

# ALUMNI NEWS

Issue 28 February 2019

*for Alumni and Friends*



Earth Sciences  
UNIVERSITY OF TORONTO

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Cover photo: Students from the ESS221 Rocks and Minerals class, with Professors Grant Henderson and Russ Pysklywec, at the Library of Celsus, in Ephesus, Turkey —third largest library of the ancient world— during the International Course Module in November (see page 14)

## *Alumni & Friends Reception*

*in the*

*Library Room*

*at the*

*Fairmont Royal York Hotel*

*in Toronto*

***Tuesday, March 5, 2019***

***5:00pm to 7:30pm***

***We hope to see you there!***

## ***Feedback***

We had some feedback contesting our claim in last year's Alumni News that 2018 celebrated 175 years of teaching Earth Science at the University of Toronto. We are correct as Geology and Mineralogy were first taught as part of a Chemistry course in 1843. For the 175 anniversary of the Earth Science/Geology department we will have to wait until 2028 because the Department of Geology, under the leadership of Professor E.J. Chapman, marked the beginning of course offerings under the banner of earth science as a distinct discipline in 1853.

*The Editor*



## Message from the Chair

It's been another busy and exciting year in the department. Welcome to this year's newsletter to catch up on some of the news from here and with our excellent alumni.

We had a round of hires in geology and geophysics this year to strengthen our faculty research and teaching corps. Dr. Melissa Anderson and Dr. Dan Gregory joined the downtown faculty as Assistant Professors and greatly bolster our strength in economic geology and mineral deposits. At the UTM campus, Dr. Semechah Lui was hired as an Assistant Professor in geophysics and Dr. Paul Ashwell as a Teaching Stream Assistant Professor. You can read detailed profiles of these exceptional young scientists within. Together, these and our other recent hires, means an exceptionally busy time of growth and renewal in the department.

On the other end of the faculty career path, this year marks the retirement of Professor Dan Schulze after 30 years at Erindale/UTM. I got to know Dan well starting from my early days as a UofT faculty member and teaching a course at Erindale. He was a dedicated teacher and distinguished researcher; certainly generations of students were fortunate to learn geology in the field from him during the Algonquin autumns. I will miss sharing with Dan the occasional bottle of Niagara College Dean's list red in my office as we discussed garlic horticulture and solved the important problems in academia today, but I look forward to a visit with Dan and Rita at their cabin for the next bottle.

Our programs continue to go strong at both the graduate and undergraduate levels. It's interesting to consider how the strength of the resource industry can influence our student numbers (despite our efforts to hedge against such fluctuations!). On page 12, I've included some figures on student and faculty numbers over the past few decades so you can see where we are now, and where we've been over time in department numbers.

Most sincere thanks to new and ongoing donations for all of our graduate and undergraduate student scholarships. These are too numerous to name individually, but the scholarship pages within give some measure of the hugely positive impact these make: we are able to provide student opportunities for an exceptional breadth and depth of graduate and undergraduate research and learning owing to this exceptional donor support. Our strong emphasis on field education continues with the on-going generous support of our Explorers Annual Fund for Field Education. This year these included trips to Turkey, Scotland, Trinidad, and other places, in addition to our regular field camps to Whitefish Falls, Deep River, and Benny Belt. Without the very generous financial backing of alumni and friends for the Explorers Annual Fund, these trips would not be possible. I've learned from my conversations with other departmental Chairs that this support and the field education opportunities it provides make us the envy of geoscience departments across Canada!

We held a number of alumni events over the past year: the traditional PDAC reception; several Backpack-to-Briefcase functions; gatherings in Calgary and Vancouver; a new reception at the 2019 AME Roundup meeting. Building and maintaining connections with and among our esteemed alumni group in geology and geophysics are very important to us, and such events are fun casual ways for alumni to catch up with old classmates and make new acquaintances. Many of you know Karyn Gorra as one of our excellent technical staff members. We've revised her role in the department to enhance our community outreach efforts and help foster alumni connections to the department. So you may be hearing more from Karyn about new events going on and we encourage you to keep connected.

As usual there is a long list of accomplishments, events, and awards that mark the activity of our alumni and departmental members this year: Far too many for me to highlight. Thanks to Professor Emeritus Henry Halls as Editor and Karyn Gorra as Assistant Editor for assembling yet another top-quality Newsletter publication to feature some of these happenings—please enjoy reading it!



*Russ dressed for a mine visit during a field trip to Turkey*

*Russ Pysklywec*

## New Faculty and Staff Appointments

### Melissa Anderson

Melissa Anderson is an economic geologist who began her appointment as Assistant Professor in the Department in August, 2018, following the completion of her PhD at the University of Ottawa and the GEOMAR Helmholtz Centre for Ocean Research Kiel (Germany) under the supervision of **Mark Hannington** (PhD 1989).

After growing up on the land-locked prairies, Melissa wanted a change of scenery and her attention turned towards deep-sea research. Her work focuses on understanding the relationships between tectonics, volcanism, and ore formation in subduction-zone settings in the western Pacific. In particular, she tests the hypothesis that subduction-related tectonic complexities, such as terrane collisions, asymmetrical hinge roll-back, or pre-existing structures, directly influence the location, size, and composition of seafloor massive sulfide deposits. Given the scale of this problem, Melissa draws on a diverse set of field-based and analytical approaches, involving international seagoing research expeditions, innovative approaches to remote-predictive seafloor geological mapping, and integrated petrology, trace element geochemistry, stable and radiogenic isotopes, and alteration studies. Her long-term research focus will be on the transfer of modern seafloor research to the development and enhancement of genetic and exploration models on land. The structural and geodynamic controls on ore formation in ancient submarine volcanic environments are a fundamental missing piece of the puzzle for resource exploration. Finding innovative ways to identify major upflow zones in fossil submarine magmatic-hydrothermal



*Melissa with erupting Yasur volcano on the island of Vanuatu in the background.*

systems will be an important focus of this work, with an emphasis on comparing the structural elements of world-class mineral districts with modern arc-backarc settings. New research is also needed to better understand the origins of giant ore deposits found on land for which there are no modern analogs. Are large deposits waiting to be discovered in unexplored settings of the modern oceans, or do geological processes operate in a fundamentally different way today? Melissa is thrilled to join the Department and continue the legacy of seafloor research pioneered by **Steve Scott** and his students and post-docs.



### Daniel Gregory

Daniel, originally from Vancouver Island, recently joined the Department of Earth Sciences as an Assistant Professor at the University of Toronto, in August 2018. He received his bachelor's in Chemistry and Earth Science from UBC and his PhD from the Centre of Excellence in Ore Deposits (CODES) in Tasmania. Daniel worked as an exploration geologist for four years prior to his PhD. He held postdoctoral positions at CODES and at the NASA Astrobiology Institute at the University of California, Riverside.

Daniel's research on pyrite trace-element geochemistry stems from his work from CODES on orogenic gold deposits in Australia and sedimentary pyrite from around the world. His current research includes using artificial intelligence techniques to develop new ways to discover mineral deposits,

understanding how trace elements are held in minerals, and using in-situ techniques to determine the chemistry of past fluids. More specifically, he uses Random Forests analysis on LA-ICPMS trace element data of pyrite to classify ore deposit types based on their geochemical profile. The techniques will allow for more efficient exploration and reconnaissance work based on the deposit type of interest. Daniel is currently working on ways to expand this technique to bulk sample analyses and vectoring studies. In relation to mining and

environment impacts of pyrite in mineralized systems, Daniel is working to solve how trace elements are held in pyrite at the atomic level, using nano-scale analytical techniques such as TEM, LA-ICPMS, APT, and synchrotron-based XANES. In paleo-ocean studies, his work on using pyrite to inform about the chemistry of past oceans will continue to be tested on several grounds, especially in regionally metamorphosed basins where current methods are unreliable.

## Semehchah Lui

Semehchah started in the UTM Department of Earth Sciences in July 2018 as Assistant Professor in applied geophysics. She recently received her PhD degree in 2017 from the California Institute of Technology. Prior to joining the Department, she was a postdoctoral fellow in the Department of Civil and Mineral Engineering at the University of Toronto.

Semehchah's primary research interest lies in the physics of earthquakes. Using both observational and numerical approaches, she studies earthquake source processes and fault rupture dynamics to explore the complex physical mechanisms that drive such devastating phenomenon. Recently she has extended her work from tectonic earthquakes to induced seismicity, i.e., earthquakes with an anthropogenic origin such as unconventional hydrocarbon productions. Many key questions about induced seismicity remain unanswered. For example: What are the major injection or frictional parameters that control the triggering mechanisms? Does aseismic slip assume an important role in the triggering of induced earthquakes? Can induced earthquakes, typically small to moderate in size, trigger much



larger events? She seeks answers to these questions through seismic-waveform analysis, numerical simulations of the slipping of seismogenic faults, and laboratory-scale stick-slip experiments. Her long-term goal is to develop physics-based earthquake models and methodologies that can contribute to natural and induced seismic hazard mitigation and earthquake prediction.



## Paul Ashwell

Paul Ashwell joined the Department of Chemical and Physical Sciences at UTM as a Teaching Stream Professor in Earth Science in July 2018. Paul has come to UTM from the University of Canterbury, New Zealand, where he completed a PhD in Volcanology and spent 4 years as a Senior Tutor teaching the field geology program around many locations in the South Island of New Zealand.

Paul's research is focused on lava domes; the viscous lava extrusions that often follow large, explosive eruptions, in order to determine their style of extrusion and better understand the volcanic hazards which are associated with the eruption. In particular, lava domes have a tendency to collapse and form devastating pyroclastic flows, however,



why and when they do this is unclear. Paul has studied the links between collapse events and preserved structures in lava domes to determine the 'signature' of these events left on the domes. This research has also lead Paul to undertake some experimental volcanology on the response of the lava dome to compression, as well as decompression-initiated bubble growth using labs in New Zealand and Germany, as

well as the Australian Synchrotron in Melbourne.

Paul's task at UTM is to improve the field teaching offering at UTM, as well as to introduce a new course on Geochemistry and Volcanology. He plans to use the newest methods and equipment (such as drones and 3D photogrammetry and visualization) to help students gain a better understanding of complex geological processes.

## Sheila Ballantyne

Sheila started at UTM in September, 2017, as the Earth Science Laboratory Coordinator. She completed her BSc in Earth Science at Dalhousie University, with a thesis on physical models of salt tectonics. She completed her MASc at UBC, and worked on a number of research projects there related to rock mechanics and empirical mine design. She has industry experience in greenfield mineral exploration (in NW B.C.), laboratory rock strength testing, and rock mechanics consulting for various operating mines in North America. Her current research interests include rock mechanics and structural controls on ore deposits.

Her position at UTM focusses on undergraduate labs and field trips. She works alongside the UTM faculty to run earth science lab exercises, ensuring all our materials, geologic sample collections, and equipment are in good working order. Sheila loves to help students in their learning, works towards connecting taught concepts to industry, and finds that acting as an unofficial industry liaison for students is very rewarding. She also takes care of field trip logistics and



safety, and assists in instruction and development of new field courses. Sheila has found UTM faculty and staff to be very supportive. She was recently given the Chemical and Physical Sciences Outstanding Staff Award. Says Sheila: "It's a joy to be a part of the growing earth science program! Please come by and visit our new teaching labs at UTM, expected to be completed this summer!"

[The Editor sincerely apologizes for overlooking Sheila's arrival at UTM in last year's issue of Alumni News]

## Promotions, Appointments and Awards



**Jochen Halfar (UTM)** was promoted to the rank of full Professor, effective July 1<sup>st</sup> 2018. Jochen started as Assistant Professor in Earth Sciences in 2006, obtained tenure and was promoted to the rank of Associate Professor in 2011. His road to fame is the reconstruction of centuries of climate records in

the Arctic region from coralline algae growing at the bottom of the ocean. He is an avid explorer and has gone to some cold and harsh places up north to collect samples, usually as part of international collaborative teams. His research has been published in high-impact journals. He has been often featured in the media—most recently in a European documentary soon to be released in North America. Our congratulations!

