

Petroglyphs



2016-17

# PETROGLYPHS

2016-17 EES Newsletter

6<sup>th</sup> Edition

## Message from the Chair: Peter Drzewiecki

I hope this Newsletter finds you well and enjoying summer in New England! We have had a very busy and productive year in the Environmental Earth Science Department at Eastern. About 15 new EES alumni have entered the work force, and they are being followed by a cadre of talented students who are still working toward their degrees. For several years now, the department has been stable in terms of faculty, and we are really seeing the pay-off. The Sustainable Energy track has begun to strengthen and streamline its curriculum. Faculty have been around enough to develop sustainable research programs that involve undergraduate students. For example, this year 36 students (out of about 90) were engaged with faculty in some sort of experiential learning opportunity, including undergraduate research, practica, internships, and service learning projects. Seventeen students presented their work at both Eastern's undergraduate research conference (CREATE) and at professional conferences. Faculty continue to be active in research as well. This past year, we have collectively contributed 18 papers, guidebooks, and conference abstracts to the geoscience literature. I can truly say that it is a privilege to work with people so dedicated to their discipline and to the success of their students.

Our alumni are great as well! Over 35 returned to Eastern in May to attend the year-end celebration in which we honor our students for their high achievements. It was exciting to see such a crowd. We appreciate the support that alumni have shown our students. The greatest way you can help our department is by being there for our students! Whether this is done by coming to campus to address students, or by being available to help if they apply to work at your company, any help or advice you can give them is appreciated.

This Newsletter is a brief summary of the many wonderful things going on in the department. It covers our own, as well as our students' research, and highlights activities within the department. I hope you enjoy reading about how much things have changed since the "good old days" when you were a student in the department, whether you measure that in months, years, or decades. Enjoy! And if you are ever near Eastern, don't be a stranger. Stop in and tell us your news.

**Inside this issue: Faculty Highlights, Student Research, Iceland and Arizona Trip reports and other notable events and achievements!**

## FACULTY HIGHLIGHTS

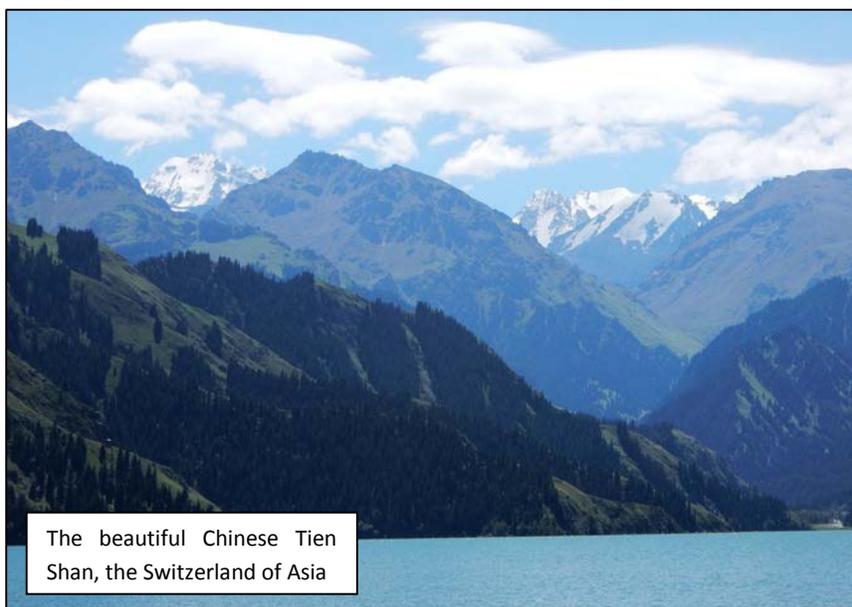
### Dickson Cunningham

Another year has rolled by and our department is on very firm footing with many individual and collective accomplishments to report. For myself, the last 12 months have been extremely busy both professionally and personally, but also very fulfilling and rewarding. At the start of this year's annual news cycle, my ambition of starting an undergraduate field trip to Iceland was realized and 16 students and 3 faculty spent 11 days exploring the amazing geology and scenery of south Iceland. Please see the separate trip report in this newsletter for more details of our adventure. Following the Iceland trip, I spent 3 weeks



Professor Goofyose in front of the Kviarjokull Glacier, EES Iceland trip

carrying out research in western China. This was my 19<sup>th</sup> field season in Central Asia and this time I was working in the stunningly beautiful eastern Tien Shan and hyper-arid margins of the Turfan Depression. My research in China is supported by Chinese grants and this year I was working with uranium geologists interested in sandstone-hosted 'rollfront' deposits. I was invited to help resolve the structural/tectonic context of the known deposits and help in the exploration for new deposits. This was an unusual field season in that we visited basal uranium occurrences in and around the Tien Shan, and also examined the thrust systems and transpressional deformation higher up in the mountains. We carried out a number of detailed transects across remote ranges that have been



The beautiful Chinese Tien Shan, the Switzerland of Asia

scarcely studied and saw many impressive folds and thrust/oblique-slip faults and documented the Neogene reactivation of the region. The higher ranges of the Tien Shan are cool and forested with colorful Kazakh villages and impressive alpine scenery including many glaciated summits. I have been to the Tien Shan before and have always thought of it as the Switzerland of Central Asia.

We spent a few memorable days in and around the Turfan Depression which is famous because it is the second lowest place on Earth and annually records China's highest temperatures. We weren't disappointed by the heat and one day we trekked more than 20 miles in extreme 115°+ temperatures. This is no exaggeration. It was 45°C (113°F) when we started at 8:30 am and got hotter during the day probably reaching at least 120°F by mid-afternoon! This was a poorly planned death march up a canyon with no water, nor life of any kind – not even a blade of grass. I was not told at the outset of how far the Chinese planned to hike and suffice it to say, the day became a physical ordeal and an exercise in survival.



17,000' summits of the eastern Tien Shan rising above the northern margins of the Turfan Depression, western China

A few of the Chinese geologists barely made it out alive and had to be put to bed for 2 days and rehydrated. After we returned to our base that night in a town called Toksun, all agreed that it was the hardest field day of our careers. I believe I saved my life by carefully rationing my water, wearing a wide-brimmed hat and regularly monitoring my pulse to make sure I wasn't reaching a state of heat exhaustion.

While in China I gave a live-translated lecture to geologists of the Xinjiang State Geological Survey and China National Nuclear Agency. I was also invited to eastern China for 5 days where I gave three lectures to geologists at the China University of Geosciences, Center for Global Tectonics. The China University of Geosciences is the largest center of geological study and research in the world and is ranked the top university in Geoscience in China. It is an impressive institution with more than 44,000 undergraduates and graduate students investigating every possible geoscientific discipline. The campus is huge and has every kind of geochemical and geochronological laboratory and many research groups of high international standing. My visit there was very stimulating and I established new contacts and future collaborations.

During the past year, I published a paper with Chinese colleagues in *Tectonophysics* on the North Tibetan margin and how the plateau is expanding both laterally and vertically. I also published a paper in the relatively new open-access on-line journal *Geosciences* on folded basinal compartments in the virtually unexplored north China-south Mongolia borderland region. I also co-authored a paper in the journal *Landslides* with Chinese collaborators on landslide risks in Nepal following the Gorkha 2015  $M_w$ 7.8 earthquake. I presented a poster at AGU in December in San Francisco on my Gobi Corridor neotectonics research and gave a talk at the CCSU Faculty Research Conference in March. At the time of writing, I am sitting in the departure lounge in Sao Paulo, Brazil on my way home from Iguassu Falls where I spent 2 days visiting one of the great natural sights of the western hemisphere. Iguassu Falls dwarfs Niagara and

中国地质大学(武汉)全球大地构造中心  
Center for Global Tectonics, China University of Geosciences

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**Invited Lecture Series, Wuhan**

**学术报告**

**Academic Activities**

**Dyke Swarms: Keys to Paleogeographic Reconstr...**

The theme of the Seventh International Dyke Conference (IDC7) is 'Dyke Swarms: Keys to Pal...

2015-12-09

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sits on the Brazil-Argentina border surrounded by pristine rain forest. There are more than 280 individual waterfalls as the Iguassu River pours over a mile-wide eroded escarpment of the Parana basalts. I am here because I was invited to Brazil to give a keynote talk at the bi-annual Simposio Nacional Estudos de Tectonicos (SNET) in Salvador, Bahia state. This was the 30<sup>th</sup> year of SNET and fortunately the Brazilians funded my trip which enabled me to stop at Iguassu on the way home.

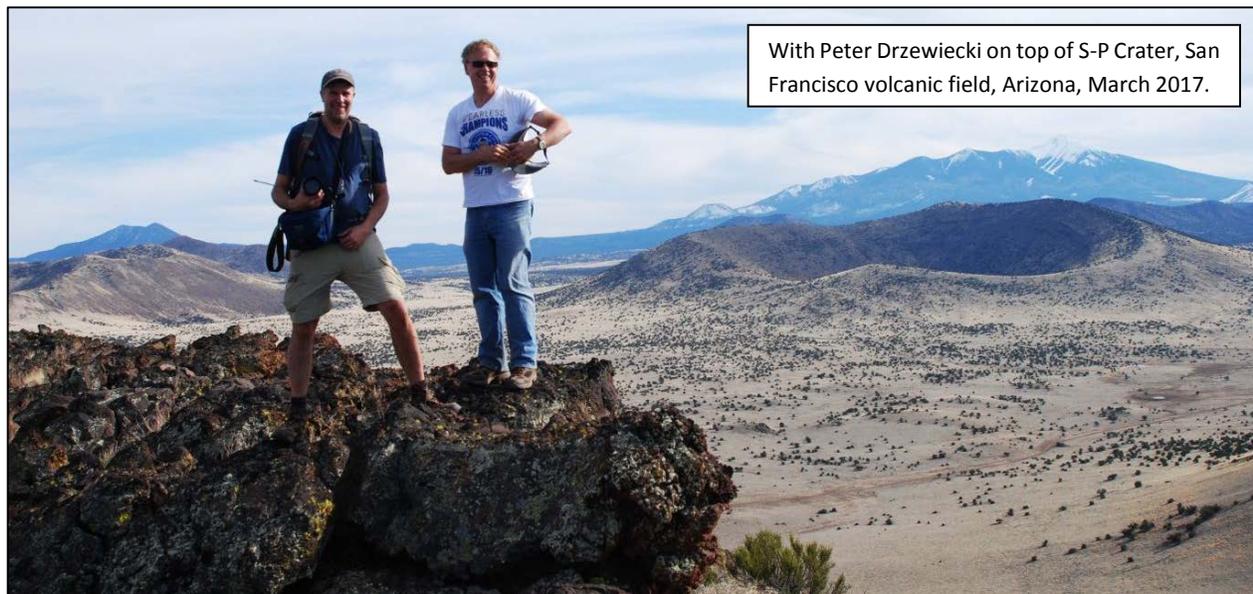
At spectacular and thunderous Iguassu Falls, Brazil, May, 2017. When Eleanor Roosevelt visited in 1944, her first words were "Oh, Poor Niagara".



Another highlight of the past year was a return trip with 9 EES students to Arizona in March. This was the second time we have taken students to Arizona and we had an action-packed 10 days exploring the state's incredible geological diversity. Please also see

the separate account in this newsletter for further details about that trip. I also had 2 undergraduate students work with me this year on independent research projects. Kevin Lacy carried out a structural study of the Lantern Hill silicified fault zone in North Stonington and documented multiple stages of veining and brittle fracturing within a major paleo-hydrothermal system. Luke Davis carried out a multi-faceted independent project in preparation for his planned career as an earth science teacher. Luke developed several sample-based learning units for school children using minerals and fossils, created a Google Earth exercise for middle-high school kids, and helped design a new EES corridor display on

important minerals and igneous and metamorphic basement rocks of Connecticut. His project also involved several sampling trips to pegmatite quarries in eastern CT.



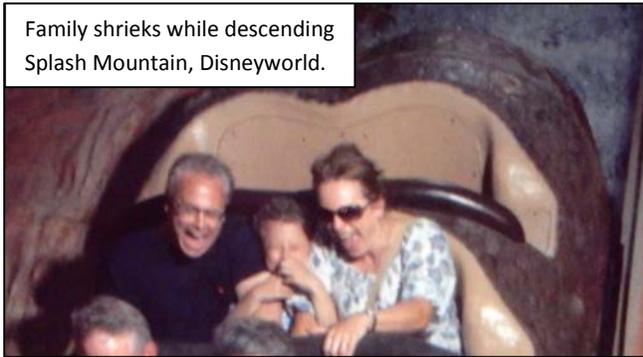
With Peter Drzewiecki on top of S-P Crater, San Francisco volcanic field, Arizona, March 2017.

I continue to teach an introductory geology course and upper-level hard-rock petrology/mineralogy and structural geology with some tectonics thrown in. The annual spring field trip is now a regular EES course and I hope to lead future return trips to Arizona, Wyoming and Iceland and potentially new courses to the White Mountains/coastal Maine, Nepal Himalayas and possibly Slovenia (eastern Alps, karst region), where I worked extensively 10-15 years ago.

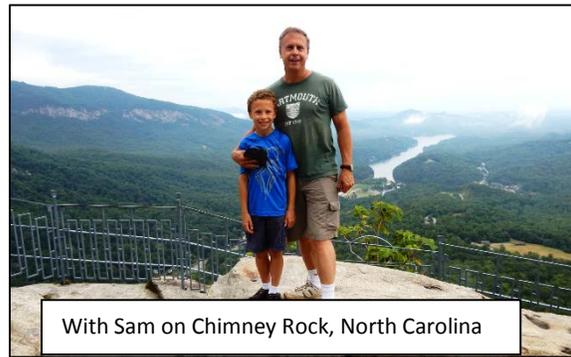
On the home front, my wife, son and I enjoyed a summer vacation in the southern Appalachians and Florida. In North Carolina, we hiked along the crest of the Great Smoky Mountains, visited family in Hendersonville and then drove to Florida and did the usual Disney-ride screaming, hotel-pool splashing and swamp-gator gawking. Back home, we travelled widely in Connecticut during the last 8 months because our son had ice hockey games all over the state. We never expected to become hockey parents, but we are now hooked and enjoying the excitement of the sport and getting to know the other families involved. When time permits, we are busy with our home life in Lebanon and have expanded our fruit and vegetable gardens and made other improvements to our property.

