Diamond Exploration and Research Training School

Winter 2018, Issue 1

Newsletter

In this Issue

Introduction

Welcome to the inaugural issue of the DERTS newsletter! In this issue, we provide information about our program, a summary of our 2016/2017 activities, introduce our students and include updates about upcoming events.

We currently have 12 students enrolled in and fully funded by the program; with ten students at the University of Alberta (U of A) and two students at University of British Columbia (UBC). Additionally, seven students are funded from other sources but participate in the DERTS program as Associates.

We would like to extend our gratitude to all our partners and collaborators for their generous support in getting the DERTS program off to a great start. We look forward to working with you in the future!

Graham Pearson
DERTS Program Director

Funding provided by:

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About the program

DERTS is a graduate studies program focusing on diamonds that brings together industry, government and academia to train students in the latest advances in exploration geophysics, remote-sensing, volcanology, geochronology and indicator mineral analysis/ interpretation. DERTS includes an industrial internship component that provides on-site experience at mines, on exploration projects and with geological surveys. The DERTS program is funded through a 6-year $1.65 million NSERC CREATE grant with additional support of $400,000 from the University of Alberta. The grant provides for 15 (13 at U of A, 2 at UBC) fully funded scholarships for high-performing MSc and PhD students per year. Individual supervisors and industry/ government partners provide the funding to support the research projects of the students. Since the inception of the program 18 months ago, these contributions have exceeded $300,000. Additionally, numerous DERTS collaborators have provided funding to support DERTS events including fieldtrips, conferences and internships, to date totaling over $80,000.

For more information about the DERTS program, please visit: www.uab.ca/diamonds

2016/2017 Program Overview

International Diamond School 2016

http://cms.eas.ualberta.ca/diamond-school/

2016 IDS fieldtrip at the EKATI Mine.

Examining the pillow lavas, Yellowknife.

The DCO (Deep Carbon Observatory) co-funded the International Diamond School held at the University of Alberta, Edmonton in June 2016. This School provided networking opportunities for the DERTS Students and Associates with the numerous industry participants, as well as recruitment opportunities into the DERTS program. Speakers from the United States, Australia, the United Kingdom, Israel, Japan and Canada presented their latest research on numerous topics including:

- Diamond formation
- Cratonic mantle composition and evolution

- Kimberlite magmatism and emplacement
- Statistical discrimination of indicator minerals
- New approaches to diamond exploration

The School also included visits to the Ekati and Diavik Diamonds Mines and field tour of the Archean geology around Yellowknife. We thank Jon Carlson (Ekati) and Yuri Kinakin (Diavik) for their generous provision of support for the mine visits; and Scott Cairns, John Ketchum, Hendrick Falck and Barrett Elliot of the NWT Geoscience Office for organizing the field tour.

Connecting with Industry Partners

We received very constructive feedback from industry and government partners for establishing and subsequently improving the DERTS program. Graham Pearson and Thomas Stachel, with the generous help of Barbara Scott Smith, attended 2 days of meetings in Vancouver in July 2016 soliciting input from numerous industry partners. In January 2017, we had a booth at the Mineral Exploration Roundup to connect with industry and prospective students. In addition to these formal events we are continually in contact with our industry partners seeking input and feedback about the program. We welcome the opportunity to show visitors around our facilities and introduce you to our students. If you are interested in visiting, or are passing through Edmonton, let us know and we would be happy to arrange a tour.

Kimberley Ferguson of Dominion Diamond Mines tours the Ion Probe Lab or the Canadian Centre for Isotopic Microanalysis at the University of Alberta.

Resource Extraction and Northern Societies Workshop

DERTS and TERRE CREATE workshop participants and presenters.

In collaboration with UAlberta North and TERRE CREATE, the DERTS Students attended the Resource Extraction and Northern Societies workshop in Edmonton in June 2017. Presented by experts in the field, this workshop exposed students to the socio-economic and cultural effects of resource extraction, including presentations by Dr. Angele Alook, a member of the Bigstone Cree Nation.

