Welcome to another edition of the graduate student-run Rox newsletter. Fall colors have paved the way for what is hoped to be a fantastically snow-filled winter. In the months since the last edition, the department celebrated a handful of masterful students as well as welcomed a few fresh faces. This newsletter highlights our annual Stretch as well as reports on some of the exotic summer research locales listed in the previous ROX Newsletter. We’ve also included general updates from the Earth Sciences department as well as a word from our current Chair, Dr. Brian Dade.

Additionally, these summery to wintery months have bore witness to innovative ways the EARS department has endeavored to enhance our sense of community on campus. We have implemented a “tea”-rrific Thursday Tea Time where faculty and students mingle over hot beverages and bickies while discovering the miscible nature of scientific and social conversations. We have restored Geolunch to its original, savory intent. We have initiated a student-run group to assist with retention and recruitment. There were some exciting times in 2012, and we’re all excited for 2013.

Happy Reading!

Gifford Wong (Editor in Chief)
Margaret Baber
Alex Lauder
Justin Stroup
John Underwood
Dr. Brian Dade (Department Chair)
2012 has been a rewarding year for the Earth Sciences Department. Our (relatively) new Administrator in Chief, Patty Alves, is settling in, taking the reins, and cheerfully keeping us all in line. Thanks to the hard work and dedicated teaching by EARS faculty Feng, Hawley, Kelly, Meyer, Osterberg and Sharma, our intro courses have seen enrollments of many hundreds of students in total. This year’s Stretch field program, with an enrollment of 23 students, was our largest in recent years, and truly enjoyed by all participants. Just a few of the many more notable highlights of the year are as follows:

EARS Research Associate Professor Brian Jackson brought the Department into the news spotlight with an article on which he was first author, and which recently appeared in *Environmental Health Perspectives* (*EHP*). This ground-breaking study of arsenic in organic foods highlights the lack of US regulations for arsenic in food and indicates that in certain situations dietary arsenic exposure could be at levels of concern. In the week following publication of the article by Jackson et al., the *EHP* website had 23,000 hits, and Brian has since been the subject of well-received interviews appearing on NPR, CBS, WEBMD, and in print in *Consumer Reports* and *New Scientist*.

In 2012, the Department also successfully recruited two outstanding junior faculty members, Assistant Professors Erich Osterberg and Noah Planavsky. Erich has been with the Earth Sciences Department for many years as an Obering Postdoctoral Fellow, and then as a member of our hardworking research faculty. We now welcome Erich, wife Laura and young sons Owen and Elliot to the EARS family on a long-term basis. Erich’s research interests include ice-core chemistry and mesoscale climatology, with the aim of unraveling i) a history of precipitation variability and atmospheric circulation in the northeastern Pacific and ii), with EARS Assistant Professor Meredith Kelly, the response of the northwest Greenland ice sheet to climate change during the Holocene. Erich is among the most popular lecturers on campus, and currently teaches Earth History, Oceanography, and Meteorology, among other subjects.

Soon-to-be EARS Assistant Professor Noah Planavsky earned his PhD at UC Riverside and is currently a Postdoctoral Fellow at the California Institute of Technology; he will be arriving at Dartmouth in Fall 2013. Noah’s research interests include sedimentology and chemical stratigraphy, with a view to understanding the co-evolution of life and the environment on early Earth. Be sure that there will be more to come on this exceptional young scientist.

In closing, with not so much a highlight but rather a milestone, Professor Gary Johnson will be retiring from the Department at the end of this academic year. Gary has been at Dartmouth for 42 years, during which time he has supervised 41 undergraduate honors theses and 30 graduate theses, taught 17 different courses, and served as Departmental Chair at different times for a total of eight years. We here in the Department are grateful for his dedication and hard work over the years, and wish him well going forward. Gary would be delighted to hear from any and all alumni who wish to be remembered, and who want to wish him well on his next adventure!

As I say, 2012 was a rewarding year for the Earth Sciences Department. From all of us here to all of you…warmest wishes for a healthy and productive 2013!

Brian
Following the retreat of the Laurentide ice sheet through the eyes of EARS grad students
[Justin Stroup]

This fall one of the New England Intercollegiate Geologic Conference (NEIGC) field trips came to the Upper Valley to explore some of the glacial deposits associated with the retreat of the Laurentide Ice Sheet. Carol Hildreth, Laura Levy, Justin Stroup, Meredith Kelly and Mathew Bigl led the trip. Several dozen area professors, students, and professional geologists came and spent the day visiting eight sites throughout the Upper Valley. Despite the rainy weather everyone had a great time looking at the sedimentary deposits and talking about the local geology.

