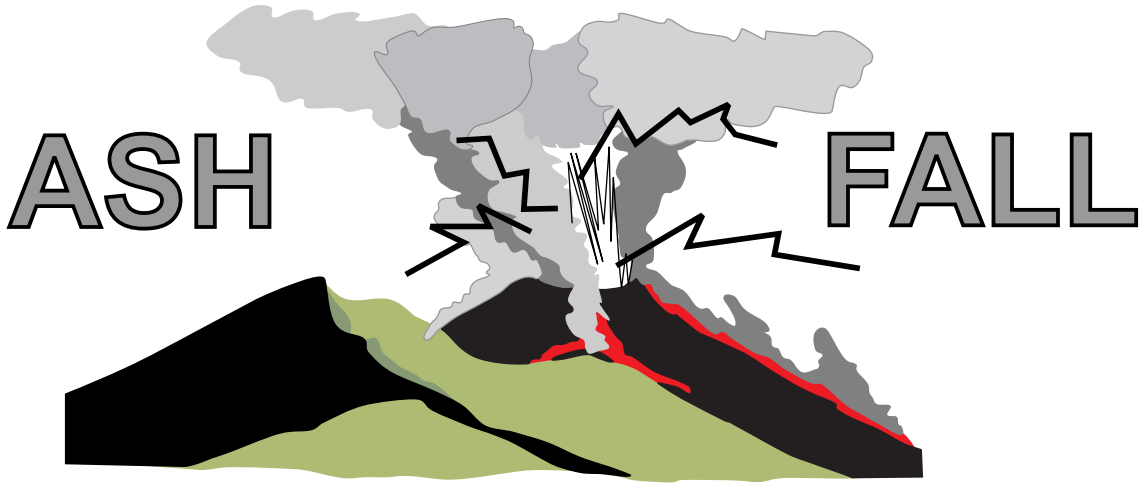


Newsletter of the Volcanology and Igneous Petrology Division
Geological Association of Canada

No. 83 February 5, 2021

In this issue

A message from the VIP Chair

In this final year as Chair of the VIP Division (May 2021), I will be leaving with mixed feelings, but am very hopeful for the future of VIP within GAC; we keep building momentum. The year 2020 started out with considerable promise with the planning of many sessions for the Calgary meeting and cycling up in terms of the advertising. The Atlantic Geoscience Society Colloquium (Feb 2020) had a session entitled Structure, Tectonics, and Magmatism of the Appalachian-Caledonides from Iapetus to Pangea that was quite well attended. Also in February the Newfoundland and Labrador Division of GAC's meeting included a Special Session in honour of Charlie Gower entitled Tectonics and Mineral Potential of Proterozoic Orogenic Belts with many great talks in this and other sessions. However we really got started this year learning to pivot like we never anticipated in March and this began with our virtual talks (webinars) beginning in April that resulted as a response to Covid lockdowns; overall we had 15 presentations (all well attended) covering a wide range of igneous-related subjects in 2020 and had two in January 2021 with several linked this winter to our next AGM; these are all listed on our VIP website under Webinars. We thank the Mineral Deposits Division of GAC for co-hosting quite a

few of these with VIP; a great tag team for those with discipline crossover interests. One such presentation was by Sarah-Jane Barnes (UQAC) in honour of Tony Naldrett (U of T).

Several Special Sessions and a general session were organized by our members and held virtually at the 2020 Geoconvention (in September): 1) Advances in Microanalytical Methods in the Study of Economic Deposits Chaired by Ian Coulson & Katharina Pfaf, 2) (2) Critical Metals and Raw Materials: research, exploration, and production Chaired by Tania Martins (MGS), Lee A. Groat UBC), Robert Linnen (Western), myself (UNB), (3) Fluid and Melt Inclusions Chaired by Matthew Steele - MacInnis (U of A), Pilar Lecumberri - Sanchez (U of A), Wyatt M. Bain (U of A), Vanessa Elongo, Ben Tutolo, & Simone Pujatt, (4) Mineral Chemistry and Igneous Processes Chaired by Zeinab Azadbakht (OGS) & Shannon Zurevinski (Lakehead), & (5) Volcanology, Igneous, Petrology, Geochemistry Chaired by Xueming Yang (MGS) & myself David Lentz (UNB). A field trip was also planned to the Crowsnest Volcanics by Robin Adair (UNB), which unfortunately could not be virtual; I am sure Robin will make this happen in the near future as there is an incredible story there. Thanks to all the co-chairs and contributors for bringing all that success to a Virtual Calgary meeting.

This coming GAC meeting has several special sessions planned as well; 1) Magmatic-hydrothermal Systems though Time, with co-chairs; Lucie Mathieu (Université du Québec à Chicoutimi), Michel Jébrak (Université du Québec à Montréal), Matthew Leybourne (Queen's), Bertrand Rottier (Laval), Nadia Mohammadi (Carleton), 2) Diamonds in Cratons, Diamond-bearing rocks, and mantle xenoliths, with cochairs Song Gao (Western University), Roberta L. Flemming (Western University), and Carl Ozyer (GSC - Calgary), 3) Melting, Crystallization, Melts, and Glasses with cochair Grant Henderson U of T), 4) Volcanology, through time and space cochaired by Stephan Kolzenburg (University of Buffalo), Michelle DeWolfe (Mount Royal University), Kim Berlo (McGill), Kelly Russell (UBC), Donald B. Dingwell (Ludwig-Maximilians-University Munich), 4) Advances in Marine Geology and geodynamics and their Application to Understanding Modern and Ancient Seafloor Metallogeny cochaired by Alan Baxter (University of Ottawa), Margaret Stewart (Mount Royal), Melissa Anderson (University of Toronto), Mark Hannington (University of Ottawa), and 5) a General Session on Contributions in Igneous and Metamorphic Petrology cochaired by Chris Yakymchuk (Waterloo) & John Greenough (UBC). There are many other sessions that I am sure will be of interest as well.

