

Sparks from the Rockpile

The Cornell College Geology Newsletter

January 2020



Photo credit: Stan Crocker

Dear Geology Alumni,

Greetings from an icy Mount Vernon! To be honest, I am hoping for some snow this weekend!

Several exciting things have happened since our last issue of Sparks. For one thing, we had a wonderful group of alumni visit us in October for our first Annual Geology Department Reception during Homecoming. Thank you all for coming! It was a real joy to meet so many geology alumni, to hear your stories about your time at Cornell, and to share our stories with you. Our current students were pleased to meet so many potential mentors and appreciated the shared advice. If you did not make it this year, we look forward to seeing you in a coming year! Beyond the goal of connecting with our alumni, we wanted to start this Homecoming reception to be able to express our thanks, in person, to our generous donors! I took a trip out west this fall with 8 students to explore the geology of the Colorado Plateau, and this trip was largely made possible by the deeply generous gifts of our alumni. These gifts have been given with the intent of providing field and travel experiences for our students, and the students are excited to get on the road! I speak for the entire geology department when I say “Thank you!” These generous gifts are already opening doors for students!

We are exceedingly pleased to introduce you to Drew Muscente in this issue of Sparks! He comes to us most recently from a postdoc at the University of Texas, Austin, by way of Virginia Tech and Cornell University. He is currently in the midst of teaching a new GIS class, which is a great new resource for the college. We are so happy to have him here! Rhawn and I realized that we were a two-person department for seven full years, so it feels good to have department meetings back to three faculty again. In the meantime, Ben Greenstein, Drew’s predecessor in the paleontology/soft rock position, has become Dean of the School of Social and Natural Sciences at Roger Williams University in Bristol, Rhode Island. We hear that he is

keeping busy (!) and is enjoying the new challenges of being a Dean. We do miss him, and we wish him the best!

Since our last newsletter, we have made some changes to the main lecture hall in Norton, classroom 208. We had the risers and old chairs removed and replaced with moveable tables and chairs to open that room up to broader use on campus. Facilities did an excellent job of remodeling the room, including adding two large computer screens to replace the old-school projector screen. In all of our classrooms, we are now set up to plug our laptops right into the projector system, which makes transition to class time delightfully smooth.

Our majors continue to be active in research and travel with the department, as well as with the Geology Club. 7 students completed honors theses over the last three years, and more than 20 students pursued independent research over the summer with a geology faculty member (most as part of the Cornell Summer Research Institute). We also placed students in a variety of fantastic off-campus summer experiences, such as research at Woods Hole Oceanographic Institute, and interpreter at Indiana Dunes State Park.

We are always looking for more research and internship opportunities for students, so if you have the potential for having a Cornell geology student at your work place, please let us know! Alternatively, if you have particular career advice for future geologists, we'd love to hear it. Come, give us a talk about what you do, or send us a video clip telling us about your career, how you got there, and how your Cornell Geology major prepared you. Come visit us at a future Homecoming! Of course, any time you plan to be in the Mount Vernon area, please let us know—we'd love to see you!

Keep in touch,
Emily

Salutations! My name is Drew Muscente, and I was hired this last spring to fill the tenure-track position vacated by Ben Greenstein. I am grateful for this opportunity to introduce myself to the extended Geology family! And I am looking forward to getting to know you in the coming years.

I would like to tell you a little about me in the hopes that you will feel comfortable reaching out. I was raised in Allentown, New Jersey, which believe it or not, is fairly similar to Mount Vernon. Actually, Allentown is a good deal smaller (and no, it's not the town from the Billy Joel song). After leaving home, I went to Cornell University before completing my Ph.D. at Virginia Tech and postdocs at Harvard and UT Austin. It took some time, but I was eventually able to explain the difference between Cornell *College* and Cornell *University* to my friends. My first introduction to geology came as an undergraduate, when I did research in the gorges and quarries around Cornell *University*. Like Cornell *College*, it is surrounded by some terrific Devonian outcrops. I hope to give my future students similar field and research experiences.

I am living in Mount Vernon not far from campus, and in many ways, it's been like coming home for me. I am very happy to be able to walk back and forth between Norton and my house, particularly because I frequently need to check on my rescue dog, Cupid. She has certainly made herself at home too, having become a popular attraction among the students.