*Claudiu Gradinaru, Chair, Dept.  
Chemical and Physical Sciences, UTM*



**Marc LaFlamme (UTM)** was granted tenure at the rank of Associate Professor, effective July 1<sup>st</sup> 2018. Marc has undertaken pioneering research into the phylogeny and nature of Ediacaran fauna, the earliest macrofossils in the geological column at about 570 million years ago.

**Barbara Sherwood Lollar** has been appointed the *Dr. Norman Keevil Chair in Ore Genesis Geology* for a five year term. The stature, scope, and impact of Barb's research on the geochemistry of fluids and gases, and their rock interactions, make her an ideal recipient for the endowed Chair position established in 1997 through a generous gift to the University of Toronto from the Canadians Resident Abroad Foundation.

***Barbara Sherwood Lollar is Awarded the Logan Medal,  
the Highest Award of the Geological Association of Canada***



Congratulations to University Professor **Barbara Sherwood Lollar** on receiving the Logan Medal, the highest award of the Geological Association of Canada, presented to an individual for sustained distinguished achievement in Canadian earth science.

*“For her innovative applications of compound-specific stable isotope analysis which have revolutionized geochemistry, notably by establishing the source and fate of anthropogenic organic contaminants in groundwater, and also the presence of abiogenic methane and hydrogen trapped, for more than 1 billion years, in crystalline rocks that are more than 2 km below the surface of the Canadian Shield.”*



**Kim Tait** (ROM) was promoted to Senior Curator at the Royal Ontario Museum. Aside from her various duties with collections and public engagement at the ROM, the promotion recognizes Kim's excellence in research in mineralogy. We are very fortunate to have Kim connect her research program to our department, and she is an excellent

teacher and student mentor here as well. She has also been appointed as a Senior Fellow at Massey College.

*Russ Pysklywec, Chair, Dept. Earth Sciences*

**Nick Eyles** was the editor of a book, *Georgian Bay: Discovering a Unique North American Ecosystem* which has just won the prestigious Chalmers Award from the Champlain Society. **Andrew Miall** was a co-contributor. (see page 22)



**Adam Brudner**, 4th year Geology Specialist, was the winner of the mineral draw, a tradition started by **Dan Schulze**, at the Alumni and Friends Reception during the PDAC in March.



## Dan Schulze Retires



After 30 years as a faculty member at UTM, **Dan Schulze** has retired and moved with his wife Rita to Kingston, where he plans to continue his research at Queen's University. They have bought a delightful cabin in nearby woods (photo at right), built right above an unconformity between Paleozoic limestones and the underlying gneisses of the

Grenville Province with an intervening basal conglomerate. The gneisses are at the foot of the small scarp in the photo.

One facet of Dan's research has been through the use of an ion probe to determine the oxygen isotope compositions of tiny minerals inside diamonds and the carbon isotope composition of their host rocks. In papers published in *Nature* (2003), *Lithos* (2004), and *Geology* (2013) he showed that many diamonds have inclusions that originated as basalt on the sea floor with the diamonds having a biological component to the carbon. In particular he reported (Schulze et al., 2013, *Geology*, v. 41, p. 455) an anticorrelation between low  $\delta^{13}\text{C}$  of eclogitic diamonds and high  $\delta^{18}\text{O}$  of their coesite and garnet inclusions, that showed convincingly that their carbon was of crustal origin and had arrived at great mantle depths by subduction. The impermeable nature of diamonds ensured that no internal alteration had taken place since they had formed. Many of us will remember an extraordinary photo by Dan of the interior of a diamond on the cover of an earlier volume of Alumni News (Issue 22, 2013) that accompanied an article about his research. This diamond (bottom photo) became known as the "Picasso's diamond" because of its cubist-like appearance caused by impurities. To me it resembles the interior of a laboratory with a scientist (head in black) working busily at a desk!

Recently (with **Don Davis** and others) he has strengthened the hypothesis (originally by Harry Hess) that the Colorado plateau was elevated by hydration (olivine to serpentine with a volume increase) of the upper mantle by fluids derived from the subducted Farallon plate below with dates suggesting most uplift and uplift occurred 28 to 30 My ago (Schulze et al. 2015 *Geology* v.43, p.727). Another important contribution was an innovative application of a high energy CT scanner to reveal the location and abundance of diamond inside mantle xenoliths (Schulze et al., 1996, *J. Geol.* v. 104, p. 109). In the CT scan (second from bottom photo), garnet in red (fresh) and yellow (altered), surrounded by pyroxene (blue and green) accompany a triangular slice through an

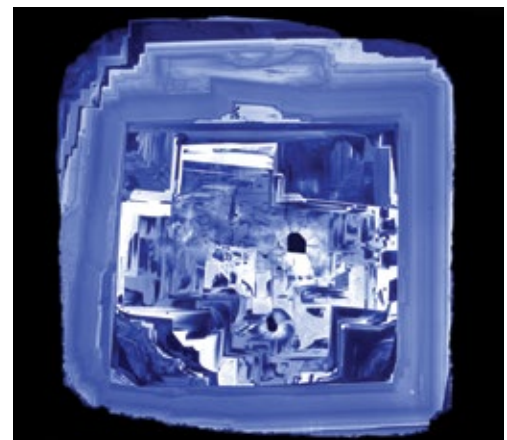
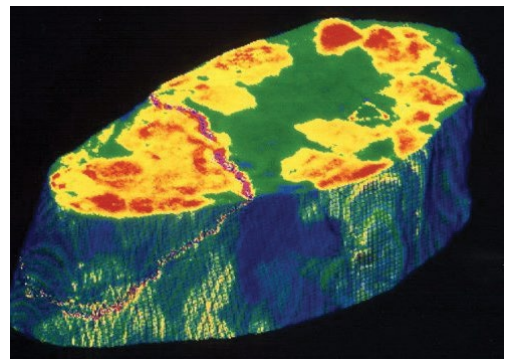


octahedral face of a diamond with barite alteration in the right centre.

Dan was a passionate undergraduate teacher, firmly believing in field trips as a component of the courses he taught. Many students became so interested in seeing "real" geology that they switched their courses of study. One example was a student who became so engrossed in collecting samples that he was (only briefly!) left behind when the vans departed!

Over the years we have all admired Dan's enthusiasm for field geology and his love of nature in all its forms. We wish him well in Kingston and many enjoyable days spent with Rita in their cabin hideaway.

Henry Halls





## ***Barbara Sherwood Lollar involved in Hunt for Extraterrestrial Life***

Today (October 10, 2018 at 11am) I watched a live program from Washington D.C. featuring a public briefing of a special report on Astrobiology Strategy: the scientific procedures to be followed to optimize the successful hunt for Extraterrestrial Life. The report was in response to a US congressional mandate to the NASA Science Missions Directorate and involved an international team of sixteen including microbiologists, astronomers, geochemists, chemists and planetary scientists. The team, led by **Barb Sherwood Lollar**, conducted a major survey highlighting key scientific questions and technologies that are emerging and likely to shape the field of astrobiology in the next twenty years. She gave a most impressive and eloquent account of the report, without a single hesitation, which added to the perception of her intimate and thorough knowledge of the document. The presentation was followed by questions from the floor and again Barb rose to the occasion. I am sure that all of us in the department are very proud to have Barb making international headlines and being in the public eye with such an impressive scientific performance.

*Henry Halls*

The live streaming of the meeting can be found at <https://livestream.com/NASEM/AstroBioScience> and details of the report can be found at [nap.edu/astrobioscience](http://nap.edu/astrobioscience) where the report can be purchased for US\$55.



*The National Academies of Sciences, Engineering, and Medicine graphic image promoting the public briefing webcast*



*Barbara Sherwood Lollar and colleague Alan Boss from Carnegie Institute in Washington D.*

## ***Bacon and Eggheads***

**Miriam Diamond** was the guest speaker at the September 27, 2018 Bacon and Eggheads Breakfast Speaker Series. It brings together Parliamentarians with experts in science and engineering, showcasing outstanding Canadian research accomplishments to provide unbiased insight into topical scientific issues, within a non-partisan forum. This prestigious forum represents a unique opportunity for scientists to communicate important findings to a distinguished and influential audience. More information is available at: <http://pagse.org/en/breakfasts.htm>

Miriam's talk was titled "*How Did that Chemical from My TV End Up in Me and an Arctic Fish?*"

Abstract: We are exposed to thousands of chemicals, some of which are or could be of concern for our health. In this talk, we follow the journey of flame retardants that are commonly used in, for example, electrical and electronic products, from their source to final destination in people and the environment far from their point of use. The journey illustrates the complexities and challenges of understanding and effectively managing chemicals in today's fast-paced consumer world. Ensuring that legislative reform keeps pace with these challenges is key to ensuring the long term effectiveness of Canada's Chemical Management Plan.



## Class of 2018

### PhD Graduates

Priyanka Chandan  
Alex Humphreys  
Sara Mazrouei-Seidani  
Siobhan Williams

### MSc Graduates

Yaw Adjei-Kyereme  
Francisco Bucchi Morales  
David Bysouth  
Margaux Daly  
Kristina Da Silva  
Brock Edwards  
Julia Field

Yun Ting Fung  
Camille Hebert  
Camille Malcolm  
Jordan Poitras  
Cairan Tirona  
Joanna West  
Hao Wang

### Bachelor of Science (BSc)

Parham Adiban  
Hou Chun Chan  
Brianna Jade Chan  
Hsun Kuan Chen  
Yue Du  
Samuel Duckworth Battye  
Sabastien Coltrane Dyer  
Elisa Ting Wei Fung  
Aldo Fusciardi  
Nuur Ghazali  
Adam Gregg  
Zafir Sean Imamshah  
Norbert Kapa  
Ryan Norman Kennedy

Holly Kuzmyn  
Oi Yin Lai  
Margaret Lin  
Shuangyi Liu  
Garnet Sherwood Lollar  
Jamil Mahamud  
Rachel Marcus  
Jianing Mo  
Joseph Moysiuk  
Louisa Murray-Bergquist  
Thea Myrskog  
Jennifer Nemcik  
Michael Nienhuis  
Monica O'Neill

Ying Woei Ooi  
Yian Qian  
Samuel Robb  
Tyler Rogers  
Nora Sahel-Gozin  
Jahnvi Shah  
Abbiraami Subramaniam  
Clara Thaysen  
Shantel S. Turna  
Jeevaa Velayutham  
Armita Zaferani  
Yiru Zhou

## Undergraduate Student Awards

(2017/18 Academic Year)

### NSERC Undergraduate Student Research Awards

Thea Myrskog,  
Colleen Metcalf  
Timothy Liu  
Jason Hinde  
Nathan Stoikopolous