We are still looking into building an Atlas of Igneous Textures, with an emphasis on Canadian examples, so please pass this around, as there will be a call for contributions in the near future. I thank Donnelly Archibald (StFX, Secretary-Treasurer) for all his help over the past year and at our last AGM held virtually. Pete Hollings (Lakehead) has kept the website up for us as well. Zeinab Azadbakht (OGS) has helped posting some of those VIP webinars and looking after our Outreach on our Facebook site that remains active and populated also with the help of Shae Nickerson (Acadia). Thanks again to all our active regional councillors for their help and others who have helped adjudicate the three thesis awards (medals) and the Career Achievement Award as well; very much appreciated.

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 to spread the word about this GAC Division. Hope to see you in London! However, we invite you to the AGM in May and any other virtual events between now and the November 2021 GAC meeting!

David Lentz (2019-2021 VIP Chair)

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. John D. Greenough for his lifetime scientific contribution to the fields of Volcanology and Igneous Petrology

Nomination Letter

We are pleased to nominate Dr. John Greenough for the Career Achievement Award offered by the Volcanology and Igneous Petrology Division of the GAC. John has conducted research centered on the fields of volcanology, igneous petrology and geochemistry for 37 years. This corpus of work is breathtaking in its breadth and quality. His early work, initiated during his PhD research at Memorial Univeristy of Newfoundland, focused on the geochemistry of mafic volcanic rocks in Atlantic Canada. He didn't restrict himself to establishing traditional petrotectonic models for the genesis and significance of these rocks, but focused on novel aspects of their geochemistry, notably the role of volatiles on differentiation, the effects of assimilation on their isotopic signatures, emplacement mechanisms and flow direction indicators, and PGE content. He was the first to undertake dating of baddeleyite (Zr oxide), now routinely used to determine the age of mafic rocks lacking zircon. John didn't restrict himself to investigating mafic igneous bodies, but also worked on suites of xenoliths that occur in some, notably fragments of gneissic rocks in lamprophyres in Nova Scotia that he postulated represented the basement to the Meguma terrane. This inference has since been confimred by the O isotopic composition of granitoid rocks in southern mainland Nova Scotia. Not surprisingly given his interest in mafic rocks, John has contributed to our understanding of the mantle sources of various types of basalt, notably OIB.

A decade after completing his PhD studies, John extended his research program to include a variety of other media besides rocks. After setting up an Earth Sciences program at Okanagan University College (now UBC-Okanagan), in the centre of British Columbia's wine country, John tackled the complex problem of establishing geochemical signatures for different types of wine, as a means of confirming provenance and therefore authenticity on the one hand, and flagging those containing, or wholly consisting of, wines not produced from sources of grapes as indicated on the labels. This required him to master exploratory statistics, notably mulit-dimensional scaling, an approach that he subsequently applied to petrological studies as well as lithic and ceramic archaeological ceramics and even maple syrup!

John has continued an active and influencial research program, mentoring large numbers of thesis students while his Department at UBC-Okanagan grew, despite having heavy administrative responsibilities. He brokered and set up the Fipke Lab, which continues to expand in the range of data that it provides, including most recently (autumn 2019), Pb isotopic ratios of feldspars in granitoid rocks. He also served two terms as Editor-in-Chief of Canadian Journal of Earth Sciences. He has published over 100 papers in refereed journals, mostly as first author. This include many tier one periodicals (e.g., Journal of

Petrology, Contributions to Mineralogy and Petrology, Lithos, Geochimica et Cosmochimica Acta, among others).

We conclude that Dr. John D. Greenough is most worthy of being awarded the GAC's Career Acheivement Award.

Jarda Dostal and J. Victor Owen
Department of Geology, St. Mary's University
Halifax Nova Scotia

Acceptance letter

Considering the stellar international stature of past recipients, it is amazing to be the 2020 recipient of the GAC's Volcanology and Igneous Petrology (VIP) division Career Achievement Award. I express appreciation to my nominators and to the VIP for this great honour. Whatever I accomplished over the course of my career, nothing would have been possible without the help and support of more people – relatives, colleagues and friends – than I can name here. Collectively, their names would fill an issue of Ashfall, so here is a "short list"; I apologize for those omitted. First and foremost, I thank my parents, Russel and Adelaide, who instilled in me a love of science and gave me a fabulous education. My sister Helen, and her husband John, have been my mental "rock" and they housed and fed me for 35 years when I was in Halifax doing research.

Inspirational professors include Harold Nathan and Sandra Barr (undergraduate), Keith Bell (M.Sc.) and Steve Papezik, Brian Fryer and Henry Longerich (Ph.D). Henry encouraged my discovery of exploratory statistics (multi-dimensional scaling) and co-authored the first research papers on agrifood biogeochemistry. The many lithic, geochemical-archaeology papers with Leanne Mallory are amongst my most-cited and they helped develop data preparation methods for using exploratory statistics in petrology. Brian Fryer's Memorial and University of Windsor groups graciously gave access to world-changing ICP-MS analytical techniques that yielded novel papers on OIB PGE geochemistry, agrifood biogeochemistry, geochemical archaeology, and gold trace element geochemistry. Tom Krogh and Sandra Kamo (U of T) collaborations led to the first terrestrial baddeleyite date and the discovery of perhaps the largest layered mafic intrusion (Suwar) in 50 years. Work with Jarda Dostal sparked a fascination with mantle component geochemistry/evolution that has been the focus of my research for twenty years. The work also enabled dabbling in planetary geology.

