. Hyperspectral imaging is a non-destructive tool that can be used to characterize the composition of rocks based on their spectral signature.

Approximately 3000 m of Walton mine drill cores are preserved at the Stellarton core facility. For this project, ca. 300 m of drill cores were digitized using Scient Analytics' LithoScan mobile platform for high-resolution RGB and hyperspectral scanning. The scanners give reflectance spectroscopic images of core in the ultraviolet to shortwave infrared range which encompasses the optical absorptions of rocks and minerals including clay, mica, carbonate, and many sulfates. This talk will describe the methodology behind hyperspectral imaging and discuss how this tool can be effectively used to characterize the mineralogical variability of the Walton deposit and the surrounding area.

Petrography, contact metamorphism, and geochronology of mafic sills in the Wolfville area

Jonathan Koulouras, Deanne van Rooyen, Chris White

Acadia University, 15 University Ave., Wolfville, NS B4P 2R6

In the Wolfville and Bear River areas pre-Carboniferous rocks of the Goldenville, Halifax, and Rockville Notch groups are intruded by mafic sills (Type I and Type II) that have similar chemistry but different textures, alteration, and mineralogy. Type I sills appear to be penecontemporaneous with the country rock based on their field relations but there are no conclusive geochronological data for the sills. The relationship between type I and type II sills is not clearly understood and their respective effects on the country rock has not been investigated. Field mapping of sills in the Wolfville area shows that sills range from 1 to 65 m in thickness are concordant with bedding. All the sills have sharp bottom contacts with the country rock, but only larger sills have sharp top contacts. The larger sills are generally homogeneous from bottom to top and show poorly developed cleavage along their bottom contacts with the country rocks. Some of the smaller sills have vesicular textures and convoluted margins along their top contacts. Contact aureoles at the margins of the sills are variable in thickness and some appear to be silicified. Further field mapping and petrographic work will focus on mineralogical changes from bottom to top in the sills, comparisons among different sills, as well as the extent and mineralogy of the contact aureoles in contrast to the country rock unaffected by the sills. Laser Ablation ICP-MS U-Pb analysis will be used to determine the zircon crystallization and apatite cooling ages for the sills.

Reconstructing changes in the Northwest Atlantic ^{14}C depth gradient using deep water bamboo corals

Lauren Kew, Wilder Greenman, Liam Jasperse, Aislinn Fox, Brett Walker

Dalhousie University, University of Ottawa

Radiocarbon (^{14}C) analysis is an important tool in chemical oceanography. Nuclear bomb testing between 1945 and 1963 added artificial ^{14}C to the surface ocean, which is useful for tracking the movement and mixing of water masses. However, ^{14}C data for the North Atlantic are significantly lacking, so proxy records of seawater ^{14}C are needed. A more complete record of past ^{14}C variability could better constrain the changing influence of water masses off eastern Canada, one of the fastest warming regions globally. This region is home to a wide range of geologically and oceanographically diverse environments and hosts Canada's only known cold-water coral reef. Bamboo corals have been put forward as proxies for seawater ^{14}C since they are long-lived, have annual growth rings, and have a two-part skeleton of “gorgonin” and calcite. This two-part skeleton allows for the differentiation of ^{14}C variability in surface and deep waters. The proteinaceous gorgonin fraction is derived from sinking particulate organic matter (POM) from surface waters while the calcite fraction is derived from dissolved inorganic carbon (DIC) at the 300-1500m depths where the corals live. In this study, we measure time-resolved ^{14}C in both skeletal fractions of recently collected corals and compare to *in situ* data from 1997, 2003, 2012 and 2022 to determine if bamboo corals resolve accurate ^{14}C depth gradients over the last few decades. If our measurements align with the *in situ* data, then bamboo corals could be used to fill an important gap in ^{14}C time histories in the ocean.

