Greetings from the Geology Department! We hope this newsletter finds you all well. As I write this on a warm fall afternoon with autumn colors ablaze, I review my calendar of all the notable events that transpired in the Geology Department over the past year. I’ll note a few in the lines below, and in the pages that follow, you’ll read about the significant scholarly accomplishments of our students and faculty, field research trips to far away places, and news of our alumni who set examples for all of us through their accomplishments and generosity.

This past June, we celebrated the graduation of 5 seniors; four of these either went on to graduate school or found employment in the geosciences. As we start the current academic year, the Geology Department is home to 37 majors, which is close to our all-time high, slightly more than Physics, and tied with Chemistry. We are especially pleased with the high percentage of our majors who are female (49%), which is considerably higher than the national average. According to the American Geological Institute (AGI), the percentage of females majoring in the geosciences nationally is under 40% and falling at an alarming rate (AGI Geoscience Currents, v. 69, 2013). The AGI suggests that this trend may reflect a gender bias in the effect that the booming energy sector is having on drawing new majors to the geosciences. That we are not seeing any decline in the percentage of our majors who are female as our major numbers stand at near record levels is encouraging.

Some of our majors, both male and female, do seek careers in the energy sector, but many have their sights set on careers in other fields, including environmental consulting, urban planning, secondary school teaching, and research. This broad range of interests within the geosciences may be why we are bucking the national trend of declining female majors.

Early last winter, we received the very good news that Holli Frey was granted tenure at the college. While this was not the least bit surprising given Holli’s exceptional record of teaching, research, and service to the department and college, it was, nonetheless, a relief to have the months-long review completed! We are all looking forward to many more years of Holli’s myriad contributions to the department and college. While space prevents me from enumerating those contributions here, I would note that much of our success in attracting female majors to the geosciences at Union (as noted above) stems from having an exemplary role model among the faculty.

This year Holli Frey and Dave Gillikin are on well-deserved sabbaticals. To cover their courses, we have hired as visiting faculty Matt Manon and Anouk Verheyden-Gillikin, both of whom have worked in the department as visiting faculty for several years. With 17 seniors, each doing thesis projects, we need all the help we can get!

The Department is also fortunate to have continued outstanding administrative support in Deb Klein, and technical support in Bill Neubeck, Matt Manon, and Joanne Dalakos. We all benefit from their attention to detail and their genuine interest in the Department and in our students.

In closing, the Geology Department is doing very well. We hope you enjoy reading our newsletter, and we invite you to send us notes to add to future newsletters. As always, we look forward to visiting with you at meetings or on campus. Be well!
This fall, I begin my seventh year at Union on sabbatical following my tenure and promotion to associate professor last winter. The last year has been filled with lots of exciting happenings on both the research front, with the start of a new research program in the Caribbean, as well as the personal front, with the birth of our second daughter in March.

Last year, I taught the intro Environmental Geology course, along with Volcanology, and the senior capstone seminar, so I interacted with students at all levels of their undergraduate career. In the introductory courses, it’s always gratifying to introduce students to geology for the first time and see some declare as majors. This year’s volcanology course was an excellent and dynamic group; most students had participated in the winter break field trip to the Caribbean, so they had seen many volcanic features in the field and were excited to learn more. The annual poster session was again a success, with students gaining experience giving presentations, not only to their peers and geology professors, but faculty from physics and chemistry who ventured by the Wold Atrium. In the capstone course, the seniors continued to tackle the geological literature and hone their scientific communication skills, gaining confidence in their ability to pursue grad school or the job market.

One of the highlights of the year was our “Action at the Arc!” departmental field trip to Barbados and Dominica over winter break. The trip was comprised of John Garver, Matt Manon, and myself, leading 15 undergraduates in an exploration of the forearc sediments and explosive volcanic deposits of the Lesser Antilles in the Caribbean. Part of the impetus for the trip was to do some reconnaissance of Dominica as a new potential field area for my research. Dominica was appealing because of its volcanic density (9 centers and tens of associated explosive deposits since the Pleistocene) and the lack of published research in the area due to rugged terrain and climate. I had been studying explosive deposits in Mexico, but travel to my field area has become unsafe. In both regions, the fundamental research questions concern magma chamber processes and eruption triggers and how we can use a variety of analytical techniques to address said questions. On our Dominica trip, we collected 20 samples from three different ignimbrite deposits (Roseau, Grand Savanne, and Grand Bay). Initial characterization of these samples was done by my three sophomore scholars students last year, Kaitlyn Suarez ’15, Tara Metzger ’15, and Sarah Brehm ’15. Over the summer and this academic year, these samples are being studied in more detail by two thesis students, Ali Flake ’14 and Lauren Main ’14, using a combination of petrography, whole-rock chemistry (ICP-MS), and mineral chemistry (SEM and LA ICP-MS). We hope to decipher the conditions in the magma chamber prior to eruption and whether the deposits shared a common plumbing system or were discrete batches of magma. This has implications for why Dominica has experienced so many explosive eruptions in the past and what future hazards may exist. This December, I will be returning to Dominica to collect additional samples to continue ignimbrite fingerprinting and unravelling magma chamber processes.

As I begin new work in Dominica, I’ve wrapped up some of my other research projects. My research with Kathryn Szramek (Drake University) on weathering of young volcanic rocks in the semi-arid Deschutes Basin of Central Oregon was published in June in *Chemical Geology*. Through detailed petrography, trace element analyses, and work on the SEM, we documented how the climate inhibited weathering and affected the breakdown of individual phenocryst phases, adding an important new dataset to compilations of silicate fluxes and weathering. My project with Rebecca Lange (University of Michigan) which documented the eruptive history of Volcan Tepeitllectic in western Mexico will be published next month in *GSA Bulletin*. With *Ar*/*Ar* geochronology, we have documented a 160 kyr andesite cone-building phase, followed by ~100 kyr hiatus and then a rhyolitic Plinian eruption. It appears as though the magma chamber beneath Volcan Tepeitllectic became sub-solidus after the initial stratocone effusive eruptions and was then rejuvenated and partially melted by the influx of basaltic andesite.