There have been many B.Sc. honors and graduate student M.Sc. publications but Mikkel Tetland's ground-breaking work on a gold reference standard stands out. Saving one of the best for last, I owe Victor Owen a debt of gratitude because I published more journal papers (igneous and metamorphic petrology, geochemical archaeology) with him than with anyone else. Circa 1990, Murray Roed invited me to help write and/or edit the best-selling books on the geology of the Okanagan Valley. These have generated a $100,000.00 scholarship endowment and garnered him the GAC's E.R. Ward Neale Medal.

Throughout the Okanagan, there are teachers, naturalists, rock hounds and professional geoscientists, who know of me from these books. I am perhaps most proud of the group effort with Jeff Curtis, Ian Walker and Yuan Chen that created the OUC Earth and Environmental Sciences Department, and ultimately a B.Sc. degree program, during a time when "geology" was not a popular word. Astrid Blodgett was the Editorial Assistant god-send who enabled my thirteen year stint as Associate Editor, and ultimately Editor, of CJES.

Fortuitously, in 1990, I met my friend Charles Fipke, the greatest Canadian exploration geologist of our time. His vision in 2003 allowed us to design and build the Fipke Laboratory for Trace Element Research (FiLTER) with support from UBC O. Critically, in recent years, Kyle Larson supplied a raft of graduate students and gave the lab new initiative. The brilliant technical expertise of Burt Mueller and David Arkinstal set up and productively-operated the multi-instrument lab, and today Mark Button and Sudip Shrestha are making it jump. All these wonderful friends, their families, and my dear friends the Bakers, helped in another way; they enriched the life of my precious 15-year old daughter, Catherine, as we brought her along on the thrilling geoscience joy ride. I am proud that one of her earliest words was "salt" which she remembered for 4+ months after hearing it because basalt is Daddies favorite rock.

To summarize, I express my heartfelt appreciation to VIP for this prestigious award and thank the collaborators, students, friends and family members who helped give me this rewarding life and career.

John Greenough
University of British Columbia, Okanagan

Fluorite in the St. Lawrence area was discovered in the early 1800s by local residents. Before 1870, it was mined possibly by French settlers, then intermittently by various companies between 1933 and 1991 (Smith, 1957; https://canadafluorspar.ca). Canada Fluorspar Inc. (CFI) resumed mining operations in 2018 on the recently discovered AGS deposit, which is currently the only operating fluorspar mine in Canada (https://sead.nrcan-rncan.gc.ca). Fluorite in the AGS area was known in the 1940s as the Grebes Nest occurrence, but no significant mineralization was found until 2013, when CFI completed geophysical surveys followed by drilling, which led to the discovery of the deposit. In 2014, the estimated resource at the AGS deposit was 9,389,049 tonnes at 32.88% fluorite (NI 43-101 compliant; Sparkes and Reeves, 2015). Despite the long history of mining, the geology of the fluorite veins and surrounding rocks are not well understood.

There are over 40 known fluorite veins in the area ranging up to 30 m in width and 3 km in length (Reeves et al., 2016). Most of the veins are hosted in the St. Lawrence Granite (SLG). The AGS deposit is considered unique in the St. Lawrence area because it is the first economically significant fluorite deposit not entirely hosted in the SLG. The discovery of the AGS deposit questioned the existing genetic models for the fluorite mineralization, and further expanded exploration into the surrounding rocks.

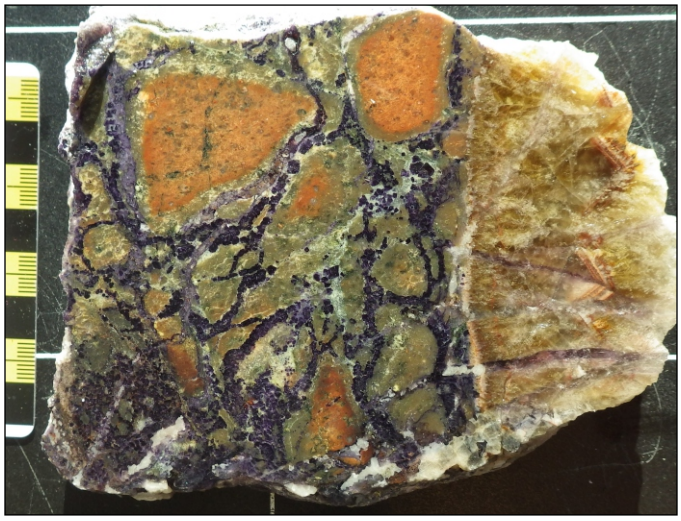


Figure 1 Stockwork veins of purple and yellow fluorite

The AGS deposit is hosted in clastic sedimentary rocks and the AGS porphyritic granite sills, a phase of the SLG, intruding them (Sparkes and Reeves, 2015). Drilling by CFI revealed that the AGS area is underlain by the main SLG, approximately 250 to 300 m below the surface, and the fluorite veins continue into the main granite suggesting that the fluorite mineralization is related to the underlying granite. Although the mineralogy, texture and structure of the AGS deposit is broadly similar to the granite-hosted deposits, differences include higher amounts of calcite and sulphide and the presence of green and blue fluorite in the AGS deposit. The deposit is hosted in a sinistral strike-slip fault composed of several phases of fluorite, typically brecciated, with the later phases cementing earlier phases. Local extensional zones host high-grade mineralization. This indicates brittle conditions with high fluid pressure according to the “fault-valve” model described by Sibson et al. (1988).