The impact of precipitation phase on changing groundwater recharge in mountain regions of Canada and the US

Sana Salehi, Jenacy Samways, Lauren Somers

Dalhousie University, 6299 South St, Halifax, NS, B3H 4R2

Groundwater in alpine regions plays an essential role in downstream water supply. As the climate warms, mountain water resources are under threat with reduced snowpack and glacier recession negatively impacting summer streamflow. However, the extent to which such global changes can impact the mechanisms that contribute to groundwater recharge remains poorly understood. This project aims to address the limited spatial and temporal extents of observational studies surrounding the groundwater in mountainous regions, moreover, enhancing our understanding of long-term trends across geographical boundaries. My primary research question is: Does snowmelt or rainfall precipitation dominate mountain groundwater recharge across mountain regions of Canada and the US? My secondary research question is: will a shift towards less snow and more rain impact this groundwater recharge, due to climate change? We will address the research question by analysing a dataset of 171 observation well from mountain regions across Canada and the US. First, we will build on previous work by categorizing each well as rainfall or snowmelt dominated. We will use stepwise multiple linear regression on each group (snow/rain dominated) of wells to identify which watershed attributes (climate, geology, etc.) are associated with positive/negative trends. Then, we will compile new data from nearby weather stations which includes precipitation phase (rain/snow). We will select ~10 wells for detailed correlation analysis between the well hydraulic head data with the precipitation volume/phase to quantify the groundwater recharge sources and infer how future climate change will impact groundwater recharge.

Developing mineralogical and geochemical discrimination methods to classify Li-barren and Li-prospective pegmatites in southwestern Nova Scotia

Youssef Yammine

Saint Mary's University 923 Robie St, Halifax, NS B3H 3C3

The parental magma composition that produces a plutonic rock is what gives the lithium bearing pegmatite its distinct elemental composition. These magmas have very high concentrations of specific incompatible trace elements that differentiate them from other types of pegmatitic magma. A sought-after incompatible element, lithium, is challenging to detect through most routine analytical techniques. It occurs in abundance most commonly bonded within aluminosilicate minerals; for example, as the lithium aluminium silicate mineral spodumene ($\text{LiAlSi}_2\text{O}_6$). The current research is focusing on the detection of this element in prospective terranes aided geological and geochemical data. The practical goal of the study is to be able to predict the occurrence of lithium-rich pegmatites that may not contain the spodumene at a site of pegmatite dyke exposure but that contain hidden spodumene inventory. In other words, the goal is to find a “fingerprint” that can indicate the presence of geologically lithium-rich minerals. The main objective is to investigate if we can use the chemical composition and mineralogy of chemically developed rocks can be used to differentiate between economic and sub-economic lithium rocks in the absence of spodumene. This research is meant to find a way to facilitate lithium detection and to more reliably uncover lithium prospective deposits

Determination of the source of uranium for the Lac Cinquante uranium deposit, Nunavut, Canada

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The Lac Cinquante uranium deposit located in the western Churchill Province of Nunavut is currently characterized as a vein-type uranium deposit consisting of uranium mineralization concentrated in fractures, shear zones, and stockworks. The host rock of this deposit are Archean basement rocks overlain by Proterozoic sedimentary and volcanic strata of the Baker Lake Group. The source of uranium in the Lac Cinquante deposit is unknown. We hypothesize that the uranium was sourced either by 1) being leached and transported by hydrothermal basinal fluids through faults and fractures in the underlying Hudson and/or Nuelin Granitic Suite where it became deposited in the Baker Lake Basin; or 2) was sourced from the host Baker Lake Group and the granitoids provided the heat to drive the hydrothermal system that leached and precipitated uranium. Preliminary results after XRF analysis and petrographic study show zirconium to be associated with uranium mineralization, which may indicate high field strength element mobility within the hydrothermal fluids that circulated throughout the system. Furthermore, the XRF data shows evidence of two distinct mineralization events, one hosted within a calcite matrix, and the second disseminated within an albitic plagioclase matrix. These findings suggest that there are two characterizations of mineralization that can be made for this deposit: hydrothermal uranium in addition to a vein-type deposit. Future work will aim to resolve the timing of discrete mineralization events by U/Pb dating to produce a paragenetic sequence. Finally, trace element analysis will be used to deduce the source of uranium for this deposit.

