

## President's Preamble

Greetings and welcome to another year of activities of the Geological Association of Canada. As I sit down to compose my first contribution to *GEOLOG* as President it's hard to believe that the summer season is coming to an end. While the summer fieldwork period is always an exciting and intense period of discovery for geoscientists, the fall season brings its own excitement as the field season comes to an end and we embark on our next phase of data organization, analysis and interpretation, etc. In the academic world it also comes with much anticipation (and perhaps trepidation) for both students and professors alike, as classes and a new round of learning are about to begin.

This summer season was an extremely special one for me in a couple of ways. Not only was it marked by my first few months as the President of this amazing organization, but it was also my 20<sup>th</sup> year of living and working at the University of Regina – a milestone by any stretch of the imagination! In some people's minds Saskatchewan (and the greater Prairies) conjures an image of endless remarkably flat stretches of mainly agricultural land. However, as I have learned in my time here, this impression is far from the truth! I was reminded of this recently by a mid-August visit to the Cypress

Hills (both west and east blocks)

followed by our annual pilgrimage to the twin cities of Creighton, Saskatchewan, and Flin Flon, Manitoba, in late August for our senior-level field school. The latter is focused on the remarkably

exposed crustal cross-section from the Pelican window in the west, where exposures of deeper, higher grade of rocks of Archean Sask craton are found, to the higher level Paleoproterozoic supra-crustal rocks of the Flin Flon greenstone belt in the east.

What's cool about this trip, aside from the spectacular geology, is the remarkable transition in landscapes and ecological zones in the ~8 hour journey northward – from the great plains in the south, where trees and shrubs are exceedingly sparse, through the parkland zone, where trees are more evident in large stands bordering the farm-lands, and then farther north into the nearly 100% tree-covered boreal forest. In particular, there is a remarkable and noticeable difference in vegetation as one crosses the Saskatchewan River along Hwy 6, north of Melfort – near the small villages of Fairy Glen and Gronlid – where, north of the river, the percentage of trees increases markedly. Thereafter, it's into the boreal forest along the Hanson Lake Road (Hwy 106) north of Smeaton. A similar increase in tree coverage is evident crossing the South followed by the North Saskatchewan River at points west, along Hwy 2 at St. Louis and Prince Albert, respectively. As for the Hanson Lake Road, there is nothing to distinguish location; one could be anywhere within the boreal forest ecozone within Canada – parts of Newfoundland, northern Québec,

*Cont'd on p. 4*



Radiating amygdulites in pillow basalts, Flin Flon, Manitoba  
*All photos by Kathy Bethune*

## GEOLOGICAL ASSOCIATION OF CANADA

The MISSION of the Geological Association of Canada is to facilitate the scientific well-being and professional development of its members, the learned discussion of geoscience in Canada, and the advancement, dissemination and wise use of geoscience in public, professional and academic life. The VISION of the GAC® is to be a multidisciplinary scientific society supportive of the entire scope of the geosciences in Canada. The GAC® aims to be a geoscience community that is knowledgeable, professionally competent and respected, whose input and advice is relevant, widely sought and utilized, and whose vital contribution to the economic prosperity and social well-being of the nation is widely acknowledged.

La MISSION de l'Association géologique du Canada est d'aider au développement scientifique et professionnel de ses membres, de favoriser les échanges géoscientifiques au Canada ainsi que de promouvoir et de diffuser l'utilisation éclairée des géosciences dans un contexte public, professionnel et académique. La VISION de l'AGC® est de faire connaître une communauté géoscientifique de grand savoir, dont les compétences professionnelles sont respectées, dont les suggestions et les avis sont pertinents, recherchés et utiles, et dont la contribution largement reconnue est considérée comme vitale pour la prospérité économique et le bien-être de la nation.

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## GEOLOG

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GEOLOGICAL ASSOCIATION OF CANADA  
c/o Dept. of Earth Sciences, Memorial University of Newfoundland  
St. John's, NL A1B 3X5  
Tel: 709-737-7660  
Fax: 709-737-2532  
E-mail: gac@mun.ca  
Web: www.gac.ca  
Editor / Éditeur  
ALWYNNE B. BEAUDOIN  
c/o Royal Alberta Museum  
9810-103A Avenue, Edmonton, AB T5J 0G2  
E-mail: Alwynne.Beaudoin@gov.ab.ca

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*GEOLOG* (ISSN 0227-3713; 1712-3747) est le bulletin trimestriel de l'Association Géologique du Canada, à St. Jean, Terre-Neuve-et-Labrador. *GEOLOG* s'adresse aux membres de l'AGC® et son contenu reflète le caractère polyvalent de cette organisation. Nous invitons la soumission de nouvelles et articles courts pouvant intéresser les membres, incluant les thèmes de sensibilisation du public aux sciences de la Terre. Les articles suscitant des échanges d'opinions et d'informations entre les secteurs académique, industriel et gouvernementaux sont également la bienvenue. *GEOLOG* accepte et publie les articles dans les deux langues officielles du Canada. Les idées sont celles des auteurs et ne représentent pas nécessairement la position officielle de l'AGC®. *GEOLOG* n'est qu'un des nombreux forums offerts par l'AGC® aux scientifiques à travers le monde.

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## Acknowledgements and Thanks

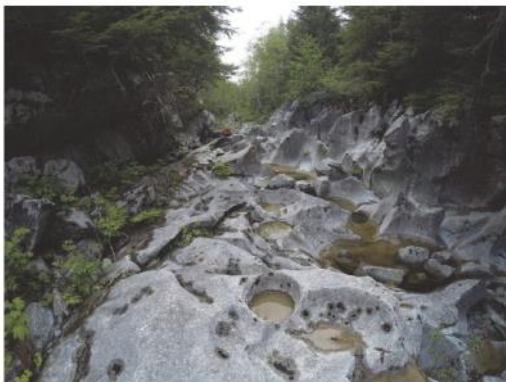
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## Contributions for next issue

Please send items for the next issue of *GEOLOG* by e-mail to Alwynne.Beaudoin@gov.ab.ca by **December 1 2019**.

**GEOSCIENCE CANADA**  
JOURNAL OF THE GEOLOGICAL ASSOCIATION OF CANADA  
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Attributes of Appinites and Ascending Asthenosphere

Ten Thousand Holes in British Columbia?

2019
VOLUME 46

*Geoscience Canada, Volume 46, Issue 1, 2019. Cover image: "Dry karst stream and canyon in limestone of the Quatsino Formation, Tahsish River, Vancouver Island, British Columbia, Canada".*

*Photo credit: Paul Griffiths. See p. 17 for more Geoscience Canada news.*





Sunset over Amisk Lake from the deck of Rocky View Lodge, Denare Beach, Saskatchewan

northern Ontario and/or Manitoba–Alberta. For field school this year we were fortunate to stay (for the first time) at the beautiful Rocky View Lodge on Amisk Lake, near Denare Beach. The highly perched deck overlooking the lake is a good location for catching views of the northern lights, as well as late August sunsets.

I would be remiss if I did not mention that we are not the only university using the playground of spectacularly exposed rocks in the Flin Flon area as our field school venue. The University of Saskatchewan has conducted its senior field school at this location,

directly collaborating with University of Regina over many years, and more recently Mount Royal University (Calgary) has developed a class there. The University of Calgary has also visited periodically over the years. Thus, like the Whitefish Falls area of Ontario, which is frequented by several universities in southern Ontario, Flin Flon has become a hub of geology academic training and learning for several of the prairie universities; so much so that this year the university groups were recognized in an announcement by the local radio station, the WOLF!