On the homefront, our daughters Natalie (almost 3) and Zoe (7 months) keep us busy. Natalie loves joining us in the field and brings her plastic hammer to tap on rocks. She’s also a frequent patron of the Burnt Hills Library and the Schenectady Green Market. Zoe hasn’t expressed her preferences yet, but seems content to accompany the family on most outings.

Recent publications from Holli (* = students):

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This has been a productive year of teaching, research, and community service. I have continued to work on issues in the Mohawk Watershed in the aftermath of Irene and Lee and then Sandy. While Sandy did comparatively little damage in Upstate NY, the onslaught of these extreme events has focused political attention to damage and restoration in the watershed. I continue to direct much of my research effort toward Alaskan tectonics and the systematics of zircon as a geochronometer. We had a safe and productive NSF/Keck field project on Baranof Island in Southeast Alaska. This last summer our work was aimed at collection of the Maastrichtian Sitka Graywacke and its metamorphic equivalents in the Baranof Schist.

The Union Fission Track Group is focused on Alaskan tectonic and also on understanding the systematics of radiation-damaged zircon. We are also developing a method of measuring apparent radiation damage in single zircon grains using Raman spectroscopy. This avenue of research has allowed us to understand the source and thermal history of Precambrian zircons that have found themselves in the Chugach accretion complex in Alaska. We are applying this latter technique to rocks of the Chugach-Prince William terranes in Alaska, which is funded by the Keck Consortium and the National Science Foundation. This project is a collaboration between myself and Cam Davidson at Carleton College.

As an offshoot of this work on FT dating of detrital zircon, we continue with U/Pb analysis of detrital zircon. Our research effort continues to use the facilities at the LaserChron center at the University of Arizona to date detrital zircon from Maastrichtian to Eocene strata of the Chugach Prince William terrane. Part of this effort was directly related to the thesis work of Mike DeLuca (2013), who completed his thesis on the thermal evolution of rocks in the Shumagin Islands. Part of Mike’s thesis involved an interesting double-dating experiment where fission-track dated zircon where then dated by LAICPMS allowing us to evaluate the time of crystallization and the time of cooling in single 100 um zircon crystals.

Collectively, the dating and radiation damage work is focused on terrane accretion and Alaskan tectonics. Much of this work started with the NSF funded St. Elias Tectonic and Erosion project (STEEP), which is a multi-institutional project focused on understanding the collision of the Yakatuk terrane and the thermal history of the continental framework affected by this. The current work, now in its third year, has moved to more outboard rocks of the Chugach-Prince William terranes (see Keck Alaska summary in this Newsletter).

I continue to be busy with research, advocacy, and politics in the Hudson and Mohawk watershed. I serve on the board of directors of the Dam Concerned Citizens, Inc., which is an advocacy group keeping an eye on rehabilitation of the NY City-owned Gilboa Dam. I serve on the Glenville Wellfield protection committee where we are focused on protecting this key resource from surface and subsurface threats. I was recently appointed to the Steering Committee for the Mohawk River Basin program being coordinated by the NYSDEC under the authority of Governor Cuomo’s office. I have also been an active member of Congressman Tonko’s Mighty Waters Initiative, which is focused on clean waters, flood mitigation, and economic development. In March 2013, Jackie Cockburn and I were again co-chairs for the Mohawk Watershed Symposium at Union (this was the 5th annual), which was well attended by both professionals and students. In the next several years we should see a greater oversight in the Mohawk watershed, which will enhance recreational opportunities, and develop a mechanism for better oversight of our water resources.

Recent publications from John (* = students):


David Gillikin

This has been an excellent year for me at Union. The new NSF-funded isotope ratio mass spectrometer (IRMS) was installed in February and has been running well ever since. The new lab space is beautiful and practical. Since installation, we have run hundreds of carbonate samples from bivalve shells and cave deposits for C and O isotope determination, as well as tree-ring cellulose for C and O isotopes. Lake cores and fossil bones are next. The instruments are being heavily used for five senior theses this year! The lab is just starting to accept samples from other users and should be a very busy place within the next year.

My research program has been going quite well. The special issue on Sclerochronology I have been working on for some time is finally published in Palaeogeography Palaeoclimatology Palaeoecology. I have several other papers nearing completion, which should be submitted soon. I have also taken on a position on the Biogeosciences editorial board (www.biogeosciences.net), which is both a lot of work and fun.

I was able to return to the Central African Republic (CAR) to continue my research program on African freshwater bivalves as recorders of environmental conditions last November. We obtained more water chemistry data and collected new shells from the rainy season. Unfortunately, shortly after we left the country, rebel groups started to take over towns in the northern part of the country. In March, when my local collaborator collected additional shells and the temperature dataloggers, we were told that had been in the water for three years, the rebels marched on Bangui, the capital, and president Bozizé fled. Since then the country has been thrown into anarchy and people have been suffering from the horrible consequences. My thoughts are with all the people I have met there and I hope the situation will improve soon. We have a research proposal pending to further fund this research and expand it to different African regions. Currently, Holly Havel (’14) is conducting her senior research on this topic and has analyzed isotopes in shells from Kenya, CAR, and Mali providing a nice east-west transect across the continent. She will be presenting her data at the annual Geological Society of America (GSA) meeting in Denver this October.

I have also continued working on cave deposits (speleothems, aka stalagmites). Kyle McQuiggan (’14) and I travelled to Belgium this past summer to collect new samples from the Han-sur-Lesse cave in the Belgian Ardennes. We are working closely with Dr. Sophie Verheyden from the Royal Belgian Institute of Natural Sciences on this project and hope to shed light on the Northern European climate over the past 5,000 years. Kyle has been busy with the department’s Laser Ablation ICP mass spectrometer and will soon start analyzing isotopes using the new IRMS. He is also presenting his research at the GSA meeting.

I have been enjoying teaching at Union as well. Last year I taught Stable Isotopes in Environmental Science (I am looking forward to teaching this again with the new IRMS!), Introduction to Oceanography, Advanced Oceanography, and Earth and Life Through Time. The Advanced Oceanography class started with a trip to the Keys Marine Lab on Long Key Florida. We spent a week sampling Florida Bay nearly to the Everglades, the Atlantic ~20 miles out to the Gulf Stream (where we went for a dip in over 600 feet of water), and the mangroves on the Island. The trip was a great success and fun.