Figure 2: Reddish grey fluorite

Fluorite mineralization is divided into three stages, and further subdivided into 10 phases. The early stage comprises barren breccia, purple fluorite and fine-grained fluorite alternating with bands of yellow coarse-grained fluorite, locally changing to a layered hematite–fluorite–quartz phase (Figure 1). The main stage consists of massive reddish grey fluorite (Figure 2) and massive elongated grey to light pink fluorite, separated by an approximately one cm thick fine-grained layer of sulphides composed of sphalerite and minor galena (Figure 3). The late stage comprises octahedral green fluo-

rite followed by cubes of blue or clear fluorite and quartz with trace pyrite and chalcopyrite on top (Figure 4). Fluid inclusion analyses indicate homogenization temperatures ranging between approximately 89 and 183 °C and salinity ranging between approximately 9 and 27 wt. % NaCl equivalent (Magyarosi et al., 2019). Eutectic temperatures indicate the presence of $CaCl_2$ and other unidentified salts in addition to NaCl.

The SLG is one of the highly evolved Devonian granites in Newfoundland, which are associated with various types of mineralization including fluorite, Cu–Mo, Sn–W and Pb–Zn. These granites were emplaced during the late stages of the Acadian Orogeny (Kerr et al., 1993a, b; Kellett et al., 2014 and references therein). The SLG is an A-type, peralkaline to metaluminous granite. It intruded along ~N-trending structures and is composed of several phases based on variations in mineralogy, texture and geochemistry. Fluorite veins occur in most phases, but economic quantities of fluorite are only associated with the southern part of the E lobe, which is the only peralkaline phase, and the phase underlying the AGS area, which is either part of the E lobe or similar to it. The SLG intruded at shallow levels suggested by the abundance of porphyritic sills and dykes, presence of miarolitic cavities, tuffisites, undercooling features such as dendritic feldspars, epithermal nature of the fluorite veins (texture and temperature), and the association with the Rocky Ridge Formation, interpreted as the volcanic equivalent of the granite (Williamson, 1956; Teng and Strong, 1976; Kerr et al., 1993b). In the peralkaline phase, the top of the intrusion is towards the south suggested by the increase in the abundance of most of these features towards the south. Dating with U-Pb in zircon yielded 374 ± 2 Ma for the E lobe (Kerr et al., 1993b) and 377 ± 1.3 Ma for the AGS porphyry (Magyarosi et al., 2019). The slightly older age of the AGS porphyry suggests that it separated early, intruded at shallow levels and cooled faster than the rest of the SLG.

The peralkaline phase of the SLG is equigranular and consists of mainly quartz, perthitic feldspar and up to 5% mafic minerals consisting of sodic amphiboles (arfvedsonite to ferro-fluoro-eckermannite) and aegirine. The AGS porphyry consists of quartz and feldspar phenocrysts in a groundmass of the same minerals with chlorite as the only mafic mineral. Alteration in the peralkaline phase ranges from moderate to strong and the degree of alteration increases towards the south. Alteration includes albitisation, arfvedsonite altering to aegirine + magnetite or quartz + hematite ± chlorite, magnetite altering to hematite and calcite replacing quartz, which occurs only in the southern part of the granite. In the AGS porphyry, K-feldspar is altered to sericite around the fluorite veins and chlorite may be alteration after biotite. The most strongly altered areas are composed of mainly albite and calcite. A detailed study by Strong (1982) in one of these areas suggests that fluids were trapped in the granite causing autometasomatic alteration.

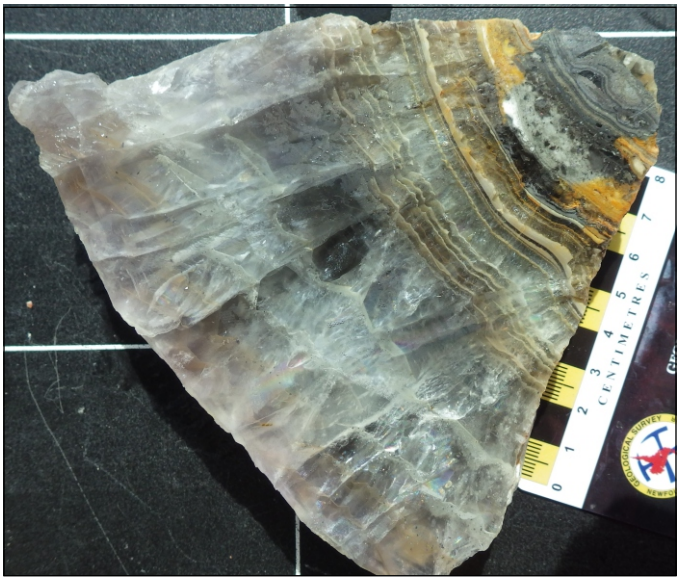


Figure 3: Elongated grey to light pink fluorite with a layer of fine-grained sulphides composed of sphalerite and minor galena

Fluorite mineralization and alteration were the results of volatiles exsolving and moving towards the top of the granite, suggested by increasing both, the degree of alteration and the amount of fluorite mineralization towards the south, representing the top of the granite. Volatiles included F, Cl, C and water. There is evidence for the presence of two fluids. The first fluid was responsible for the formation of the fluorite veins. Volatiles in this fluid included F, Cl, C and water, based on the vein mineralogy and fluid inclusion studies. This fluid was initially a vapour phase, suggested by the presence of tuffisites and miarolitic cavities (Candela, 1997). Quartz and fluorite in the miarolitic cavities suggests that F was in the vapour phase and was transported as mostly SiF_4 complexes, which is a gas and typical in dry peralkaline granites (Dolejš and Baker, 2004, 2007; Dolejš and Zajacz, 2018). The second fluid

was responsible for the late alteration in the SLG dominated by calcite. This was a denser liquid that could not leave the granite. The increasing degrees of alteration towards the south indicates that this fluid migrated along the upper contact of the SLG towards the top. Strongest alteration is in the cupolas, the highest points in the granite, where the fluids accumulated. This fluid was rich in C, but relatively poor in F, suggested by the abundance of calcite and the lack of fluorite in some of the strongly altered autometasomatized areas. The origin and evolution of the fluids is uncertain, but the F-rich vapour formed earlier and/or travelled faster than the denser liquid, suggested by the late nature of the calcite alteration and the widespread albitisation indicating early volatile loss from the system (e.g. Pirajno, 2013).

