ASH FALL

Newsletter of the Volcanology and Igneous Petrology Division
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In this issue

View of Cinder Cone from within Lassen Volcanic National Park. The hike to the top provides excellent views of the surrounding landscape dotted with lots of other cones and lava flows (courtesy of S. Leiter).

UNB field trip participants (courtesy of F. Yousefi).

A message from the VIP Chair

This is my final year (May 2023) as chair of the VIP. I am excited about the future of the division as we have built a strong, dedicated, experienced executive, and an active membership.
The division was quite visible at GAC-MAC 2022 in Halifax, sponsoring one symposia, "Supercontinents, orogenic processes and magmatism: a celebration of the career of Brendan Murphy" and three special sessions: From the mantle to the crust, the geochemical signatures of igneous processes: a session in honour of Jarda Dostal", "Zooming in to see the big picture: using nano- to micro-scale observations to better understand Earth processes", and "Current perspectives on the setting and origin of volcanogenic massive sulfide (VMS) Deposits". The division also sponsored two field trips at the Halifax meeting, "Geology of the Coastal Volcanic Belt exposed along the coast of Passamaquoddy Bay" and "Stratigraphy and tectonic setting of the Bathurst Mining Camp".
At the upcoming GAC-MAC in May the VIP Division will be sponsoring 2 special sessions, Iron-rich Au, Ag, Bi, Co, Cu, F, Mo, Nb, P, Pb, REE, U, Zn, PGE Mineralization: Genetic Processes and Feedback Mechanisms between Magmatism and Metasomatism (SS18) and Rare Metals in Igneous Systems (SS26). VIP continues to welcome new and continuing members of GAC and VIP, as well as invite you all to contribute to future ASHFALL and GEOLOG newsletters. We are interested in all activities related to VIP and those that spread the word about this GAC Division. Remember you are invited to the AGM that will occur in May 2023 as part of the GAC-MAC meeting. Hope to see you in Sudbury!

West Greenland. Cover photo: View from Hekla, Iceland (courtesy M. DeWolfe).

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Career Achievement Award

The Volcanology and Igneous Petrology Division of the Geological Association of Canada in recognition of career achievements in the field of volcanology and/or igneous petrology present the Career Achievement Award. Candidates are judged on their lifetime scientific contributions.

Dr. Richard Ernst for his lifetime scientific contribution to the fields of Volcanology and Igneous Petrology

Nomination Letter

It is a great pleasure to nominate Dr. Richard Ernst (Carleton University, Tomsk State University, and Ernst Geosciences) for the Career Achievement Award of the Volcanology and Igneous Petrology Division of the GAC. Richard is a superb scientist and is an international leader in the study of Large Igneous Provinces (LIPs). Perhaps Richard's greatest attribute is his ability to attract LIP collaborators from the spectrum of the earth sciences: geochronologists, geochemists, field geologists, tectonicists, ore deposit and hydrocarbon geologists, and even climate specialists, across academia, government and industry. Richard and his students also apply concepts of large-scale magmatic activity learned on Earth to interpreting the surface features of Venus. The innovative science driven by Richard and colleagues has resulted in almost $1M CDN in successful research grant proposals in 2020 alone!

Richard completed his PhD in 1989 at Carleton University, Ottawa. Through the 1990's and early 2000's he worked at the Geological Survey of Canada in Ottawa. In the early 2000's, Richard established his consulting firm, Ernst Geosciences. From 2004 to 2011, he was an Adjunct Research Professor in the Department of Earth Sciences at Carleton, and in 2011 he was successfully nominated for a Scientist In Residence position in the Faculty of Science and Department of Earth Sciences at Carleton. In 2014, Richard was engaged as a Professor at Tomsk State University, Tomsk, Russia, where he is currently head of the TSU Laboratory of Geochronology and Geodynamics.

Richard has authored or co-authored over 200 papers in diverse research fields. His accomplishments include:

(a)Global mapping of giant dyke swarms.
(b)Linking of giant radiating dyke swarms to mantle plumes, and their important role in the plumbing system of LIPs.
(c)Continent and supercontinent reconstructions based on ages of magmatic units, the geometry of giant dyke swarms and paleomagnetism of dykes and sills.
(d)Large igneous province (LIP) research on the distribution and timing of these major magmatic events around the world, and modelling of LIP plumbing systems.
(e)Links between LIPs, mantle plumes and continental breakup. Richard has published numerous papers over the past 30 years which bear on these important links.
(f)LIP plumbing systems. Richard has worked over the past three decades on the various components of the feeder systems for flood basalt provinces.
(g)Ore deposit and hydrocarbon potential of LIPs and their plumbing systems.
(h)Links between LIPs, catastrophic climate change and mass extinction events.
(i)Geological mapping on Venus, especially the comparison of tectonomagmatic features on Venus and Earth
(j)Collaborations between academia, government agencies, and industry

Richard has established a group of collaborators from countries on nearly every continent on the planet, including Cameroon, South Africa, Australia, India, Morocco, the United Kingdom, Sweden, China, the United States and the Russian Federation.

Richard is author of the 2014 text “Large Igneous Provinces” published by Cambridge University Press (653 pages), which covers all aspects of this broad topic and has quickly become the standard reference source on LIPs for researchers around the world. Richard has been co-leader (2003-2013) and leader (2013-present) of the Large Igneous Provinces Commission (of International Association of Volcanology and Chemistry of the Earth's Interior, IAVCEI), which highlights research on LIPs through an ongoing series of on- line “LIP of the Month” articles by international scientists.

At Carleton University, Richard has assembled an enthusiastic and productive research team, including professors Claire Samson, James Mungall and Brian Cousens, that collectively co-supervise undergraduate and graduate students investigating all aspects of LIPs world-wide and on Venus. The work is supported from a variety of sources, including NSERC, the National Natural Science Foundation of China, the Russian Foundation for Basic Research, the Ministry of Education and Science of the Russian Federation, the Russian Science Foundation, the Swedish National Research Grant Agency, and a consortium of global mining companies.