On a personal note, we just bought an old farmhouse in nearby Glenville, which we will spend the next years fixing up, and enjoying. There is plenty of land to explore (including an awesome fault) and a large pond. Plenty to keep us busy for a while!

Recent publications from Dave (* = students):


Sampling the Lobaye River, Central African Republic November 2012
In the past year I taught Physical Geology, Geochemistry, and Petrology. Two petrology weekend field trips went fine, but the third, to Mt. Monadnock in NH, was canceled because of severe weather (including snow, in late May!). I gave two NEGSA talks in March, and attended one field trip at the meeting. The meeting took place at the Mt. Washington Hotel at Bretton Woods. It was a spectacular place, and it was amazing to me that the outcrops were actually visible and not buried under snow.

We've had a good series of Dinner and Disaster Movie gatherings this past year. In the spring the featured flick was Ice Spiders, in which a self-satisfied bunch of young ski racers plodded around in the slush while being pursued by giant mutant spiders. Plenty of laughs, especially at the fake ski lingo.

This summer I finally made it to Mt. Monadnock. My father, as part of a fundraising raffle for an eastern Massachusetts civic group, offered a geologic field trip to the mountain. Naturally, as soon as he had winners he called me. The list of hikers changed several times, but eventually three did the hike on a spectacularly fine July day. Though the hike could easily be done in two hours, we took six and a half with all the stopping to see metamorphosed graded beds, boudins, folds, tourmaline-quartz veins, etc.

I've been working on a number of papers, including one on metamorphosed cumulate gabbros in Norway (with Colleen Kennedy, now an alum) and another on Late Precambrian rocks in central Massachusetts (with Leah Engelder, another alum who I had to apologize to for taking so long to get to the paper). The first has been submitted, and I'm still working on the second, struggling to decide if it should be a bare-bones ‘here’s the data’, or if I should chub it out with some wild speculation. I've also been working on a picture book on metamorphic rocks in the field. How I got into that project is a long story. I can truthfully say that a book, even a picture book, is more work than I ever could have imagined. It's back from technical review and I'm still making revisions. Let me know if any of you want to buy the movie rights.

I also spent a total of about two weeks in the basement (Olin 003) sorting the rock and mineral teaching collections. What a mess! It's the first time it was done on a semi-comprehensive scale since at least the 60’s. I didn't find much new stuff, but I was able to consolidate a lot of things from many cabinets into fewer. We were also given loan of 34 drawers of teaching rocks and minerals from SUNY Albany, which has shut down its geology program. There was fear that, with upcoming renovations, the collections would end up in state storage somewhere and lost. They are now organized with the rest of our teaching collections.

**Recent publications from Kurt ( * = students):**


I’m getting more and interested in teaching structural geology as I get to know more and more of the little details of the Taconic Orogeny. Union is a really great place to teach structure, because there are vastly different styles of deformation within an hour or so drive in any direction. The field-based nature of Structure makes it so much fun to teach at Union. This year our weekend fieldtrip toured the spine of the Taconic orogeny, including some classic localities in Western MA and Western VT (see attached photo of the Castleton Syncline).

This year, I am advising Greg Brenn with his senior thesis work on aftershocks from the M 7.6 earthquake of September, 2013 on the Nicoya Peninsula. As part of the 2013 Costa Rica Keck Project Greg and a few other students installed a local seismic network, and recorded many small aftershock events from the area of fault rupture. Greg was one of only three freshmen who accompanied John Garver and I on our Costa Rica trip in 2010, and it is wonderful that he had the opportunity to return as a budding seismologist. He is presenting his work at the national AGU in San Francisco, so if you’re there, stop by and say hi.

Our second daughter, Zoe was born in early March, and she has kept us quite busy, mostly by being incredibly cute. Another obvious highlight of this year was the winter trip to Barbados and Dominica. It is always a treat to get students into the field, looking at a subduction zone up close. It’s a gift to take them to see the two types of rocks I’m most interested in, deformed accretionary sediments and arc volcanics! We had a great group of very motivated and interesting students, which makes any trip more exciting.

I’ve had the opportunity to spend time assisting students on many different kinds of research projects during my first full year managing the department’s instrumentation under the generous support of the Sawtelle Fund. From water, to pollution, to glacial sediment and volcanic tephra, it’s been an interesting year to say the least. The advanced oceanography class analyzed samples from their trip to Florida on the ICP-MS and the ICs, getting a chance to swamp the ion chromatograph detectors with seawater in the process! I’ve been measuring arsenic samples from two different experimental studies on the ICP-MS, working with students of an environmental geologist from Bennington College, and an environmental chemist from here at Union. With Don Rodbell and students we continue to refine the procedure for determining biogenic silica values in glacial lakes. The SEM has been a real workhorse for the Volcanolgy group, producing publishable mineral analyses of feldspars, pyroxenes, amphiboles and (hopefully on Friday) oxide compositions good enough to determine eruption temperature. In short, the lab has been working very well, and is producing lots of data. I am enjoying the role I get to play, interacting with many different students and giving/gaining insights into their work.

Most of my research this year has been focused on phenocryst chemistry of volcanic rocks, working with Holli and many students on the Dominica project. As I write this note, we’re acquiring trace element data on the ICP-MS for our presentation at National GSA in Denver. By the time you read this, GSA will have happened, and I’m staying home with the kids this year so hopefully Holli saw you there.