Two of the NEIGC field trip stops were in Hanover. At the DOC house, we looked at lake sediment cores collected from Occum Pond (http://www.youtube.com/watch?v=-TxEYt5Z4) and Post Pond (Lyme, NH). These cores provide a record of Glacial Lake Hitchcock which occupied the Connecticut River Valley about 15,500 - 13,500 years before present. We also walked from the DOC house north along the Connecticut River to the top of an esker (a landform that was deposited under the retreating icesheet) and into Pine Park. Here, along the creek, we examined a number of exposures to see Glacial Lake Hitchcock sediments and delta deposits.

The field trip was a great opportunity for Meredith, Laura, Justin and Matt to share the local glacial geology and discuss the regional pattern of deglaciation. After hearing about the trip, Diane Taylor of the Valley News wrote a nice article based on a walking tour of Pine Park with Laura Levy and Justin Stroup (http://www.vnews.com/news/dartmouth/2639204-95/lake-really-glacial-area).

The EARS Stretch in 2012
[John Underwood]

For decades now, the Earth Sciences department has been sending its undergraduates gallivanting across the world thirsting for knowledge, scenery, and most of all, science! This year, 23 students from the classes of 2014 and 2013 started their journey on the annual off-campus program in the Rockies of Western Canada. The group studied glaciers with Professor Bob Hawley (http://now.dartmouth.edu/2012/03/professor-bob-hawley-explores-secrets-of-the-sleeping-giants/) and Eric Lutz near Banff, Alberta. As has become the norm over the
past few years, the students were extremely impressed with the landscapes around them, including the glacial Peyto Lake, which one student claimed had water “bluer than the sky!”

From there, the students traveled south, crossing the U.S. border and landing in Montana for a glimpse at Glacier National Park (complete with grizzly bear sightings!) Montana and Wyoming consisted of multiple geological mapping projects including the well-established Bighorn Mountains segment with Professor Meredith Kelly (http://rookiemag.com/2012/11/why-cant-i-be-you-meredith-kelly/) and newest part of the stretch: Professor Devon Renock’s (http://www.flickr.com/photos/dartmouthflickr/6987709737/) Henderson Mountain segment. Next came a tour of several national parks with Professor Carl Renshaw, a trip through Owen’s Valley in California with Professor Brian Dade, and a foray through Nevada and Death Valley with Professor Leslie Sonder. The final stop on that list included an 8-mile hike across the lowest terrain in the United States with small groups of students taking gravity readings. Each segment provided the students with valuable insight into each professor’s research, as well as their own interests, fueling potential senior thesis ideas.

The trip wasn’t all rocks and maps however; as with any long trip, students needed to find strategies to occupy the long van rides. The first group activity of this stretch was making friendship bracelets for each other. By the time some of the later professors and TAs arrived, students had decorated their gear (and each other) with ornate designs. As the colder months approached, knitting became the new thing. By trip’s end, the vans and trailers were fully laden with carefully crafted hats, scarves, and balls of colorful yarn.

This year’s stretch ended with a visit to the Grand Canyon with professors Ed Meyer and Jonathan Chipman. For many students, this was the perfect culmination to the program. “What better way to end the trip than by walking through a billion years of time and seeing many of the same rock units we had seen previously? It tied everything together nicely!”

**Maggie Baber and Glaciers of Uganda**

[Alex Lauder]

Dartmouth Earth Science graduate students often play a role in pioneering research in distant locations. This past summer Maggie Baber’s research took her to the Rwenzori mountains of Uganda. At an elevation of over 5000m, the largest glacial system in Africa is found here. With her advisor, Professor Meredith Kelly, Maggie investigates the past ice extent of these rapidly disappearing glaciers. According to Maggie, Margherita summit, the highest peak in the range and third-highest in Africa, could lose its permanent snow cover within twenty years. The research team has a particular interest in tropical glaciers like these due to their sensitivity to climate change.
Maggie’s goal is to develop a chronology of past glaciation based on beryllium-10 exposure age dating. This recently developed technique takes advantage of the formation of this beryllium isotope on rock surfaces caused by high energy cosmic rays. Maggie explains that “cosmic rays constantly bombard the Earth, colliding into any material that is exposed to the atmosphere.” As a glacier recedes, previously covered boulders become exposed. A greater concentration of beryllium-10 indicates a longer length of exposure, and measuring the concentrations of a number of boulders can be used to determine when ice last covered an area. Prior to the field season, Maggie used imagery to map the study area and identify potential sampling sites (moraines).