University of Regina students at work in the field  
(Brianne Macnab, Jeremy Zver, Liam Schmidt)



Students measuring structures  
(Dan Ferguson, Micheala Balkwill)



Spectacular trough cross-beds in Missi Sandstone-conglomerate, overprinted by strong cleavage (parallel to pencil), Flin Flon

On the more serious side, as we enter the fall of 2019, I am pleased to report that this past year was marked by some significant planning and restructuring initiatives at GAC® and these changes are currently in the process of being implemented. In October 2018, the Executive Team and Council took part in a strategic planning workshop funded by a sizeable grant from the Canadian Geological Foundation. This two-day workshop took place in conjunction with the fall council meeting in mid-October 2018 and was coordinated by past (and then) President Dène Tarkyth and facilitated by Peter Wright of the Planning Group. In advance of the workshop, Peter conducted wide-ranging, one-on-one interviews with individuals, past and present, that have been closely associated with GAC®, including a few past presidents, members of council and Sections and Divisions, as well as HQ staff. The workshop itself involved a series of facilitated discussions and exercises aimed at identifying our core values as an organization, and formulating an up-to-date 'practical vision' for GAC®. Most importantly, from the planning perspective, we formulated four strategic imperatives to be put into place over the next 3 to 5 years, including: 1) implementing a new and improved conference model to ensure more predictable, repeatable and successful financial results; 2) improving and streamlining governance and business practices; 3) implementing an awards strategy to better leverage endowments and improve the prestige and recognition of geoscience excellence in Canada; and 4) improving our professional development programs and offerings, in conjunction with Sections and Divisions.

Each of these strategic imperatives has a set of sub-goals and objectives and this past year your Executive and Council have been busy working towards putting elements of the plan into action. Significant headway has been made on a variety of fronts and we will be providing updates as we progress. Briefly, on the

business side, this past year we engaged with a new auditing firm, receiving valuable recommendations to implement starting this year. In the fall we will also be engaging with an association management firm to take over aspects of our day-to-day operations to ensure more predictable and stable membership services, and assist with aspects of the new conference model. This year, through a variety of new initiatives, we are aiming to increase awareness, recognition and the number of nominations for our major awards. With respect to our conference, I am pleased to report that our annual meeting in Québec City this past May was a significant success, with nearly 800 participants from 17 different countries, thanks to the experienced and able leadership of Michel Malo, Johanne Caron and all the highly committed volunteers on the Québec Local Organizing Committee. It also marked a successful collaboration between GAC-MAC and the International Association of Hydrologists Canadian National Chapter (IAH-CNC) led by Diana Allen. A short report on the meeting is included in this issue of *GEOLOG*. This success in Québec will set the stage for success and financial stability as we embark on fuller implementation of the new conference strategy going forward. Our 2020 GAC-MAC meeting will be held in Calgary as part of Geo-Convention. Then GAC-MAC 2021 in London, Ontario, will demonstrate how effectively this new model works, as we try to move much of the burden of conference planning from the LOCs to the professionals.

In closing, what has struck me most since I joined the Executive two years ago is that the GAC® is an extremely complex organization with a myriad of diverse activities. The backbone of this organization is a handful of highly dedicated volunteers that are quietly and diligently working behind the scenes to make things happen, as well as two dedicated and enthusiastic staff members (Karen and Eleanor) at GAC® headquarters. With a clearly defined, newly developed set of strategic directions, the current Executive Team and Council, in collaboration with HQ staff, are in a good position to continue to make meaningful and impactful changes to this organization to ensure its sustainability into the future.

Looking forward to a year of significant and meaningful progress, and hoping to see you at GeoConvention 2020 in Calgary, Alberta!

Kathryn Bethune  
Professor, Dept. Geology, University of Regina and  
President of GAC®



## Milestones, Memories, and Tributes

### Steven Donald Scott Ph.D. June 4, 1941 – June 11, 2019

Steven Scott, born in 1941 in Fort Frances, Ontario, passed away at Sunnybrook Hospital in Toronto, Canada, on June 11, 2019 due to complications from leukemia. He is survived by his wife Joan, his children Donald and Susan, his grandchildren Jacqueline and Hunter, his sisters, nieces, nephews and his extended family.

Steve was an Emeritus Professor in the Department of Earth Sciences at the University of Toronto, where he has been for his entire academic career. He completed his B.Sc. in 1963 and his M.Sc. in 1964 (both from the University of Western Ontario) and his Ph.D. in 1968 from Pennsylvania State University, where he studied under Hu Barnes.

Steve was an internationally renowned economic geologist who also enriched the lives of many through education, outreach, and mentoring. As a testament to Steve's scientific research impact, he recently received the highest honour and lifetime achievement awards of the World's two leading scientific societies in the field of Economic Geology, the SGA-Newmont Gold Medal (2015) of the Society for Geology Applied to Mineral Deposits (SGA), and the Penrose Gold Medal (2016) of the Society of Economic Geologists (SEG). Indeed, Steve's work has garnered eleven other top awards and medals in his fields throughout his academic career, including the Lindgren Award and Silver Medal of the Society of Economic Geologists, the Past President's Medal of the Mineralogical Association of Canada, the Michael J. Keen Medal of the Geological Association of Canada, the Haddon Forrester King Medal of the Australian Academy of Sciences, the Bancroft Award of the Royal Society of Canada, the Duncan R. Derry Medal of the Mineral Deposits Division of the Geological Association of Canada, and the Moore Medal of the International Marine Minerals Society. There are two main themes to Steve's lifetime of scientific research contributions. The first of these is experimental sulfide, oxide, and silicate mineral

petrology that focused on specific minerals present in metallic mineral deposits. These theoretical and experimental studies provided (and continue to provide) the fundamental understanding of hydrothermal ore deposit formational and post-formational conditions (temperature, pressure, sulfur and oxygen activity). Steve built on this by applying these findings to specific mineral deposits around the World.



The second theme is the study of base-metal sulfide deposits presently forming in many places on the World's ocean floor from so-called "black smoker" vents. Steve was the first to recognize that these deposits are modern counterparts (analogues) to so-called "volcanogenic massive sulfide" (VMS) deposits that provide much of the World's copper, zinc, lead, precious and other byproduct metals. Steve was the first economic geologist to participate in a manned submersible dive using the deep submergence vehicle Alvin in 1982 to observe these deposits first-hand in Guaymas Basin, Gulf of California (Mexico). That experience hooked him into exploring for (and discovering), and studying these enigmatic deposits, firstly off the west coast of North America, and then elsewhere in the southwest Pacific. Steve has focused on many facets of seafloor hydrothermal deposits, including their tectonic setting, geology, geochemistry of mineralization and host rocks, precious and other metal enrichment mechanisms, mineralogy, geotechnical properties, biological controls on mineralization, fluid properties and metal sources, including magmatic input, associated hydrothermal sediments, hydrocarbon generation, and vent fauna. His co-discovery of the large and high-grade Solwara 1

seafloor massive sulfide deposit offshore Papua New Guinea sparked a push to mine these deposits, and the Canadian company Nautilus Minerals and other such ventures garnered financial and other interest from major mining companies such as Placer Dome, Teck Resources, and Anglo American. Since then, we are in a hiatus for a global debate and introspection to better understand the environmental implications of such future mining activities.

Steve forged strong international ties with like-minded researchers at research institutions around the World (Scripps Institution of Oceanography, Université de Bretagne Occidentale, L'Institut Français de Recherche pour l'Exploitation de la Mer, Woods Hole Oceanographic Institution, Leibniz Institute of Marine Sciences at Kiel University, National Oceanography Centre Southampton, and Commonwealth Scientific and Industrial Research Organisation, to name a few of the key players). To facilitate his ocean research, Steve doggedly solicited and procured outside research funding from Scotiabank for the namesake Scotiabank Marine Geology Research Laboratory in the Geology Department at the University of Toronto, for which he served as director. He brought undergraduate and graduate students and postdoctoral fellows and visiting researchers from around the globe to work with him. Several of his students (and their students) are now vigorously pursuing similar research.