Recent Publications from Matt (* = students):


My research activities this year involved our continuing project to document Holocene climatic change as recorded in glacial deposits and lake sediments in the Andes of Peru. This project is a collaborative effort, funded by the NSF, with colleagues from the University of New Hampshire. This year we returned to the Huaguruncho Massif in east-central Peru. Two Union students, Grace Delgado ’14 and Dane O’Neil ’14, joined me and Joe Licciardi and his team from UNH for 3 weeks of field work. The Huaguruncho Massif is important to our work because it is a presently glaciated region in the upper Amazon Basin that is far to the east of the main crest of the Andes. Because the bulk of the moisture that nourishes glaciers in the tropical Andes comes from the tropical Atlantic Ocean, there is a steep E-W precipitation gradient across the tropical Andes. On the western side of the Andes, mean annual precipitation (MAP) is less than 50 cm, and glaciers only exist on the very highest peaks. From a paleoclimatic standpoint, this region is highly sensitive to precipitation change, given that precipitation is the glacier-limiting climatic variable in this region. In contrast, on the eastern side of the Andes, MAP can exceed 300 cm, and glaciers can exist at much lower elevations. This region is far more sensitive to changes in temperature than the western side of the Andes, and taken together our glacial geologic studies in both regions will delineate records of both temperature change and precipitation change in the tropics. One of the problems with this approach is finding glaciated peaks in the upper Amazon Basin. Summit elevations descend in an eastward direction in the Amazon basin, and few peaks are high enough to support glaciers in spite of the abundant precipitation. The Huaguruncho Massif is one exception to this. The massif is a quartz monzonite dome, with summit elevations of ~18,800’ that stand well above the regional snowline. The massif supports numerous active glaciers and the moraine record, which we have been working on for several years, provides a temporally detailed record of glaciation spanning tens of thousands of years. We are using the cosmogenic nuclide \(^{10}\)Be to date the deposition of moraines in the region. In addition, the region is dotted with numerous glacial lakes and bogs, and we have extracted sediment cores from several of these. The lake cores should complement the moraine dating by providing a continuous record of sedimentation that can be related to the waxing and waning of upvalley glaciers.

Normally, the southern hemisphere winter (JJA) is the dry season, and most field seasons are very dry, and our rain gear remains safely stashed in the bottom of our packs. This year, however, was the exception to the rule, and we witnessed first hand, just how wet it can be in the high elevations of the western Amazon Basin. After the 8th day of rain, I am sure that Dane and Grace were ready to strangle me when I assured them that it “is not normally like this”!

I continue to work to build the program of personnel and funding needed for the deep drilling of Lake Junín, in the central Peruvian highlands. This lake has the potential to provide a continuous archive of glaciation and climate change that spans more than 200,000 years. Last May, my colleagues and I were notified that the International Continental Drilling Program would contribute $550,000 to the drilling budget, and as I write this note, my colleagues and I are busy putting the final touches on a proposal to the NSF for the balance of the costs associated with drilling and basic science. It has been 7 years since I first started the process of assembling the team and the funding needed for the Junin Drilling Project; it seems that, finally, we might be seeing the culmination of this effort!

In March 2013, faculty and students from Union College attended the northeastern section meeting of the GSA in Breton Woods, New Hampshire. Mike Sachs ’14 presented our work on sediment cores from floodplain lakes in the Mohawk Valley as a means of reconstructing flood history. He and all the Union students who presented performed commendably!

On the home front, our daughter, Erika, is a sophomore at St. Lawrence where she is studying Conservation Biology. Gaby is a high school junior, and the college search for her has already begun! Ceci and I are contemplating our soon-to-be empty nest years, and I must admit, there is a certain appeal!

Recent Publications from Don ( * = students):


This year has been an exciting and very stimulating year for me at Union College. Last winter the isotope ratio mass spectrometer funded by Gillikin and Rodbell’s NSF grant was delivered and installed. As a lab manager I oversaw the installation and went through a steep learning curve on how to use the instrumentation. The mass spec analyzes gasses such as CO₂, CO, H₂, N₂ for their isotopic composition. In order to transform solid samples into a gas, we have several peripherals. The elemental analyzer (EA) combusts organic samples and separates the resulting gases using gas chromatography. This allows us to measure C and N isotopes of organic material such as hair, soils, tissue samples, wood, etc. The GasBench allows us to measure O and C isotopes of carbonates by adding phosphoric acid to the carbonate and analyzing the resulting CO₂ gas. The GasBench can also measure O and H isotopes of water as well as C isotopes of dissolved inorganic carbon. The high temperature conversion elemental analyzer (TC/EA) uses pyrolysis to decompose organic samples and since there is no addition/contamination of atmospheric oxygen, it allows us to measure O and H isotopes in organic materials.

After, the installation, which itself took more than a month, we proceeded with testing out the equipment by running lots of standards. This allowed us to get a feel for the mass spec and get an idea of the level of reproducibility. It took another couple of months before we were ready to measure our first samples. This is because the mass spec is far from being a plug and play machine. There is a lot of daily monitoring involved and regular tuning to focus the ion beam. With the many connections and hair-like capillaries, leaks appear once in a while, which need to be fixed. The mass spectrometer has been running great and students have been running their own samples, gaining valuable lab experience.

While, the mass spectrometer has kept me very busy last winter and this fall, I also taught Paleontology last spring and am guiding three research students this year. Jordan Thomson (’14) investigates whether hurricane years are recorded in the isotopic composition of tree rings at sub-annual resolution. This summer, Jordan and I went to coastal North Carolina to collect her samples of Loblolly Pine. Isabel McRae (’14) is doing a one term thesis with John Garver and I as thesis advisers. She studies slope instability in the Wolf Hollow using tree rings of Hemlock. Zack Wahl (’14) pursues his passion for paleontology and, in collaboration with Penny Higgins from the University of Rochester, he studies the potential to use carbon isotopes in fossil reptile teeth as proxies for climate/environmental change during the early stages of the Cenozoic.

Recent Publications from Anouk:


Recent Publications from Bob:


During Union’s winter term break, fifteen geology majors traveled to the Caribbean for a 10 day field trip to Barbados and Dominica, accompanied by Profs. Holli Frey, John Garver, and Matt Manon. The trip afforded the students an opportunity to study different aspects of a subduction zone, from the forearc sediments in the accretionary wedge in Barbados to the explosive volcanic deposits blanketing Dominica. Barbados is dominated by a Pleistocene coral reef limestone cap, but Tertiary sedimentary rocks of marine origin are exposed in the northeastern part of the island. Known as the Scotland District, the sediments are grouped into two fault-bounded deformed units: The Scotland Formation (sandstones and clays of early to late Eocene) as well as the Oceanic Formation (turbidites and deep water biogenicals of mid Eocene to Miocene). Dominica is one of the most volcanically active islands in the Caribbean, with nine relatively young volcanic centers (<Pleistocene) and the site of the largest explosive eruption in the Caribbean in the last 200 kyr. It is almost entirely volcanic, with numerous ignimbrites and block and ash deposits from lava dome collapses. The volcanism has resulted in geothermal activity, high heat flow, and frequent shallow seismic swarms.