DERTS 2017 Fieldtrip

The inaugural DERTS Fieldtrip in June 2016 included a tour of the operations at the Diavik Diamond Mine including the processing facility, underground mining operations, new dyke construction and even the wind farm! Our hosts at Diavik were very generous with their time and hospitality; we are grateful to Yuri Kinakin and Gus Fomradas for organizing the tour and all staff onsite for showing us around. The trip provided a very thorough overview of all aspects of an operating mine for our DERTS students. On the way home from the mine we examined the roadside geology along the Ingram trail from just outside of Yellowknife to the beginning of the ice road.

Top: DERTS Students: Matthew Hardman (left)and Matthew Wudrick (centre-right) along with Program Director: Graham Pearson (centre-left) and DERTS Collaborator Fabrizio Nestola (right) from the University of Padova, Itlay visiting Diavik.
Middle: Examining a pegmatite dyke of the Sparrow Pluton, along the Ingram trail.
Bottom: Fieldtrip participants standing on the pillows lavas in front of the Giant Mine, Yellowknife.

Internships

Denelle, Mei and Ben sharing their internship experiences at Victor Mine, Dominian Diamonds and Misasa, respectively.

Industry and other partners have provided excellent internship opportunities along with financial support to make the initial internships run smoothly. Denelle Smyth had the incredible opportunity to participate in a 4-month internship at Victor Mine. Working on a 2-week rotational schedule she experienced first-hand the life of a mine geologist. Mei Yan Lai was very privileged to work with Dominion Diamonds in Calgary over the summer. Her internship included working with Leapfrog software, a visit to the Ekati Mine and the diamond sorting facility in Toronto. Ben Gruber was

fortunate to be invited to participate in an internship at the Institute for Planetary Materials in Misasa, Japan. Ben gained experience working with an international team on mantle melt experiments trying to identify the electrical signature of mantle magmas. The students presented on their internship experiences at the DERTS Annual meeting in October.

The additional financial support provided by intern hosts to facilitate internships in 2017 exceeded $20,000. We are very grateful to our 2017 Internship partners for the excellent opportunities they arranged for our students.

Transition to Career Training https://www.ualberta.ca/career-centre/programs-events/t2c

Based on recommendations from industry and our partners, we have enrolled the UofA and UBC DERTS students in the T2C (Transition to Career) program organized by the Career Centre at the University of Alberta. The program provides individualized support, mentoring and training in the sphere of professional development including job searching, resume/cover letter training and mock interviews. The program also provides training for on-the-job skills.

DERTS Seminar Series

www.uab.ca/diamonds

Vancouver Kimberlite Cluster (VKC) Live - Streaming

https://www.eoas.ubc.ca/research/diamonds/vkc.html

The DERTS Seminar Series enables visiting industry professionals and scientists to present recent approaches/advances in exploration and evaluation techniques and cutting edge research. It also provides an opportunity for discussion and networking among the visitors and students and provides a forum for developing collaborative research. In the past 18 months we hosted Oded Navon (Hebrew University), Herman Grütter (Peregrine Diamonds), Fabrizio Nestola (University of Padova), Adrien Vezinet (University of Lyon), Maya Kopylova (UBC) and Kelly Russell (UBC).

Video streaming and webinar facilities have been set up to promote interaction between the UBC and UofA DERTS Students and Associates. These facilities also allow for streaming of special lectures/meetings in both directions. This has provided the opportunity for the Edmonton-based DERTS students to participate in most of the VKC (Vancouver Kimberlite Cluster) seminars and interact with the speakers, who are mainly industry professionals, via the video link.

11th International Kimberlite Conference
http://www.11ikc.com/

DERTS Students, Associates and Researchers were among a group of 16 from the U of A and 4 from UBC who attended the 11th International Kimberlite Conference in Botswana in September 2017. Matthew Wudrick, Janina Czas, Matthew Hardman and Theetso Motsamai gave oral presentations on their research projects, whilst Garrett Harris and Nicole Meyer presented posters.

DERTS Participants and Collaborators at the 11IKC.

