MacGeology

Spring 2017 Newsletter

Students in History and Evolution of Earth crossing the Cannon River to get to the St. Peter Sandstone (April 2017).

MACALESTER

GEOCLUB

Greetings From the Chair

Hello from Mac Geology! We hope that our Spring 2017 Newsletter finds you all happy and healthy! We are wrapping up another exciting year here in the Geology Department, and we wanted to take the opportunity to fill you all in on some happenings and geology highlights. For the next few years we will target the spring (and the end of the semester) for the production of an annual newsletter.

First things first, I (Ray) am back at it as Chair of the Geology Department. This year marks my tenth year as department chair—always an adventure. I want to take this opportunity to thank my colleague Kelly MacGregor for her previous five years of service as chair. She did a great job, and she is now serving as "Director of the Olin-Rice Science Center." Her charge now is to help the occupants of OLRI find ways to live in a building that is far too small for the number of faculty and students that reside within. Challenging times in Olin-Rice.

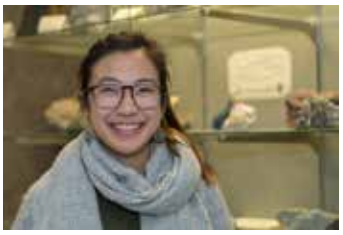
Several alumni have visited over the past few months. This past fall Josh Miller ('00) stopped by to visit with the department during the fall poster session (he was one of a few distinguished alumni brought in for this campus-wide event). Josh is now a professor at the University of Cincinnati, where he teaches a variety of courses and conducts research related to conservation paleobiology. In the spring semester we brought several alumni to campus as part of Senior Seminar. The goal was to introduce our graduating seniors to the variety of potential career paths that await them. Genevive Mathers ('05), a geologist with British Petroleum in Houston, visited with our current students and introduced them to the life and adventures of a petroleum geologist. Curt Hudak ('79), a local alum who has always been an advocate for the department, introduced our graduating seniors to his career path in environmental engineering and consulting. So too did Justin Enwall ('06), who is an environmental consultant here in the Twin Cities with Terracon Consultants. Tom Tobin ('08), who is currently in his second year as a professor at the University of Alabama, described his path to an academic career to our crew. Dhiren Patel ('06) flew in from Nevada to describe his life as a geologist for Newmont in the mining industry. Our last official Senior Seminar guest was Alex McKiernan ('02), who runs an organic farm operation in Nebraska with Chloe Diegel ('03), who is also a geology alum. Other alums who stopped by for a quick visit with the department include Hali Englert ('15), Bolton Howes ('14), and Brady Foreman ('04).

And speaking of alumni visits, Karl, Alan, and I had a great time visiting with 17 alums at the annual Geological Society of America meeting in Denver this past October. At the suggestion of Patrick Sullivan ('16), who is now living in Denver and working at the Denver Museum of Nature and Science, we booked a room at City O' City in downtown Denver (a great venue, thanks Patrick!). A second alumni event was hosted by Kelly at the annual AGU meeting this past January in San Francisco (12 attendees). Thanks to all who attended our get-togethers at GSA and AGU!

And last, but certainly not least, some info on our graduating class. In 2016, 23 students graduated with geology degrees from Macalester. This was the largest graduating class that Karl can remember, and he has been here since before the Anthropocene. This year 16 students graduated with geology degrees!

Graduating seniors on the night of capstone and thesis presentations (back row: Emily Gross, Meghan Klapper, Eric Kittilsby, Eamon McDevitt, Brooke Hunter, Jamie Goodin, Ted Toegel, Glen Hartford; front row: Anik Regan, Sierra Swenson, Jenny Grischuk, Olivia Stern, Hoai-Nam Bui, Grady Johnson, Grace Guenthner, Connor Vinson).

