Greetings from the Geology Department! It has been another eventful year since our last newsletter. In the pages that follow, you’ll read the details of a year of active scholarship on the part of faculty and students, field excursions both near and far, and active and generous alumni.

This past June, we celebrated the graduation of 17 senior geology majors, a record for the department. As of this writing, we count 37 Geology majors, who include 6 declared first-year students. Both of these numbers are records for the Department and both will surely increase as they do over the course of every academic year. All of this means quite simply that interest in Geology at Union is at an all time high. Some of this is due to national trends in the Geosciences. According to the American Geological Institute’s (AGI) Status of the Geoscience Workforce (2014), after peaking in the early 1980s at ~37,000 undergradate geology majors nationally, that number fell to less than ~15,000 majors by the end of that decade. A long slow and uneven rebound followed, with a significant surge in undergraduate majors beginning in 2007 to the current level of ~27,000. Much of the recent increase in interest in Geology nationally has been attributed to the boom in oil and gas exploration. While this may explain some of the increase in interest among Union students, it tells only part of the story. Many of our majors do not pursue careers in the energy sector, and their interest in the geosciences aligns more toward environmental consulting, urban planning, secondary school teaching, and research. Many of these students “discover” the geosciences at Union through one of our many introductory courses, which many students take with the initial intention of simply satisfying their general education science requirement. Currently, on a per faculty member basis, the Geology Department teaches more general education science students than any other science department at Union, so our exposure to students is disproportionately high. In addition, the faculty who teach these courses invariably foster students’ “discovery” of geology, and students commonly use the term “passionate” in end-of-term course evaluations to describe their Geology instructors. Other commonly repeated refrains include “[the instructor] clearly loves what she/he does”, and “[the professor] really cares about the students”. It is clear that high quality teaching at the introductory level is what piques many students’ interest in the geoscience, and eventually leads many of them to major in geology. In addition, Union students are increasingly aware of Geology Department activities. From the new rock and mineral display in the Olin atrium to the atrium’s new flat screen monitor that cycles through dozens of images of Union students in the field, the visibility of Geology at Union has never been higher.

The Department is fortunate to have continued outstanding administrative support in Deb Klein, and technical support in Bill Neubeck, Matt Manon, and Anouk Verheyden-Gillikin. We all benefit from their attention to detail and their genuine interest in the Department and in our students. One sad note to report is the passing of Research Professor Robert Finks in late May, after a long illness. Bob had been with us for about 10 years, he was an active researcher who occasionally taught paleontology courses. He was affectionately known as Sponge Bob for his long-held research interest in the Porifera phylum; he will be missed.

We hope you enjoy reading our newsletter! Please do send us notes to add to future newsletters, and, as always, we look forward to visiting with you at meetings or on campus. Be well!
This past year in my post-tenure sabbatical, I’ve been working on several research projects in Dominica. Dominica has the most volcanic hazard potential of any island in the Caribbean, with nine potentially active volcanic centers that are Pleistocene or younger in age and voluminous explosive deposits. The young volcanism, shallow seismicity, and fumerolic activity in Dominica suggest an active magma reservoir and potential for future eruptions. In order to better understand the magma plumbing system beneath Dominica and where magma is more prone to erupt, we have been examining the volcanic history of Dominica using whole-rock chemistry, mineral chemistry, zircon dating, and stable isotopes of geothermal areas.

By combining the history of the explosive eruptions with present-day levels of degassing, we are testing whether 1) all of the ignimbrites are young (<50 ka) and emanate from a single magma chamber. If the ignimbrites derive from a single large magma chamber, there is an increased likelihood of a more catastrophic eruption that poses an island wide threat. If the zircons in the ignimbrites display disparate histories and/or a systematic age progression, there may be multiple or smaller ephemeral magma chambers feeding the explosive eruptions. We will also determine whether 2) stream chemistry, particularly carbon isotopes, can be used to infer shallow magma degassing and potentially used for volcano monitoring. We are comparing our data to data collected from 2000-2006, during which time volcano seismicity increased in northern Dominica.

The students involved in these research efforts include Ali Flake ’14, Lauren Main’14, Sarah Brehm ’15, Emily Crampe ’15, and Tara Metzger ’15. Ali and Lauren accompanied me to Dominica is December and were focused on an island-wide characterization of the ignimbrites. In June, Sarah, Emily, and Tara joined me and Matt Manon for two weeks in the field. Sarah is using U-Th and U-Pb dating of zircons to determine eruptive periodicity. Emily is doing a petrologic study of Morne aux Diables, a northern lava dome region which has seen heightened seismicity since 2000. Tara is interested in using stable isotopes, particular carbon, in water to track magmatic degassing. For our fieldwork in Dominica, we were based at the Archbold Tropical Research Center, affiliated with the University of Clemson. Each day in the field, we drove narrow, winding roads and hiked through tropical rainforests and along rugged coastlines to collect our samples. We returned home with almost 500 lbs of rock and 75 water samples. We have presented some of our preliminary results at GSA and NE GSA (see below) and look forward to learning more about the volcanism on Dominica and preparing manuscripts for publication.

In the spring term, I taught petrology to 15 students. One of the highlights of the course was the weekend field trip to the Adirondacks. We visited the NYCO wollastonite mine in Elizabethtown to learn about metasomatism and drove to the summit of Whiteface to get an overview of the anorthosite massifs. We also tried to observe the polished anorthosite in the Ausable River at the covered bridge at Jay, but were surprised to find the outcrops under several meters of water due to a very wet spring. The skarn deposits at Cascade Slide have recently become more accessible, with several meter-scale boulders transported downslope during Hurricane Irene. Students were excited to find large crystals of blue calcite, diopside, garnet, monticellite, and magnetite.