EES is firing on all cylinders and we continue to enhance our curriculum, expand our experiential learning through exciting field trips and undergraduate research opportunities, and further strengthen our department community with various events during the year. The department was proud that our eminent and always serious Peter Drzewiecki was voted ECSU's Distinguished Professor of the Year. Many of our students also received awards and our Sustainable Energy program was highlighted by Paul Torcellini during the spring, 2017 University meeting, further raising the profile of the department. I was awarded the 2017 ECSU creative/scholarly activity award. All faculty in the department contribute in so many ways. I think it is fair to say that EES is a thriving department led by hard working and dedicated faculty who

distinguish themselves in their individual fields and commitment to undergraduate education. In September, I succeed Peter Drzewiecki as Chair and look forward to taking the department forward as we continue to build and strengthen all that we do, building on the solid foundation we have already established.



Family shrieks while descending Splash Mountain, Disneyworld.



With Sam on Chimney Rock, North Carolina



Chinese field vehicle which EES is hoping to order for future undergraduate field trips.

## **Peter Drzewiecki**

As time goes on, life at Eastern seems to get busier and busier. The 2016-17 academic year was no exception. The summer of 2016 featured travel to 3 separate countries: Iceland, Spain, and Bermuda. As you have undoubtedly read in this Newsletter, Dickson Cunningham, Drew Hyatt, and I led a student group from Eastern to Iceland – the land of fire and ice. And trolls. The students had a great time exploring volcanic and glacial geology embedded in a quasi-European culture. The scenery and geology were spectacular, and students and faculty alike learned much. My favorite part of the trip was the hike to the top of Eldfell Volcano – a cinder cone that erupted in 1973. The students were quick to point out that their professors were older than the mountain! The only complaints would be the lack of lithified sedimentary rocks and the exorbitant cost of beer! A week later I headed to Spain to provide sedimentological support to a new interpretation for the formation of an anticline that is rapidly becoming a classic geology site in Europe (and to buy much cheaper beer). This structure, traditionally interpreted



**Above: The three stooges (Cunningham, Drzewiecki, and Hyatt) in front of Kiviarjokull, Iceland. Right: Relaxing on a bed of Cretaceous rudist clams after a long field day near Miravete de la Serra, Spain.**



to have formed by inversion of an older rift basin, is now interpreted as a salt-related feature. The structural geologists who were investigating the anticline asked several sedimentologists to come and see if their interpretation was confirmed by the syntectonic sedimentary deposits. It was, and we are now working on a paper! The trip to Bermuda was a cruise celebrating my father-in-laws 80<sup>th</sup> birthday! We had a blast on the boat, as well as on the island. There is something very attractive about the seemingly stress-free tropical island lifestyle. Other than dealing with the lack of freshwater on the island and an occasional hurricane, it is hard not to relax. Although the purpose of the trip did not include any geology, I did get to impress my teenage kids and their cousins by winning multiple free rum swizzles (official Bahamian drink) by answering questions about the geology of the island correctly on one of our side excursions. They now see a purpose to geology – getting free drinks! In addition to these three foreign excursions, we managed to visit family in Buffalo, spend a week on the coast of Maine, climb Mount Washington (a family goal for several years now), and survive a few intense weeks of the Pokémon Go craze.



**Left: Sun, boats, and crystal clear blue water in Ely's Harbor (Bermuda) where we kayaked with sea turtles.**

**Right: Bermuda's Royal Naval Dockyard on Ireland Island North, where the ship docked.**

September rolled around and school started. The family settled into the daily routine that directs our lives for most of the year. I once again helped lead a field course in Spain for Statoil in September. I also served my final of four years as department chair. I taught Ancient Environments in fall and Sedimentology and Stratigraphy in spring. In addition, I had two students engage in undergraduate research. Martha Denisky investigated the Triassic/Jurassic paleoecology of the Hartford Basin. She examined nearly every fossil found in CT museums, and combined it with the sedimentary and geochemical work I have been doing for years. It was a monumental task! Chris Kaminski worked with me examining 6 cores and an outcrop of strata located near the edge of the Hartford Basin. We observed a location of long-term coarse sedimentation adjacent to the fault, which we interpreted to be related to the proximity of a relay zone between two segments of the Eastern Border Fault. During spring break, Dickson Cunningham and I embarked on another field trip with students to Arizona. We visited the Grand



**Above: Silicified log at Petrified Forest National Park.**

Canyon, Sunset Crater, Meteor Crater, several ancient native American cliff dwellings, and several mining communities. My favorite place, though, was petrified Forest National Park, for both its spectacular geology and its raw beauty. The highlight of the year for me was when I won the 2017 Distinguished Professor Award at Eastern at the end of the spring semester.

My family continues to grow up! My oldest daughter (Kaela) just completed her Junior year at Franklin and Marshall College, which included a semester in

Copenhagen. My oldest son (Aiden) graduated from high school, earned his Eagle Scout rank, and will begin studies in Engineering at UConn next semester. My daughter Shelby completed her sophomore year of high school and has college-hunting and driving on the horizon – two things she is very excited about (to my dismay). My youngest son, Max, finished sixth grade and found a new love in lacrosse

because, in his words, “I can hit people with the stick”. My wife is a state auditor, and has recently been assigned to UConn. This cut her commute time and provides some stability. Finally, we gained two new family members – Sammie and Charlie – two kittens who arrived in September. They are grown now, but are still full of energy and have a way of driving our family (especially the dog) nuts!

I hope you are all doing well and had a productive year. If you ever get to Eastern, stop in and say hi!



## **Drew Hyatt**

Well another year has passed in a flash! As usual, the past 12 months have been busy, engaging, and for the most part fun. This past academic year started with a bang as I participated in the 3<sup>rd</sup> summer field excursion to Iceland (EES 270), this year led by Drs. Cunningham and Drzewiecki. As described by Dickson elsewhere 16 EES students travelled to many sites that reflect the impressive internal and external geologic processes that shape a truly spectacular landscape. Come by and check out the display on the second floor of Science that includes images from the first three field courses to Arizona, Wyoming, and Iceland. Following the class, Trudy (on our own dime) joined me for six additional days in Iceland. We revisited some sites and hiked new locations viewing many spectacular waterfalls, coastal settings, and glaciated areas in south Iceland. What a fantastic country to visit.

Upon returning from Iceland, it was time to prepare for fieldwork at Napatree Point in Rhode Island, a collaboration with Bryan Oakley, and Dufford Quarry in Glastonbury (collaborating with Peter Drzewiecki). Projects at both sites involved several EES students and utilized new digital photogrammetry techniques to map the size, shape and micro-topography of selected geologic targets. This involves collecting many high quality, overlapping images of the target. Images are aligned to generate dense point clouds that consist of millions of survey-grade points. Point clouds are used to build photo-realistic computer models for representation, measurement, and manipulation. The first site, at Napatree, examined an eroding till-cored bluff. Jennifer and Haley collected images and supporting survey data to build preliminary point clouds and models. Unfortunately, Haley was not able to do a follow-up project, but 2016 data sets are supporting new student research at the site. Fieldwork in Glastonbury involved all three students, although Jennifer Croteau was the principle, completing two follow-up practicum classes. Jennifer always keep me on task finally presenting her research at the spring 2017 CREATE conference.



Celebrating Hannah's graduation day at Plymouth in May.

The year was also full of change for our family. Hannah graduated in the spring of 2017 with her B.S. in Biology from Plymouth State University, and took up a summer job guiding zip-line tours in South Carolina (a break from undergraduate research on horseshoe crabs, which occupied her previous two summers). It was also Hannah's senior year on the Plymouth State varsity volleyball team. We went to as many games as we could and cheered them on all the way to the Little East Conference finals that ultimately did not go Plymouth's way. We also visited my son Jake in Ottawa as he continues to recover from a concussion. We are lucky and fortunate to have two great kids, both of whom make us very proud.

This coming year is off to a good start. As some folks know, I have worked with several students at Dinosaur State Park for a number of years. Recently, through collaborations with James Farlow (Indiana-Purdue University) I have been building new photogrammetric models of the tracksite. James and I are preparing a book proposal that will draw together contributions from a variety of researchers (including Peter Drzewiecki) that have examined the DSP site. As well, some early work from the park is included in a recent field guidebook published by the Connecticut Geological Society in April of 2017. This is a great organization and I encourage any former/ongoing students to join – simply visit the society website for more info (full disclosure: I am the society's secretary this year). In addition to the DSP work, I am really enjoying working collaboratively with department colleague Bryan Oakley at sites in Rhode Island (both Napatree point and now on Block Island). Finally, I am looking forward to teaching Process Geomorphology this coming fall semester, and have begun to think about developing a geoinaging/geoinformatics course that introduces more students to some of the new and amazing things that can be done with imaging in the geosciences.

That is most of the news for me; have a great year, stop by if you can, and, as we say in the business, Rock on!



A quick dip in the Blue Lagoon seemed the perfect way to start the Iceland course.



Left: The motley crew minus moi on a volcanic tumulus south of Reykjavik. Below: Now that is a wool sweater!; some of the local inhabitants on Heimaey





A view of the town and cinder cones behind. The class hiked up the cone to the left (Eldfell).



Connor, Kevin, Rachael, Sydney and Kevin in front of the Kiviarjokull.

Views of Jennifer Croteau (top and bottom) and Haley Celotti while conducting field and laboratory work at Napatree Point and at Eastern.



## **Meredith Metcalf**

As I complete my 6th year of teaching at Eastern, I'm realizing that every year it becomes a little harder to wish our graduates well as they continue their life journey and begin their new adventure. Some of these graduates I have seen consistently or had in class for the past four semesters. Thomas Jefferson said, "friendship is precious not only in the shade but in the sunshine of life; and thanks to a benevolent arrangement of things, the greater part of life is sunshine." We've endured clouds and sometimes rain together – but the sunshine we share warms my face, and my heart.

I've continued to work closely with Bill Warzecha (EES, Class of 1976) from the Connecticut Department of Energy and Environmental Protection and Margaret Thomas, Connecticut's State Geologist. As part of the Arsenic Working Group, we have been working with additional colleagues from the University of Connecticut, Central Connecticut State University, the USGS, and the Connecticut Department of Public Health to enhance our understanding of arsenic in domestic wells across the state. Given the results from the two previous summers, I worked with Madeleine (Maddie) Haynes and Jennifer (Jenny) Petrario to statistically evaluate arsenic concentrations as a function of rock type by comparing concentrations observed for two towns with similar lithology. Typically, home owners are encouraged to test their wells for certain parameters, including arsenic, based on the underlying geology. This may be the case for parameters that are only found in the rocks but this is not necessarily true for groundwater contaminants that may also be anthropogenic. As such, Maddie and Jenny assisted in the collection of well water from residents across the town of Bozrah in the summer of 2016 and Maddie analyzed this data as an independent study research project. Maddie statistically evaluated data accumulated over the past few summers and presented these results at several professional conferences. This work was presented at the Northeast Regional Undergraduate Research, Scholarly and Creative Activity Conference in North Adams, Massachusetts, the American Association of Geographers Conference in Boston, the National Council for Science and the Environment Conference in Washington, DC, and Eastern's CREATE Conference.

This summer I will be working with Luke Davis and Christopher Kaminski to evaluate groundwater contaminants for the northeastern towns of Connecticut, specifically Eastford and Pomfret, where the hydrogeologic characteristics and historical land use are similar to Lebanon and Bozrah and arsenic has been known to occur.

In addition to research, we have had (and continue to have) many students completing internships focused in geographic information systems (GIS). Last summer Jenny Petrario completed an internship for the City of Hartford's Department of Public Works, Kevin Lacy completed an internship with the Town of East Lyme, and Maddie Haynes completed an internship with the Department of Energy and Environmental Protection. Student's within EES have outshined many other students across the state. As such, EES received a grant which allows students with GIS skills to complete internships during the academic year, under the supervision of Keene Morrow, for the Land Acquisition & Management Office of the Commissioner for the Department of Energy and Environmental Protection. To date, 14 students have participated in this internship (some for two semesters). Students are primarily responsible for creating much needed parcel data for the DEEP's Wildlife, Park, and Forest areas mandated in Public Act No. 14-169. The GIS



Dubrovnic, Croatia



Roman Colosseum

parcel data is available to the public through the Public Use and Benefit Land Registry web application.

Last summer my husband and I were in the Mediterranean on a traveling odyssey. This trip included cities we had never been including Dubrovnic (Croatia), Sarande (Albania), Nafplion (Greece), Corfu (Greece), and Olympia (Greece). In escaping the winter's cold, I always look to travel to places where I can learn new things and what a better place than Mexico's Yucatan. There I learned of Chichén-Itzá, meaning "mouth of the well". Like all great civilizations, the Mayans built theirs' on a great supply of water and quarried megalithic stones to build structures to their gods. What a bonus that the local food and culture was a unique way to ring in the new year!