Steve was not only a tireless and highly successful researcher (he published over 200 journal articles and book chapters in leading international publications), but also served selflessly on scientific societies and bodies, including the International Marine Minerals Society, Canadian Scientific Submersible Facility, and the Canadian Ocean Drilling Program. He was a consummate educator and raconteur. He has delivered countless keynote and guest lectures at various venues about his seafloor discoveries around the World, and in doing so, promoted science education and a passion for science, technology, and engineering in the next generation of researchers. Since his "retirement" in 2006, Steve continued to be active in research and education, and consulted to the mineral resource industry, specializing in the genesis and potential mining of modern seafloor sulfide deposits.

Lastly, and most importantly, Steve was a kind, gentle person and a true friend to many. He is greatly missed.

Donations can be made to the Graduate Student Scholarship/Bursary Fund in Honour of Emeritus Professor Steven D. Scott and Joan Scott at the University of Toronto, Department of Earth Sciences (<https://donate.utoronto.ca/give/show/47>), and this would be a fitting legacy.

Jan M. Peter  
Geological Survey of Canada  
Ottawa, Ontario

## Death Announcements

We regret to announce the deaths of the following members of the Earth Science community:

### **Brian Skinner 1928-2019**

Brian Skinner, the Eugene Higgins Professor of Geology and Geophysics Emeritus at Yale University died on August 21, at the age of 90. Dr. Skinner was a long-time GAC® member, retiring his membership from GAC® in 2014 on his retirement from Yale. Among his many professional contributions, he was the president of the Geochemical Society, the Geological Society of America (GSA), and the Society of Economic Geologists, and also served as editor of the journal *Economic Geology*. In 1974, a mineral was named Skinnerite in his honour.

### **John Paul Golightly 1940-2018**

John Paul Golightly died in Sudbury, Ontario, at the age of 78. Paul was one of the most visible geologists in Sudbury, attending most Sudbury Geological Discussion Group meetings and Laurentian University seminars, and one of the most active Adjunct Professors at Laurentian University, teaching in the Magmatic Ore Deposits modular course, serving on numerous thesis advisory and examination committees, and working regularly with other members of the Mineral Exploration Research Centre at the Harquail School of Earth Sciences on magmatic Ni-Cu-PGE deposits. These activities complemented a long career (1969-1998) as a research geologist for Inco Limited working on a wide variety of mineral deposits in Canada and overseas.

[Editor's note: Short announcements do not preclude longer tribute articles at a later date.]

## Events and Happenings

### Coming soon to a lecture theatre near you...

Two distinguished Canadian geoscientists are embarking on Canada-wide lecture tours this fall: Dr. JoAnne Nelson (British Columbia Geological Survey) and Dr. Brian Kendall (University of Waterloo). Please check GAC® social media and departmental websites for details of the dates and times of their presentations.

Dr. JoAnne Nelson is the Howard Street Robinson Lecturer for 2019-2020 as selected by the Mineral Deposits Division of GAC. Her tour is funded through the Howard Street Robinson Fund and is intended “for furtherance of scientific study of Precambrian Geology and Metal Mining”. Dr. Nelson has prepared two lectures for her tour: *The great Triassic-Jurassic Cu-Au-Mo porphyries of the central Canadian Cordillera: Why there? Why then?* and *British Columbia’s “Golden Triangle”: Arc-axial porphyry belt, or mineralized deep-crustal corridor?*

See below for the lecture abstracts. Dr. Nelson will be completing a tour of the Maritimes in September and early October, and will be travelling to the Prairies in late October. Other venues will be added.

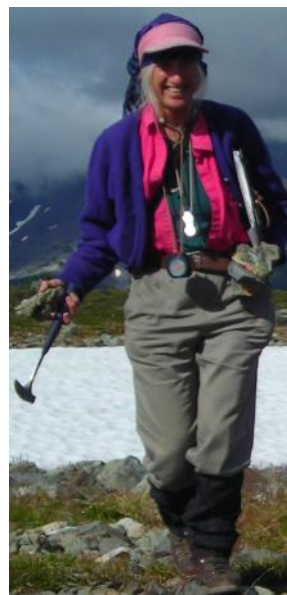
**Citation:** JoAnne Nelson is an exceptional scientist, mentor, and teacher who synthesizes research at many scales that has led to a career of innovative and insightful studies on the tectonics and metallogeny of the northern Cordillera, as related through more than 125 publications that include geological maps, bulletins, and peer-reviewed papers.

JoAnne Nelson began her career in 1976 as a high school teacher in Masset on Haida Gwaii off the west coast of British Columbia. She moved on, working for eight years as a geologist for various exploration companies based in Vancouver. In 1986, JoAnne joined the British Columbia Geological Survey where she undertook bedrock mapping and the study of mineral deposits in the northwestern part of the Province. She

continues to work in the rugged Coast Mountains and over the past 15 years she has been the co-organizer and British Columbia’s Lead Scientist in, first, the “Ancient Pacific Margin” and, second, the “Edges” co-operative research projects that involve geologists from the Geological Survey of Canada, the Yukon Geological Survey, the United States Geological Survey and several universities. Her involvement in these projects gives her exceptional knowledge of the geology, tectonics, and metallogeny of a vast area of western North America. In addition to her many maps, bulletins, and annual reports of fieldwork, she has published several “big-picture” papers that synthesize the tectonic and metallogenic history of the Canadian Cordillera. She is also the co-author of a book aimed at the general public called *The Geology of British Columbia: A Journey through Time*.

JoAnne’s accomplishments were formally recognized in 2013 when she was listed in the top “100 Global Inspirational Women in Mining” by the United Kingdom’s Standard Bank. In 2015 she received the “Gold Pick” Award from the Kamloops Exploration Group in recognition of “outstanding services and contributions to the minerals industry”. In 2017 she was given a “Special Tribute” by the Association for Mineral Exploration in BC for her decades of distinguished work in British Columbia. She was awarded the Provincial and Territorial Geologists Medal in 2017 for the breadth of her contributions to northern Cordilleran geology, tectonics, and mineral deposits, together with her involvement in collaborative projects with many of the most insightful “big picture” thinkers. Now her knowledge and insights will be shared across Canada by her 2019 Howard Street Robinson lecture tour.

[Editor’s note: This citation was unavailable for the Summer 2019 GEOLOG issue.]





## **The great Triassic-Jurassic Cu-Au-Mo porphyries of the central Canadian Cordillera: Why there? Why then?**

The Canadian Cordillera has developed as an orogenic belt over 700 million years, beginning with a Neoproterozoic-Early Cambrian intracontinental rift that created the western margin of Laurentia. Its history as an active tectonic region continues today, though interactions with the Pacific Plate: earthquakes along the Queen Charlotte and Denali transform faults, and collision of the Yakutat block that is lofting the St. Elias Mountains and creating a zone of tectonic instability that extends over 1000 kilometres inland to the eastern front of the MacKenzie Mountains. Construction of the Cordilleran orogen was preceded by evolution and interaction of offshore and exotic terranes, which eventually accreted to the western Laurentian (North American) cratonal margin, primarily in Middle Jurassic to Cretaceous time. During a relatively short time interval prior to accretion (220-178 Ma), world-class belts of porphyry and related gold deposits – famous names like Highland Valley, Mt. Milligan, Afton, Copper Mountain, Red Chris and KSM-Brucejack – emerged in two of the offshore terranes, Quesnellia and Stikinia. This presentation attempts to explain how, in the larger context of Cordilleran evolution, Quesnellia and Stikinia became perfect porphyry hosts, and why Cu-Au-Mo porphyries flourished in the two separate terranes during the same brief period of time. To grasp the long-term processes that primed and prepared the lithosphere of these two multistage island arc terranes, and the profound tectono-magmatic events that triggered porphyry emplacement in them, is to understand that their full metallogenetic potential has yet to be realized. Major deposit discoveries in the last decade (Red Chris, KSM-Brucejack, Tatogga, Deep Afton) illustrate this optimistic view: that like the history of the Cordillera itself, the saga of exploration within it is set to continue into unknown future time.