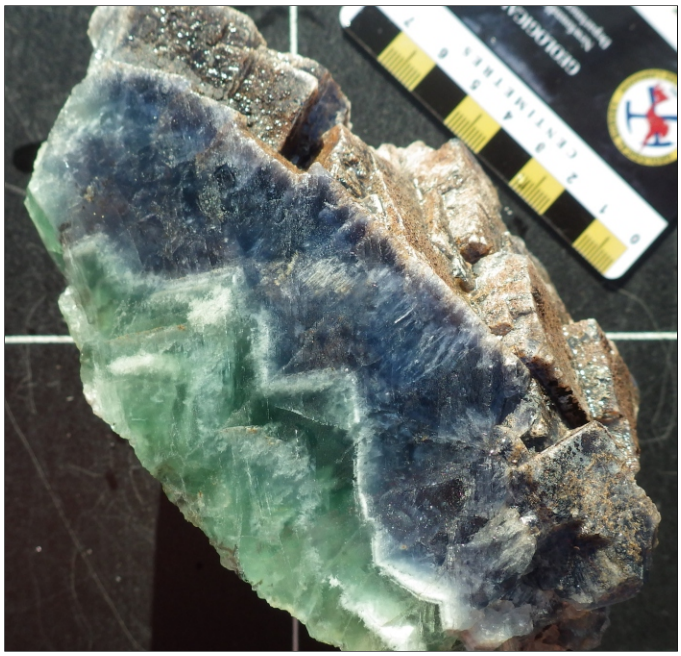


Figure 4: Green octahedral fluorite and cubes of blue fluorite

References

Candela, 1997. Journal of Petrology, v. 38, p. 1619-1633.
Dolejš and Baker, 2004. Contributions to Mineralogy and Petrology, v. 146, p. 762-778.
Dolejš and Baker, 2007. Journal of Petrology, v. 48, p. 785-806.
Dolejš and Zajacz, 2018. Springer Geochemistry, p. 431-543.
Kellett et al., 2014. Canadian Journal of Earth Sciences, v. 51, p. 943-972.
Kerr et al., 1993a. In Current Research. Government of Newfoundland and Labrador, Report 93-1, p. 239-278.
Kerr et al., 1993b. Canadian Journal of Earth Sciences, v. 30, p. 2328-2333.
Magyarosi et al., 2019. In Current Research. Government of Newfoundland and Labrador, Report 19-1, p. 59-83.
Pirajno, 2013. In Metasomatism and the Chemical Transformation of Rock. Lecture Notes in Earth System Sciences, Springer Verlog-Berlin, p. 203-251.
Reeves et al., 2016. Canadian Institute of Mining Journal, v. 7, p. 77-86.
Sibson et al., 1988. Geology, v. 16, p. 551-555.
Smith 1957. Newfoundland Fluorspar Limited, Assessment Report (001L/0016).
Sparkes and Reeves, 2015. AGS Project, project review and resource estimate, Canada Fluorspar Inc. Presentation, Baie Verte Mining Conference.
Strong, 1982. Chemical Geology, v. 35, p. 97-114.
Teng and Strong 1976. Canadian Journal of Earth Sciences, v.13, pages 1374-1385.
Williamson, 1956. Government of Newfoundland and Labrador, Department of Mines, Agriculture and Resources, Unpublished report, 140 pages.

For more information, contact Zsuzsanna Magyarosi (zsuzsannamagyarosi@gov.nl.ca)

Submitted by Zsuzsanna Magyarosi
Mineral Deposit Section, Geological Survey of Newfoundland and Labrador

GAC-VIP Virtual Seminar Series

Since the beginning of the pandemic, the GAC-VIP Division organized a virtual seminar series. These seminars are well-attended. Below is a list of the virtual seminars:

April 15th, 2020, James Brenan (Dalhousie University)
Title: Soret separation of iron isotopes in metallic liquids: Evidence for a leaky core?

April 30th, 2020, Richard Ernst (Carleton University)
Title: The plumbing system of Large Igneous Provinces, including insights from Venusian LIPs

May 14th, 2020, John Greenough (University of British Columbia, Okanagan)
Title: Multidimensional Geochemical Space – The Last Frontier: Boldly Exploring, with MDS, Where No One Has Gone Before

May 28th, 2020, Melissa Anderson (University of Toronto)
Title: Volcanological Controls on Hydrothermal Venting on the Seafloor

June 11th, 2020, Lucie Mathieu (UQAC)
Title: Magmatic evolution of a Neoarchean greenstone belt and significance for Cu-Au magmatic-hydrothermal systems

June 25th, 2020, Catherine Hickson (Geothermal Canada)
Title: Remembering Mount St. Helen's and Honouring the Legacy of 2020 Penrose Medalist James G. Moore (USGS)

July 9th, 2020, Sarah-Jane Barnes (UQAC)
Title: Crystallization of magmatic sulfide liquids: Examples from Sudbury, Noril'sk and the Bushveld Complex - a tribute to Dr. Tony Naldrett

July 23rd, 2020, Peter Hollings (Lakehead University)
Title: Metallogeny and Magmatism of the 1.1 Ga Midcontinent Rift

July 30th, 2020, John Hanchar (Memorial University)
Title: What can the chemistry of magnetite tell us about magnetite-apatite deposits?