The block schedule certainly presents its challenges. But Emily, Rhawn, and many others at the college have been extremely supportive, and for that, I am very thankful. In the first block of the year, I taught GEO 213 Invertebrate Paleontology. My research is focused on paleoecology and fossil preservation, so this course was a great opportunity to wade into the block schedule and learn about the local geology with a field trip to the Devonian Fossil Gorge. Currently, I am teaching GEO 105 Marine Science, and working hard to recruit students for the major. Over the next

year, I will also teach GIS, Historical Geology, and Sedimentology and Stratigraphy.

I spend a month or two in the field almost every summer. This past summer, I travelled to Bavaria with colleagues and students from UT Austin to work on the Jurassic Lagerstätten of Germany. A Lagerstätte, which incidentally is a German word meaning 'storage place,' is a type of deposit with 'exceptionally preserved fossils.' How *exceptionally preserved* are they? I brought back *boxes and boxes* of fish, each containing remains of internal organs and skin. The preservation is so good that I can, in some cases, identify the last meals of the fish that lived 150 million years ago. The stomachs of these fish have been fossilized

along with their gut contents. I am now looking for students that want to help me unpack and study these amazing fossils.

If and when you find yourself in Mount Vernon, I hope you will take the opportunity to introduce yourself. I am still learning

about the history and traditions of my new *Cornell* and my new department, and I can't imagine a better resource.

Best,
Drew



Hi! Happy October to all of you! I am writing this onboard an airplane headed for Las Vegas—with a class of 8 students—to study the geology of the Colorado Plateau. I am super excited—it's been a while since I was out in that area, and I look forward to sharing the amazing geology with the students (and seeing alumna Becca Ellerbroek '09!).

I haven't taught an off-campus course for quite a few years, as my kids are pretty young, however; this opportunity came about due to a change in the Cornell College general education requirements. For the first time, this year, the college is offering a campus-wide first-year seminar, where all students take essentially the same course introducing them to the liberal arts. I have been teaching geology-based first-year seminars ever since I arrived at Cornell (15 years ago!), but, sadly, teaching a non-geology first-year seminar doesn't help us recruit majors! So, instead I'm taking students out west. (Not a bad trade-off, after all!). I did really enjoy teaching a new first-year seminar last year, though—the Scientific Secrets of Crystals and Gems. We wrapped the course up with a trip to the Field Museum to see their gem collection, and with guest lectures by alumna Nikki Ahline '15 of the Gemological Institute of America. It was really terrific to have Nikki in class, teaching us about what she does! I also had a really great group of students in that class, and most of them have come back to take an additional class in the department (including 3 who are on the trip with me now!).

In other news, I have been ramping up a new research project with some colleagues from Albion College in Michigan. In August, 2017, we traveled to Sweden for an initial look at the field—considerably different from my former field experiences in Norway (think: wet, boggy, and lots of mosquitoes!!). The rocks are terrific, however, as is the research question, so we plan to go back summer of 2020 with students! Essentially, we are working to reconstruct part of the tectonic history of the Scandinavian Caledonides, using: metamorphic petrology to understand the path the

rocks took through the earth during metamorphism, and petrochronology to understand the timing and rates of metamorphism. I have worked with students over the past two summers on both aspects of the project, taking students to the University of Iowa to use the electron microprobe and to the University of California, Santa Barbara, to use the laser-ablation mass spectrometry lab. (Santa Barbara is a lovely get-away in March!).

On a more personal note, my kids are getting so big! Franklin just turned 9 and is enjoying 3rd grade—he has become a real baseball fan and also loves playing Minecraft. Edwin is now 5 and is in Kindergarten—he is an outdoor adventurer who loves to tell stories. They still really like to come up to Norton to draw on the big chalkboards and play with the stream table (we bring the houses from our game of Life, and they have created many a devastating flood!).

Please come visit us or drop us an email update! We love to hear from you!

Cheers,
Emily



Dear Geology Alumni,

Greetings from Norton. It was wonderful to see so many of you at our first annual homecoming geology reception. It was wonderful to meet several alums from before my time at Cornell who have meant a great deal to the department - Steve and Julie LaFollette, Preston Sitterly, and Bill Rapier, to name a few. It was also a pleasure to run into students I did overlap with, like my old research student, Mike Barthelmes, and some who didn't major but who are still very much part of our geology family, like Shannon Carty and Harper Reed. Emily, Drew, and I are already looking forward to next year!