### **British Columbia's "Golden Triangle": Arc-axial porphyry belt, or mineralized deep-crustal corridor?**

The "Golden Triangle" refers to the Iskut district, an exceptionally well-mineralized region within the Stikine multiphase arc terrane of northwestern British Columbia. The district extends 250 kilometers from Kitsault in the south to the village of Iskut in the north and the Stikine River in the northwest. Major porphyry camps within it include Schaft Creek and Galore Creek (Late Triassic) in the northwest, the Red Chris-GJ-North

Rok-Tatogga cluster near Iskut (latest Triassic), and the KSM-Brucejack and Snip Bronson (Early Jurassic; porphyry-gold vein) camps in the centre of the belt. The host intrusions have been considered arc-axial bodies, associated with the Late Triassic Stuhini and Early Jurassic Hazelton arcs. Although coeval volcanic sequences are present, new paleogeographic interpretations suggest that the main Stuhini and Hazelton arc fronts lay elsewhere within Stikinia.

This presentation focuses instead on the first-order features of the Iskut district: its prolonged, complex and varied metallogenetic history, and the key role of structures in localizing both individual deposits and the mineralized district as a whole. The overall structural grain of northwestern Stikinia shows sets of northerly fault arrays that are interrupted at intervals by narrow, orthogonal easterly fault systems. Schaft Creek and Galore Creek show strong northerly control by pene-contemporaneous faults. The ~12 km long northerly KSM porphyry trend lies in the immediate footwall of a north-striking Cretaceous thrust fault, interpreted as a reactivated Early Jurassic synmineral lineament. Red Chris is localized along a minor splay of the easterly Pitman fault system, as is the newly discovered Saddle Zone at the Tatogga property which, like KSM, lies in the immediate footwall of a later thrust fault. The sets of northerly and easterly lineaments exerted control on some of the oldest intrusive bodies in Stikinia, the Late Devonian Forrest Kerr and More Creek plutons, as well as the youngest post-accretionary overlap unit, the Quaternary-Recent Mt. Edziza volcanic complex. They probably originated as fundamental zones of weakness in the unexposed, unknown pre-Devonian basement of north-central Stikinia.

Besides porphyry and porphyry-related gold deposits, the Iskut district also hosts volcanogenic massive sulphides, notably Granduc (Late Triassic), and Eskay Creek and Anyox (Middle Jurassic). Eskay Creek and Anyox lie within a narrow, post-arc rift zone, the Eskay rift, that follows the entire length of the northerly axis of the Iskut district, with older porphyry deposits on both sides. Granduc lies along the western bounding fault of the rift, the South Unuk-Harrymel fault, which is probably an expression of a co-spatial Late Triassic back-arc structure. A second, subsidiary rift hosts the Dolly Varden Ag-rich VMS deposit (Middle Jurassic), which lies along strike with the Homestake Au-rich porphyry occurrence.

The great mineral endowment of the Iskut district is due to its location along intersecting sets of long-lived deep crustal lineaments that provided conduits for magmas and fluids during a succession of tectonic regimes. Although the bulk of “Golden Triangle” mineralization is of Late Triassic – Early Jurassic age, the Kitsault molybdenum porphyry deposit at its southern tip was emplaced in Eocene time. The multi-phase tectonic and metallogenetic history of the Iskut district is reminiscent of large-scale crustal breaks such as the Larder Lake – Cadillac fault zone in the Superior province. Such lineaments provide ideally fertile ground and permeability conditions that can, and do, result in near-superposition of vastly different mineral deposit types.

Dr. Brian Kendall is the Hutchison Lecturer for 2019-2020. This tour is undertaken by the recipient of the W. W. Hutchison Medal and is funded through the Canadian Geological Foundation (CGF). The award is given to an outstanding young geoscientist for exceptional advances in Canadian earth science. The 2019 medal was awarded to Dr. Kendall, for the application of unconventional geochemical and isotopic techniques to address questions related to interactions between atmospheric, oceanic, and biological systems, geochronology, and the geochemical evolution of Earth from the Proterozoic to the Cenozoic.



Dr. Kendall has prepared two lectures for his tour: *Tracking the rise and fall of oceanic O<sub>2</sub> levels on the Precambrian Earth using the redox-sensitive trace metal geochemistry of sedimentary rocks* and *Non-traditional redox-sensitive metals in sedimentary rocks as tracers of global ocean redox conditions: Lessons from Phanerozoic anoxic events*. Abstracts for these talks are given below. Dr. Kendall will be travelling to the Maritimes in late October, with other venues to be added later.

#### **Tracking the rise and fall of oceanic O<sub>2</sub> levels on the Precambrian Earth using the redox-sensitive trace metal geochemistry of sedimentary rocks**

Accurate estimates of atmosphere-ocean redox conditions through time are necessary to address grand

challenges such as explaining the time lag of several hundred million years between the evolution of oxygenic photosynthesis and the early Paleoproterozoic Great Oxidation Event, as well as constraining the relative importance of environmental versus genetic barriers as controlling factors behind the late initial animal diversifications in the Ediacaran and Cambrian. Traditionally, efforts to infer Precambrian ocean redox conditions at ocean-basin to global scales have been hampered by the need to make such inferences from marine sedimentary rocks preserved in continental margin environments because open-ocean abyssal seafloor has been lost to subduction. Recently, new insights on Precambrian ocean redox conditions at these larger spatial scales have been provided using the concentration and isotopic composition of non-traditional redox-sensitive trace metals (e.g., molybdenum, uranium, rhenium, osmium, thallium) in black shales, carbonates, and iron formations. Despite the fragmentary nature of the Precambrian rock record, the redox-sensitive metal geochemical data from sedimentary rocks point to a complex history of rising and falling environmental O<sub>2</sub> levels, including transient oxygenation events in the Archean and middle Proterozoic. The redox instability on the Proterozoic Earth likely contributed, at least partially, to the nearly ~2 billion-year delay in initial animal diversification after the Great Oxidation Event.

#### ***Non-traditional redox-sensitive metals in sedimentary rocks as tracers of global ocean redox conditions: Lessons from Phanerozoic anoxic events***

Global ocean redox conditions can be inferred from the concentration and isotopic composition of redox-sensitive metals in sedimentary rocks (particularly black shales and carbonates) when these metals have oceanic residence times significantly longer than typical ocean mixing times. Mass-balance models can use the sedimentary data to infer the global extent of seafloor covered by oxygenated, anoxic/non-sulfidic, and euxinic waters. These models take advantage of distinctive metal burial rates and isotope fractionations in different oceanic redox settings and are becoming more sophisticated. Molybdenum and uranium isotope data from sedimentary rocks can constrain the extent of ocean euxinia but are more ambiguous regarding the extent of oxygenated versus anoxic/non-sulfidic marine environments. Rhenium enrichments in black shales are a potential tracer for the extent of total global ocean anoxia (euxinic and non-euxinic) whereas thallium

isotope compositions from black shales may constrain the extent of well-oxygenated seafloor where manganese oxides are buried. Using these redox proxies, studies of Phanerozoic sedimentary rocks deposited during large igneous province events (and their associated mass extinctions) suggest that ocean

anoxia expanded by ~1-2 orders of magnitude relative to the modern ocean. A multi-proxy approach applied to the same samples, coupled with improved mass-balance models, has potential to yield more precise estimates of global ocean redox changes.

## Canadian Paleontology Conference

Organized by the Paleontology Division of the GAC®, this year's Canadian Paleontology Conference was held at the University of Toronto

Mississauga where dozens of talks and posters showcased the breadth of Canadian Paleontology. Generous funding was provided by the University of Toronto, most notably the Office of the VP Research (UTM), Office of the VP Academic and Dean (UTM), UTM Library, MBIotech, and the Departments of Chemical and Physical sciences, Biology, and Ecology & Evolution.

During the meeting, Dr. Jisuo Jin was presented with the Billings Medal at the Conference Banquet and students Kelsey Grimes and Joseph Moysiuk were each presented with a T. E. Bolton Award.



Jisuo Jin being presented with the Billings Medal by his nominator, Frank Brunton.