Again, this year, I also helped chaperone my husband's annual Spring Break travel-study abroad program in March to

some of my all-time favorite locations – Rome, Florence, the Amalfi Coast, Pompeii, Athens, and Santorini to name a few. This was the same trip that Kelli O'Brien ('12) and Emily Kapostas ('13) completed in 2013. This year Maddie Haynes and Jenny Petrario joined us on this trip, having received scholarships. The program always balances historical and architectural aspects but cannot escape the geological and sustainable components incorporated in the development of these past and current civilizations. Did you know, that the Romans invented concrete almost by mistake after the 79 AD eruption of Mount Vesuvius; perfecting the mix of pozzolana ash, lime slake, and water to harden like stone revolutionizing the Empire's construction? During the waning years of Rome, the Colosseum structure was bored into to retrieve bronze pins and attachments as knowledge of metallurgy slipped away. We also traveled to Mykonos where the inhabitants capitalized on the winds of the Cyclades Isles. Here the windmills were used for grist of wheat and barley; Mykonos was a must-stop for ancient traders for "*paximadi*" (Greek), namely dried



out bread which could be preserved for months. The grist stone is granite, native to the Island with local naturally-occurring barite (barium sulfate) used as a lubricant. You can't escape the geology!



My husband and I last summer (upper right) and Maddie and Jenny this Spring Break (lower right) in front of the iconic windmills in Mykonos, Greece.



## **Steve Nathan**

2016-2017 was a busy and exciting year for me! I went on several wonderful trips, worked with students on two great research projects during the summer and academic year and had a wonderful time teaching in the classroom.

During June 2016, I joined my colleague Associate Professor Bryan Oakley and students Emma Avery and Brynn O'Sullivan for fieldwork on Block Island, Rhode Island. Our project was a pilot study to gauge the feasibility of using microscopic marine organisms called foraminifera, as a proxy for measuring the severity and/or frequency of historical tropical/extratropical storms, and in turn, climate change upon Block Island and Block Island Sound. We spent two and a half days collecting a dozen sediment grab samples and four sediment cores from Sachem and Middle Ponds on Block Island. One core from each pond was later split, photographed, described and sub-sampled for analysis by Emma. She continued this summer research as an independent study during the fall 2016 semester and will make it the focus of her senior Honors Thesis. The project is funded in part by Eastern Exemplary funds for undergraduate summer research (2016 and 2017) and by a 2017-2018 faculty research grant from CSU-AAUP (Connecticut State Universities-American Association of University Professors).

Following Block Island, in July 2017 students Alex Fazzino and Dan Scribano joined me on a project to investigate the geothermal properties of bedrock within the Hartford Basin. Geothermal energy is a sustainable resource, available 24/7. However, the design of efficient geothermal heating and cooling systems is lacking due to a poor understanding of the thermal conductivity of bedrock found in southern New England.

Alex and Dan helped identify, retrieve and analyze bedrock cores (test borings) that are warehoused by the City of Hartford's Metropolitan District (MDC). They took nearly 300 images of the bedrock cores, described cores found within 28 coreboxes, and used a rock saw to cut 30 samples for later analysis at the University of Massachusetts Amherst. Alex continued his summer research as an Independent Study during the 2016-2017 academic year. He made over a dozen thermal conductivity measurements and created two dozen high resolution, full sized photomosaic images of the coreboxes. Alex presented his research at the April 2017 Eastern CREATE Conference. Much of this project is done in collaboration with my colleagues at the UMass Amherst XRF laboratory (i.e., X-ray fluorescence spectrometry; located in the Department of Geosciences) and the Massachusetts Geological Survey.

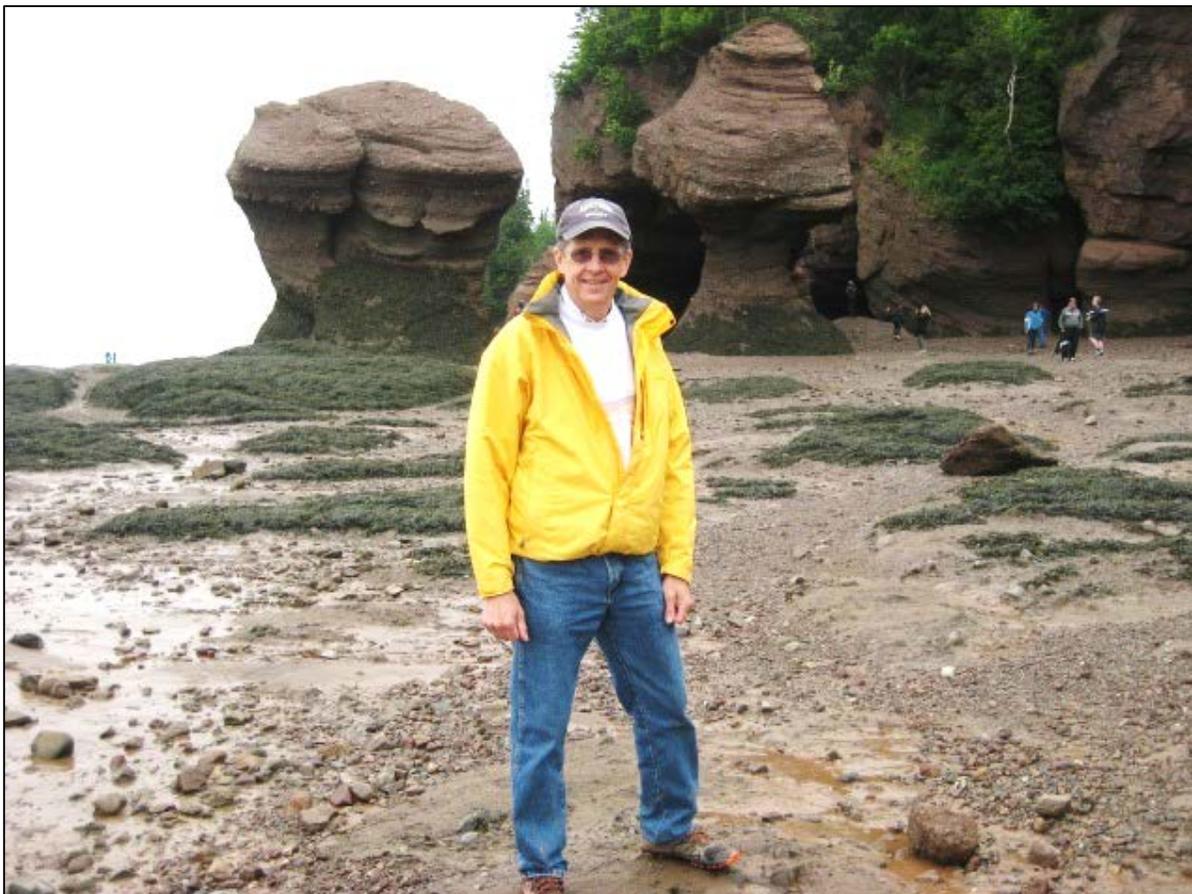
Regarding my teaching, last fall (2016) I taught Oceanography for the first time at Eastern. The students gained awareness that the ocean isn't just a resource for our species to utilize, it is a complex and dynamic system that is vital to the wellness of all life on Earth. I also continued to upgrade my advanced course, EES 402 Energy Issues in Geoscience, with student active projects in geothermal energy and fracking for oil and natural gas. This summer (2017), I am preparing to teach EES 130 Ancient Environments (a.k.a. Historical Geology). I'm covering the class for my colleague, Professor Peter Drzewiecki, who will be on sabbatical next fall. I am very much looking forward to the challenge of meeting Peter's high standards in teaching this key introductory course for EES majors.

To further my research skills in micropaleontology, this past spring I attended the conference "Geologic Problem Solving with Microfossils IV" in Houston (April 4 to 7, 2017; sponsored by North American Micropaleontology Section of SEPM - the Society for Sedimentary Geology). This meeting brings together industrial and academic micropaleontologist from across the globe. Held every four years, this

is *the* conference to hear presentations, view posters and expand professional networks in this highly specialized scientific niche that ties energy exploration with paleoclimate and paleoecology.

On a personal note, this spring (2017) I was granted tenure and promoted to Associate Professor of Energy Geoscience. I am very honored by these awards and it's my intent to continue serving our students, my EES colleagues and the University.

Remembering there is more to life than just work, last summer my wife and I traveled to Nova Scotia and New Brunswick. Canada is beautiful. We explored Halifax, Peggy's Cove, the Bay of Fundy's infamous extreme tides and Hopewell Rocks (see image; yes, you can literally watch the water rise, or fall, on the scale of ~45 feet in just six hours, remarkable!). We also took in Campobello Island, the summer home of FDR (before he became president). During winter break we made a quick five day trip to Old San Juan, Puerto Rico. The island's climate is wonderful (i.e., how can you argue with leaving a negative 8°F windchill at Bradley Int. Airport, and after a 3.5 hour direct flight, be under coconut trees swaying in an 80°F ocean breeze). The old city is also a historical treasure (Spanish forts, vintage hotels, parks and museums); I highly recommend P.R. as a quick and economical winter getaway.



Steve at Hopewell Rocks, Bay of Fundy, New Brunswick.

## **Bryan Oakley**

Wow! Why is it when we look ahead to the end of the semester it seems to arrive at a glacial pace, yet the beginning of the semester seems like yesterday? This was a busy academic year; in addition to my introductory courses, I taught Coastal Geologic Hazards in the spring 2017 semester. On the home front, my kids continue to grow; Aidan is 7 ½ and Haley is approaching 4 ½, and they give my wife and me lots of fun and fast times (and even furious times!)! Aidan is counting the years until he is old enough to be Dad's field assistant at the beach, and Haley is just trouble (in a good way!). I just returned from a vacation on the Kenai Peninsula in Alaska, and while I was there taking in the local geology and wildlife, I partook in my other passion, which is fishing, and landed a few halibut, some pacific rockfish, and the oddity of the trip was a 50lb Giant Pacific Octopus (see photo below)!



In front of the calving face of the Portage Glacier

My on-going research projects are focused on monitoring the shoreline on Block Island (collaborating with volunteers), Napatree Point and Misquamicut State Beach. Both the Napatree and Misquamicut research have been assisted by numerous students over the years. Misquamicut is currently part of research being undertaken by EES student Mike DePinto. On the Napatree front, I have been named to the science advisory panel for the Napatree Point Conservation Area, and the Watch Hill Conservancy has funded my on-going monitoring at Napatree through 2018. Dr. Hyatt and I are continuing to use photogrammetry to evaluate changes to the bluff at the western end of Napatree Point. The projects there have expanded in scope beyond shoreline change. EES student Jennifer Croteau began a project in the spring of 2017 examining the vulnerability of the salt marsh within the Napatree Lagoon to sea level rise and crab predation. Additionally, EES student Madie Varney is going to begin a project examining the evolution of the barrier spit that enclosed the Napatree lagoon following the 1938 Hurricane. The partnership between Eastern EES, the University of Rhode Island Coastal Institute and the Watch Hill Conservancy

remains a great asset to the department and will continue to provide student research opportunities in the future! The research on Napatree has garnered significant local and national attention. Locally, the Coastal Institute at the University of Rhode Island has named Napatree a designated example of natural coastal resilience and has commissioned a documentary on Napatree, which will be released in the fall of 2017, so stay tuned!

Outside of Eastern I continue to be involved with the Rhode Island Shoreline Change Special Area Management Plan, which we hope will become a national model of science-based policy, aimed at guiding sustainable development along the RI shoreline. This past year my colleagues and I completed maps ‘projected’ shoreline change for the south shore of Rhode Island, which depict the future position of the shoreline under both the historic and accelerated rates of shoreline change. These maps will hopefully serve as guidance for coastal communities and stake holders as they look to further develop the shoreline.



This project, and other aspects of our research have led to a handful of publications with my Ocean Engineering colleagues on coastal risk in the *Journal of Marine Science and Engineering* and *Natural Hazards*. We are continuing to evolve our thoughts on this topic as we develop the planned Coastal Environmental Risk Index (CERI), and were funded for this project beginning in 2018. CERI is gaining traction nationally as coastal cities are looking closely at our protocol and ‘stakeholder’ approach to training the local municipalities in coastal risk.

Collaborating with John King at the Graduate School of Oceanography at URI, we just completed a technical report examining sand and gravel resources offshore of Rhode Island as part of a project funded by the Bureau of Ocean Energy Management, and we continue to work on a sediment budget using side-scan sonar, surface sediment grab samples and underwater video imagery for the same shoreline, funded by the Department of Interior and National Fish and Wildlife Federation. EES Student Cody Murphy and recent alumnus Joel Hara worked on this project, and Cody is

in the middle of an independent study focusing on sediment deposition in the Point Judith Harbor Refuge following the construction of the harbor breakwaters in 1914.

As many of my research projects are on-going, I am always looking for motivated students to help with field and lab work, especially if you have already taken GIS! More information on these projects can be found on my website: <http://www1.easternct.edu/oakleyb/>



EES student Jenn Croteau (center) examining green crabs (a salt marsh grazer) at Napatree with Drs. Peter August (left) and Nicole Rohr (University of Rhode Island Coastal Institute)

## **Paul Torcellini**

The mixture of fuel sources we are using is changing dramatically. This past year marked the closure of the last large-scale coal generating station in Southern New England. Nationally, it was the first time that natural gas exceeded coal in the amount of electricity produced. The first commercial off-shore wind turbines in the U.S. went on-line near Block Island, RI, and the number of solar electric systems installed continues to increase exponentially. The Center for Sustainable Energy (CSE) housed in the EES Department continues to educate students about these advances as we move towards a more sustainable energy future. Dr. Torcellini, in his third year, continued to lead the Center working with other faculty to prepare students for jobs of the future.

A highlight of the classes continues to be field trips to power plants including a combined cycle natural gas plant and a small-scale hydroelectric plant. The sustainable buildings class made a trip to a local zero energy house and other building tours show how decisions are made to be more sustainable. Students also designed and modeled their own sustainable homes including energy features and implementing sustainable materials. EES 407 (Energy Analysis) was taught for the first time in many years with a new collection of data loggers and measurement equipment. Students built small house replicas (actually plywood boxes) and outfitted them with 80W grid-tied solar panels. Web-based data acquisition systems monitored the houses including heating loads. Students worked to reduce large sets of data to simple graphics to explain their results as well as write (and rewrite) reports focused on communicating results. As in the past few years, three interns of the Endowed Chair gained experience in working on integrating sustainability into the Eastern campus along with the efforts of the Institute for Sustainable Energy. They organized solar demonstrations on the quad lawn, organized Earth Day activities, hosted sustainability films for the campus and continued to promote mixed recycling on campus. Not only is recycling environmentally sound, but putting items into recycling bins saves Eastern money!