Those of you were in my classes might be interested to know that I now have a college age daughter. Anna is currently a first-year student at a small liberal arts college, and as a result, I am find myself feeling a little fatherly to all of them. Funny how that works. She is considering taking a geology class, but is a little reticent, possibly because she still feels the after-effects of the one-on-one home-schooling course in paleoclimatology I put her through in 8th grade. We will see. Harper is in the throes of her junior year in high school and has her nose to the grindstone. I admire how hard kids work at their studies these days, but it seems to require the sacrifice of the sort of childhood many from my generation experienced, and it makes me feel more than a little sad and conflicted.

Jen is still writing for Lonely Planet, albeit sporadically. She is becoming increasingly politically involved and is hosting a get-together for Mayor Pete campaign staff as I write. Chilton, our golden retriever, was diagnosed with a terminal illness and given 6 months to live. That was almost two years ago. Immediately after the diagnosis, and thinking he had only a short time left, Jen and I decided we wouldn't let his last day on Earth be a "diet day", so we started buying him gourmet wet chow and giving him lots of treats. He is now a very large dog; the vet

recently told us “It wouldn’t hurt for him to lose a *little* weight”, which is vet-speak for “he needs to lose a *lot* of weight”. We will see.

I continue my research using stalagmites to reconstruct past climates. After more than a decade working in the Australian tropics, I am beginning to wind down that project. There are a few more papers to write and then I will begin looking for something new. One area that has taken on new life is the work I began in 2004 in



Portugal.

Alyssa Borowske and I went there together and did some caving with my archaeologist colleague from Louisville University, Jonathon Haws. That started an on-again, off-again research program that finally yielded a publication a year ago. Amanda Houts, Setsen Altan-Ochir, and others worked hard on that study, and it was nice to see it finally published. I am now collaborating on stalagmite research there with colleagues from Iowa State, the Woods Hole

Oceanographic Institution (WHOI),

Union College, and the University of New Mexico. We are examining drought histories over the last 2000 years, and it’s going really well. If you’re interested, look for papers

(posted to my website) in the next year or two. I am also occasionally pulled in other areas by students, such as Tom Weiss and Kira Fish, who worked on well-preserved fossil corals, or Cali Pflieger, who has been using computer climate models with my colleague, Caroline Ummenhofer at WHOI, to examine how Australian rainfall patterns changed during large prehistoric eruptions.

I am approaching my 20th year at Cornell, and have laid down a reasonably long line of tracks in the sand. It is increasingly clear to me that the pleasure I have gained during that time has been closely tied to my work with students in the classroom, the field, and the lab. It absolutely makes my day to hear from you, so please stay in touch.

Rhawn

GEOLOGY STUDENTS



Brandon Beck '20
Omro, WI



Alex Boller '20
Inverness, IL



Jace Bricker '20
Los Angeles, CA



Morgan Coleman '20
Lubbock, TX



Zoe Kane-Preissing '20
Chicago, IL



Dati Klever '20
Elizabeth, IL



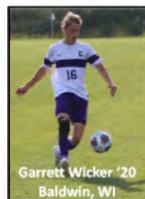
Cali Pfeifer '20
Milwaukee, WI



Joby Read '20
Burke, VA



Jillian Shaw '20
Thornton, CO



Garrett Wicker '20
Baldwin, WI



Watt Steward '20
Stillwater, MN



Gabe Amber '21
Thetford Center, VT



Gabj Hiatt '21
Iowa City, IA



Paige Klug '21
Huntingdon, PA



Chloe Martin '21
Blair, NE



Jordan Clemens '22
San Diego, CA



Julian DeBrower '22
Marion, IA



Jake Engellen '22
Centennial, CO



Shai Greenberg '22
Seattle, WA



Adam Harwood '22
Dallas, TX



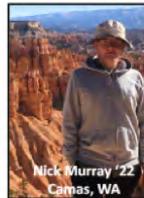
Sydney McDaniel '22
Potomac, MD



Scott Meyer '22
West Des Moines, IA



Allie Moore '22
Taos, NM



Nick Murray '22
Camas, WA



Colt Spencer '22
Laurel, MT



Sydney Swift '22
Aurora, CO



Laura Zonarich '22
Memphis, TN



Frank the Seal
Mount Vernon, IA

Brandon Beck ('20) – Geoarchaeology in Portugal

This past summer I went to Mira De Aire, Portugal for an archaeological dig at the site Lapa do Picareiro with undergraduates, graduates, and professors from the University of Louisville and University of North Carolina Wilmington. A lot of time was spent digging and searching for stone tools. Many small blades were found and were made of chert or quartz. These stone tools give insight as

