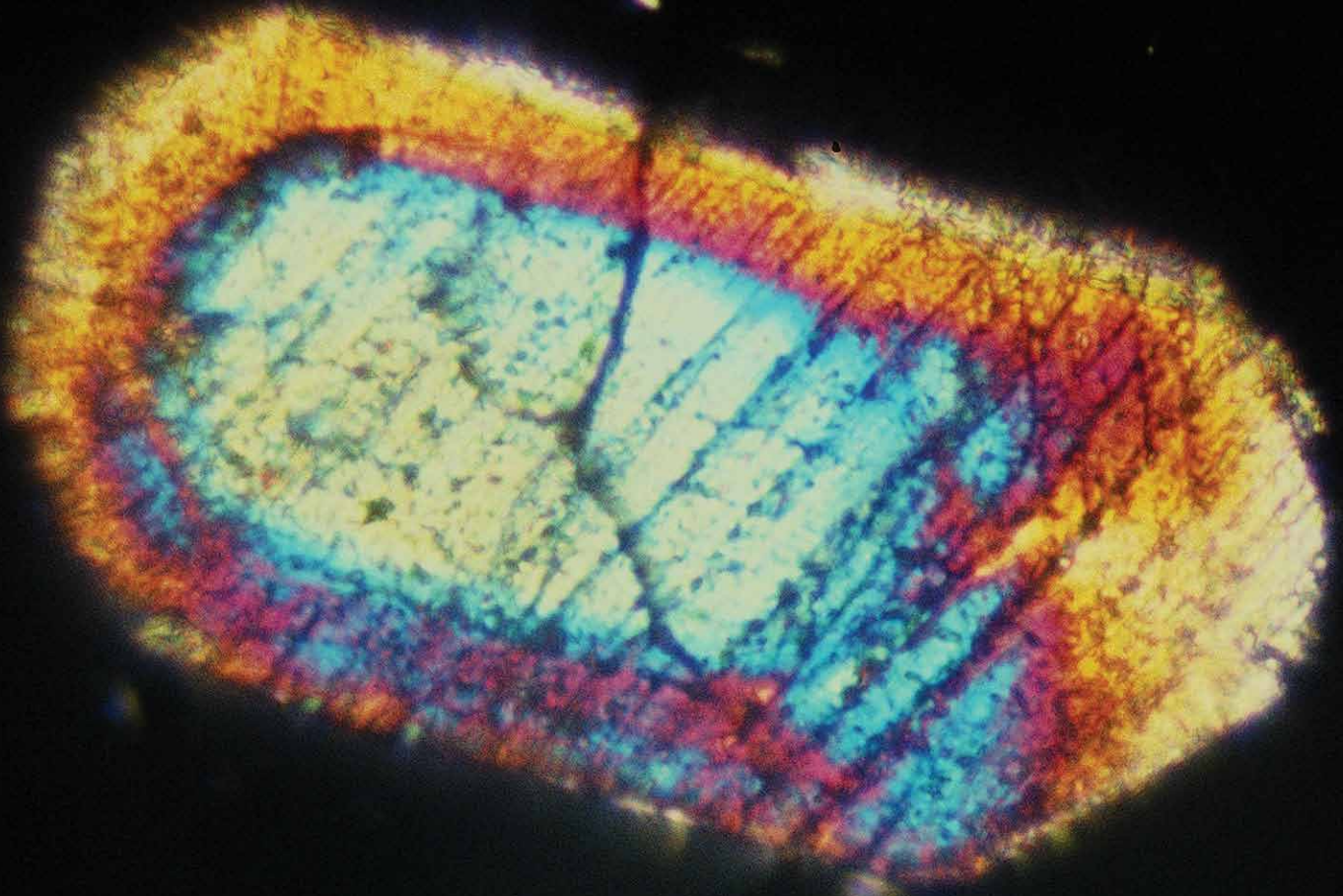


ALUMNI NEWS

Issue 32 April 2024



Earth Sciences
UNIVERSITY OF TORONTO

Message from the Chair

Welcome to the latest edition of the Earth Sciences Alumni News! One of the best parts of being Chair is having the opportunity to sing the praises of our outstanding faculty and students. This year we had much to celebrate with several faculty honoured with major awards and recognitions, five faculty receiving promotions to the rank of Professor, and two new faculty colleagues joining us as Assistant Professors. We also gave out more than 160 awards and scholarships to recognize and support undergraduate and graduate student achievements; this number is remarkable and is strong evidence both for the excellence of our students, and for the incredible support of our alumni and friends. Enrollments have been up in many of our courses and programs, showing strong interest from the next generation in studying Earth Sciences. On a more sombre note, we were saddened this year by the passing of Professor Emeritus Geoff Norris, micropaleontologist, palynologist, biostratigrapher and exceptional leader. Geoff served two terms as Chair from 1980-1990 and leaves an outstanding legacy of collegiality, innovation, collaboration and scientific excellence for our department. A scholarship has been established in honour of Professor Norris, with details provided in this issue. On behalf of the whole department, I'd like to thank all of our alumni and friends who play such an important role in supporting excellence in Earth Sciences at U of T.



Sarah Finkelstein, Professor and Chair

Our cover is in honour of Professor Sandra Kamo who is the 2023 Logan Medal recipient.

The photo is a Zircon crystal (~ 200 microns long) from the gneissic basement along the north rim of the Sudbury Impact Structure. Dark lines are planar deformation features produced by intense shock. Colour zonation is related to chemical composition. The photo, taken by Tom Krogh, forms the cover to the *Nature* Issue, volume 366, No. 6457, 1993.

Alumni News

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Sandra Kamo in the field at Green Point, Gros Morne National Park, a UNESCO World Heritage Site in western Newfoundland, pointing to the Cambrian – Ordovician boundary. (Photo by Stewart McIlwraith)

Honours & Awards

Professor Sandra Kamo: 2023 Logan Medal Winner

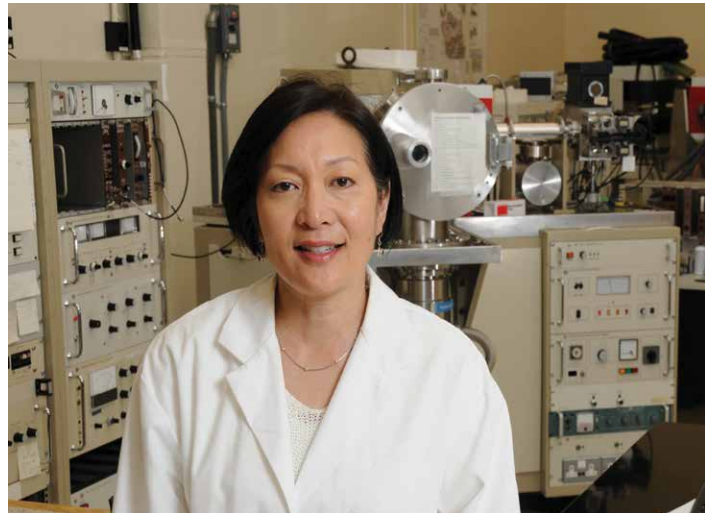
Congratulations to Professor Sandra Kamo on being awarded the Logan Medal, the highest award of the Geological Association of Canada.

After graduating with a BSc from the department, Sandra immediately started her geological career as a laboratory technician in the Jack Satterly Geochronology Laboratory (JSGL) in 1986 when it was housed in the Royal Ontario Museum (ROM), Toronto. The JSGL was founded in 1977 when Canadian research scientist, and 1989 Logan Medalist, Dr. **Tom Krogh**, who pioneered modern U-Pb dating methods at the Carnegie Institution of Washington, was hired by the ROM to establish a laboratory specializing in radio-isotopic geochronology, mainly for the dating of the Canadian Shield. Sandra was promoted to Laboratory Research Associate in 1990 and to Laboratory Manager in 1996. During this time, Sandra also earned an MSc at McMaster University (1992) and in 2012, a PhD in our department. The JSGL was moved to the Department of Earth Sciences in 2003 and in 2016, Sandra became Director, and an Assistant Professor in the department. This was followed by a promotion in 2023 to Associate Professor. Sandra's entire career has thus been under the auspices of the Jack Satterly Laboratory, which has always been regarded as one of the world's leaders in geochronological research.

The JSGL includes lab spaces on multiple floors of the department and the lab includes a tightly knit team of technicians, professors, some of whom have been there for more than 40 years, and graduate students. It was a thrill for all members of the department to learn that one of their own had been awarded Canada's most prestigious geological prize and honour!

Sandra's preferred research endeavors tend to fall into four main areas: meteorite impacts, mass extinctions, large igneous provinces, and the evaluation of International Mineral Standards, so vital for inter-lab age comparisons around the world.

Sandra first gained prominence in 1989 as the lead author on a paper that reported the time of initial opening of the proto-Atlantic ('lapetus') ocean based on U-Pb dating of a mafic dyke swarm in Labrador. It was one of the very first papers to evaluate the U-Pb systematics of zircon ($ZrSiO_4$) with that for a newly discovered dating mineral called 'baddeleyite' (ZrO_2) and showed that the ages were virtually identical. For the next 20-30 years baddeleyite became a key dating mineral for mafic rocks, as petrographic studies showed it was a primary mineral, in contrast to zircon which can be inherited. With improved analytical capabilities and suitability for chemical



abrasion, zircon has recently returned to favour as providing the most precise and accurate ages for mafic igneous rocks.