Students are excited about sustainable energy, taking jobs in the energy efficiency programs at utilities, solar electric vendors, and pursuing graduate studies in this field or a closely related field. There is also a large student interest in other areas closely coupled to sustainable energy including sustainable food and farming systems, and the connection of sustainability to human health.

CSE has also been working on Municipal Action Plans to help local towns reduce their energy impact. As part of this effort, students have been learning about these plans and strategizing on ways to save energy for town buildings. Two students conducted senior thesis research on the energy use of Eastford Elementary School and made recommendations to the Board of Education. This summer, new energy efficient lights will be installed saving over 30% of the lighting energy, and a strategy is being developed to install solar electric on the school roof at no expense to the town. Students are learning how to use the data loggers and interpret data to look for energy waste.



EES 305 students looking at the condensing towers at Lake Road Generating in Killingly



Solar cooking demonstration on a beautiful fall day



Noah Hallisey '18 cooking eggs.

Left: Turbine room at the Kirby Mill.



EES 305 students on a tour of the Kirby Mill Dam and power plant in Mansfield Hollow, CT.



Creating solar powered "houses" for EES 405, Energy Analysis.



EES 306 Tour of roof-top mechanical systems in the new Fine Arts Instructional Center.

## Wow! Look, the Earth is huffin' and hey, there goes a puffin!

### EES Travels to Iceland

In May, 2016, sixteen intrepid EES students and Professors Cunningham, Hyatt and Drzewiecki arrived in Iceland at 5 am, then promptly examined fissures on the Mid-Atlantic Ridge where it makes landfall on the Reykjanes Peninsula, ate breakfast at a swanky hotel, paddled in the thermal waters of the Blue lagoon and then drank beer – all before 8 am! Thus began EES's inaugural undergraduate field trip to Iceland. Only Cunningham knew the area from a previous visit, but he could not speak the language except for 'geysur' and 'jokulhau' and 'Bjork' and so a local expert named Gugga was hired as our guide complete with 20 seater minibus and her husband as driver. We gushed with gratitude as guests of the good guide Gugga.



We explored the highlights of the Reykjanes Peninsula for the first 2 days including stumbling over inflated and cracked tumuli, climbing onto cone rows and into lava caves, discovering palagonitic tuffs and various lava types and feeling the Earth's inner furnace at the Krysuvik geothermal site. The Reykjanes Peninsula's raw landscape and expansive views enthralled us and whetted our appetite for more spectacular geology as we then headed east.

Next, we followed the classic 'golden circle' tour and explored the Thingvellir rift on the plate boundary and were stunned by the huge fissures and extensional escarpments, tilted blocks and huge volcano-tectonic landscapes. Then we went to see the geysers including the enthusiastic Stokkur and other expressions of crustal indigestion. The magnificent Gullfoss was the climax of the day. This huge jaw-dropping waterfall thunders down from the high interior and was almost lost to a hydro-electric scheme, but saved due to the efforts of a single determined environmentalist named Sigridir Tomasdottir - now clearly an Icelandic heroine. Gullfoss awed us with its power and reminded us of Iceland's endless battle between volcanism, crustal uplift and glacio-fluvial erosion.



The following day was filled with a wonderful tour of Heimaey in the Vestmann Islands. These islands comprise a line of Quaternary volcanoes that mark the eastern arm of the Mid-Atlantic Ridge – interpreted to be the newest expression of the plate boundary as it migrates eastwards from the Reykjanes Peninsula. We toured the island which is famous for its sudden and violent 1973 eruption and the heroic efforts by the small fishing community to divert the lava that threatened to engulf their town and destroy their livelihood. We climbed the Eldfell cinder cone and marvelled at the view and the residual heat emanating

Lexi on Eldfell summit  
spatter cone, Heimaey



At Kiviarjokull outlet glacier,  
Vatnajokull, Iceland



from fumarolic cracks at the summit. The climb was cold and blustery and to some, a bit precipitous and scary. But, views of the rugged peaks and cliffs that surround the island's green fields (adorned with scattered shaggy sheep) and the snug little fishing harbour, combined with the surrounding tempestuous North Atlantic and distant ice caps on the mainland, left us deeply moved by the forces and beauty of nature.

The next day was rainy, but we hiked up to the Sólheimajökull glacier – an outlet glacier from the Mýrdalsjökull ice cap. Despite the wet gloom, we ventured onto the melting edge of the glacier and saw many classic features of the ablation zone. Kettles, striated pavements, roche moutenees, outwash channels and stranded dead ice blocks all provided a clear lesson on the erosional, sedimentological and geomorphological processes at work. This glacier's recession is well documented and so discussions ensued as to the future fate of Iceland's valley glaciers and icecaps. Next we headed to a wet coast and saw our first puffins and then beautiful columnar basalts on the cliffs of the Dyrholaey Peninsula. Then it was on to Skogar where we visited an excellent folk museum which preserves the cultural history of this small Icelandic settlement including its courageous fisherman, puffin hunters and farmers. We entered the tiny stone walled and sod-roofed homes and marvelled at the hardiness of the people who carved out their lives in such a cold, windy and damp North Atlantic climate.



L to R: Brynn, Lexi, Morgan, Sam and Emma on fissure-fed cone row, Reykjanes Peninsula.

We then hiked up to Skogafoss which forms a beautiful backdrop to the small town and which offers free showers to anyone standing within 100 feet of the falls. Several students climbed up the flanks of the ridge adjacent to the falls and gave the leaders heart failure, except for Peter who was out searching for mud cracks.

Next we headed east and crossed the huge sandur plains which are swept clean by periodic jokulhaups from the huge Mýrdalsjökull and Vatnajokull icecaps. These braided plains are notable for their pebbles and cobbles and Peter's inexplicable fascination with gravel. We passed the night in rustic cabins at a place called Hörgsland where we dined out at a simple restaurant serving fish and cheeseburgers that cost about 80 dollars per plate. After paying what we could and then helping wash the dishes, we decided to return to our self-catered pasta dishes and corn flakes for the rest of the trip.

Then it was on to the ice lagoon at Jökulsárlón where we felt first-hand the insignificance of our existence amongst the giant glaciers in the distance and windex-blue icebergs floating about us as we cruised the huge melt-water lake. We stopped at other beautiful valley glaciers emanating from the south side of the Öraefajökull strato-volcano, the highest mountain in Iceland, before we arrived at Skaftafell National Park, where we spent the afternoon hiking around the tundra-like landscape and stunted forests below the glaciers. We also walked to the snout of the Skaftafellsjökull glacier and saw many more impressive examples of kettles, push-up ridges, dead ice features and other erosional, and sedimentological features in the terminal zone. Peter found some more gravel, Drew took his 9357<sup>th</sup> photo and waxed lyrically about periglacial cryo-morpho-scan-sites for Agisoft and Dickson still tried to understand how palagonite forms and explain it to students who were slowly drifting away and joining Peter's search for mudcracks.

Then we headed back to Reykjavik with stops at the Seljalandsfoss where our student Thor stripped and roared under the icy meltwater as he attempted to communicate with his Viking ancestors. We stopped at the famous eroded basalt columns at Kirkjubæjarklaustur which resembles a church pavement. Back in Reykjavik we had time to tour the Hellisheiði geothermal plant east of the city where the hissing ground's heat energy is harnessed to supply local power. This was a highlight for all of us including the sustainable energy track students because the facility provided excellent exhibits and an informative tour guide who explained the natural energy source and technology used to exploit it.

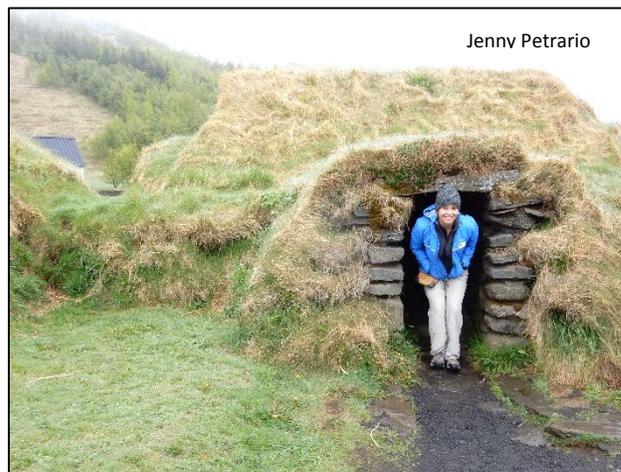
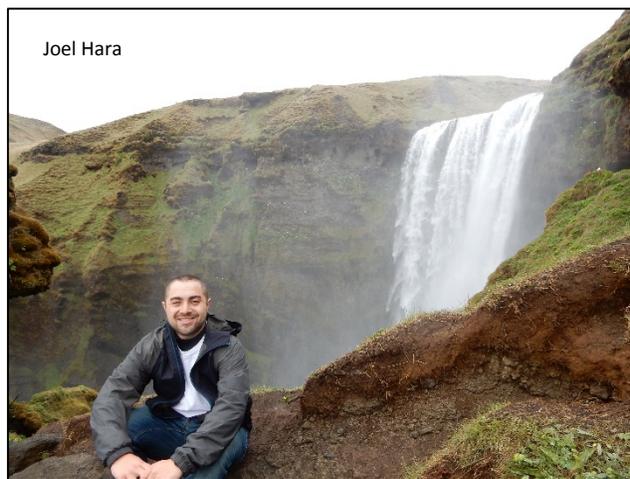


We spent a nice afternoon and evening in Reykjavik and had a farewell dinner where more than milk and cookies were consumed. Then it was time to head home, all weary but fulfilled, each with unforgettable memories happily stored away. As we took off, we watched puffins flying outside the airplane window— a fitting goodbye after an amazing Icelandic adventure.



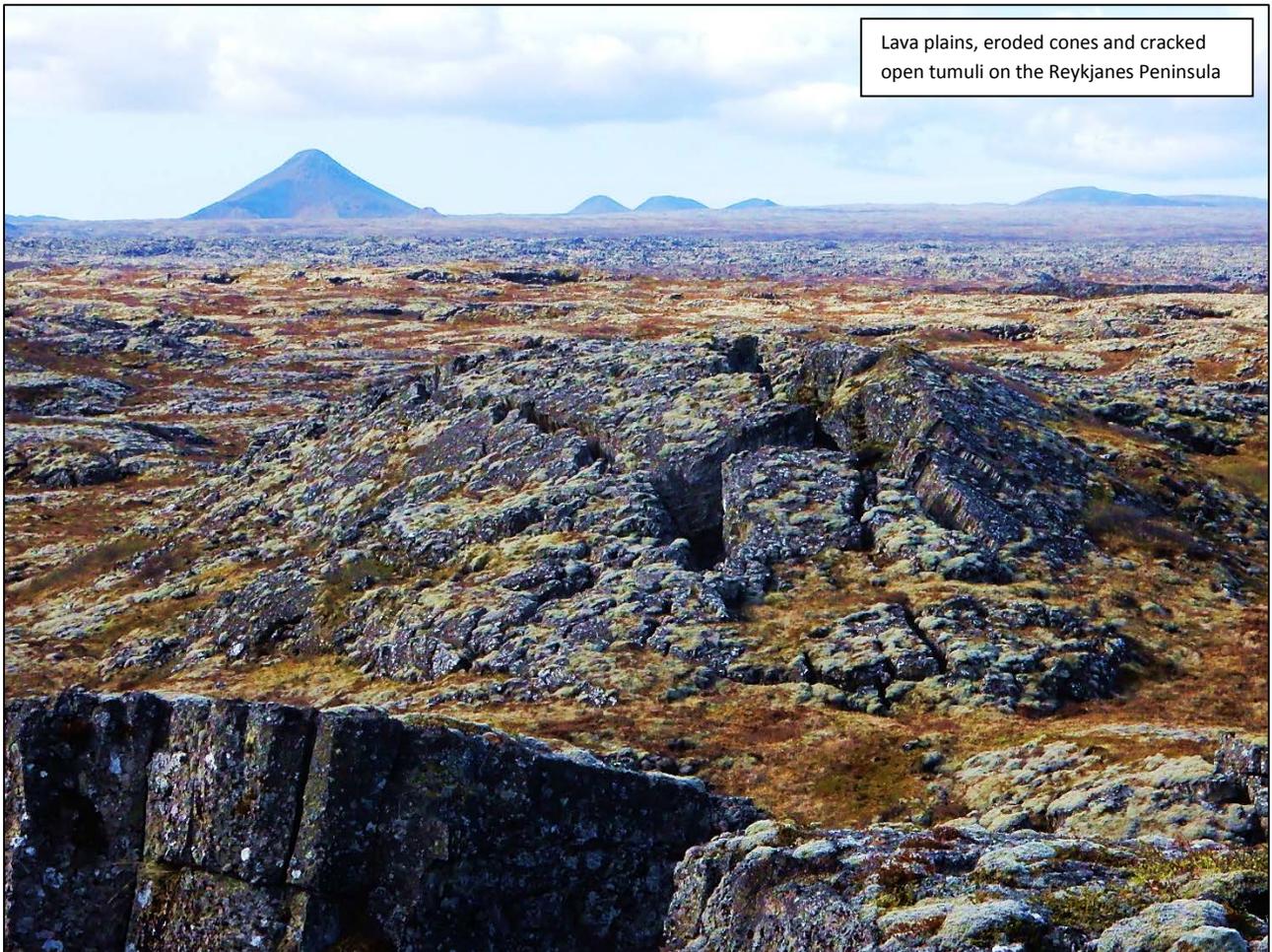
Iceland Trip Scenes – clockwise from top left:  
 Grinning at Gullfoss; Dramatic Heimaey coast;  
 Jokulsarlon; Stunning Gullfoss; Sea stacks in  
 the fog near Vik; EES ladies on Heimaey.