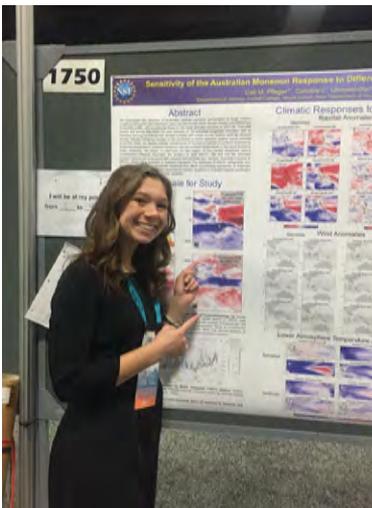


to how ancient humans advanced in technology throughout time, as techniques for making the tools improved and changed. These tools usually date back from 60,000 to 9,000 years ago. Animal bones such as fish vertebrae, pieces of rabbit skeleton, and various other small animals were also found. Although

some of these bones are from predators eating prey, some have been found nearby charcoal. This indicates that there was a fireplace there and that the bones found nearby were food that was being cooked by early humans.

Cali Pflieger ('20) – Climate Modeling at Woods Hole Oceanographic Institute

I studied paleoclimate reconstruction as a Guest Student at Woods Hole Oceanographic Institution (WHOI) in Woods Hole, MA for the past two summers. During my time at WHOI, I studied the Australian rainfall response to large volcanic eruptions over the last millennium. While at WHOI, I learned coding languages specific to climate modeling and learned new analytical techniques. My research has allowed me to learn how to use analytical instruments to gather paleoclimate rainfall data from stalagmites Prof. Rhawn Denniston previously collected



from Australia. With the synergy between climate modeling on the computer and using recorded data from stalagmites, I have been able to investigate the rainfall response to the AD 1257 Samalas eruption. This eruption is of particular interest because it was one of the largest recorded historical volcanic eruptions and created changes in climate around the world following the eruption. I also have been

looking for signals of large volcanic eruptions in the stalagmites, such as large sulfur spikes, which will help her to better understand the anomalies in the recorded rainfall signals. At WHOI, I was able to learn much more than just my specific research topic as I attended many lectures, reading groups, networked with different scientists, presented my work at lab meetings, and talked plenty of science with peers. I presented my research at the 2018 AGU Fall meeting in Washington D.C. and will be presenting my most recent research at the 2020 AMS Annual Meeting in Boston.

Chloe Martin- Climate Research in Australia and the University of New Mexico

I am a junior geology and Spanish double major. Over the last two summers I have been working with Rhawn doing research on past cave flooding and climate variability in Australia. Cave flooding in north-central Australia is caused by extreme rainfall from the summer monsoon and tropical cyclones. Cave flooding events are visibly recorded in stalagmites by mud layers which are deposited from flood water. When flood water recedes from the cave, the stalagmites continue growing and mud layers are encapsulated within the structure. Using 19 stalagmites, we have created a reconstruction of cave flooding that spans the last 4,000 years and allows us to



study variability of monsoon and tropical cyclone rainfall in relation to varying climate conditions during this time. My work over the last year and a half has included counting and recording mud layers in stalagmites, doing lab work measuring U-Th concentrations of stalagmites to

create age models, traveling to Australia to collect modern rainwater and cave flood monitoring data from cave KNI-51, and researching the impacts of monsoon and tropical cyclones in northern Australia and the climate mechanisms which drive the variability of these systems.

Daniel Klever – Metamorphic Petrology

My favorite aspect of the geology major is its unique perspective and world-view, which I can apply to classes