In 1993, Sandra was the second author (after Tom Krogh) in a *Nature* paper that reported zircon in a breccia from the Chicxulub impact crater in Mexico, and in clay at the Cretaceous – Tertiary boundary in Colorado and Haiti. The zircon grains were variably shocked. The least shocked showed an age of 550 Ma, the same age as the basement beneath the Chicxulub crater. The most shocked zircon grains at 66 Ma recorded the age of the impact held responsible for the Cretaceous-Tertiary mass extinction, which included non-avian dinosaurs. The photomicrograph on the cover of this *Alumni News* was originally on the cover of the *Nature* issue. It was the first paper to show conclusively that the world-wide layer at the end of the Cretaceous was linked to fall-out from the Chicxulub crater. Sandra has obtained similar results from Saskatchewan, Italy, and Spain corroborating the result from the Colorado site, and demonstrating that the Mexican impact could transport fragments at least one quarter of the way around the world! A feature of this work was that the results were obtained on individual shocked zircons with the lowest Pb contamination ever recorded (0.2 picograms) and providing robust data on zircon grains weighing only 0.2-0.8 micrograms and containing as little as 4 picograms of Pb (1 picogram = 1×10^{-12} grams)!

Sandra investigated breccias of the Vredefort dome in South Africa, whose origin had been debated for about 50 years. Long believed to be either a deeply eroded impact site or a 'crypto-explosion' (endogenic) structure, the zircon grains were discovered by Sandra to be shocked, which confirmed an impact origin. Sandra also identified a small subpopulation of pristine unshocked crystals and interpreted them as having been formed in interstitial melt within the impact breccia. The 2023 Ma age of the pristine crystals has long been accepted as the most accurate for the age of the oldest terrestrial impact crater on Earth. This result also provided solid

evidence that impact was ~35 million years later than the Bushveld Complex (see below), dispelling the suggestion that the two events were related. This result was an early example of using newly crystallized zircon from melt to accurately date the time of impact.

South Africa provided other major areas of Sandra's research – her work on the crustal evolution of the iconic Barberton greenstone belt helped transform tectonic interpretations of one of Earth's oldest Archean terranes. She also has worked on Large Igneous Provinces (LIPs), enormous areas of mainly basaltic extrusive and intrusive rocks, igneous events that have punctuated Earth history, at least since 3.5 Ga. One of these in South Africa is the Bushveld Complex, the largest repository of chrome and PGE minerals on Earth, and long considered to be a giant magma chamber that crystallised from the bottom up. Sandra has shown that a part of the layered suite has ages younger than the units above, showing that the intrusion was not the result of a single magmatic entity but one in which intrusive episodes occurred! To demonstrate this difference required uncertainties of ~200 Kyrs on 2.05 Ga rocks, which is an order of magnitude smaller than what had hitherto been accomplished. Sandra had achieved something that few laboratories throughout the world had managed!

A second LIP-related rock suite that Sandra has worked on is the Raglan deposit in Canada, one of the world's most significant Proterozoic mafic units to host Cu, Ni and platinum group elements. Sandra's work showed an 1882-1884 Ma time of formation of the Raglan units, demonstrating a precise synchronicity with Ni hosting mafic rocks in Manitoba (Thompson Nickel Belt), 1500 km to the west! The result demonstrates that mafic magmatism occurred all at once on a vast scale around the Canadian Shield which likely led to continental breakup.

A third LIP of interest to Sandra has been the giant Tunguska Flood basalt event in Siberia that occurred 252 Ma ago and is thought to be responsible for the world's largest extinction episode that occurred at the Permian-Triassic boundary. However, the first ion-probe ages were of insufficient precision to convincingly prove the connection. Sandra then stepped in and provided high precision results that were the same as the best available ages for the timing of the marine extinctions as documented previously in China by the MIT laboratory. Sandra's results therefore supported synchronicity of the Siberian eruptions and extinction by an order of magnitude greater precision than the initial study on the Siberian LIP, and furthermore showed that the Siberian volcanic event had a time span on the order of 0.6 Ma! Such an enormous and brief eruption could have altered the biosphere to which plants and animals were unable to adapt. In a separate but related study in the Karoo Basin of South Africa, Sandra's work has shown that the end-Permian vertebrate extinctions on land may have occurred about 300,000 years prior to

the marine extinctions, a result that may be explained by an atmospheric change that might be expected to take more time to affect deep ocean deposits.

Sandra's research has not only helped to understand major events in Earth history through all her collaborative and solo studies, she also has participated with ROM colleagues in developing and testing an innovative micro-sampling technique whereby a state-of-the art Xe⁺ plasma source focused ion beam is used to excise tiny crystals in situ from polished mounts or thin sections prior to dating by ID-TIMS. This method will increase age precision over currently available micro-beam methods by at least an order of magnitude! The method will allow dating of tiny crystals while at the same time preserving them in their original matrix. Matrix preservation then allows petrographic examination leading to improved age interpretation.

Also among the contributions by Sandra is the evaluation of International Mineral Standards. These are crystals of a variety of minerals that after being dated accurately and evaluated isotopically and geochemically are distributed worldwide to 100s of other dating laboratories to be used as standards for microbeam dating methods. Sandra has been a major contributor in investigative ventures that have explored new chronometers like vesuvianite and calcite (the latter in collaboration with **Don Davis** in the lab). She has also evaluated collaboratively other potential reference materials like allanite, titanite, rutile, andradite, schorlomite, monazite, apatite, and xenotime. Some of these like xenotime and calcite have impact in the direct dating of sedimentary rocks! In other major international collaborative projects involving multiple laboratories, Sandra has long participated in an effort to reduce sources of inter-laboratory bias as well as bias among different dating methods.

In summary Sandra and the JSGL team have been at the forefront of U-Pb geochronology research for more than thirty years in producing ages of ever-increasing precision and investigating new applications, thus leading to an expansion of many kinds of geological studies throughout the time scale. She has produced ages that have led to the solution of major controversies in meteorite impact studies and global extinction events. To show how deserving Sandra is in being honoured as a Logan Medal recipient, just consider some facts: She has authored or co-authored over 120 journal articles, including *Nature* and *Geology* contributions, many dozens of published non-refereed reports, and co-supervised over 20 graduate students and postdoctoral fellows. Since 2011 she has published an average of 5 times per year! In Google Scholar, Sandra has an H index of 51 with ~15, 500 citations; in Scopus, another online global assessment routine, she has an H Index of 44 with ~11,100 citations. Truly remarkable!

Henry Halls, Professor Emeritus and Editor

Professor Joe Desloges Wins Major Award



A Vivek Goel Faculty Citizenship Award has been bestowed on Professor Joseph Desloges.

Presented to senior faculty members in recognition of their invaluable contributions to U of T in various leadership roles, the award was created in 2008 in honour of Vivek Goel's many contributions to the University, most recently as Vice-President and Provost. The honour is one of the Awards of Excellence presented by the University of Toronto Alumni Association in collaboration with the University.

Joe's research focuses on the effects of humans and climate change on river floodplains and landscapes dominated by glaciers. This award recognizes Joe for his outstanding commitment to student mental health and student success. As provostial advisor on Student Mental Health Process Redesign (2020 - 2022), Joe made vital contributions to the University's rethinking and improvement of student mental health supports.

Joe also made invaluable contributions as principal of Woodsworth College (2008 - 2019) and as Chair of the Department of Geography and Planning (1998 - 2007) and is widely recognized as a mentor and leader dedicated to the success of faculty, as well as undergraduate and graduate students.

"It is a true honour to be a recipient of this award," says Joe. "Citizenship to me involves being deeply engaged in a community just as our former provost and vice president Professor Goel was. It has been my absolute privilege to be engaged across all three campuses — and especially in Arts & Science — with terrific students, staff, faculty and alumni on issues of importance to the U of T community."

Modified article by Chris Sasaki for A&S News

Professor Kim Tait Receives Killam Award



Kimberly Tait, Senior Curator and Teck Chair of Mineralogy at the Royal Ontario Museum (ROM), and Professor, Status Only, in our department, has been selected for the Dorothy Killam Fellowship.

The two-year fellowship – previously the Killam Research Fellowship – is bestowed by the National Killam Program Office and

the Killam Trusts to mid-career researchers of exceptional ability. It will be delivered through the ROM and will allow Kim to focus on research by relieving her of teaching and administrative duties during that period.

In a position she describes as "the best of both worlds," Kim works with students at the University of Toronto and, at the ROM, is responsible for the mineralogy, meteorite, gem and rock collections and oversees research on those collections.

Kim is working with an international team of experts from NASA and the European Space Agency in preparation for the return of rocks from Mars expected to arrive in the mid – 2030s. She is also studying Martian meteorites, using novel techniques to understand how they are put together at the atomic level.

Professor Corliss Sio receives Research Awards and a Distinguished Lectureship

Assistant Professor **Corliss Sio** has been awarded a 2023 Dorothy Shoichet Women Faculty in Science Award of Excellence. The award was established in 2016, and provides teaching release time for research projects. Corliss is leading the establishment of the new GEMINAE [Geochemistry of Elements and Metal Isotopes in Nature and Experiments]



laboratory, which will put U of T at the leading edge of isotope geochemical research. Corliss's research lies at the intersection of isotope geochemistry, experimental petrology and numerical modelling, and includes research on asteroids and the Moon.

Corliss also received a Connaught New Researcher Award, and was named a Mineralogical Society of America Distinguished Lecturer for 2023-2024, delivering the Peter Buseck Public Lectures on: "Enigmatic archives of magmatic processes: Decoding mineral zoning and melt inclusions with Fe-Mg isotopes", and "The silver lining of disequilibrium: Iron isotope perspectives on planetary petrology"

New Faculty

Rodrigo Correa Rangel



Rodrigo is joining the Department of Earth Sciences as an Assistant Professor of Near Surface Geophysics. He grew up in a small town called Iguape on the coast of São Paulo state, Brazil. He did his bachelor's (with an exchange year at the University of Lisbon) and master's degrees in Geophysics at the University of São Paulo, and PhD in Geophysics at the University of Wyoming. Before doing his master's degree, Rodrigo worked in industry for several years with seismic data processing. More recently, after finishing his PhD in August 2022, he spent one year as a postdoctoral researcher at the University of São Paulo applying geophysical methods to investigate an underwater archaeological site in the eastern Amazon region, Brazil.