*Image credit: Mario Cournoyer*



Two students were selected to receive the T. E. Bolton Award at the CPC Conference: for best poster, Kelsey Grimes, Queen's University, and for best oral presentation, Joseph Moysiuk, Royal Ontario Museum and the University of Toronto.

Marc Laflamme (R) is seen here presenting the awards.

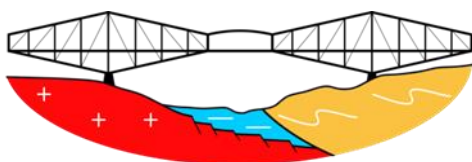
*Image credit: Mario Cournoyer*



# AGC-AMC-AIH

## QUÉBEC 2019

Où les géosciences convergent



# GAC-MAC-IAH

## QUÉBEC 2019

Where geosciences converge

Three geological provinces converge toward Québec City: the Grenville province, the St. Lawrence platform and the Appalachians. Likewise, three geoscientific associations converged their efforts to organise the GAC-MAC-IAH Québec 2019 conference. The Geological Association of Canada and the Mineralogical Association of Canada (GAC®-MAC) held their joint annual meeting in Quebec City, together with the Canadian National Chapter of the International Association of Hydrogeologists (IAH-CNC), from May 12 to May 15, 2019.

Under the theme “Québec 2019: Where geosciences converge”, this event formally brought together for the first time specialists in geological sciences and hydrogeology to discuss and share the most recent advances in the broad field of Earth Sciences around four unifying themes: Geosystems and Hydrogeosystems; Resources, Energy and Environment; Data Science for Geosciences; and Geosciences and Society. The conference had international appeal, with nearly 800 participants from 17 different countries including from Europe, Asia, North and South America and Australia. The next generation of geoscientists was well represented with 261 student registrations.

A total of 427 talks and 118 posters were presented within 5 symposia, 30 special sessions and 6 general sessions. Thanks to the well-organized schedule and the spacious Quebec City Convention Center, eleven parallel scientific sessions were held simultaneously and the posters were displayed in the Exhibition Hall each day of the three-day conference. Each conference day was marked by a plenary lecture preceding the lunch breaks. Keynote lectures were given by Dr.

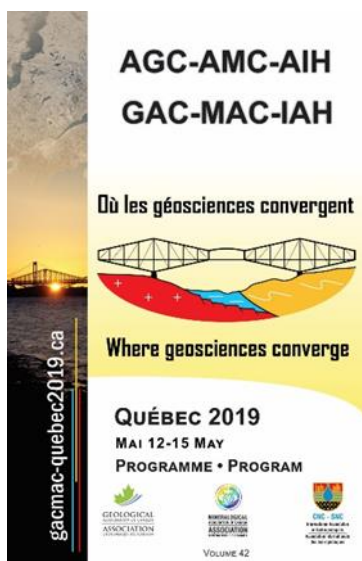
Barbara Sherwood Lollar (University of Toronto) on “Subsurface habitability in the Earth’s deep hydrosphere”, Mr. Darrell Beaulieu (Denendeh Investments Inc.) on “A Dene perspective on resource development in Canada for, by and among First Nations”, and by Dr. Guy Desharnais (Osisko Gold Royalties) on “How BIG data is changing mining”.

The publication and scientific committees carefully edited the abstracts, refined the abstract volume and program format based on best practices of previous meetings, added citations of medal and award winners, personalised the meeting with photos of the committee members, keynote speakers and award winners, and published a 204 page abstract volume and a 144 page program. Templates for both documents should be easy to reuse for future meetings.

Eight short courses and one workshop were well attended, and three one-day field trips were a success. Participants had the opportunity to visit and discover the warmth and charm of Quebec City and to explore its many attractive historical and natural sites during three social events: the Old Québec walking tour, the Quebec City craft breweries and beer tasting tour and the famous dinner cruise on the St. Lawrence River which was enjoyed by many participants.

Thanks to the financial support of the Canadian Geological Foundation and Canadian Museum of Nature, the meeting program was supplemented by the outstanding traveling Mineral Exhibit of the Canadian Museum of Nature. The mineral exhibit was set-up in the main hall at the Quebec City Convention Centre and open during the icebreaker party on Sunday night and throughout the three days of the conference. In addition, a public discovery day with Earth Sciences educational activities for primary and secondary schools welcomed 75 students and their teachers from Quebec City.

The GAC-MAC-IAH Québec 2019 conference could not have successfully happened without its exhibitors and sponsors, which are thanked for their financial contribution. A special acknowledgement goes to the



four organizations involved with the local organizing committee: INRS, the Geological Survey of Canada (Natural Resources Canada), Laval University and the Québec Ministère de l'Énergie et des Ressources naturelles. We also sincerely thank employees and volunteers of the GAC and MAC. Finally, thanks to all attendees that made this meeting a success.

The local organizing committee –  
GAC-MAC-IAH Québec 2019  
August 31, 2019

Trois provinces géologiques convergent à Québec: la province du Grenville, la Plate-forme du Saint-Laurent et les Appalaches. De la même manière, trois associations géoscientifiques ont fait converger leurs efforts pour organiser la conférence AGC-AMC-AIH Québec 2019. L'Association géologique du Canada et l'Association minéralogique du Canada (AGC®-AMC) ont tenu leur congrès annuel conjoint à Québec avec la Section nationale canadienne de l'Association internationale des hydrogéologues (AIH-SNC) du 12 au 15 mai 2019.

Sous le thème "Québec 2109: Où les géosciences convergent", cet événement a réuni formellement, et pour la première fois, des spécialistes des sciences géologiques et de l'hydrogéologie pour discuter et échanger des plus récentes avancées dans le grand champ des sciences de la Terre autour des quatre thèmes unificateurs : Géosystèmes et hydro-géosystèmes; Ressources, énergie et environnement; Science des données en sciences de la Terre; et Géosciences et société. La conférence a attiré la



Brief introduction to the Mineral exhibit guided tour for primary school students.

Brève introduction à une visite guidée de l'exposition des Minéraux du musée canadien de la Nature pour les élèves du primaire.

Photo by / par Jean-François Bureau.

communauté scientifique internationale avec près de 800 participants de 17 pays provenant de l'Europe, l'Asie, l'Amérique du Nord et du Sud, et l'Australie. La nouvelle génération des géoscientifiques était bien représentée avec 261 inscriptions d'étudiants.

Au total 427 conférences et 118 affiches ont été présentées dans 5 symposia, 30 sessions spéciales et 6 sessions générales. Grâce à un programme scientifique établi avec soin et le spacieux Centre des congrès de Québec, onze sessions scientifiques ont été tenues simultanément. Les affiches géoscientifiques étaient exposées dans la grande salle d'exposition pendant les



Participants standing at the top of the Jacques-Cartier River delta in Pont-Rouge.  
Participants à l'une des excursions se tenant au sommet du delta de la rivière Jacques-Cartier à Pont-Rouge.

Photo by / par Guillaume Légaré-Couture.



trois jours du congrès. Chaque jour, une conférence plénière a été présentée : le lundi par la professeure Barbara Sherwood Lollar (Université de Toronto) sur « *L'habitabilité en sous-surface dans l'hydrosphère profond de la Terre : implications pour la science planétaire et l'astrobiologie* », le mardi par M. Darrell Beaulieu (Denendeh Investments Inc.) sur « *Une perspective des Dénés sur le développement des ressources au Canada pour, par et au sein même des Premières Nations* », et le mercredi par Guy Desharnais, PhD, (Osisko Gold Royalties) sur le thème « *Comment les mégadonnées (Big Data) changent l'industrie minière* ».

Le comité des publications et le comité scientifique ont édité soigneusement les résumés, peaufiné le format du volume des résumés et du programme en se basant sur les bonnes pratiques des congrès précédents, ajouté les citations des récipiendaires des médailles et autres prix annuels, personnalisé le congrès avec des photos des membres du comité d'organisation, des conférenciers d'honneur et des récipiendaires des prix, et publié le volume des résumés de 204 pages et celui du programme de 144 pages. Le canevas pour les deux documents devrait être facile à réutiliser pour les prochains congrès.