August 20th, 2020, Andy Kerr (Memorial University)
Title: Long Walks, Lost Documents and the Birthplace of Igneous Petrology

September 3rd, 2020, John Stix (McGill University)
Title: The mechanisms of phreatic eruptions

September 17th, 2020, Michelle DeWolfe (Mount Royal University)
Title: Archean volcanic settings: Evaluating VMS prospectivity in the Slave craton

October 1st, 2020, Nelson Eby (University of Massachusetts)
Title: A-type granites: characteristics and petrogenesis

November 5th, 2020, Alex Wilson (University of British Columbia)
Title: Glacial pumping of a magma-charged lithosphere: the link between ice and volcanoes in the Garibaldi volcanic belt

December 10th, 2020, Zsuzsanna Magyarosi (Geological Survey of Newfoundland and Labrador)
Title: The St. Lawrence Granite and associated fluorite mineralization, NL

January 7th, 2021, Dr. Louis Cabri
Title: Reflections on mineralogy over nearly seven decades - anecdotes from the past - PGM and trace element analyses

January 20th, 2021, Dr. Brendan Murphy (StFX University)
Title: Appinite suites: small igneous complexes provide big clues into how continents are made

Several of the seminars were recorded and are available on the GAC-VIP Division on YouTube. Check out the GAC-VIP Division YouTube page (https://www.youtube.com/channel/UCErZFfwdDwz86qy_gwzKUiA) or the GAC-VIP Division Website (http://www.vip-gac.ca/Webinars.html) for links to these talks. Thanks again to all of our speakers!

Leopold Gélinas Medals

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 Medal
Dr. Alex Wilson
University of British Columbia

The 2020 winner of the Volcanology and Igneous Petrology (VIP) Léopold Gélinas Gold Medal award for the best PhD thesis goes to Alex Wilson for his astounding thesis titled "Glaciovolcanism in the Garibaldi volcanic belt" supervised by Dr. Kelly Russell at the University of British Columbia, Okanagan.

Nomination letter

Please accept this letter as a formal nomination of Dr. Alex Wilson for the GAC Gelinas Medal (2019) awarded annually for the best PhD Thesis in volcanology and igneous petrology. Alex's PhD research at the University of British Columbia is a field- and lab-based study of glaciovolcanism (volcanoes that erupted within ice sheets) in the Garibaldi Volcanic Belt (GVB) of southwest British Columbia (Canadian Cascade Arc). The questions his thesis addressed include:

1) How has the Cordilleran ice sheet waxed and waned over the last 3 Ma, and
2) Did glacial loading/unloading of the lithosphere modulate volcanism - if so how?

Alex came to UBC to complete and MSc degree, fell in love with the topic in his first year, and upgraded to the PhD program. Alex began his PhD in January 2015 and defended his thesis (PDF copy attached) September 2019. He won the top NSERC graduate fellowship (CGSD Alexander Graham Bell). He was also awarded a Michael Smith Foreign Study supplement in support of his studies in France (Clermont Ferrand) with Professor Ben van Wyk Devries. From the moment he switched to the PhD program he essentially drove the research program independently with only minor direction and supervision.

Alex is passionate about field work and mapping and, quite simply, he is the most accomplished mapping geologist I have had the pleasure to supervise. Over the course of two full field seasons, Alex mapped ~25 volcanoes and produced 9 publication-quality maps (with extend legends and supplementary information); these are in the process of being released via the BCGS Geoscience map series.

His PhD thesis and defense were absolutely first-class and he passed with essentially no revisions. Professor John Smellie, the world's leading expert on Glaciovolcanism served as the external examiner. Professor Smellie's endorsement of Alex's contribution to volcanology is very high praise given Smellie's stature and position in the field. "It is easily one of the top two PhD theses that I have examined in my entire career (> 40 years). Alex is an outstanding student who has used his field studies and associated novel modeling methods to advance our understanding of the emplacement of glaciovolcanic rocks and to examine their relationships to glacial cycles. The standard of his geological field mapping is the best I have seen in very many years."

Alex has been very productive in publishing his science and its import in high quality international journals (see below). He has published four high quality, innovative, peer-reviewed journal articles and has a 5th in preparation (EPSL). Glaciovolcanic edifices have distinctive morphologies and deposits indicative of ice enclosure or contact. These edifices are of tremendous significance to understanding the processes that have shaped the Earth's surface over the last 5 million years. Specifically, these volcanoes and their deposits establish the paleopresence of ice and, with informed mapping, can constrain the thickness and age of ancient ice sheets (Can J Earth Sci, 2017; Am J Sci, 2019). Such data are a vital element to paleoclimate reconstructions spanning the Neogene and Quaternary periods. However, the key to these reconstructions is the geological mapping which provides a spatial (x-y-z) distribution of the individual lithofacies – in particular those that are indicative of interactions with water or ice.

Alex's extensive mapping of glaciovolcanoes across the Garibaldi volcanic belt, combined with $^{40}Ar/^{39}Ar$ geochronology, allowed him to build GIS-based models for the distributions and thickness of the Cordilleran ice sheet through time (Geol Soc Am Special Paper, 2018). However, models are only models! What makes Alex's "ice-space-time" models pertinent (Quaternary Sci Rev, 2019) is the very high quality mapping upon which they are built.