His research in near surface geophysics focuses on investigating the coupled hydrologic and carbon cycles, estimating material properties from geophysical measurements, and seeking novel applications for emerging geophysical technologies. In the past, he has used geophysical measurements for hydrogeological investigations in Brazil and to study permafrost processes in Arctic-boreal Alaska. He is interested in further developing his research into applying near surface geophysical methods to investigate the link between permafrost dynamics and carbon cycling, lake ice properties, and snow hydrology. His research spans environmental geophysics, hydrogeophysics, cryosphere geophysics, and archaeological geophysics.

Rodrigo is very excited about the opportunities for collaboration in an interdisciplinary context with the faculty and students at the University of Toronto. One of his overarching goals is to help promote diversity and inclusion in the geosciences. During his spare time, he enjoys playing drums, soccer, hiking, camping, and backpacking.

Neil Bennett



Neil graduated with a PhD from the University of Toronto in 2013, and subsequently held a post-doctoral fellowship at the Carnegie Institution of Washington's Geophysical Lab. After three years, he moved to California and spent a brief period working at both UC Davis and the Geophysical Lab, running experiments to investigate the formation of pallasite meteorites. This was followed by several jobs in industry, including as a geoscience curriculum designer and with a startup building wind-powered drones for oceanographic research. In August 2021, he returned to the University of Toronto's Department of Earth Sciences on a contract limited term appointment. After two years in this position, he obtained a tenure track position in Mineral Systems, starting in August 2023.

His research is focused on element, and more recently isotope, partitioning in high temperature systems. He uses experiments to probe the underlying physicochemical controls on fractionation, then applies results to understand the variability observed in nature. Most of his previous work has focused on using the highly siderophile elements (PGE, Au, Re) to study planetary accretion and core-mantle differentiation. He has worked on a range of topics, however, including: mechanisms for granite emplacement, the origins of Earth's dynamo, and element speciation in silicate melts.

As a tenure-stream faculty member at U of T, Neil has begun studying the role of magmatic salts in igneous systems, while maintaining several projects in planetary science. Outside of research, he enjoys photography, racket sports (badminton and squash), and sailing.

Promotions

Congratulations to these faculty members on being promoted to full professor and associate professor.

Professor



Charly Bank

*Geophysics &
Geoscience Education*



Bridget Bergquist

Metal Geochemistry



Marc Laflamme

Paleontology



Ulrich Wortmann

*Chemical Hydrogeology
& Biogeochemistry*

Associate Professor



Sandra Kamo

Geochronology

Retirements



Grant Ferris

Professor **Grant Ferris** joined the department in 1991 after starting his career as a geomicrobiologist in the Calgary oil patch. Grant's research focused on studying the impact of microbes on the interfacial chemistry of mineral and bacterial cell surfaces, particularly in terms of evaluating bacteria-induced metal ion adsorption and precipitation. His endeavors exploring dynamic interactions between microbiological and geochemical processes resulted in over 100 publications, and supervision of more than 30 MSc, PhD and Postdoctoral students. The research has increased knowledge about bacterial involvement in the formation of iron oxide, carbonate and silicate minerals. It has also improved understanding of the fossilization of microorganisms. A further contribution is in the development of geotechnical applications using bacterial-induced mineral plugging to control fluid flow in hydraulically conductive geologic materials. Grant also studied bacterial activity as a means for sustainable natural remediation of metal and radionuclide contaminants in groundwater and wetland systems, microbial-induced corrosion of underground gas and oil pipelines, and the use of geophysical methods to evaluate the decomposition of soil organic matter and emission of greenhouse gases by bacteria.

Reflecting on his career, Grant comments, "Arriving in the Department of Geology, as it was known back then, I was introduced around by some of my senior colleagues as the Department's pet microbiologist. That epithet might not have been too far off the mark because I have never taken a formal geology course! At least my background in physical chemistry and biophysics helped when I ended up having to teach geochemistry after **Greg Anderson** retired. Before then I was relegated to 'Geology in Public Issues' and 'Confronting Global Change'. Teaching hydrogeology in later years was another matter, which required a considerable amount of 'learning-on-the-fly', much of which I gleaned from staff hydrogeologists at the Chalk River Labs of Atomic Energy Canada." Grant also notes, "Over the years I was

lucky to have a stellar group of talented graduate students and postdocs who have gone on to extremely successful careers in their own right. I am humbled and gratified by their achievements.”

Department colleague Professor **Charly Bank** relates that “Grant’s first task in Toronto was the development of two new courses which he called ‘Confronting Global Change’ and ‘Controversies in Earth Science’ -- both run to this day with no plans to cancel them since they have our largest enrolments! He also developed a hydrogeochemistry field course at Chalk River. However, the restricted access to the Chalk River nuclear facilities after 9/11 led him to install piezometers to conduct groundwater studies down the highway at the Meilleurs Bay site where the group was staying. He continued to teach his field camp even after officially retiring (and he produced several fun videos over the years). The biogeochemical measurements there produced a string of research projects on microbial activity in the subsurface, and he also ventured into biogeophysics and invited me to participate, which I accepted. The camp kitchen and dinner discussions were legendary (Grant is a great cook, he even curated the ‘Field Camp Cookbook’); one would head back to Toronto at the end of summer with extra pounds in addition to new research and teaching ideas.

His department and university service included stints as Associate Undergraduate and Associate Graduate Chair, as well as Associate Dean at the School of Graduate Studies. Grant is now enjoying retirement in the maritimes where he keeps a careful eye on hurricane warnings and two cats. Rumour has it that he may occasionally swing by Ontario to check on those 60 piezometers he installed at Meilleurs Bay.”

Charly Bank and Henry Halls

Nick Eyles



The three pillars of the academic tradition, research, teaching and outreach, have rarely been combined so thoroughly and successfully than by Nick Eyles, Professor in the Department of Physical and Environmental Science at UTSC. He is a true

Renaissance man. Nick retired from his professorship earlier this year, but apart from dropping his undergraduate courses it is unlikely much else will change. His enthusiasm and the productivity of his remarkably diverse and energetic career are unlikely to lag in the foreseeable future.

Nick was born in London, England, and came to us by a diverse route, full of useful experience. He completed his first degree at the University of Leicester, and came to Canada to study glaciology at Memorial University in 1974. His research took him to glaciers in northwestern British Columbia, to which he travelled by bus! He recounts passing through the Georgian Bay area on the way there and back, and falling in love with the scenery. That fascination was to pull him back there many years later.

On completion of his Masters degree he returned to the UK, to complete a PhD degree at the University of East Anglia. This involved glacier studies in Iceland and the Alps. While there one of the undergraduate students in his classes consulted him about organizing a field trip to Iceland, and so began the foundation of a 42-year marriage to Lynn. They hitch-hiked together across the United States, and then Nick took up a teaching position at Newcastle, back in the UK. This was followed by a short stint at the Natural History Museum in London, and then, finally, the move that brought them to Toronto, a position at the Ontario Geological Survey.

My first encounter with “Nick n’ Lynn” came when this young power couple descended on my St. George office in 1981 to talk about facies analysis of glacial sediments. This began a partnership that resulted in the pair essentially rewriting the sedimentary geology of the Quaternary, and the ancient glacial record. Sedimentological studies were able to show that many coarse glacial deposits traditionally interpreted as ice-laid till, were in fact subaqueous deposits deposited in lakes and marine basins as melting glaciers and icebergs dropped their immense sediment loads. Much of it was then carried downslope by sediment gravity flows.

Critical work was carried out on the classic Scarborough Bluffs section, and in southern Alaska, and later Nick and Lynn travelled the world to study the late Paleozoic glacial deposits of Gondwana and the Neoproterozoic deposits that gave rise to the Snowball Earth hypothesis. Their own work led them to be skeptical of this idea, based on the facies analysis methods that they had pioneered together.

Nick started as an adjunct professor at UTSC and this, too, soon became a permanent position. He helped to introduce the first modern environmental geoscience degree program at UTSC, soon to be supplemented by a MSc and then a PhD program, all of which became highly popular.

Nick has compiled and edited research books on urban and environmental geology, and four books for non-specialist student and general public audiences, the so-called “Rocks”

series: *Toronto Rocks*, *Ontario Rocks*, *Canada Rocks* and *Canadian Shield: The rocks that made Canada*. I co-authored *Canada Rocks* with Nick. A chapter was devoted to each region of Canada, and Nick added lengthy treatments of the history of Canada's resource industries, and environmental issues. These were enhanced at many points by sidebar "boxes" highlighting the history and people of the regions.

As this book was being completed, Nick began a major project with the CBC to develop a five-part television series on the geology of Canada, entitled "*The Geologic Journey*". Hired initially as a consultant, he soon became the on-screen personification of an adventurous Canadian geologist, complete with his trademark broad-brimmed "Indiana Jones" hat. This very successful series, narrated by David Suzuki as part of the *Nature of Things* series, was followed by an even more ambitious series to document the geology of the world.

Nick's work has been recognized by three major awards, the Geosciences in the Media Award from the American Association of Petroleum Geologists in 2012, the McNeil Medal of the Royal Society of Canada in 2013, and the E. R. Ward Neale Medal by the Geological Association of Canada in 2015.