We began the trip around midnight, the Monday after Thanksgiving, with a drive to JFK to catch our flight to the Caribbean. After our arrival in Bridgetown, shuttles took us to Holetown, our home base in Barbados, consisting of three houses in a coastal neighborhood. In Barbados our days were filled with visits to various outcrops of limestone and sediments, followed by a swim to cool off before heading home to prepare dinner. In the field, we spent most of our time in the Scotland District, highlighted by a ridge walk along the siliciclastics and turbidites of Chalky Mount. One of the students’ favorite excursions was to Welchman Hall Gully, a collapse feature in the Upper Coral Rock that has been developed as a botanical garden by the Barbados National Trust. In addition to the unique limestone solution and precipitation features and the beautiful lush vegetation, we spotted numerous small green monkeys playing in the canopy.

After four days in Barbados, we hopped on a small plane to get to Dominica, a more rural, economically poor region, due in part to the rugged volcanic landscape, which precludes abundant sandy beaches. Our group stayed in the 19th century Springfield Plantation in the Hills of Dominica, which is now part of the Archbold Tropical Research & Education Center run by Clemson University. The perks of the plantation included amazing creole food and the opportunity to see the local boa constrictor on the grounds. During our four days on Dominica, we visited several volcanic centers and ignimbrite deposits, mapping and sampling thick sequences (>10 m) of pyroclastic flow deposits. We also did several hikes in the interior of the island, including an excursion to see welded ignimbrites at Trafalgar Falls and another to smell fumeroles at Sulfur Springs. The last day was an arduous 15 mile trek through the rainforest and geothermal fields in the Valley of Desolation to Boiling Lake, site of a small phreatic eruption in 1997.

Student participants included Eileen Alejos ’15, Michelle Barube ’15, Sarah Brehm ’15, Emily Crampes ’15, Mike Deluca ’13, Ali Flake ’14, Holly Havel ’14, Kate Kaminski ’14, Lauren Main ’14, Tara Metzger ’15, Dane O’Neil ’14, Mike Sachs ’13, Kirk Seaman ’14, Kaitlyn Suarez ’15, and Jordan Thomson ’14. The trip was made possible by student contributions and the Geology Field Fund of the department.

In addition to being a departmental field trip, the Caribbean excursion was also a reconnaissance sample collecting trip for me. Despite the plethora of lava domes and associated deposits on Dominica, very little published research exists for the region. We targeted three ignimbrite deposits from different parts of the island (Grand Savanne, Roseau, and Grand Bay) and collected multiple pumice and lithic clasts from each for petrographic and geochemical analysis. Initial characterization of the samples was done by Sarah Brehm, Tara Metzger, and Kaitlyn Suarez, as Sophomore Scholars Projects, and their results were presented at the Steinmetz Symposium. Sarah continued working on the project over the summer and into the fall as an independent study project. Building on the initial results, Ali Flake and Lauren Main are doing senior theses, further characterizing the textures and phase assemblages with the SEM and LA ICP-MS. I will be presenting some of this research at the GSA meeting in Denver at the end of October.
This past summer, I entered an 8-week fellowship program through Union, and during this time was fortunate enough to embark on a 3-week field season to the Huaguruncho Massif in the Peruvian Andes. The field team consisted of me and two others from Union, Professor Don Rodbell and fellow senior classmate Grace Delgado, along with three from the University of New Hampshire, two graduate students and Professor Joe Licciardi. The aim of our collective project is to analyze Quaternary climate change through cosmogenic radionuclide dating as well as through lake core extraction. Currently I am now sampling the lake cores for radiocarbon and calcite, and hope to run stable isotopes samples by the end of the term. The work that I’ve done and will continue to do through the winter will constitute the bulk of the research for my thesis.

Over the summer I traveled to Colton, NY in order to obtain a core from Fox Fen, which was retrieved with a square rod piston corer. The core retrieved was approximately 20m, and was analyzed for magnetic susceptibility, bulk density, and moisture content. Currently I am using the charcoal data from Fox Fen to analyze how climate influences charcoal deposition.

Over the summer I began work on my senior thesis, which is looking at the isotopic signatures of carbon and oxygen in hurricane and non-hurricane years in Loblolly Pine from North Carolina. Therefore, I set up and tested an α-cellulose extraction method on some Loblolly pine. This process is essential to my thesis as it isolates the cellulose from each sample, which closely correlates with climate. I was able to run my trial cellulose samples through the mass spectrometer, and learn how to troubleshoot some issues that can arise.

This summer I continued research on the Pleistocene ignimbrite deposits in Layou and Roseau, Dominica. During the 2012-13 school year we traveled to Dominica and collected pumice samples from both locations. Previous work had hypothesized that the deposits may have come from the same volcanic center in Micotrin. My sophomore project focused on using geochemical analysis of trace elements, whole rock chemistry, and phenocryst composition to determine if the deposits left in Layou and Roseau both originated from a magma chamber in Micotrin.

Throughout our research we discovered a complicated pattern of zoning in plagioclase, orthopyroxene, and hornblende crystals indicating there may have been different populations of both minerals. Over the summer we developed and refined a method to perform quantitative analyses of hornblende crystals and OPX crystals on the Scanning Electron Microscope. Preliminary data show that there may be slight differences in chemical composition indicating different populations. This fall we will continue to perform quantitative analyses on plagioclase crystals and hornblende crystals to determine and/or confirm data and develop a relative sequence of events in the magma chamber under Micotrin.
Detrital Zircon Fission Track Analysis of the Baranof Schist of Whale Bay, Alaska

The Baranof Schist in southeastern Alaska is the metamorphosed region of the Sitka Graywacke of the Chugach-Prince William terrane. Samples of the Baranof Schist were collected from a transect of exposed rocks in Whale Bay on Baranof Island, Alaska. Previous detrital zircon fission track analyses have dated other samples from Baranof Island, with average ages of sedimentary rocks ranging from 72-105 m.y. (Haeussler et al., 2004). Adjacent to the exposed units of the Chugach-Prince William terrane is the Crawfish pluton, which through U-Pb dating is placed at 50.1 ± 0.1 m.y. (Cowan, 2003).