None of these contributions could be made without his commitment to basic geological mapping of these volcanoes. This is attested to by the fact that every one of his journal articles includes one or more geological maps as a key figure to the science. Alex also has excellent lab and modeling skills. His last manuscript, which he intends to send to EPSL, addresses the causal linkages between glacial loading and unloading and volcanism in the Canadian Cascades. It is unlikely that arc magmatism is affected by the Cordilleran ice sheet - but can arc volcanism be modulated by glacial loading and unloading? Alex's Monte Carlo simulations suggest suppression of volcanic eruptions during loading and a 3-4 fold increase in volcanism immediately following glacial retreat? I suspect that this final manuscript will become very highly cited and it will reward Alex for his efforts to produce a field-based record of glaciovolcanism in space and time across British Columbia's Garibaldi volcanic belt.

In summary, Alex Wilson is a bright, dedicated, highly focused young scientist who has completed important and topical research in volcanology. I am incredibly fortunate to have had him in my lab for the past 4 years and he has my highest regard and my strongest recommendation for VIP Division's Gold Gelinas Medal. His work ethic and commitment to first class science remind me of another "star" PhD student of mine - Professor Ben Edwards (Dickenson College, Pa) who was also a Gelinas medallist.

Nomination by Kelly Russell
University of British Columbia, Okanagan

Alex's response

I am thrilled to accept the Léopold Gélinas Gold medal for 2020! Thank you to the Volcanology and Igneous Petrology Division of the Geological Association of Canada for selecting my thesis. I was extremely fortunate to work on an amazing project that led me deep into the Cordilleran mountains chasing some of the most exciting volcanic rocks out there (in my opinion!).

I would like to acknowledge the NSERC for supporting me financially throughout my Ph.D, and am indebted to the support of my supervisor, Prof. J. Kelly Russell at the University of British Columbia, who was always there with endless enthusiasm to share ideas, provide support and guide me. I would like to thank my research collaborators, Prof. Brent Ward, Dr. Melanie Kelman, Dr. Steve Quane and Prof. Benjamin van Wyk de Vries, and my field assistants, Nikolas Matysek and Nate Willett, who worked tirelessly collecting samples and mapping the remote corners of southwestern British Columbia. Finally, my lab mates Amy, Mila and Ryan and my partner, Olenka who provided invaluable support and laughter at the crucial times.

Glaciovolcanism is a dynamic and exciting research field that blends a diverse array of geologic disciplines. I am grateful to have had the opportunity to share in this world and am excited for the challenges that lie down the road.

Thank you very much!

Alex Wilson

MSc Medal
June Cho
University of British Columbia

The 2020 winner of the Volcanology and Igneous Petrology (VIP) Léopold Gélinas Silver Medal award for the best MSc thesis goes to June Cho for her outstanding thesis titled “A micro-analytical investigation of feldspars in the Skaergaard intrusion, East Greenland: Ternary feldspar compositional relations and lead isotopic geochemistry” supervised by Dr. James Scoates and Dominique Weiss at the University of British Columbia, Okanagan.

June's research focused on the major element and lead isotopic geochemistry of the feldspars, in one of the best-studied layered intrusions, the Skaergaard intrusion. Remarkably after all these years, there is still much to learn from the Skaergaard intrusion, the type example of closed-system differentiation of basaltic magma in the Earth's crust. June is an exceptional analyst, very comfortable working with the scanning electron microscope, electron microprobe, and LA-ICP-MS systems. In fact June helped to develop a split-stream method for analyzing trace elements and Pb isotope ratios in her feldspars in polished thin section. The datasets that she produced are impressive and her systematic documentation proved invaluable for interpreting the spatial context of her analyses. June has prepared several manuscripts for submission to international geoscience journals.

Summary by Donnelly Archibald

June’s Response

I am very grateful to have received the Leopold Gélinas Silver medal for my MSc research project. First, I would like to thank the Volcanology and Igneous Petrology Division of the Geological Association of Canada for awarding me this medal. All of this would not have been possible without the support and guidance of many people, especially my advisors, Drs. James Scoates and Dominique Weis at the University of British Columbia (UBC). I'm very grateful to them for encouraging me to pursue a Master's degree and engaging me in this amazing and challenging project. Your unwavering support and mentorship have had a huge impact on my success. I would like to thank Dr. Jon Scoates (Geological Survey of Canada) for providing me with samples and feedback along the way. Thanks also to the Layered Mafic Intrusions group at UBC– I realize now what a unique experience it was to be part of such a large research group working on different aspects of layered intrusions. The laser ablation analyses involved in this project were made possible due to the expertise of Dr. Marghaleray Amini and the staff at the Pacific Centre for Isoto-

pic and Geochemical Research. Many thanks are also owed to the Electron Microbeam team at UBC EOAS for their assistance with the electron microprobe. Financial support was provided through NSERC Multidisciplinary Applied Geochemistry Network and NSERC Discovery grants. To be recognized for my work is an honor and something I will always be proud of as I start my career as a geoscientist. Thank you again to the GAC!

June Cho
University of British Columbia, Vancouver

BSc Medal
Shae Nickerson
St. Francis Xavier University

The 2020 winner of the Volcanology and Igneous Petrology (VIP) Léopold Gélinas Bronze Medal award for the best BSc thesis goes to Shae Nickerson for her exceptional thesis titled “The mineralogy and petrogenesis of rare-element granitic pegmatites in northeastern Nova Scotia” supervised by Dr. Donnelly Archibald at St. Francis Xavier University.