Richard's contribution to student research at Carleton is significant: in the last seven years, he has supervised or co-supervised 10 BSc Honours, 9 MSc, and 9 PhD students. In addition, he has co-supervised PhD students at Tomsk State University in Siberia, Ibn Zohr and Cadi Ayyad universities in Morocco, and the China University of Geosciences in Beijing.

In summary, Richard Ernst is an international leader in the study of large igneous provinces and their applications to ore deposit research, continental reconstructions, igneous petrology and climate change. He has, and continues to, train a new cadre of geoscientists at Carleton University, Tomsk State University, and other academic organizations around the world. Richard is a superb collaborator and a prolific writer in a number of fields (many of which are novel) associated with LIPs. As such, Richard is an excellent candidate for a Career Achievement Award.

Brian L. Cousens, Carleton University and
Kenneth L. Buchan, Geological Survey of Canada

Acceptance letter

First of all, my deep thanks to the GAC-VIP and my nominators, Brian Cousens and Ken Buchan for the honour of receiving this Career Achievement award. I must say, that it feels a little awkward to receive such an award when there is (hopefully) still much exciting research ahead. I appreciate this award as an opportunity to reflect on the winding path of life and science to this point, including all the amazing opportunities a career in geosciences can provide, the many unexpected career turns, and to acknowledge dear mentors and valued colleagues along the way.

My career path started from study of regional dolerite dyke swarms particularly in the Canadian shield, their recognition as part of plume-generated Large Igneous Provinces (LIPs), helping expand the record of LIPs through Earth history including into the Archean, and exploring the role of LIPs: in continental breakup, formation of a range of economic deposits, climate change including mass extinctions and as planetary analogues. It now seems that plumes and their LIPs are as important as plate tectonics, in their influence on Earth's global geodynamic system. Carleton University has been my steady homebase throughout my career. I have also had long term associations with other universities, notably, Tomsk State University in Siberia.

I think back to the beginning of my scientific journey to my undergraduate supervisor at Wesleyan University (US), Jelle de Boer who instilled in me a love of adventure through his tales of remote field work. He encouraged my journey to Canada to the U. of Toronto for an MSc supervised by the visionary Henry Halls, who saw the importance of regional mafic dyke swarms at a time when they were considered to obscure more 'important' geology. My MSc on the Matachewan dyke swarm, was followed by a PhD on the 700 km long Great Abitibi dyke at Carleton University (mainly supervised by my mentor, Keith Bell). My research journey included working with another mafic dyke swarm pioneer Walter Fahrig (GSC). I was also thrilled to work with mentor Bob Baragar (GSC), and together we produced evidence (from magnetic fabric and geochemistry) for lateral emplacement of the famous Mackenzie dyke swarm. I also began my long >35-year fruitful collaboration with Dr. Ken Buchan (GSC), mainly on dyke swarms of Earth, and more recently those on Venus. There have been so many other key collaborators and friends on dyke swarm studies in key regions around the world-- to name a few: Dima Gladkochub (Siberia), Michiel de Kock (Kalahari craton), Peng Peng (North China), Rajesh Srivastava (Indian cratons), Wilson Teixeira (Amazonia), Mike Wingate (Australian cratons) and Nasser Youbi and Lenka Baratoux (West African craton).

In the 1990s Ken Buchan and I realized that these amazing regional dolerite dyke swarms in the Canadian shield and elsewhere, were in fact the plumbing system of LIPs, and contributed this idea as a chapter in the first major LIPs volume (AGU GM 100, 1997) edited by John Mahoney and Mike Coffin. Subsequently, I had the opportunity to work with Franco Pirajno (University of Western Australia) who introduced me to linking plumes, LIPs and ore deposits. This was followed by an opportunity to partner with a plumes/LIPs pioneer Ian Campbell (Australian National University) in co-leading the IAVCEI LIPs Commission from 2003-2013 and as solo leader since. Through this role I had the opportunity to help expand thinking on all aspects of LIPs, which I tried to summarize in my 2014 book on Large Igneous Provinces.

Interest from exploration companies in LIPs as targets for economic deposits of Ni-Cu-PGE and many other commodities, marked a turning point in dykes/LIPs research. In 2009-2010 myself, Wouter Bleeker (GSC), Mike Hamilton (University of Toronto), and Ulf Soderlund (Lund University), launched the LIPs Industry Consortium, which over the past nearly 14 years has included 12 major companies, with funding matched by NSERC, and a broad international team (including Kevin Chamberlain, Dave Evans, Simon Jowitt, Sandra Kamo, Jim Mungall, Julian Pearce, Sergei Pisarevsky, Rajesh Srivastava, and many other key colleagues). This engagement and support from industry has been a game-changer in global LIPs research, while providing our Industry partners new ideas and targets for exploration.

It has also been exciting (in collaboration with remarkable colleagues including Andrey Bekker, Hafida El Bilali, Nasser Youbi, and Shuanhong Zhang) to explore the role of LIPs in environmental/climate change, including mass extinction, toward fulfilling a dream of fully integrating every LIP with climatic changes recorded in the sedimentary record, and also developing lessons for modern climate change and global warming remediation. We (myself and Nasser Youbi) proposed that LIP ages can be a good proxy for 'golden spikes' in the sedimentary record (representing significant environmental/climatic changes) and thus useful for defining natural Precambrian time boundaries, as already recognized for the Phanerozoic.

Another area of interest to me is planetary LIPs and their link with plumes, particularly on Venus. I was initially inspired in the 90's through collaboration with mentor Jim Head and Eric Grosfils at Brown University, and further influenced through subsequent collaborations, including with Daniel Mege, Misha Ivanov and Claire Samson. Most recently this interest has included establishing (with my wife Hafida El Bilali and Jim Head) the International Venus Research Group (IVRG) which includes mainly students from four countries (Canada, Morocco, Russia and India) doing detailed geological mapping of 40+ areas on Venus to aid in targeting for the upcoming fleet of 6 separate space missions and also helping train the next generation of planetary mappers.