Les huit cours intensifs et l'atelier, avec tous une très bonne assistance, ainsi que les trois excursions d'une journée ont été un succès. Les participants ont eu l'opportunité de visiter et de découvrir la chaleur et le charme de Québec. Les participants ont pu aussi explorer les nombreux attraits historiques et les sites touristiques de la ville de Québec lors de trois événements sociaux : la Visite à pied privée du Vieux-Québec, la Visite guidée des microbrasseries artisanale de la Ville de Québec et la dégustation de bière. Enfin, le fameux Souper-croisière sur le fleuve Saint-Laurent a également été particulièrement apprécié par de nombreux participants le mardi soir.

Grâce au support financier de la Fondation géologique du Canada et du Musée canadien de la nature, le programme du congrès a bénéficié de la superbe exposition itinérante des minéraux du Musée canadien de la nature. L'exposition présentée dans le hall principal du Centre des congrès a été ouverte pendant la cérémonie de bienvenue du dimanche soir et puis pendant les trois jours du congrès. De plus, une journée découverte avec des activités d'éducation et de vulgarisation en sciences de la Terre destinée aux



Shatter cones in the Charlevoix Impact Crater during the GAC-MAC-IAH 2019 field trip.

Structures d'impact au cratère de Charlevoix pendant une excursion du congrès.

Photo by / par John Molson.

écoles du primaire et du secondaire de la Ville de Québec a accueilli 75 élèves et leurs professeurs.

La conférence AGC-AMC-AIH Québec 2019 n'aurait pas pu connaître une telle réussite sans les commanditaires et exposants que nous remercions pour leur contribution financière. Un remerciement spécial va aux quatre organisations impliquées dans le comité d'organisation local : l'INRS, la Commission géologique du Canada (Ressource naturelles Canada), l'Université Laval et le Ministère de l'Énergie et des Ressources naturelles du Québec. Nous voulons aussi remercier sincèrement les employés et volontaires de l'AGC et de l'AMC pour leur appui dans l'organisation du congrès. Finalement, des remerciements vont à tous les participants qui ont fait de ce congrès un franc succès.

Le comité d'organisation local –  
AGC-AMC-AIH Québec 2019,  
31 août 2019



## Announcements

### CGF Grants Awarded 2019

19-05	Bio-geological Walk Through Time (Ann Timmermans, Quartermain Earth Science Centre)	\$25,000.00
19-06	Podcast "Through the Eons" (Kirsten Hodge, Pacific Museum of Earth, UBC)	\$10,000.00
19-07	"Geoscience and Canada" bilingual booklet (Andrea Waldie, Geoscientists Canada)	\$5,000.00
19-08	Interactive Activities in Earth Sciences (Pierre Hudon)	\$9,000.00
19-10	Western Canadian Basin Display (Stephen Johnston, UofA)	\$5,000.00
19-11	"The Geodiversity of Whistler" lecture and field guide (John Rae, Municipality of Whistler)	\$18,000.00
19-12	"Bringing the Carboniferous to Life at the Joggins Fossil Cliffs" exhibit (Melissa Grey, Joggins Fossil Institute)	\$14,000.00
19-13	Eastern Geological Network Bilingual Promotion Brochure (Kathi Stacey, Eastern Geological Network)	\$9,000.00
19-14	Mining Rocks (Marg Fraser, Mining Matters)	\$18,500.00 for 3 years
19-15	"Go Take a Hike" geology of trails in Rockies book (Lis Bjeld, CSPG)	\$5,000.00
19-16	Silver Queen Mine Trail Guide reprint (Mark Read, Friends of Murphy Point Park) Thayer Lindsley Endowment Trust Fund	\$3,608.90
19-18	"UR Rocks" guidebook (Jeanette Roelofsen, Univ of Regina)	\$1,500.00
19-19	YouTube Video of Fogo Island Geology (Jane Wynne)	\$1,520.00
19-22	Earth Science for Society 2020 printing of K-12 Scavenger Hunt booklet (Annette Milbradt, CSEG Foundation)	\$5,000.00 for 3 years
19-23	Planet Earth 2020 & the Earth Symphony (Philippe Tortell, UBC)	\$10,000.00
19-25	"Anticosti, une mer de fossiles" (André Desrochers, Comité de pilotage pour la nomination de l'île d'Anticosti au programme du patrimoine mondial de l'UNESCO)	\$20,000.00
19-26	User-friendly toolkits for geoscientists: how to bring geology experts in the classrooms (Stéphanie Larmagnat et al., GSC)	\$4,360.00
19-28	Moon Rocks! (Gordon Osinski, Western Univ)	\$11,000.00
19-29	Geoscience kits for primary schools... Quebec (Chris Brooks, Geoscience Education in Action)	\$20,000.00
19-30	Geoscience Canada – promotion and marketing to build a world class journal (Karen Dawe, GAC)	\$3,500.00

## CGF Grants Awarded 2019 (Cont'd)

19-31	Mineral Exploration Game + Video + Documentary (Jamal Amin, Next Gen Geo)	\$5,000.00
19-32	Taking Earth Science on the Road (Andrew Randell, Below B.C. Geological Association)	\$8,100.00
19-33	A rock-solid investigation (Melissa Green, GUEPE)	\$3,000.00
19-35	Educational book for children and geologist tools (Isabel Cyr, Percé UNESCO Global Geopark)	\$10,000.00
19-36	Geology Outreach at the University of Saskatchewan (Courtney Onstad, Usask)	\$3,000.00
19-37	Education and Interpretation Project (Amanda McCallum, Discovery Aspiring Geopark Inc)	\$20,000.00
19-38	Teacher Catalysts: Supporting Earth Science in Saskatchewan Schools (Terry Johanson, Saskatchewan Mining Association)	\$1,250.00
19-39	ENERGIZE! The Intersection of Energy, Emissions, and Earth Science (Alexandria Shrake, ENERGYminute)	\$5,000.00

## Renew your GAC® membership!

Be sure to renew your GAC® membership before year end in order to enjoy continuous benefits. Renew online at <https://gac.ca/members/join-renew/>

Remember: GAC® Members save on books purchased through GAC®, The Geological Society of America, and Geological Society (London). PLUS save on registration costs for meetings.

## GeoConvention 2020

GeoConvention 2020 will take place May 11-15, 2020 at the Calgary TELUS Convention Centre in Calgary, Alberta. This meeting only takes place once a decade and GAC® is one of the sponsoring societies. Other societies sponsoring the event include the Canadian Society of Petroleum Geologists (CSPG), Canadian Society of Exploration Geophysicists (CSEG), Canadian Well Logging Society (CWLS), the Mineralogical Association of Canada (MAC) and the International Association of Hydrogeologists (IAH-CNC). GAC® encourages members to make a strong showing at the event, by convening or leading technical sessions, field trips or workshops. And, of course, by attending the meeting! If you have a session, workshop, or field trip proposal, please submit by October 1, 2019 using this link: [https://www.geoconvention.com/conference/2020\\_CFS/html](https://www.geoconvention.com/conference/2020_CFS/html)

## 2019 GAC® Student Member Photography Competition

The Geological Association of Canada is proud to announce our 2019 GAC® Student Member Photography Competition!

Photo entries should showcase Canada's varied scenery from a geological perspective or spectacular geological features (e.g., outcrops, fossils, thin sections, minerals).

And, yes, there are prizes: 1st Prize – \$500; 2nd Prize – \$200; 3rd Prize – \$100. Prizes are provided from the Jérôme H. Remick III Endowment Trust Fund.

The competition is open to 2019 GAC® student members. Entries may be submitted from September 18 to October 30, 2019. Each student member can submit a total of 4 entries.

Winners will be informed by November 27, 2019. All judges' decisions are final.

For full entry details, and terms and conditions, please download the GAC® Student Photo Competition Registration and Release Form.