Senior Thesis and Capstone Titles (2017)



Hoai-Nam Bui

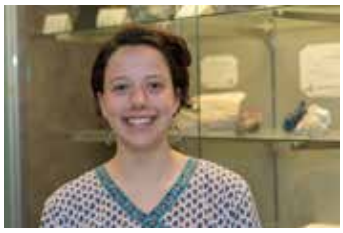
Pathological Vertebrae in Sauropod Dinosaurs from the Late Cretaceous of Madagascar

Grady Johnson

Geochronologic and Hafnium Isotopic Constraints on the Evolution of the Salinian Magmatic Arc

Connor Vinson

Identifying Mineralogic Changes in Glacier Lake Sediments using X-Ray Diffraction



Jennifer Grischuk

Detrital Zircon Geochronology of the Condrey Mountain Schist Reveals a ~30 Ma Record of Subduction-Related Underplating, California and Oregon

Anik Regan

Comparative Taphonomy of Molluscan Death Assemblages from the Gulf of Mexico

Emily Gross

Preservation of a Subduction Related Geothermal Gradient in the Schist of Sierra de Salinas, Central Coast Ranges California

Olivia Stern

Rocks and Pots: Mineralogy of Crystalline Ceramic Glazes

Grace Guenthner

The Agricultural Importance of Glacially Derived Soils as seen at Common Harvest Farm, Polk County, Wisconsin

Glen Hartford

Search for the Lost Arc: A U-Pb Zircon Geochronologic and Isotopic Study of the Las Tablas Unit, Franciscan Complex of Central California

Eamon McDevitt

Sand: the Duct Tape of the Jersey Shore

Sierra Swenson

Taphonomy of Late Cretaceous (Campanian) Coprolites of the Two Medicine Formation of Northwestern Montana

Jamie Goodin

Unusual Igloos and Live-Live Host-Parasite Interactions in the Upper Cretaceous Judith River Formation, Montana

Ted Toegel

Phosphorite Nodules of the Permian Phosphoria Formation, Southeast Idaho

Eric Kittilsby

Geobotanical Identification and Characterization of Trimlines on Juneau Icefield Nunataks

Brooke Hunter

Quantifying Gaping Behavior of the Freshwater River Mussels in Response to Increased Suspended Sediment Concentrations in Flume Experiments

Meghan Klapper

Thermobarometry of the Condrey Mountain Shear Zone

Recent Student Awards and Scholarships

Glen Hartford (’17)	AIPG Scholarship (American Institute of Professional Geologists), George C. Marshall Award (University of Minnesota ROTC Program)
Ted Toegel (’17)	Oberg Family Scholarship (an endowed scholarship created by geology alum Rollie Oberg ’60)
Hoai-Nam Bui (’17)	Hugh S. Alexander Endowed Prize (Geology Department Award)
Sierra Swenson (’17)	Henry Lepp Award (Geology Department Award)
Diala Aboud (’20)	NASA Scholarship
Alora Cruz (’20)	NASA Scholarship

…and some award-winning alums!

Two of our alums cleaned up at the recent awards banquet/end-of-year dinner hosted by the Department of Earth and Environmental Sciences–Fresno State University. Awardees Jessie Shields (’15, left) and Magaly Perez (’14, right) hold their many accolades, with Mara Brady (’05), a professor in the department, smiling in the middle. Go Jessie! Go Magaly! Go Mara!

Updates From Faculty

Ray

Kristi and I are back from our sabbaticals (we were on leave during the 2015-2016 academic year). We had some great adventures, not the least of which was our participation in 19th Biennial meeting of the Palaeontological Society of Southern Africa, which took place in Stellenbosch, South Africa, this past June (2016). Stellenbosch is a beautiful little town in the heart of South Africa's wine country, and we hope to return in the near future (we made some great research connections while there). Another highlight of my sabbatical was the opportunity to work with Mac Geology alum Colin Robins ('01) on the ancient soils of Madagascar (this adventure opened my sabbatical back in the summer of 2015). Colin is now a professor at Claremont McKenna College out in California. Working together on the ancient soils of the Maevarano Formation, we hope to discover some of the Cretaceous climatic history of the Great Red Island. And congratulations Colin on the new baby boy!