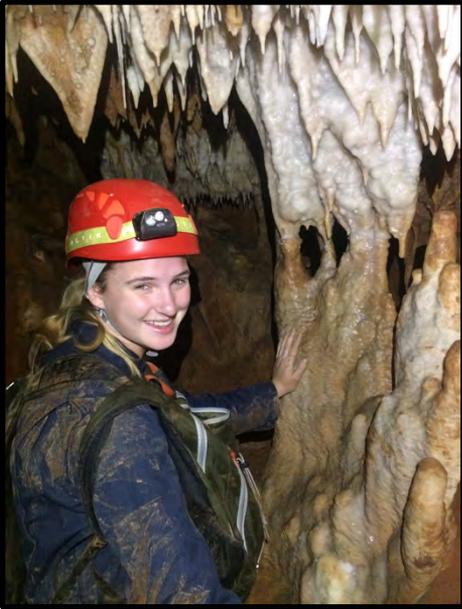
outside of my major, as well as to my daily life. The department faculty are encouraging and generous in providing field experiences, research experiences, and support for all geology students. My geology classes have given me hands-on experience with the geology of various localities within Iowa, Wisconsin, Missouri, and New Zealand, and I have benefited from two very different research

opportunities. My first research experience, the summer after my first year, involved sample preparation on stalagmites with Professor Rhawn Denniston, with the goal of analyzing the past climate of Nepal.

Over the last two summers, I have participated in the Cornell Summer Research Institute with Professor Emily Walsh, studying the tectonic history of the Scandinavian Caledonides through analysis of metamorphic rocks. My specific work is thermobarometry: using the chemistry of minerals within the rocks to understand the mineral reactions that happened as the rocks changed pressure and temperature during tectonic movement through the Earth. Thermobarometry allows us to reconstruct the pressure and temperature history of the rock in order to draw conclusions about the tectonic formation of the region. This past year, Professor Walsh and I received an R.J. McElroy Student/Faculty Research grant to expand the scope of this thermobarometry research.

Gabi Hiatt – Climate Research in Portugal

Hi! My name is Gabi, and I am a junior major and President of Geology Club this year. Geology holds a special place in my heart because I've loved it since before I could remember; if you can imagine a little five year old playing in a pile of rocks - that was me! There's something euphoric about understanding the world around you and the processes that have molded it to what it is today. This department has so many unique opportunities to engage in traveling and research and I'm so grateful to have been a

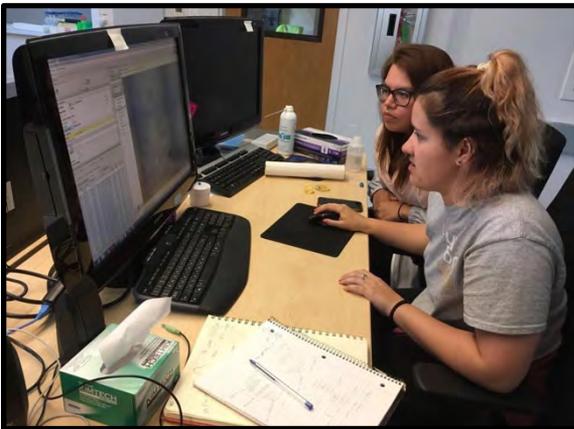


part of it! Fall of 2018 and summer of 2019 I performed climate research with Professor Rhawn Denniston in Portugal to monitor cave environments in relation to the North Atlantic Ocean Oscillation. Additionally, I've worked at the Iowa Geological Survey the summers of 2018 and 2019 as a well-ship specialist. My favorite memory with

this department is going to New Zealand, more specifically watching the stars at our field station after long days of mapping.

Jill Shew – Metamorphic Petrology

Over the last two years, I have worked with Professor Emily Walsh performing research on ultrahigh-pressure metamorphic rocks from the Swedish Scandinavian Caledonides. We first analyzed samples using the scanning electron microscope (SEM) at the University of Iowa to locate and image zircons in a series of thin sections. We then worked to crush the rock samples and separate out the individual zircon grains, which we picked by hand under a stereozoom microscope and mounted in epoxy for age dating. Another student and I traveled to the University of California, Santa Barbara, with Professor Walsh to date the zircons using their laser ablation split stream (LASS) system. This system can measure radiometric isotopes for age calculation, as well as trace elements to help correlate the age with the pressure–temperature conditions of the rock.



Unfortunately, our zircon age data are not entirely clear due to the very thin nature of the metamorphic rims we targeted. So, recently, we have used the SEM to locate and image both

monazite and titanite to date via LASS to help determine the chronology of these samples.

Joseph B. Read



I am currently working with Professor Walsh to test whether rocks from the Seve Nappes in Sweden are ultrahigh-pressure rocks. I am using Raman spectroscopy at the University of Iowa to calculate the pressure on quartz inclusions in garnet, and I plan to use Ti ratios of the same quartz grains to estimate temperature at peak pressure. This method avoids the problems of conventional thermobarometry by measuring quartz pressure–temperature conditions at the

time of quartz entrapment within the garnet grains. The peak pressure estimates are calculated from remnant strain in quartz measured via Raman peak shifts.