Dynamics of porewater ions across two Scotian Slope cold seeps

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The Scotian Slope is a deep ocean, passive margin environment off the coast of Nova Scotia. Recently, several active cold seep sites have been discovered. We hypothesize the biogeochemical cycles that naturally extend into surface sediments on the ocean floor will be altered by the upward migration of reduced hydrocarbon-rich fluids from these cold seeps. In this study we will reconstruct down core profiles of carbonate, fluoride, nitrate, nitrite, phosphate, ammonia, iron, manganese, and sulfate porewater ions from frozen push core sediment samples. These samples were collected during a 2021 research cruise by a remotely operated vehicle (ROV). The push cores are from a transect between two newly discovered cold seep sites named 2A-1 and 2A-2 that reside between 2680m - 2740m below the sea surface. Porewaters will be measured using a Dionex Aquion Ion Chromatography System and Hanna Instruments photometer. With this data set, we will construct a subsurface ion concentration heat map across the transect to examine the extent of the cold seep fluid migration. We will calculate diffusion fluxes to better constrain the microbially mediated sulfate methane transition zone (SMTZ), which in turn will help better characterize the range and effects of the cold seep fluid migration into the surrounding area. Upon completion of this study, we plan to provide a better understanding of the shallow sediment architecture of these two cold seep sites on the Scotian Slope.

Natural or anthropogenic: Determining drivers of ecomorphodynamic change

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The Avon River is a hypertidal, muddy estuary in the upper Bay of Fundy. The substantial tidal range results in significant volumes of water and sediment moving in and out of the estuary with each tidal cycle. The system has been in dynamic equilibrium since construction of the causeway in 1970, but recent construction activities and changes in flood gate management have caused an observable shift to disequilibrium. To assess the environmental consequences of these activities, we will determine the influence of natural and anthropogenic drivers of ecomorphodynamic change within the Avon River, downstream of the Highway 101 causeway by comparing data from 2019-2023 to baseline conditions, 2007-2019. Ecomorphodynamics is the study of how coastal morphologies are impacted by interactions between sediments, dynamic processes, morphology, and vegetation. In our research, changes in morphology will be represented by channel cross-sections, vegetated areas, and sediment budgets, while dynamic processes will be represented by tidal prisms, and sediments by changes in grainsize distributions. Potential drivers of ecomorphodynamic change are flood gate manipulations, construction activities, tidal cycles, and precipitation records. We aim to understand the relative influence of these drivers on the system. Correlations between ecomorphodynamic changes and anomalous conditions will be evaluated by aligning a timeline of the drivers with satellite images (Sentinel-2), orthophotos, cross-sections, and collected sediment samples. Preliminary results indicate coarser sediments with less variation across the sandflat compared to baseline conditions. Visual observations from satellite images indicate erosion in the north and accretion in the south of our study area.

Timing and structural controls on mineralization in the Prairie Creek zinc-lead-silver deposit, Northwest Territories

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The Prairie Creek Zn-Pb-Ag deposit is located within the Mackenzie Mountains of the Canadian Cordillera. It is hosted within a thick marine succession of fine-grained dolomitic rocks deposited in the Late Ordovician to Middle Devonian in a N-S oriented paleo-depression along Laurentia's western margin. The deposit involves two main styles of mineralization: stratabound massive sulphides, which formed by the replacement of host rocks, and quartz-carbonate-sulphide veins. Regional showings of vein-style mineralization parallel large-scale structural trends, including the S-striking Prairie Creek fault and the N-S trending Prairie Creek anticline, indicating that structure is a key control on this mineralization style. This study aims to understand the timing of formation of major structures to provide the first absolute dates for Zn-Pb mineralization and to characterize the relationship between deformation and mineralization. Preliminary observations from core indicate that vein-style mineralization contains two generations of sulphides, including an early assemblage of quartz-sphalerite (ZnS)-galena (PbS) and later calcite-galena. The orientation of these veins and other structures were measured from oriented core samples to determine their relationship with regional structures. Petrographic analyses of thin sections will be used to further characterize the relative timing relationships of ore mineral assemblages and to identify targets for in situ Rb-Sr dating of sphalerite and U-Pb dating of gangue minerals (e.g., carbonate). Slickenfibres from the Prairie Creek fault will also be dated using the U-Pb radiogenic system. By combining geochronological and orientation data we hope to provide timing constraints for both mineralization and structures that control it.