On the homefront, Natalie and Zoe (now 3.5 and 1.5 years) are keeping us busy with trips to the library, Scheectadty Green Market, and numerous local playgrounds. Natalie likes accompanying us in the field and collecting samples for her rock collection and Zoe is following in her footsteps.

Recent publications from Holli (* = students):


This has been another productive year of teaching, research, and community service. I have continued to work on issues in the Mohawk Watershed and we hosted the Sixth Annual Mohawk Watershed Symposium at College Park Hall in March. Plans are coming together for a basin-wide watershed management plan, and work continues to build resilient flood-smart communities. My primary research effort continues with Cam Davidson at Carleton College toward deciphering tectonics of the southern Alaskan margin. Lab studies are also directed to better understanding the systematics of zircon as a geochronometer. We had a safe and productive NSF/Keck field project with six students in eastern Prince William Sound in southern Alaska. This last summer our work was aimed at collection of the Paleocene and Eocene Orca Group and we hope to show that these sediments were derived from the uplift and erosion of the Coast Range in British Columbia. The Union Fission Track Group continues to direct attention to the issue of radiation damage in zircon. Zircon is a common accessory mineral that is used for geochronology, industrial applications, and gemstones. Radiation damage affects the material properties of the mineral, but routine measurements of this damage and understanding of the crystallographic affects are poorly understood. We are 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 terrane in Alaska, which is funded by the Keck Consortium and the National Science Foundation. 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 Maasstructian to Eocene strata of the Chugach Prince William terrane. Part of this effort was directly related to the thesis work of Kate Kaminski (2014) and Meghan Riehl (2014), who completed theses on the thermal evolution of rocks in the Chugach Prince William terrane. As noted above, 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 served 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 also have been an active member of Congressman Tonko’s Mighty Waters Initiative, which is focused on clean waters, flood mitigation, and economic development. In March 2014, Jackie Cockburn and I were again co-chairs for the Mohawk Watershed Symposium at Union (this was the 6th 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. As part of my effort to teach and understand natural disasters, I bought a drone (quadcopter) this spring with the hope of getting a better understanding (or view) of floods, landslides, and other events in the area. No sooner had I learned to fly and photograph the Capital District where I had I learned to fly and photograph the Capital District was hit by the third tornado in last four years. With the permission of a local landowner we were able to capture damage from above and relate this damage to tornado path and wind direction.

Recent publications from John (* = students):


I had my first ever sabbatical this past year, but it was anything but restful. I taught my Biogeochemistry course in the Fall term and took the class of 18 students to San Salvador Island in the Bahamas for field research. Students paired up into groups of two and investigated nine different biogeochemistry projects on the island. This is always a lot of fun and students walk away with valuable field experience.

With my teaching load being light this past year, I focused more on the isotope ratio mass spec (IRMS) and my research. We have now run thousands of samples through the lab involving many student theses from both Geology and Biology. The lab has also attracted many outside users. We held a well-attended workshop this summer to illustrate how isotopes can be used in teaching and research. Several of the attendees are now regular users of the lab. We held a well-attended workshop this summer to illustrate how isotopes can be used in research. Several of the attendees are now regular users of the lab.

In addition to the busy weekdays, my weekends have also been busy with the myriad projects in the 200-year-old farmhouse we moved into last November. Overall it has been a fun and rewarding year for me in the department.

Recent publications from Dave (* = students):


*David Gillikin and Nicholas Weidhaas sampling a stream in the Peruvian Andes this past summer.*

*Students sampling Pigeon Creek in San Salvador on our new inflatable kayaks.*
This year was one mostly of teaching and writing for me, without too much excitement. I went to the NEGSA meeting in Lancaster, PA, with my student Kirk Seaman. Kirk presented a poster on his work on gneissic rocks in west-central Norway, that correlate in age and lithology, but not location, with the Taconic arc in western New England. That’s the arc, mind you, not the Taconic mountains which are made of the Taconian accretionary wedge. The arc is about 90 km farther east. The poster was large, colorful, contained a lot of data, and drew a lot of interested people. The conclusions are still being worked on, because it turned out that the rocks hold some geochemical surprises that we are still working out. Maybe I’ll tell you about them next year, if they are worked out by then. That’s the paper I’ve been writing. I’ve also been working on another paper that was rejected by a journal, partly because it was outside the scope of the journal, which it might have been, and partly because one of the reviewers was (apparently) a dyspeptic baboon. I’ve rewritten it, and if my coauthors would stop snoozing and actually read it, we can tweak it and send it off to a different journal. Probably one with healthy bonobos as reviewers. Educated humans are probably too much to hope for. At NEGSA I went on a field trip to the Wissahickon Schist, now subdivided into three different units on the basis of tectonic associations, metamorphic history, amphibolite geochemistry, and detrital zircon populations. My favorite stop was of a kyanite schist, with large, blue kyanites. That was fun in itself, but remember that southeastern Pennsylvania has never been glaciated. They have real soil development, from the actual rocks rather than from till, outwash, or glacial lake clay, as in New York. The slope next to the outcrop was very steep, and it was in the woods so there was almost no ground cover. The soil surface was covered with a lag gravel deposit of kyanite blades, it being the largest, most weathering-resistant mineral in the rock. I picked up a handful for the Union teaching collections. I also went on a hike up Mt. Cardigan, a small mountain in the Cardigan Pluton of Kinsman Granite, New Hampshire. It featured candy bar-sized white K-feldspar crystals, pegmatite dikes exposed on the summit that can be seen in Google Earth, and plenty of wasps. We were chased off by a thunderstorm. A few days later, I took a field trip to the igneous rocks around nearby Sunapee Lake, which included all major phases of the mostly Devonian New Hampshire magma series. I took a lot of photos showing crosscutting relationships. I hope future Petrology students will enjoy those rocks as much as I did. I also finished my picture book on metamorphic rocks in the field. Ten years ago, when I agreed to do the book, my only thought was “Sure, how hard can a picture book be?” Now I am older and wiser. Pictures are one thing, but captions, supporting text, line drawings, and the index, not to mention endless fights with the editors over layout, are quite another. It is coming out this fall as “A Pictorial Guide to Metamorphic Rocks in the Field.” Please feel free to buy several copies. The movie rights are still available, too.
Hello alumni! Once again it has been a great year. I’ve had the fortune to be occupied by many different teaching and research projects. Our second annual structure trip to the Taconic slate belt was a big success. In addition to the ever-stunning axial cleavage in the West Castleton syncline, we successfully found the great unconformity along the Appalachian Trail in the woods near Pittsfield, MA. Although the Potsdam sandstone sitting on Grenville aged gneisses is a familiar sight in New York, it was a treat to see it deformed into a stretched pebble conglomerate sitting on vertically foliated gneiss. With Holli on sabbatical, I had the opportunity to teach Environmental Geology for her in the fall, which was a real joy. It is exciting to expose not just our department’s majors, but a wider range of students from around Union and reminds me how I loved the combination of scientific observation when I first discovered geology. A highlight of the class is the trip to the Clarksville Cave.