The conference provided a great opportunity for the students to interact with internationally acclaimed geoscientists from industry and academia. Additionally, several students were fortunate to participate in fieldtrips that visited diamond mines in Botswana and South Africa.

DERTS Students and Researchers presenting at the 11thIKC. *Clockwise from top left: Garret Harris, Matt Wudrick, Theetso Motsamai, Matthew Hardman, Garahm Pearson, Nicole Meyer, Janina Czas, Kelly Russell and Thomas Stachel.*

We would like to congratulate Janina Czas and Garrett Harris for receiving the best Oral Presentation and Best Poster presentation awards of the conference!

***IKC Presentation Awards** winners including DERTS participants: Janina Czas (far left) and Garrett Harris (center-right).*

DERTS Outputs

DERTS students have been very prolific in presenting and publishing their research results. To date a total of 13 abstracts have been published, 15 presentations given at national and international conferences and 5 papers are submitted to peer-reviewed journals. In addition to the papers co-authored with the DERTS students, the DERTS researchers have authored 25 publications related to diamonds and kimberlites since the inception of the DERTS program. A comprehensive list of publications authored by DERTS students and researchers is included at the end of the newsletter. If you would like to receive a copy of any of these publications, please contact us: DERTS@ualberta.ca.

Introducing Our Team

The DERTS Students

The first cohort of 6 DERTS students started in 2016. A second cohort of 6 students joined the DERTS program in 2017 bringing the total number of DERTS Students currently enrolled in the program to 12. Additionally, 7 students participate in the DERTS program as Associates but are funded through other grants. DERTS Associates have access to all DERTS activities and events including fieldtrips, conferences, seminars and workshops. Brief summaries of the student's research projects are provide below, for additional information about the projects/students please visit our website: www.uab.ca/diamonds. DERTS students have been very successful in securing funding from numerous external sources including the Mineralogical Society of Canada, Faculty of Graduate Studies and Research U of A, Faculty of Science U of A, Government of Alberta and the IKC to help offset the cost of conference attendance.

2016 Cohort

Ben Gruber *(U of A)*
MSc
Tom Chacko/Graham Pearson

Ben is investigating how lower crustal chemical and thermal parameters affect mantle geotherms and the diamond capacity of kimberlite pipes through the in-situ analysis of trace elements in indicator minerals. Samples for this project were provided by Diavik and Ekati.

Garrett Harris *(U of A)*
MSc
Graham Pearson

Garrett is trying to establish the composition, age and geotherm of the lithospheric mantle in the West Central Rae Craton using peridotitic and eclogitic xenoliths from the Darby Kimberlite field, Nunavut.

Mei Yan Lai *(U of A)*
MSc
Thomas Stachel

Mei is working on understanding the structural defects that cause the yellow colour in diamonds from the Misery (Dominion Diamond Mines) and Chidliak (Peregrine Diamonds) kimberlites using spectroscopy (FTIR and UV-Vis) and mass spectrometry (SIMS).

Stephane Poitras *(U of A)*
MSc with Graham Pearson

Stephane is working on understanding the diamond potential of the Central Mackenzie Valley, NWT based on kimberlite indicator minerals collected from stream sediments and tills. His project is sponsored by the NWT Geological Survey.

Denelle Smyth *(U of A)*
MSc with Larry Heaman/Graham Pearson

Denelle is working on Pikoo kimberlite samples provided by North Arrow. Her study will provide the first detailed look at their character and genesis including U-Pb in perovskite dating and ilmenite chemistry.

Matthew Wudrick *(U of A)* MSc with Graham Pearson/Thomas Stachel

Matt is using Re-Os dating of garnet and spinel peridotite xenoliths from the Karowe Mine (Lucara Diamond) to determine the age and the chemical evolution of the lithospheric mantle in that area.

2017 Cohort

Sean Bettac *(U of A)* MSc with Martyn Unsworth

Sean's research is focused on better understanding the structure of the lithosphere of the Slave Craton in the Northwest Territories using magnetotellurics (MT) to delineate regions that are favourable for diamondiferous kimberlites.