In some ways Nick is only now getting to what could become his most significant work of education and outreach, as a prime mover in the project to designate the Georgian Bay area a UNESCO Geopark. This area exhibits a wide range of rocks ranging from Archean to Quaternary. A book *Georgian Bay: Discovering a Unique North American Ecosystem*, edited by Nick and published in 2017, includes chapters on its natural ecology, a history of the first indigenous population of the area, and its industrial history.

While leading one of his field trips, Nick met **Tuzo Wilson's** daughter, Susan Wilson. Conversations with her led to a recounting of family memories, and a sharing of Tuzo's personal papers. This all added immeasurably to Nick's next successful book, *Tuzo: the Unlikely Revolutionary of Plate Tectonics*. Unlike many biographies of successful scientists, this book contains many useful maps and diagrams illustrating Tuzo's ideas.

The geopark project also draws on one of Nick's greatest assets, the ability to bring innovative research skills and new technology to a deeper investigation into the area's geology. Digital mapping and the employment of LIDAR surveying from aircraft and unmanned vehicles is revealing a new richness to the erosional and depositional history of the ancient ice margin. For example, deep iceberg scours are preserved in Ontario's farm fields. Who would have thought it! An earlier project helped to explain why there were periodic earthquakes in the middle of the Canadian Shield. This involved high-resolution seismic surveying of the floor of some of the larger lakes in the Shield. The surveys revealed faults in the post-glacial lake floor sediments, which suggested an explanation

for the earthquakes: post-glacial rebounding as the mantle responded to the removal of the weight of glacial ice. Nothing to do with plate tectonics in this case!

Interesting surprises such as these are part of Nick's legacy. Not surprising is that he is likely to continue to do this engaging and rewarding work for many years to come.

Andrew Miall, Professor Emeritus

Henry Halls Retires from Alumni News



For the past ten years, Henry has been editing the *Alumni News* – always with an interest to showcase the vibrant research and teaching community in the Department of Earth Sciences, and with a flare for finding and telling a great story. He introduced the *Emeritus Corner* to share news from retired professors about their memories or current activities which ranged from past and current excursions, recent papers and street parties! The magazine reached 40 pages in one year with many awards, accolades, adventures, alumni updates, and goodbye's. At age 82, and finding he is spending less time at the office, Henry has decided to retire as Editor of the *Alumni News* and leaves a challenge for future Editors to follow with new ideas while maintaining our strong connections with our many alumni and friends.

Thank you, Henry, for helping to keep our community of earth science, geology, geophysics, and geoen지니어ing alumni connected.



Alumni News covers from 2014 to 2023

Graduate Student Awards

Graduating Class of 2023

PhD:

Junxing Chen
Natasha Leclerc

MASc:

Mehmet Duyan
Merve Gonul
Merve Uygur

BSc:

Nouf Hassan Al Raisi
Jiyuan Bai
Nyah Bay
Katherine Bormann
Andrea Caratsch
Jiazheng Chen
Carissa Chen
Yufei Chen
Kathryn Cheng
Melissa Rose Croft
Oliver Dong
Hannah Eaton-Tessier
Esther Isadora Falkson
Mallory Jennifer Furlong
Kabir Rishi Gandhi
Alexandre Guillerez
Akshith Veer Hooda
Alexander Hans Jain
Yi-Chin Sabrina Juan
Alina Kostyuk

MSc:

Brianna Barnhart
Daryll Bien Concepcion
Josephine Di Maurizio
Alexandra Korolev
Danielle McGill
July Paola Rivera Parra
Tina Tsan
Jessica Verschoor

Seyon Kugan
Elizabeth Lai
Weijiang Lu
Chelsey Merrick
Rebeca Moya
Alexander Vargas Murphy
Yiwen Pang
Hailey Rose Ribble
Mrinmayee Sengupta
Christopher Singh Bhullar
Hannah Victoria Stuve
Taylor Kris RaoThiele
Abraham Deng Tor
Zachary Walker
Grace Wei
Morgan Wolfe
Fannie Yiu
Lai Yuan
Shaoyu Zheng

Natural Science and Engineering Research Council of Canada Post-Graduate Doctoral Scholarship (NSERC)

David Aceituno-Caicedo

Connaught International Scholarship for Doctoral Students

Anna Whitaker
Silvia Castilla Montagut

Massey Fellowship

Silvia Castilla Montagut

Faculty of Arts and Science Top Doctoral Fellowship (FAST)

David Summer
Megan Swing
Sarah Mount

Ontario Graduate Scholarship (OGS)

Sheila Ballantyne
Minoli Dias
Jonathan Umbsaar
David Summer
Johnathan Sorrentino
Sara Vaezafshar

Queen Elizabeth II Graduate Scholarship in Science and Technology (QEII) Awards:

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

Sarah Lavoie-Bernstein
Sara Vaezafshar

QEII / J. J. Fawcett Graduate Scholarship in Science and Technology

Danielle McGill
Minoli Dias
Jonathan Umbsaar
Tina Tsan
Johnathan Sorrentino

QEII / Lamontagne Geophysics Graduate Scholarship in Science and Technology

EvelynLove Fosu-Duah

QEII / Reford Scholarship in Science and Technology

Matthew Belanger

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

Armagan Kaykun

Doctoral Recruitment Award

Mohammad Khosravi
Kayla Simpson



Mexico Scholarship CONACYT

Jose Fernando Gutierrez Alejandre

Eric L. Hoffman Memorial Scholarship

Krystal Nason

James P. Nolan Explorers Fund Graduate Scholarship

Himani Yadav

David Strangway Award in Earth Science

Sara Vaezafshar

Hugh Snyder International Scholarship in Earth Sciences

Juan David Bello Rodriguez

Silvia Castilla Montagut

Bruna Da Silva Ricardo

Nelson Roman Moraga

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

Mohammad Khosravi

Hoi Leung Pun

D.H. Gorman Explorers Fund Graduate Scholarship

Olivia Filson

Jeff Fawcett and John Gittins Graduate Explorers Fund

Daniela Lozano La Cock

Ozgur Tekin

Laurence and Theresa Curtis Explorers Graduate Scholarship

Nanqiao Du

Nick and Marilyn Tintor Explorers Graduate Scholarship

Esther Isadora Falkson

Krystal Nason

Irene Gale-Rucklidge Explorers Fund Graduate Scholarship

Lorie Morency

Cameron Allen Graduate Scholarship

Zhong-zheng Yuan

David and Virginia Moore Graduate Scholarship in Exploration Geology

Sabrina Juan

Graduate Student Scholarship/Bursary Fund in honour of Emeritus Professor Steven D. Scott and Joan Scott

Saif Al-Silwadi

H.V. Ellsworth Graduate Fellowship in Mineralogy

Shannon Murtonen

Dr. H.O. Seigel Scholarship in Applied Geophysics

Matthew Belanger

EvelynLove Fosu-Duah

Ting Lei

W.W. Moorhouse Fellowship

Synah Saeedi-Tabar

A.T. Griffis Memorial Graduate Scholarship

Jonathan Umbsaar

Margaret Amelia Miller Scholarship

Peter Liberty

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

Jose Fernando Gutierrez Alejandre

Sheila Ballantyne

Mauricio Barcelos-Haag

Nanqiao Du

Aneila Ghanie

Jose Dominik Guballa

Sabrina Juan

Arman Kaykun

Oya Ak Kaykun

Hoi Leung Pun

Jonathan Rich

Kayla Simpson

Ivan Strahkov

Xinyu Tan

Jonathan Umbsaar

Himani Yadav

Alan Yu

Dr. Norman Keevil President's Fellowship in Geology

Paolo Attanasio

Natalie Minda

Synah Saeedi-Tabar

Josephine Di Maurizio

Peter Liberry

Minoli Dias

Julia Hathaway

Jonathan Sorrentino

Anna Whitaker

Joshua Wolpert

Nyah Bay

Laurence Curtis Teaching Assistantship Award

Nelson Roman Moraga

KEGS Foundation Pioneer Scholarship

Julia Andersen

Undergraduate Student Awards

NSERC Undergraduate Student Research Awards

Zeynep Rana Uzunel
Jamie Chow
Laura DiNunzio

University of Toronto Excellence Award

Frannie Favot Miranmee Sengupta
Sabrina Juan Sylvia Wolk

Wesley Tate Scholarship in Geology

Katherine Bormann

James P. Nowlan Explorers Fund Undergraduate Scholarship

Magnus Roland Marun

Daniela & Alexander Tintor Undergraduate Scholarship

Yuchao Niu

The Undergraduate Explorers Fund Award

Adrienne Lauren Brown

Alexander MacLean Scholarship in Geology

Daneil Luigi Giannotti

Roger E. Deane Memorial Scholarship in Geology

Danielle Anderson McGill

Joseph Michael Housam Memorial Leadership Award

Zeynep Uzunel

Ed Spooner Undergraduate Scholarship in Mineral Deposits Geology/Exploration

Katherine Bormann

The H.V. Ellsworth Undergraduate Award in Mineralogy

Katherine Bormann

Joubin James Scholarship and Prize

Katherine Bormann

The Garnet W. McKee-Lachlan Gilchrist Scholarship

Hailey Ribble

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

Alina Kostyuk

Daniel Wilson Scholarship in Science

Katrina Ashely Cristino

Russell Pysklywec Field Study Opportunity Fund

Magnus Roland Marun

Jim Hasse Award

Shadman Irtiza

Professor Fried Schwerdtner Undergraduate Bursary

Gilda Seguiza

The Energy Scholarship

Michael Beney
Yvonne Facinabao
Stephanie Jonah
Nahin Morshed Kadery
Sabrina Wong
Sybgteib Yeom