Through 40 years (and hopefully at least another decade) of work on dykes, LIPs and their economic, environmental and tectonic implications, several things stand out. What a gift it has been to experience so much of the world, both through conferences and remote field work, and the honour of working with so many talented colleagues. I am currently fortunate to have a wife and partner Hafida El Bilali who shares my life and my research interests. I am proud of her daughters (Sophia and Jihane), and Heather (my daughter), and greatly miss my son Justin who passed away in 2010.

To students, I wish you a wonderful career, and that you contribute important 'building blocks' to the amazing 'edifice' for understanding the world, called science, and also contribute to making life better for all. To my former and current students—I have been very proud to contribute to you finding your voices as scientists. It is a truism that doing research with enthusiasm and a sense of wonder infused with hard work can get you far, but be prepared for surprises and some setbacks along the way. Above all, savor your amazing journey through life.

Dr. Richard Ernst in Appreciation of Receiving the 2022 GAC-VIP Career Achievement Award

GEOLOGICAL ASSOCIATION OF CANADA
ASSOCIATION GÉOLOGIQUE DU CANADA

Volcanology field work across the western US: the ash project at INRS

Some of the members of the volcanology group at INRS in Quebec City – Pierre-Simon Ross, Grégoire Pasdeloup, and Sophie Leiter – were lucky enough to spend two months in the field this summer mapping tephra fallout sheets and collecting samples. Grégoire and Sophie were conducting field work for their PhD projects, which focus on using the size, componentry, morphology and textures of ash particles to understand the mechanisms of primary fragmentation in magmatic and phreatomagmatic eruptions. For this work we need ash from young, unaltered, basaltic volcanoes. We were able to combine our mapping and sample collection with some sightseeing and attending a conference. The hike to the top provides excellent views of the surrounding landscape dotted with lots of other cones and lava flows.

We started our whirlwind volcanology tour of the American West with Cinder Cone in Northern California. We spent a week digging ash pits and collecting samples. Cinder Cone erupted in 1666, blanketing the surrounding area in tephra. We used the pits to track the changes in thickness of the two main layers which represent different phases from the eruption with different eruptive styles. We also spent a day exploring Lassen Volcanic National Park and got to check out tons of excellent volcanic and hydrothermal features. Lassen Peak, the focal point of the park, erupted in 1918, and there are also excellent exposures of products from previous eruptions.

Following our work in Lassen we drove north and spent a day at Crater Lake on the way to Sisters, OR. We were all impressed by the views of the lake and excellent roadcut exposures. In Sisters we connected with Dr. Emily Johnson of the Cascades Volcano Observatory. Emily has previously done a lot of work at Blue Lake Crater, our next field site, and she helped orient us to the major facies and history of the eruption (and also helped dig a big pit!). Blue Lake Crater is a phreatomagmatic volcano that erupted ~3000 years ago. We spent the next three weeks digging more pits to refine Emily's existing isopach map and construct our own isopleth map (Fig. 1).

Fig. 1: Collecting samples from a pit along the dispersal axis at Blue Lake. We logged the layers, then sampled each layer, removing fully the layer above it, from the top down to ensure no contamination in samples.

We also collected a huge suite of samples to bring back to Quebec and analyze over the winter. The eruption produced surges and fallout from alternating magmatic and phreatomagmatic phases, giving us a varied sample suite to investigate. During our three weeks of field work we did also manage to take a day off to explore Belknap crater, a nearby small shield sitting between the Three Sisters and Mt. Jefferson.

We spent a brief week and a half at home in Quebec to rest and do laundry before jetting off to Arizona. Flagstaff, AZ sits adjacent to the San Francisco Volcanic field, a collection of ~600 volcanoes containing everything from scoria cones (Fig. 2) to stratovolcanoes.

Fig. 2:View of SP Crater, another monogenetic cinder cone in the San Francisco Volcanic Field.

We were there to study Sunset Crater, a misnomer because it's actually a scoria cone that erupted in 1085. Sunset Crater is an incredible site for investigating magmatic ash fragmentation as there is an expansive tephra sheet full of young volcanic ash. We spent several weeks adding to the existing isopach map and collecting samples for study in Quebec. We got some help digging an especially deep pit from USGS volcanologists Dr. Emily Johnson, Dr. Lis Gallant, and Dr. Kellie Wall (Fig. 3). As you can see from the photo we were grateful for the extra hands! Kellie and company are working on dating the lava flows (Fig. 4) in the San Francisco field. We also managed to take a quick field trip to the Grand Canyon to get a break from digging holes.

Fig. 3: Tephra pit ~8 km from the vent at Sunset Crater. There are five major units representing five phases of the Sunset Crater eruption and all were visible in this pit.

Fig. 4: Picture-perfect hornito near the base of Sunset Crater.

In the middle of our Arizona field work we spent a week at the AGU Chapman Conference on Distributed Volcanism. The goal of this meeting was to bring together scientists who work on distributed volcanism to share recent results and collaborate on a plan for the field going forward. We got to meet some great people and see some interesting talks and posters (Pierre-Simon gave a keynote on monogenetic volcanoes, their eruptive styles, and their hazards). The last two days of the week were spent on a field trip to the Springerville Volcanic Field led by Chris Condit, Larry Crumpler, and Jayne Aubele, who have all spent their careers mapping in the field. It was a great learning experience to be in this field with the people who know it best!

After two months of field work we were ready to return home and get some rest before organizing and analyzing a whole summer's worth of samples.