David Sasse *(UBC)* MSc with Kelly Russell

David is studying the attrition of macrocrystic minerals in xenoliths as these are entrained by rising kimberlite magma. His research will broaden our understanding of kimberlite transport.

Marina Karaevangelou *(UBC)* MSc with Maya Kopylova

Marina is working on diamonds from the Lace Mine (DiamondCorp). Her research will include description of the physical characteristics of the diamonds and analysis of their mineral inclusions.

William Siva Jothy *(U of A)* MSc with Thomas Stachel/Graham Pearson

Will is working on diamonds provided by DeBeers from the recently opened Gacho Kue Mine. His study includes characterization of diamond forming fluids through nitrogen and carbon isotopes as well as analysis of the mineral inclusions.

Ian Beitz *(U of A)* MSc with Bob Luth/Graham Pearson

Ian is investigating the properties of melt pockets within kimberlites from the Chidliak field (Peregrine Diamonds) to determine melt genesis, how melt has interacted with/relates to other features of the kimberlite, and the influence on diamond growth/destruction.

Christian Veglio *(U of A)* MSc with Graham Pearson/ Tom Chacko

Christian is analyzing mantle xenoliths from the Jericho and Muskox to assess the presence and mobility of gold and other precious metals in the mantle. The goal is to determine the role of the lithospheric mantle on ore deposit genesis.

Associates

Janina Czas
(U of A) PhD with Thomas Stachel/ Graham Pearson

Janina studies diamondiferous and non-diamondiferous eclogite xenoliths from Fort a la Corne (Shore Gold) to assess their metasomatic history and possible relationships between metasomatism and diamond formation.

Matthew Hardman
(U of A) PhD with Graham Pearson/ Thomas Stachel

Matthew is defining a new, robust graphical classification scheme for low-Cr crustal and mantle garnet. The classification is based on a compilation of published data and new analyses of samples that were provided by industry and academia.

Mandy Krebs
(U of A) PhD with Graham Pearson/ Thomas Stachel

Mandy studied diamonds from the Victor Mine (DeBeers), Finsch (DeBeers) and Newlands (Graham Pearson) kimberlites. Her analyses of ultra low abundances of trace elements indicate that the diamond forming fluid is similar for gem and fibrous diamonds.

Nicole Meyer
(U of A) PhD with Thomas Stachel/ Graham Pearson

Nicole is working on inclusions in diamonds from the Koffiefontein Mine to provide improved inclusion-based geothermo-barometry. Samples were provided by Jeff Harris and Petra Diamonds.

Theetso Motsamai *(U of A)*
PhD with Thomas Stachel

Theetso is characterizing the diamonds and their mineral inclusions diamonds from the Karowe Mine (Lucara Diamond). His study aims to evaluate the mantle sources associated with a coarse diamond population containing exceptionally large gem-quality stones.

Margo Regier *(U of A)*
PhD with Graham Pearson

Margo is using Raman spectroscopy, and synchrotron methods in conjunction with stable and radiogenic isotopes to trace the mantle sources and deep mantle processes recorded by super-deep diamonds from Kankan (Guinea) and Juina (Brazil).

Xinchen Xia (U of A)
MSc with Thomas Stachel

Xinchen is working on characterizing diamonds and their minerals inclusions from the Chidliak kimberlites (Peregrine Diamonds) to gain an understanding of the mantle substrates beneath Baffin Island.

The Researchers

The DERTS research team is internationally recognised in a broad range of expertise ranging from diamond mineralogy and geochemistry, kimberlite petrography and volcanology, geochronology, theoretical and lab-based experimental studies, to exploration geophysics and hyperspectral techniques for mineral exploration.

Graham Pearson, FRSC
U of A

Graham is one of the world's leading scientists in diamond studies and understanding the formation of diamond-forming roots beneath continents. He is at the forefront of developing new techniques for geochemical analysis, and has pioneered new methods of dating minute geological samples.