### Coleman Gold Medal in Geology

Ying Woei Ooi

### Wesley Tate Scholarship in Geology

Ying Woei Ooi

### Joseph Housam Memorial Leadership Award in Earth Sciences

Colin Roth

### Edward Blake Scholarship in Earth Sciences

Timothy Liu

### Joubin James Scholarship and Prize

Joy Carter

### James P. Nowlan Explorers Fund Undergraduate Scholarship

Nathan Stoikopolous

### Daniela and Alexander Tintor Undergraduate Scholarship

Michael Rego

### Undergraduate Explorers Fund Award

Clara Thaysen

### Alexander MacLean Scholarship in Geology

Ivano Gennaro

### Roger E. Deane Memorial Scholarship in Geology

Naomi Welt

### H.V. Ellsworth Undergraduate Award in Mineralogy

Ivano Gennaro

### Garnet W. McKee-Lachlan Gilchrist Scholarship

Jeevaa Velayutham

### Frederik W Schumacher Scholarship

Stephen Korchinos

### Dr. E.T. Tozer Scholarship in (Triassic) Stratigraphy/Palaeontology

Colleen Metcalf

### Don Salt Scholarship

Bahareh Doroudiani  
Jeevaa Velayutham

### KEGS Foundation Scholarship (2018-19)

Nathan Stoikopolous  
Albeta Ondercova

### Logan Prize

Sabastein Dyer

*continued on page 11*



**Women's Association of the Mining Industry of Canada Edith Tyrrell Award and Medal**

Darrel Kwong

**Student Industry Field Trip (SIFT) offered by the Canadian Society of Petroleum Geologists**

Rhys Buceta

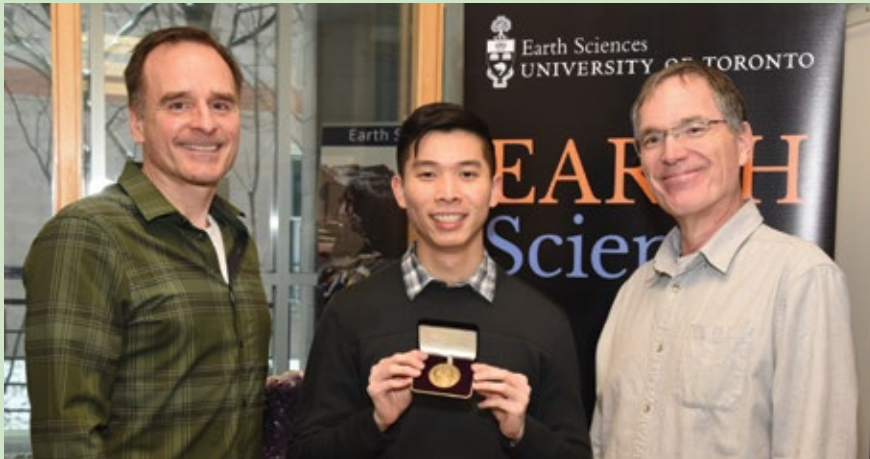
**Student Industry Mineral Exploration Workshop (S-IMEW) offered by the Prospectors and Developers Association of Canada**

Ying Woei Ooi



Colin Roth is the inaugural recipient of the **Joseph Housam Memorial Leadership Award in Earth Sciences**, presented to him at the annual Semi-formal event, by **Russ Pysklywec**. Colin is the President of the Undergraduate Earth Science Association, a member of the U of T "Iron Dragons" Dragon Boat Team and the Student Leader for the ES Department Trip to Trinidad and St. Vincent (February 2019).

**Joe Housam** (BSc 2014, MSc 2016) was a dynamic young man and brilliant geologist who was very active in student life and leadership in the department. He died suddenly in June 2017. The scholarship was created by family, friends and his employer Agnico Eagle.



**Darrel Kwong**, centre, a fourth year geoscience major, was presented with the **Edith Tyrrell Medal** by **Joe Desloges** (right), Principal of Woodsworth College and Professor in the Earth Sciences and Geography Departments and **Russ Pysklywec** (left), Chair of the Earth Sciences Department.

The Award and Medal is awarded to students registered in the third or fourth year of the Lassonde Mineral Engineering Program in the Faculty of Applied Science and Engineering or a Geology program in the Faculty of Arts and Science. Candidates must rank academically in the top quarter of his or her class and demonstrate outstanding leadership skills.

## ***Graduate Student Awards***

**Ontario Trillium Scholarship**

Tianshi Liu  
Mitchell MacMillan

**Natural Science and Engineering Research Council of Canada Post-Graduate Doctoral Scholarship**

Daniel Dick  
Marissa Davies  
Natasha Lecler  
Katie Maloney  
Elizabeth Phillips

**Natural Science and Engineering Research Council of Canada-Graduate Scholarship**

Natalie Szponar

**Ontario Graduate Scholarship (OGS)**

Carter Grondahl  
Tanya Kizovski  
Alice Tsang

**Queen Elizabeth II Graduate Scholarship in Science and Technology / J.J. Fawcett Graduate Scholarship in Science and Technology**

Dustin Liikane  
Max Chipman  
Audrey Manuel  
Anna Phillips

**Queen Elizabeth II Graduate Scholarships in Science and Technology (QEII):**

**QEII/Canadians Resident Abroad Foundation Graduate Scholarship in Science and Technology**

Francisco Bucchi Morales  
Neal Sullivan

**QEII/Reford Scholarship in Science and Technology**

Payman Janbaksh

**QEII/Lamontagne Geophysics Graduate Scholarship in Science and Technology**

Anna Anderson

*continued on page 12*

**QEII/Harold O. Seigel Graduate Scholarship in Science and Technology**

Mostafa Khorshidi

**Faculty of Arts and Science**

**Doctoral Fellowship**

Marissa Davies  
Thomas Kosciuh  
Natasha Leclerc

**Connaught International Scholarship for Doctoral Students**

Eunji Byun  
Jacob Kvasnicka  
Natasha Leclerc  
Marissa Davies

**Hugh Snyder International Scholarship in Earth Sciences**

Heriberto Rochin Banaga

**P.C. Finlay Q.C. President's Fellowship in Geology**

Francisco Bucchi Morales

**Jeff Fawcett & John Gittins Graduate Explorers Fund**

Nabila Rahman  
Neal Sullivan  
Sean Yokoyama

**Emeritus University Professor A.J. (Tony) Naldrett Graduate Scholarship Fund**

Jeremy Rimando  
Erin Seagren

**D.H. Gorman Explorers Fund Graduate Scholarship**

Matthew Duffy  
Alice Tsang

**James P. Nowlan Explorers Fund Graduate Scholarship**

Junxing Chen

**Irene Gale-Rucklidge Explorers Fund Graduate Scholarship**

Saif Al-Siwaldi  
Chantal Norris Julseth

**Dr. H.O. Seigel Scholarship in Applied Geophysics**

Erkan Gun

**H.V. Ellsworth Graduate Fellowship in Mineralogy**

Alice Alex  
Carter Grondahl  
Tanya Kizovski  
Zhenhao Zhou

**Margaret Amelia Miller Scholarship**

Allen Chochinov  
Natasha Leclerc  
Jonathan Sorrentino  
Megan Zullian

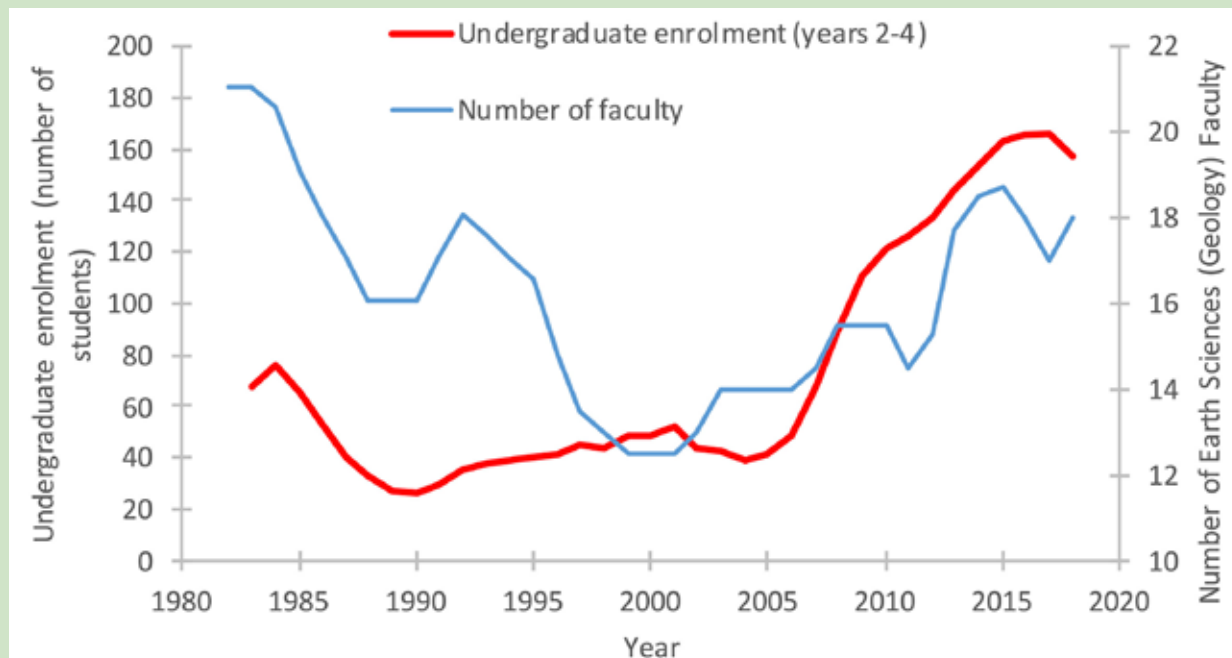
**Laurence Curtis Teaching Assistantship Award**

Carter Grondahl  
Vasa Lukich

## Geology/Earth Sciences—the last 40 years

For those interested to see how our departmental population has changed over the past few decades, this graph plots the undergraduate student enrolments (red) and faculty numbers (blue) at the downtown St. George campus since the early 1980's. The student numbers include the total number of students in years 2–4 enrolled in all of our programs—specialist, major, minor—in a given year.

You can see we're at a time of growth and expansion of the department. We have seen significant growth in the student population in geosciences, although there is always some influence of cyclical strengths in the resource industry. Our recent growth in faculty numbers reflects endowed faculty Chairs established in the very late 1990's and then the addition of physical geography and geophysics faculty since 2011.





## *Hugh Snyder Pledges a Second Major Gift to Earth Sciences*

Russ Pysklywec announced in September that Mr. **Hugh Snyder** made a very sizeable donation to the **Hugh Snyder International Scholarship in Earth Sciences**, bringing the initial endowment established for the award in 2014 to more than one million dollars.

“This generous gift means the department has endowed scholarships for two international students in the graduate program. This type of support is a major boost to our graduate program in that it allows us to recruit and admit an additional cadre of excellent international students into our graduate community, over and above the strict quotas and restrictions on graduate admissions imposed by FAS/SGS.”

Mr. Snyder is a recognized leader in the North American mining industry and has been active at the senior level for more than 50 years in the evaluation, exploration, development and production of mineral deposits in Spain, Mexico, Central and South America. He established this scholarship in gratitude for the support and encouragement he received, and the pleasure of working in these countries, to support academically outstanding students interested in pursuing graduate studies at UofT. He has become a great friend to the department and has taken part in student mentorship events with both graduate and undergraduates.

A luncheon, held at the UofT Faculty Club to officially thank him for his support, was held in December where Krista Slade, Director of Advancement, Faculty of Arts and Science, presented him with a gift, an antique map of Spain and Portugal, as a token of appreciation in recognition of his support for geoscience education and the University of Toronto. Golf paraphernalia presented to Hugh by Grant Henderson and Russ Pysklywec signalled their hope that Hugh doesn't give up on his ongoing bid to score his age!



*Earth Sciences Professors and the Hugh Snyder International Student Scholarship recipient at a luncheon to thank Mr Hugh Snyder for his generosity in establishing the Hugh Snyder International Scholarship in Earth Sciences. Left to right: Professors Dan Gregory, Russ Pysklywec (Chair), Zoltan Zajacz, Sandra Kamo, Grant Henderson, Mr. Hugh Snyder, PhD Candidate Heriberto Rochin Banaga, Professors Melissa Anderson, Don Davis and Maria Dittrich (Associate Chair, Graduate Studies)*

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## Undergraduate Field Trip To Turkey

During the November fall break, thirteen students from the second year introductory mineralogy class (ESS221, Rocks and Minerals) participated in an ICM (International course module) trip to Turkey with Professors **Russ Pysklywec** and **Grant Henderson**. ICMs provide an opportunity for the incorporation of an intensive international or Indigenous experiential module into the framework of an existing undergraduate course. For most of these students it was their first field experience in geology.