On the research front, 2016–2017 was a good year. In 2016 my paper on the stratigraphy of the Judith River Formation out in Montana came out in the Journal of Geology. In this paper I propose correlations that extend well up into the plains of southern Canada, and just this past month (April) I had a chance to travel to Alberta (and Dinosaur Provincial Park) to test these correlations – they work! Ken Nelson ('09) was a co-author on this paper – his senior thesis focused on the clay mineralogy of the Judith River Formation. I published a second paper in early 2017 that focused on the concept of "isotaphonomy" in the Judith River record. This paper, which was published in Paleobiology, included two Mac Geo student co-authors: Magaly Perez ('14), who is presently working on her master's thesis at Cal State Fresno with Mara Brady ['05]), and Anik Regan ('17), who graduated just this spring.

With regard to my day job of teaching folks about sedimentary rocks and fossils, I was happy to return from sabbatical in the fall to teach Paleobiology to ten students (the smallest class in many years – it was great fun!). We traveled as always to Rockford Quarry in Iowa to collect way too many brachiopods, and we of course ended the semester with the one-and-only Phylum Feast (as part of the Rockford Symposium)! In the spring I taught Sedimentology and Stratigraphy and History and Evolution of Earth, along with Senior Seminar. It was a busy spring, but the weather was great for field-tripping, and we did manage to combine the sed-strat and structure trips into one grand adventure to Baraboo!

And lastly, I did find the time to revise my web page – updates on my activities, teaching, and research can be found right here: rogerslab.weebly.com

Ray and Colin taking a break from paleosol work in Ankarafantsika National Park, Madagascar.

Alan

The past year was a real momentum builder for my research group. Team Chapman grew from three to twelve and began research on two federally funded grants in the last year. The first project is funded through the National Science Foundation to study garnet-clinopyroxenite xenoliths from central Arizona. The second, made possible by the Keck Geology Consortium, is aimed at investigating the tectonic assembly of the Salinian block of central coastal California. For more details on the exciting work being done by my research group, please visit my newly redesigned webpage: alandchapman.weebly.com.

In January, 2016, we began work on the first project, which aims to

Team Chapman in the Lab.

improve our understanding of how tracts of lower crust and upper mantle at the edges of continents respond to collisions with oceanic plateaus. Work on this project began in central Arizona with myself, post-baccalaureate researcher Jessie Shields ('15), Brooke Hunter ('17), and colleague Jeff Thole hunting for chunks of lower crust and mantle that had been blasted up from 50-100 km depths to the surface by ca. 30 million year old (now dead) volcanoes. After collecting over 200 samples and dating a number of them via U-Pb zircon and Sm-Nd plus Lu-Hf garnet-whole rock methods, we now have a pile of data that we will be working up for publication in the coming year.

The purpose of the Keck project was to constrain the processes that led to the construction of a ca. 100 million year old (now dead) continental arc, exposed over a wide range of paleodepths (~10-35 km), in central California. Seven students (three from Macalester), myself, and co-PI Sarah Brownlee from Wayne State University descended on central California in June, 2016 to collect samples for dating via the U-Pb zircon method and for structural work. This project involved ten days of fieldwork, two weeks of sample preparation at Macalester, and three days of analyses – half at the University of Minnesota and the other half at the University of Arizona. Macalester students Emily Gross and Grady Johnson (both '17) and four Keck students from other institutions wrote up their exciting results for senior theses and capstones.

I taught one new course ("Structural Geology" – spring, 2016), a first-year course version of "Dynamic Earth and Global Change" (my first – fall, 2016), and the upper level elective course "Tectonics" for the second time. As a firm believer that geoscientific knowledge begins (or is at least strongly reinforced) in the field, I led countless fieldtrips to view exciting rocks in Minnesota, Wisconsin, and Michigan in 2016. To be fair, students are in charge of leading discussions at individual fieldtrip stops (I believe that this structure makes for more dynamic fieldtrips and gives students a sense of ownership), so these trips are actually student-led and Alan-chauffeured.

While it's taken immense amounts of time and effort to get my teaching and research programs established and building momentum, I am continually amazed at the diligence and enthusiasm that Macalester students show in the classroom, in the field, and in the lab.

Team Chapman in the Field.

Getting energy back from students and channeling it back into teaching and research is a tremendous gift that keeps giving. The closest I can come to a geology-related analogy is the circular pattern of convection currents in the mantle.