Tom Chacko
U of A

Tom is a leading expert in stable isotope fractionations at high temperatures and their use in tracing the origin of carbonaceous phases. Has made fundamental contributions to quantifying carbon isotope fractionations between different carbon-bearing phases and has applied this to diamond-bearing mantle eclogites.

Larry Heaman, FRSC
U of A

Larry's research focuses on the application of radiogenic isotope systems to a wide variety of geological problems related to crust/ mantle evolution through time. He is a pioneer of and the world's leading exponent of high precision kimberlite geochronology and has dated over 800 kimberlites across the globe.

Maya Kopylova
UBC

Maya's research focuses on the petrology and volcanology of kimberlites, the characterization of diamonds and their mineral inclusions, as well as the petrology of mantle xenoliths. Through her research she has made significant contributions to understanding the cratonic lithosphere in Canada's North.

Robert Luth
U of A

Bob's research aims to understand the present state and evolution of the Earth's mantle by high-pressure, high-temperature experimental studies and thermodynamic modelling. Dr. Luth is one of the world's leading experts of mantle C-HO fluids, and has contributed seminal papers on mantle redox, the formation of mantle carbonates, diamonds and kimberlites.

Benoit Rivard
U of A

Benoit is a leading expert in the development of hyperspectral imaging applications in mineral exploration, with a current focus that includes diamond exploration and Canada's North. Dr. Rivard is establishing a new hyperspectral drill core scanning technology that is of major interest to the diamond industry and is unique in North America.

Kelly Russell
UBC

Kelly is the Head of the Volcanology and Petrology Lab, and co-director of the Centre for Experimental Studies of the Lithosphere. His recent work has focused on the Slave cratonic mantle (geotherm modelling) and the volcanology and petrology of Canadian kimberlite bodies (kimberlite ascent).

Thomas Stachel
U of A

Thomas is the Canada Research Chair in Diamonds and the acknowledged leading world expert on inclusions within diamonds. He established and directs the Canadian Centre for Isotopic Microanalysis, a unique-in-Canada multi-collector ion microprobe that has a major focus on the analysis of diamonds. Dr Stachel has made seminal contributions to the understanding of diamond forming processes in the Earth's mantle.

Martyn Unsworth
U of A

Martyn is a leading expert in the application of magnetotelluric data to imaging Earth structure including applied studies focused on mineral and geothermal exploration, and research in volcanology. He has used magnetotellurics to study lithospheric structure and past tectonic processes including studies of regions hosting diamondiferous kimberlites.

The Program Coordinator

Anetta Banas M.Sc., P.Geol

Anetta joined the DERTS Team as the Program Coordinator in 2017. Anetta is an alumnus of the University of Alberta where she completed her MSc thesis on the characterization of diamonds and their inclusions from the Buffalo Head Hills, Alberta and De Beers Pool Mines, South Africa.

She has over 10 years experience working as a consultant to the diamond exploration industry on projects across Canada, the USA, and Australia. Her input has been invaluable to the set up and development of the DERTS program. We are glad to have her on our team!

Upcoming Events

2018 is shaping up to be a busy year for the DERTS program participants!

2018 International Diamond School in Bressanone, Italy
http://www.internationaldiamondschool.org/

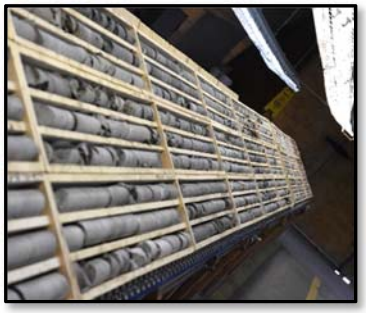
The GIA is sponsoring the 3rd International Diamond School that will be held in Bressanone, Italy in January 2018. It includes internationally acclaimed invited speakers from across industry and academia including presentations by DERTS researchers G. Pearson and T. Stachel, and DERTS collaborators: J. Armstrong (Lucara Diamond), M. Breeding (GIA), H. Grütter (Peregrine Diamonds), J.W. Harris, B. Kjarsgaard (GSC), and Dr. Wang (GIA). This School provides networking opportunities for the

DERTS Students and Associates in a small environment of mixed international graduate students from across the globe.