## Some EES Rock Stars in Iceland





Sydney Day and kettles,  
Skaftafell National Park



Lava plains, eroded cones and cracked  
open tumuli on the Reykjanes Peninsula

## EES Spring 2017 Arizona Trip

In March, 2017, nine EES majors accompanied Professors Cunningham and Drzewiecki to Arizona for an action-packed geological tour of the Grand Canyon state. After an early morning flight to Phoenix, the group drove north to Val Verde and then ate a cheap Mexican dinner and collectively got heartburn. But, after some recuperative sleep, we were ready for the adventure to begin and so we explored the continuously bubbling Montezuma Well sinkhole, stood in awe beneath the Montezuma Castle cliff dwelling and scrambled over and squinted at the glistening Camp Verde salt mine. The latter is possibly the oldest mine in the Americas and famous for its gypsum, halite, glauberite and calcite deposits. We learned about the geological evolution of the Camp Verde rift system and the 6<sup>th</sup>-15<sup>th</sup> century Sinagua culture and what human and natural causes may have caused its demise. Then we headed up the Mingus Mountain footwall block to the famous Jerome mining town where we went to the excellent museum and watched an entertaining and educational documentary film about the town's mining heyday, fortunes, misfortunes, vices, virtues and modern revival as a tourist and artisan center. We couldn't resist a 45-minute hunt for colourful copper minerals in one of the town tailings dumps. Some nice azurite and malachite samples were found by our eagle-eyed students.



The next day we drove to Sedona and took two beautiful hikes where we came face-to-face with the upper Colorado Plateau stratigraphy exposed in the stunning canyons around the city. On our second hike in the upper Oak Creek canyon region, we made 6 stream crossings before bushwacking our way up to a

high area where gorgeous cliffs, cross-bedded strata and the forested canyon below kept our camera shutters busy.

Then we drove to Flagstaff and spent a day exploring the San Francisco volcanoes including Sunset Crater National Park and the Wupatki National Monument pueblo ruins. Late in the day, we ventured NW to the famous S-P cinder cone, a first visit for all of us. We slogged up to the crater rim which was a stumbling, back-sliding, 3-steps-up/2-steps-down struggle, but upon reaching the top, all felt triumphant. We were rewarded with sublime views of the surrounding volcanic landscape with lavas, cinder cones and the snow-capped Humphreys Peak strato-volcano looming to the south. We had the mountain entirely to ourselves and for many of the students, this adventurous hike with its dramatic views of the vast northern Arizona landscape was the highlight of the trip.



The next day was sunny and gorgeous and perfect for heading north to the Grand Canyon. We stood on the south rim and gazed at the canyon's majesty while discussing the stratigraphy, unconformities and landscape features that are visible from different points along the rim trail. We then took the shuttle bus to the South Kaibab Trail head and began our hike to Ooh-Aah Point. The park was crowded, but as we descended, we stopped to observe geological features of the Kaibab and Toroweap Formations and to discuss evidence for paleo-environments of deposition. We all took photos of ourselves at Ooh Aah Point which is aptly named. It is an amazing experience to be 800 feet below the rim, but to look over the cliff and realize there is still at least another 4000 feet to go down before reaching the Colorado River. Once again, we were impressed with the sheer immensity of the canyon.



The following morning we travelled east and geologically up-section into the red Triassic Moenkopi sandstones and saw what happens when an extra-terrestrial nickel-iron rock, 50-m across, hits the Earth at 13km/second. Meteor Crater is a powerful reminder that our planet is vulnerable to dramatic impacts at any time. We went on a tour of the crater rim and learned about the geological and environmental effects of the impact, the composition of the meteor, the history of geological thought about the crater's origin, and the mining of the iron meteorite fragments.

In the afternoon we ventured east to Petrified Forest National Park and the Painted Desert. We hiked the Long Logs and Blue Mesa trails and visited other overlooks and sites of interest that included sedimentological/stratigraphic features, stark desert landscapes and pre-Columbian petroglyphs. We were amazed at the sizes of some of the petrified logs and the beautiful diversely colored silicification that each log displays.

The next day was a long drive south via the impressive Salt River Canyon to Tucson, returning to the Basin and Range Province and springtime in the Sonoran Desert. In the Salt River Canyon, we stopped at several locations to see the famous Mogollon Rim gravels, Precambrian stromatolitic marbles, doleritic sills and Transition Zone scenery. In the late afternoon, following a brief visit to the beautiful 18<sup>th</sup> century San Xavier Mission, we arrived at the Asarco Mission Mine Mineral Discovery Center where we took a tour of the huge open-pit copper mine and its mineral processing facilities. The sheer scale of the operation with



its massive open pit, gigantic diggers and haul trucks, and rotating steel ball mills left an indelible impression on all of us. The information on how the raw ore is extracted, physically crushed, separated and chemically refined was perhaps the most educational part of the tour.

The next day we took the public trolley up the oasis-like Sabino Canyon into the heart of the Santa Catalina Mountains on the north side of Tucson. We were able to see the mylonitic orthogneisses and pegmatites in the footwall of the metamorphic core complex and study the lithologies, structures and tectonic history of the rocks in the context of Basin and Range Province crustal extension. We also took note of the impressive rock joints in the valley walls and discussed competing processes of desert canyon development in the American southwest. After lunch we drove up the Catalina Highway as far as Windy Point where we enjoyed stupendous views of the Tucson Basin a mile below and the rugged mountain landscape of the inner Santa Catalina range. We could see as far as the Mexican border and from this high vantage point, the basin and range topography of southern Arizona was obvious to everyone.

On our final day, we ventured into the Tucson Mountains to examine the Laramide volcano-sedimentary history of the range's caldera complex and the diverse and colorful ecology of the Sonoran Desert in Saguaro National Park. We completed several desert hikes including one to an abandoned copper mine. After lunch, we visited the Sonoran Desert Museum which has wonderful displays of the deserts flora, fauna, geology and cultural history.

The trip was a great success. We had ideal weather – sunny and pleasant every day. The students were engaged and enthusiastic throughout, and the small cohort allowed us to get to know each other well and collectively enjoy a marvelous educational adventure.





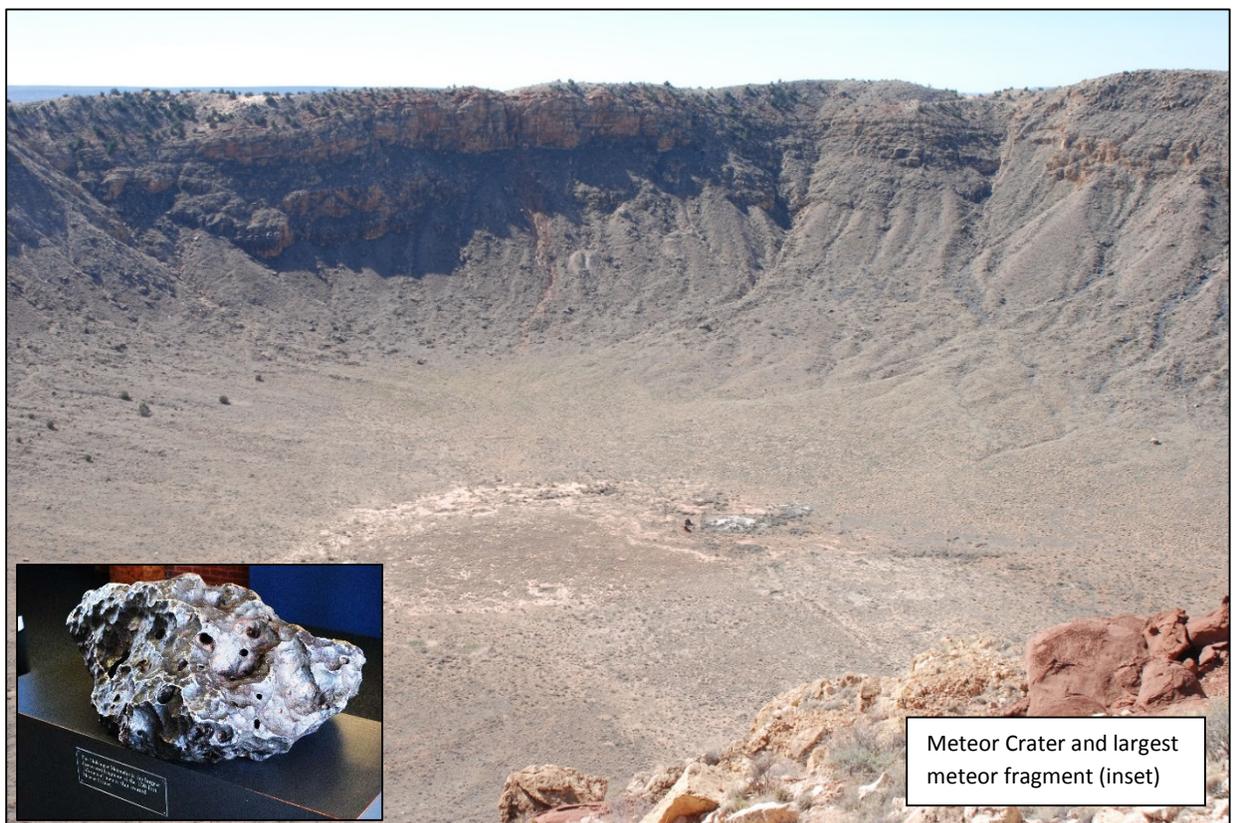
Fay Canyon, Sedona



Wupatki Pueblo



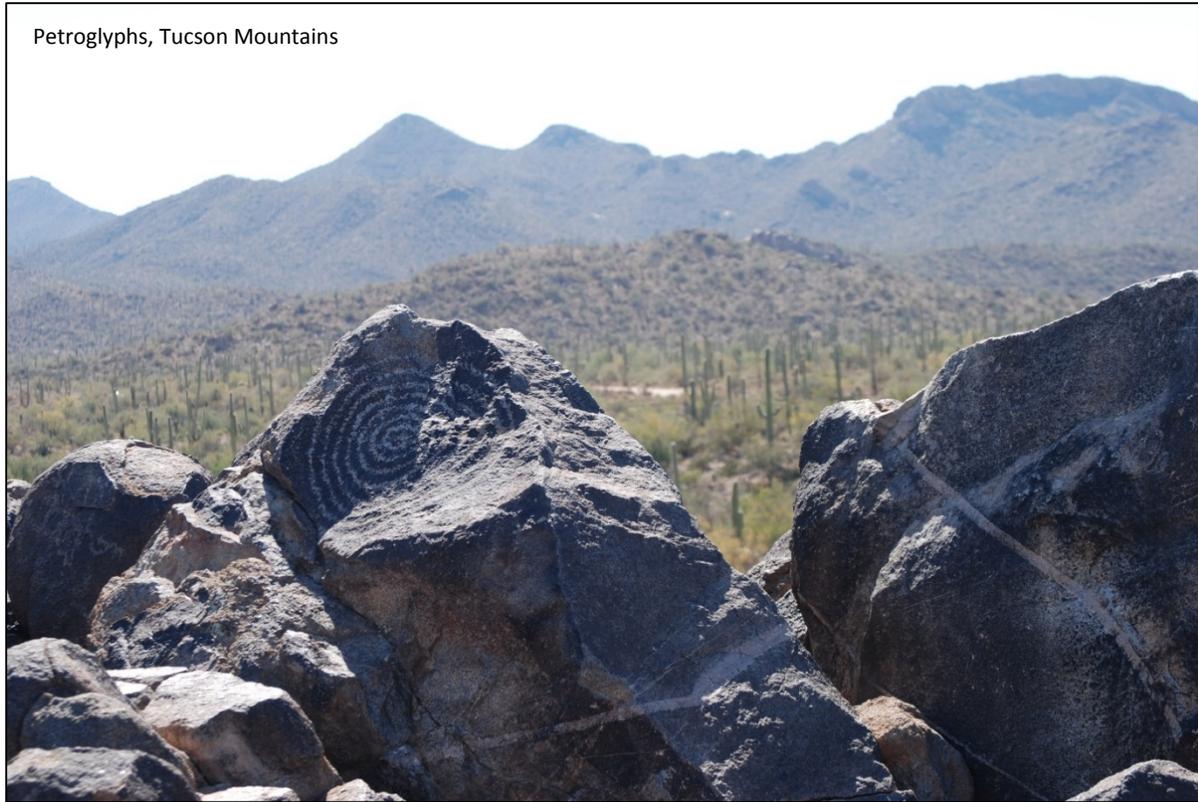
Lava flow view from SP Crater rim



Meteor Crater and largest meteor fragment (inset)



Springtime in the Sonoran Desert, Sabino Canyon, Tucson



Petroglyphs, Tucson Mountains

## **The Environmental Health Science Minor – A Student’s View**

By Lauren Polansky, 2017 EES graduate

During my second semester of my junior year, I walked by a flyer hanging up on the bulletin board outside the second-floor bathrooms in the Science Building that read, “Environmental Health Science.” This was the first time I ever saw this phrase, and was immediately intrigued. I grabbed a pamphlet that was hanging next to the flyer and began to read more about it. Environmental Health Science explores the relationships between human health and environmental health. This science is a two-way road; human activities can affect the quality of the environment and the quality of the environment can in turn affect human health. I have always had a passion for protecting the Earth and I constantly look for ways to get others involved. Humans tend to care more about issues when it affects their personal health directly rather than just the health of the environment. Through Environmental Health Science, we can educate humans on how to protect themselves from danger in the environment while in turn protecting the Earth as well.