Kristi

Sabbatical came to an abrupt end for me back in August, when I hopped on a flight the night before my very first course meeting for a new crop of Biology first years. This fun new course was titled Human Functional Anatomy (and it included a yoga twist). Yep – you heard right. Yoga. During my sabbatical last year I worked with Ray on the Paleobiology paper, published a Science paper on a tiny baby sauropod dinosaur from Madagascar (which included Mac biology alum Megan Whitney), and completed a 230 RYT Yoga Teacher training program.

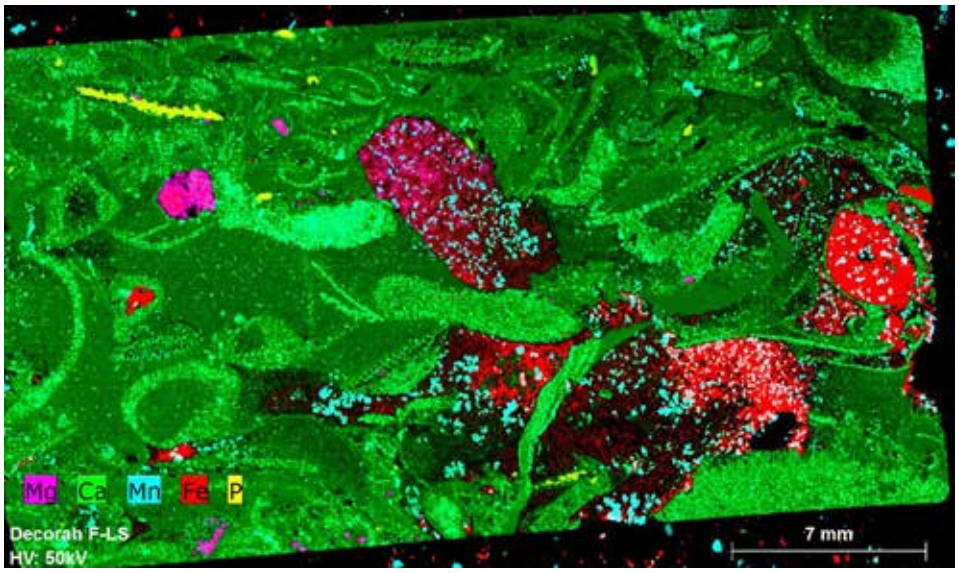
I continue to plug away at Madagascar sauropod fossils, and have been working with Zoe Kulik ('16) on finishing up a manuscript on bone histology and growth rates in Rapetosaurus. Zoe and I presented at the annual SVP meeting back in October on this collaborative work. I've also been neck deep in sauropod vertebrae – especially those that are disease-ridden and infected. Back in 2015 Rachel Karlov ('14) took a first pass at figuring out what the heck was causing these strange pathological features in a collection of juvenile sauropod bones from Madagascar. Hoai-Nam Bui ('17) built upon Rachel's work, and recently completed her senior honors' thesis that provides a tentative 'diagnosis' for these poor dinos. Hoai-Nam branched out of the geo mold and hit up the annual Society of Integrative Comparative Biology meeting in New Orleans in January, where we were hoping that some biologists would have some great ideas about the causes of the weird anatomical features of sauropods. Nobody really had any great insights, but the trip was worth it – Ray and I discovered Sazerac (& beignets) and we all got to hang out with Krista Jankowski ('07), who is wrapping up her PhD at Tulane University.

I'm still teaching Dinosaurs for the Geology Department, and this year the big project EXTRAVANGZA was extra special. It occurred on the one-year anniversary of Prince's demise, so the event was purple themed (picture below), and even included a project that rewrote the entire Purple Rain album with a Mongolian Dinosaur theme. The entire 48-person class sang along for the chorus. I'm looking forward to 2018-2019, when I'll be teaching more for Geology and bringing back Vertebrate Paleobiology, which I taught only once, back in 2002-2003. Can't wait to be back with the GEO people!

Kristi ready for the Dino Extravaganza, Ray (and Jeff) just back from the field.