My work with the department’s major instrumentation has again exposed me to many interesting projects. I’ve again worked with students on the LA-ICPMS, the ICP, the SEM. With Rodbell’s group we’ve put the portable X-Ray Fluorescence Spectrometer to new use measuring trace elements every few cm, down lake cores. I also got the chance to design a new mineral display for the Olin atrium. If you’re ever back on campus, check out the rest of campus, on display in the Olin rotunda.

This year I worked with Greg Brenn as he studied earthquakes on the Nicoya Peninsula, in Costa Rica. It was my first foray into seismology, and it was quite rewarding to work with Greg as he investigated the aftershock sequence of the 2012 Mw 7.6 Nicoya earthquake. As a freshman, Greg was part of our department trip to Costa Rica, and it was great to see how he has grown into a young scientist. I am happy to report that he is working on his master’s thesis in seismology at the University of Alabama. This summer, I worked with Colby Howland who spent four weeks examining the aragonitic marbles from Crete. We’re starting to get an estimate of how much aragonite was inverted to calcite upon exhumation. Colby got to experiment with several identification techniques, the most reliable of which was the Raman spectrometer combined with CL on our SEM. To our chagrin, we discovered that the classic Feigl’s solution stained calcite and aragonite indiscriminately.

Holli and I returned to Dominica in the summer, along with three rising seniors, Sarah Brehm, Emily Crampe and Tara Metzger. We had just over a week in the field, but we managed to collect ~50 water samples, from nearly every part of the island. Sampling geothermal waters was a new challenge, but an exciting one. Recorded temperatures got up to 96 °C, but the waters were surprisingly basic. Next year, we’ll see if we can record higher temperatures, or find some with negative pH. We got to new locations, including the beautiful, undeveloped northern side of the island, location of Morne Aux Diablotins, where Emily Crampe is doing her thesis work.

Sarah Brehm collected large volumes of sample, and we’re currently separating zircons and apatites from her Dominican tephra and dome samples, in an effort to date some eruptions and correlate tephra. Mineral separation is something I’ve never done before. It is a bit tedious, but every once in a while looking down the microscope you can see a beautiful double terminated teatragonal prism (zircon), which makes it all worth it. Check back next year to see the results.

Recent Publications from Matt (* = students):


For three weeks in June and July, a group of eight students and faculty joined me for a tropical, high-altitude field season in the Peruvian Andes. The Project is funded by the Keck Foundation, an NSF research grant, and by the Geology Department’s field fund. Union College senior Nick Weidhaas along with students Alia Payne (Macalster College), Julie Daniels (Northern Illinois University), and faculty Nathan Stansell (Northern Illinois), Joe Licciardi (University of New Hampshire), Dave Gillikin (Union) and I camped for two weeks in the Queshque Valley and one week in the Quilcayhuanca Valley, both on the western side of the Cordillera Blanca. The Blanca is the world’s most extensively glaciated tropical mountain range, and the glacial and tectonic geomorphology is outstanding.

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 range, mean annual precipitation (MAP) is less than 50 cm, and glaciers only exist on the very highest peaks (>18,000 feet). From a paleoclimatic standpoint, precipitation is the glacier-limiting climatic variable in this region and so glaciers have likely been highly sensitive to changes in precipitation. 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 tropical Andes. For the past four years, students, colleagues and I have been detailing the chronology of glaciation from both the eastern and western sides using a combination of cosmogenic radionuclide dating of moraines, and lake cores from moraine-dammed lakes. Taken together, these studies in both regions are delineating records of both temperature and precipitation change in the tropics. One of the problems with this approach has been to find glaciated drainage basins in the western cordillera that also have moraine-dammed lakes from which to acquire continuous sedimentary records of upvalley glacier extent. The active normal fault that runs along the western side of the Cordillera Blanca has caused many moraine-dammed lakes to drain abruptly during faulting and seismic events. The Queshque Valley is unique among glaciated catchments in the Range for having a well-preserved sequence five paternoster lakes. We managed to acquire about 35 samples of erratics from moraine crests for cosmogenic dating using $^{10}Be$, and sediment cores from most of these lakes and wetlands.