My experience through this minor was quick, since I completed the required classes all in my senior year, but I enjoyed the classes I took. The Introduction to Environmental Health Science course was a great launching point for the classes to come. I took the intro class as a tester to see if I would actually enjoy this material and want to learn more, and now here I am, the first Eastern graduate with the Environmental Health Science Minor. After the intro class, I went on to take Environmental Toxicology, Epidemiology, and the HAZWOPER certification course. I was also able to use credits from Introduction to GIS that I took my junior year. This minor shed new light on my daily activities and what I can do differently to protect my own health, those around me and the health of the environment. I also gained more hands-on experience from taking the 40 hour HAZWOPER certification course. Never did I think I would get to wear a level A Hazmat suit for class!

I’m excited to be able to graduate with this minor and apply what I have learned to whatever career path I choose, and I wish the best of luck to future students who complete this minor.

For more information on the Environmental Health Science Minor see:

<http://www.easternct.edu/environmentalearthscience/environmental-health-science-minor/>

or contact Dr. Catherine Carlson, Professor of Hydrogeology & Hydrology

[carlsonc@easternct.edu](mailto:carlsonc@easternct.edu)

## **Environmental Earth Science Student Research Projects, 2016-2017**

In the summer of 2016, six EES faculty members offered undergraduate research experiences to 13 students through the EES Exemplary Program Fund. Many of these students continued their projects throughout the 2016/2017 academic year, with the goal to present their results at the ECSU CREATE Conference, and/or a national conference. Below is a summary of the student projects.

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### **Project Title: Developing Geological Learning Units for Community Outreach and Recruitment Enhancement**

**Faculty Mentor: Dickson Cunningham**

**Student: Luke Davis**

**Description:** The Department of Environmental Earth Science has extensive rock, mineral and fossil collections. The samples are used largely for its undergraduate lab classes. Occasionally EES professors visit local schools as part of the department's community outreach. Preparing for these visits involves raiding the collections and preparing a one-hour demonstration or a hands-on activity. Finding appropriate samples for the presentation topic and devising a meaningful school exercise can take hours. It would be practical and time-efficient, if the department had a number of ready-made learning units, each with a box of relevant samples that could be used by all of its faculty for school visits, whenever needed.

During summer, 2016, Luke Davis an EES senior who is preparing to be an elementary school teacher, created portable learning units for school children/adolescents that faculty can use for school visits. This independent project required that Luke envision and develop learning units that enable young students to effectively learn about geological concepts and materials. Luke also helped Professor Cunningham create a new educational corridor display of Connecticut bedrock geology. To support his project, Luke visited several key mineral collecting sites in eastern Connecticut to add fresh samples to the portable learning units and the department's in-house collections.

Luke created four major hands-on activities involving a fossil suite, minerals suite, economic materials suite and garnet suite (CT's state mineral). Each hands-on activity requires students to analyze the sample suites and answer questions in accompanying booklets. Luke's learning units were trialed with forty 4<sup>th</sup>-graders at Lebanon Elementary School in November, 2016 and were a huge hit with the children. The department is now better poised to visit local schools and inspire the next generation of environmental earth scientists!



Luke Davis pointing to huge garnet crystal mass from sample collection site in Lisbon, CT.

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**Project Title: A structural and lithological study of Lantern Hill, North Stonington, CT**

**Faculty Mentor: Dickson Cunningham**

**Student: Kevin Lacy**

**Description:** Lantern Hill is a north trending ridge near the Foxwoods Casino Resort in North Stonington, CT that was previously mined for its rich silica deposit. The silica zone is an unusually thick vein complex that represents the infill of the inactive Lantern Hill Fault. In this project, Kevin Lacy completed field investigations of the Lantern Hill ridge line to identify variations in lithologies and to collect structural data within and adjacent to the vein complex. The principal results of Kevin's study are the following: 1) The vein system cuts through a Devonian quartzite which provided the silica source that precipitated into the vein dilation sites within the fault complex. 2) The vein system runs N-S and nearly orthogonal to strike trends in the underlying quartzite. 3) The vein forms a backbone ridge that is pervasively cut by steep brittle fractures parallel to the ridge line. 4) The veins are multi-generational and cross-cutting despite their dominantly N-S trends. The youngest veins are locally vuggy containing both clear and milky terminated quartz crystals. 5) The fault kinematics are unclear, but probably dextral transtensional. 6) Breccia textures in marginal zones suggest that a long-lived hydrothermal system cause hydraulic fracturing within the fault zone. Thirty-five locations were studied and structural data were collected and analyzed.



Kevin Lacy measuring fracture orientations on Lantern Hill, North Stonington, CT. Foxwoods resort in distance.

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**Project Title: Paleocological Study of Jurassic Lacustrine Strata from the East Berlin and Lower Portland Formations, Hartford Basin, Connecticut**

**Faculty Mentor: Peter A. Drzewiecki**

**Student: Martha Denisky**

**Description:** This project involved synthesizing all available sedimentological, paleontological, and geochemical data for the perennial lake and playa (dry lake) deposits from the New Haven, Shuttle Meadow, East Berlin, and Portland Formations of the Hartford Basin (central Connecticut) in order to reconstruct the changes in ancient lake ecosystems through time. In addition, new sedimentological data were collected from a core that was recently acquired from the base of the East Berlin Formation in South Hartford. Specific tasks included: (1) measuring a stratigraphic section for the core, (2) visiting Dinosaur State Park and the Peabody Museum to collect paleontological data, (3) preparing 28 rock samples for thin section analysis, (4) examining rocks exposed in 3 outcrops in the Hartford Basin, and (5) searching the geological literature for geochemical data related to paleoenvironmental conditions.



Changes in the number and diversity of fish, dinosaurs, reptiles, invertebrates, and plants were investigated. Results show that the ecology of the Hartford Basin changed through time in response to an overall drying climate, the shift between lake and playa environments, the tectonic evolution of the basin, and the evolution of life in the late Triassic to Early Jurassic (in particular, the emergence of dinosaurs). This research will provide the foundation for future, more detailed paleoecological studies of the basin.

Outcomes for this project include a final report, an honors thesis, and a presentation by Martha Denisky at Eastern's CREATE Conference. In addition, data collected will be incorporated into a larger study of the ancient lakes preserved in central Connecticut that has been the focus of Dr Drzewiecki's research for years.

Martha measuring a core at the MDC Core Shed in South Hartford.

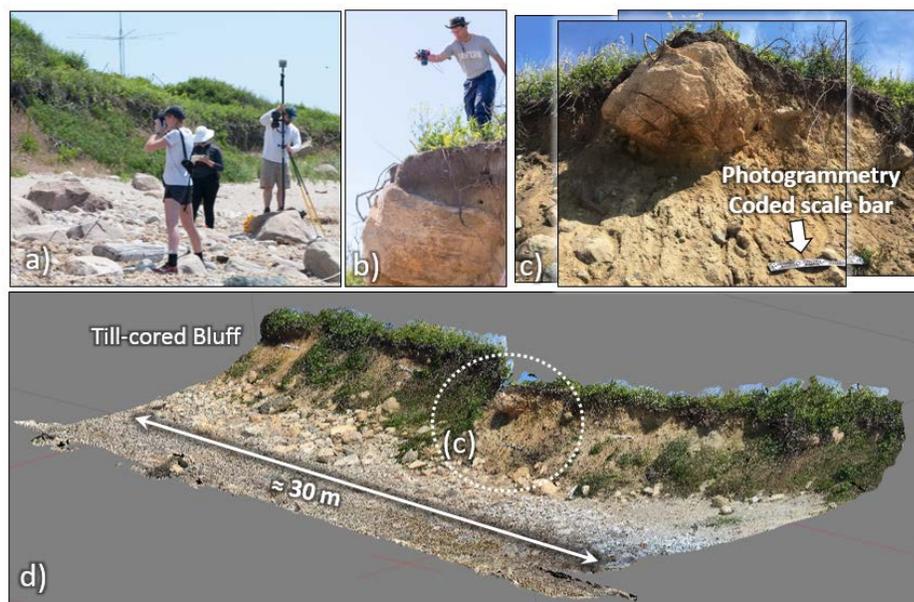
**Project Title: Utilizing laser scanning and photogrammetry to measure bluff erosion at Napatree Point, RI.**

**Faculty Mentor: Drew Hyatt**

**Students: Jennifer Croteau and Haley Celotti.**

**Description:** EES senior Haley Celotti and Jennifer Croteau worked as part of a 2-member research team to help set up survey equipment and capture imagery of an eroding headland scarp at the Watch Hill nature preserve on Napatree Point, Rhode Island. Both students were heavily engaged in data collection at Napatree Point. Field work at WHNP involved transporting surveying and imaging equipment to an eroding bluff, setting up photogrammetric markers, collaborating with Dr. B. Oakley in EES, to collect high precision global positioning system measurements, and capturing controlled overlapping imagery of the eroding bluff to support 3D modelling. Data collected in the field has helped to prepare a new CSU grant-funded project that should enable a new student to continue this work and present findings at future meetings. Images below depict (a) students collecting imagery at the site, (b) GPS surveying of a control point, and (c) a preliminary 3D textured model of a portion of the field site

**Figure 1.** Assorted images related to field work at Napatree Point in Rhode Island. **(a)** Student assistants Jennifer Croteau (foreground) and Haley Celotti (middle) along with colleague Dr. B. Oakley (back), collecting images and high-precision GPS measurements. **(b)** Principle investigator Hyatt, captures images



of the top-side of a large boulder lodged in the eroding cliff. Students collected and learned to photogrammetrically process **(c)** overlapping images, so as to build **(d)** highly detailed survey-grade 3D models of the coastline. This field work will lay a foundation for new student research planned for the summer of 2017.

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**Project Title: Constructing 3D models to evaluate detailed characteristics of rock cores and related bedrock exposures of Mesozoic conglomerates in Glastonbury, CT.**

**Faculty Mentor: Drew Hyatt**

**Students: Jennifer Croteau and Haley Celotti**

**Description:** EES students Jennifer Croteau, Haley Celotti and with some additional assistance from colleague Dr. P. Drzewiecki and his student Tim Kaminsky worked as a team to survey and image complex bedrock exposed at an old sand and gravel pit in Glastonbury (called the Dufford Quarry Site). Field work consisted of clearing the outcrop of brush and debris, establishing a survey coordinate system, and collecting detailed overlapping images from 3 sites on the outcrop for subsequently photogrammetric modelling. As well, Jennifer Croteau conducted several days of additional field work at Eastern imaging rock cores obtained from CT-DEEP. Jennifer conducted a follow up practicum in the fall of 2016 to learn how to perform photogrammetric data analysis and to prepare a number of models and graphics that help her to characterize both the outcrop and cores. Jennifer is presently working on a spring poster presentation for the CREATE meeting that will explain her data collection and use of photogrammetric data. Chris is working with Dr. Drzewiecki on a separate project that examines the same rock cores.



**Figure 1.** Images from the **(a)** the Dufford Quarry bedrock site. Students (top left) helped to clear the outcrop of vegetation and dust at 4 sites (one not visible here) in order to capture imagery and survey data in support of 3D computer modeling of the rocks. **(b)** The students worked as a group to systematically image the outcrop using several cameras. As well, later in the summer **(c)** Jennifer learned to image rock cores from DEEP so as to build 3-dimensional models that will enable her to test new analytical techniques on the rocks.

**Project Title: Arsenic in Bedrock Groundwater Resources of Connecticut: A Comparative Study**  
**Faculty Mentor: Meredith J. Metcalf**

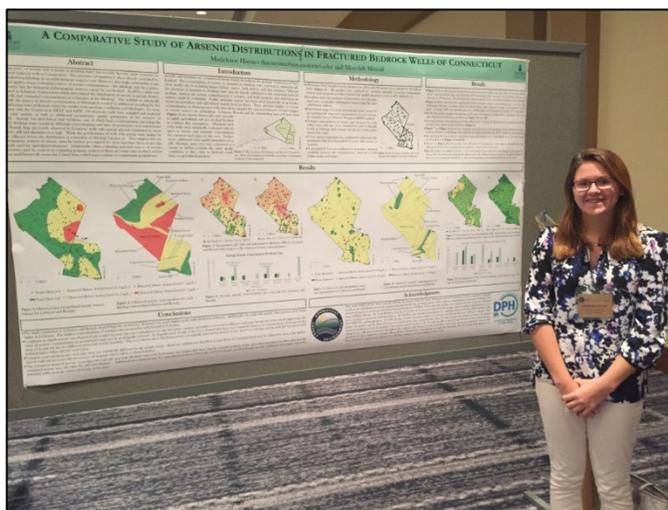
**Students: Madeleine Haynes, Jennifer Petrario**

**Description:** This research project allowed two Environmental Earth Science students to work with Dr. Metcalf to conduct similar research as previous years in order to compare groundwater quality trends (specifically arsenic) for two towns with similar geologic and hydrogeologic conditions. Several studies have been conducted in Lebanon since 2013 after the elementary school tested positive for arsenic. Although the source of arsenic contamination remains unknown, many local and state officials have quickly assumed that the cause is natural yet there is no statistical evidence to support this. Thus, this comparison was the first attempt to address this assumption. Students assisted several days a week for the duration of the summer to organize sampling events with homeowners in Bozrah, collect water samples following a newly developed technique developed by Dr. Metcalf and Dr. Robbins, submit samples to the Department of Public Health, enter data, and communicate findings with homeowners. Given the amount of hours required, the summer was only used for sample collection. Madeleine Haynes

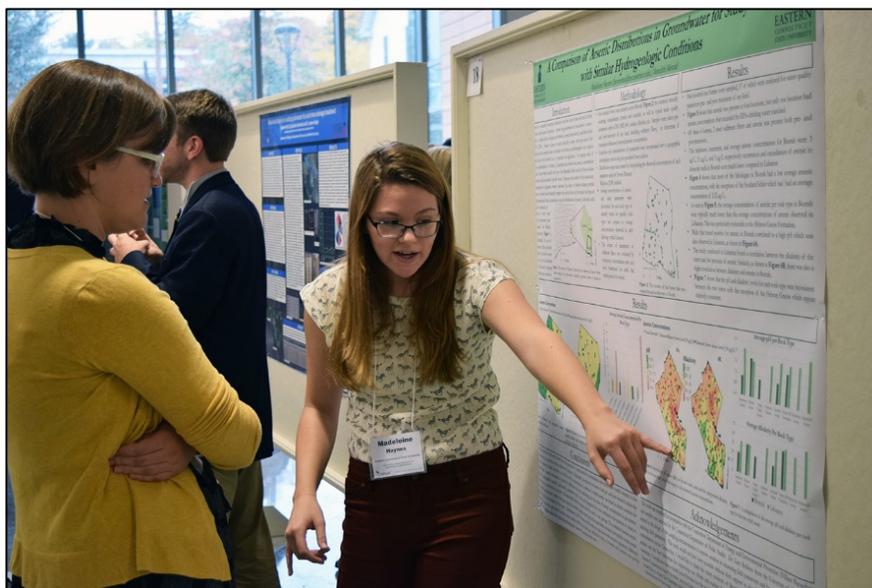
worked with Dr. Metcalf through fall 2016 and spring 2017 conducting Independent Study research. Madeleine submitted abstracts and presented the findings of this work at Council of Public Liberal Arts Colleges in 2016 and the National Council for Science and the Environment's 17<sup>th</sup> national conference and global forum on science, policy, and the environment in 2017. Maddie also submitted an abstract to present at the American Association of Geographers meeting later in spring 2017 and received a Jean H. Thoresen ECSU-AAUP Scholarship. Madeleine continues to work with Dr. Metcalf and presented at CREATE.