Sophie Leiter, PhD student

University of New Brunswick Earth Science fieldtrip to Montreal and Quebec City, August 02-07, 2022

During the first week of August, two undergraduate and six graduate Earth Sciences and Economic Geology students from the University of New Brunswick attended a field trip planned by the Society of Economic Geologist (SEG) UNB Student Chapter. The students along with faculty supervisor, Dr. David R. Lentz, travelled to the Montréal - Québec City region. The trip focused on the geology and petrology of this part of North America. The group travelled from Fredericton through New Brunswick into Quebec.

The le Bizard diatreme, le Saint Helene diatreme, and associated igneous diatreme breccias, Mount Royal, and the Oka Carbonatite Complex were visited. The field trip included a variety of strongly silica-undersaturated rocks intruding the carbonatitic complex, associated with the production of pyrochlore (niobium oxide concentrate), also containing rare earth elements (REE) and thorium, from 1961 to 1976. Leaving Montréal and heading to Québec City, we visited the Centre Historique de la Mine King and part of the Thetford Mines ophiolitic complex. This report focuses on the Monteregian Hills around Montreal (Oka Carbonatite Complex, Mount Royal Park, and le Bizard and le Ste-Hélne).

Igneous activity in Monteregian Hills is divided into a variety of magma types from silica undersaturated to saturated (Fig. 1).

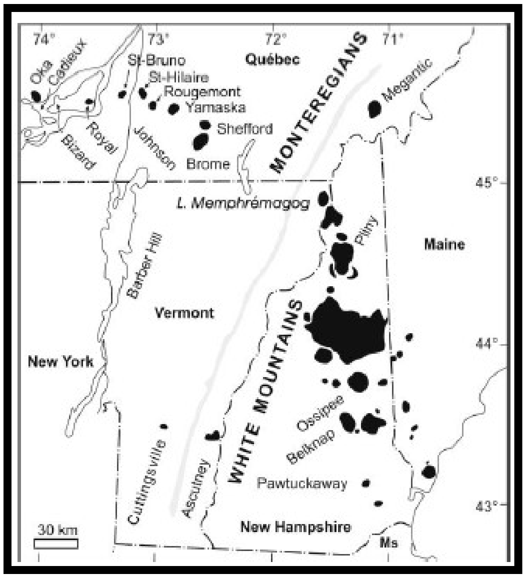

Fig. 1:Geological map of the White Mountains and Monteregian Hills (modified after Eby, 1987).

The first stop was the Oka Carbonatite Complex (45° 30' 0.10" N and 74° 1' 20.60" W). The Oka complex is hosted by Grenvillian metamorphic rocks and breccia pipes within the complex containing xenoliths of Paleozoic sediments including Utica Shale and Trenton Limestone (Fig. 2). The composition of this complex is divided into four groups: a) carbonatites, b) alnoite and alnoite breccia, c) melteigite-urtite series, and d) okaite series. Carbonatite in the Oka complex contains coarse-grained calcite-carbonatite (sovite) with accessory amounts of sodian augite, biotite, phlogopite, apatite, nepheline, monticellite, melilite, pyrochlore, perovskite, niocalite-wöhlerite-låvenite series disilicate, richterite, pyrite and pyrrhotite. In the NW end of the complex, dolomite-bearing carbonatites (rauhaugites) occur. These carbonatites locally become very micaceous containing phlogopite (Fig. 3). The Oka carbonatite complex represents one of the westernmost expressions of the Monteregian Petrographic Province. This province includes alkaline intrusive rocktypes (Eby, 1975). The silica content of the numerous intrusions increases eastward, with rocks in the western portion displaying a peralkaline trend (modal nepheline), whereas rocks in the eastern part displaying a nepheline-free trend. In the Oka area, diatremes, breccia pipes, and other features can be seen. According to Fairbairn et al. (1963), the collective Rb/Sr age of the province is 110 ± 20 Ma. The rocks in the Oka complex intruded into a Precambrian inlier composed of quartzo-feldspathic gneiss, granulites, anorthosite, and gabbro. Based on Sr isotope data (Powell et al., 1966), the alkalic rocks and carbonatites are comagmatic and the magma derived from the mantle and was emplaced with little contamination of crustal rocks.

Fig.2: Carbonatite phase examples of the Oka Complex in the vicinities of the former Oka mine.

Fig.3: Phlogopite in the carbonatite phase of the Oka Complex.

The group had the chance to see the Oka mine from a distance. The Oka mine was developed in a carbonatite (coarse- to fine-grained) -urtite-ijolite-jacupirangite intrusive complex in 1961 by the St. Lawrence Columbium and Metals Corporation company. The ore in this mine was used to make a concentrate of niobium oxide that also contained REE and thorium. Carbonatite magma is interpreted to originate from low-degree partial melting of the mantle. During the dynamic emplacement process, the carbonatite rocks and dykes rich in REE formed through the immiscibility of carbonate-silicate magma and fractional crystallization of carbonate minerals from carbonatite magma. Carbonate-rich rocks associated with diverse potassic or sodic peralkaline saturated to undersaturated magmas derived predominantly from metasomatized lithospheric mantle (Mitchell, 2005).

Visiting of Mount Royal Park (45°30' 1.50" N and 73° 35' 7.70" W) was one of the goals of this trip. In the Mont Royal stock and dykes, one phase of essexite with minor amounts of nepheline monzodiorite, settled into the limestones of the Trenton Group (Ordovician). The essexites include two 'gabbro' types, heterolithic pyroxenite-melagabbro and leucogabbro. The essexite contains xenocrysts of olivine wholly or partly enclosed in titanaugite megacrysts, surrounded by a matrix of plagioclase (oligoclase - andesine) with minor analcite sodalite and nepheline. Reaction of feldspathic groundmass with the megacrysts created subsolidus alkali titanian amphibole (titanian hastingsite or kaersutite) that co-exists with ilmenite or titanomagnetite. One of the features in the mafic dykes in this area is the existence of vesicles (Fig. 4).