New page: <https://gac.ca/gac-student-member-photography-competition/>

## GAC® award nominations are open

Consider nominating a deserving colleague for one of GAC®'s prestigious awards. Nomination deadline for National Awards is November 30 2019; the deadline for Student Awards is December 15 2019

### National Awards

- Logan Medal
- W. W. Hutchison Medal
- E. R. Ward Neale Medal
- J. Willis Ambrose Medal

### Student Awards

- Mary-Claire Ward Geoscience Award
- Eric Mountjoy Exchange Award

### Division / Section Awards

- Canadian Sedimentology Research Group—Middleton Medal
- Marine Geosciences Division—Michael J. Keen Medal
- Mineral Deposits Division—Duncan R. Derry Medal, William Harvey Gross Award

- Paleontology Division—Pikaia Award
- Precambrian Division / Mineral Deposits Division—Howard Street Robinson Medal
- Canadian Tectonics Group—Jack Henderson Prize for Best Thesis, Ph.D. and M.Sc.
- Volcanology and Igneous Petrology Division—Career Achievement Award, Léopold Gélinas Medal (Ph.D., M.Sc., and B.Sc.)

For more information and nomination forms, go to <https://gac.ca/about/grants-awards/> and click on “Read More” under each award.

## CANQUA 2020

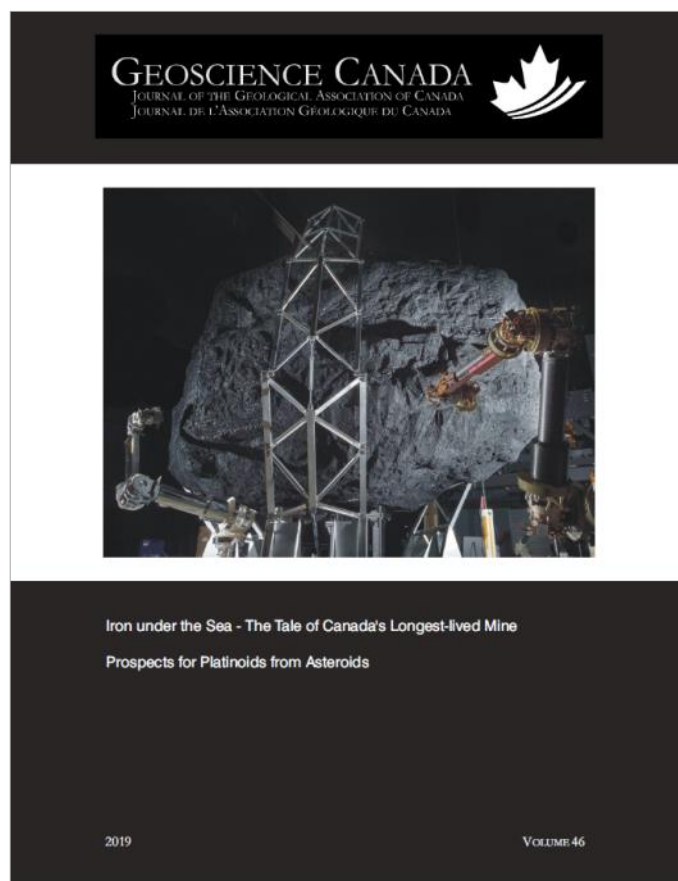
The Canadian Quaternary Association's biennial meeting, CANQUA 2020, will be held in Prince George, British Columbia, from August 7 to 10, 2020. Please monitor the Association's website or Twitter feed for more information, including details of field trips: [www.canqua.com](http://www.canqua.com) and @CANQUA\_org

## GeoScience Canada

The latest issue of Geoscience Canada (Volume 46, Issue 2, 2019) has just been published and can be accessed at [http://www.geosciencecanada.ca/geocan\\_current.htm](http://www.geosciencecanada.ca/geocan_current.htm)

Content includes: “GREAT MINING CAMPS OF CANADA: Geology and History of Wabana Iron Mines, Bell Island, Newfoundland” by Jeffrey C. Pollock (subscription required), and “IGNEOUS ROCK ASSOCIATIONS: Near-Earth Asteroid Resources: A Review” by Liam Robert John Innis and Gordon R. Osinski (open access).

The cover (right) shows an image linked to the second article: “A NASA image from the testing of technology at the Goddard Flight Center, Maryland, intended to recover a boulder from a near-Earth asteroid, and bring it into Earth orbit for further examination. In the image, they are using a 'mock asteroid boulder' for simulation. The boulder is made from wood, styrofoam, aluminum and real rock. *Photo Credit: National Aeronautics and Space Administration (NASA).*”





## *Palaeontographica Canadiana* Origins, History and New Publications

On a few recent occasions we have been asked about the status of the *Palaeontographica Canadiana* series. We are taking this opportunity to announce the publication of volumes No. 36 and No. 37 and that we have three manuscripts under review. Also an important change is our new Editor, Sofie Gouwy of GSC Calgary, who replaces Mike Melchin from St. FX. Our sales are handled through the Geological Association of Canada. All volumes except the out-of-print Morocco trilobite issue (No. 25) are available. Please contact GAC® (<https://www.gac/>) for prices.

Why publish monographs? Systematic study of animal and plant fossils require formal publication of results, and often these studies are so detailed that the paleontologist either has to break the study into small journal-sized papers, or ideally find a publisher that produces monographs. Illustrations of fossils are critical in paleontology, and monographs are usually not restricted in the number of illustration plates, as journals are. Furthermore, the nature of taxonomic studies means the monographs do not become obsolete – they have a long shelf life.

*Palaeontographica Canadiana* was created in the late 1970s by paleontological members of the Geological Association of Canada and the Canadian Society of Petroleum Geology who recognized the need for a Canadian monograph series. At that time the Canadian alternatives were GAC® Special Papers, CSPG Memoirs, Royal Ontario Museum Life Science Contributions, and the Geological Survey of Canada Bulletins, and more recently the NRC Monograph Series. The ROM, GSC and NRC series are either no longer publishing, or not publishing large taxonomic works. The first monograph *Palaeontographica Canadiana* No.1 was published in 1983. *Palaeontographica Canadiana* No. 37 was published in 2018.

Since its inception, *Palaeontographica Canadiana* has been independent of both sponsoring societies—in both the financial and publishing sense. GAC® is the sales outlet for the volumes, and it recovers a handling fee for each sale. The Canadian Geological Foundation has periodically provided grants, as have author institutions. The rest of the funding comes from sales.

*Palaeontographica Canadiana* is a Canadian success story in publishing scientific books. Thirty-seven published volumes (not counting the three new manu-

scripts) in thirty-six years is an impressive number. The subjects are mostly Canadian fossils, but these paleontology studies have a global appeal. The print run is not large, but with many copies being in research libraries the readership is high, and volumes are typically well cited, with three being cited over 100 times in Scopus. The majority of fossils illustrated in *Palaeontographica Canadiana* are permanently stored at the National Type Collection in Ottawa for use in future research and continuing citation of the series.

We recognize that we need to step up the promotion of this series. As a first step we encourage *GEOLOG* readers to promote this series to their library and colleagues, and of course, purchase volumes of interest.

*Sandy McCracken* (Committee Chair 1992-2005, Editor 1995-2001, presently Co-Business Manager and GAC® Paleontology Division Publications Coordinator)  
*Keith Dewing* (Committee Chair 2005-present, Editor 2001-2005, also presently Co-Business Manager)  
*Sofie Gouwy* (Editor since 2019)

### New Publications

**No. 36 (2017) - UPPERMOST VISEAN AND  
SERPUKHOVIAN (MISSISSIPPIAN) RUGOSE CORALS  
AND BIOSTRATIGRAPHY, CANADIAN CORDILLERA**  
**E.W. Bamber, S. Rodríguez, B.C. Richards  
and B.L. Mamet**

169 pp., 26 pls. ISBN 978-1-897095-80-5  
\$64 GAC® members, \$116 non-members

Upper Mississippian rugose corals representing 11 families are described from uppermost Viséan to middle Serpukhovian open marine carbonates of the Western Interior and eastern Alaska coral provinces in western and northern Canada. This fauna is mainly from the uppermost Mount Head Formation and the overlying Etherington Formation of the southern Canadian Rocky Mountains and is also present in the middle Alapah Formation of the British Mountains in northern Yukon. The families include two new sub-families (Schoenophyllinae, Petalaxinae), 20 genera of which one is new, and 36 species of which 31 are newly named or left in open or uncertain nomenclature.