Troilus Experiential Learning Fund

Matthew Advani
Katerina Isabel Benevides
Eve Alexandra Carrothers
Jamie Chow
Matteo Clemente
Dorothy Ella Curtis
Matthew James Dunkerley
Francesca Anne Favot
Benjamin Gallagher
Daniel Luigi Giannotti
Yifan Hao
Alexander Hans Jain
Anjali Catherine Jarvis
Stephanie Jonah
Tarun Singh Marwaha Kalsi
Clemence Korwin-Szymanowska
Jia Yin Li
Yu Luo
Nathan Gregory Anthony Mallia
Oliver Michael Pohlers Meek
Hailey Rose Ribble
Magnus Roland Marun
Nicole Schoenherr
Brandon Patrick Slisarenko
Zeynep Rana Uzunel
Kate Estella Wagner
Lemeng Wang
Yue Wang Zhang
Yi Chun Xie
Sungyeon Yeom
Eva Yu
Pingfang Zhang
Shaoyu Zheng

PDAC Student Industry Mineral Exploration Workshop (S-IMEW)

Matthew James Dunkerley

Don Salt Scholarship

Aidan Armstrong

KEGS Foundation PioneerScholarship

Jamie Chow

The GAC-PDAC Logan Student Prize

Magnus Roland Marun

Earth Ring Ceremony



Several recent graduates received their Earth Rings at a ceremony held at the U of T Faculty Club in April 2023. Standing, from left, Yulu Shi, Juliana Sideritz, Aisha Sharif, Adrea Hamid, Alan Yu, Aneila Ghanie, Thanuka Sivanathan, Abraham Deng Tor, Jimena Carillo Lay, Kathryn Cheng, Professor **Dan Gregory**, Nyah Bay, Adrea Caratsch, Nouf Al Raisi, Cheng Peng, Chelsey Merrick, **Heather MacDonald** (MSc 1999, Canada Operations Manager / VP Jacobs). Kneeling in front left to right, Alina Kostyuk, Alexander Guillerez, Katherine Bormann, Morgan Wolfe.

Outreach: Pursue STEM

Introducing earth science to high school and elementary students is an outreach priority and as part of our Reconciliation, Equity, Diversity and Inclusion (REDI) initiatives, the department has been working to develop respectful and collaborative relationships with Indigenous peoples whose lands are often research and teaching areas, and to encourage underrepresented groups to learn more about our programs and to consider studying science at university.

Pursue STEM is an outreach program that encourages and supports Black students in the GTA who are interested in science, technology, engineering and math (STEM). The program is delivered in partnership with the Department of Physics and Leadership by Design (LBD) with Math and Physical Sciences departments contributing content and activities. Students enter the program in grade 10 and progress through subsequent grades as a distinct cohort.

Since the program began in 2021, professors, student volunteers and staff in the Department of Earth Sciences have led online activities where students have learned about the rock cycle, water contamination and ocean acidification.



The 2022 PursueSTEM grade 11 cohort at Crawford Lake

In person programming in the department has included teaching mineral exploration, Scanning Electron Microscopy (SEM) techniques to learn about Martian meteorites, mineral identification, and using forensic geoscience methods to solve an environmental crime. Grade 11 students participate in a field trip to three different locations in collaboration with the Department of Chemistry and School of the Environment to test surface water and bedrock chemistry using portable chemical techniques to analyze the water and portable XRF to analyze nearby rocks.

The Gorman Collection



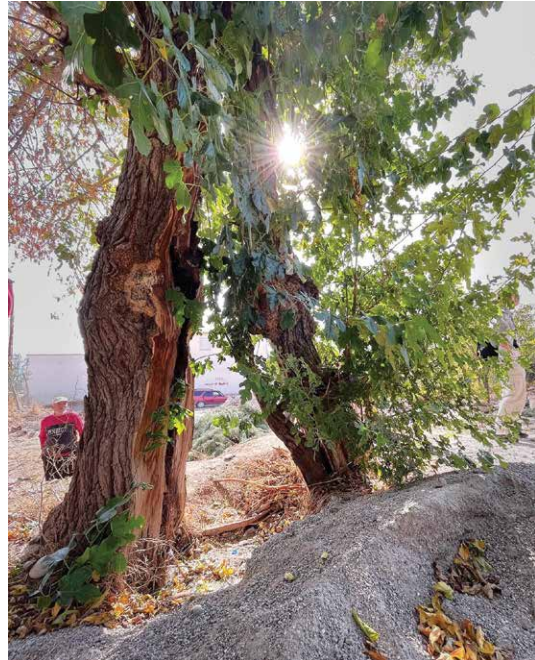
Working with undergraduate student **Matteo Clemente**, left, and **Heidi Tomes**, right, David Joyce—a local mineral collector, mineral dealer and friend of the department—has been lending his extensive knowledge of minerals and mineral localities to help identify and catalogue the remarkable collection that the late Professor Emeritus **Donald (Digger) Gorman** put together over his 41 years of teaching mineralogy at U of T.

Field Education

A field trip to view the Troodos Massif in Cyprus and earthquake damage in Türkiye



Undergraduate students from the Geochemistry and Global Tectonics classes explored the geology and geophysics of Cyprus and southeast Türkiye during a 10-day field trip in November 2023. A comprehensive introduction to the tectonics (and history) of Türkiye for the students was conducted at Istanbul Technical University by Professor **Oguz Gogus**—a 2010 UofT Geology PhD graduate from my Geodynamics research group. We then travelled to the self-declared Turkish Republic of Northern Cyprus to investigate the famous Troodos Ophiolites. These are spectacular exposures of Tethyan ocean crust obducted onto the surface since ~20 Ma, with outcrops showing primarily pillow basalts from the upper parts of the ophiolite sections. On Cyprus we also visited the heavily militarized border crossing at its capital of Lefkosa (Turkish side)/Nicosia (Greek side)—an interesting view of a conflict in stalemate since 1974. A short flight brought the group to Gaziantep (in Türkiye just north of Syria). This region was the epicentre of the devastating doublet earthquakes (M7.8 and M7.7) in February 2023 that killed 60,000 people in Türkiye and Syria. The area has recovered, but destruction from the earthquakes was still evident everywhere.



A kind group of local people led us through their mountain village to show the earthquake damage, such as a large tree split and displaced by a sinistral fault (photo) and many offset rupture zones still showing in the region—with up to 3–4 m of offset, all sinistral—were incredible field examples of the kinematics of earthquakes. The trip was led by Dr **Erkan Gun**, **Jon Umbsaar**, Professor **Grant Henderson**, and myself. Overall, it was an amazing opportunity to see and explore the seismic hazards and plate tectonics of this geologically active part of the world, and we thank the Faculty of Arts and Science International Course Module (ICM) program, department, and donors for the generous funding that made the trip possible.

Russ Pysklywec, Professor

“ *The 2023 ICM trip to Türkiye was one of the highlights of my undergraduate experience at the University of Toronto. Getting to see first hand how the geology and processes I’ve been learning about transfer into the real world was invaluable, and I had the best time exploring Türkiye and making new friends.* ”

Kate Wagner, 4th year student

U of T SEG Trip

In May 2023, I travelled with ten student members of the Society of Economic Geology (SEG) U of T Student Chapter and an industry participant through Utah, Wyoming, and Montana on a field trip to study the geology of the area. The first stop was a field trip through the Tintic district, guided by Erich Petersen from the University of Utah. The group examined the different parts of the district that showed how the regional geology could be used to understand how the gold deposits in the area formed and how they could predict where to find new mineralization. This was followed by an underground tour at the Trixie Mine, owned and operated by Osisko Development.

Next, we drove north, leaving behind the ancient hydrothermal fluids that formed the mineral deposits of the Tintic district to observe modern hydrothermal fluids at Yellowstone National Park, making a stop along the way to look at flood basalts and have a quick dip in Lava Hotsprings in Idaho. At Yellowstone, the group saw a wide range of different hydrothermal features including the large geysers that make the park famous, and were lucky enough to see Beehive geyser erupt, as well as Old Faithful, of course. Other geothermal features included travertine terraces, water with extremophilic organisms, and bubbling mud pools. This left the participants in awe of nature's beauty and thinking about how the processes they saw were also active in the formation of mineral deposits.

Bidding Yellowstone and Wyoming goodbye, and heading for Montana, we first visited the Black Butte deposit of Sandfire America, an interesting sediment-hosted massive sulfide deposit in the famous Belt Purcell Basin that also contains significant amounts of cobalt. Afterward, the group visited the mining town of Butte and explored the museum



at the Montana Institute of Technology, the World Mining Museum, and the Berkeley Pit before heading back to Toronto.

U of T SEG Student Chapter would like to thank the Society of Economic Geologists Stewart R. Wallace Funding, the Tom Lane Student Field Trip Award from the MDD of the GAC, the Department of Earth Sciences at the University of Toronto, the Toronto Geological Discussion Group (TGDG) and an anonymous mining executive for funding this trip. Thank you to Osisko Development and Sandfire Resources America Inc. for providing us with the amazing opportunity to visit their sites. We'd also like to thank Erich Petersen for the tour of the Tintic District and Jeff Hedenquist for giving us pre-trip lectures and instructions to get the most out of the trip to Yellowstone.

In 2024 the SEG trip will be to the Iberian pyrite belt. If you're interested, please contact Dan Gregory at daniel.gregory@utoronto.ca for more information.

Dan Gregory, Assistant Professor



Annual Graduate Student Trip

Incoming and returning grad students, along with faculty members, enjoyed a weekend trip to cabins near Killarney provincial park. Emeritus professors **Pierre Robin** and **Friedr Schwardtner** guided the group in visiting some spectacular outcrops of the Grenville Province. The highlight of the trip was a hike up "The Crack", followed by fish and chips in the town. Everyone had a (porphyro) blast!