Upon arriving in Africa, the team quickly set off to the mountains near Uganda’s border with the Democratic Republic of the Congo. During the 15-day expedition they were reminded by their porters that the remote mountains are revered by local residents who rarely venture up the highest slopes. In this collaborative project, Maggie and Meredith were accompanied by researchers who employ other approaches in investigating regional climate. Dr. James Russell (Brown University) and his graduate student, Shannon Loomis, spent the trip recovering temperature loggers from lakes to obtain a current record of climate impacts in the region. Maggie’s search for boulders took her to moraines 4000 m above sea level, and porters, who were from nearby villages, were excited to learn about her research. After Maggie taught the porters how to identify quartzite rock, they applied their new geology knowledge to find additional sampling locations. In total, Maggie was able to collect samples from 55 boulders.

Maggie plans to compare her resulting glacial chronology to other existing African glacial chronologies on Mount Kenya and Mount Kilimanjaro. She also hopes to compare temperature reconstructions from paleoclimate models to investigate the link between east African climate and glacial extent.
Graduate Student 2012 Summer Fieldwork

[Alex Lauder]

This past summer, Earth science graduate students conducted field research in diverse environments both near and far. For students, field research not only provides opportunities to learn from other researchers in exciting locations, it is a vital component in training young scientists on how to conduct thorough data collection and constructively revisit one’s experimental design.

In addition to Maggie Baber’s fieldwork in Uganda, featured above, other students conducted paleoclimate research in unique locales over the summer. In northwest Greenland near Thule, professors Meredith Kelly and Erich Osterberg, Eric Lutz (post-doc), Matt Bigl (GR ’13), Lee Corbett (GR ’16), Ellen Roy (’13), and John Thompson (’13) spent a month at various helicopter-supported field camps trying to unravel the history of the North Ice Cap, a small ice cap near the coast. They focused their efforts on collecting an ice core, sediment cores from lakes near the ice margin, fossil organic material embedded within the ice edge for radiocarbon dating, and rock samples from previously-glaciated surfaces for beryllium-10 dating. Recalling the successful field season Lee Corbett recounts, “We had a few spectacular campsites on ice-marginal lakes, and were entertained by frequent calving events right out front of our cook tent.”

Over 1000 km south of Thule, Annie Putman (GR ’13) and Ben Kopec (GR ’15) were also conducting fieldwork in Greenland. Annie Putman and Ben Kopec traveled to the town of Kangerlussuaq to continue a multi-year sampling effort of lakes around the region to understand the hydrologic cycle of the region. To investigate the water balance of lakes, they collected water samples and measured the stable water isotopic composition. Ben Kopec noted “the past year has been very wet, as opposed to a very dry time before sampling in 2011. This provides a great comparison to see how differences in the local climate and hydrologic cycle are shown through the lake water chemistry.”

Students also performed field research in locations across the United States. Hehe Jiang (GR ’13) and Sam Michalak (GR ’13) spent their summer field season in the Bighorn Basin in Wyoming as part of their project with professors Gary Johnson and Devon Renock investigating the development of the Cordilleran volcanic arc. They collected bentonite and tephra samples from Jurassic and Cretaceous strata which they believe were deposited in relation to the formation of the Cordilleran arc caused by the subduction of the ancestral Pacific plate. Closer to home, Jenica Andersen (GR ’13) and John Underwood (’11, GR ’13) studied river sediment transport in New England. Justin Richardson (GR ’16) spent the summer collecting soil samples...
as part of his investigation of mercury mobility and transport. He was able to sample from eight different New England peaks from the Green Mountains in Vermont to the White Mountains of New Hampshire in addition to a site in northern New Hampshire. Like other students who have now returned to Dartmouth, he is busy conducting tests and analyzing his newly acquired data.

On the left, Devon using an XRF in Wyoming. On the right, Justin Richardson getting his hands dirty. [SM; Dartmouth.edu]

**Department Updates**  
[Margaret Baber]

Congratulations to **Eirik Buraas (GR ’12)**, **Hannah Hallock (GR ’12)** and **Kelly Landau (GR ’12)**, on successfully completing and defending their Master’s theses this summer.