Western and Central Anatolia has a fascinating geologic history of active and past tectonics. It is situated at the ancient Tethyan plate boundary that finished closure with the collision of the Himalayan system further to the east. Subsequently the entire Anatolia block seems to have been extruded westwards away from the Arabian plate collision and towards the retreating African subduction, now south of Crete. For Western Anatolia, these plate motions have been pulling apart the crust in a N-S direction while sliding the region westwards along the major North Anatolia strike-slip fault. In Central Anatolia there is widespread recent volcanism. As such, the areas are complex regions of major seismicity, tectonic extension, and geothermal activity and this remarkable geologic diversity makes it an ideal location to study minerals, rocks, and tectonics. The geological intrigue of Anatolia is also reflected in the cultural and historical complexity of Turkey. As the meeting place of continents and civilizations, the area represents one of the unique regions of the world to understand human socio-economic development, conflict, and interaction from antiquity to the present day. Some of the past and present-day human life in the region has been impacted by the regional geology and tectonics.

The itinerary consisted of visits to: Istanbul and the Istanbul Technical University where the students were given an introduction to Anatolian geology and met students from the university; the Dardanelles-Canakkale and the Eurasian

Earth Science Institute where they learnt about the North Anatolian Fault, Gallipoli, earthquake hazards, the tectonics of the Dardanelles, Troy-Assos and the history of the 7 (possibly 8) cities of Troy, the Izmir-Menderes Massif and the Efemçukuru Gold Mine (more below), Ephesus including the ancient Greek city, and extensional faulting.

Over the next 10 days all the students' perspectives of the world, history and career aspirations would be altered in some permanent manner. For most, the biggest shift was caused either by their trip into the gold mine or talking to former PhD student and now professor at the Istanbul Technical University (ITU), **Oğuz Göğüş** better known to us as Oz. On our first day, we went to ITU and met Professor Oz, who much like the wizard of Oz, brought ideas and theories of Geology to life with what seemed like magic. Throughout the trip he gave us insight and an in-depth education that enriched the experience; he taught us a way of looking at the topographical landscape of Turkey and made it so we could not "unsee" what he was teaching us. We were amazed at the amount of seismic activity that occurs in Turkey, and how fascinating the movement of the tectonic plates is. He explained the geological wonders of Turkey, including the



*Photos top left to right: Trojan horse from the movie "Troy" at Canakkale; In the gold mine; the "Great Theatre" in Ephesus—our classroom for a day; bottom photo: On our way to the mine*



North Anatolian Fault, the Volcanics of Assos, the gold mine, the Menderes detachment and extension.

When Professor Oz mentioned the Gold Mine we fell in love with the idea of going underground. The morning of the mine visit everyone was up early and especially restless. After a long winding drive to Efemçukuru and the Tüprag mine, we met the Geology manager, Nadir Arslan. We started by learning about the site and what we needed to do in order to maintain our safety. We were given hard hats, glasses, ear plugs, ID badges, dust masks, gloves, coveralls and hard-toed rain boots. The mine lies on the Izmir-Ankara suture zone, full of Miocene sediments, Phyllite, Schist, Serpentinite, and Hornfels. So now that we had learnt about the mine and what we were likely to find there we hopped into vehicles to enter



*Professor Oz*

the mine (photo), and began our trek downwards. At our first stop we discovered some Galena and Pyrite. With rock hammers we smashed away the wall and cracked open the treasures we had found. While comparing our samples we ventured further into the mine. At the second site, we saw lots of Quartz and got to learn what mining can be if there are no safety standards in place, as well as, what “pitch black” really means. We all turned off our headlamps; an eerie experience. Afterwards, leaving the mine we got to see core samples, and learn more about what geologists are looking for in the samples. This experience shaped a lot of the students’ vision for the future.

We are all so thankful to Nadir and all the mine personnel, Professor Oz and his students, Professors Pysklywec, and Henderson, the ICM office, and all the donors to the Explorers Fund, for allowing us to have this opportunity to learn about the history and geology of Turkey, as well as shaping our thoughts on possible future careers.

*Jessica Patterson (3rd yr Geology Specialist)  
and Grant Henderson*

## ***Capstone Returns to Scotland***

The capstone fieldtrip, attended by 15 undergraduates and led by grad student **Vasa Lukich** and **Charly Bank**, went back to Scotland in summer 2018. We saw many sites significant to the history of geology as a science, such as Siccar point, (the site of Hutton’s Unconformity) the Ordovician-Silurian boundary, and Craigeven Bay where George Barrow first described metamorphic zones using indicator minerals. We also explored the northern islands of Scotland, and unlike the previous capstone trip, visited Orkney and Shetland. These islands displayed amazing sedimentary structures, volcanic deposits, and even an ophiolite, while also being home to archeological sites like the standing stones at the Ring of Brodgar, excellent whiskey and puffins! Unfortunately, bad weather prevented a boat trip to the island of Staffa, home to columnar jointing and Fingal’s cave. We demonstrated

and combined ideas from various courses to analyze and interpret some unique geology, while learning even more in the process. All this work was not without some fun, including swimming in a kettle lake on top of a mountain and a night of cooking home-made schnitzel!

*Ivano Gennaro (4th yr Geology Specialist)  
and Charly Bank*



*Above: Columnar basalts near Ardtun on the Isle of Mull.  
At right: Exploring at Dob’s Linn, near the Ordovician and Silurian boundary*



## Whitefish Falls Field Course



*Climbing down to Whitefish Falls*

In early May 2018, U of T Earth Sciences Professors **Xu Chu**, **Ulrich Wortmann** and UTM lecturer **Lailmah Malik** led the annual mapping field camp in the Espanola-Whitefish Falls-Manitoulin area. Twenty-nine students enrolled in the field course, from both UofT St. George and Mississauga campuses. This trip exposed our students, most in their second years, to a variety of geological phenomena, from supercontinental amalgamation to meteorite impact. For most of the students this was their first time learning geology at outcrops in a field

setting and for some students the first time they saw moose, beaver dams, and afterglow in late evening over frozen lakes.

The two-week adventure consisted of two modules: a few days' geologic touring followed by independent mapping. Students measured and interpreted a stratigraphic section of fossil-rich Paleozoic limestones, and mapped bedrock in 1.5 km × 1.5 km areas. Their mapping area is home to the anomalously pristine and beautifully exposed Paleoproterozoic Huronian Group, the first set of passive-margin sediments on a stable continent of North America. The sedimentary sequence dates 2.5–2.2 billion years in age, records global glaciation of early days, and reflects the evolution of Earth's habitability from an anoxic atmosphere to the first Great Oxidation event. The continental collision during the assembly of Nuna compressed the sequence into a series of folds 1.8 billion years ago. The group humbly visited Dreamer's Rock, a sacred site of both spiritual and geological significance. The students were also able to examine the pseudotachylite dikes and shatter cones in the Sudbury crater.

The UofT trip was reported by a local newspaper in Espanola. The Whitefish Falls camp is among a series of field courses in the Earth Sciences Department, to ensure that students are learning geology the best way possible—through field excursions.

*Xu Chu*

## Annual Graduate Fieldtrip

This year, the Grad Trip took place from September 21–23 in Muskoka, Ontario. Faculty, alumni, post-doctoral fellows and new and returning grad students came along on the trip. We were lucky enough to have sunny weather on both days we were out in the field.

The trip was led by Professors Emeriti **Fried Schwerdtner** and **Pierre Robin** with new professors **Xu Chu** and **Daniel Gregory**. Over the course of the trip, we stopped at many different outcrops within the Grenville Province (a deeply eroded mountain chain that was formed about a billion years ago in response to continental collision). We were shown orthogneiss with different degrees of metamorphism, mineralogy and structure, all related to their deformation at mid- to upper crustal levels within the orogen. The field stops were all local to Muskoka so we were able to enjoy the beautiful scenery of the area. Some students were even brave enough to take a dip in the lake!

In the evenings, we had dinner together, discussed what we had seen throughout the day and had campfires. Overall, the



*Photo taken by Pierre-Y. Robin*

trip was a great opportunity for everyone to get to know each other and see some Ontario geology before the start of a new semester.

*Liz Phillips*

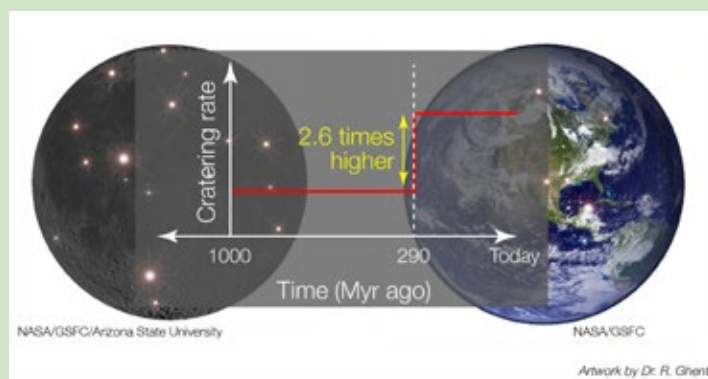


## Earth and Moon Impact Flux Shown to Increase at the End of the Paleozoic

A paper in the journal *Science* has just been published with lead authors PhD student **Sara Mazrouei** and supervisor **Rebecca Ghent** that examines the rate of meteorite bombardment on the Moon and the Earth for the last one billion years.

Meteorite impact craters on the moon leave a pile of ejecta fragments around them, ranging from grains of sand to house-sized boulders. These can be studied by the Diviner thermal radiometer on NASA's Lunar Reconnaissance Orbiter (LRO), which measures the temperature of the lunar surface. At lunar sunset, fine-grained regolith and small rocks reach relatively cooler temperatures than large ( $d \geq 1$  m) rocks, which have higher thermal inertia and stay warmer through the 14-day lunar night. This difference allows calculation of the fractional coverage by large rocks of any given Diviner pixel. Young craters have abundant large rocks lying near their rims, which are readily detectable in Diviner data. With increasing crater age, the abundance of large rocks decreases, as they are broken down by the action of small meteorite impacts and covered by regolith transported by nearby impacts. In a 2014 paper, Professor Ghent previously established a quantitative relationship between the Diviner-observed ejecta rock abundance and crater age; now, the team has used that relationship to estimate ages for all lunar craters with diameters greater than 10 km, in order to investigate the rate of crater formation for the past billion years.

The age spectrum of this population of lunar craters showed that the Moon experienced a jump in the rate of bombardment during that time. The team tested a simple rate model, in which a prior uniform rate changed instantly to a later rate, and solved for both the time of the break in impact rate and the level of change. They found strong evidence that



the incoming flux increased by a factor of 2.6 at about 290 Ma implying that the impact rate today is as high as at any point in the past billion years.

Because the Earth receives the same population of impactors as the Moon, this increase also affected Earth. The team analyzed terrestrial craters younger than 650 myr and larger than 20 km in diameter, and found that where those large craters are preserved, their size and frequency spectrum is very similar to that of the Moon. This suggests that, contrary to previous thought, the terrestrial large crater population younger than 650 myr is well-preserved. In support, the team documented spatial and temporal associations between well-preserved kimberlites and the craters they studied. Prior to 650 Ma, a sharp decline in the abundance of both kimberlites and large impact craters, suggests much higher levels of crustal erosion during the Cryogenian period.

This research comprised part of Mazrouei's PhD thesis, which she completed in September of this year. The details of the publication are: Mazrouei S., Ghent, R. and three others. 2019 *Science* Jan 18 issue 6424, p. 253.

*Becky Ghent, Henry Halls*



*Students on the Whitefish Falls Field Course*

## ***Discovery of the Deepest Historical Volcanic Eruption Ever Detected***

Professor **Melissa Anderson**, a new faculty member in the Department, was part of an international team of researchers that set out to find new hydrothermal vents in the Mariana back-arc, located north of Guam and to the west of the famous Mariana trench.

Unexpectedly, they also discovered a newly-erupted lava flow with spectacular glassy tentacles, ~4.5 km below sea level. The timing of the eruption was constrained by collecting high-resolution bathymetry using an autonomous underwater vehicle, and comparing seafloor depth changes to a similar survey collected two years prior. The lava flow reached a maximum thickness of 138 m, with a length of 7.3 km and a width of 200–800 m. Follow-



scale: photo width ~ 5 meters

up work included photo surveys and direct seafloor observations and sampling using a remotely-operated vehicle. The lava flow was still-cooling at the time of discovery—indicated by the widespread discharge of hydrothermal fluids—and was likely only a few months old. It had just begun to be colonized by mobile creatures, like shrimp and squat lobsters, but lacked slower colonizers like sponges and anemones. This finding represents the deepest underwater volcanic eruption during human history ever documented by scientists. The science team had expected to find only old lava flows in the back-arc region, as eruptions are expected to occur only once every few hundred years or so. As such, this discovery was enormously serendipitous.