Mapping and petrographic analysis of the gold bearing rocks beyond the known deposit zone - Marathon Gold

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The purpose of this study is to determine the importance of the newly mapped region of the North-East Arm and to test through comparison and contrast of samples collected, with those of gold bearing host rocks from the main Marathon deposit localities, as well as to the Western margins of the property, determining the extent of the mineralized host rock on the property. The Valentine Lake Shear Zone (VLSZ) is located in the central region of the island of Newfoundland, approximately 80km South-West of the nearest town, Millertown. Marathon Gold (MOZ) has conducted prospecting programs towards both the East and the West of the five main centralized gold deposits, located along the VLSZ, currently under construction to be mined. The prospecting team has been able to successfully extend the VLSZ from 20km to 32km, nearing the margins of the property boundaries toward the East and the West of these deposits, where ongoing work is being conducted on and around the areas. Igneous rocks consist of a wide range of granitoids, including trondhjemite-tonalite-granite-granodiorite-gabbro. Samples collected will undergo petrographic analysis through the use of microscopy on polished thin sections, classified and named based on composition, mineral assemblage, textures and interpretation of igneous/fluid alteration processes. Petrographic descriptions of samples will allow for comparison and contrast between rock samples from different localities, and an age determination will be conducted through absolute dating giving insight into the petrogenesis of the sample, where new petrographic analysis will allow for insight into the paragenesis of the area.

Building the foundation for a 3D offshore model of Newfoundland

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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 is released. My work 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.

AUGC 2023 - Awards

Judging

Oral and poster presentations at AUGC are evaluated by a panel of at least 3 qualified judges with diverse geoscience expertise. In consultation with the award sponsors (as described below), the AUGC student organizers are responsible for assembling the panel of judges. At least four weeks before the date of the conference, the student organizers should contact the Science Atlantic Earth Science Committee and ask that they suggest at least one appropriate and available judge. Similarly, the student organizers should contact Imperial Oil, CSPG, CSEG, and the Mining Society of Nova Scotia to invite them to send representatives to the conference. If such representatives are present at the conference, they may take the lead in judging the awards of those organizations. Professors at the host university can also be asked by the student organizers for advice in assembling the judging panel. Note: In all cases where plaques are awarded, the winner's department is responsible for ensuring that the plaque is suitably engraved and that it is returned to the AUGC in the subsequent year so that it is available to be given to the next recipient. Normally the awards are presented by representatives of the award sponsors at the closing banquet of the conference.

Science Atlantic Best Paper Award

The Science Atlantic Presentation and Communication Award is given for the best overall student paper on any geoscience topic presented orally at the annual AUGC (Atlantic Universities Geoscience Conference).

Judging:

The award is judged primarily based on the scientific quality of the topic, the amount of original work done by the student, and his/her understanding of the subject.

Evaluation criteria include:

Abstract – Clear statement of problem, objectives, principal findings;

Presentation – Clarity, visual aids, organization;

Scientific merit – Experimental design, innovative approach, and interpretation of data;

Understanding - Overall knowledge and response to questions.

The award will be judged by a panel of at least 3 qualified judges with diverse geoscience expertise as described under judging above.

The Award:

The award consists of a monetary prize (\$500 in 2015) and letter of commendation for the presenter, as well as a plaque which resides at the winner's university for one year, after which the winner's university is responsible for bringing the plaque to the next annual conference. The award is usually presented by a representative of the Science Atlantic Earth Science Committee at the annual banquet of the AUGC.

Sponsor Information:

This award (previously known from 2004-2012 as the APICS-NSERC Award) is the AUGC version of the Science Atlantic Undergraduate Research Award and Communication Award offered at all Science Atlantic-sponsored conferences. The Communication part of the award is sponsored by Canadian Science Publishing. A separate Communication Award is not offered at AUGC.

Imperial Oil Best Poster Award

The Imperial Oil Best Poster Award is given to the student presenting the best overall student poster on any topic at the annual AUGC.

Judging

The award is judged primarily on the basis of the scientific quality of the topic, the amount of original work done by the student, and his/her understanding of the subject.

Evaluation criteria include:

Abstract – Clear statement of problem, objectives, principal findings;

Presentation – Clarity, visual appeal, organization;

Scientific merit – Experimental design, innovative approach, and interpretation of data;

Understanding - Overall knowledge and response to questions.

The award will be judged by a panel of at least 3 qualified judges with diverse geoscience expertise as described under judging above. When a representative of Imperial Oil is present, he/she will take the lead in judging this award.

The Award:

The award consists of a monetary prize for the student presenter.