Buraas, along with advisors Carl Renshaw and Frank Magilligan, investigated geomorphic response of unregulated streams in Vermont to the flooding caused by Tropical Storm Irene. Buraas spent many hours in the field surveying cross-sections and interpreting the landscape. According to Buraas, the field-work consisted of “long days, remote locations, and cold water.” He added, “It was a great experience to be outside and to learn by doing.” Results of his study show that there is incredible variation in geomorphic response to flooding; 80% of the channel change occurred in areas above certain unit stream power and bank stress thresholds. Buraas is currently looking for fluvial geomorphology and consulting jobs.

Hallock, working with professor Mukul Sharma, measured levels of platinum group elements (mainly Re, Os and Ir) in sediment samples from the K-Pg boundary using thermal ionization mass
spectrometry. Hallock clocked more than a few hours in the clean lab, separating Re, Os, and Ir and measuring the low concentrations of her samples. Her results confirmed the location of the K-Pg boundary in samples from Stevns Klint, Denmark, and Hell Creek, MT. Hallock is currently applying to PhD programs in the Boston area.

Landau, also advised by professor Mukul Sharma, defended her thesis, titled “Insights into the behavior of osmium in the ocean” in July. Landau was unavailable for comment.

The Ears department welcomed 4 new graduate students this Fall: Ruth Heindel (GR ’17), Danielle Niu (GR ’14), and Jimmy Voorhis (GR ’14).

Heindel got a jump start on her research this Summer by working as a field assistant for Julia Bradley-Cook (GR ’14), a Dartmouth Ecology PhD student. Heindel spent six weeks in Kangerlussauq, Greenland, taking soil respiration measurements. Her research focuses on understanding the deglaciated landscape in the Kangerlussuaq region of West Greenland, and specifically how soil deflation may have responded to Holocene climate fluctuations. Heindel is advised by professors Meredith Kelly and Ross Virginia and will be heading to the Dry Valleys LTER site in Antarctica this January.

**Four Questions with Visiting PhD Student Clara Almécija Pereda**

[Giﬀord Wong]

The Earth Sciences Department welcomed a colleague during the fall term. She is part of the Grupo de Bioxeoquímica Mariña at the Instituto de Investigacións Mariñas (IIM-CSIC) in Pontevedra, Spain. Working extensively with Professor Mukul Sharma, she quickly became a friendly fixture in Fairchild. She has just returned to finish her thesis work in Spain, and here is a quick conversation about her science:

1) **What are you researching and what makes this interesting to you?**

   In my research I’m trying to improve the knowledge of the geochemistry of Pt in coastal environments. Pt is a very rare element in the Earth’s crust, and its use in catalytic converters has caused a huge anthropogenic input of Pt for the past 30 years.

   Human activities impact so much of the environment, and I think it’s really important to know as best as possible what this effect is. Catalytic converters greatly diminish the release of greenhouse effect gases caused by the combustion of fossil fuels, but I think it’s interesting to know what is happening with all this Pt that we are releasing and, overall, if there is any transfer via the food chain.

   There is no data in the scientific literature about some of the analyses that we are trying to do. This is an added interest to me. However it’s also an added difficulty, too. Thinking, “This is the first time that somebody is analyzing Pt or Os in porewater!” is my motivation when I lose all hope in the lab.

2) **What was your most recent conference presentation or poster?)**

   Before coming to Dartmouth, I went to the 9th International Symposium of Environmental Geochemistry in Aveiro (Portugal). It was my first oral presentation about my PhD study and I was frightened. After all of my nervousness, I ended up winning the prize for giving the best oral presentation. I don’t like being proud, but having other scientists recognize and reward your research is so nice!

3) **What is an interesting tidbit about yourself? Fun job from the past?**

   I don’t know! Before starting my PhD, I worked two and a half years on a small research vessel as a technician. It was a hard job, but I have so many wonderful memories! Once, we rescued a nearly-unconscious
shipwrecked guy with hypothermia. We tended to him until the helicopter arrived. Because of his hypothermia, I quickly undressed him because his clothes were wet and cold. All of the crew joked about this for months!