While submarine eruptions account for ~80% of Earth's volcanism, the identification of deep-sea eruptions is rare, due to the depth and remoteness of the study sites. Before 1990, not a single submarine eruption had ever been detected. Today, even with improvements in technology and an increase in oceanic exploration, only about 40 have been found.

This discovery is an opportunity to learn about a fundamental Earth process that we know little about. The relatively-unaltered young volcanic rocks provide insights into the physical and chemical processes responsible for their formation. It is also an opportunity to study diverse communities of deep-sea creatures as they emerge and change as hydrothermal systems develop and then decline, and the relationships between volcanism and the chemistry of the oceans.

The researchers reported their discovery in a recent edition of *Frontiers in Earth Science* (doi:10.3389/feart.2018.00172, Open Access), led by Dr. Bill Chadwick (NOAA-PMEL). It has since been reported by international news sources and science blogs, including the *New York Times* and *IFL Science*.

This work was supported by the Schmidt Ocean Institute on expeditions FK151121 and FK151129 on *R/V Falkor*, in cooperation with the AUV *Sentry* and ROV *SuBastian* teams. NOAA OER also supported Okeanos Explorer operations in 2016 using the ROV *Deep Discoverer*.

Melissa Anderson

## ***Vatican Workshop on Meteorites and Extraterrestrial Samples***

The Vatican Observatory hosted the first-ever workshop on the Curation of Meteorites and Extraterrestrial Samples September 10–13, 2018 at its headquarters in the Papal gardens of Castel Gandolfo, Italy. Twenty-nine curators from around the world were invited to highlight their work and their collections from institutions such as the Royal Ontario Museum, the Smithsonian Institution, the Natural History Museum of London, several curators from the Johnson Space Centre, and Natural History Museum in Vienna, Austria.

Some topics that were discussed were subjects related to these collections, such as legal issues surrounding meteorite collecting, the storing and sharing of information about meteorite samples, best practices for taking care of and organizing the samples themselves, and growing the collections to better serve the scientific community. Not only were topics discussed around meteorites that fall to Earth, but upcoming missions that will be returning materials in the near future were discussed and the curation challenges that they may pose.





*The telescope building at the Vatican Observatory located at Castel Gandolfo outside of Rome*



*Historic photo of the Carte du Ciel telescope. For more about the project, see [https://en.wikipedia.org/wiki/ Carte \\_du \\_Ciel](https://en.wikipedia.org/wiki/ Carte _du _Ciel). There were 18 of these exact telescopes worldwide, with the collective plan to map all of the stars. Photos courtesy of the Vatican Observatory*

The Vatican Observatory is one of the world's oldest astronomical institutes and holds one of the largest meteorite collections in the world, with 1,100 specimens. The Catholic Church has been incredibly active in astronomy and meteoritics for centuries and remains active to this day. With rich traditions in science that date back to Pope Gregory XIII in the mid- to late-1500s, Pope Leo XIII formally re-founded the Vatican Observatory and located it on a hillside behind the dome of St. Peter's Basilica. In the 1930's when the smoke and city glow made it difficult to conduct useful observations in Rome, the Observatory was relocated to Castel Gandolfo, which is 25 km southeast of Rome. With the increasing population of Rome, the skies above the Observatory there also became too bright. By 1961 the Observatory founded a second research centre, the Vatican Observatory Research Group which operates one of the world's largest and most modern centres for observational astronomy on the grounds of the University of Arizona, in Tucson, Arizona.

*Kim Tait, Senior Curator, Royal Ontario Museum and Associate Professor, Department of Earth Sciences*



## ***UofT's Newest Economic Geologists Welcomed by the TDSG***

On October 23, 2018, the Toronto Geologic Discussion Group hosted a "UofT Night" to welcome the University's newest Assistant Professors, Dr. **Melissa Anderson** and Dr. **Daniel Gregory**. Following an introduction by **Russ Pysklywec**, Professor and Chair of Earth Sciences, Dr. Anderson and Dr. Gregory spoke about their research in economic geology.

Dr. Melissa Anderson (PhD, University of Ottawa and GEOMAR), spoke about her research that looks at genetic and exploration models for massive sulphide deposits in back-arc tectonic terrains. Dr. Dan Gregory (PhD, CODES, University of Tasmania) explained his use of micro-analytical techniques (NanoSIMS, LA-ICPMS, synchrotron-based XANES) on pyrite to characterize the geochemical profile of major mineral deposit types (porphyry, SEDEX, VHMS).

The event was well attended by industry professionals as well as several University of Toronto students. "It was really interesting to hear about the research that is being carried out in the department by our own professors," remarked third-year Geology student Jan Villarin, also mentioning that he "looked forward to learning from [Dr. Anderson and Dr. Gregory] in the coming years."

His sentiment is shared by many Earth Science students who have noted the enthusiasm that Dr. Anderson and Dr. Gregory have already expressed since joining the University in September. From sending out emails to promote various networking events, to actively engaging in discussions about prospective career paths with students, the pair bring their knowledge and ideas to the department with new vigour that is already inspiring the University's next generation of Earth Scientists.

To learn more about the Toronto Geologic Discussion Group or to register for upcoming talks, please visit <http://www.tgdg.net> for more information.

*Joy Carter  
Industry Liaison  
Undergraduate Earth Sciences Association (UESA)*

## Emeritus Corner

### **John Westgate and research team discover origin of enigmatic tephra deposit in Saskatchewan**

About 1 million years ago, the Calles Caldera in New Mexico, one of the largest and long-lived volcanic centres in north America, was testimony to a giant Plinian eruption that produced a cloud of ash over 40 km high. At the time the wind was from the south and blew the ash northwards for 1500 km into Canada, to form the Duncairn tephra in Saskatchewan. This discovery is based on a multidisciplinary study comprising major and trace element geochemistry, fission track dating, and paleomagnetism. The lead author, **John Westgate**, discovered the Duncairn tephra in 1971, a flat-lying fine grained and friable white deposit lying in a depression which subsequently disappeared as a result of rural development. Fortunately John took many large samples which could be oriented with respect to their way up because very fine graded bedding was preserved. This allowed a positive comparison of the inclination and polarity of remanent magnetization with potential tephra correlatives in the US.

Ten authors contributed to a paper and four, (Westgate, **Henry Halls**, **Mike Gorton** and **Colin Bray**), all from our department, possibly making this publication, in terms of internal collaboration by faculty and staff, the largest ever!



*Mike Gorton, Henry Halls and John Westgate after a joint presentation of their research [Photo: Jerry Roth].*

The high purity of the Duncairn ash was probably due to deposition on snow during winter or early Spring. When melting occurred the ash was flushed into a pond and was not contaminated by mixing with the underlying sediments because the ground was frozen. A waterlaid origin for the tephra is demonstrated by its finely laminated nature and the presence of primary sedimentary features such as graded and cross bedding. The happy coincidence of a major Plinian eruption and a relatively rare northward jet stream, allowed the only known deposit from the Valles Caldera to be found in Canada.

The paper has been accepted for publication in the *Journal of Quaternary Research*. doi:1017/qua.2018.139

### **Norcamphor ( $C_7H_{10}O$ ) and the Earth's crust**



Years ago, **Michael Schweinberger** (MSc, 2002; Robin), then a graduate student in our department, and **Frank Fueten** (PhD, 1990; Robin), now professor at Brock University and Mike's PhD supervisor, were running experiments in which a mechanical device deforms a thin slice of polycrystalline norcamphor sandwiched between two thin

section plates on the stage of a petrographic microscope. Norcamphor, like camphor, is a colourless easily deformable organic compound that melts at 95°C. In addition to being easily deformed, norcamphor is optically uniaxial: through a petrographic microscope at room temperature it appears similar to—but much faster than—quartz deforming at 400°C or more. Grain boundaries migrate, some grains shrink while others grow and break-up, or even disappear. See the video at <http://www.es.utoronto.ca/wp-content/uploads/2019/02/MaxInt0011.mp4> To monitor the deformation, small specks of grinding powder are scattered through the norcamphor. Frank and Mike asked if I could provide a method to calculate a two-dimensional 'strain' (a

quantitative measure of deformation) from the motions of these specks. I could and I did. But Mike left before using the method. A few months later, a visitor in the department talked about monitoring crustal deformation by repeated surveys of GPS stations over several years. Moving GPS stations is rather like moving specks of grinding powder: I thought my method might also be useful in geodesy. A paper, using both specks and GPS stations as examples, is now in press to *J. Structural Geology*. I am currently using the method to look at crustal deformation in British Columbia and Alberta south of the 57th parallel and in the northern parts of Washington State, Idaho and Montana. Except for the north end of Vancouver Island, the crust is contracting along a direction perpendicular to the west coast as expected, and the contraction rate decreases eastward. The deformation is slow, even on Vancouver Island, and strain should remain elastic over many centuries. Yet we know it is not entirely elastic, because crustal earthquakes occur there all the time. Large 'megathrust earthquakes' occur every 300 to 900 years on the Juan de Fuca subduction zone, off the west coast. Where is their very large elastic energy stored?

*Pierre Robin*





*Digger Gorman*

## ***“Digger” Gorman; In His Own Words, Part Two***

In last year's Alumni News (Issue 27, 2018, p.6) we included an interview that **Steve Scott** had with **“Digger” Gorman**, our oldest Professor Emeritus at 95. We promised to run the second installment on the Department's web page, but have decided to continue it here as it records an interesting and never-told-before story concerning the attendance of **Madeleine Fritz**, Professor of Paleontology and Professor **M.A. Peacock**, Professor of Mineralogy and Crystallography, at Department Orals. These comprehensive examinations on all aspects of Geology had to be passed in order to be admitted to a PhD Program. With this background, Digger's story continues.....

“I remember ending my first session in the department as a fully-fledged student under Professor Peacock. When I came to UofT, Professor Peacock had tried very hard to have the department called the Department of Mineralogy. He was, of course, a very powerful man. In fact, his title at the University of Toronto was Professor of Mineralogy and Crystallography, never Professor of Geology. He was very proud of that and he used to say that he was the only geology professor in the world with that title. Somewhere along the line, there must have been a department of mineralogy because, when I took

my crystal drawing from him as a graduate student, the draughting board that I used had that name in large stencilled official letters; at that time his wish for the department to be called the Department of Mineralogy had lots of competition and, of course, he never won.”

“At that time, there was quite a controversy between Dr. Peacock and Dr. Fritz and I arrived just in the middle of it. I'll tell you this anecdote as part of UofT history. Dr. Peacock used to go to the paleontologists' departmental orals and give the young paleontology students a really hard time. He said every person should know mineralogy and crystallography and, indeed, I think he actually flunked a few people. To counteract that, when a mineralogy student came up and there were many of them (Dr. Peacock took two PhD students a year so there were often six !), Professor Fritz used to say all mineralogy students should know the Earth's history and paleontology. She would often flunk out Professor Peacock's students. Now, I came along as a maritimer. I had to go and see various professors to see what make-up classes I had to take, and of course I had to see Miss Fritz as we called her. I entered her office, told her who I was and she said ‘Oh, you're from UNB. You're from New Brunswick. I'm from New Brunswick. I'm from St John. My father was a sea captain. Sit down!’ I sat down and she said ‘Do you like dalts?’ Dalts are dried seaweed and a NB delicacy. I said that I did love dalts. She opened her drawer and threw a handful of dalts at me. We sat there and probably chatted for over an hour eating these dalts. The long and the short of it was she said ‘I hear you have a nickname ‘Digger’. I said ‘Yes’ and she said ‘I'll call you Digger. Please call me Madeleine.’ This was sort of unheard of. She was a senior professor and a bit prudish at times. I can always remember going up to the lounge afterwards and saying ‘I just had a meeting with Madeleine’ and **Bill Gross**, one of my fellow graduate students, said ‘Dig, if you call her Madeleine, you can pack your bags and get back to Fredericton. She's not going to have any truck with you.’ In any case, Madeleine and I became old friends and, when it became time for me to take my department oral, I went to see her to say ‘What should I brush up on?’ She said, ‘Oh no Dig, you're a mineralogy-crystallographer. I've come to the conclusion that you don't have to know any paleontology and I'm not going to come to your departmental oral.’