**Figure 1 (left):** Jenny Petrario and Maddie Haynes sampling groundwater and recording field parameters at a private domestic well in Bozrah, Connecticut in May 2016.



**Figure 2 (above):** Madeleine Haynes presenting her findings at the National Council for Science and the Environment in January of 2017



**Figure 3:** Madeleine Haynes presenting her findings at the COPLAC Conference in October 2016

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**Project Title: Hartford Basin Test Borings: A New Tool for Designing Better Geothermal Systems****Faculty Mentor: Steve Nathan****Students: Alex Fazzino and Daniel Scribano**

**Description:** The purpose of this project was to engage two EES students (Alex Fazzino and Daniel Scribano) in my ongoing geothermal research. Alex and Dan helped identify, retrieve and analyze bedrock samples (i.e., test borings/bedrock cores) of the Hartford Basin. These samples were first collected by the City of Hartford's Metropolitan District Commission (MDC) and are currently warehoused in south Hartford. At the warehouse Alex and Dan photographed the bedrock cores (taking nearly 300 images), described cores found within 28 core boxes, and used a rock saw to cut 30 samples for later analysis at UMass (this included measuring the thermal conductivity and density of the samples, as well as preparing the samples for analysis at the UMass XRF laboratory (i.e., X-ray fluorescence spectrometry; located at the Department of Geosciences, University of Massachusetts Amherst).

Alex and Dan gained valuable experience learning how to select and collect over 30 bedrock samples (i.e., test borings) from the MDC warehouse. At the warehouse they also gained experience using a photographic copystand, setting up a photo assembly line, and operating a rock saw. They also learned how to describe cores and keep detailed records of the work being done.

Alex continued his summer research as a credited Independent Study (EES 480; fall 2016). He used the data collected from the laboratory analyses to model the thermal behavior of the Hartford Basin sediment. Ultimately, this modeled data is intended to help better predict the thermal conductivity of these materials for the design of more efficient geothermal systems. Alex presented his research at the spring 2017, ECSU CREATE Conference.



**Figure 1.** Daniel Scribano (L) checks camera settings while Alex Fazzino (R) aligns a mobile stage for photographing core boxes of Hartford Basin test borings at the MDC core repository (May 2016).

**Project Title: Benthic Foraminifera of Block Island Sound: Gauging a Proxy of Historical Tropical Cyclone Severity in New England**

**Faculty Mentor: Steve Nathan, Assistant Professor of Energy Geoscience**

**Students: Emma Avery and Brynn O'Sullivan**

**Description:** The purpose of this study was to engage two EES students (Emma Avery and Brynn O'Sullivan) in my climate change research. Namely, using foraminifera (benthic and planktic) to gauge the severity of historical tropical/extratropical cyclones (i.e., hurricanes/nor'easters) that over wash Block Island, RI.

Brynn and Emma joined me in collecting marine/fresh water sediments from Sachem Pond and Middle Pond on Block Island, RI. They collected 12 sediment grab samples and four sediment cores. Two cores were later split, photographed, described and sub-sampled for analysis.

Brynn and Emma gained valuable field experience from this project. They saw firsthand the details that need to be addressed for carrying out fieldwork. They worked with coring equipment (i.e., a push core and a macaulay sediment sampler, a.k.a., a Russian peat borer), described and photographed the cores (using Munsell color charts and grain size cards), kept detailed field records and began preliminary microscopic examination of the samples. Brynn and Emma also used a real time kinematic GPS to measure and record beach profiles (to determine the extent of coastal erosion on Block Island).

Emma continued working with the samples collected from Block Island during the 2016/2017 academic year as a part of her senior Honors Thesis. She presented her research at CREATE 2017.



**Figure 1.** Brynn O'Sullivan (L) and Emma Avery (R) using coring equipment to collect sediment samples on Block Island, RI. (June 2016).

**Project Title: Monitoring 2014 Beach Replenishment – Misquamicut State Beach****Faculty Mentor: Bryan Oakley****Students: Mike DePinto and Cody Murphy**

**Description:** Mike DePinto and Cody Murphy assisted (and at time lead) the field collection of beach profiles and mapping the Last High-Tide Swash position at Misquamicut State Beach under the supervision of the faculty PI. The specific goal at Misquamicut involves tracking the erosion/deposition of beach replenishment, added to Misquamicut State Beach in May, 2014. This work involves monthly beach profile surveys, as well as surveys mapping the position of LHTS and quarterly surveys mapping the surface of the beach using RTK-GPS. This work represents a continuation of currently unfunded research being conducted by the faculty PI, collecting beach profiles, mapping shoreline position and collecting RTK-GPS topographic models of the shoreline. This research has offered numerous EES students opportunities to learn valuable field skills.

Cody continued working on an additional (externally funded) project in fall 2016 and spring 2017 semesters as part of a practicum (EES 392) and independent study (EES 480). Mike will be continuing on the project in the summer of 2017 and will likely present at the 2018 CREATE conference.

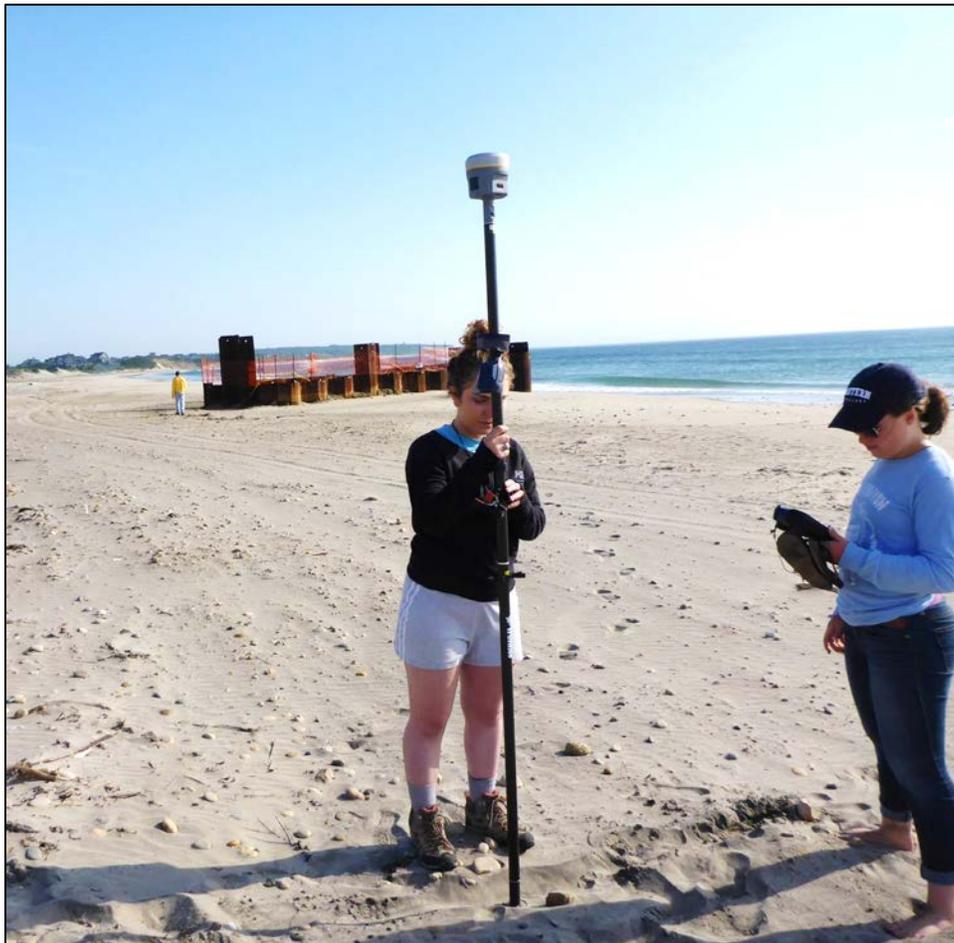


**Figure 1. Mike DePinto measuring an RTK-GPS profile on Misquamicut State Beach, Rhode Island**

**Project Title: Beach Profiling and LHTS Mapping – Block Island, RI****Faculty Mentor: Bryan Oakley****Student: Brynn O’Sullivan and Emma Avery**

**Description:** Brynn O’Sullivan collected beach profiles and Last High-Tide Swash on Block Island, Rhode Island under the supervision of the faculty PI. This work represents a continuation of currently unfunded research being conducted by the faculty PI, where volunteers who live on Block Island collect beach profiles and submit the data to the PI. Brynn was responsible for measuring two sites with RTK-GPS, which helps to ensure that the volunteer collected profiles are measured accurately. Additional work was done mapping the position of the last-high tide swash line, which were compared to the shoreline position in aerial photographs in the spring 2017 semester as part of an externally funded research project.

Brynn was unable to continue on the project in the academic year so additional students (Alexia Bohnenkamper + others) have continued working on Block Island in the current academic year and during summer, 2017.

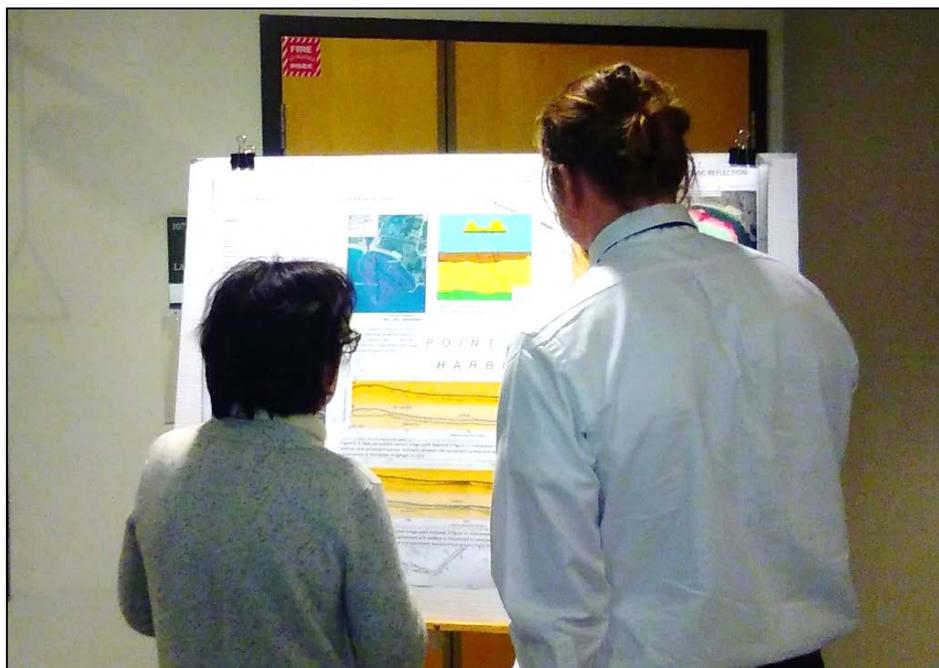


Brynn O’Sullivan (left) and Emma Avery measuring an RTK-GPS profile on Crescent Beach, Block Island using RTK-GPS.