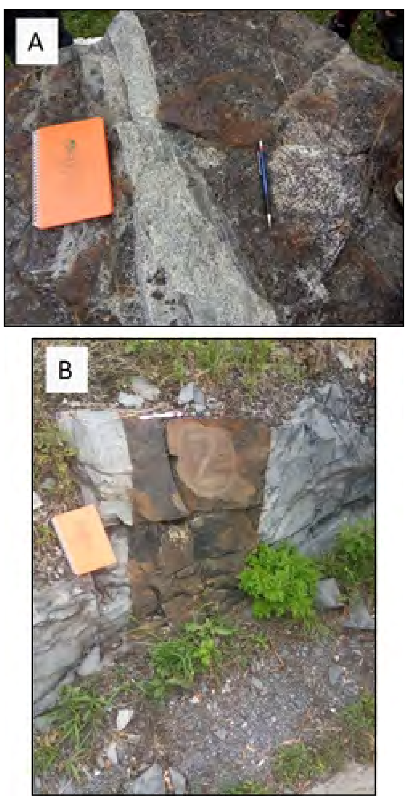

Fig. 4. A) Devitrification reactions on the surface of dyke; B) Mafic dyke intruding limestone in Mount Royal Park.

The next stop was Île Ste-Hélène (45° 30' 52.20" N and 73° 32' 2.30"W). The rocks include alkalic mafic dykes with Utica Shale and diatreme breccia (Fig. 5). The larger hill on this island in the St. Lawrence River is a diatreme breccia. The breccia contains a large variety of clasts including fossiliferous shale and limestone clasts with Devonian brachiopods. No igneous clasts have been observed in the Île Ste-Hélène diatreme breccia (Lentz et al. 2006).

Fig. 5: Polymictic diatreme breccia on Île Ste-Hélène.

A schematic cross-section of an erupting maar-diatreme volcano is presented in Fig. 6.

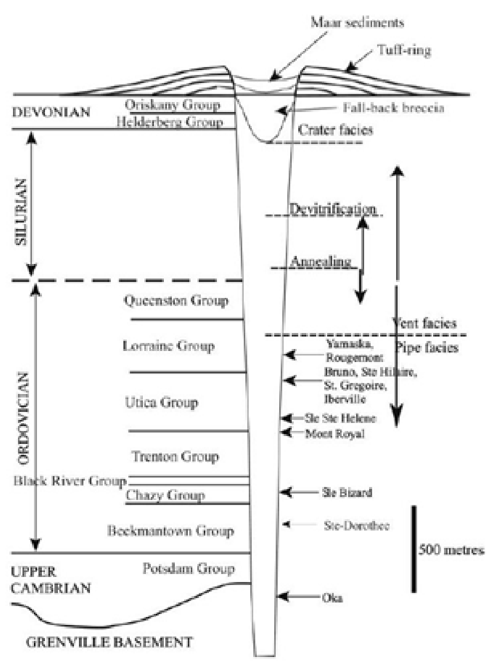

Fig. 6: Schematic cross-section of a diatreme breccia with the stratigraphy of the St. Lawrence lowlands and emplacement levels of the various Monteregian bodies (after Hawthorne, 1975).

The next stop was the Île Bizard Breccia (45° 23' 23" N and 73° 54' 26"W). The first map of Île Bizard Breccia was completed by Clark (1952). Marchand (1970) classified the rocks as kimberlitic. Mitchell (1979) suggested that they should be classified as alnoitic. A variety of ultramafic nodules occur in the alnoite including websterite, lherzolite and amphibole-clinopyroxene. The igneous matrix consists of serpentinized megacrysts of olivine and orthopyroxene and unaltered phenocrysts of clinopyroxene, phlogopite, and magnesian titanomagnetite in a fine-grained groundmass of serpentine, calcite, melanite, magnetite, and apatite (Fig. 7). Raeside (1978) discovered four types of igneous breccias: intrusive, densely porphyritic tuffisite, sparsely porphyritic tuffisite, and autholithic tuffisite. The breccias were intruded by an analcite phonolite. Heaman and LeCheminant (2001) obtained U-Pb ages for apatite, baddeleyite, perovskite, and melanite from the intrusive breccia. Based on the perovskite U-Pb data,the crystallization age for the alnoite was 139.9 ± 2.6 Ma.

Fig. 7: Angular fragments of limestone, sandstone, and gneiss in the Île Bizard Breccia.

Acknowledgements: The group participants are very grateful for the financial support of the UNB's Department of Earth Sciences McAllister Field Education Fund and Society of Economic Geologists (SEG), and Prof. David Lentz for leading the field trip.
Fazilat Yousefi, PhD student

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Leopold Gélinas Awards

Every year, the Volcanology and Igneous Petrology Division of the Geological Association of Canada presents three medals for the most outstanding theses, written by Canadians or submitted to Canadian universities, which comprise material at least 50% related to volcanology and igneous petrology. A gold medal is awarded for the best Ph.D. thesis, a silver medal for the best M.Sc. thesis and an antique copper medal for the best B.Sc. thesis. Nominated theses are evaluated on the basis of originality, validity of concepts, organization and presentation of data, understanding of volcanology and petrology, and depth of research.

PhD Award
Dr. Pier Paolo Comida
Institut National de la Recherche Scientifique, Québec (INRS)

Nomination letter

I would like to nominate Pier Paolo Comida for VIP Gélinas Gold Medal. His PhD thesis at Institut national de la recherche scientifique is entitled “Magma fragmentation and juvenile pyroclast shapes, with a focus on lava fountains”.