After eight years of setup work, the Lake Junin (Peru) Drilling Project was funded by the National Science Foundation; drilling will happen in July and August of 2015, and we anticipate retrieving as much as 1.2 km of lake core from six different drill sites! The total cost of the project is about $3.2 million with $550K coming from the International Continental Drilling Program, and the remainder from the NSF. Union College is the lead institution; others include Pittsburgh, MIT, Minnesota, Oregon State, and the Florida Institute of Technology. For the next 10 months we will be preparing the lake shore for the arrival of a drilling platform, and conducting a public outreach and education campaign to inform and gain the support of the local population.

In March 2014, faculty and students from Union College attended the northeastern section meeting of the GSA in Lancaster, PA. Grace Delgado (’14) presented her thesis research on the glacial geology of the eastern side of the tropical Andes. She and all the Union students who presented their work performed with poise and aplomb!

On the home front, our daughter, Erika, a junior at St. Lawrence, is on a term abroad in Tanzania this semester. Gaby is a high school senior, and we are in full search mode for a suitable college for her!

Recent Publications from Don (* = students):


Last year was another great year at Union. I taught Introduction to Oceanography and Earth and Life Through Time. I took over these courses from David Gillikin, who was on sabbatical. I truly enjoyed teaching both of these courses, but slightly favor Earth and Life Through Time because the many fieldtrips allow us to visit some of the geological gems New York has to offer. I also really enjoyed participating in another trip to the Island of San Salvador, Bahamas, with the biogeochemistry class. The trip is a wonderful opportunity for students to get experience with the difficulty of doing fieldwork and they really enjoy it!

Last summer, I directed a Keck project with six sophomore students. This was a unique opportunity for both the students and myself. Typically, only senior students participate in Keck projects. However, in an effort to attract and retain students of underrepresented groups to the science of geology, the Keck consortium has decided to include a Keck sophomore project. The aim was to expose rising sophomores to experience science in the field and lab. Five students from different colleges and one student from Union College participated in the project. The project involved using stable carbon and nitrogen isotopes to track pollution in New York streams. We mostly focused on streams around Schenectady, the Schoharie valley, and the Catskills. We spent the first two weeks sampling different streams, seeing some wonderful scenery along the way. Although, summer temperatures were on the cool side, some of the students were brave enough to have their picture taken under the Kaaterskill waterfalls! The last two weeks were spent in the lab: cleaning and drying samples, analyzing the samples on the Isotope ratio mass spectrometer and interpreting the data. I was very fortunate to have Michelle Berube (‘15) help with the logistics of the Keck project. Michelle is also now continuing the project for her thesis. In addition, Emily Crampe (‘15) is also working with me. She is doing an independent research project investigating the high resolution isotope profiles in tropical trees. The tree cores she is working on were collected by David Gillikin during a trip to the Central African Republic. This region is now not accessible anymore due to severe political instability. High resolution isotope profiles of tropical trees can potentially give us information about growth rates, carbon sequestration and age of the trees. This is very important information for sustainable silviculture practices. Due to the small sample size of the pilot study, Emily has first been perfecting her skills on some cores from the nearby Plotterkill Preserve. Now that all the potential drawbacks of the method have been worked out, she will soon start sampling the African tree cores.

Meanwhile our isotope ratio mass spectrometer is working at almost full capacity. This term, we have four classes that are using the mass spectrometer. It takes some careful planning to measure the many samples and divide the time between the three peripherals. And of course, we always need to calculate in time required for maintenance and repairing the mass spectrometer.

Recent Publications from Anouk ( * = students):


The Keck Sophomore project of this summer: from left to right: Anouk, Larenz Storey (Union College), Michelle Berube (‘15) Alesia J. Hunter (1st row, Beloit College), Anny Sainvil (2nd row, Smith College), Sara Marcela Gutierrez Diaz (1st row, University of California, Berkeley), Angel Xavier Tate (2nd row, Oberlin College) and Celina Brieva (Mount Holyoke College)
I continue to enjoy "retirement", spending a good part of each weekday in my office in the basement of Olin. Last year about this time I received a call from a former student asking if I still had the high pressure equipment I had moved to Union from Minnesota when I arrived in 1988. Naturally I still had it. He wanted to know if he could use it to make some measurements on various salt solutions at high pressure and temperature in order to get very precise thermodynamic data for geochemical modeling important to understanding the deep interiors of the satellites of the outer planets (which may have liquid oceans beneath their ice cover, especially Europa and Enceladus). With Bill’s help I packaged and sent him the pressure vessel and auxiliary equipment. A few weeks later we were talking again about my possible participation. He had enough money to have me make several visits and help set up the equipment. When he said he was going to put together a pressure generating system, I replied that, “if I’d known that I would have sent the pumping system I had along with the rest,” which I then did. It required a fair amount of modification in order to be used for his work, so I did the redesign and much of the reworking during several visits to Seattle (UW). It appears to be operational now and I’m planning another visit to overlap the GSA meeting in Vancouver.

At the meeting I’ll be co-chair of a special session honoring one of my former professors at UW, Eric Cheney. Eric was/is an economic geologist and was influential in the lives of many graduate and undergraduate students at UW. He provided some of the most intellectually stimulating material in his advanced course in Economic Geology. In particular, his treatment of banded iron formations (BIF) started my interest in the Earth’s surface conditions during the Hadean and Archean. I have been working on several aspects of this for the last ten years or so and will be presenting a paper during the session on one aspect of this work.