Sponsor Information:

This award has been sponsored by Imperial Oil since 2007. Imperial Oil recognizes that business success depends on the economic, social and environmental health of the communities where they operate and views community investment not simply as a responsibility but as an essential component in building a strong society. Imperial Oil gives back to local communities through financial contributions, in-kind donations and volunteer efforts and supports scientific research with a number of awards and sponsorship.

Canadian Energy Geoscience Associate (CEGA) Award

The Canadian Energy Geoscience Associate Award is awarded annually for the best presentation of a petroleum geology-related paper at the annual AUGC. If the winner of the Science Atlantic Best Paper Award gave a petroleum geology-based presentation, then the CSPG award will go to the petroleum geology-based paper judged to be next best.

Judging:

The award will be judged by a panel of at least 3 qualified judges with diverse geoscience expertise as described under judging above. When a CSPG representative is present, he/she will take the lead in judging for the award.

The Award:

A plaque is presented to the winner at the AUGC banquet as well as a monetary prize (\$500 in 2015), preferably by a CSPG member or representative. The plaque will reside at the winner's university until the next AUGC, when the winner's university is responsible for bringing the plaque to the next conference.

Sponsor Information:

This award is sponsored by the Canadian Society of Petroleum Geologists. Founded in 1927, the mission of the Society is to advance the professions of the energy geosciences – as it applies to geology; foster the scientific, technical learning and professional development of its members; and promote the awareness of the profession to industry and the public.

The Frank S. Shea Memorial Award in Economic or Applied Geology

The Frank S. Shea Memorial Award honours the student making the best presentation regarding an aspect of or with implications for economic or applied geology. If the winner of the Science Atlantic Best Paper Award gives an economic or applied geology presentation, then the Shea Award will go to the economic or applied geology presentation judged to be next best. The award was established by the Mining Society of Nova Scotia at its annual meeting in June 1981 to honour Frank Shea, a long-time member and former president.

About Frank Shea

During some 27 years, Frank Shea was engaged in mineral resources exploration and development activities in the Atlantic region. For more than 10 years he served as Chief Geologist and division director of the Mineral Resources and Geological Services Division in the former Nova Scotia Department of Mines. Frank graduated from St. Francis Xavier University in 1954 with a BSc in geology. He continued his studies at Dalhousie University, receiving his Master's degree in 1958. Frank had a great love for his native province and promoted its welfare by assisting mineral exploration and research projects whenever and wherever he could. He was a strong supporter of educational programs in geology such as the geology field school at Crystal Cliffs near Antigonish and prospector training

Judging:

Student papers are reviewed and judged for content in economic or applied geology or implications for economic/applied geology by a panel of practicing geologists. For practical purposes, this will be done the same panel of judges as evaluates the other awards. If there are no papers on economic or applied geology deemed worthy during the annual AUGC, the award may not be given.

The Award:

The award consists of a cheque (\$500 in 2015) for the winning student and a \$100 cheque for the geoscience club that the student represents.

Sponsor Information:

The Frank Shea Memorial Award is sponsored by the Mining Society of Nova Scotia. Organized in the 1890s to promote the mineral industry, to share technical knowledge and to encourage fellowship, this Society was one of the founding members of the Canadian Institute of Mining and Metallurgy (CIM), the premier mining organization in Canada. The Society is pleased to support this award honouring a student, the contributions of Frank Shea, and the economic impact of geology on the Canadian economy.

Atlantic Geoscience Society (AGS) Environmental Geoscience Award

The Atlantic Geoscience Society Award was established in 2015 by the Atlantic Geoscience Society to recognize the best project (talk or poster) at the annual AUGC involving a significant component of environmental geoscience.

Judging:

Student papers are reviewed and judged for content in economic or applied geology or implications for economic/applied geology by a panel of practicing geologists. For practical purposes, this will be done the same panel of judges as evaluates the other awards. If there are no papers on economic or applied geology deemed worthy during the annual AUGC, the award may not be given.

The Award:

The award consists of a monetary prize (\$100 in 2015) to the winning student and a plaque that will reside at that student's university until the next AUGC.

Sponsor Information:

The Atlantic Geoscience Society exists to promote a better and wider understanding of the geology of Atlantic Canada, both to its members and to the public. An entirely volunteer association, the AGS brings together earth scientists from universities, government institutions, the environmental, mining, and petroleum industries, and consultants in the Atlantic provinces.