NEW! Lab Opening at University of Alberta to Process Diamond Bearing Samples

Late February (date to be confirmed) will see the opening of a new facility to process diamondiferous kimberlites and xenoliths, and other samples. The Sel-Frag System, donated by Isomass Calgary, uses ultra-high voltage (200 kV) to disaggregate rocks without crushing. The facility will be open to demo and pilot projects from industry and academia, more detail to follow. For additional information, please contact Graham Pearson (gdpearso@ualberta.ca).

Core Logging and Kimberlite Workshop, University of Alberta



We are planning a Core Logging and Kimberlite Workshop for Spring 2018. The workshop will be led by Bruce Kjarsgaard of the Geological Survey of Canada and will be based on core from various Canadian localities donated to the University of Alberta. All DERTS Students and Associates will be enrolled in the workshop. We plan to open the workshop up to industry and Government geoscientists.

2018 Resource Extraction and Northern Societies Workshop

We are working closely with the TERRE CREATE program to plan the 2018 Resource Extraction and Northern Societies Workshop. Based on feedback from this year's workshop we are exploring holding the workshop either in Yellowknife or Fort McMurray where students would be able to directly interact with, and visit indigenous communities.

GIS Workshop

We are planning to organize a 2-day practical GIS workshop focused on working with geological data. This workshop will expose students to publically available exploration and government geological datasets. It will include the basics of GIS data management and setting up a coherent GIS Project.

Fieldtrip 2018

We are currently finalizing details of the 2018 DERTS field trip. Any industry partners/researchers interesting in accompanying the trip should express interest to Anetta Banas (banas@ualberta.ca). We will circulate the location and dates by e-mail once they are confirmed.

Resources for Future Generations Short Course

Graham Pearson has been invited to discuss the composition and formation of the subcontinental lithospheric mantle as part of the *Geophysical and Geochemical Imaging of the Continental Upper Mantle for Mineral Systems Regional Targeting* Short Course to be offered on June 22, 2018 in Vancouver, BC. This short course aims to impart the importance of thinking holistically about

geophysical and geochemical data on regional scales in terms of enabling cost-effective targeting of large-scale mineral systems. For more information about the topic and registration, please visit: http://rfg2018.org/en/RFG/2018/Technical-Program/Workshops

Seminars

The first 2018 VKC seminar will be presented by Maya Kopylova from UBC. On February 7, 2018 Maya "Inclusions in Cullinan diamonds: Insights on an ancient hot spot and the origin of Type II diamonds". If you are in Vancouver please join us at 6pm PST UBC Robson Square Room C100. In Edmonton, please join us for the live-stream in ESB 1-23 at the University of Alberta. We are currently gauging interest in broadening the live-stream feed for the VKC lecture series. If you are interested in viewing the VKC lectures through a live-stream presentation please let us know and we will endeavor to make this happen!

Internships

We are proactively seeking internship opportunities for our students in 2018. Currently we have arranged internships with Alberta Geological Survey, DeBeers and Dominion Diamond Mines. If you would be interested in hosting an intern in 2018 or in the future please contact us for more information.

Applications

Applications are now being accepted for January and September 2019 admission. For more information, please visit our website www.uab.ca/diamonds or contact us!

Connect with us!

www.uab.ca/diamonds

Program Director: Graham Pearson gdpearso@ualberta.ca

Program Coordinator: Anetta Banas banas@ualberta.ca

Diamond Exploration and Research Training School

Publications

Bragagni A. Luguet A., Fonseca R.O.C., **Pearson D.G.,** Nowell G. M., Kjarsgaard B.A. (2017) The geological record of Base Metal Sulfides in the cratonic mantle: A microscale Os study of xenoliths from Somerset Island, Rae Craton (Canada). Geochimica Cosmochimica Acta, 216, 264-285.

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11 IKC EXTENDED ABSTRACTS

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