Because of my interest in the Hadean/Archean atmosphere I co-chaired another session at GSA when it was in Minneapolis a few years ago. The result of that session is a GSA Special Paper (#504) which I edited and which was published last spring. My ideas about Earth’s early atmosphere continue to be somewhat controversial (read ignored!) as they are pretty much directly counter to the conventional wisdom, but I continue to try to get others to look at both the contradictions inherent in the “wisdom” and the solutions that I am proposing. Retirement can be such fun!

I will soon be making a trip to the Grand Canyon to make a high resolution digital panoramic image from Point Sublime, a remote area on the North Rim. I will try to duplicate the coverage (for comparison) of a drawing made in 1873 from the same location. Lower resolution photographs I took in 1995 suggest the results should be quite interesting.

Finally, I am working on two projects with engineering faculty, one in ME and one in EE. The first is an underwater robot to explore (initially) Ballston Lake. This project has been ongoing for some time but we are taking a somewhat different tack this year and it looks promising. The second project has already produced some interesting, if apparently unrelated, results. It is a winch system for placement in the deep water in Ballston Lake that will be able to raise and lower a float with an attached Hydrolab sensor for measuring several water parameters (temperature, pressure, electrical conductivity, transparency and oxygen) as a function of depth, and transmitting the data to shore. This will provide a very detailed data set over the course of a full year or longer. In order to test the electronics and drive for the winch we placed it in the center of the Nott Memorial with a helium balloon to simulate the float. Because it seemed like a great opportunity to get some interesting video we attached cameras beneath the balloon and attached my cell-phone to the top. The video from the cell phone provides a startling image of what it might look like to approach the top of the Nott dome from the bottom:


We hope to have the winch ready for deployment next spring, perhaps in conjunction with the early tests of the swimming robot.

I guess I better get back to work…or retirement.
Sarah Brehm’s Summer Research Summary

This summer I continued research on the Pleistocene ignimbrite deposits in Layou and Roseau as well as various other volcanic deposits throughout the island of Dominica. During the 2012-13 school year we traveled to Dominica and collected pumice samples from the Layou and Roseau river valleys. Previous work had hypothesized that the deposits may have come from the same volcanic center in Micotrin. My summer research and senior thesis are focused on using geochemical analysis of trace elements, whole rock chemistry, and phenocryst composition as well as U/Th dating of zircon to determine the pre-eruptive history of the magma chamber(s) beneath Dominica.

We traveled to Dominica for a third field season and collected over 400 pounds of volcanic samples from various locations. These samples were then processed in the lab to extract both Fe-Ti oxides and zircon grains using a variety of methods including pulverization, powdering, density separation, and Frantz magnetic separation. This fall, the separated zircons will be mounted and analyzed on the SEM and the LA-ICPMS to determine size distribution, zoning patterns, and trace element composition of the zircon crystals. In January, we will be analyzing zircon crystals on the SHRIMP to determine U/Th content and thus the age of zircon crystals from each location. Age and chemical insight into volcanic deposits throughout the island may indicate the number of distinct magma chambers beneath Dominica and the possibility for future volcanic activity.

Tara Metzger’s Summer Research

This summer I worked both in the field and at Union College collecting samples and data for my senior thesis under the Mellon Foundation Grant. Professor Frey, Professor Manon, Emily Crampe, Sarah Brehm, and I spent 10 days traveling to the volcanic island of Dominica, which is located in the Lesser Antilles island arc. The focus of my research involved the collection of water samples from 71 various streams and hydrothermal pools in Dominica to categorize water types, determine the influence of magmatic water, and to determine magma outgassing on the island. The water samples were analyzed at Union College for trace element and rare earth element concentrations via ICP-MS, for cation and anion concentrations via ion chromatography, and for alkalinity. This academic year, I am continuing the data collection of oxygen, carbon, and deuterium isotopes via mass spectrometry and completing the bulk of the interpretations for my thesis. I also hope to correlate my findings to previous studies to see if water monitoring in Dominica would be a beneficial form of volcano hazard monitoring on the island.

Matt McGavick’s Summer Research

This summer I drilled a Belgian speleothem from about 125,000 years ago. Right now, and in the near future, I am drilling a modern speleothem in hopes of drawing comparisons between the climates of today and the last interglacial time period over 100,000 years ago. The drill machinery is so high-tech that I am able to drill up to 40 lines in between each growth line. Upon drilling the sample, I collected the debris and sorted the samples in vials. I used the Mass Spectrometer machine to analyze the isotopic composition of the two speleothems. Being able to use the MicroMill and the Mass Spectrometer machine has been a unique and exciting experience as I attempt to broaden my geologic research abilities. Spending my summer working in a lab all day was a lot more rewarding and exciting then I envisioned it would be!

Dan Freidman’s Summer Internship

This summer I was lucky enough to get the opportunity to work for Newfield Exploration, an independent crude oil and natural gas exploration and production company in Houston, Texas. I was a Geology Intern, and was able to work on some really cool projects. My main project was looking at well logs, which are typically 10-12,000 foot boreholes that allow geophysicists and exploration geologists to peek into what kind of geologic formations they could be dealing with in an area of potential interest. I learned how to splice these logs together using a special splicing software, gained an understanding of header information, and learned a few basics in terms of interpreting curves typical of a well log, such as gamma rays and neutron density.

