



# Mineralogical Association of Canada

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## MAC FOUNDATION SCHOLARSHIP WINNERS

We congratulate Jillian Kendrick and Justin Drummond, each a recipient of a Mineralogical Association of Canada Foundation Scholarship in 2016.



**Jillian Kendrick** completed her BSc degree (Earth Sciences) at Dalhousie University (Canada) in 2015, where, for her honours thesis, she studied coronitic metagabbro from the Grenville Province (Canada) and pseudomorphs after olivine. Further pursuing her interest in metamorphic petrology and micro-analysis, she began her MSc degree the following fall at Memorial University of Newfoundland (Canada) working with Dr. Aphrodite Indares. Her MSc research combined trace element analysis with cathodoluminescence (CL) imaging to examine seemingly uninteresting minerals in partially melted aluminous rocks and show them in a new light. She first focused on quartz, using CL imaging and high-resolution mineralogical maps of thin sections to identify different generations of quartz growth in the samples. This work was combined with trace titanium analysis of the quartz to assess the applicability and limitations of the Ti-in-quartz thermobarometer. Using similar methodology, she has since begun to study kyanite, identifying prograde and retrograde generations of kyanite growth, typically preserved in the same crystal. The aim is to determine the possible reactions involved in kyanite growth and consumption during the metamorphic evolution of the rocks. The results of her work have implications for the behaviour of these minerals, and of some minor elements, during metamorphism, particularly during partial melting at high temperatures and subsequent melt crystallization.



**Justin Drummond** completed his BSc (2012) and MSc (2014) in Earth and Environmental Science at Acadia University (Canada). His MSc research integrated sedimentology and multi-technique petrography to constrain the depositional environment of phosphorus accumulation in Neoproterozoic phosphatic sediments of the ~610 Ma Sete Lagoas Formation of central Brazil. This study provided

further insight into phosphorus cycling in the Precambrian ocean during the Late Neoproterozoic, just before the ventilation of Earth's deep oceans. After completing his MSc, Justin began his PhD in geochemistry at Queen's University (Canada) under the supervision of Dr. Kurt Kyser and Dr. Noel James. Justin's PhD focuses on characterizing groundwater calcretes and calcrete-hosted uranium deposits in Western Australia, and assessing whether there are potential U deposits in the calcretes of the Western Canadian Sedimentary Basin (WCSB). This study integrates petrography, mineralogy, sedimentology and isotope geochemistry to constrain the primary factors influencing uranium accumulation. This study will help refine ore genesis models and should aid in determining where in the WCSB there may be uranium deposits. Additionally, this information will provide context for the application of novel exploration techniques, such as the use of trace-elements in vegetation as vectors to ore.

## MAC TRAVEL AND RESEARCH GRANT AWARDS IN 2016

MAC awarded 11 student travel and research grants in 2016 totalling of \$10,000: one to an undergraduate student, four to MSc students, and six to PhD students. Congratulations to these deserving individuals! Excerpts of their reports follow.



**Janina Czas** is a PhD student at the University of Alberta (Canada), under the supervision of Prof. Thomas Stachel. She received the MAC Student Travel Grant to attend the 2016 GAC-MAC conference in Whitehorse (Yukon, Canada). Her research is focused on diamonds, which is part of her PhD on investigating the age, formation and diamond population of the lithospheric mantle of the Sask Craton (Canada). The conference's special session "Cratons, Kimberlites and Diamonds" provided an excellent venue to present her research on diamondiferous micro-xenoliths from the Fort à la Corne (FALC) area of the Sask Craton. For her talk she discussed how FTIR (nitrogen aggregation characteristics) and SIMS ( $\delta^{13}\text{C}$ ,  $\delta^{15}\text{N}$  and N concentrations) data are used to investigate the formation and evolution of the FALC diamonds. During the meeting, she also had the opportunity to discuss her PhD research with the session's keynote speakers.