*Sarah Mount, PhD Student,
AGESS Co-President*

Research

Mid-Atlantic Expedition: In search of hydrothermal vents associated with mantle serpentinization

I was aboard a recent 6-week-long seafaring expedition on the *Falkor (too)* Research Vessel to the middle of the Atlantic Ocean to investigate the seafloor for hydrothermal vents associated with exposures of uplifted, serpentinized mantle rock. This rock can become exposed at surface along large-scale detachment faults associated with slow-spreading ridges. Using a combination of seafloor maps, water chemistry, and Remotely Operated Vehicles (ROVs), we managed to successfully locate 3 new vent sites on the ocean floor. These vents are home to a litany of animals, including shrimp, anemones, and snails, but they are also geologically fascinating because of the sulfide minerals that form from these hot vent fluids. These vents are rich in copper, zinc, lead, gold and silver, and demonstrate modern analogues to the deposits that we mine on land across the globe. Learning about the geochemistry of these systems is valuable for our understanding of the origin of life, seafloor ecology, magmatic processes, and can also aid in the discovery of similar deposits on land. My roles aboard this ship were to identify and classify rock samples, and to assist in water column sample capture, and processing seafloor bathymetry.

Our understanding of seafloor massive sulfide (SMS) deposits has historically hinged on the convention that heat is entirely derived from sub-seafloor magmatism, which in turn causes seawater to become acidified through reactions with the host rock, ultimately creating an acidic, briny fluid that is capable of precipitating sulfide minerals. However, the discovery of the Lost City deposit in 2000 (Kelley et al., 2001) challenged these notions, as hydrothermal venting was identified to be producing very basic (high pH), and highly reducing fluids (abundant H_2 and CH_4) there. My recent expedition aboard the R/V *Falkor (too)*, hoped to identify a similar deposit for comparative models. It would seem that the Lost City deposit represents an “end-member” species whose fluid composition is almost entirely produced as a by-product of the serpentinization of mantle rocks that become exposed adjacent to slow-spreading ridges. Serpentinization is a spontaneous, exothermic reaction wherein the reduced iron species (Fe^{2+}) in olivine/pyroxene becomes oxidized to Fe^{3+} , and the hydrogen in the water becomes reduced from H^+ to form H_2 . The results of this reaction are a removal of free hydrogen (increasing pH), a more reducing fluid, and a relatively high temperature ($\approx 120^\circ C$) as a result of the exothermic heat release during serpentinization. This basic fluid is capable of forming calcite ($CaCO_3$) at depths far below the carbonate compensation depth. Our three newly-discovered hydrothermal vents



The R/V Falkor (too) helideck (left), and Jonathan Umbsaar (right) aboard the vessel.

had variable degrees of serpentinization input, although no calcite/carbonate chimneys were found. It would seem that SMS deposits can be represented by two end-member species: one dominated by magmatism (acidic, high temperatures), and one dominated by serpentinization (basic, moderate temperatures). Therefore, all SMS deposits seem to exist on a compositional spectrum, with the fluid geochemistry being directly influenced by the host rock alteration. The degree of serpentinization contribution may prove to be a defining factor in the critical metal abundances seen in subaerial volcanogenic massive sulfide (VMS) deposits worldwide.

My experiences aboard the R/V *Falkor (too)* have helped me to gain new insights into other scientific fields, broadening my perspective of seafloor science, and providing me with new skills to tackle various geochemical challenges. The friends, knowledge, and confidence I gained from this experience has been a tremendous benefit to me, and this expedition has had profound ripple effects in both my personal and professional life. Ongoing research into these vents has made me increasingly interested in the evolution of vent fluids as they interact with the host rocks and nearby magma bodies.

Jonathan Umbsaar, PhD student, supervised by Professors Melissa Anderson and Dan Gregory

A New Helium-Hydrogen Gold Rush

Helium is a globally important resource with a \$6 billion annual market essential for many medical, scientific and industrial processes. Helium has traditionally been found as a by-product of conventional hydrocarbon gas fields, and as such, production is associated with significant carbon emissions, contributing to climate change. Further, the world has long relied on just a few key helium-rich locations. As these traditional stocks decline, helium is in critically short supply worldwide. The situation has been exacerbated by the Ukraine war, since this ruled out helium being supplied from the new Russian Amur plant, planned to supply 35% of the global helium demand.

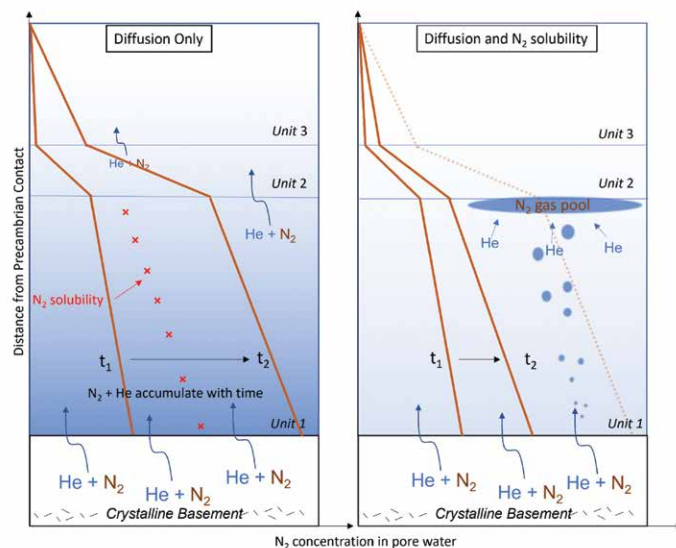
New insight into the recent resulting helium “gold-rush” was published in *Nature* in March 2023 by Anran Cheng, carried out jointly with Dr Chris Ballentine of Oxford and Dr **Barbara Sherwood Lollar** of the University of Toronto. The study provides exploration models to understand where new helium-rich fields can be found and could help locate new reservoirs of carbon-free helium – and potentially also naturally occurring hydrogen-rich gas fields.

Where rare helium-rich underground gas fields have been found, they always occur alongside high concentrations of nitrogen gas. Until now, there has been no explanation for this. The authors identified the geological conditions where the concentration of nitrogen becomes high enough to create gas bubbles in the rock pore space. Such a process can take hundreds of millions of years, but when it happens the associated helium escapes from the water into the gas bubbles. These bubbles rise, because of buoyancy, towards the surface until they hit a rock type that doesn't allow the bubbles through. According to the model, the helium-rich gas bubbles then collect beneath the seal and can form a substantial gas field. Typical geologic settings may include the base of sedimentary basin rocks directly overlying crystalline basement rocks. In such settings, the gas concentration mechanism may include not only helium and nitrogen, but also naturally-occurring hydrogen gas, since the radioactivity that generates helium also splits water to form hydrogen. With a global market of \$135 billion, hydrogen is used to create fertiliser and to produce many compounds essential for the food, petrochemical, and pharmaceutical industries. Virtually all hydrogen gas is currently produced from coal and natural gas (methane), and this alone accounts for 2.3% of global CO₂ emissions.

This new insight into mechanisms of formation of economically valuable gas fields with helium and hydrogen, potentially decoupled from hydrocarbon production, are fostering excitement and a new global hunt for these essential resources.

<https://www.nature.com/articles/s41586-022-05659-0>

The paper ‘Primary N₂-He gas field formation in intracratonic sedimentary basins’ was published in *Nature* in March 2023 by Anran Cheng, Barbara Sherwood Lollar, Jon Gluyas and Chris Ballentine. (DOI 10.1038/s41586-022-05659-0). All contributed to this summary as well as Josslyn Johnstone (U of T) and Kate Hatton (Durham).



- N₂ co-accumulating in the groundwater with ⁴He and H₂.
- With typical N₂ /⁴He basement flux ratios of 20-50, the nitrogen solubility limit can be exceeded.
- N₂ gas phase is a sink for the ⁴He (and H₂) and buffers any further change in the ⁴He water concentration.

A mechanism to account for observed primary ⁴He + N₂ gas fields in sedimentary basins and a mechanism for co-location with H₂.

Barbara Sherwood Lollar, University Professor

Uli Wortmann to release an oceanic environmental modelling kit in 2024

Uli Wortmann spent a half-year sabbatical at the Hanse Institute for Advanced Studies (HWK) in Northern Germany. During this time, Uli worked towards finishing the Earth Science Box Modeling Toolkit (ESBMTK). This toolkit is a collection of software tools that aims to simplify the creation of so-called box models representing the Earth System as a collection of interconnected reservoirs (boxes). In its simplest form, a model would, e.g., have reservoirs representing the low-latitude, high-latitude, and deep ocean and the atmosphere. Such a model can then be used to investigate, e.g., the changes to gas-exchange fluxes across the air-sea interface or how anthropogenic carbon emissions affect ocean acidification. Uli started this work four years ago and targets a public release in the spring of 2024.

Take a peek at <https://github.com/uliw/esbmtk>.

Professor Miriam Diamond contributes to building international pollution panel



Miriam Diamond, second from left, participated in a meeting dedicated to establishing a new science-policy panel on Chemicals, Waste and Pollution Prevention initiated by the United Nations Environment Assembly. This new panel on chemicals and waste will join the Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Panel on Biodiversity and Ecosystem Services or IPBES as three global panels to tackle the triple threats of climate change, loss of biodiversity and pollution.

Diamond attended this meeting as part of the delegation from the International Panel on Chemical Pollution, a group of independent scientists of which she is Vice-Chair.