This project aims to date samples taken from Whale Bay using detrital zircon fission track analysis in order to better understand the cooling and uplift ages of these rocks. Deposition ages of the Sitka Graywacke and Baranof Schist are already known, but further investigation could lead to dates and processes of exhumation, as well as determine the effect proximity to a pluton has on the resetting of zircons in the samples.

Kate Kaminski Summer 2013 Keck Fellowship

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Gregg Brenn Summer 2013 Keck Fellowship

I participated in a Keck Geology Consortium project to the Nicoya Peninsula of Costa Rica, where I was characterizing the aftershock seismicity above the rupture zone of the September 5, 2012 Mw= 7.6 Nicoya Earthquake. The Keck group consisted of a geophysics team and a geomorphology team, and I was part of the the 4-student geophysics team, along with Costa Rican seismologist Dr. Marino Protti, in which we deployed a local, 5-station seismic array and GPS network. Our goal was to monitor for earthquakes, and with the data collected, we will locate the epicenters and depths to understand where the earthquakes are occurring along the plate interface. This was a great opportunity to gain experience deploying and servicing seismic stations in a tectonically active field environment, and I hope to use this data to contribute to future megathrust earthquake prediction on the Nicoya Peninsula.

Kyle McQuiggan Summer Research

This past summer I was granted an eight-week research grant through Union College to examine the elemental and isotopic ratio changes in a Belgian Speleothem. My work on my speleothem has evolved into my senior thesis and is part of a much larger project to generate a paleoclimate proxy using chemistry changes in speleothems. Through the grant, I was able to travel to Belgium and work closely with Sophie Verheyden, head Cave Geologist at the Royal Institute of Natural Sciences in Brussels, Belgium. While in Brussels I collected drip water and recent calcite from the cave that my speleothem grew in. Working outside of the U.S. with Belgian scientists was incredibly rewarding and I am extremely grateful to the Union College Undergraduate Research program and the Geology Field Fund for making this international research experience possible.
Union College hosted the Fifth Annual Mohawk Watershed symposium, and we are pleased that momentum continues to build for this effort. We saw our biggest year, with forty-three presentations and nearly 180 meeting registrants. The Watershed Symposium has played and continues to play a key role in facilitating a healthy dialog between stakeholders in the watershed.

Hurricane Sandy, which caused so much damage and devastation in the coastal areas, really didn't have a direct physical impact on the Mohawk Watershed. But the proactive response to the potential threat of this historic storm in the basin was profound. In the wake of a number of devastating floods in the watershed over the last decade we are starting to see important responses at the local, state, and federal levels. Much of this response is aimed at building resilience and adaptation through a number of mitigation efforts. Some of these mitigation efforts are costly and complicated, but building resilience will have long-term benefit to those in the watershed, especially those adjacent to floodways.

The future of the watershed looks bright especially considering the close collaboration and communication between stakeholders, which is partly demonstrated by the tremendous response to the Mohawk Watershed Symposium. Ongoing efforts continue to focus on the implementation of the Mohawk Basin Action Agenda, which is focused on ecosystem-based management. Last June Congressman Tonko introduced H.R. 5927 to the US House of Representatives, entitled: “Hudson-Mohawk River Basin Act of 2012.” If funded, this bill would finance and create a Hudson-Mohawk River Basin Commission, which would focus on flood control, energy production, agriculture, recreation, regional history, and economic development. This sort of regional oversight is long overdue in the Mohawk Watershed.

Last year, Secretary of the Interior Ken Salazar created the National Blueways System, which seeks to protect and highlight our waterways by recognizing a holistic approach to river conservation and management. The Connecticut River was designated our first National Blueways designation, and at the time of designation in the spring of 2012, it was noted that this river should be a model for how communities can integrate land and water stewardship efforts in a basin-wide approach. The National Blueways Initiative is part of the America’s Great Outdoors Initiative, which is aimed conservation and recreation efforts driven by stakeholders in a watershed. The effort seeks to protect and restore lands of national significance, to build a new generation of urban parks, and to increase our focus on rivers. Can the Mohawk Watershed win National Blueways designation?

We were fortunate this year to have Rebecca Wodder from the Department of the Interior as our keynote speaker. She is the Senior Advisor to the Secretary of the Interior, and she is working primarily on conservation issues and the America’s Great Outdoors Initiative. When she was President of American Rivers, she led efforts to help communities restore the health of their riv-
ers through a variety of conservation measures including the creation of river trails, dam removal, and practices to safeguard clean water. We are hopeful that we can profit from her expertise and background.

Finally, our youngest stakeholders had another busy year, and the watershed continues to provide students with a host of scientific and cultural activities. Over the years we have been very impressed by the activities of students and the important role that they play in collecting data, formulating hypotheses, and articulating the message that emerges from the work they do.

Invited Talks:

Keynote Address: Rebecca R. Wodder, Senior Advisor to the Secretary of the Interior: The National Blueways System - Stakeholder-led River Conservation on a Watershed Scale (Keynote is delivered at the banquet).

Symposium highlight address: Congressman Paul D. Tonko, 20th District of New York. Talk title: Climate Change and the Mohawk: Challenges and Opportunities for Citizens and Stakeholders

William A. VanDeValk, P.E., NRCS Area Engineer - Schoharie, NY. Talk title: Natural Channel Restoration after Irene and Lee - a Schoharie County Opportunity

Steve Botsford, NYS-DEC Region 6 Water Engineer. Talk title: An Introduction to Water Quality Issues in the Upper Mohawk

Frank Montecalvo, West Canada Watershed Alliance, Inc., Talk title: The Competing Interests in the Waters of the West Canada Creek

John Vickers, P.E., Chief, Western Operations Division, NYC Environmental Protection Bureau of Water Supply, Operations Directorate. Talk Title: NYCDEP Dam Safety and the Reconstruction of the Gilboa Dam

Karin E. Limburg, State University of New York, College of Environmental Science and Forestry in Syracuse, NY.