**Sarah Davey** is a PhD student at Carleton University (Canada), under the supervision of Professors Richard Ernst and Brian Cousens. The MAC grant allowed her to visit the geochronology laboratory at the University of Toronto (Canada) to learn about general geochronology procedures and, more specifically, sample preparation and mineral separation techniques. She had never conducted geochronological analyses before so it was important for her to learn the detailed, step-by-step, process, from crushing and separation, to selecting appropriate grains, to using the thermal ionization mass spectrometer, and how to perform analyses and the calculations that follow. She sat with Dr. Sandra Kamo who explained the processes involved in dating zircons and baddeleyite. Now that Sarah knows how heavy liquids and the Wilfley table are used for separation, she will return to the University of Toronto to hand pick zircons and baddeleyites from her own samples for dating.



**Abd-Erraouf Djirar** is a geophysics MSc student at the University of Western Ontario (Canada) under the supervision of Prof Sean Shieh. Abd-Erraouf was awarded a MAC research grant to carry out radial X-ray diffraction studies on samples of baddeleyite that have been compressed in diamond anvil cells. The research aims to understand how baddeleyite behaves under high-pressure conditions. The experiments were conducted at the Advanced Photon Source synchrotron at the Argonne National Laboratory (Illinois, USA) and provided high-quality X-ray data that will allow him to understand the deformation in baddeleyite that occur at very high pressures in the diamond anvil cell. These high-pressure regions are difficult to explore with normal X-ray diffraction equipment and require high powered 3<sup>rd</sup> generation synchrotron sources. The results of this experiment will go towards completing his MSc thesis.



**Lauren Harrison** is a PhD student at University of British Columbia (Canada) who is studying the geochemistry of Northwestern Hawaiian Ridge lavas and mantle dynamics under the supervision of Dr. Dominique Weis. Lauren attended the Goldschmidt 2016 in Yokohama (Japan), which was a rewarding experience providing many new and interesting ideas, and a rich mentorship opportunity as it attracted different experts in her field. Her conference mentor was Takahashi Nakagawa, a numerical dynamicist who was most instructive to talk to about a model she was developing at the time to explain some of her geochemical data. Lauren was able to meet Ryoji Tanaka

(Okayama University, Japan), whose Hawaiian end-member models she uses extensively in her own research, and to discuss with him the criteria and possible characteristics of those end-member mixing sources in the Hawaiian plume.



**Malcolm Hodgskiss** is an MSc student at McGill University (Canada), under the supervision of Prof. Galen P. Halverson. Malcolm travelled 28 days to six locations throughout the Belcher Islands (Canada) to study the entirety of the Belcher Group, a Paleoproterozoic succession composed predominantly of carbonate sediments. In order to better constrain the paleoenvironmental evolution of the area, approximately 8 km of stratigraphic sections were measured and sampled at a high resolution. Additionally, the approximately 1.9 Ga Tukarak Formation was sampled for “molar tooth structures”, ribbon-like veins of microcrystalline calcite which formed in argillaceous carbonate sediments from approximately 2.6–0.6 Ga. These would complement a suite of molar tooth structures already collected from nine other field locations spanning the period 1.4–0.6 Ga. Several volcanic tuffs were also collected from the Kasegalik Formation, in the lowermost Belcher Group, to better constrain the age of this succession.



**Brendt C. Hyde** is a PhD student at the University of Western Ontario (Canada) who carried out in situ trace element analyses on two meteorites using laser ablation inductively coupled plasma mass spectrometry at the University of Portsmouth (UK). Mineral specific rare earth and highly siderophile element concentrations were acquired to assess the extent of melting and differentiation that occurred on the meteorites' parent body/bodies. Uranium, thorium and lead isotopic ratios were measured from phosphates to determine the chronology of the melt environments. His PhD aims to describe early melt processes on asteroids – now represented by meteorites – and so obtain a better understanding of how and for what duration these melt environments thrived and their ultimate contribution to the formation of current terrestrial bodies.