In brief, some of his scientific contributions are as follows:

·Pier Paolo played an important role in developing a standardized methodology to analyze juvenile pyroclasts in comparative studies of magma fragmentation. We hope that this method is adopted worldwide, which would make ash analyses comparable between different laboratories and different volcanoes, and would allow scientists to better determine the eruptive style of past eruptions based on their products;

·We now better understand fragmentation of magma in lava fountains based on his experiments involving remolten volcanic rocks and novel application of jet breakup theory to lava fountains;

· The same experiments, when compared with the eruptive products of natural lava fountains, allow the main physical and chemical factors that control pyroclast shapes in these eruptions to be identified.

The thesis is being published as a series of papers in Bull. Volcanol. and JVGR. Here is a quote from one external member of the jury at INRS that summarizes the thesis' qualities:

The scientific content of this dissertation covers some very relevant and actual topic in the field of explosive volcanic eruptions. On the one hand, textural analyses of eruption products are a prime tool to understand the eruptive dynamics of past eruptions, to monitor ongoing volcanic activity, and to assess the potential hazards from eruption products. On the other hand, experimental volcanology is key to access the inaccessible processes that drive the eruptions. In both cases the dissertation does an excellent job at pushing further the use of both innovative and consolidated techniques, setting up much-needed standardized protocols and providing new experimentally-based interpretations. Despite its large breadth in methodologies and scopes, the dissertation still retains a well-defined common thread and overarching goal, reflecting both the strong curiosity and depth of knowledge of the subject of the candidate and the effectiveness of the supervision. The scientific rigor in the dissertation is absolute, in the methodological procedures and data treatment alike.

The form of the dissertation is unquestionable, both in written text and figure layout. It was a real *pleasure to go through the dissertation, and I never had problems in evaluating methods or data, or in grasping the scientific message. Indeed, in many years of reviewing and editing for scientific journals, I rarely had to do so few editorial comments within three papers.*

Thank you for considering Dr. Comida's thesis for the Gold medal.

Regards,

Pierre-Simon Ross (Institut national de la recherche scientifique)

Acceptance letter

It is truly a great honour to receive the Léopold Gélinas Gold Medal, and I thank the Volcanology and Igneous Petrology Division of the Geological Association of Canada for selecting my PhD dissertation. This award constitutes a confirmation of all the hard work carried out in the last five years, reflecting my strong passion for volcanoes and a long lasting desire to become an experienced volcanologist.

This PhD project was fascinating and challenging under every aspect, focused on better understanding primary magma fragmentation during explosive volcanic eruptions through the investigation of morphological and textural features of juvenile pyroclasts. Exciting laboratory experiments involving fragmentation of actual magmas were carried out in Germany, allowing me to work with fantastic and renowned volcano researchers from several countries around the world. Beyond the project itself, the whole experience of living in Quebec for many years and to visit several countries along the way enriched me both as a person as much as a volcanologist. For all this and more, my utmost gratitude first goes to my supervisor, Prof. Pierre-Simon Ross at INRS, for selecting me first for the PhD project and then nominating me for this award. His long experience as a researcher, professional guidance and constant support throughout the project were essential, as testified by the quality of both thesis and related scientific publications. His mentorship made me a better scientist, and opened the way to many opportunities in the future. A genuine thank also goes to my many collaborators both at INRS and abroad, for the many improvements to several parts of the work.

Finally, I would like to thank my amazing partner, Jenny, to the constant support and love that kept me going in the difficult times. The same goes to my best friend Nicolò and all the other friends in Quebec and Sardinia. Thank you all for let me become the person I am today.

Sincerely,

Pier Paolo Comida

MSc Award
Gabrielle Jones
University of Alberta

It is our great pleasure to nominate Ms. Gabrielle Jones (Gaby) for the GAC-VIP Leopold Gélinas Medal for best M.Sc. thesis, titled: Implications of in situ zircon U-Pb, Lu-Hf, oxygen-isotope, and trace element geochemistry on the petrogenetic history of the northern Hogem batholith in the Quesnel terrane, north-central British Columbia, Canadian Cordillera.

Gaby's thesis was supported by an NSERC scholarship – a mark of her excellence as a student - and contributed to part of the BC Geological Survey's Hogem batholith mapping project, where she undertook bedrock mapping and collected samples for the study. At the University of Alberta, she undertook mineral separation, grain mounting, analyzed the samples and did all the data reduction. The resulting dataset is a remarkable contribution in understanding the evolution of a Cordilleran batholith. Gaby generated and interpreted a four-fold igneous zircon dataset that includes U-Pb, Lu-Hf, $\delta^{18}O$, and trace elements, in addition to testing titanite and apatite U-Pb and Sm-Nd, while also incorporating whole rock

rock geochemistry from all the intrusive units in the batholith. This is the first such comprehensive dataset from any igneous suite in the Canadian Cordillera. What makes this thesis stand out even more, likely having sustained impact on the research community, is that any one of the individual datasets (e.g., U-Pb zircon) contained within the thesis could have represented a single Master's thesis study. It is a testament to Gaby's drive and ingenuity that she successfully stitched these databases together to form a truly comprehensive thesis.

Gaby not only collected the diverse data but learned and applied the fundamental petrological techniques to properly understand, interpret, and present the results. She also worked on and learned the intricacies of sophisticated instrumentation including secondary ion mass spectrometry (SIMS), and LA-ICP-MS, including both sector field and multi-collector instruments, and application of single stream and split-stream lass ablation (LASS) analysis. A mastery of these techniques is evident throughout the thesis, supported with exceptional figures; for example, zircon εHf and δ^{18}O modelling of the evolution of the batholith, and estimation of oxidation state and crystallization temperature of each intrusive suite.