In the southern Rocky Mountains five widespread coral zones are established, based mainly on the biostratigraphic succession in the Lizard Range, where they are dated by associated world-wide foraminiferal zones 16-18. In ascending order, these are the Upper Viséan *Siphonodendron*, *Palaeosmilia*, and *Enniskillenina* zones,

the uppermost Viséan to lowest Serpukhovian *Lublinophyllum* Zone and the Lower to Middle Serpukhovian *Cystolonsdaleia* Zone.

The presence of genera common to upper Viséan/Serpukhovian coral faunas of western Canada and the Western Paleotethyan Coral Realm indicates east-west faunal exchange through a shallow marine corridor separating Laurentia and northern Gondwana at this time. Diversity in these faunas reached a maximum during the latest Viséan, followed by a marked decrease during the Serpukhovian, reflecting the development of conditions unfavourable for coral development during the early phases of the Appalachian and Variscan orogens.

**No. 37 (2018) - FASCIPHYLLID AND SPONGOPHYLLID  
RUGOSE CORALS FROM THE MIDDLE DEVONIAN OF  
WESTERN CANADA**

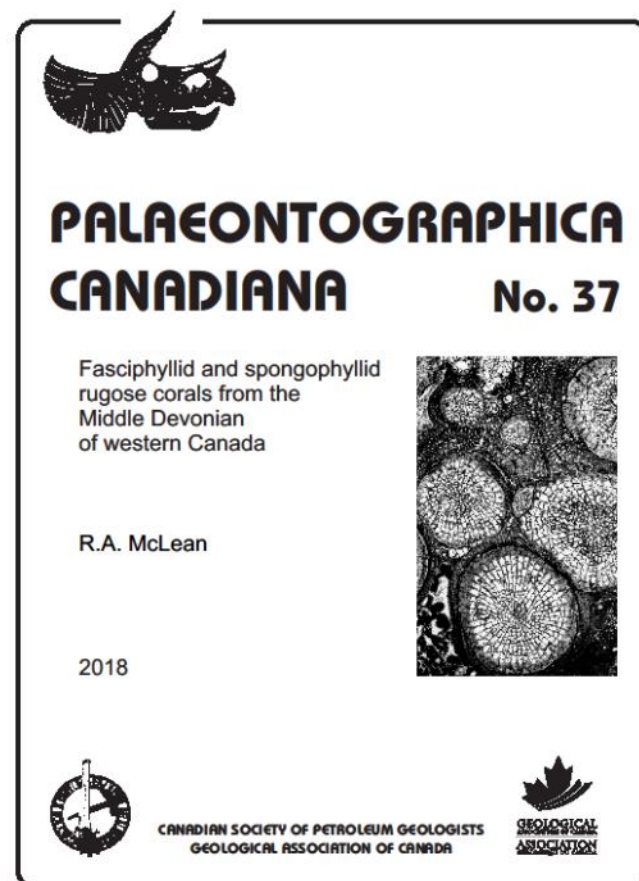
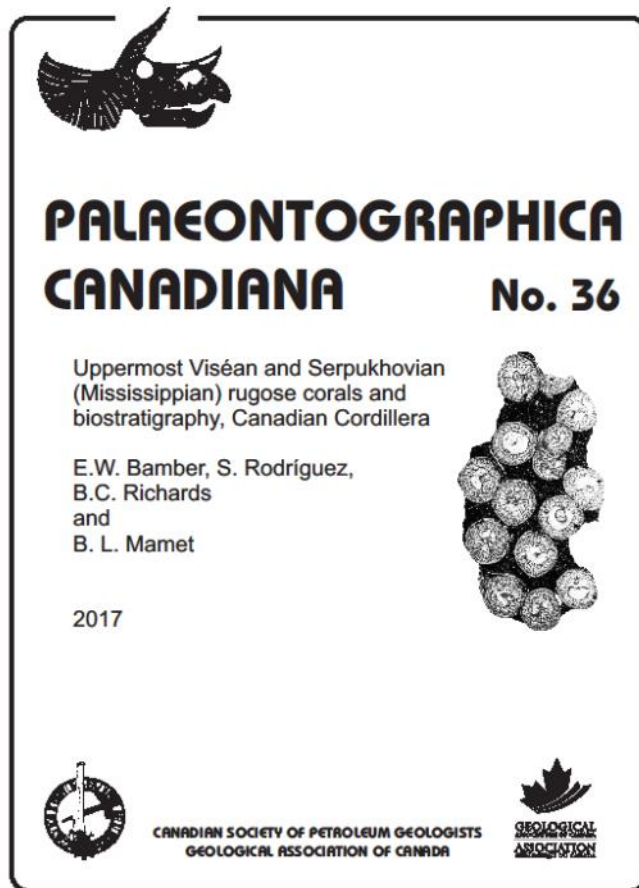
**Ross A. McLean**

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Representatives of the rugose coral families Fasciphyllidae and Spongophyllidae are characteristic components of the rugose fauna in the Middle Devonian of the Western Canada Sedimentary Basin. Detailed taxonomic treatment is done on 7 genera and 14 species. Five of the species are new. Significantly the Russian form *Loyolophyllum polygonum* is recognized in Canada for the first time. Seven of the other species are revised on the basis of the type and new material. In addition, new illustrations of the type material of the type species of *Battersbyia* and *Loyolophyllum* are provided.

The geographic setting includes the Lower Mackenzie Valley, Mackenzie Basin, Presqu'île Barrier and margins, Bekami Basin, Macdonald Platform and margins, Eastern Ospika Embayment and margins, and the Rainbow Sub-basin of Western Canada. The stratigraphic framework for the coral fauna is reviewed and its age constraints are considered in terms of all available conodont data.

Most of the specimens described in this monograph were collected by the author, and support for the collection and preparation of this material was provided by Amoco Canada Petroleum Company Limited (now BP Canada Resources), and later by Anadarko Canada Corporation (now Canadian Natural Resources Limited).



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Sunrise, North Saskatchewan River, Edmonton, October 2015

### Information for Contributors

Contributions should be submitted by e-mail to [Alwynne.Beaudoin@gov.ab.ca](mailto:Alwynne.Beaudoin@gov.ab.ca), with GEOLOG in the subject line. Contributions are welcome in either of Canada's two official languages. MS Word (.doc or .docx) is the preferred format for contribution but generic word processing (.rtf or .txt) files are also fine. Please do not submit PDF files. Up to four hi-res images may be submitted per contribution: preferred format is .jpg, RGB colour, with a minimum 300 dpi resolution at 5" x 3" size. Please ensure that images are cropped and colour-corrected, and provide a caption for each image, and an image credit line if needed. Contributors are responsible for securing permission to publish for any third-party images or images of living recognizable people. Diagrams (vector graphics) may also be submitted. Preferred format for graphics is Adobe Illustrator (.ai); make sure that the file is saved with "save text as lines" option enabled to ensure no font substitutions. Additional information on other file formats can be obtained from the Editor. Please do not embed images or graphics in your text document; images or graphics should be submitted as separate files. In your text, use a call-out in parentheses to indicate the approximate placement of each image and graphic. If files are larger than 10 mb, please contact the Editor for alternate delivery arrangements. Your contribution will be copy-edited to ensure consistent spelling and orthography and to correct any obvious typos or errors. Contributions may also be edited for clarity and length. If the Editor has questions about specific information in the text, she will contact contributors for clarification. Contribution deadlines are March 1, June 1, September 1 and December 1.

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