I remember leaving her office and coming up to the lounge. Professor Peacock was there and I said ‘Well, you know, I have just come from Professor Fritz's office. I got good news at least. I don't have to study any paleontology’ and he said ‘Why's that?’ I said ‘Well,



*Professor Madeleine Fritz*



*Professor M. A. Peacock*

*Continued on page 22*

Professor Fritz said you guys in mineralogy and crystallography really don't have to know much paleontology' and he said 'Did she say that?' I said 'Yah' and he said 'Well, you know, come to think of it, I've been a little hard on the paleo people. Really, you know, those paleontologists don't have to know much about crystallography. I don't think I will come to their departmental orals anymore.' So, I spread that word around to several of the graduate students who were paleontologists. Some had become very high up in paleontology in the geological survey and, although I was a mineralogist, I had many young friends in paleontology because I was their hero who stopped Professor Peacock from going to their departmental orals. That was quite a leap forward for graduate students".

As an addendum, did you ever wonder why Professor Gorman was nicknamed "Digger"? His studies to be a geologist at UNB were interrupted when the second World War broke out. At that time he joined the navy where his comrades on board, on learning that he studied rocks, called him "Digger". The name stuck!

*"Digger" Gorman, Steve Scott and Henry Halls*

## A Chance Encounter

I was out on one of the 30,000 islands in eastern Georgian Bay last summer, one of the Mink Islands, with a group of about 30 folks as part of an annual Rock Walk that we do under the auspices of the Georgian Bay Land Trust where I am a Board Member. Typically we do three walks each summer and pick different locations every year when weather and waves permit. The GBLT is a registered charity with the aim of preserving as much of the iconic Shield landscapes and ecosystems of Canada's largest freshwater archipelago as possible by donations of islands and land. I just edited a book on this wonderful place (*Georgian Bay: Discovering a Unique North American Ecosystem* published by Fitzhenry and Whiteside, Markham ON, 260 pp) which has just won the prestigious Chalmers Award from the Champlain Society (**Andrew Miall** was a co-contributor) but that's another story. I was explaining the significance of the beautifully banded gneisses and of the surrounding terranes for our understanding of how the planet has worked over the last 4 billion years and thus, our place in it. It was as usual, an attentive group not scared of asking simple and fundamental questions on the entire gamut of geology from the Archean to the last ice ages (and climate change of course) for which the crystal blue waters, bobbing boats and surrounding low islands with their wind swept pines were a wonderfully serene backdrop. Inevitably, the name of one of our famous former colleagues at UofT came up in discussion: **Tuzo Wilson** of course and his fundamental mountain-moving role in all that we do as geologists. During a pause in the discussions, one of the group members came over and whispered 'Hey, his daughter's over there' and there indeed, looking very sprightly and tanned was Susan Wilson. Once I had gotten over my initial shock (and awe I must confess) she told me of the



family's cottage on Go Home Bay and their time together on the Bay especially sailing in her father's Chinese junk the *Mandarin Duck*, but that as a young woman she'd been quite unaware of the global importance of her father's work having learned of it much later in life from others.

It was a special moment, one of those brief encounters of which long-term memories are forged.

Map courtesy of the Ontario Geological Survey  
*Nick Eyles*

For information on the Chalmers Award visit the website:  
<https://champlainsociety.utpjournals.press/chalmers-award>



## Alumni Events in Western Canada

We went west this year to connect with some of our alumni!

In June, **Russ Pysklywec**, with Robin Kester and Diana Kupral from University of Toronto, Faculty of Arts and Science Advancement Office travelled to Calgary, Vancouver and Seattle. In January, Professor **Dan Gregory** and **Karyn Gorra** went to Vancouver for an alumni night during the AME Roundup. Alumni **Anne Thompson** (MSc 1984) and **John Thompson** (MSc 1978; PhD 1982) and **Don Poirier** (BSc 1983) helped bring together a number of alumni attending Roundup. It was an enjoyable event and we'd like to do it again! Alumni planning to attend the AME Roundup next year are invited to contact Karyn Gorra—[k.gorra@utoronto.ca](mailto:k.gorra@utoronto.ca)—if you are interested in attending an event during the conference.



Vancouver, June 2018, left to right: Diana Kupral, David Moore (MSc 1977), Russ Pysklywec (MSc 1994; PhD 1998), John Thompson (MSc 1978; PhD 1982), Paul Sorbara (MSc 1979), Anne Thompson (MSc 1984), Robin Kester, Don Poirier (BSc 1983).



Calgary, June 2018, left to right: Roger MacQueen (BA 1957; MSc 1960), Robert McGrory (HBSc 1994) Kun Guo (HBSc 2013), Russ Pysklywec, Andrew Willis (PhD 1997), Brad Hayes (BSc 1978)



A group of alumni and guests met at the Rogue Kitchen and Wetbar in Gastown area of Vancouver during the AME Roundup meeting in January 2019. Left to right front row: Dan Gregory, Anne Thompson, John Thompson, Konrad Chrzastowski (MSc 2017), Karyn Gorra, David Moore, Richard Mazur (BSc 1975), Christian Veglio (HBSc 2017), Erica Veglio (HBSc 2016; MSc 2017), Casey Hetman (HBSc 1993; MSc 1996) Virginia Cooke (guest). At back left to right: Thomas Schuster (BSc 1995), Chris Charles (PhD 2013), Dylan McCarthy (guest) Roger Moss (PhD 1995), Christine Norcross (MSc 1997), George Gorzynski (MSc 1978), Don Poirier.

## Major Publication on the Earth's Oldest Rocks

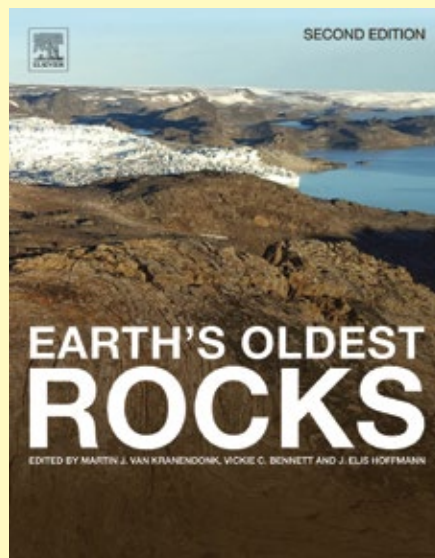
**Martin Van Kranendonk** (MSc 1987; Schwerdtner), is the lead editor of the second edition of the book “*Earth's Oldest Rocks*”, which has been published by Elsevier at the end of 2018. It has 42 chapters and 1078 pages dealing with just about everything you ever wanted to know about the history of Earth accretion and early Archean rocks (up to 3.2 Ga). Of the 126 contributors, four are associated with our department: **Yuri Amelin**, **Nick Arndt**, **Stephen Barnes** and Martin, all of whom have played major roles in formulating key ideas about the Archean. The preface, written by Martin, talks from a personal perspective about the wonders of geological field work and introduces colleagues, both past and present, who have been major players in the field. The first one cited is UofT Prof. **Alan Goodwin** and here is a short extract from the Preface (with minor modifications to save space!)

“For me it was the adventure, combined with the beauty of remote places, and the wonder of the unknown that drew me into the study of early Earth. As an undergrad at the University of Toronto, I was fortunate enough to have lectures on the Precambrian by Alan Goodwin (now deceased) who always finished his lectures with a stunning scenery shot of some far-off place that had old rocks: India, Australia Northern Canada. To me his love of the field brought to my developing mind a human aspect to geology that I had not known existed – one could both study *and* love what one did. It was through his course “The Precambrian”, including a required essay, that I first became aware of, and fell in love with, the Pilbara region of Western Australia.

For my PhD, I was fortunate enough to hitch a ride on a fishing boat for an eight hour trip up the Labrador coast from the remote village of Nain to Hebron, to start what

were three incredible summers of mapping ancient rocks by Zodiac (dodging icebergs), by helicopter (dodging fierce winds) and on foot (dodging polar bears). There is an incredibly wonderful feeling of aloneness—but at the same time completeness—of being in wilderness when the drone of the plane's engines disappears over the horizon and all you hear is the dripping of an iceberg washed up on the shore, where your seemingly meagre store of supplies awaits some sort of ordering, and you hope the batteries for your radio—your only contact with civilization—haven't died *en route*. Being in wilderness forces you to become self-reliant and it gives you the precious gift of confidence as you solve every problem, and overcome daily dramas that could have serious or even fatal consequences.”

*Martin Van Kranendonk, Henry Halls*



## News from Alumni

**Alan Gregory** (BA, Victoria College 1950; PhD U. Wisconsin 1958)

Born in Lindsay, Ontario in 1926, temporally homeless during the Depression, his family ultimately moving to Toronto, Alan Gregory registered in Geology at Victoria College. He graduated in 1950 with honours in both athletics and academic standing in Geological Sciences that included the Coleman Gold Medal and Victoria College's Regent's Gold Medal.

Alan recalls his time spent in the Geology Department of the old Mining Building.





"In October of 1948 I joined university classmates on a field trip near Bancroft. Despite complex geology, exotic minerals and autumn colours, my most vivid memory was the beautiful piccolo solo played at sunset by **Martin Peacock**, a staid professor of mineralogy. I fondly recall several of my other Professors:

**Alexander Maclean**, who lectured on glacial geology, had a cluttered office at the top of the stairs in the old Mining Building. There, I and many others, always received a warm welcome with tea, cookies and solace.

**Tuzo Wilson**, professor of geophysics, was an enthusiastic and well-loved lecturer who was not above involving undergraduate students in his research on continental drift, research that later brought him international recognition.

**George Langford**, professor of economic geology, was irreverently but respectfully known as "Big Dome" because of his lofty stature and bald head. He was greatly admired for his knowledgeable presentations, as well as for leadership in his profession.

**Madeleine Fritz**, professor of paleontology, shared her love of fossils with all budding geologists because she believed that even hard-rock geologists should understand the perspective of life developing through geologic time.

In my graduating class were six other students: **Bob Blackadar**, **Stan Charteris**, **Pat Farrell**, **Al Gorrell**, **John Harvey** and **Russ Waines**. Stan quickly established himself in mineral exploration and enjoyed a successful career as a consultant. Al worked in the petroleum industry as a well-traveled consultant until, sadly, he perished in a hotel fire in the Philippines, and Bob joined the GSC. Two classmates chose careers in education, with Russ becoming a geology professor at the State University of New York and John Harvey a teacher of earth sciences in schools of south-western Ontario".

After graduation Alan was employed by Eldorado Mining & Refining as a field geologist interpreting airborne gamma-ray surveys. In the summers of following years, he worked as a research geologist for the Exploration Division of Eldorado. In the winters, he attended graduate school at the University of Wisconsin and ultimately moved to Madison to complete his studies in geology and geophysics. Running low on funds, he and his wife Dorothy moved back to Eldorado. When the Exploration Division was disbanded, they moved to Toronto where Alan worked as an assistant in **Digger Gorman's** mineralogy lab while working on his thesis which he completed in 1958. In 1956, they moved to Lynn Lake, MB, and he worked as an exploration geologist in northern Canada for Sheritt Gordon Mines. In 1958, he moved to

Ottawa and spent eight years in magnetic and radiation survey research with the GSC, three months as consultant in mineral exploration to the Geological Survey of Nigeria, three years as associate professor at Carleton University and four years as a consultant to the department of Energy, Mines and Resources, the United Nations and several countries and mining companies. His research helped to develop airborne gamma-ray spectrometry and remote sensing from satellites. His knowledge of remote sensing was utilized in drafting the agreement with the USA that facilitated Canadian participation in the Earth Resources Technology Satellite program with NASA. He worked for EMR to help create the Canada Centre for Remote Sensing (CCRS) in Ottawa.