Diamond was invited by the meeting secretariat to present her views on the function of the panel as part of two “deep dive” sessions held during the week. In her view, those functions include scanning the horizon for “emerging” and continuing pollution and waste issues, innovating to develop new solutions to reduce threats posed by chemical pollution, inviting inclusive “ways of knowing” that respect lived experiences and Indigenous learning and knowledge, and ensuring strict conflict-of-interest provisions so that those who stand to benefit financially undertake full disclosure. In addition, she intervened to express the need for independent scientists to be involved over the next two years as the panel is established.

Miriam Diamond, Professor

Thank you

We acknowledge, with thanks, donations made in 2023 to a variety of scholarship funds by the following individuals:

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Laurent de Verteuil

Arpad Farkas

Sylvia Fawcett

Sarah A. Finkelstein

George A. Gorzynski

Donald G. Gratton

James and Rebecca Hilton

Sarah K. Hirschorn

Ann F. Hubbs

Sandra L. Kamo

Stephen E. Kesler

Stephen Kissin

Robert M. Kuehnbaum

J. Douglas and Sheila D. Macdougall

Timothy McConachy

Andrew Miall

Bernd Milkereit

David W. Moore

Catherine Narduzzi

Donald Pysklywec

Walfried M. Schwerdtner

Maureen Simpson and Almos Tassonyi

Edward Spooner

Quentin Neil Stossel

Michael W. Sutton

Anne and John Thompson

Edward G. Thompson

Ian S. Thompson

A. S. J. Tozer

Paul Tozer

Norman F. Trowell

Elizabeth Turner

and several anonymous donors

50th Year Reunion

Dan and Connie Dupak hosted a 50th anniversary reunion of the 1973 graduating class of Geological Engineers and Arts and Science Geology that gathered for a celebration on the afternoon of June 3, 2023. Don and Connie hosted a previous event that was held in 2018 when the 45th anniversary event was held.



The gathering attendees were (L to R in photo): **Eric Grunsky, Duncan McKay, Horst Helbig, John Galbraith, Tom McAuley, Geoff Taylor, Frank Weinstock and Dan Dupak** along with partners Connie Dupak, Jean Hubay, Gayle Taylor and Mary Weinstock. Although **Fried Schwerdtner** was invited to attend the event, his field work activities (Fried is still going strong!) prevented his attendance. Fried asked **Dennis Waddington** (BSc 1970, MSc 1973) who had just returned from some field time with Fried and who had been the assigned “lab demonstrator” for Fried’s third-year structural geology course for the class of ‘73, to act as his proxy. Dennis’s participation was enjoyable as he shared his own past observations and activities of the Department of Geology.

The afternoon event was filled with great and humorous recollections of our past as students in the Department of Geology. Horst and John brought some old photographs from our days in field school and the notorious campus activities by the engineering students (and some Arts and Science students). We reflected on the great mentorship of our previous faculty and reflected on their absence; as well as those fellow students who are no longer with us.

Karyn Gorra, Outreach Coordinator for the Department of Earth Sciences attended the event and updated us on many of the current events occurring in the Department. We extend our thanks to the Chair of the Department, Dr. **Sarah Finkelstein** for the gift of a beautiful fruit basket as a contribution to the event.

We are all grateful for the opportunity to meet up again and share stories. Our heartfelt thanks to Dan and Connie Dupak for hosting the event again.

Eric Grunsky and colleagues

Medal Winner at World Dragonboat Championships



In August of 2023, I had the honour of joining Canada’s Premier National Dragonboat Team and competing at the World Dragonboat Championships in Pattaya, Thailand. I was introduced to competitive dragonboat when, while studying geology at U of T, I joined the U of T Engineering Iron Dragons for four years. After graduation, I joined the affiliated True North Paddling Club Mixed and Open teams, and this year I tried out and was selected for Team Canada.

Canada did extremely well in all divisions at the World Dragonboat Championships, taking home the Junior Cup, Senior Cup, Women’s Cup, and the highly coveted Nations Cup - the grand prize of the tournament! I competed in many races in the Premier Mixed and Open divisions, bringing home a gold medal in the 2 km Mixed Small boat (10 paddlers) race, a silver in the 200 m Mixed Small boat, and bronze in 500 m and 2 km Open Standard boat (20 paddlers). Overall, it was a dream come true to represent Canada and compete with the best in the world. Now it is back to training as the True North Paddling Club builds up to the Club Crew World Championships in Ravenna, Italy in September 2024 (think ‘Champions League’ as opposed to the 2023 ‘World Cup’).



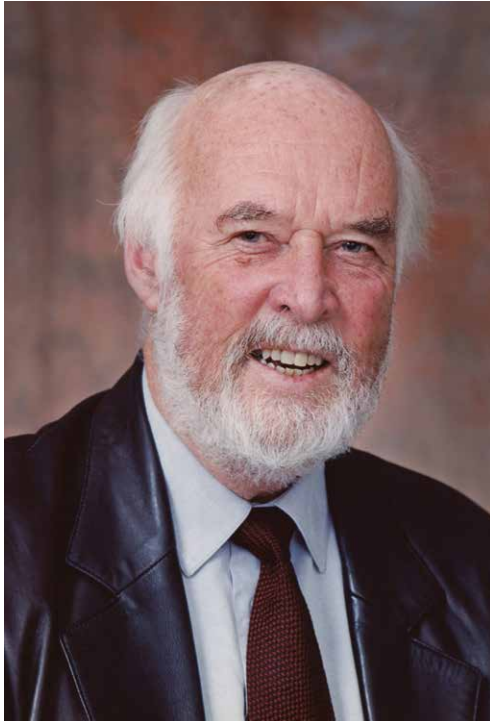
Photos: top, **Colin Roth** with his medals, and left, Mixed Small boat race, 2 km - Canada is the top boat with Colin in the middle left seat.

When I’m not training, I work at BGC Engineering, applying earth science to help solve the complex challenges faced by industry and communities across North America. Primarily I focus on geohazard management programs, identifying and monitoring the impacts of landslides, rivers, erosion, karst, etc. on infrastructure.

Colin Roth (BSc 2019)

Obituaries

Geoff Norris (1937–2023)



Geoff Norris, Professor Emeritus and former Departmental Chair, passed away at home on June 26th 2023, six weeks short of his 86th birthday.

Geoff was educated at Cambridge University, UK, receiving his bachelor's degree in 1959 and his PhD in 1964. He had married Anne in 1958 and started their family, and upon completion of the research for his PhD they moved in 1961 to New Zealand where Geoff worked for the Geological Survey as a palynologist. In 1964 the family moved back to North America, first to Hamilton to take up a post-doctoral position at McMaster University. From 1965 to 1967 he was employed as a Senior Research Scientist with Pan-American Petroleum at Tulsa, Oklahoma. He joined the Geology Department at the University of Toronto as an Assistant Professor in 1967.

Geoff was an important leader in our department, notably during the 1970s and 1980s, when the plate-tectonics revolution was underway, and environmental concerns were growing. He was a significant supporter and enabler of the formation of the first environmental earth science program in a Canadian university, working with the then chair, **David Strangway**, and professor **John Westgate** to establish the Terrain and Environmental Earth Sciences (TEES) Program at the Scarborough College Campus (now UTSC) in 1981. He was one of the first in the Department to adopt the new ideas about plate tectonics that **Tuzo Wilson**, then a professor in the Physics Department, was promoting, and invited him as a guest lecturer to the Geology Department at a time when there was still significant opposition.

Geoff, who served two terms as Chair from 1980 to 1990, made several notable and forward-thinking hires of faculty and staff, and played a key role in the move from the Mining Building into the Earth Sciences Centre in 1989. He was heavily involved in the design of the new building, ensuring that it would meet Earth Sciences faculty needs at the time of the move and also for future generations. The design of the new building and the move into it were massive undertakings. It was a highly successful project, for which we have Geoff to thank. He retired in 2003 and continued to be active with his research as an emeritus professor.

Geoff was highly regarded for his research in the areas of palynology and biostratigraphy. He was a pioneer in the early study of fossil dinoflagellates and contributed significantly to their modern understanding as vital tools in biostratigraphy and paleoenvironmental analysis. Geoff's lengthy publication record includes important contributions on dinoflagellate systematics, acritarchs, Cretaceous and Cenozoic palynofloras, and paleoclimatic inference. Geoff proposed a suprageneric classification of dinoflagellates at a time when such schemes were considered impractical. Undaunted, Geoff pursued this research with others, most notably one of his Research Associates, **Rob Fensome**. This led to the now classic and universally embraced 1993 publication that integrates the taxonomy and classification of fossil dinoflagellates with their living relatives. Geoff also published a monograph on the Mesozoic geology of the Moose River Basin and co-authored with ROM-colleague **Jock McAndrews** the highly cited and still standard guide *Quaternary Pollen and Spores of the Great Lakes Region*. He and his students made important contributions to the stratigraphic work of the Ocean Drilling Program. His work nimbly transcended different geological time periods. Over his lengthy career, Geoff inspired and mentored many students, postdocs and visiting scientists with his enthusiasm and innovative ideas.

Geoff's work was global in scope. His overseas activities included a Humboldt Fellowship in Cologne, Germany, a research program in Venezuela, several visiting lectureships in China, and a stint at the Florida Bureau of Marine Research. Similarly, his students, and visiting professionals were numerous, and hailed from all over the world. Later in his career, Geoff consulted for a consortium of palynologists and also for **Pierre Zippi**, a former PhD student, in order to provide paleo-environmental and biostratigraphic information to the petroleum industry, and for some years he was active in supporting exploration work in the "sub-salt" plays in the Gulf of Mexico. He would talk enthusiastically about the complex structures and stratigraphy, hidden from seismic analysis beneath the thick salt, that the drilling was

exploring and which added significant reserves to the already highly productive Gulf petroleum province. Unfortunately, owing to industry confidentiality he was never able to publish any of this work.