Chris Kelly’s Summer Research

My research conducted this past summer as part of a four-week Davenport Undergraduate Research Grant involved the preparation and geochemical analysis of a speleothem collected in 1828 from the Gage Caverns in Schoharie, New York. Laser ablation Inductively-Coupled Plasma Mass Spectrometry (ICP-MS) was to collect trace element signatures within the calcite that forms the sample. Trace element data can be used to directly reconstruct paleoclimates through Mg/Ca, Sr/Ca, Ba/Ca, and Na/Ca ratios. This data will be compared to isotope values in the same speleothem, as well as an additional sample collected from a Belgian cave.
Emily Crampe’s Summer Research

This summer I was able to explore two different aspects of geology: Dominican petrology and paleoclimate reconstruction through oxygen isotopes in trees. The summer started with a ten-day trip to Dominica with professors Holli Frey and Matt Manon and students Sarah Brehm ('15) and Tara Metzger ('15). In preparation for my thesis, we collected rock samples from the Northernmost section of the island near the lava dome Morne aux Diables. When we came back to Union, I cut thin sections and powdered the rocks for later analysis in the fall. For the second half of the summer, I started working with Professor Anouk Verheyden-Gillikin on an independent study that I have continued this fall. We are looking at tree cores taken by Professor David Gillikin from the Central African Republic in 2011. The fact that we only have tree cores, and not stem disks, poses a unique problem because there is only a small volume of sample available to analyze. After reading several papers, and experimenting on cores taken from Rotterdam, N.Y., I determined that the best way to sample the cores would be to use a micro mill to drill away small portions of the wood. This powder will then be analyzed for oxygen isotopes in an attempt to correlate these data with precipitation data from the sample site.

Matt Worthington’s Summer Experience

I spent the summer on Martha’s Vineyard working for a Nature Conservancy, the Trustees of Reservations. This organization is the oldest statewide conservation group in the nation, protecting over 25,000 acres across 100+ different properties in the state of Massachusetts. I was a park ranger/tour guide for the Cape Poge Wildlife Refuge branch of the organization which is located on Chappaquiddick, a small separated island on the far east margin of the Vineyard. On most days, I led two kayak tours within the beach barrier lagoon ecosystem that comprises the part of the island where the branch is located. On any given tour I would lead from 5-15 people around the waters of the wildlife preserve and educate them on the conservation efforts made by the trustees and the ecological/historical significance of what they were seeing. The view was magnificent from the office, and I learned an incredible amount about conservation while refining my public speaking and leadership skills. It was a fantastic experience and a summer I shall never forget. This was a 9-5, five days a week position, filled with various ranger tasks when I was not leading the 2-3 hour tours twice daily.

James Barrett’s Summer Experience

This summer I worked for in the environmental sector of Kleinfelder. Kleinfelder works with Exxon Mobil and Cumberland Farms in efforts to help clean up their oil/gas spills. This job required me to work in the field and in the office. When I was working in the field I would sample soil and groundwater to test for any concentrations of pollutants or other specific chemicals. When I was working in the office I would organize and produce data to get a better understanding of how bad the contamination was at a specific site. Overall it was an amazing experience and the skill set and people that I met were all amazing. I look forward to doing something similar in my future or try and travel west to work in exploration.

Robert Queirolo’s Summer Research

To accurately predict future climate change, a greater knowledge of paleoclimate and influences controlling climate variations must be obtained. There exists an increasing demand for precisely dated high-resolution records of past environments. Speleothems, secondary calcite formations, are considered to be one the most powerful multi-proxy paleoclimate archives that exist. Speleothems are mineral deposits consistent of calcite and aragonite, which are produced by the calcification of minerals dissolved in karstified host rock settings. Speleothem deposit formation is controlled not only by the distribution, quantity, and chemistry of the water percolating through the karst environment, but is strongly influenced by the external climate (Fairchild et al., 2006). Through the study of the elemental ratios and oxygen and carbon isotopes (d^18O and d^13C), these formations provide data regarding mean annual temperature, rainfall variability, and vegetation response.

The research conducted in part of the Mellon Research Grant involved the preparation, dating, and drilling of a speleothem dating back 4200 years before present. The sample was collected in 1828 from the Gage Caverns located in Schoharie New York. Through the study of the elemental ratios and oxygen and carbon isotopes (d^18O and d^13C), this formation provides data that enables the recreation of past climate within northeastern New York, leading to a deeper understanding of controlling environmental factors. With a better understanding of past environmental climates, and the influences driving such conditions, it is possible to better predict variations within future climate. A special thanks to my research advisors, David Gillikin and Donald Rodbell, as well as the entire Union Geology Department, for the help and support throughout the process.
Nick Weidhaas’ Summer Keck Fellowship

This summer I had the great opportunity to spend three weeks in the Peruvian Andes as part of a Keck Geology Consortium fellowship. While there, we collected water and surface sediment samples and took direct measurements of water chemistry from glacially-fed lakes in two valleys of the Cordillera Blanca. Our field research team consisted of myself, Prof. Rodbell and Gillikin, Prof. Stansell from Northern Illinois University, Prof. Licciardi from UNH, and three students. The goal of my research is to understand the biogeochemistry and sediment transport through the paternoster lakes of Queshque Valley and to then compare my findings on a regional scale to the nearby Quilcayhuanc Valley. My study will serve as a modern proxy calibration for paleoclimate reconstruction using lake cores.

Once back at Union, I was engaged in a six-week research fellowship through the college. During that time, I analyzed the water and sediment samples we collected in the field. For the water samples, I measured total alkalinity, total suspended material, dissolved inorganic carbon, and CO₂ content. In the field, I took direct measurements for temperature, pH, dissolved oxygen, specific conductivity, and turbidity. In the lab, after the extensive process of freeze-drying all 24 sediment samples, I analyzed them for grain size, and total carbon content.