A key outcome of the study is that the Hogem batholith, in central Quesnel terrane evolved over 8 million years (>2 to 125 Ma), from early mantle-derived magmas that are synchronous to igneous suites that host porphyry-Cu deposits, to later crustal-derived melts, including identification of magmatism during a Cordilleran-wide magmatic gap. The data and interpretation indicate that ancient basement played no role in the genesis of magmas in the central Quesnel terrane, even after accretion to North America; Quesnel terrane cannibalized its own crust. The Quesnel terrane hosts abundant Late Triassic-Early Jurassic porphyry-style Cu mineralization and the results provide a baseline to evaluate this porphyry environment in the accreted terranes. Further, this study has fundamental bearing on tectonic interpretation of accreted terranes in the Cordillera and accretionary orogens in general. Some of this work has now been published as part of BC Geological Survey Fieldwork papers, and data included in supporting Geofiles. Incorporation of the data within two journal articles is underway, with submission – to leading international journals - expected in the coming months. This comprehensive study will stand as a benchmark for future research to test against.

Gaby Jones's combination of bedrock mapping of a rugged and remote location in the Canadian Cordillera, state-of-the-art geochemical measurements and theoretical modelling has produced an exceptional thesis, far beyond the "norm". The public / industry interest in the results has been extraordinary. We recommend this thesis for your award without hesitation.

Graham Pearson (University of Alberta)
Luke Ootes (British Columbia Geological Survey)

Acceptance letter

I am humbled and grateful to receive the Leopold Gélinas Silver Medal from the Volcanology and Igneous Petrology Division of the Geological Association of Canada. Firstly, I would like to thank my supervisor at the BC Geological Survey, Luke Ootes, for nominating me for this award. Completing my MSc under the supervision of Dr. Graham Pearson and Luke Ootes was an incredibly rewarding experience and their mentorship helped me take massive strides in becoming a better geologist. Not only did they help me develop and hone my skills in the field, research, and writing, but they kept me on track during a global pandemic. I would also like to thank the research staff at the University of Alberta, especially Dr. Adrien Vezinet, Dr. Yan Luo, and Dr. Richard Stern, for their support and insight on this project and for keeping the labs running. Thanks to everyone who has contributed to the BCGS Hogem batholith mapping project over the last several years. I am grateful for financial support provided by the BC Geological Survey, the Diamond Exploration Research Training School (DERTS), NSERC, and Geoscience BC.

Thank you again to GAC-VIP for this award,
Gabrielle Jones

BSc Award
Kathleen Clark
Dalhousie University

I am very pleased to submit the B.Sc thesis entitled "Trace element geochemistry of biotite from the Scrag Lake and New Ross plutons of the South Mountain Batholith, Nova Scotia, Canada: Implications for magma differentiation" by Ms. Kathleen Clark for consideration for the Gelinas Bronze Medal.

The important question addressed by the thesis is: Is there a geochemical distinction between the early (Stage 1) and later (Stage 2) intrusive phases of the South Mountain batholith (SMB; Nova Scotia) that can be traced in the chemistry of biotite? Although the major element geochemistry of the early and late SMB intrusive phases are remarkably similar, initial results had suggested that the biotite from Stage 2 intrusions recorded a significantly greater extent of differentiation, as gauged by the levels of highly incompatible elements, such as tantalum. This is an interesting result, given that Stage 2 plutons are the predominant host of incompatible element (i.e., Sn, U) related mineralization, so perhaps there is a causative link between the two. The initial observations of trace element variation were based on point analyses of the biotite, and there was a potential bias in the dataset to move evolved Stage 2 samples, and less evolved Stage 1 samples.

Kathleen's task was to fill the Stage 1 "compositional gap" in terms of measurements on more evolved samples, and also to document the spatial variation in trace element concentrations by developing the mapping routine with the Iolite 4.0 software. Kathleen did an outstanding job of accomplishing these tasks, which were done carefully and with a high level of independence. As Iolite 4.0 is a completely new interface compared to previous versions, Kathleen's first task was to learn how to use the mapping routine; soon she had not only done this, but also written a comprehensive user guide. She also became an independent operator of our LA-ICPMS, and was able to start and tune the instrument, and acquire data on her own. All the while, Kathleen was making careful observations and documenting the sample textures, both with the petrographic microscope and electron microprobe. Kathleen was able to document several distinct zoning patterns, which she attributed to a variety of factors, that include "normal" fractional crystallization, a possible component of fluid interaction, as well as magma recharge. The unusual oscillatory zoning in Ba and Ga from some samples was a surprise, and she was able to work out a plausible scenario for its origin by a past event of K-feldspar dissolution. Importantly, she was also able to confirm that the compositional distinction between Stage 1 and Stage 2 biotites is robust, although the origin of these differences is still somewhat enigmatic. My experience with honours students is that after the data acquisition stage, they often run out of time/energy to develop a meaningful interpretation of their data. This was not the case with Kathleen, and she was able to think more deeply about her results and come up with models that satisfied the observations.

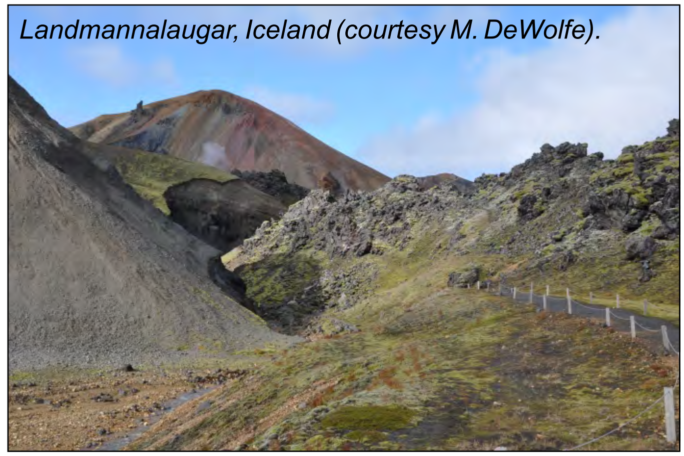
I certainly hope that the committee will agree that Kathleen's thesis is worth of the Gelinas Bronze Medal, as it represents a very novel contribution to understanding trace element behaviour during magmatic differentiation, and further confirms the unusual differences between the different intrusive phases of the South Mountain Batholith.