**Ty Magee** is an MSc student at the University of Saskatchewan (Canada) who participated in the KarratZinc expedition to West Greenland, along with a scientific crew that included geologists from four institutions, including the Geological Survey of Denmark and Greenland. The expedition focused on the stratigraphy, structure, and the distribution of potential zinc (Zn) and lead (Pb) deposits within the Paleoproterozoic Karrat Group. The expedition was a unique and unforgettable experience that allowed him to see firsthand how expeditions are run both logistically and scientifically. The MAC Student Travel Grant allowed him to travel to Greenland and join this unique venture. He was able to do geological mapping, collect sulfide samples for his thesis, and gain valuable experience from talented geologists. The objective of his thesis is to analyze sulfide samples from two formations of the Karrat Group that host Pb–Zn mineralization.



**Brayden McDonald** is an MSc student at the University of Saskatchewan (Canada) who carried out a uranium isotope analysis of shales samples from the Cenomanian–Turonian (Cretaceous) ocean anoxic event (known as “OAE-2”), a temporally and paleo-geographically well-constrained event. Samples of OAE-2 provide a unique opportunity, as they are already well characterized but have never been analyzed for uranium isotopes.

This project is helping to develop methods needed to identify similar environments within the Precambrian Earth. By looking at a well-defined event, the methods developed to analyze ocean anoxia through the use of variations in the isotope record, he can confidently apply those same methods to Paleoproterozoic aged shale in order to analyze the changing availability of oxygen within Precambrian oceans and the driving forces behind previous ocean anoxic events.



**Mallory Metcalf** is an undergraduate student at Queen's University (Canada) under the supervision of Prof Ronald C. Peterson. She received a MAC travel grant to attend the GAC–MAC 2016 conference in Whitehorse (Yukon, Canada). She presented her undergraduate thesis, which focused on the chemical analysis of cadwaladerite, a rare aluminium halide discovered near a small sulfate outcrop in Cerros Pintados (Chile) but declared as questionable species by the IMA due to inadequate analyses. This research project is comparing cadwaladerite to lesukite using SEM, XRD, FTIR and Raman spectroscopy, to explore the relationship between them. Her GAC–MAC experience was very positive and she found comfort in everyone's enthusiasm to learn about other colleagues' work, including her own. She also appreciated listening to the work being done in different fields, specifically on Mars and the ore petrology sessions.



**Rebecca Paisley** is a PhD student at McGill University (Canada) who has completed a field expedition to the Cordón Caulle volcanic complex in Chile. Her current project focuses on constraining gas pathways in rhyolitic magmas using short-lived radionuclides. Preliminary work on samples collected by previous researchers had yielded some interesting results. Rebecca found the hike exhausting but as she came above the tree line, hiked past the active fumarole fields, and spotted the 40-m high obsidian flow, there was a palpable sense of anticipation for the days ahead. Over the next three days she and the team analyzed, described and sampled volcanic bombs from the 2011 eruption; explored the most recent vent structure; and examined past flows and bombs for comparison. The experience was one of the most extreme, eventful but satisfying expeditions she has undertaken during her career. It has allowed her to collect samples that she can use to finalize her projects.



**Emily Scribner** is a PhD student at the University of British Columbia (Canada) who received a MAC travel grant to attend the GAC–MAC 2016 conference in Whitehorse. She presented her research on the Ash Mountain tin-bearing skarn of northern British Columbia, whose goal was to provide a detailed characterization of the mineralogy of the skarn as well as to determine the conditions that resulted in the crystallization of the tin-bearing silicate mineral malayaite. Attending this conference provided her with many beneficial experiences, such as presenting her research to a large group of scientists and receiving constructive feedback from the audience following her talk. She also had the opportunity to attend a number of talks, including ones on tin-, tantalum-, and tungsten-mineralization, metamorphism and petrology, as well as pedagogical techniques applied to the teaching of earth sciences, which was of great interest to her.