Keynote Speaker Rebecca Wodder, who is currently the Senior Advisor to the Secretary of the Interior in Washington DC. She is currently an advocate for the National Blueways System. (Photo: Matt Milless, Union College).

Talk title: River Herring: Past, Present, Future

Mark Cornwell, Dept. of Fisheries & Wildlife, SUNY Cobleskill, NY. Talk title: Stream ecosystem changes in Schoharie Creek tributaries following Hurricane Irene and Tropical Storm Lee

Amanda Stevens, Environmental Research, NYSERDA. Talk title: ClimAID: How climate science helps us understand and prepare for climate change in New York State

Don Rodbell, Geology Department, Union College. Talk title: The long-story: Reconstructing flood frequency along the Mohawk through the last 1000 years.

UNION COLLEGE TALKS and POSTERS

A LIDAR Analysis of Bed and Bank Patterns at Curved Segments Along the Mohawk River A.M. Ghaly, Department of Engineering, Union College

Ice Jams and Flood Monitoring: Mohawk River, Schenectady, NY (slides not available) G. Wall, C. Gazoorian, and J.I. Garver

A GIS Study of Environment-impacting Activities at the Confluence of the Mohawk and Hudson Rivers A.M. Ghaly, Department of Engineering, Union College


Post-Irene Suspended Sediment, Alkalinity and Metal Dynamics in the Schoharie and Mohawk Rivers P.R. Manning, D.P. Gillikin, J.I. Garver, J. McKeeby

Over the hill: flow variability across Catskill catchments J. Cockburn and J.I. Garver

A changing flight Schedule for Ducks and Geese in the Mohawk Watershed J.I. Garver, Geology Department, Union College

The Sedimentary Record of Flooding Along the Schoharie River Preserved in Sediment Cores from Young’s Lake M. Sachs and D.T. Rodbell, Geology Department, Union College

Patrick Manning at MSW 2013
The Union College Geology Club is an organization dedicated to bringing together students and professors in an effort to explore everything about the geosciences. Discussions and questions are commonplace during our weekly Thursday club meetings, whether it is an argument of a topic in petrology, or a deliberation of hydrofracking, everything geology is encouraged (not to mention there is free pizza!). The Geology Club takes numerous trips, including one to the illuminating Howe Caverns, and we’re also fans of “Dinner and Disaster!”, where Professor Kurt Hollocher takes time to discuss everything that’s geologically false with some of our favorite movies. Each year the Geology Club orders apparel for the department, so we can represent our club and department on campus. At the culmination of each academic year, the Geology Department holds an end of the year party, where students and professors come together to celebrate all the great work and research completed that year. In addition graduating seniors receive the much anticipated rock hammer, which is engraved with their name.

Last spring the geology club ordered pint glasses. If you are interested in purchasing a Geology Department Pint glass please email Deb Klein at:

kleind2 @ union.edu
(remove the spaces)
Prizes, Awards and Grants

The E.S.C. Smith Geology Prize is awarded annually to graduating seniors for outstanding performance and high probability of success in the geosciences.

The Edward S.C. Smith Prize was first awarded in 1961 to William Kirchgasser. The prize was established by Smith’s former students as a way of honoring him upon his retirement in 1960. Currently, the Prize is awarded annually on Prize Day marking the culmination of the Steinmetz Symposium.

The 2013 Smith Prize recipient is Mike DeLuca ’13.

The Geology Faculty Prize was awarded to Mike Sachs ’13 for outstanding contributions to the morale and intellectual climate of the Geology Department.

Alumni Supported Geology Field Fund scholarships were awarded to the following students to help them participate in the field trips to the Lesser Antilles, the Florida Keys and Belgium: Eileen Alejos ’15, Michelle Berube ’15, Sarah Brehm ’15, Emily Crampe ’15, Grace Delgado ’14, Mike Deluca ’13, Ali Flake ’14, Davis Hastings ’14, Holly Havel ’14, Kate Kaminski ’14, Lauren Main ’14, Kyle McQuiggan ’14, Tara Metzger ’15, Dane O’Neil ’14, Mike Sachs ’13, Kirk Seaman ’14, Kaitlyn Suarez ’15, and Jordan Thomson ’14, Nicholas Weidhaas ’15, Matt Worthington ’15.

New and Ongoing funded research in the Geosciences

$96,000 - Acquisition of a Laser Ablation System for Inductively Coupled Plasma Mass Spectroscopy at Union College


$303,000 - Tropical Holocene climatic insights from Andean paleoglacier dynamics

Principal Investigator: D.T. Rodbell. Organization: National Science Foundation

$299,638 - MRI-R²: Acquisition of Micro-Raman and Micro-IR Spectrometers for a Multi-disciplinary Spectroscopy Laboratory at Union College


$231,779 - Collaborative Research: Provenance and thermal evolution of the Chugach-Prince William terrane flysch, southern Alaska National Science Foundation

Principal Investigator: J.I. Garver. Organization: National Science Foundation

$48,523 - Developing archives of aquatic chemistry from freshwater mussel shell geochemistry: Stable isotopes, trace elements, and biomineralization

Principal Investigator: D. Gillikin. Organization: Research Corporation for Science Advancement, Single Investigator Award Cottrell College Science Award

$325,000 - Acquisition of a Stable Isotope Ratio Mass Spectrometer for Interdisciplinary Research and Undergraduate Research Training


$550,000 - Junin Drilling Project

Principal Investigator: D.T. Rodbell. Organization: The International Continental Drilling Program
Alumni News

Spotlight on Raymond Robinson ’36

Raymond Robinson (Ray) turned 100 years old last month and he shared some highlights of his life with us in a recent phone conversation. Here’s what we learned!

Ray was born in Albany, Oregon on September 25, 1914. Ray’s father was a civil engineer and moved around a little while Ray was growing up. Ray grew up in parts of New York, Missouri, and Vermont. According to alumni records he graduated from Lansingburgh High School in Troy, NY. Since both his father, Edwin H. Robinson, ’09, and his uncle William C. Robinson, ’07, had gone to Union, he never considered going anywhere else. Ray came to Union and majored in geology because he had always been interested in rocks and minerals and he said: “I was born with a rock in my hand”. There where only a few Geology majors during the time that Ray was at Union Al Van valkenbugh ’36 and Bennie Wilson ’36. Ray fondly remembers playing lacrosse for Union, and he was affiliated with the Theta Nu Epsilon fraternity.