Jeff

Wow, does time fly (and especially when you are having fun). I'm now well into my 20th year here in the department. Some of you may remember me having a couple of small children around the department. Well now, after some nurturing and ontogeny, my oldest (Emerald) just finished her second year here at Mac. My youngest and tallest (Charlie), will be joining us next year as well.



Bruker M4 Tornado element map, with what looks to be a graptolite fragment in the top left corner! Students in this spring's History and Evolution of Earth class had the opportunity to map some of their discoveries on the field trip!

I've been fortunate to be part of this dynamic department and interact with our great students on many levels. My favorite events though have to be our field trips. Northern Minnesota (Soudan Mine and plummeting to our deaths, I mean destination, nearly a half mile underground), the volcanic and intrusive rocks of the north shore of Lake Superior, the Baraboo Syncline in Wisconsin, the fossil-rich sediments and karst features of southeast Minnesota, and the spectacular variety of rocks and fossils we see in north central Montana each summer. In the summer of 2015, I was also lucky enough to participate in a field course in Iceland with colleagues from the University of St. Thomas (Iceland should be on everyone's bucket list).

My fun also includes running and maintaining our growing arsenal of analytical instrumentation. The Geology Department recently installed a micro-XRF unit - a Bruker M4 Tornado. The M4 Tornado uses a precisely focused X-ray beam (~20 µm) to fluoresce elements within a sample resulting in high spatial resolution and low detection limits (10s of ppm) using the integrated silicon drift detector. Samples can be analyzed under vacuum or atmospheric pressures and the large, high precision stage allows a variety of sample types to be analyzed including solids, powders, and even liquids. No conductive coatings need be applied and the analysis is totally nondestructive. This technique can be applied to many different analytical problems including semi-quantitative elemental mapping of entire thin sections and sediment cores (even wet), measuring elemental gradients in minerals, forensic and provenance investigations of paintings, ceramics, and archaeological artifacts, and measuring elemental distributions in biological specimens such as insects, leaves, and feathers.

Meet the Bruker M4 Tornado, ready for business on the Keck lab bench.

Kelly

2016-17 has been an exciting year! During summer 2016 I did collaborative research with two awesome students – Brooke Hunter ’17 (Geology major, Applied Math and Statistics minor) and Lea Davidson ’18 (Biology major, Geology minor) on a research project with Dan Hornbach (Environmental Studies & Biology). Our three-year project, funded through the Legislative-Citizen Commission on Minnesota Resources, is examining the effects of river sediment on native freshwater mussels. We spent the summer at the University of Minnesota’s St. Anthony Falls Laboratory working with our collaborator Dr. Jessica Kozarek conducting flume experiments with live mussels!!! In the Outdoor StreamLab we looked at interactions between bed sediment transport and mussel movement, and in the indoor flume we quantified mussel gaping behavior in response to increasing suspended sediment concentrations. As part of the project we got to ‘flex our mussels’ at the DNR booth at the Minnesota State Fair! Summer 2017 will take our project back to the field on the Snake and Cottonwood Rivers in Minnesota.

Kelly and Brooke Hunter (’17) flexing their muscles in front of mussels.

In May 2016 I had the opportunity to spend two weeks with Macalester faculty, staff and students in Copenhagen on an International Seminar focused on urban sustainability. Seeing more bike traffic than cars, as well as renewable energy production on a city-wide scale, was amazing! I was also lucky enough to be a part of the Macalester Alumni trip in August to Southeast Alaska. Amazing glaciers, incredible wildlife including whales and bears, and a polar plunge made my time with alumni very special!

This year I got to teach fantastic students in Geomorphology in the Fall. As always I had a fun mix of sophomores, juniors, and seniors in the group. Wading around Minnehaha Creek at bankfull flows was a highlight! For the first time in 8 years I taught Environmental Geology this spring! The mix of Geography, Environmental Studies, and Geology students made discussions really lively, particularly on topics such as energy and climate policy in the US.

Brooke Hunter (’17) and Lea Davidson ’18 (Biology major, Geology minor) explaining their work on sediment and mussels at the State Fair.