I still have to analyze the water and sediment samples for oxygen and carbon isotopic signatures. For the sediment samples I’ll measure carbon and nitrogen isotopic signature, C:N ratio, inorganic/organic carbon content, biogenic silica content, and do an elemental analysis. Coming up soon, I’ll be presenting a poster on my preliminary results at the Geological Society of America national meeting in Vancouver under the title, “Biogeochemistry and sediment transport through a tropical Andean paternoster lake system.” This is a great opportunity I’m very excited to be participating in!

Kaitlyn Suarez’s Summer Keck Fellowship

This summer, I spent three weeks in Alaska on the Keck Geology Consortium fellowship. The group consisted of six students from around the country led by Professor John Garver and Professor Cam Davidson. It was the experience of a lifetime! We were stationed out of Seward and Cordova, Alaska in the Prince William Sound where we used zodiac boats to conduct fieldwork in isolated locations. A typical day included loading the boats, driving to the targeted location, collecting samples, and writing observations about the rocks. We were always kept company by the bald eagles, whales, bears, salmon, and sea otters! We will research the collected samples for our senior theses. My thesis investigates the radiation damage of Precambrian detrital zircons using Raman spectroscopy. The overall goal of the Alaskan project is to determine the source region and thermal history of the Chugach-Prince William terrane.

Eileen Alejos’ Summer Keck Fellowship

This summer I went to southeastern Alaska to study the flysch of the Prince William – Chugach terrane with a group of 6 students led by professors John Garver and Cameron Davidson. Keck Geology Consortium and the National Science Foundation funded this fieldwork and research. Conducting fieldwork in Alaska for my senior thesis was an incredible experience that has changed my life and confirmed my passion for geology. Alaska is an remarkable place. Not only was I amazed by the abundance and variety of wildlife but the unparalleled scenery also intrigued me.

Our main study areas included Seward, Cordova, and Hinchinbrook Island. We collected volcanic and sandstone samples along beautiful shore outcrops. These samples will help us to determine the provenance of the terranes in Alaska as well as their thermal evolution. My senior thesis will focus on using fission track analysis of detrital zircons to date the Orca Group rocks on Hinchinbrook Island.

Michele Berube’s Summer Research

This summer I worked with Anouk Verheyden-Gillikin at Union College, doing field research for my Senior Thesis. The purpose of this project is to monitor water quality and nutrient loading in waterways in order to determine major sources of pollution. To accomplish this, I will be researching the distribution of stable carbon and nitrogen isotopic composition of fluvial systems in the Catskill and Schoharie, Albany and Adirondack regions of New York, with the goal to pinpoint polluted areas. This summer we were lucky enough to have 6 sophomore Keck Geology students working with us, helping take samples out in the field and process the samples in the lab. So far, this project has required many hours of working in the field, collecting samples of various types of benthic macro-invertebrates and algal species from various sites for analysis on the mass spectrometer in the Geology Department. I have been continuing my sample research throughout this fall term and in the winter the samples will be run through the mass spectrometer.
Currently we have three scholars in the department that have been awarded the Wold Geoscience Scholarship. Each year the scholarship is awarded to a freshman Geology major who demonstrates high academic achievement.

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 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 prize was awarded to William Kirchgasser. The Edward S.C. Smith Prize was first awarded in 1961 to William Kirchgasser.

The 2014 Edward S. C. Smith Prize recipients are Greg Brenn ‘14 and Kate Kaminski ‘14. The Geology Faculty Prize was awarded to Jordan Thomson ‘14 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 trip to San Salvador: Eileen Alejos, Sarah Brehm, Grace Delgado, Holly Havel, Colby Howland, Kate Kaminski, Chris Kelly, Tae Kim, Matt McGavick, Paulina Piontrowski, Meghan Riehl, Kirk Seaman, Nick Weidhaas, and Matt Worthington.

New and Ongoing funded research in the Geosciences


$1,290,000 - Deep Drilling of Lake Junin, Peru: Continuous Tropical Records of Glaciation, Climate Change and Magnetic Field Variations Spanning the Late Quaternary. Organization: National Science Foundation Principal Investigator: D.T. Rodbell.
Alex Beuchert '98

Having spent numerous weeks last winter again skiing in the Espace Killy area of the French Alps, we returned in the summer for two weeks of alpine adventures; thankfully my husband’s mountaineering skills are building appreciably so I can concentrate on just trying to be scared less! It’s amazing to get up close & personal with all the rock that we normally are skiing over & is covered by meters of snow in the winter. Climbing & crossing the many steep scree slopes can be harrowing; the rock in Tignes and Val D’Isere can be pretty unstable and is not great for rock climbing gear.

Later in the summer we visited my family in lower Westchester, New York—after living in the UK for 14 years, I always love returning as the natural beauty of rock outcrops everywhere excites me and is something I generally really miss where we live in Leicestershire. My husband took a rock climbing trip to the Gunks (I’ve got fond memories of a Union geology field trip there!) and was amazed. We also enjoyed some scrambling on the Palisades.