4) If you could go back in time and teach yourself something (say your 8th grade self), what would it be and why? (say, "you'd teach yourself differential equations because then you wouldn't have to take it now as a grad student? :D)

Ohhh, “Learn English, young Clara!” I always hated studying English vocabulary as a kid.

**Department Banter**

[Similar questions posed to our current crop of grad students …]

**How would you describe your studies?**

**Derek Smith (GR ’13):** I consider myself a Geomicrobiologist studying anoxic phototrophs in batch and continuous culture. Microbes have been and are instrumental and monumental in shaping the planet we know today, facilitating key reactions that had previously been assumed to be abiotic.

**Danielle Niu (GR ’14):** My research is looking at the diagenetic pathways that formed barite-iron sulfide assemblages in the Marcellus Shale. I think it's interesting because in thin sections of the shale, you can see barite, and framboidal and massive pyrite all coexisting together but it's not clear why or how they got there.

**Ali Giese (GR ’16):** [Writing from Scott Base, Antarctica, during my first field season] I research the past configuration of the Ross Ice Shelf in West Antarctica through vertical strain and temperature measurements (following an introduction to the latter with a project concerning thermal properties of Greenland snow). The past configuration of the ice sheet provides a powerful indication of its future response to anthropogenic climate change and, thus, to future sea level rise. Accurate projections are increasingly important because of the need to mitigate the effects of rising seas on coastal populations and agricultural lands.

**Hehe Jiang (GR ’13):** I’m researching on the Chronlogym sources and transport mechanism of mid-Jurassic - early Cretaceous tephras deposited in the Bighorn basin, north central Wyoming.

**Kristin Schild (GR ’16):** I'm a second year PhD student in the Glaciology group and I'm studying subglacial hydrology through remote sensing. This basically means that I'm attempting to study how water flows at the base of a Greenland glacier (something we cannot directly observe) by looking at satellite images of supraglacial lake drainages and ocean sediment plumes.

**John Gartner (GR ’13):** I'm in the Army now! I have a new part-time job at CRREL, the U.S Army Corps of Engineers Cold Regions Research and Engineering Laboratory, while I wrap up my PhD. I am studying ways to better define the "Ordinary high water mark" of the flash-flood prone streams in the southwest U.S. This ordinary high water mark sets the boundary of the federal jurisdiction over waterways by the Army Corps of Engineers. This complements my PhD research in fluvial geomorphology.

**What was a fun (unusual) job pre-Dartmouth?**

**Gifford Wong (GR ’14):** I used to work as a Federal wildland firefighter. My last firefighter gig was with a USFS/NPS joint heli-rappel crew based in Jackson Hole, WY. That was fun, rappelling ~200’ from a hovering helicopter (A-Star B3) to fight a fire in the Wyoming wilderness. And then there’s HeloOps in Antarctica, where I met John Gartner, young scientist, in 2002. Who knew we’d be working side-by-side in NH 10 years later?
AG: I took time off from college to backpack with troubled youth in the Utah desert.
JG: Mint Fairy at the Rustler Lodge at the Alta Ski Area.
Laura Levy (GR ’14): I used to work for Grand Canyon National Park studying acoustics in an effort to reduce noise pollution from air tours, buses, and other human-induced noises.
DS: I used to do demolition using sweat, sledge hammers, and crow-bars to gut turn of the century apartment buildings (all the while being covered in soot, plaster dust, asbestos, and general grime).

If you could go back in time and teach your 8th-grade self something, what might it be?
DS: Be patient and be resilient, good things come to those who wait, it was the tortoise and not the hare that won the race.
DL: Stop using floppy disks. Look into this "e-mail" thing.
LL: I wish I learned how to juggle- it is a good way to entertain people in the field.
LC: If I could go back in time and teach myself something, I think it would be Greenlandic. I've now been to Greenland four times, but can't seem to pick up any of the language (it's incredibly difficult). I feel like I could understand the place, culture, and people so much better if I knew the language.
JR: If I could go back in time, I would force myself to learn how to read and speak another language: Mandarin, Hindi, or French. There is no better way to bond with someone than to speak their language, literally. And, speaking those languages could help you meet around a billion new people.
AG: Travel more!
HJ: I'd like to teach myself cooking so that I would not be such a bad cook now, ha.
GW: I would’ve told my California-living, 8th-grade self to learn how to cross-country ski or ice skate … because either would’ve helped with New England winters and Antarctic summers!
JG: I would teach myself how to program!