We selected Shae Nickerson, from StFX, as the winner of the Gelinas BSc medal. Ms. Nickerson's thesis was a well written study investigating the petrography and chemical composition of the Kelly Brook pegmatite, Nova Scotia. The student completed field work (including generating a map), thin section analysis, mineral major (EPMA) and trace element (LA-ICPMS) chemistry, and whole rock chemistry, mastering a number of techniques to demonstrate the degree of enrichment of this LCT pegmatite. Her examination of the pegmatite's relationship to granite-related mineralization in the Meguma terrane is quite good and exceeds expectations for an undergraduate thesis.

Summary by Michelle Dewolfe

Shae’s Response

It’s an absolute honour and surprise to receive the Leopold Gélinas Bronze Medal. I would first like to thank the Volcanology and Igneous Petrology Division of the Geological Association of Canada for taking the time to read my undergraduate thesis and awarding me this medal. I'd like to thank my supervisor Dr. Donnelly Archibald, this thesis would not have been possible without his support and guidance. I am also grateful for Dr. Sandra Barr and Alan Anderson for their advice and discussions on topics included in my thesis. Financial support was provided by a Nova Scotia Department of Energy and Mines Mineral Resources Development Fund grant to D. B. Archibald and S. M. Barr. Thanks again GAC-VIP division for this honour and privilege.

Shae Nickerson
St. Francis Xavier University

VIP Awards Reminders

The Career Achievement Award - the deadline is **31 January 2021**
Please send nominations to Dave (dlentz@unb.ca)

The Gold Gélinas medal for an outstanding PhD thesis in the fields of volcanology and igneous petrology - the deadline is **28 February 2021**.

The Silver Gélinas medal for an outstanding MSc thesis in the fields of volcanology and igneous petrology - the deadline is **28 February 2021**.

The Bronze Gelinas medal for an outstanding Honours thesis in the fields of volcanology and igneous petrology - the deadline is **15 April 2021**.

Please send nominations for the Gélinas medals to Donnelly (darchiba@stfx.ca).

2020-2021 VIP Executive

Chair:	David Lentz	dlentz@unb.ca
Vice-Chair:	Michelle DeWolfe	mdewolfe@mtroyal.ca
Secretary/Treasurer Ashfall Editor:	Donnelly Archibald	darchiba@stfx.ca
Past Chair:	John Greenough	john.greenough@ubc.ca
Outreach:	Zeinab Azadbakht	zeinab.azadbakht@ontario.ca
Councilor West:	Ian Coulson	Ian.Coulson@uregina.ca
Councilor Central:	Pierre-Simon Ross	pierre-simon.ross@ete.inrs.ca
Councilor East:	Zsuzsanna Magyarosi	ZsuzsannaMagyarosi@gov.nl.ca
Student Councilor:	Shae Nickerson	shaenickerson@acadiau.ca
Webmaster:	Peter Hollings	peter.hollings@lakeheadu.ca

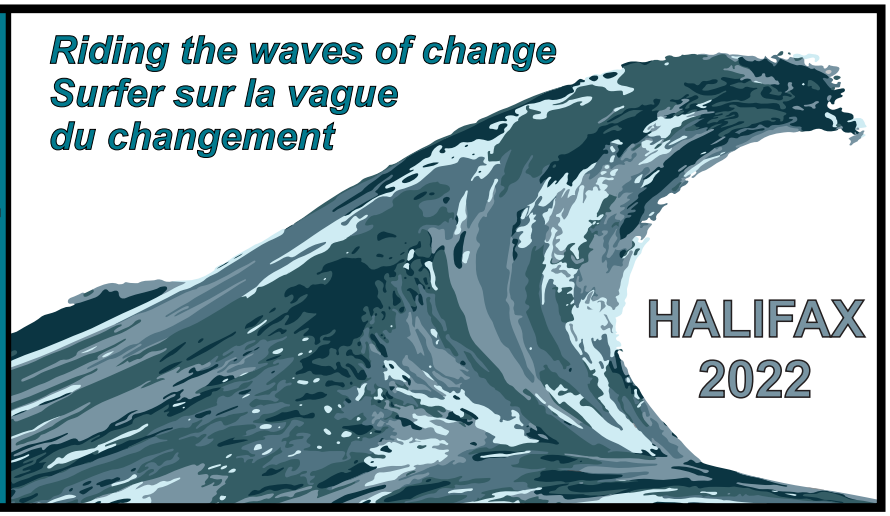
GEOLOGICAL ASSOCIATION OF CANADA
ASSOCIATION GÉOLOGIQUE DU CANADA

GAC-MAC-IAH-CNC-CSPG

May 15-18

AGC-AMC-AIH-SNC-SCGP

15-18 mai



Mark your calendars! Join us in Halifax from May 15-18, 2022 for the Annual Meeting of the Geological Association of Canada (GAC), Mineralogical Association of Canada (MAC), Canadian Society of Petroleum Geologists (CSPG) and International Association of Hydrogeologists Canadian National Committee (IAH-CNC). This meeting coincides with the 50th anniversary of the Atlantic Geoscience Society, the conference host organization. The conference promises a diverse program including special sessions, field trips, and short courses related to a wide variety of geoscience disciplines.

Please visit our website: http://ags.earthsciences.dal.ca/Halifax2022/ and follow the conference social media accounts on Facebook (Halifax Geoscience), Twitter (HalifaxGeo2022) and Instagram (halifaxgeo2022) for more information.

See you in Halifax!

GAC-MAC London 2021

November 1-3, 2021

GEOLOGICAL ASSOCIATION OF CANADA
ASSOCIATION GÉOLOGIQUE DU CANADA

MINERALOGICAL ASSOCIATION OF CANADA
ASSOCIATION MINÉRALOGIQUE DU CANADA

Exploring Geosciences Through Time and Space

Explorer les géosciences à travers le temps et l'espace