This past year was my second year as the Director of the college’s Howard Hughes Medical Institute grant supporting ‘big data’ teaching and learning on campus, which included summer research stipends for more than 25 students each year. In addition, I’ve taken on a new position as the Director of the Olin-Rice Science Center, which has been an exciting challenge. As the number of STEM majors has climbed over the past 5-10 years, we are outgrowing our building space and in need of additional faculty and staff support. The departments are working together to come up with creative solutions as we move into the future!

Karl

During 2016-17 I taught Dynamic Earth and Global Change, Mineralogy, Exploring the Solar System, and Petrology. Believe it or not, the petrology students still haven’t figured out why the intermediate halide compositions are so unstable, so we’ll keep doing the experiment a bit longer! The past year also ushered in a number of new directions for me. Working with another geologist and long-time collaborator (Ed Nuhfer) along with a mathematician and two psychologists, I co-authored two papers on science literacy and a classically held view of self-assessment. We now have compelling evidence that self-assessment skills really do improve during college, so a huge thanks to all of you for helping shape my thinking about self-assessment as you completed knowledge surveys over the past few decades. I recently returned from Iowa State University where I presented the results of this work and visited with Maddie Mette (’10) who is in the final stages of finishing her doctorate. Work with Alec Shub (’16) on the chemistry of stone tools from northern Tanzania resulted in a GSA presentation and helped feed my passion for Tanzania. The 2015 Keck project on Belize coral reefs (co-directed with L. Greer and H. Lescinsky) finally made it into two publications and a number of conference presentations during 2016-17. Kelly MacGregor and I co-supervised Jinqiao Lin’s (’16) honors project that used a novel approach (geochemical mass balance modeling) to understand changes in the bedrock sources of glacial lake sediments as a function of climate; Jinqiao presented her research at the Fall 2016 AGU meeting. Sarah Baumann’s (’16) honors project on pathways into the geosciences not only resulted in a well-received 2016 GSA presentation, but also played a significant role in helping to prepare me to write a successful proposal to the National Science Foundation for support of the Keck Geology Consortium. Cam Davidson (Carleton) and I will serve as co-Directors of the Keck Consortium for the next four years, and we look forward to helping develop new programs to meet the changing needs of the Consortium. Work with Olivia Stern (’17) on her capstone project on the phase relations of ceramic glazes pushed me to explore new areas at the intersection of art and petrology. Finally, I just returned from the Annual Keck Geology Symposium where Emily Gross (’17), Grady Johnson (’17), and Anik Regan (’17) showcased their research results. While there, I also had a chance to catch up with Zeb Page (’99) who is geology faculty at Oberlin. In my spare time, I have been working on my underwater photography (Mexico, Tanzania, and Philippines) and I started teaching SCUBA classes for a local dive shop. Diving (with Jose Cuervo) anyone?

Welcome Anna Lindquist

Anna Lindquist will be joining the department for the 2017-2018 academic year as a Visiting Assistant Professor. Her courses include