In his own words: "We foresaw many practical developments from our research but never anticipated public services like Google Earth which subsequently developed from commercial research in the USA and Canada. In 1973, Dottie and I incorporated Gregory Geoscience Limited in Ottawa. In time, we had a staff of scientists to interpret satellite images and develop an optical instrument (ProCom-2) to assist in that interpretation. For a short time, Gregory Geoscience was the largest user of ERTS/LANDSAT images according to NASA and CCRS data. Digital analysis was developing and eventually captured the market, as we had foreseen, and bought our own small digital analyser before Dottie and I retired in 1990".

*Alan Gregory, Henry Halls*

**Graeme Bonham-Carter**  
(PhD 1966; Beales)

After leaving UofT in 1966 (where my interest in computers was sparked by **Gordon Smith**), I spent 3 years at Stanford as a post-doc with John Harbaugh working on sedimentary simulation models, culminating in a book with him: *Computer Simulation in Geology* (Wiley Interscience, 1970). During this time, in 1968, I was slated to attend IGC in Prague. I was driving in a new VW Camper from Austria with my first wife, and as we approached the Czechoslovakian border, we heard that the Russians had invaded the night before: their tanks got there ahead of us, so we never made it. At this conference the International Association of Mathematical Geology (IAMG) was due to hold its first meeting, and I was almost a Founding Member. Instead of research presentations, a small group held a brief organizational meeting in a building surrounded by tanks, and IAMG was born. This past summer, 2018, I



attended a 50th Anniversary Meeting of IAMG in Olomouc, near Prague, and a celebratory day and dinner was held in the same Prague university building as the initial meeting in 1968. I attended as a 'founding member' despite missing the original by a hairsbreadth.

During the early 1970s I taught at the University of Rochester and my primary research was developing wind-driven circulation models of Lake Ontario. I also did some work with **Bruce Waterhouse**, a palaeontologist then teaching at U of T. But teaching was not for me, and I took 3 years out to go dairy farming in UK—a total and rather crazy break, because I soon realized that I should get back to geological research in order to make a better living (part of the story anyway). I joined the Geological Survey in Ottawa in the early 1980s, spending the next 25 years working in the Geomathematics Section of the then Mineral Resources Division. Lots of papers and conferences—this was a satisfying career, and at one stage in 1994 I published a book “Geographic Information Systems: Modelling with GIS (Pergamon Press)”. Much of my GSC work involved working on GIS-based methods for prospectivity analysis.

Although retired from GSC the past 13 years, I have continued to do consulting work. I was Editor-in-Chief of Computers & Geosciences for almost 10 years, being succeeded by **Eric Grunsky** (see this page). It is satisfying to see that the journal has 12 issues per year and a very healthy impact factor. In the 1980s I remarried and settled in Merrickville in 2007, a small community south of Ottawa.

**Cameron Allen** (BSc 1970; MSc 1972; Gittins, PhD Cambridge)

After leaving Toronto, Cam went on to complete a PhD at Cambridge studying the Troodos ophiolite in Cyprus and then spent about 40 years as an exploration geologist with Cominco and Teck. He is presently retired with wife Deidre and living in Spokane, WA. His interests include collecting, restoring and driving vintage Porsches and being a significant contributor to Earth Science scholarship funds, particularly our Department's Cameron Allen Explorers Graduate Fellowship. He has sent us the following amusing article:

“Geological field trips are universally agreed as the best teaching mechanism for undergrads and grads alike, but sometimes the geological merit is eclipsed by social and human interests. A case in point is a September 1971 field trip from Kenora greenstones to the Sudbury eruptive to the Grenville Front, being part of a Precambrian geology course led by “Smiling Al” **Goodwin**. The early 70s at UofT were remarkable for both the number and the nationality



*Cam standing beside his 1965 Porsche 356*

of grad students enrolled in the earth sciences. Literally, the department was a United Nations of research interests, experience and disparate nationalities. This was a well subscribed trip with some 15 guys and at least 5 gals and a supporting cast of other academics. Perhaps the most anticipated segment of the trip focused on Sudbury and Inco, especially the underground mine tour. Circa 1971 Inco (now Vale) famously had a long-standing mine policy—call it a superstition from the Middle Ages—of not allowing women underground, a policy which was waived only once—for Queen Elizabeth II in the late 1960s! On any geological excursion, women participants were shuffled off to a surface tour while the men went underground. Imagine then our amazement the night before our scheduled trip when Inco advised by phone from head office that this policy had been rescinded and the five women were free to join the rest of us. The mine tour was uneventful, but the big drama played out only after the cage returned to surface. As the cage doors rolled open the hard-hatted, mine-booted, yellow-slickered crew of 15 guys and 5 gals were bathed in the glare of several TV cameras and newscasters who had caught wind of this historic event. I can recollect all of the girls objecting that their hair was a total mess, their hard hats unbecoming, while diving into their backpacks for makeup repairs before they would submit to brief TV interviews. This consternation, the shock of the glaring TV cameras and the many incongruities of the event played into an intensely humorous occasion that was, to many of us, the most vivid and memorable part of the trip. In the final analysis, what this UofT geology field trip did was to mark the beginnings of the breakdown of the glass ceiling within Inco in particular, and more widely in the mining business across Canada”.

**Eric Grunsky** (BSc 1973; MSc 1978; Schwerdtner, Robin and Bailey; PhD, 1988 U. Ottawa)

During a 38-year career (1977–2015) I had the privilege of working for several provincial geological surveys (Ontario, British Columbia, Alberta), the Geological Survey of Canada and CSIRO in Australia. Recognition for my work is



## From the Archives

*A student photo of  
Eric Grunsky in 1971!*



documented in:

<https://link.springer.com/article/10.1007/s11004-012-9425-2>

After retiring from the Geological Survey of Canada, in 2015, offers came in to participate on Science Advisory Boards with national research projects which included the Footprints project, supported by NSERC and CMIC, and more recently the Metal Earth project being managed out of Laurentian University. I have maintained an active role with the International Association for Mathematical Geosciences (IAMG), first, as a member of Council (1992–1996); Editor-in-Chief of the IAMG journal, *Computers & Geosciences* (2006–2011) and currently as Secretary General (2016–2020).

I've also maintained an Adjunct Professor status at the Department of Earth and Environmental Sciences at the University of Waterloo and continue to offer a short course at conferences and universities on the use of multivariate statistical and machine learning methods for interpreting geochemical data. I also carry out consulting activities in the same field.

As a professor (part-time) at the China University of Geosciences Beijing, I have been working with graduate students and teaching a graduate-level course in the use of multivariate methods for interpreting geochemical survey data. I've also visited several earth science departments at universities across China. The accompanying photo was taken while I was at the Panda Bear Research Base in Chengdu, China.

During the past few years, I have been working with colleagues from Canada, Australia, Ireland and Northern Ireland where we have been studying near-surface geochemical survey data for mineral resource identification/potential and mapping tectonic terranes.

Life in retirement has been busier than anticipated. In June of this year, several of us, from the graduating class of 1973, met for a barbeque hosted by **Dan Dupak**. It was great to catch up with former classmates, some of whom I haven't seen since 1973! I continue to keep in contact with many of my former classmates from my undergraduate and graduate time in the department and never miss an opportunity to attend the annual reception at the PDAC.



*Eric Grunsky and panda in China*

### **John Bladek** (BSc 1984)

John graduated with a Geology Specialist BSc in 1984. A member of New College, he particularly recalls time spent in the old Mining Building. He has kept in touch with some of his original classmates including **Sandra Kamo** who is now the Director of the Jack Satterly Geochronology Laboratory. John retired from the oil industry in 2011 and moved from Calgary to rural Nova Scotia where, since 2016, he has become a full time artist. He paints mostly landscapes in a style that he calls “geometric”. His degree in Geology and Geography, and a love of the outdoors combine to provide inspiration for his paintings. He is just getting started and has already had his art in shows and galleries in NS and Calgary. John is presently enrolled at the Alberta College of Art and Design in Calgary. He also produces Rock Calendars, such as one for 2014 which featured metamorphic boulders from the shores of Georgian Bay. More information about his art can be found at [www.johnbladekart.com](http://www.johnbladekart.com)



*John Bladek with his painting “the Fossil Cliffs at Joggins, NS*

**Eira Thomas** (BSc 1991) was appointed CEO of Lucara Diamond in Vancouver. Known as the “Queen of Diamonds” after helping her father discover the Diavik diamond mine in NW Canada, she was interviewed by Henry Sanderson of the Financial Times June 25 2018. Here she advocated changes to diamond trading that would eliminate industry middlemen and allow individual diamond purchases directly to manufacturers through a digital platform.

**Mirek Benes** (PhD 1995; Scott) is VP Exploration/Executive Director of Kazzinc in Kazakhstan, a subsidiary of large Glencore International Ltd. Members of his consulting team include **Tucker Barrie** (PhD 1990; Naldrett), **Jun Cowan** (PhD 1996; Schwerdtner), **Werner Klemens** (PhD 1996; Schwerdtner) and **Petri Peltonen** (PDF 1987; Scott).

#### **Dominic Channer** (PhD 1994; Spooner)

Dominic Channer finished his PhD on fluid inclusion geochemistry in 1994 and, somewhat to the surprise of his colleagues, took a job in diamond exploration in Venezuela on the Guaniamo project, site of high diamond grade kimberlite sheets. This was a wonderful learning experience that included many of the non-technical aspects of exploration (stakeholder engagement, logistics and people management, permitting, etc). Unfortunately, political



changes put an end to investment in 2006 and a move to Ecuador ensued, to be the Country VP for Aurelian Ecuador. Soon after, Aurelian Resources was bought by Kinross, to which he transitioned. Dominic stayed in Ecuador running External Affairs (Community and Government relations and Communications) for Kinross and then returned to the Country VP role where he became very involved in mining contract negotiations with the Government of Ecuador. This was a difficult time politically and Kinross ended up selling the company to Lundin Gold. Dominic then took on regional external affairs for South and North America for Kinross, before moving to his current role in early 2016, which is VP Community Relations at the corporate office in Toronto. This job takes him to all of Kinross' operations around the world and is a lot of fun, keeping him on the road much of the time. He was married while still doing his Ph.D and his three kids grew up between Venezuela and Ecuador, with the eldest two now in university. UofT and the mining industry have given Dominic and his family a great life and for him personally, endless learning opportunities.

**Ulrich Riller** (PhD 1996; Schwerdtner)

Now at the University of Hamburg in Germany, **Ulrich Riller** has been a researcher at the GFZ Potsdam (1998-2002), professor at Humboldt University in Berlin (2002-2007) and then at McMaster University in Hamilton (2008-2012). For his PhD he studied the structure of the southern footwall of the Sudbury Basin, the deformed relic



of a giant meteorite impact structure. Afterwards he and his graduate students studied the Vredefort impact structure, South Africa, and the Sudbury Basin, regarding impact-induced and orogenic deformation and their relevance to ore deposit formation. UofT Alumni **Richard Grieve** (MSc 1967; Gittins, PhD 1970; Fawcett) and **Peter Lightfoot** (MSc 1982; Naldrett) have been involved in these studies. Recently, a particular scientific focus of Ulrich has been the 200 km diameter Chicxulub crater, Mexico, caused by impact of a bolide some 15 km across and deemed responsible for the extinction of the dinosaurs. A paper has just been published in the journal *Nature* by Ulrich, twelve co-authors and the IODP-ICDP Expedition 364 Science Party, of which he is a member [*Nature* v.562, p. 51–518, 2018]. It provides evidence for the existence of acoustic fluidization during initial cratering and shows that catastrophic rock weakening is followed by gradual localization of brittle deformation. The latter points to an increase in rock strength during cratering and explains the formation of morphological rings rising hundreds of meters above flat crater floors typical of large impact structures on terrestrial bodies of the solar system. This work was reported in a BBC documentary and can be viewed at:

<https://www.bbc.com/news/science-environment-45986449>

Apart from impact tectonics, Ulrich and his students are engaged in volcano-tectonic studies of collapse calderas and active volcanoes in the Patagonian Andes and unravelling Proterozoic tectonics of southwest Finland. Recently, they also established a state-of-the-art analogue modelling facility at Hamburg University. Having benefitted tremendously from a scholarship of the German Academic Exchange Service (DAAD) during his PhD thesis work, Ulrich now enjoys serving the DAAD as a board member in the selection of hundreds of Latin American scholarship recipients each year.