Geoffrey Norris served the broader scientific community diligently for most of his career, including long terms as a member of Council of the Geological Association of Canada, and as a member of many other panels and advisory boards, including the Natural Sciences and Engineering Research Council. He served as an executive and conference organizer for several professional societies in his field. He was elected a Fellow of the Royal Society of Canada in 1983, and served as a Council member and Director of the Earth, Ocean and Atmospheric Sciences Division of the Academy of Sciences.

Geoff and Anne loved Florida, and for many years would spend as much of the winter as possible there. Following his retirement in 2003 they wintered at a condominium near the beach on Hutchinson Island, on the east coast, near Stuart, a location carefully chosen by Geoff because the local council permitted dogs to be walked on the beach. Geoff continued his palynological work there, as his laboratory, consisting of a microscope and a dedicated computer system, was mobile, and could be easily packed in their vehicle for travel to and from Toronto. While in Florida, Geoff advised local communities on the problem of the dinoflagellate “red tides” that periodically occur along Florida’s coastlines, and pollution issues associated with Lake Okeechobee.

The spirit of the Department during Geoff’s tenure owed much to the hospitality he and Anne extended to students and to new faculty. New students were often welcomed with temporary accommodation at their house, and parties and dinners there were legendary. His warmth, enthusiasm, sense of humour, and hearty laugh will be sorely missed. A Celebration of Geoff’s life was held at their residence, Concorde Place, Toronto, on July 29th, 2023. Many former colleagues, students and friends attended, together with Anne and their four children, Grant, Sonia, Brett and Theresa, most of their eight grandchildren and their three great-grandchildren.

Andrew Miall, Professor Emeritus and Martin Head, Status Only Professor, U of T and Professor, Brock University, with contributions from John Westgate, Professor Emeritus, and the Norris family

New scholarship

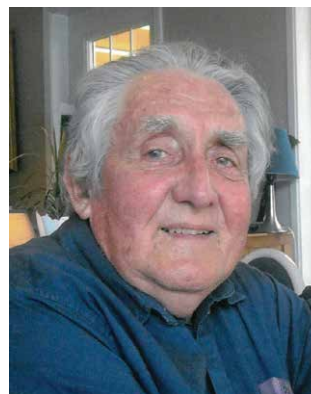
Geoffrey Norris Memorial Award Fund

A bursary has been established in memory of Emeritus Professor Geoffrey Norris. This award will support students in the Department of Earth Sciences based on financial need.

Donations may be made online through the [Department of Earth Sciences “Giving” webpage](#).

For more information or if you require assistance making your gift, contact Richard DeLisle, Senior Development Officer, at r.delisle@utoronto.ca or 416-978-2720

Desmond Collins (1938 - 2023)



Desmond Collins, who retired from the ROM in 2004 after 36 years of service, passed away at the age of 85. Dr. Collins considerably increased the ROM’s Invertebrate Palaeontology collections during his career, most notably with specimens from the Burgess Shale. These collections are some of the most important globally and will continue to fuel new research and exhibits for decades to come.

Dr. Collins, Head and Senior Curator of the Department of Palaeobiology, joined ROM in 1968 as Curator of Invertebrate Palaeontology.

Born and educated in Perth, Western Australia, Des attained his Bachelor of Science degree in Geology at the University of Western Australia in 1960 and his PhD at the University of Iowa, U.S.A. in 1966, while working as a Technical Officer at the Geological Survey of Canada in Ottawa in 1964-1965. A three-year Senior Research Fellowship followed at the

British Museum (Natural History) in London. In 1970, Des was cross-appointed as an Associate Professor to the Department of Zoology (now Ecology and Evolutionary Biology) and in 2000 as an Associate Professor to the Department of Geology (now Earth Sciences), both at the University of Toronto. He taught Paleontology for several years at the University of Toronto at Mississauga (UTM) for the Earth and Planetary Science discipline, now incorporated into the Department of Chemical and Physical Sciences.

Dr. Collins' greatest achievement is the nineteen summer field seasons (1975-2002) he spent in the Burgess Shale of British Columbia, excavating and collecting 505-million-year-old fossils, discovering many new sites and species previously unknown to science. These collections, the world's largest, are held in trust for Parks Canada and the people of Canada and provide a clearer view of animal life soon after it first appeared on Earth. Many of the Burgess Shale fossils that Des and his teams collected throughout the years were featured in media and documentaries and published in top science journals, including *Science* and *Nature*. A film documenting Des in his laboratory at the ROM can be seen at shapeoflife.org/video/des-collins-paleontologist-burgess-shale

David Evans, Co-Chief Curator, Natural History & Temerty Chair in Vertebrate Palaeontology (slightly modified by the Editor from the original article)

Stewart Jackson (1942 – 2023)



Stewart Jackson passed away in Vancouver in his 82nd year. He obtained a BSc in Geology from the University of Western Ontario, an MSc in Stratigraphy and Mineral deposits at U of T under the supervision of the late **Frank Beales**, and a PhD from the University of Alberta. He stayed in touch with the department and was featured in the 2017 Alumni News.

Dr. Jackson was a longtime exploration specialist. He founded Crown Resource Corporation where he discovered and

initiated production from multiple gold discoveries totaling several million ounces in Washington State, USA, including the current Buckhorn Mine of Kinross. He was involved in the acquisition and exploration of multiple gold and silver deposits in North, South and Central America, the Philippines, and Indonesia. He acquired and delineated a major uranium, molybdenum, nickel and vanadium resource in Sweden, and was instrumental in the advancement of the Turnagain nickel deposit in Northern BC from a prospect to the status of a very large nickel resource. In addition to metals exploration, he was involved in a broad range of exploration fields, including oil, gas, industrial minerals, and diamonds.

Henry Halls, Editor

Bruce Craig Jago (1957- 2023)



Bruce Jago died on August 5, 2023, at the early age of 66 having developed early onset Alzheimer's disease. He came to Toronto after some time in the diamond search that was then in full spate and began an experimental petrology study in which he pioneered the role of fluorine in carbonatite magma genesis. In addition to fitting in so splendidly to the Geology Department community he will be remembered as well by students and faculty of the day for his beloved dog Seamus who became a permanent resident of the Mining Building. His doctoral research is still widely cited in the world of carbonatites. From Toronto, as an exploration geologist to the core, he returned for a while to the diamond search but later settled in Sudbury with INCO where he spent many years. In 2013 he joined Laurentian University as Executive Director of the Goodman School of Mines and Professor of Earth Sciences and led it until his death. He is survived by Mary his wife of 42 years as well as two daughters Caitlin and Emily.

John Gittins, Emeritus Professor and PhD thesis supervisor

Claire Lo (1962-2023)



Following nearly nine years of living with cancer, Claire Lo, age 61, died in Paris on March 31st, 2023.

She was raised by her grandmother in Hong Kong after which she moved back to Canada to be with her family. Claire married her husband Gerald in July 1990 at the Lo family home in Port Credit. They had one son.

Claire studied Geology at the University of Toronto and graduated in 1985. Following graduation, Claire worked as a field geologist with several firms and travelled to remote sites across Canada. Eventually Claire's interest shifted away from Geology towards Information Systems, and she landed a job in Sales for IT Systems.

Eventually, she was relocated with her family to London, England – it was supposed to be for 2 years, but she loved it so much she ended up staying for 11 years. Around 2010, Claire finally retired from the corporate world and began looking for a new perspective on life. Luckily, her husband was transferred to Paris, and this was the start of new adventures.

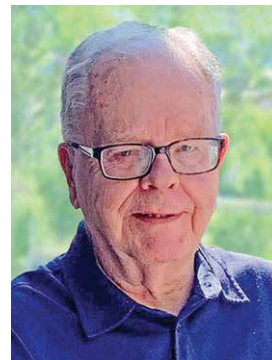
Jock McAndrews (1933- 2023)



Jock McAndrews, Curator Emeritus at the ROM with appointments at U of T in the Departments of Earth Sciences and Ecology of Evolutionary Biology, passed away on July 21, 2023. Jock's research expertise was in the areas of

Quaternary biostratigraphy, paleoclimate, and palynology. Jock completed a PhD at the University of Minnesota in the 1960s which resulted in a set of novel and well cited papers on late Quaternary shifts in the positions of the prairie, savanna and forest biomes in the western Great Lakes region. Jock maintained an active research program in palynology of lake sediments, working all over Ontario and the Great Lakes region. He contributed many seminal papers on these lake records, and was the first to uncover the remarkable pollen record in the sediments of Crawford Lake in southern Ontario. This work built the foundation for the recent announcement of Crawford Lake as the candidate site for a new geological period called the Anthropocene. Details are given at <https://www.cbc.ca/news/science/crawford-lake-anthropocene-1.6902999>

Roger Macqueen (1935-2024)



Roger Macqueen graduated from the department in 1957 and continued with an MSc under the supervision of **Frank Beales**, graduating in 1960. His first permanent employment was in 1965 with the Geological Survey of Canada based in Calgary. Starting in June 1971 he was on leave from the Survey for a year at the University of Toronto in Mississauga (UTM) where he taught sedimentology in the Division of Earth and Planetary Science. Roger's favourite assignment was a field trip to study modern carbonates around Qatar in the Persian Gulf in 1961. He often talked of the two weeks he spent returning from Qatar to London by way of the Giza pyramids in Egypt, and from there to the Acropolis and Parthenon in Greece via Beirut in Lebanon.

Roger was the Editor of one of Canada's foremost earth science publications, *Geoscience Canada*, from 1996 until his final retirement in 2022. He leaves his wife and four children.

Can you spot the (sinistral) earthquake rupture offset?



Photo taken by Professor Russ Pysklywec during the ICM field trip to Türkiye.

Alumni News

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