Morgan Casarez – Metamorphic Petrology

Over the past two summers, I have been conducting research with Professor Emily Walsh. This cutting-edge geological research has entailed examining thin sections of rock samples collected from the Seve Nappe Complex in the Swedish Scandinavian Caledonides. The Seve Nappe complex underlies a large part of the Swedish Caledonides and forms a fairly continuous north–south unit of rocks. However, this unit of rocks contains two distinct areas of ultrahigh-pressure metamorphism with a more than 20-million-year age difference. In order to determine whether



the two metamorphic events were related through time, another student and I used laser ablation split stream (LASS) analysis at the University of California, Santa Barbara, to date

zircons from rocks within and between the two metamorphic areas. This technique is particularly useful in dating small metamorphic rims on the zircons and provides trace element data for each spot to help correlate the age with the pressure–temperature conditions. Because the datable zircon rims were so small, we plan to date other minerals, including monazite and titanite, on LASS in the future.

Paige Klug – Paleoclimate Research

For my research over the summer, I went to Australia to collect data from data monitors in three caves with another student and my advisor, Rhawn Denniston. These caves have been monitored for years in order to look at the pressure, temperature and flooding trends to see how well they represent what is going on above the cave as well as how well the stalagmites from those caves can be used as proxies to reconstruct past climates. Stalagmites are good proxies for reconstructing past climates because they can be relatively easy to date and give information about rainfall and temperature can be looked at due to the chemistry that is trapped in the calcite/aragonite of the stalagmite. Stalagmites have already been collected from one of the caves and the mud layers in the stalagmites are being used to represent cave flooding events. Two summers ago, I counted and measured mud layers. Caves are more likely to flood more often in Australia during La Nina years. The goal of the research is to see El Nino/La Nina years from the past,



based on the flooding due to hurricanes over Australia, and perhaps use this information to figure out

if/how hurricanes are different from the past. I spent the rest of the summer analyzing flooding and temperature data and writing a paper about our findings.

Matt Stivland – Paleontology Research in New Mexico

I've been working as a research intern this fall at the Museum of Paleontology at Ghost Ranch in New Mexico. I've been studying the taxonomy of phytosaurs and will soon present a poster at the New Mexico Academy of Science regarding sexual dimorphism in these 230 million year old dinosaur relatives. I hope to use this experience to continue to pursue vertebrate paleontology into graduate school!

I'm comparing and measuring skulls from a certain population of preserved phytosaurs in order to determine if two separate species are actually the "male" and "female" versions of a single species. Certain features such as the shape and size of the squamosal bone seem to vary much more than at first believed, and it's possible there's an unidentified third species that hasn't yet been discovered. My research may strengthen or weaken the existing "male" and "female" hypothesis.



Zoe Kane-Preissing – Metamorphic Petrology

During the summer of 2018, I participated in the Cornell College Summer Research Institute (CSRI). I worked with Professor Emily Walsh and four other geology students to analyze metamorphic rocks from the Caledonide mountains in Sweden. The most interesting rocks from the 435-400 million year old mountain belt are high- to ultrahigh-pressure rocks. Ultrahigh pressures are experienced by rocks when they are subducted to mantle depths $> \sim 90$ km. These rocks are then exhumed back to



the surface by tectonic forces, where they can be collected for study. Mineral structures in the rocks go through changes in this process, and new minerals form from the

intense pressures. Ultrahigh-pressure rocks are important in understanding the rate of subduction and exhumation, as well as the overall tectonic forces that caused the mountain range to form. Our goal over the summer was to characterize thin section samples by examining their minerals with optical microscopy and scanning electron microscopy. In particular, I analyzed which rocks would be most appropriate for future dating using radioactive decay of U to Pb in zircon, monazite, or titanite. The ultimate goal of the project is to date these rocks and link their ages to pressure and temperature changes in order to understand the tectonic history of the Swedish Caledonides.



We would like to close with a special thanks to all those alumni who have donated so generously with time, money, internship ideas, job opportunities, and advice. You have made an enormous impact on our students, and everyone here in Norton is very grateful.

Emily, Drew, and Rhawn