Yours sincerely,
James Brenan (Dalhousie University)

Acceptance letter

It is a huge surprise and honour to receive the Léopold Gélinas Bronze Medal! I would like to express my gratitude to the Volcanology and Igneous Petrology Division of the Geological Association of Canada for taking the time to look at my undergraduate thesis and for awarding me this medal. This thesis was a lot of work, and I would like to thank my supervisor Dr. James Brenan for

his guidance throughout the project. I would also like to extend this thanks to James' graduate students, who all provided help or guidance at one point or another while I worked on my thesis. I would also like to further extend my gratitude to the rest of the faculty, staff, and students of the department of Earth and Environmental Sciences at Dalhousie; so many of you provided help, inspiration, or encouragement over the past year. I would also like to gratefully acknowledge the Nova Scotia Department of Natural Resources and Renewables Mineral Resources Development Fund for the financial support for my thesis. Finally, I would like to thank my family and friends for their invaluable support along the way.
Kathleen Clark



Landmannalaugar, Iceland (courtesy M. DeWolfe).

VIP Awards Reminders

The Career Achievement Award - the deadline is 15 March 2023.

The Gold Gélinas medal for an outstanding PhD thesis in the fields of volcanology and igneous petrology - the deadline is 15 March 2023.

The Silver Gélinas medal for an outstanding MSc thesis in the fields of volcanology and igneous petrology - the deadline is 15 March 2023.

The Bronze Gélinas medal for an outstanding Honours thesis in the fields of volcanology and igneous petrology - the deadline is 15 April 2023.

Please send all nominations to zsuzsannamagyarosi@gov.nl.ca.

GEOLOGICAL ASSOCIATION OF CANADA
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Upcoming VIP sessions at GAC-MAC Sudbury 2023

GAC MAC SGA 2023 SUDBURY

Special session (SS18) focused on iron-rich critical metal systems at the GAC- MAC-SGA Joint Annual meeting in 2023

Working with metasomatic or magmatic iron-rich mineral systems with IOCG and IOA deposits, nelsonites, ferrocarbonatites, or magnetite-cumulates? Exploring for them? We would like to draw your attention to a special session at the 2023 GAC-MAC-SGA joint annual meeting that targets these controversial and puzzling deposits and how they precipitate critical and precious metal resources. Please join us for special session SS18: Iron-rich Au, Ag, Bi, Co, Cu, F, Mo, Nb, P, Pb, REE, U, Zn, PGE Mineralization: Genetic Processes and Feedback Mechanisms between Magmatism and Metasomatism

About the session: In recent years iron-rich mineral deposits and mineral systems that can contain abundant iron oxide (e.g. IOCG-IOA and host metasomatic iron and alkali-calcic systems, nelsonites, Fe-carbonatites, magnetite-cumulates, etc.) have become an increasingly important exploration target for critical metals and other commodities key for a greener future. However, these systems are enigmatic in that they occur in a spectrum of geologic and tectonic settings, but commonly share unusual mineralogical and textural features and extremely iron-rich chemistries that can be expressed by the abundant formation of iron oxides, iron silicates, iron sulfides, and iron carbonates. The shared iron-rich nature might suggest a common process driving the availability and mobility of iron and critical metals, as well as the stability of the host mineral phases during metasomatism. However, consensus is lacking, and the answers may not be unique.

Genetic models for these systems invoke a wide range of contrasting magmatic and metasomatic processes, and key questions regarding the dominance of and/or feedback between processes on the system and deposit scales pervade. Moreover, recent research suggests the potential involvement of a range of fluid types in iron- and critical metal-rich systems that are distinct from the silicate melts and aqueous chloride solutions typically involved in the formation of conventional base- and precious-metal resources. Taken together, these factors underpin a vigorous and wide-ranging contemporary debate focused on the formation of a spectrum of iron- rich deposit types that represent a frontier of ore deposit research.

In this session we aim to highlight how iron-rich mineral deposits and mineral systems, including those with abundant iron oxides, precipitate a wide range of critical and precious metal ores, notably Au, Ag, Bi, Co, Cu, F, Mo, Nb, P, Pb, REEs, U, Zn, and/or PGEs, and explore potential intersections between magmatism and metasomatism in their formation. This session will also explore the ultimate source of iron enrichment in theses systems and the factors driving their formation from crust to mantle. We invite talks focused on the field geology, metallogeny, petrology, mineralogy, geochemistry, and fluid/melt evolution of iron oxide deposits and mineral systems at the lithosphere scale and beyond. Please consider submitting an abstract to our session and we look forward to seeing you all at GAC-MAC-SGA 2023 in Sudbury!

If you have any questions, comments, or suggestions please feel free to contact the session chairs: Wyatt Bain (wmbain@lakeheadu.ca), Louise Corriveau (louise.corriveau@nrcan- rncan.gc.ca), and Jean-François Montreuil (jfmontreuil@macdonaldmines.com).

Upcoming VIP sessions at GAC-MAC Sudbury 2023

Special Session (SS26): "Rare Metals in Igneous Systems"

Chairs: Zsuzsanna Magyarosi (GSNL), Nadia Mohammadi (GSC), Zeinab Azadbakht (OGS), Tarryn Cawood (GSC), Anne-Aurélie Sappin (GSC)

Description: In January 2021, the Government of Canada released a list of 31 critical minerals to secure key supply chains necessary for Canada and its allies. Rare metals, such as REEs, Y, Nb, Li, Cs and Ta, play an important role in Canada's transition to a low carbon economy and are included on this list. In this session, we welcome contributions that highlight advanced methods of targeting rare metals prospective regions and address their genesis, geochemistry, geochronology, mineralogy, and metallurgy with special emphasis on their economic aspects within various igneous systems.
Keynote speakers: Anthony Williams-Jones (McGill University) and Bob Linnen (Western University)