Ray graduated in 1936. He went on to receive a master of science from McGill University in Canada then to Harvard to work on a PhD. He started working for Anaconda Copper, between semesters at Harvard. Due to WWII and the increased need for war materials, Ray was required to stay on at Anaconda. At the end of the war Ray had married and started a family, so he continued with his career and did not go back to Harvard to finish his PhD.

Ray’s family includes his wife Jeanne, 7 children, 25 grandchildren and a number of great grandchildren. He has worked in hard rock mining and exploration for about 30 years for various mining companies such as: Anaconda Copper; ASARCO, Sunshine Mining Co., Bear Creek Mining, Duval Mining, and Phelps Dodge Corporation. Ray also worked briefly for the USGS and supervised the district station in Tucson, AZ. He worked in consulting for the last 30 years. Ray retired in 2004 from consulting. While working for nearly 60 years he has lived in Quebec, western Canada, Alaska, Idaho, Nevada, Mexico, Chile, Peru, Puerto Rico, and China.

When asked if geology has changed during his lifetime Ray replied “Geology has remained the same. The tools have changed.” Ray’s advice to our undergrads is to "work hard and work diligently".

Currently Ray lives in Reno, Nevada and enjoys yard work, woodworking and Fox News.

Jeff Smith ‘68

I would love to join the department at the Hyatt in Denver if possible. I’m consulting for several Denver companies. Oil business is crazy right now, I’ve never been in such demand. Hope geology at Union is thriving. I have many fond memories!

Mark Dobday ’75

Mark P. Dobday, P.G. Geotesting Express’ Rock Laboratory Manager has been appointed the Subcommittee Chairman for ASTM D18.12 on Rock Mechanics. Mark will promote test standards development in the field of rock mechanics as well as encouraging the development of new methods and technologies in the rock testing field.

Stefan Bagnato ’00

Hello! Lots of big exciting news from Albany. At long last Amy and I are engaged and will get married next summer in Lake Placid. I passed the Pennsylvania P.G. exam with flying colors last fall; many thanks to the department for how well prepared I was, despite being out of school for 12 years. We traveled to Acadia National Park this summer and got to do some pretty sweet rock climbing right on the ocean (see photo). During the coming year I will take the lead on a remedial system performance evaluation for a large jet fuel spill at Ft. Drum using compound specific isotope analysis as the primary tool, which should bring much more science to my workload.

I can be reached at stefan.bagnato@arcadis-us.com. I hope all is well with everyone.
Sarah (Newell) Benson ‘02

I am still working at CHA in Albany, New York as a Project Manager, working on all kinds of projects both environmental and geological. I’ve been spending about half of my time doing environmental compliance work and the other half doing both remediation and water supply. In July of this year, my then fiancé Christopher and I bought a “new” 220 year old farmhouse in West Glenville, New York with a beautiful view of the Green Mountains. After 8 ½ years together, we were married in a small ceremony on our property on a gorgeous fall day in September. We are enjoying life in the country with our two golden retrievers, Maya & Piper, and looking forward to some down time before our next adventure begins.

Lauren Graniero, ‘12

Hello fellow geologists! I am currently in my second year of my PhD at Texas A&M University working with Dr. Ethan Grossman. This summer I had the opportunity to spend 6-weeks at the Smithsonian Tropical Research Institute as a Short-Term Fellow with Dr. Aaron O’Dea on a project investigating nitrogen isotopes as a proxy for wastewater nitrate in coastal environments in Bocas del Toro, Panama. Coastal coral reef ecosystems, especially in nearshore environments receiving river runoff, are extremely susceptible to anthropogenic influence. In Panama in particular, this runoff contains excess nitrogen in the form of nitrate, originating from untreated wastewater. It was my first opportunity as a PhD student to collect my own samples by snorkeling in the gorgeous Bocas del Toro Archipelago. We collected live bivalves of various species attached to mangrove roots and dock supports, from locations with varying degrees of wastewater pollution. We will be looking at the nitrogen isotopes present in water that was filtered at each site, as well as the bivalve tissues and shell carbonates. It was an amazing experience to have the opportunity to work with Dr. O’Dea and Dr. Grossman, and others in the field. We hope this project will have a significant impact on locals living in the Bocas del Toro Archipelago, as well as paleo-environmental impacts on concurrent studies I am currently working on. This project will test, for the first time, the application of nitrogen isotopes to characterize the input of wastewater nitrogen in marine environments of Panama. With completion of this first calibration step, I will be able to investigate how nitrogenous nutrient cycling in coastal Panama has changed as a result of human impacts not only in modern times, but over thousands and possibly millions of years.

Liz Morgan ‘11

I started a M.S. in Geology at Brigham Young University. I’m working with Professor Steve T. Nelson Ph.D to analyze stable-isotopic and diatom data in order to determine the ages of landslides on the north slope of the Uinta Mountain range (Blacksfork River/Green River Drainage Basins). While utilizing coring instruments and ground penetrating radar on bog terrain to reconstruct basin floors, we are also isolating the cause of the landslides as a function of climate change and/or tectonic events.
Geology Funds and Support

Donations to the Geology Department can be made to two dedicated funds:

1. The Geology Alumni Fund is a relatively small, continuing fund that is used by the Geology Department for items not covered by the normal Departmental budget, grants, or other sources of funds. This fund is used to sponsor speakers, fund geologic symposia, and Geology Club. This year, for example, it helped us sponsor the Mohawk Watershed Symposium, which was held in March.

2. The Geology Field Fund is an endowed fund dedicated to supporting student field work, including field camp, long course-related trips, and summer research work. This year the fund will help defray costs for the Winter Field trip to San Salvador.

Together, these funds help us to help our students have the opportunities they need to excel in graduate school, the geoscience industry, and any other field to which they wish to apply themselves. We thank all those who have so generously donated to the Geology Department.