A final summer jaunt for us both, shortly before celebrating our 17th wedding anniversary, was a week on Lundy Island—effectively a 3 ½ mile long by ½ wide island in the Bristol Channel, with our local climbing club. What a wild place! (Go if you have the opportunity.) It’s all sea cliff climbing—adventurous abseils necessary on nearly all climbs—on largely coarse grained granite with some big basalt dykes running through. Great grippy rock for climbing, and thoroughly interesting to touch & behold. There’s a colony of seals who are constantly watching climbers’ activities and providing amusement. (photos below) [I mostly did easy climbs—and threw in a few runs...the abseiling was scary to start with...and actually to end with---unbelievably on my last abseil, halfway down a 50m pitch, I noticed hesitation...looked to see the rope fraying away in my belay device! Scary—ensue panic from my highly experienced (!) co-climber. Got back up OK and we all decided "That’s enough climbing for this trip"!]

If anybody wants to catch up, I’m on Twitter as @oadby_alex and LinkedIn: http://uk.linkedin.com/pub/alexandra-beuchert/10/1b5/a13

Stefan Bagnato ‘00

After a beautiful wedding in Lake Placid this July, Amy and I set off for an amazing honeymoon skiing in Portillo, Chile (see photo) and tasting some great wine along the way. Just a stone’s throw from Aconcagua, the Chilean Andes around Portillo are gigantic and absolutely breathtaking! Learning/relearning Spanish was a fun and interesting part of the adventure as well; thankfully the people there were very patient with us! Having won another significant project at Ft. Drum, multiple petroleum remediation sites at the base will likely occupy much of my time for the next 5 years, and should be a great learning experience. I can be reached at stefan.bagnato@arcadis-us.com. I hope all is well with everyone.

Jeremy Newman '98

I’ll be moving to Lander, Wyoming, in January of 2015 to work as an emergency physician. The town is at the base of the Wind River mountain range and is home of the National Outdoor Leadership School (NOLS). Cindy and I have been married for a decade now and our 4-year old son Bryce loves to play outdoors with us. We all ski, rock climb, hike, and camp together.

Stefan and Amy

Cindy, Bryce and Jeremy
Figured now that I’m finally doing something more productive with my life it might be worth sharing. Although it is largely still undecided, I am just starting a Masters programs at Western Washington University working on neotectonics and seismic hazard in NW Washington with Elizabeth Schermer and Colin Amos. Very excited but it has certainly been a pretty immense load right off the bat. TAing adds a whole new stress level to academic life. Fortunately I was able to take advantage of the incredible Cascade Mtns and Olympic coast for some amazing hiking and surfing before the work began and I’m loving life in Washington.

Ben Carlson ’12

Robert Finks, Research Professor of Geology at Union College, passed away at the age of 87 on March 25, 2014, after a prolonged series of illnesses. He was born on May 12, 1927, in Portland, Maine, but spent most of his growing up in New York City and vicinity. He was a Professor of Paleontology at Queens College, Queens, New York, from 1961 to his retirement in 2001. After retirement from Queens he moved to a small house in the woods in Catskill, NY. In 2003 he became a Research Professor at Union College. There he continued to supervise graduate students, taught a course in paleontology, led field trips, and published three research papers and a book of poetry. He loved cats and wild animals, and enjoyed the quiet of the Catskill foothills.

Robert M. Finks

I just started graduate school at the University of Alabama this past August, working towards my Master’s in Geology with a concentration in geophysics. I’ll be leaving for Antarctica at the beginning of November and will be down there for about six weeks, servicing seismic stations presently deployed in the northern Transantarctic Mountains. When I’m not preparing for Antarctica or in the lab picking P-waves, I’m kayaking on the Black Warrior River or going to football tailgates, because apparently that’s big down here!

Greg Brenn ’14

To help with next year’s issue of the newsletter, please keep us informed on what you are doing and where you’ve been. A note with your current email and mailing address is always appreciated. Take a moment and send an update to: Deb Klein (kleind2@union.edu).

Thank you for all your updates and articles. We hope you enjoy the Newsletter!

In Memoriam

Robert M. Finks

I would like to update everyone on the birth of our second child. Josephine (Josie) Chase McCowan was born on August 6, 2014. She came a full month early but still weighed 6lbs 7oz and was 19 inches long and is doing great. My husband Derek, big brother Hal and I are all in love with our new munchkin. We feel so blessed!

Josephine Chase McCowan

Tyler Izykowski ’11

The past year has been a busy one. I wrapped up my master’s degree at the University of South Carolina, where I completed my thesis analyzing multi-temporal scale tectonics and basin evolution in North Africa. My work was a collaboration between David Barbeau’s Tectonics and Sedimentation Laboratory at USC and the Union College Fission Track Lab. As always, John Garver’s insight and research support proved invaluable.

After graduating from South Carolina in December, I moved out to Denver, CO to begin my career with Schlumberger’s PetroTechnical Services division as a Geomechanics Engineer. There has been a steep learning curve, but I’ve already contributed to numerous commercial projects as well as a few Society of Petroleum Engineers journal publications. Outside of work, I’m absolutely loving living in Denver and looking forward to the winter, when I’ll be renting a condo in the mountains for the ski season with some co-workers and friends.

Kathryn McCowan ’04

I’m a project executive with J. Calnan & Associates, a commercial construction management firm in the Boston area. After stints with a couple other construction companies and a few years in the geotechnical engineering field, I’ve finally settled into a company and career I really love.

In November I’ll be competing in my first Olympic-distance triathlon in Florida to raise money and awareness for the Crohn’s & Colitis Foundation of America. This is a cause that hits close to home for me, as my wife Nicole has suffered from Crohn’s disease for over 20 years. Anyone interested in more info can find it here: http://www.active.com/donate/trirockclearNT14/DConner73

David Conner ’98

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Robert M. Finks
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 symposiums, 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 in any other field to which they wish to apply themselves. We thank all those who have so generously donated to the Geology Department.