**Jennifer McKelvie** (MSc 2002, PhD 2006; Sherwood Lollar )

Jennifer was recently elected to the Toronto City Council in the 2018 municipal election. She represents Ward 25 (Scarborough—Rouge Park) and was one of only two non-incumbent candidates to unseat an incumbent councilor.

She fell in love with Scarborough—Rouge Park when volunteering with Friends of the Rouge as a teenager. Witnessing the passion of local residents inspired her to pursue studies at the University of Toronto Scarborough (BSc Environmental Science) and later obtain a doctorate in Geology in our department. Jennifer has dedicated her career to community engagement and site assessment for infrastructure development.

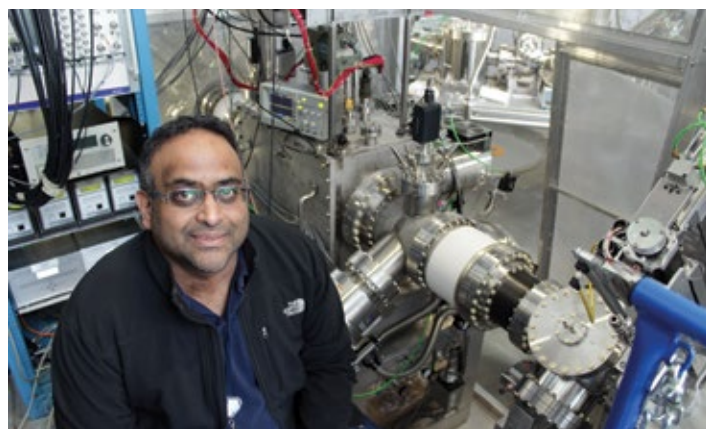


Since 2005, she has proudly called Ward 25 home with her husband and two children. After finishing as runner-up in the 2014 campaign, Jennifer was asked by the Rotary Clubs of Scarborough to serve as first President of the Scarborough Community Renewal Organization, a non-profit dedicated to creating and realizing bold visions for Scarborough ([www.renewscarborough.org](http://www.renewscarborough.org)). She also served as a member of the University of Toronto Scarborough Campus Council (2015–2018), and as a citizen member of the Toronto Region Conservation Authority (2015–2018).

**Chris Charles** (PhD 2013; Davis)

Chris Charles, who has been at the UofT on and off for the last 21 years, has left to take up a permanent research Physicist position at the TRIUMF National Laboratory at UBC in Vancouver as of January 2019. Chris will be designing novel ion sources for the 520 MeV cyclotron and associated beam lines, and envisioning new ways to produce rare and exotic isotopes for nuclear and particle physics, astrophysics and cancer research.

His introduction to isotopes came in 2004 when, as an Honours B.Sc astrophysics student, he used the IsoTrace 3MV tandem accelerator in the department of Physics to search for the supernova-produced isotope  $^{146}\text{Sm}$  by Accelerator Mass Spectrometry (AMS). Much later, he was the last person to



*Chris in his lab at TRIUMF*

use the accelerator before its final decommissioning in 2016. Throughout his IsoTrace years (2013–2016) he benefited from advice and discussions with A.E. Litherland, X.L. Zhao, W.E. Kieser, R.J. Cornett and I.D. Clarke. As a newly minted PhD, Chris moved to Ottawa in 2014 to help build the new 3MV AMS facility at U. Ottawa. He continued his work on isobar separation with radio-frequency quadrupole gas-reaction devices for AMS, and rare actinide detection in natural samples, using the geochemical techniques learnt at the Jack Satterly laboratory under the guidance of **Don Davis**, where, for his PhD, he studied meteorite U/Pb isotope geochemistry.

In 2015 Chris had the good fortune to spend six weeks in the Canada Basin of the Beaufort Sea (80N, 150W) aboard the icebreaker C.C.G.S *Louis St. Laurent*, collecting Oceanic Depth profiles for  $^{236}\text{U}$ ,  $^{129}\text{I}$  and other rare nuclides for AMS.

Chris returned to UofT from 2016–2018, working at **Barb Sherwood Lollar's** Stable Isotope Laboratory, as a PDF/Lab manager. Here he learnt stable isotope gas mass spectrometry, and applied  $^{36}\text{Cl}$ ,  $^{129}\text{I}$  and  $^{236}\text{U}$  in AMS to better understand the age of the oldest known water on Earth (at the Kidd creek mine, Timmins).

We all wish Chris good fortune in his new venture on the west coast. Chris has a beautiful daughter Ashelyn (see photo), the light of his life, who at age 10, will undoubtedly enjoy the outdoors life that BC has to offer. I for one will always remember the good times in the Graduate Union bar, where Chris was a fountain of interesting and often amazing stories relating to his earlier experiences as a graduate student in the department.



*Henry Halls [with notes from Chris Charles]*

**Phoebe Chan** (PhD 2016; Halfar)

Although Phoebe was featured in last year's magazine, we just had to tell you about her recent exploits. When she left Toronto to take up a three-year position as a PDF in Bergen, Norway, Phoebe had been awarded a combined total of over half a million Canadian dollars from VISTA (Norwegian Academy of Science and Letters) and from Equinor (a petroleum company). In addition she was awarded an NSERC two-year PDF which she will be taking up concurrently with the VISTA fellowship. This surely makes her one of the richest awardees for a newly-minted PhD! She was also nominated for the NSERC and L'Oréal-UNESCO Women in Science Supplement which recognizes promising female PDF researchers, but she had to decline because the award was only offered to Fellows pursuing research in Canada.

This past summer Phoebe went on an Arctic expedition in search for long-lived coralline algae. Her project uses these annually banded calcareous algae to reconstruct past marine productivity in the Arctic. As co-leader of the 14-person expedition, her exploits took her to Svalbard, an island archipelago north of Norway where she rented a 25 metre-long icebreaker, the *Ulla Rinman*, otherwise nicknamed "the bathtub" by those on board (see photo), a reflection of the



ship's ability to handle rough weather! The cruise took place from July 3–9 during the Midnight Sun, a natural Arctic phenomenon when the sun remains in the sky for 24 hours a day. The ship set sail from Longyearbyen to a small island off the west coast of Svalbard called Prins Karls Forland. Ten new collection sites were discovered with the aid of **Jochen Halfar** and five scientific divers, working from a Zodiac, who used hammers and chisels to recover the algae from depths of ~15 metres. Scientists and crew members lived onboard the ship surrounded by abundant Arctic wildlife. Seabirds, belugas, and even walrus were sighted, but most memorable were the curious seals that swam alongside the ship and even played with the underwater cameras!

## Obituaries



**Robert McNutt** (1936–2018)

Professor Emeritus **Robert McNutt**, former Principal of UTM, who passed away on June 24, 2018, had a long and distinguished career as both an academic and administrative leader. He received his BSc in geology from the University of New Brunswick in 1959 and his PhD in geochemistry from the Massachusetts Institute of Technology in 1965. He was an expert on the applications of isotope geochemistry to the study of water/rock systems. Bob made pioneering contributions in isotope geochemistry to the study of ancient groundwaters, rocks and ores of the Canadian Shield. At McMaster, he supervised several PhD students who became well-known figures in the Canadian Earth Science community, most notably Fred Longstaffe (University of Western Ontario) and Larry Heaman (University of Alberta).

Bob was involved in many significant research collaborations in isotope geochemistry. With Shaun Frape at Waterloo, he used strontium isotope data to understand ancient water/rock systems, a topic of strong ongoing interest in Canada. With Alan Dickin and James Crocket at McMaster, he used osmium isotope data from Sudbury nickel deposits to show that the sulphide ores were produced by impact melting of the crust. Also with Alan Dickin, he used neodymium isotope data to map ancient crustal rocks in the Grenville Province of the Canadian Shield. Over the course of his academic career, he published more than 80 scientific articles.

A former McMaster dean of science and faculty member for more than 30 years, Bob went on to serve seven years as Principal of UTM from 1995 to 2002, at which time he also became a member of the Department's graduate faculty. Under his guidance, UTM formulated plans for major transformations of the campus, including increased student enrolment,



new buildings and new programs—all of these in times of fiscal restraint and uncertainty. He was especially effective in developing new partnerships and providing leadership to the city and community. Within UTM, he led through discussion and consensus.

**Barbara Murck**, a professor and director of the UTM Environment Program and former graduate student of our department (PhD 1986; Campbell & Naldrett), has fond memories of McNutt. “I credit Bob with starting UTM on our modern pathway to success, particularly with regard to our very positive relationship with the City (of Mississauga). Also a super nice guy, and a geologist on top of everything. He will be missed.”

**Henry Halls** recalls: “In 1997 when I was living at the Artist’s residence on the UTM campus, Bob, who was residing at the nearby Principal’s residence, Lislehurst, invited the Earth Scientists to a party at the mansion. There was nothing unusual in this as he had also issued an invitation the previous year as an adjunct to my own annual “midnight croquet” party at the Artist’s Cottage. However, 1997 was a little different as I had just become married. My wife Leigh said that she would not come to the midnight croquet party because noise and inebriation progressively increased prior to the croquet tournament. However, to my surprise she changed her mind when Bob issued his invitation. This puzzling behaviour was explained when, on being ushered through the front door of Lislehurst, we were confronted by a large crowd of people from UTM and from our own department all singing “Surprise!” It was indeed a surprise party to celebrate our marriage and great fun was had by all. I will always owe Bob and his wife Paula a debt of gratitude for their part in arranging such a memorable and totally unexpected (for me) party. Leigh knew in advance of what was going to happen which explained her sudden change of mind!”

*Henry Halls, Ulli Krull, Barbara Murck, Nicole Wahl and Alan Dickin*



**George William (Bill) Pearce (1942–2018)**

Bill was originally from St. John’s, Newfoundland and obtained a BSc there in the Physics department of Memorial University.

He then undertook a PhD program in Physics (Geophysics) at University of Toronto under **David Strangway**, but spent much of his time in Houston at the NASA laboratories where he began measuring the magnetic properties of newly-returned lunar samples. He obtained his PhD in 1973.

Bill joined Erindale College (now UTM) in summer/fall of 1973. He came with a large amount of equipment from NASA that found a home on the third floor of the J. Tuzo Wilson Research Wing in the William G. Davis Building.

Although Bill’s undergraduate teaching was largely at UTM, many geology students on the St. George and Scarborough Campus would have met him because he led the Whitefish Falls Field Camp from 1979 to 1989 (at a time when professors were not given any teaching credit for field camps!)

In 1989, Bill resigned from the University of Toronto and moved to Queen’s University in Kingston, where he worked in statistics and networking support for the School of Kinesiology and Health Studies.

Bill made his name in the earliest (1972–73) studies of the magnetic properties of samples returned from Lunar missions in which he, in collaboration with Wulf Gose and Dave Strangway, were the first to affirm that almost all the magnetic properties were due to native iron and that much of it was multi-domain, due to heating by meteorite impact that reduced the basaltic silicate minerals. He also discovered that single domain samples gave coherent remanent magnetization directions suggesting that the Moon at one time had a very weak internal field, being confirmed by subsequent paleointensity measurements.

*Pierre Robin and Henry Halls*



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## Alumni News

Editor: Emeritus Professor Henry Halls  
Assistant Editor: Karyn Gorra

Comments and contributions are most welcome – especially news of former students.

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