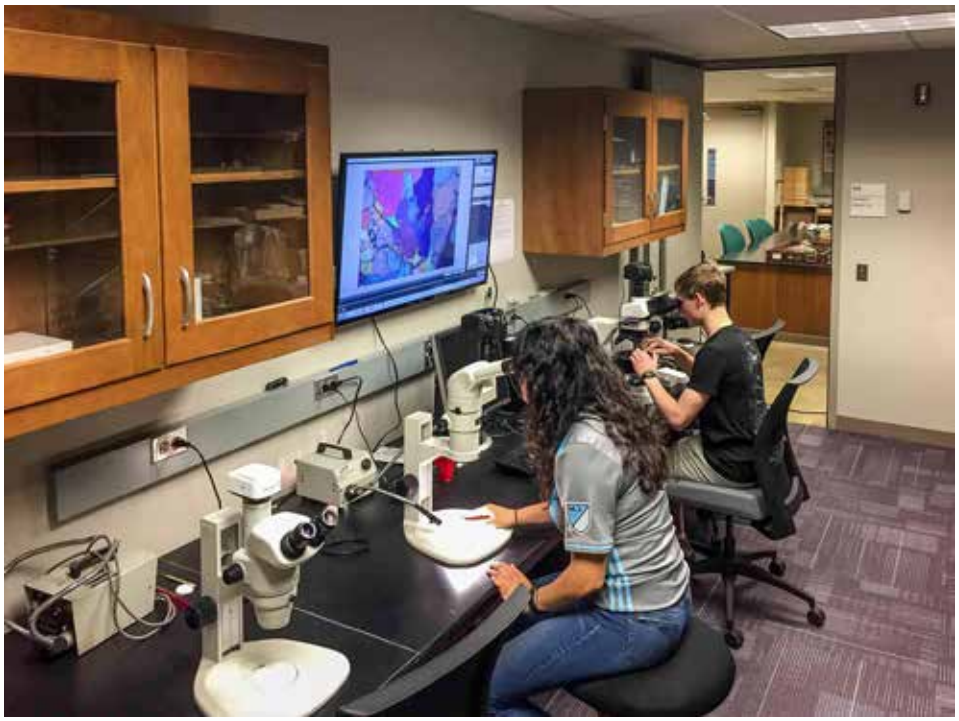
Anna Lindquist.

Mineralogy and Soils: Science and Sustainability. Anna earned bachelor's degrees in geology and physics from Gustavus Adolphus College in 2008 and a Ph.D. in geophysics from the University of Minnesota in 2013. Her research interests focus on sediment and mineral magnetism.

Scenes from the Dept

We are happy to introduce our new imaging lab in the space between OLRI 175 (Geomorphology, Hydrology, Sedimentology and Stratigraphy, Paleobiology) and OLRI 179 (Mineralogy, Petrology, Structure, Tectonics). We now have four great microscopes with new cameras and stages so that students can study and photograph minerals, rocks, and fossils.

With the space pressures in Olin-Rice, the college is repurposing our little student lounge and study room so that colleagues in other departments can have faculty office space. We in geology certainly understand the need, but we will miss this communal space. The good news is that we are finally recycling the smelly refrigerator (after the CDC inspects it for biohazards).



Didi Aboud ('20) and Michael Murphy ('19) working in our new imaging lab.

Didi Aboud and Michael Murphy lamenting the loss of our student lounge. They will both earn acting credits for this heart-rending shot.

News from Alumni

Erik Hankin, 2005
Calling all Geology Alumni!

I am working with Ray and co. to start up two exciting opportunities for Mac geology alumni to help out current students and recent grads: a career pathways corner and a fund to provide travel assistance to geology students.

Career Pathways
It is not always clear to geoscience students what careers are out there waiting for them. Sure, there's grad school, internships, and non-profits galore, but where do those opportunities lead and what less-traveled routes are available? We would like to start highlighting geology alumni, either on the Mac Geology Facebook page or website, noting where they work, how they got there, any fun advice they have, and contact information. This will be a valuable resource for students and recent grads and help older alums stay in touch!

Student Research Travel Fund
Summer research projects and presentations at scientific meetings are incredibly valuable learning experiences and often are prerequisites for graduate school in the geosciences. The problem is that there just is not enough funding! Since we are all good alumni, we already give to Mac (hint: make your gift if you haven't already), but it would be awesome if we could direct our donations to the Geology Department to help students do field work and present their research. There may be an opportunity to do this, but we need support to make it happen.

These ideas, while exciting, are early in the works, so your input and guidance are much needed and appreciated! If interested in helping out with either of these opportunities, please email me at erikhankin@gmail.com.

We would like to know more about you

We love hearing from our Geology alumni. Complete this very short form to tell us what you've been up to and how you'd like to help the Geology department. Tell us more about you

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Have you tried the new MacDirect yet? It's a great way to find Macalester's Geology alumni. Go to Search Alumni, click More Options, select major Geology, and search away. Use MacDirect

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Spring 2017 newsletter created and designed by Ray and Karl.

Karl And Two Students With A Nose For Rocks

Karl walking Hatcher and Otzi through the process of describing rocks.

Hatcher (left) and Ötzi (right) geared up and ready to get to work!