Brynn O'Sullivan (left) and Emma Avery mapping the position of the last high-tide swash (LHTS) on Crescent Beach, Block Island using DGPS

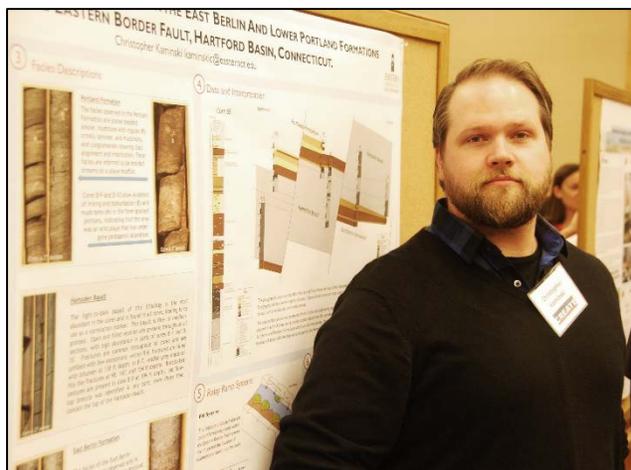
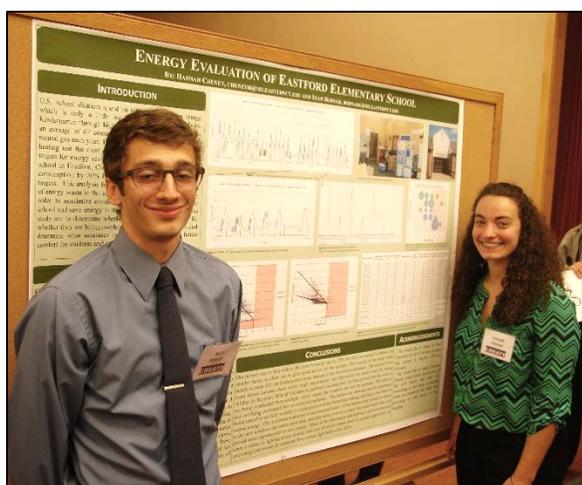
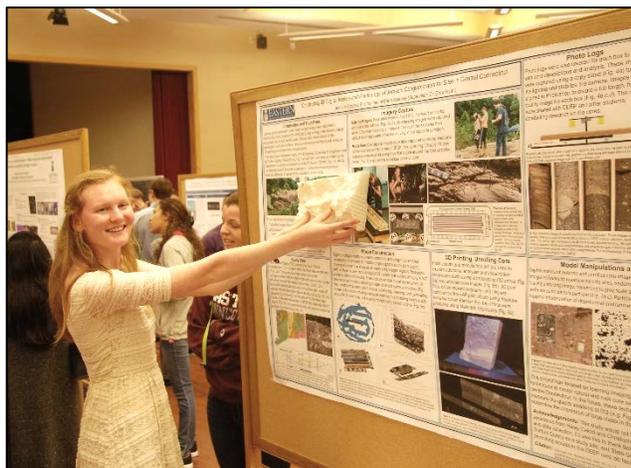
Eastern Connecticut State University student **Cody Murphy** received an **Honorable Mention for the Warren Prize for best under-graduate student poster** at the **2017 New England Estuarine Research Society (NEERS) conference**. Cody is in the middle of an independent study focusing on sediment



deposition in the Point Judith Harbor of Refuge following the construction of the harbor breakwaters in 1914. Work on this project will continue in the winter of 2017-2018, as Cody is currently on 'sabbatical' for the fall semester as he tackles the Pacific Coast Trail!

Above: Cody Murphy (right) presenting his poster at the 2017 NEERS conference

## Photos from CREATE Conference, spring, 2017 – EES Student Presenters



Left column: top - Alex Fazzino presenting to CT State Geologist, Margaret Thomas; middle – Sean Bodnar and Hannah Cheney; bottom – Martha Denisky. Right column: Jennifer Croteau; middle – Luke Davis; bottom – Chris Kaminski.

# 2017 EES Student Award Ceremony

## Discipline Awards

Soft Rock Geology Recognition: **Martha Denisky**

Geomorphology Recognition: **Jennifer Croteau**

Quaternary Geology Recognition: **Cody Murphy**

(GIS) Geographic Information Systems Recognition: **Luke Davis and Alexia Bohnenkamper**

Sustainable Energy Science Recognition: **Lucas Suchinski**

## Excellence Awards

Junior Academic Excellence: **Emma Avery and Luke Davis**

Sophomore Academic Excellence: **Jennifer Croteau**

Outstanding Environmental Earth Scientist: **Martha Denisky and Madeleine Haynes**

## Photo Highlights below!





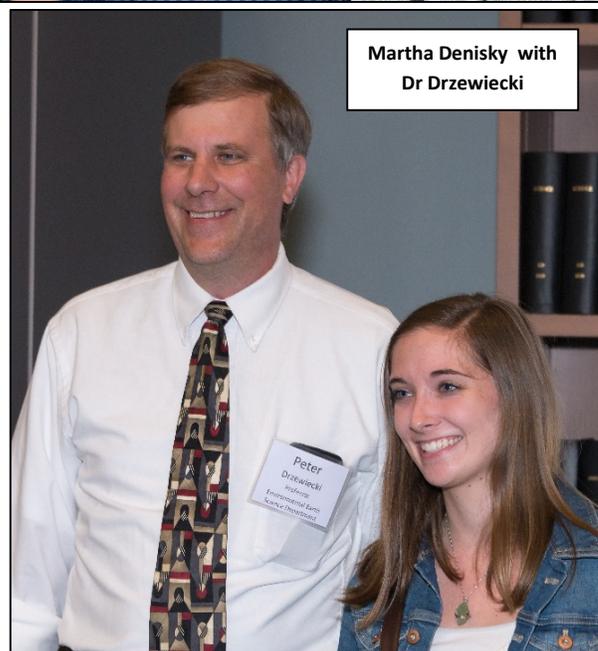
Emma Avery and Luke Davis receiving awards from Dr Cunningham



Cody Murphy and Dr Oakley



Jennifer Croteau with Dr Oakley



Martha Denisky with Dr Drzewiecki



Gleeful Giddy Graduates!

# Congratulations to the Class of 2017!



**Commencement, 2017**

## ALUMNI UPDATES

### Mimi Cedrone, ECSU Class of 2012

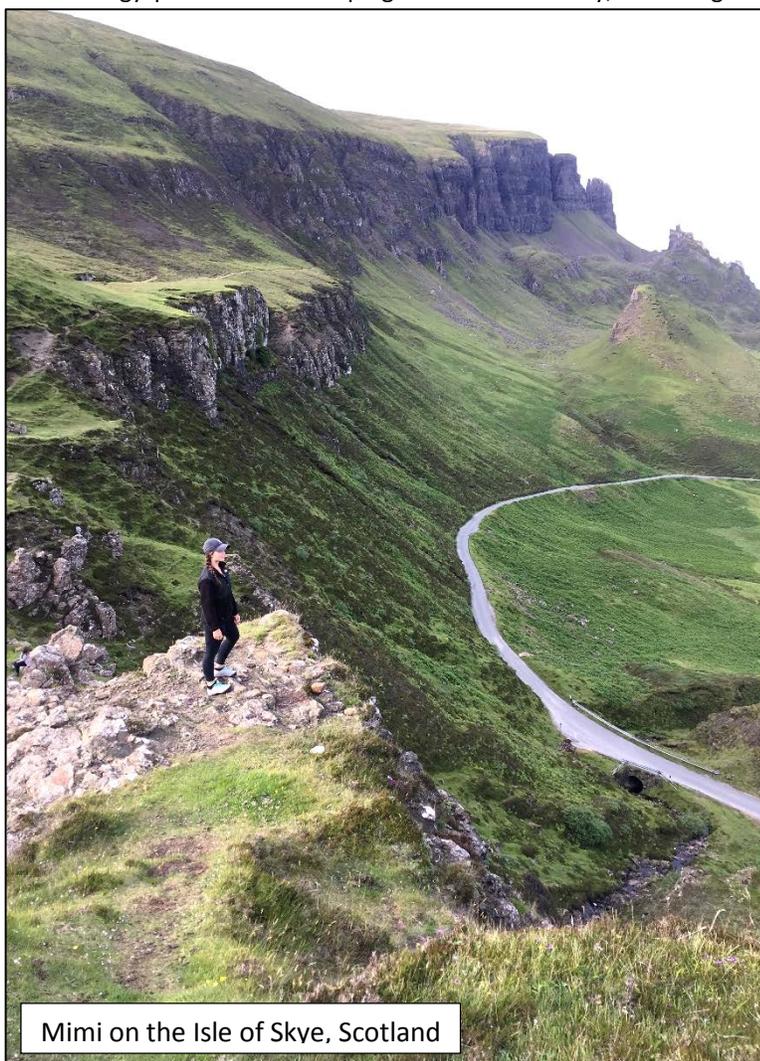
Life after graduation from Eastern has presented me with many opportunities and taken me in many different directions, both near and far from home. I started working as a student intern at Eastern's Institute for Sustainable Energy (ISE) in 2010 while I was still attending university. When I graduated, I became a University Assistant, and then a full-time Energy Technical Specialist in January 2013. My time at ISE was spent planning, developing and running energy efficiency programs for Eastern, as well as schools, colleges, universities, organizations and municipalities across Connecticut. I conducted energy audits, performed energy benchmarking, and worked with dozens of Eastern students who came to ISE as interns. I am very proud of the fact that so many of the Eastern students I worked with went on to get jobs in the energy and sustainability field, many of them with offers before they even graduated. My time at ISE was very exciting and fulfilling, and I learned many skills that will continue to help me in my career going forward.

After four years as a full-time Eastern employee, I moved to London in the United Kingdom. I am currently working as a Sustainability Projects Officer at the University of East London. My team focuses on environmental management, data reporting and analysis, engagement and communication. My role mainly involves managing the UEL energy portfolio and keeping track of electricity, natural gas and water use on campus, as well as carbon

emissions. I also work to identify opportunities for energy and cost savings on campus, which can be achieved through operational and behavioural changes, as well as through energy equipment retrofits.

As I explore my new home country, I am making good use of my EES education. The UK is a great place to visit if you're interested in geology, since it is a relatively small island with a wide range of diverse landscapes. There are many beautiful places to visit formed by lots of different geomorphological processes. One of my favorite places to visit is the Isle of Skye off the west coast of Scotland. This island is home to many dramatic landscapes such as the Quiraing, the largest landslip in Britain. It was formed through a series of landslides, with the overlying weight of lava flows bearing down on the weaker Jurassic sedimentary rocks beneath.

Five years after graduation, I continue to look back on my time at Eastern as some of the best years of my life, and I will continue to do so in the years to come as I explore more of the world and continue on in my career!



Mimi on the Isle of Skye, Scotland

**Chelsea Roston, ECSU Class of 2015**

I am working for the Big Sky (MT) Watershed Corps via Americorps in conjunction with the Bureau of Land Management at the Upper Missouri River Breaks National Monument. I am a field technician (hydrology,



biology, wildlife, archeology, and paleontology work), land/river ranger, and I help out in the museum. I am currently constructing an exhibit on the Western Interior Seaway for the museum since paleontology has always been a passion of mine. I am also an intern at Hell Creek Fossils in the Badlands of North Dakota and Montana (<http://www.hcfossils.com/>) working and continuing my passion for paleontology! We have been uncovering a triceratops for quite a while and hope to get most of the bone excavated this summer. We also just leased a whole bunch of land and hope to find something big this summer

like a T-Rex! I will keep you updated on that one! We are also always looking for future interns!



Chelsea (2<sup>nd</sup> from right) with Haley Celotti, Samantha Boyle and Carly Burgess in Sedona, on the first EES Arizona field trip, 2014.

## For Our Alumni

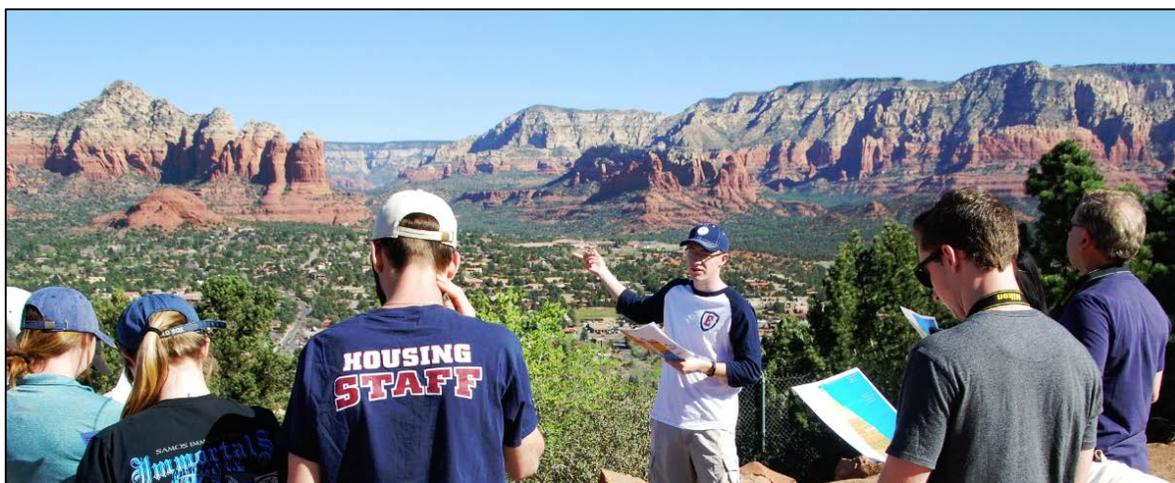
### What are you up to?

We would very much like to include updates from EES alumni in our newsletters. If you would like to contribute, please e-mail responses to the following questions to either Zosia ([carlquitz@easternct.edu](mailto:carlquitz@easternct.edu)) or Dickson ([cunninghamw@easternct.edu](mailto:cunninghamw@easternct.edu)).

All the best for a great year!

### To help us build the next newsletter, please send the following:

1. Name, graduation year, current e-mail address.
2. Tell us what you do now (and if you would like us to include this information in the newsletter).
3. A brief paragraph telling us about your other activities since graduating.



*EES Major Nicke Houle leads a student discussion on the geology and landscapes of Sedona Arizona, spring, 2017*

## Supporting EES Students

The faculty members of the EES Department are committed to providing our students with practical research, field, and presentation experience as often as possible. Many of the activities our students participate in are supported through the EES Founders Fund, which was established for these purposes. We welcome your tax-deductible donations to this fund and encourage you to contact Mr. Peter Dane at University Relations (860-465-4513), if you would like to learn more about how to contribute to experiences that open minds and support career development for new generations of EES students! Thank you in advance!

**Eastern EES Facebook Page:** Alumni, if you are not currently a member of the Eastern EES Facebook page, please email Bryan at [OakleyB@easternct.edu](mailto:OakleyB@easternct.edu) and he can send you the link. The Facebook page is a great way to stay connected to the department, as well as a growing resource for EES related jobs.